Zootaxa 4081 (1): 001–331
http://www.mapress.com/j/zt/

Monograph

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

http://doi.org/10.11646/zootaxa.4081.1.1
http://zoobank.org/urn:lsid:zoobank.org:pub:D818A5A7-A279-4E4A-AB6C-86FDD870E518

ZOOTAXA

4081

Revision of the Palaearctic species of *Eupelmus* (*Eupelmus*) Dalman (Hymenoptera: Chalcidoidea: Eupelmidae)

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Magnolia Press
Auckland, New Zealand

Accepted by I. Miko: 3 Nov. 2015; published: 17 Feb. 2016

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(*Zootaxa* 4081)

331 pp.; 30 cm.

17 Feb. 2016

ISBN 978-1-77557-895-6 (paperback)

ISBN 978-1-77557-896-3 (Online edition)

FIRST PUBLISHED IN 2016 BY

Magnolia Press

P.O. Box 41-383

Auckland 1346

New Zealand

e-mail: zootaxa@mapress.com

http://www.mapress.com/zootaxa/

ISSN 1175-5326 (Print edition)

ISSN 1175-5334 (Online edition)

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Abstract

One hundred-four extant species of *Eupelmus* Dalman (Hymenoptera: Eupelmidae: Eupelminae) are recognized from the Palaearctic region, of which 76 species of *E.* (*Eupelmus*) are recognized following a revision of the Palaearctic fauna of the subgenus. The following 25 species are described as new: *E.* (*Eupelmus*) *adustus* Gibson & Fusu **n. sp.**, *E.* (*Eupelmus*) *angustifrons* Gibson & Fusu **n. sp.**, *E.* (*Eupelmus*) *bicolor* Gibson & Fusu **n. sp.**, *E.* (*Eupelmus*) *brachypterus* Fusu & Gibson **n. sp.**, *E.* (*Eupelmus*) *brachystylus* Gibson & Fusu **n. sp.**, *E.* (*Eupelmus*) *brachyurus* Fusu & Gibson **n. sp.**, *E.* (*Eupelmus*) *fasciatus* Gibson & Fusu **n. sp.,** *E.* (*Eupelmus*) *gelechiphagus* Gibson & Fusu **n. sp.**, *E.* (*Eupelmus*) *hayei* Gibson & Fusu **n. sp.**, *E.* (*Eupelmus*) *infimbriatus* Gibson & Fusu **n. sp.**, *E.* (*Eupelmus*) *iris* Fusu & Gibson **n. sp.**, *E.* (*Eupelmus*) *kamijoi* Gibson & Fusu **n. sp.**, *E.* (*Eupelmus*) *lanceolatus* Gibson & Fusu **n. sp.**, *E.* (*Eupelmus*) *luteipes* Fusu & Gibson **n. sp.,** *E.* (*Eupelmus*) *magdalenae* Fusu & Gibson **n. sp.**, *E.* (*Eupelmus*) *mehrnejadi* Gibson & Fusu **n. sp.,** *E.* (*Eupelmus*) *melanostylus* Gibson & Fusu **n. sp.**, *E.* (*Eupelmus*) *punctatifrons* Fusu & Gibson **n. sp.**, *E.* (*Eupelmus*) *setosus* Fusu & Gibson **n. sp.**, *E.* (*Eupelmus*) *tanystylus* Gibson & Fusu **n. sp.**, *E.* (*Eupelmus*) *tetrazostus* Gibson & Fusu **n. sp.**, *E.* (*Eupelmus*) *vanharteni* Fusu & Gibson **n. sp.**, *E.* (*Eupelmus*) *weilli* Fusu & Gibson **n. sp.**, *E.* (*Eupelmus*) *xenium* Fusu & Gibson **n. sp.**, and *E.* (*Eupelmus*) *zebra* Fusu & Gibson **n. sp.** Of previously described species of *Eupelmus*, 17 are newly assigned to *E.* (*Eupelmus*), 10 to *E.* (*Episolindelia* Girault), and 8 to *E.* (*Macroneura* Walker). Formally transferred to *E.* (*Macroneura*) from *Macroneura* are *E.* (*M.*) *algiricus* (Kalina 1981), *E.* (*M.*) *coleophorae* (Kalina 1981), *E.* (*M.*) *impennis* (Nikol'skaya 1952), *E.* (*M.*) *longicornis* (Kalina 1981), *E.* (*M.*) *pleuratus* (Kalina 1981) and *E.* (*M.*) *sugonyaevi* (Kalina 1981**) n. combs.** *Eupelmus* (*Eupelmus*) *kalinai* Gibson & Fusu **n. name** is given to replace *E.* (*Eupelmus*) *algiricus* Kalina 1988, a secondary homonym of *E.* (*M.*) *algiricus* (Kalina 1981). New synonyms proposed are *Eupelmus scolyti* Liao 1987 **n. syn.** under *E.* (*Eupelmus*) *formosae* Ashmead 1904, and *Eupelmus nigricauda* Nikol'skaya 1952 **n. syn.** under *E.* (*Eupelmus*) *microzonus* Förster 1860. *Eupelmus gueneei* Giraud 1870 and *Eupelmus xambeui* Giard 1900 are transferred to *Arachnophaga* (*Parasolindenia* Brues) as *A.* (*P.*) *gueneei* (Giraud) and *A.* (*P.*) *xambeui* (Giard) **n. combs.**, and *Eupelmus kim* Nikol'skaya 1952 is transferred to *Brasema* Cameron as *B. kim* (Nikol'skaya) **n. comb.** *Eupelmus puparum* Newport

1840 is transferred to *Pteromalus* Swederus (Pteromalidae) as *P. puparum* (Newport) **n. comb.**, a secondary homonym of *P. puparum* (Linnaeus 1758), and *Ceraphron brachynterae* Schwägrichen 1835 is removed from *Eupelmus* and Eupelmidae, and the name treated as *incertae sedis*. Lectotypes are designated for *Eupelmus azureus* Ratzeburg 1844, *Pteromalus cordairii* Ratzeburg 1844, *Eupelmus hostilis* Förster 1860, and *Eupelmus splendens* Giraud 1872. Neotypes are designated for *Pteromalus audouinii* Ratzeburg 1844 and *Eupelmus bedeguaris* Ratzeburg 1852. Newly recorded from the Palaearctic are *E.* (*Eupelmus*) *orthopterae* (Risbec 1951) and *E.* (*Eupelmus*) *peculiaris* Narendran (2011). Excluded from the Palaearctic are *E.* (*Eupelmus*) *afer* Silvestri 1914 (Afrotropical) and *E.* (*Eupelmus*) *longicorpus* (Girault 1915) (Australasian), the former being compared to *E. confusus* Al khatib 2015 and the latter to *E. iranicus* Kalina 1988 and *E. kalinai*. Seven informal species groups are recognized for the purpose of species comparisons, the *fulgens*-, *fulvipes*-, *iranicus*-, *orientalis*-, *splendens*-, *stramineipes*-, and *urozonus*-groups. The latter group is restricted to *E. urozonus* Dalman and five other species that were differentiated initially using molecular evidence. Females of all 76 species of *E.* (*Eupelmus*) recognized from the Palaearctic are keyed, described and illustrated. Males are recognized for 44 of the species, and keyed and illustrated, though not all males of the *fulvipes*- and *urozonus*-groups are distinguished from each other.

Key words: brachyptery, key, hosts, biology, distribution, DNA barcoding

Introduction

When we started this study, Noyes (2014) had listed 307 valid available species names in *Eupelmus* Dalman (Hymenoptera: Eupelmidae: Eupelminae) from all continents except Antarctica. This makes *Eupelmus*, by far, the most speciose of the 45 extant eupelmid genera recognized. Noyes (2014) also listed 80 valid extant species of *Eupelmus* from the Palaearctic region, including 52 from Europe. Some of the species were further classified in one of the three subgenera currently recognized in the genus, *Eupelmus s. str.*, *Episolindelia* Girault and *Macroneura* Walker, though not all were assigned correctly to subgenus.

Kalina (1988) revised the Palaearctic species of *Eupelmus* and included a key to females for 40 of 48 species he recognized. Included in this were species now classified in *E.* (*Eupelmus*) and *E.* (*Episolindelia*), plus a few species now classified in other genera. Kalina (1981) had earlier revised the Palaearctic species of *E.* (*Macroneura*) under *Macroneura*. The eight species Kalina (1988) did not include in his key to Palaearctic *Eupelmus* was because type material was unavailable to him and, in the case of *E. kim* and *E. nitidus* Nikol'skaya, presumed lost. Askew & Nieves-Aldrey (2000) subsequently revised the species of *Eupelmus* from Spain and included a key to females for 27 species and subspecies under *E.* (*Eupelmus*) and *E.* (*Macroneura*). Of the species keyed, 11 belong to *E.* (*Eupelmus*), 8 to *E.* (*Episolindelia*) (couplets 13–19), 6 to *E.* (*Macroneura*), and 2 to *Reikosiella* (*Hirticauda* Bouček) (see Fusu 2013). In his North American revision of *E.* (*Eupelmus*), Gibson (2011) treated four species also known from the Palaearctic, and discussed other Palaearctic species that affected North American nomenclature in what he redefined as the *urozonus* species-group. Subsequent to Noyes (2014), Al khatib *et al.* (2014) revised the western Palaearctic species of what they termed the *urozonus* complex using combined molecular and morphological analyses. They recognized 21 species in the *urozonus* complex, of which 11 were described as new, including 5 new species based only on females that closely resemble *E. urozonus* females in having a smooth and shiny scrobal depression. Unfortunately, journal policy required that the treatments of all previously described species recognized in the *urozonus* complex by Al khatib *et al*. (2014) be removed from the publication and included only as unpublished supplemental information on the journal web site. As a result, some proposed nomenclatural changes and changes in the concept of names are cited only in the abstract of the paper, and the rationale for the proposed changes given in the unpublished supplemental information. This included the resurrection of the name *E. kiefferi* De Stefani (1898) for what previous authors had interpreted as *E. fulvipes* Förster (1860) or more frequently as *E. urozonus* Dalman (1820) depending on the extent of dark colouration on the legs, the presentation of a new concept for the name *E. fulvipes,* the restriction of the concept of *E. martellii* Masi (1941), and the synonymy of *E. spongipartus* Förster (1860) and *Pteromalus cordairii* Ratzeburg (1844) under *E. azureus* Ratzeburg (1844). Furthermore, lists of designated paratypes for several new species and the names and locations of type-depository institutions, which were designated by codons in the publication, were given in supplemental, unpublished documents. Article 16.4.2 of the International Code of Zoological Nomenclature (ICZN 2012) requires that the original publication include a statement indicating the name and the location of the collection where a holotype is deposited. Therefore, with only a codon included in the publication, ambiguity resulted as to the validity of the new names proposed in Al khatib *et al*. (2014) (Krell 2015). In response,

the authors published an addendum (Al khatib *et al.* 2015) that included emended holotype data, lists of all paratypic material, and the name and location of all type specimen depositories for the names proposed in Al khatib *et al.* (2014). Based on ICZN article 10.1, availability of the names originally proposed in Al khatib *et al.* (2014) takes the date of publication of Al khatib *et al.* (2015).

The primary purpose of this study is to revise the species of *E*. (*Eupelmus*) for the Palaearctic region, though we also list in their correct subgenus all extant Palaearctic species included in *Eupelmus* by Noyes (2014). The revision is based primarily on morphological study of material from throughout the region, though some species concepts are influenced by preliminary COI analyses that are not formally included in this work.

Material

This study is based on approximately 5,800 specimens of *E*. (*Eupelmus*) from the 42 collections listed below. Another two collections, denoted with an asterisk (*), are purported to contain type material that was not examined. The museum codons are used to designate collections in the species treatments, and the names of individuals who assisted in loans of material are given in parentheses.

AICF Al. I. Cuza University, Iaşi, Romania, Lucian Fusu collection (L. Fusu).
ANCO Ionel Andriescu collection, Al. I. Cuza University, Iaşi, Romania (I. Andriescu).
ARPC Antoni Ribes† personal collection, Lleida, Spain (A. Ribes) [to be deposited in BMNH].
BMNH The Natural History Museum, Department of Entomology, London, England (N. Dale-Skey and S. Ryder).
CASC California Academy of Sciences, Department of Entomology, San Francisco, CA, USA (B. Fisher and R. Zuparko).
CMNH Cleveland Museum of Natural History, Cleveland, OH, USA (T. Pucci)
CNC Canadian National Collection of Insects, Arachnids and Nematodes, Agriculture and Agri-Food Canada, Ottawa, ON, Canada (G. Gibson).
CTPC Csaba Thuróczy personal collection, Koszeg, Hungary (C. Thuróczy).
DEIC* Institut für Pflanzenschutzforschung der Akademie der Landwirtschaftswissenschaften (formerly: Deutsches Entomologisches Institut), Eberswalde, Germany.
ELKU Entomological Laboratory, Faculty of Agriculture, Kyushu University, Fukuoka, Japan (T. Hirowatari and K. Matsuo).
EIHU Entomological Institute, Hokkaido University, Hokkaido, Japan (K. Kamijo).
ETHZ Eidgenössische Technische Hochschule Zürich, Zürich, Switzerland (R. Eastwood).
FSCA Florida State Collection of Arthropods, Division of Plant Industry, Gainesville, FL, USA (J. Wiley).
GDPC Gérard Delvare personal collection, Montpellier, France (G. Delvare).
HNHM Hungarian Natural History Museum, Zoological Department, Budapest, Hungary (S. Csősz and Z. Vas).
IAEE Institute of Applied Ecology and Ecotechnology, Kostelec nad Černými lesy, Czech Republic. [Type material presently in possession of V. Kalina, Prague, Czech Republic, though stated as deposited in IAEE.]
IBER Institute of Biodiversity and Ecosystem Research, Sofia, Bulgaria (I. Todorov).
IFSP Istituto di Entomologia F. Silvestri, Portici, Italy (B. Espinosa and U. Bernardo).
ISNB Institute royal des Sciences naturelles de Belgique, Bruxelles, Belgium (R. Gérard).
IZCAS Institute of Zoology, The Chinese Academy of Sciences, Beijing, China (Xiao Hui).
MCSN Museo Civico di Storia Naturale "Giacomo Doria", Genoa, Italy (R. Poggi).
MKUI Plant Protection Department, Mustafa Kemal University, Antakya-Hatay, Turkey (M. Doğanlar).
MNCN Museo Nacional de Ciencias Naturales, Madrid, Spain (M. París).
MNHN Muséum National d'Histoire Naturelle, Paris, France (A. Touret-Alby).
NHMW Naturhistorisches Museum, Wien, Austria (M. Vizek and D. Zimmermann).
MHNG Muséum d'Histoire Naturelle et Musée d'Histoire des Sciences, Geneva, Switzerland (B. Landry).
MZH Zoological Museum, University of Helsinki, Helsinki, Finland (P. Vilkamaa).
NHRS Department of Entomology, Swedish Museum of Natural History, Stockholm, Sweden (P. Magnusson and H. Vårdal).

NMPC Narodni Muzeum v Praze, Prague, Czech Republic (P. Janšta and J. Macek).
NWCF Northwestern College of Forestry, Yangling 712100, Shaanxi, China (Z. Yang).
OXUM* Hope Entomological Collections, Oxford University Museum, Oxford, England.
PUPB Department of Zoology, University of Plovdiv "Paisii Hilendarski", Plovdiv, Bulgaria (A. Stojanova).
RMNH Rijksmuseum van Naturrlijke Historie collection**,** Naturalis Biodiversity Centre, Leiden, The Netherlands (F. Bakker).
SBUK Zoological Museum, Shahid Bahonar University of Kerman, Iran (S. M. Madjdzadeh).
SIZK Schmalhausen Institute of Zoology, Ukrainian Academy of Sciences, Kiev, Ukraine (A. Gumovsky).
SMFG Senckenberg Natural History Museum, Frankfurt, Germany (P. Peters).
TAUI National Collection of Insects, Zoological Museum, Department of Zoology, Tel Aviv University, Tel Aviv, Israel (Z. Yefremova and D. Gerling)
UCRC UCR Entomological Teaching and Research Collection, University of California, Riverside, CA, USA (S. Triapitzin).
USNM United States National Entomological Collection, U.S. National Museum of Natural History, Washington, DC, USA (M. Gates).
ZIN Zoological Institute of Russian Academy of Sciences, St Petersburg, Russia (S. Belokobylskij).
ZMAN Zoologisch Museum Amsterdam collection, Naturalis Biodiversity Centre, Leiden, The Netherlands (F. Bakker).
ZMUC Zoological Museum, University of Copenhagen, Copenhagen, Denmark (L. Vilhelmsen).
ZMUH Zoological Museum, University of Helsinki, Helsinki, Findland (P. Vilkamaa).
ZSMC Zoologische Staatssammlung München, Munich, Germany (S. Schmidt).

Methods

Scope. Our concept of the Palaearctic region approximates that of Olson *et al.* (2001, fig. 1). It includes Europe, those countries in North Africa whose largest area lie north of the Tropic of Cancer, middle eastern countries from Turkey to Afghanistan, including for simplicity the entire Arabian Peninsula, and Russia and other countries east of the Ural mountains, including those provinces of China, whose largest part lie north of 31°. Species concepts result primarily from morphological study of specimens from throughout the region, though some concepts are influenced or supported by ongoing COI analyses that are not formally included in this work. These will be published separately upon completion, but where applicable preliminary COI results are discussed under 'Remarks'. All specimens with a "CNCHYM" DNA voucher number label were sequenced at the Canadian Centre for DNA Barcoding, University of Guelph, Guelph, Ontario, Canada, and are in the CNC. Other specimens were sequenced in the Invertebrates Diversity and Phylogenetics Laboratory at Al. I. Cuza University, Iaşi, Romania, and have a label with a voucher number formed by two letters from the species name, two letters of the country name and a number. Most of these specimens are in AICF but also ARPC, CNC or ELKU, as indicated. Where presented, mean between group genetic distances were calculated using the Kimura-2-parameters model (K2P). Although the use of this model is considered unjustified for DNA barcoding studies (Srivathsana & Meier 2008), it is used here to ease comparison with other publications because this is the most pervasive substitution model used in the DNA-barcoding literature.

Species groups. We recognize seven informal species groups, the *fulgens*-, *fulvipes*-, *iranicus*-, *orientalis*-, *splendens*-, *stramineipes*-, and *urozonus*-group (for species composition of each group see under respective species). The groups are defined primarily based on features shared by females, though males are known for at least one species in all groups except for the *fulgens* group. No phylogenetic analysis was conducted and the evolutionary significance of the shared features (synapomorphy, symplesiomorphy or homoplasy) was not determined. As such, the species groups are employed merely to facilitate comparing three or more morphologically similar species and not to imply monophyletic lineages. However, possible relationships are discussed under the 'Remarks' section for some species.

Bouček (1988) first differentiated the *urozonus* group based on females, which Gibson (2011) subsequently redefined based on males. The general concepts of these two authors were treated as the *urozonus* complex by Al khatib *et al.* (2014). Here, we treat the *urozonus* complex as per Al khatib *et al.* (2014) and restrict the *urozonus*

group *sensu stricto* for *E. urozonus* and five other morphologically similar species that were newly described and keyed through couplet 15' of the key to females by Al khatib *et al.* (2014). All five species were differentiated by both morphological and molecular evidence, but based only on females. Type specimens of the new species described in the *urozonus* complex by Al khatib *et al.* (2014) were treated for DNA extraction using the methods described therein, which resulted in digestion and removal of internal muscle tissue. Because of this, some structures such as the legs or even sometimes the mesosoma and metasoma, although perfectly preserved in the mounted types, can be seen to lack internal contents. This sometimes results in being able to see through the legs or other structures depending on the angle of light, which can affect apparent colour pattern and/or the intensity of metallic colours.

Species treatments. Our application of nomenclature for previously described species is based on examination of type specimens, if remaining and available. We indicate within the respective species synonymy what type material was studied; if stated simply as 'examined' this indicates both of us examined the specimen(s). Kalina (1984, 1988) described 11 species based on females that are now classified in *Eupelmus*. Although the original descriptions state that the types are deposited in the Institute of Applied Ecology and Ecotechnology, Kostelec nad Černými lesy, Czech Republic, the specimens remain in Kalina's personal possession. Thanks to Dr. Kalina and through the facilitation of P. Janšta (NMPC), we obtained on loan type material of all 11 of Kalina's species plus a few other specimens identified by him. This included one male of *E. ceroplastae* (Kalina 1984) and three males of *E. saharensis* (Kalina 1988) that are associated with type females of the respective species and which enabled us to newly describe, illustrate, and key the males of these two species.

Redescriptions of species usually are based only on examined specimens; however, we sometimes include between square brackets information given in the original description for species of which we saw very few specimens. This is done to more accurately encompass intraspecific variation. Our species descriptions are largely comparable, at least for species within the same species group, except for a few putative species pairs that are morphologically very similar. For such species we provide a complete description for one of the species and only describe what we consider as the essential differential features for the other recognized species. This is done to emphasize the putative differences.

GG used a Nikon SMZ-U microscope fitted with a 10 mm ocular grid having 100 divisions for measurements, and a Leitz 50-watt tungsten halogen light source to illuminate specimens. A piece of translucent Mylar tracing acetate was taped to the objective between the light source and specimen to reduce glare. LF used an Olympus SZX9 stereomicroscope fitted with a 10 mm ocular grid having 100 divisions for measurements, and an Olympus KL1500 LCD light source (150-watt) for illumination; to reduce glare, a double piece of tracing paper was used.

GG photographed specimens with a Leica DFC 425C, 5 megapixel digital camera attached to a Leica Z16 APO motorized macroscope. Specimens were illuminated with three Leica KL2500 LCD fibre optic light sources fitted with 250-watt cold light reflector lamps, filtered through a Styrofoam dome to reduce glare. As a result, lighting of specimens for photography was more uniform than the more unidirectional lighting for observation and description. LF photographed specimens with a Leica DFC 500 digital camera attached to a Leica M205 A motorised stereomicroscope and illuminated with an Olympus KL1500 LCD light source and a Kruss 150-watt light source. In all instances, serial images used to prepare the plates of illustrations were combined with Zerene Stacker and digitally retouched as necessary using Adobe Photoshop to enhance clarity. Excluding primary types, specimens imaged by GG were labelled with "CNC Photo" specimen number labels, which are cited in the figure captions. The CNC Photo numbers and museum codons of depository collections are also included along with collection data for specimens cited in the text. For specimens whose collection data is not given in the text, the photo number, museum depository, and country of origin and sex of the specimen are tabulated in Table 2. This is done so the exact specimen imaged for any putative species can be located in the future if it is necessary to review the species identification.

Whenever possible, type material of senior and/or junior synonyms was imaged to help illustrate species and justify nomenclatural concepts. Information on labels of primary types is given as it appears on the respective labels, with data on different labels separated by a backslash (/). For examined type specimens of species described by Nikol'skaya (1952), we provide the Russian label data and, between square brackets, our English translation. The examined type specimen was not always the holotype. Collection data given for paratypes of newly described species are standardized, including giving the collection month in Roman numerals regardless of the format used on the label, and not explicitly indicating what data appears on different labels. We do not include full collection

data for examined material under 'Distribution' because of the large number of specimens involved, except for comparatively rarely collected species for which our additional records are usually the first following the original description of the species. New host and country distribution records not given in Noyes (2014) or other publications are indicated with an asterisk (*) and museum acronyms are included for the specimens that validate the new records so that the specimens can be located in the future. Host family classification follows Noyes (2014) and we therefore treat Scolytidae as a separate family rather than as a subfamily in Curculionidae.

Colour. Throughout the text we use the term 'purple' to describe the metallic luster of various parts such as the scrobal depression and pronotum. We use this term as perceived in English-speaking countries, i.e. a composite colour that is a mixture of blue and red, being close to but darker than violet or violaceous. In many other countries, including Latin language speaking countries as France, Italy and Romania, the term purple (pourpre, porporìno, purpuriu) refers to a colour close to crimson, containing much more red than blue. Different types of light sources used will also affect the perception and intensity of described metallic lusters. Finally, our descriptions of colour are based on museum specimens of various ages and states of preservation. Described variation for some metallic patterns undoubtedly does not accurately reflect natural specimens because of accumulated grime and oils or fading over time that affect colour. All of these factors must be considered when identifying specimens using described colour features.

Structure. Morphological terms and abbreviations for fore wing veins and cells mostly follow Gibson (1995, 2011) and Al khatib *et al*. (2014). The **frontovertex** is the frontal surface of the head above the scrobal depression, which is subdivided into the **frons**, the part between the scrobal depression and the posterior ocelli, and the **vertex**, the dorsal surface of the head posterior to the posterior ocelli. The **lower face** consists of the frontal surface of the head below the level of the antennal toruli, but including the **interantennal prominence**, the triangular region between the toruli that partly subdivides the **scrobal depression**, the concave region above the level of the toruli that includes the **scrobes**, the dorsally convergent depression above each torulus. A difference in sculpture between the scrobes and the rest of the scrobal depression is sometimes important for species differentiation in females. The **parascrobal region** is the region between the scrobal depression and inner orbit along the height of the depression, whereas the **gena** is the lower part of the head posterior to the **malar sulcus**. The pronotum has a dorsal surface and a lateral, vertical surface, the **pronotal panel**. When describing the pronotum, positional terms (e.g. lateral or laterally, posterior, etc.) refer to the dorsal surface unless the pronotal panel is referred to specifically. As per Al khatib *et al.* (2014), the **admarginal setae** of the pronotum is the row of long setae along its posterior margin (e.g. Fig. 23g).

Variation in some features in any single species is often correlated, at least in part, with relative body size of individuals. Smaller females of the same species often have the head and mesosoma with less distinct metallic colouration and generally finer sculpture than larger females. The number of setae on the prepectus is often also affected by body size, with smaller females having fewer setae. Despite this, the number of prepectal setae is an important differential feature for females of some species and we sometimes use it as a key character. However, in addition to size-correlated differences, mounted specimens may also appear to have fewer setae than normal because some have been lost through abrasion. Any setal pores, usually visible under higher magnification and proper, oblique lighting should also be included in the count and both prepecti examined. Various ratios between body parts are often also correlated with body size to some extent, including the distance between the posterior ocelli (**POL**), between the anterior and a posterior ocellus (**LOL**), and particularly between a posterior ocellus and inner orbit (**OOL**) relative to the maximum diameter of a posterior ocellus (**MPOD**). The number of mesotibial apical pegs and mesotarsal pegs on any tarsomere also appears to be affected by body size within a species, and the number of mesotarsal pegs on the tarsomeres can even differ between the two legs. Further, the number of pegs along the posterior and anterior margins of the mesotarsus quite commonly differs regardless of body size, and then typically with one more peg on the posterior than anterior margin of one or more of described tarsomeres 2–4. Because of the variation in mesotarsal peg number we simply describe the observed range unless a difference between the anterior and posterior margins appears to have some information. We have attempted to construct the key to encompass observed variation within a species, but because body size can affect colour, sculpture and relative ratios of body parts, unusually small females may not key as readily as more typically sized females.

The clavate flagellum of females of most species is quite similar, consisting of a transverse **anellus** (first flagellomere, fl1) and seven **funiculars** (fl2–fl8 = fu1–fu7) between the anellus and **clava**, the enlarged apical segment composed of three fused flagellomeres distinguished only by fine sutures. Most commonly, the basal

funiculars are tubular and longer than wide, but increase in width and often decrease in length apically so that the more apical funiculars are more quadrate to slightly transverse (e.g. Figs 6h, 20c, 84g, h). Because of general similarity among most species we do not describe the female antenna unless it is sufficiently different to be useful for differentiating the species or species pairs.

Syntergal structure of female *Eupelmus* is similar to that of five other genera keyed through the first half of couplet 1 in the key to genera based on females by Gibson (1995), being deeply, omega-like (Ω) emarginate rather than apically flat or reflexed above the ovipositor sheaths. Female *Eupelmus* normally have the Ω-like emargination surrounding a subcircular, melanized anal sclerite such that the posterolateral angles of the syntergum are abruptly incurved toward the midline under the sclerite at about a 90º angle. The two incurved portions typically form a vertical to obliquely angled but mostly truncate surface between the anal sclerite and ovipositor sheaths (ventral-most part of the two surfaces often somewhat more incurved anteriorly just above the sheaths). Further, except for *E. peculiaris*, the cercus is posterior to and on the same level as the gastral spiracle. For brevity, females of such species are described simply as having the gaster "not atypically modified". However, females of some species have the posterolateral angles of the syntergum more strongly inflexed anteromesally, either almost vertically or obliquely. In the former instance, in dorsal view, the gaster appears more-or-less W-like posteriorly because the syntergum is V-like protuberant on either side of the anal sclerite and ovipositor sheaths (e.g. Figs 82j, 99g, h, 123h). When the posterolateral angles are inflexed at a strongly oblique angle the syntergum does not appear obviously protuberant on either side of the anal sclerite but is more flattened over the sheaths so that the anal sclerite faces posteroventrally and there is not a broad separation between the sheaths and dorsal margin of the syntergum (e.g. Figs 51, 42b insert, 46f, 126d). Females, or at least air-dried females of a few species have the dorsal surface of the syntergum completely flattened over the base of the ovipositor sheaths so that there is no separation between the two, in which case the anal sclerite is not visible and the syntergum lies flat or superficially appears to be reflexed, flange-like, above the sheaths (e.g. Figs 97h, i, 118g). In such instances the apical gastral structure superficially appears similar to females of genera keyed through the second half of couplet 1 of the key to genera based on females by Gibson (1995). The latter extreme likely results partly from collapse of the gaster with air drying, but indicates a species whose females have the posterolateral angles of the syntergum strongly inflexed anteromedially.

Females with a modified syntergum usually have the gastral apex extending over the base of the third valvulae so that the line of division between the second valvifers and third valvulae (see below under 'Measurements') is not visible, at least in dorsal or lateral views. In females with a non-modified syntergum the posterior limit of the gaster relative to the second valvifers and third valvulae often differs depending on length of the third valvulae. In most species the gaster extends only to about the line of division between the second valvifers and third valvulae (e.g. Figs 6i, 22h, 123g), but in species whose females have comparatively long third valvulae the second valvifers extend variably conspicuously beyond the gastral apex (e.g. Figs 60g, 66h). State of preservation can affect apparent syntergal structure to some extent. Critical-point dried females typically have the gaster in a more 'life-like' condition, though sometimes abnormally inflated, whereas air-dried females often have the gaster variably shrivelled or collapsed. This can affect appearance of the syntergum as well as apparent length of the third valvulae (see below).

Fewer morphological features differentiate males than females, of which flagellar structure is a primary feature used in the key. Males of most species have one of two basic flagellar types, filiform or clavate. A **filiform flagellum** (e.g. Figs 26e, 38e, 47a, 70a, 83d) is characterized by all the flagellomeres being subequal in width; usually also the flagellomeres have conspicuous, erect or decumbent, curved setae that project out from the flagellum. A **clavate flagellum** (e.g. Figs 9f, 63c, 85c, 98e, 103e, 107e) is characterized by the flagellomeres increasing in width apically to relatively less elongate apical funiculars and a broader clava, more similar in structure to that of females. This latter type of flagellum usually also has less obvious, typically shorter and straighter, more recumbent setae. The difference between an elongate-filiform and clavate flagellum is obvious, though sometimes less so between a clavate and a robust-filiform flagellum that has comparatively short and broad funiculars. However, structure and setation of the anellus usually also differs between the two basic flagellar types. Except for males of *E. pini*, males with a filiform flagellum have a very strongly transverse (discoidal) anellus that typically is smooth and shiny, but at least is bare or with at most a single row of inconspicuous setae along its extreme apical margin (e.g. Figs 26g, 38f, 47e, 70e). Males of most species with a clavate flagellum have the anellus variably less reduced, sometimes being quadrate or even slightly longer than wide, but even if obviously

transverse then dull and setose (e.g. Figs 9g, 23e, 36f, 63e, 103g) with at least two rows of obvious setae similar to the funiculars. However, males with a comparatively short and conspicuously clavate flagellum have mostly transverse funiculars (Figs 63c, 98e, 103e), including also the anellus (Figs 63e, 103g), which sometimes appears discoidal (Fig. 98e). The key to males is further complicated because males of some species have different combinations of anellar and flagellar structures. Males of *E. pini* have a filiform flagellum and a transverse anellus, but it is dull and setose rather than discoidal (Fig. 87e). Because of this combination we key out *E. pini* males in the second couplet prior to the major key division based on antennal structure. Males of *E. melanostylus* have the opposite combination of features, an obviously smooth and shiny, discoidal anellus, but a more-or-less distinctly clavate flagellum with subappressed setae (Fig. 67g, h). Males of *E. iris* also have an obviously discoidal anellus, but at least some have a subclavate flagellum with short setae (Fig. 44d). We note these discrepancies in couplet three but key out *E. melanostylus* and *E. iris* males among species whose males have a discoidal anellus.

Previously unnoticed for males of *E.* (*Eupelmus*) and *E.* (*Macroneura*) is that some species with either a filiform or clavate flagellum have a region of differentiated setae ventrally on the first two or three funiculars (see further under 'Subgeneric classification'). These regions sometimes are visible only in ventral view, consisting of shorter, lanceolate setae that are surrounded by the longer, more hairlike setae that otherwise cover the flagellum beyond the anellus. Under lower magnification the differentiated setae often appear as elongate, smoother regions on the ventral surface of the funiculars (e.g. Figs 9f, 52d, 65h, 121f). The differentiated setae are sometimes also visible in lateral view as shorter, straight, dark setae among the longer setae (e.g. Figs 12d, 52b, 70e). State of preservation of the antennae and relative size of a male can affect whether or not the differentiated setae are readily visible in males of species that should have them. Consequently, apparent absence in any single male does not necessarily mean true absence. Presence or absence of a differentiated, longer seta on the gena near the base of the mandible is also important for differentiating males of some species (see below under 'Subgeneric classification'). Also sometimes important is setal pattern of the lower face between the torulus and malar sulcus, i.e. whether the setae are more-or-less uniformly distributed and curved (e.g. Figs 14e, 21c) or with some conspicuously longer, sinuately or apically curved setae that form a denser 'tuft' of setae having convergent or overlapping apices (e.g. Figs 9c, d, 65c).

Sculpture. Accurate interpretation of sculpture, particularly of the frons and scrobal depression, is very important for correctly identifying individuals of many species. As per Gibson (2011) and Al khatib *et al.* (2014), we use **coriaceous** for meshlike sculpture that is delineated by engraved lines (i.e., as if the surface was scratched with a pin) (e.g. frons, Figs 13h, 17c, 22b, 50e), whereas **reticulate** is used for similar meshlike sculpture that is delineated by raised, though sometimes very fine ridges (i.e., with the surface of the cell depressed/concave) (e.g. frons and scrobal depression, Figs 25d, 38d, 42a, 58c). **Alutaceous** is similar to coriaceous except the sculpture is transversely elongated (e.g. vertex, Figs 16c, 71b, 75b, 92d). **Imbricate** refers to sculpture in which one margin of a sculptural cell is higher than the others so that the sculpture appears to overlap in a shingle-like manner. This type of sculpture can either have the surface of the cells flat (**coriaceous-imbricate** or **alutaceous-imbricate**) or variably distinctly depressed (**reticulate-imbricate**). The difference between these types of sculpture is sometimes very slight and usually best appreciated from a strongly oblique viewing angle with good lighting to better emphasize slightly raised edges, ridges or slightly depressed surfaces of the sculpture. Good lighting necessitates the use of some diffusing agent, such as a translucent piece of artists film (e.g. Mylar) placed between the light source and specimen, as close to the specimen as possible, to minimize glare. **The requirement of a diffusing agent and good lighting cannot be emphasized strongly enough to ensure accurate identifications using our keys.**

Individuals of many species have transverse, often partly imbricate sculpture on the vertex, with the raised sculptural margins more-or-less aligned into concentric striae. However, males and often females of the *fulvipes* group have the transverse sculpture coalesced into a variably distinct carina or stronger ridge that separates the vertex from the occiput (e.g. Figs 17d, 50f, 51e, 59c), which we term the **vertexal carina**.

Measurements. Methods of measuring structures largely follow Al khatib *et al.* (2014, figs 3, 4). However, Al khatib *et al*. (2014) took measurements digitally from live preview images, whereas we measured individual specimens using a stereomicroscope ocular grid. This difference likely explains, at least in part, differences between our measurements for some type specimens. Also, for measuring the distance between the toruli and between a torulus and the oral margin we use the inner torular margins rather than the carinate outer margins. We do this because the inner margin is delimited by the juncture of the dark cuticle and white conjunctive membrane,

which provides a more distinct point from which to measure than the carinate outer margin. We also measured eye height and length of the malar space as maximum lengths in lateral view rather than frontal view (*cf* Al khatib *et al.* 2014, fig. 3C). Length of the malar space is from the lower eye orbit to the margin of the oral cavity along a line following the malar sulcus, including what sometimes appears as a slender, less sclerotized region beyond the ventral limit of the malar sulcus. As indicated in Al khatib *et al.* (2014, fig. 3E), length of the scape for either sex does not include the radicle. Measurement of the length of the marginal vein (Gibson 2011, fig. 8; Al khatib *et al.* 2014, fig. 4B) is complicated because the submarginal vein curves into the marginal vein prior to the leading margin of the wing. This typically results in a very narrow, short membranous region between where the submarginal vein most abruptly angles to form the marginal vein and the actual leading margin of the fore wing. This slender region may or may not be visible depending on condition of the fore wing or the exact angle at which the wing is viewed, and thus can result in slight differences in measurements because of where the base of the marginal vein is interpreted. For this reason we interpret the basal limit of the marginal vein as the point where the submarginal vein most abruptly angles to form the marginal vein, if this is apparent. Measurement of length of females excludes the ovipositor sheaths unless stated otherwise. As noted by Al khatib *et al.* (2014), the ovipositor sheaths are composed of the basal **second valvifers** (= inner plates of ovipositor) and the more apical **third valvulae**. The two sheath regions are distinguished by a constriction. In dorsal view the constriction is delimited anteriorly by a slight angular protrusion on either side, and in ventral view by a transverse suture or ridge. Length of the third valvula is measured in dorsal view from the angular protrusion to its apex (Al khatib *et al.* 2014, fig. 4F) or in ventral view from the transverse suture to its apex (Gibson 2011, fig. 9). Accurate measurement of the length of the third valvula relative to length of the marginal vein or metatibia (Al khatib *et al.* 2014, fig. 4E) is important for differentiating females of many species. Couplet 39 represents a major dichotomy in the key to females, depending primarily on whether the third valvula is longer than or shorter than the length of the marginal vein. Variation in length of the third valvula relative to the marginal vein quite obviously overlaps both alternatives in a few species (e.g. *E. kamijoi*), and such species are keyed twice, through both halves of couplet 39. Some females also have the third valvula about as long as the marginal vein and thus not confidently keyed through either half of the couplet. Any such females should be keyed through both halves to determine which species they key to most readily through either half, and the female description and 'Remarks' section of the relevant species then checked for any additional information helpful for correct identification. Several factors affect accurate, comparable measurements of the length of the third valvula. In addition to species-specific differences, some species differ in whether or not the apices of the second valvifers project beyond the apex of the gaster. If they project beyond the gastral apex the apparent length of the sheaths is greater than the length of the third valvulae, whereas if the second valvifers do not extend to the apex of the gaster then the apparent length of the sheaths is less than the actual length of the third valvulae. Because of the need to accurately compare the same structures across species, we define ovipositor 'sheath length' as the length of the third valvula. We use the term 'apparent sheath length' for the length of the sheaths measured from the apex of the gaster regardless of whether this includes a projecting part of the second valvifer or only part of the third valvula because its base is concealed by the gastral apex. Apparent sheath length in any single female can also be affected by state of preservation. Air-dried females having a strongly collapsed gaster sometimes have the apical part of the syntergum reflexed dorsally so that the apical portion of the second valvifers is visible rather than being overlain by the gaster as in more naturally preserved females. Further, critical-point dried specimens sometimes have the gaster abnormally inflated over the base of the third valvulae. Such differences in preservation can affect measured variation to some extent.

Species excluded from *Eupelmus* Dalman

Eupelmidae: Eupelminae

Arachnophaga (*Parasolindenia*) *gueneei* (Giraud) n. comb.

Eupelmus Gueneei Giraud, 1870: 487. Holotype ♀, MNHN, examined by GG. Type data: Algeria, region around Biskra?
Eupelmus gueneei; Ruschka, 1921: 294–295 (female redescribed); Kalina, 1988: 4 (excluded from *Eupelmus* without transfer to another genus).

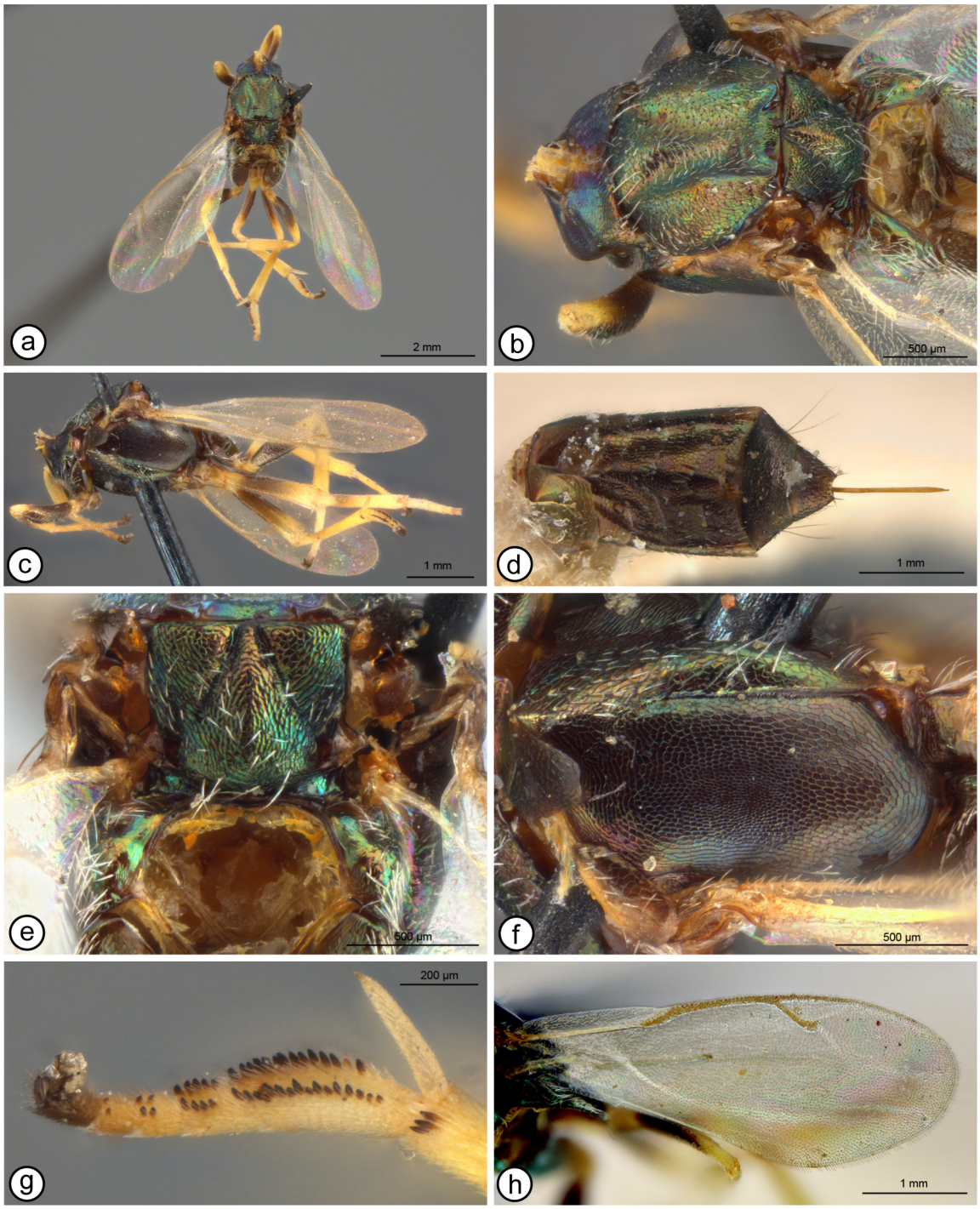

FIGURE 1. *Brasema kim*, syntype ♀: **a**, dorsal view of pinned body; **b**, mesosoma, dorsal; **c**, lateral view of pinned body; **d**, dorsal view of detached gaster; **e**, scutellar-axillar complex; **f**, mesosoma, lateral; **g**, apex of mesotibia and mesotarsus; **h**, fore wing.

Remarks. Giraud (1870) did not state the number of specimens in the original description of *E. gueneei*, but on the previous page (Giraud 1870: 486) stated that just before the publication of his paper he received from M. Guyon "one insect and three galls [i.e. the galls of *Oecocecis guyonella* Guenée (Lepidoptera) on *Limoniastrum guyonianum* Coss. and Dur. (Plumbaginaceae)] inhabited by parasites". Ruschka (1921) interpreted the text and the title of the publication to imply that *O. guyonella* is the host of *E. gueneei*, but Giraud (1870: 486) stated that the gall parasitoids he received were described above in the main text [as *Norbanus* (= *Arthrolysis*) *guyoni*], whereas the insect, i.e. *E. gueneei*, was described below in the addenda. Kalina (1988) stated that type material was not located in MNHN, but in 1991 GG examined one female, presumably the holotype, which forms the basis of our

new combination. At that time, the female lacked its metasoma and was glued to a narrow rectangular card by its left side. A circular hole through the metanotum and propodeum suggests the specimen was originally mounted with a minutien pin. There were no labels on the pin, but a hand written label with "*Eupelmus gueneei* Gir." was pinned by the specimen. LF was unable to locate this specimen when visiting MNHN in 2011. Kalina (1988: 4) realized from the original description that it did not belong in *Eupelmus* and stated that it, as well as *E. xambeui* Giard, probably belonged to either "*Mercetina* Bolivar, or, more probably, to *Macroneura* Walker". *Mercetina* is a junior synonym of *A*. (*Parasolindenia*) Brues (Gibson 1995), to which the putative holotype of *E. gueneei* examined by GG belongs.

Arachnophaga (*Parasolindenia*) *xambeui* (Giard) n. comb.

Eupelmus Xambeui Giard, 1900: 81–82. Syntypes, ♀, MNHN, lost? Type data: Eastern Pyrenees, around Ria, reared from larva of *Gynandrophthalma nigritarsis* Lac.

Eupelmus xambeui; Ruschka, 1921: 293–294 (female redescribed); Kalina, 1988: 4 (excluded from *Eupelmus* without transfer to another genus).

Remarks. Giard (1900) described *E. xambeui* from an unstated number of females. We did not locate type material in MNHN and it probably is lost as stated by Kalina (1988). We transfer *E. xambeui* to *Arachnophaga* (*Parasolindenia*) based on the original description.

Brasema kim (Nikol'skaya) n. comb.

Fig. 1a–h (♀)

Eupelmus kim Nikol'skaya, 1952: 500 (Russian), 1963: 512, 514 (English). Syntypes, ♀, ZIN, 1♀ examined. Type data: Uzbekistan. Syntype examined label: Аман-Кутан [Aman-Kutan], 13.VI.32, В. Гуссаков [V. Gussakovskiy] / Paratypus ♀ *Eupelmus kim* Nik. [red label].

Redescription (features given between square brackets from original description). [Body 2.2 mm in length; dark green with golden-red luster, frons violet]. Pronotum primarily green to bluish-green under different angles of light except for mediolongitudinal hyaline band (Fig. 1b); mesonotum more uniformly greenish with slight coppery to reddish-coppery lusters under some angles of light (Fig. 1b, e); metanotum with green luster laterally but apparently mostly brown medially; propodeum with transverse-linear plical region brown, but callus more distinctly green with light coppery luster under some angles of light (Fig. 1e); tegula brown except narrowly yellow along inner margin along mesoscutal margin; prepectus and acropleuron mostly brown with limited greenish luster under some angles of light (Fig. 1c, f). Front leg (Fig. 1c) pale except following brown: coxa, most of trochanter, femur except apically, elongate dorsal and ventral regions subbasally on tibia, and apical tarsomere. Middle leg (Fig. 1a, c) mostly pale beyond coxa but mesotibial apical pegs and mesotarsal pegs dark (Fig. 1g) and following brownish: almost basal three-quarters of femur, short subbasal region on tibia only about as long as basal pale region, and apical tarsomere. Hind leg (Fig. 1a, c) with similar colour pattern as middle leg except subbasal brownish region on tibia not quite as distinct. Gaster mostly brown with slight greenish and coppery lusters under some angles of light (Fig. 1d); [ovipositor sheaths entirely dark].

[Antenna with pedicel 1.5× length of first funicular, and last funicular appearing transverse]. Mesonotum uniformly setose with hairlike to very slightly lanceolate white setae (Fig. 1b); mesoscutum meshlike coriaceous to very slightly coriaceous-imbricate; scutellar-axillar complex with axilla shallowly meshlike reticulate to reticulate-imbricate and scutellum more coriaceous-imbricate; acropleuron meshlike coriaceous-reticulate, the cells delineated by at most very slightly raised ridges, and much more minutely punctate-reticulate mesally than anteriorly or posteriorly (Fig. 1f). Fore wing (Fig. 1h) hyaline with yellow venation; costal cell dorsally and ventrally, and disc uniformly setose with whitish-hyaline setae; cc: mv: pmv: stv = 3.7: 2.5: 1.6: 1.0. Middle leg (Fig. 1g) with 3 mesotibial apical pegs over base of tibial spur; basitarsus with 14–16 pegs, the pegs differentiated in length so as to form single serrate row on either side; second tarsomere with 4 pegs on anterior and 5 pegs on posterior margin; third tarsomere with 2 pegs on either side; and fourth tarsomere with single apical peg on either side. Gaster (Fig. 1d) with at least basal four tergites medially emarginate; syntergum about twice as wide basally as medial length, slightly incurved apically; [ovipositor sheaths less than two-thirds length of gaster (couplet 20

versus 13) and not more than one-half length of metatibia (couplet 35 *versus* 37)]. (The exerted portion of the first valvula is much longer than indicated in the original description, about 0.4× the length of the gaster and about 0.9× the length of the metatibia, but the exerted portion of the second valvula is only about 0.14× the length of the gaster and about 0.3× the length of the metatibia, and likely more closely matches the length of the ovipositor sheaths.)

Remarks. Kalina (1988: 23) stated that the type material of *E. kim* was not located in ZIN at the time of his study and probably was lost, but one female labelled as paratype was obtained on loan as part of our study. Nikol'skaya (1952) did not state the number of females on which *Brasema kim* (Nikol'skaya) **n. comb.** was based nor designate a holotype, though only a single length measurement was given, suggesting possibly only one specimen. The female we examined, labelled as paratype, is minutien-mounted through the right side of the mesonotum between the mesoscutum and tegula (Fig. 1a, c), and the mesonotum is arched so that the apex of the scutellum overlies and conceals the metanotum and propodeum medially (Fig. 1e). It lacks its head and antennae (Fig. 1b), has the gaster detached and glued to the card bearing the minutien pin, and lacks the ovipositor sheaths though the stylets remain (Fig. 1d). We briefly characterize the specimen above and illustrate it in order to facilitate recognition of the species in the future.

Brasema kim is the only recognized species of *Brasema* in Europe other than *B. stenus* Bouček (Noyes 2014). The latter name was proposed by Bouček (1968) for a species that was briefly described and illustrated by Erdős (1957, fig. 13) under the name *Eupelmus insignis* (Förster 1860) based on 15 females collected in Hungary. *Halidea insignis* was described originally by Förster (1860) based on males, but the species was subsequently transferred to *Eupelmus* by Ruschka (1921). However, based on information received from S. Novicky, Bouček (1968) believed the male syntypes of *H. insignis* (NHMW), though then presumed lost, were males of a species of *Anastatus* Motschulsky (Eupelminae) within the *giraudi-oscari* species group. One of us (LF) located two syntype males of *H. insignis* in NHMW and confirmed they belong to *Anastatus*, but could not determine the species. Gibson (1989) discussed the validity of *Halidea* relative to *Anastatus* and *Metapelma* Westwood (Neanastatinae) based on the actions of Ashmead (1890, 1896), Gahan and Fagan (1923) and Bouček (1988), and accepted Bouček's (1988) designation of *Halidea nobilis* (Förster 1860) as the type species of *Halidea* rather than Gahan and Fagan's (1923) designation of *H. insignis*. Consequently, even though Vidal (2001) transferred *H. insignis* to *Metapelma*, likely based on its listing under this genus in John Noyes's Universal Chalcidoidea Database, we treat the species as *Anastatus insignis* (Förster).

We did not examine the type material of *B. stenus*, but two females and one male of *Brasema* collected in Hungary were received among material sent on loan from CTPC. The two females range in length from about 2.3–2.75 mm and closely match the remaining parts of the examined syntype of *B. kim* in structure and colour except that the larger female has the meso- and metatibiae entirely pale whereas the smaller female has all the tibiae much more distinctly and extensively dark, indicating intraspecific variation in this feature. At least the larger female has the inner margin of the tegula yellowish similar to the *B. kim* syntype. The apparent length of the ovipositor sheaths is only 0.23× the length of the metatibia and, as to be expected from a female of *Brasema*, the sheaths are not banded but are dark basally and paler apically. Both females have the scrobal depression bright reddish-violaceous, which may well be what Nikol'skaya (1952) referred to as the frons being violet. Based on these observations, we conclude that *B. stenus* could be a junior synonym of *B. kim*, but without examining type material of the former name or studying European *Brasema* in detail we do not formally propose the synonymy at this time.

Pteromalidae: Pteromalinae

Pteromalus puparum (Newport) n. comb.

Eupelmus puparum Newport, 1840: 240. Syntypes, ♀ & ♂, depository unknown. Type data: England; reared from *Noctua* (Lepidoptera) pupae.
Pteromalus puparum (Newport), *nec Pteromalus puparum* (L.) 1758: 567.

Remarks. Newport (1840) described *Eupelmus puparum* based on about 300 specimens of both sexes that he reared from two pupae identified as *Noctua* L. (Lepidoptera). The large number of individuals reared from only two pupae indicates it is not a *Eupelmus* or a eupelmid. Further, although the descriptions are not detailed, the mandibles are stated as being quadridentate and the "sting" as being concealed in females, which further shows it

certainly is incorrectly classified in *Eupelmus*. The number of specimens reared from the two pupae might suggest that it could be some polyembryonic species, such as a species of *Copidosoma* Ratzeburg (Encyrtidae). However, *Copidosoma* has tridentate mandibles. Further, although some species have 11-segmented antennae if the clava is segmented, encyrtids lack a differentiated anellus, whereas the antenna was described as having the "third basal joint very short". The described 11-segmented antenna more likely indicates the species was some gregarious member of Pteromalinae (Pteromalidae), assuming either that exact structure of the clava or anelli was not interpreted correctly (see below). Askew & Shaw (1997) gave a key to the pteromalid primary parasitoids of butterfly pupae in Western Europe. Four genera and five species were keyed, including two species of *Pteromalus* Swederus, *P. apum* (Retzius) and *P. puparum* (L.). It is unlikely that *E. puparum* Newport (1840) was either of these two species because he described the male abdomen as "brown, with a pale band at the base", whereas males of *P. apum* and *P. puparum* do not have the gaster light coloured basally. Females of two other species keyed, *Psychophagus omnivorous* (Walker) and *Coelopisthia caledonica* Askew, have an almost circular gaster rather than the described "ovate" gaster. Further, males of *C. caledonica* do not have a light coloured band on the gaster. The description might fit that of a *Dibrachys* Förster species, but unlike the description of *E. puparum* Newport, females do not have shorter antennae than males and it is unlikely that such a large number of individuals would have been reared from just two pupae. Among the above taxa, sexual dimorphism in flagellar structure is most noticeable in *Pteromalus*. We suspect the antenna was considered to be 11-segmented because the basal two anelli of the flagellum were interpreted as a single "very short" segment and only two segments were observed in the clava, the description stating "joints at apex scarcely distinguishable". As noted above, it is unlikely that *E. puparum* Newport is synonymous with *P. apum* or *P. puparum* (L.) because of male gastral colour pattern. We therefore newly transfer *E. puparum* to *Pteromalus* as a homonym, but not as a synonym of *Pteromalus puparum* (L.). We do not provide a replacement name at this time in case the true identity of *P. puparum* (Newport) **n. comb.** can be determined more definitively in the future.

Of uncertain family and generic identity

Ceraphron brachynterae Schwägrichen *incertae sedis*

Ceraphron brachynteri Schwägrichen, 1835: 164–165. Syntypes, ♀ & ♂, depository unknown. Type data: Germany, reared from *Thecodiplosis brachyntera* (Thomson) (Diptera: Cecidomyiidae).
Calliceras brachynteri; Kieffer, 1914: 100.
Ceraphron brachynterae; Dessart & Cancemi, 1995: 41 (justified emendation).
Eupelmus brachynterae; Vidal, 2001: 59.

Remarks. Schwägrichen *in* Schwägrichen & Zimmer (1835) originally described this species in Ceraphronidae (Ceraphronoidea). However, the illustrated wing venation (Schwägrichen & Zimmer 1835, figs 16, 19–21) is of a chalcidoid because the stigmal vein is straight and subequal in length to the marginal vein rather than curved and much longer than the marginal vein. Further, the stigmal vein has a distinct stigma and uncus and the fore wing has traces of a basal fold and mediocubital fold (Schwägrichen & Zimmer 1835, figs 16, 21). Vidal (2001) formally transferred the species to *Eupelmus* based on its listing under *Eupelmus* in John Noyes's Universal Chalcidoidea Database (Stefan Vidal, Georg-August Universität Göttingen, Germany; pers. comm.). Noyes's placement of *C. brachynterae* in Eupelmidae probably was influenced by the figures of the antennae (Schwägrichen & Zimmer 1835, figs 17, 22). These show seven funicular segments and therefore resemble the antennae of many species of Eupelminae, particularly those of females because of the elongate-slender scape. Schwägrichen & Zimmer (1835, fig. 16) also illustrated the dorsal habitus of a purported male that could easily be interpreted as a male of some species of Eupelminae because of its pteromalid-like appearance. However, Schwägrichen & Zimmer (1835, figs 19, 20) provided two lateral habitus drawings of females. In the two drawings, the mesosoma is obliquely higher than long rather than obviously longer than high (fusiform), which is one of the most characteristic features of female Eupelminae. The only way *C. brachynterae* could be a eupelmid is if only males were present. This seems very unlikely based on the posteriorly tapered, lanceolate gasters in figures 19 and 20. The sex of the wings illustrated in figure 21 is not stated explicitly, but based on relative length to width ratios (*cf* figures 16, 19–21) it is almost certainly a more detailed illustration of the wings of a male rather than of a female. Figure 21 clearly shows the fore wing is completely setose, lacking the broad speculum that is diagnostic of *Eupelmus* males. The lack of a

speculum is also indicated in the somewhat less detailed drawing of the male habitus (Schwägrichen & Zimmer 1835, fig. 16). Regardless, both sexes of *Eupelmus* have the marginal vein obviously longer than the stigmal vein, rather than the two being subequal in length as is illustrated.

Skuhravý & Thuróczy (2007) summarized the known parasitoids reared from *Thecodiplosis brachyntera* (Thomson). Non-chalcidoids include species of Ceraphronidae as well as *Platygaster compressicornis* (Thomson) (Platygastroidea: Platygasteridae: Platygasterinae) and a single rearing of an unidentified species of Scelioninae (Platygasteridae). Platygasterinae typically have a 10-segmented antenna with seven funicular segments and females have a tapered, often somewhat posteroventrally curved gaster similar to that illustrated by Schwägrichen in his figure 20, but lack wing venation. Individuals of Scelioninae have a wing venation similar to typical chalcidoids, but not a 10-segmented antenna. The known chalcidoid parasitoids of *T. brachyntera* include *Pseudencyrtus idmon* (Walker) (Encyrtidae), species of *Torymus* Dalman (Torymidae), and species of four genera of Eulophidae and six genera of Pteromalidae. Based on the figures in Schwägrichen & Zimmer (1835), *C. brachynterae* could not be an encyrtid, eulophid or torymid. Further, the genera of Pteromalidae known from *T. brachyntera* are all characterized by a flagellum with five or six funicular segments and three or two anelli, respectively. Possession of seven funiculars is quite rare, at least within Pteromalinae. Of such taxa, *Hyperimerus corvus* (Walker) has completely setose fore wings and venation with the stigmal vein about as long as the marginal vein and a long postmarginal vein similar to the wings illustrated by Schwägrichen (1835). However, *H. corvus* does not have as elongate funiculars as illustrated by Schwägrichen & Zimmer (1835) and it is associated with Neuroptera (Noyes 2014) and Psyllidae (Hemiptera) (Bouček & Rasplus 1991) rather than Cecidomyiidae. Consequently, the illustrations provided are insufficient to place *C. brachynterae* confidently to species, genus or family. This could be because Schwägrichen & Zimmer (1835) had more than a single species represented in the rearing. The female in figure 19 has the scape apparently inserted at or slightly above the middle of the head, but at least with its apex extending conspicuously above the level of the vertex. The antennae and legs also appear to be uniformly light-coloured similar to the illustrated male. However, the female in his figure 20 appears to have the scape inserted lower on the face, possibly at about the ventral third, but at least with the apex of the scape not extending beyond the level of the scape, and the legs darker than either the other female or male. The fact that Schwägrichen & Zimmer (1835) included illustrations of two females rather than just one suggests that Schwägrichen was aware of variation within the specimens, which could indicate the presence of more than one species. As noted above, the gaster of the female in his figure 20 is reminiscent of a *Platygaster*. It is possible that Schwägrichen & Zimmer (1835) simply used the wing venation noted for males for the female illustrations or at least that the venation of the female represented in figure 19, a possible chalcidoid, was used for the female represented in figure 20. If so, figure 20 could be of a female *Platygaster*, a primary parasitoid of *T. brachyntera*, whereas figures 16 and 19 could be of a male and female of one or even two different species of some chalcidoid hyperparasitoid. If figure 20 is a female *Platygaster*, this would indicate the antennae are inserted at the oral margin in the figure, and that the drawings of the antennae in figures 17 and 22, which have comparatively elongate-slender scapes, are both of a *Platygaster* female. However, none of this supposition can be proven until original material of Schwägrichen & Zimmer (1835) is discovered. For this reason we consider *Ceraphron brachynterae* as an unrecognized name.

Eupelmus Dalman

Eupelmus Dalman, 1820: 136, 180. Type species: *Eupelmus memnonius* Dalman, subsequently designated by Westwood, 1839: 72.

Macroneura Walker, 1837: 353−354. Type species: *Macroneura maculipes* Walker (= *Ichneumon vesicularis* Retzius), by monotypy; synonymy by Giraud, 1863: 1270 (through inference) and Gibson, 1995: 204.

Macronevra; Blanchard, 1840: 273. Misspelling of genus name.

Holceupelmus Cameron, 1905: 316−317. Type species: *Holceupelmus bifasciatus* Cameron, by monotypy; synonymy by Bouček, 1976: 353.

Charitopella Crosby, 1909: 85. Type species: *Charitopella setigera* Crosby, by monotypy; synonymy by Gibson, 1995: 198.

Bruchocida Crawford, 1913: 245−246. Type species: *Bruchocida vuilleti* Crawford, by original designation; synonymy by Bouček, 1988: 559.

Episolindelia Girault, 1914: 23. Type species: *Episolindelia varicolor* Girault (= *Roptrocerus testaceiventris* Motschulsky), by original designation; synonymy by Girault, 1915: 2.

Lindesonius Brèthes, 1916: 419. Type species: *Lindesonius cecidiptae* Brèthes, by monotypy; synonymy by Gibson, 1995: 198, 203.

Rafa Brèthes, 1916: 420. Type species: *Rafa albitarsis* Brèthes, by original designation; synonymy by De Santis, 1971: 57, 59.

Charitopodinus Bridwell, 1918: 486−487. Type species: *Eupelmus swezeyi* Crawford, by original designation; synonymy by Gibson, 1995: 198.

Eupelmella Masi, 1919: 306−307. Type species: *Eupelmus degeeri* Dalman (= *Ichneumon vesicularis* Retzius), by monotypy and original designation; synonymy by Gibson, 1995: 198.

Lepideupelmus Timberlake, 1926: 28. Type species: *Eupelmus setiger* Perkins, by original designation; synonymy by Gibson, 1995: 198.

Neosolindenia Gourlay, 1928: 370. Type species: *Neosolindenia cyanea* Gourlay, by monotypy; synonymy by Bouček, 1988: 559.

Fanamokala Risbec, 1960: 130. Type species: *Fanamokala perineti* Risbec, by monotypy; synonymy by Fusu *et al*., 2015: 473–474.

Macroneura (*Euronmacra*) Kalina, 1981: 92, 102. Type species: *Eupelmus schmiedeknechti* Ruschka, by original designation; synonymy by Gibson, 1995: 198.

Cocceupelmus Kalina, 1984: 14−16. Type species: *Cocceupelmus ceroplastae* Kalina, by monotypy and original designation; synonymy by Gibson, 1995: 198.

Eupelmus (*Episolindelia*); Gibson, 1995: 201. Change of status.

Eupelmus (*Eupelmus*); Gibson, 1995: 202. Change of status.

Eupelmus (*Macroneura*); Gibson, 1995: 204. Change of status.

Synonymy. The above synonymy is taken mostly from Gibson (2011). It differs by inclusion of *Fanamokala* Risbec and exclusion of *Propelma* Trjapitzin as synonyms. *Propelma* was described from Baltic amber and synonymized under *Eupelmus* by Gibson (1995). However, subsequent examination of the holotype proved the taxon to be an extinct genus of Neanastatinae (Gibson 2013).

Recognition. Females of *Eupelmus* can be differentiated from those of other genera using the key to world genera of Eupelminae by Gibson (1995). Females are recognized by the mesotibia lacking an oblique groove apically between the base of the tibia and the base of the tibial spur (Gibson 1995, *cf* fig. 329 with figs 333–335) in combination with the syntergum being deeply, omega-like (Ω) emarginate posteriorly and with its dorsal surface almost always being extremely short anterior to the emargination (e.g. Figs 11b, 46f, 99g, h) [extensive dorsal surface anterior to anal plate in a few species considered secondarily derived based on otherwise derived structure of syntergum, including anal plate faced dorsally and superficially more medial in position because posterolateral margins of syntergum elongated posterior to anal plate (e.g. Gibson 1995, fig. 320)]. The penultimate gastral tergite (Gt6) is usually also divided medially by a deep emargination and/or a hyaline line (e.g. Figs 46d, f, 99g, h), though this structure is often concealed under a posteriorly protuberant Gt5 that extends to or near the apex of Gt6 (e.g. Figs 11b, 123h; Gibson 1995, *cf* figs 323, 324). Some species of *E*. (*Episolindelia*) have a more exposed, apically tapered (triangular) Gt6, though usually there is at least some indication of a mediolongitudinal line of weakness or sulcus depending on state of preservation (e.g. Gibson 1995, figs 320–322).

Regionally, the genus with females morphologically most similar to those of *Eupelmus* is *Reikosiella* Yoshimoto. *Reikosiella* females have a similarly omega-like emarginate syntergum, but the transverse penultimate gastral tergum is neither medially divided nor concealed under Gt5 and usually the dorsal surface of the syntergum is conspicuously longer (Gibson 1995, figs 309–313) than for *Eupelmus* females (Gibson 1995, figs 320–324). Fusu (2013) revised the Palaearctic species of *Reikosiella*.

In his key to genera based on males, Gibson (1995) used a single feature to differentiate *Eupelmus* males from all genera other than *Xenanastatus* Bouček (Old World tropics), the presence of a distinct bare band (speculum) dorsally behind the parastigma (Gibson 1995, fig. 491) (e.g. Figs 3g, 12f). He also gave the presence of a conspicuously longer, curved seta on the gena near the base of the mandible (Gibson 1995, figs 403, 404) (e.g. Figs 12b, 63b) as a secondary recognition feature for some male *Eupelmus*. However, males of *E. orthopterae* not only have similarly short genal setae (Fig. 81b) they also lack a speculum, having completely setose fore wings (Fig. 81e, h) (the unknown males of *E. fasciatus* likely have similar features). Further, the only known male of *E. ceroplastae* has a very slender speculum (Fig. 21f) that resembles a linea calva of females (Fig. 20g, i), though similar to a speculum it extends posteriorly to the mediocubital fold rather than being closed posterobasally by setae. Other regional males of *Eupelmus* are distinguished by a much broader speculum, even though this sometimes can be partly subdivided by setae (e.g. *E. peculiaris*, Fig. 83e, and *E. pini*, Fig. 86f). Further, males of all other species except *E. infimbriatus* (Fig. 41c), *E. peculiaris* (Fig. 83f) and *E. saharensis* (Fig. 98d) have at least one obviously longer or differentiated genal seta (e.g. Figs 9d, 12b).

Subgeneric classification. The three subgenera recognized in *Eupelmus* by Gibson (1995) are based primarily on female morphology and more likely represent grades of structure than monophyletic lineages. Recognition of *E.* (*Eupelmus*) + *E.* (*Macroneura*) almost certainly renders *E.* (*Episolindelia*) paraphyletic. Females of the former two subgenera share apomorphic mesotarsal peg patterns and males of at least some species share what likely are apomorphic setal patterns of the pedicel, flagellum and gena (see further below) that are not possessed by species of *E.* (*Episolindelia*). Females of *E.* (*Episolindelia*) are macropterous, have a V- to U-shaped, posteriorly protuberant metanotum that conceals or at least extensively overlaps a similarly shaped propodeal plical depression, and a single uniform row of white to somewhat reddish pegs on either side of the basitarsus of the middle leg. These are considered to be groundplan features for *Eupelmus* based on comparison with other eupelmine genera (Gibson 1995). Consequently, *E.* (*Episolindelia*) likely comprises a group of more basal species within *Eupelmus* prior to the evolution of the derived structures in the common ancestor of species classified in *E.* (*Eupelmus*) and *E.* (*Macroneura*). Females of *E.* (*Eupelmus*) have a non-protuberant or at least less protuberant metanotum so that the V- to U-shaped propodeal plical depression is mostly to completely visible (e.g. Figs 2e, 8c, 10f, 15d) and structure of the propodeum is intermediate between those characteristic of *E.* (*Episolindelia*) and *E.* (*Macroneura*). Further, those females of *E.* (*Eupelmus*) and *E.* (*Macroneura*) possessing mesotarsal pegs usually have these dark and typically arranged in two rows (e.g. Figs 2h, 6g, 11a) or at least differentiated in length to form a serrate row on either side of the basitarsus (e.g. *cf* Fig. 86g, h). Females assigned to *E.* (*Macroneura*) are all brachypterous and have similar apomorphic structures of the metanotum and propodeum (see Gibson 1995), which support the monophyly of this subgenus. A very few species with brachypterous females that have plesiomorphic structures of the metanotum and propodeum are classified in *E.* (*Eupelmus*). It is not yet shown whether female brachyptery arose independently in *E.* (*Eupelmus*) and *E.* (*Macroneura*) or whether those brachypterous species classified in *E.* (*Eupelmus*) are more closely related to those in *E.* (*Macroneura*) and therefore indicate *E.* (*Eupelmus*) is paraphyletic. However, shared features between *E.* (*Eupelmus*) *atropurpureus* males and those of *E.* (*Macroneura*) *vesicularis* (Retzius) suggest brachyptery evolved only once in *Eupelmus* (see further below).

Unlike females, males cannot be assigned to subgenus using only one or two differential features. For this reason our key to males does not include initial couplets to differentiate the subgenera. However, males classified in *E.* (*Episolindelia*) differ from those of *E.* (*Macroneura*) and almost all *E.* (*Eupelmus*) males by the following: 1) genal setae posterior to malar sulcus short or, if long, then of similar length (lower face sometimes with region of longer setae between torulus and malar sulcus and then with similarly long setae on gena posterior to malar sulcus); 2) pedicel ventrally lacking row of distinctly hook-like curved setae (usually with three or fewer straight to uniformly curved setae, but if rarely with four long setae then at most only basal seta obviously hook-like curved); and 3) fu1–fu3 always lacking differentiated setae ventrally. As noted above, males of *E. orthopterae* and likely *E. fasciatus* lack the primary differentiating feature for the genus, a speculum, and are similar to *E.* (*Episolindelia*) males in the above three features. Males of *E. infimbriatus* and *E. saharensis* also resemble *E.* (*Episolindelia*) males in the above three features but have an obvious speculum. The male of *E. ceroplastae* is also atypical in having an abnormally slender speculum (Fig. 21f) and not having apically hook-like setae on the pedicel (Fig. 21e), though it does appear to have a couple of somewhat longer and stouter dark setae on the gena compared to those on the lower face (Fig. 21c). Males of other species of *E.* (*Eupelmus*) and those of *E.* (*Macroneura*) have a differentiated row of at least three apically hook-like curved setae ventrally on the pedicel (e.g. Figs 3c, 9g, 14d). They also have one or rarely more setae on the gena that are quite distinctly differentiated in length so as to be more conspicuous than the surrounding or facial setae (e.g. Figs 12b, 63b). Further, some males of *E.* (*Eupelmus*) with either a clavate or filiform flagellum have regions of differentiated setae ventrally on fu1–fu3 (e.g. Figs 12d, f, 30e, 52b, d, 65h, 70e, 121f). Males of known species of *E.* (*Macroneura*) have a relatively gracile-filiform flagellum (e.g. Fig. 12g), and although presence or absence of modified setae ventrally on fu1–fu3 is unrecorded for most species, they are possessed by some species such as *E.* (*Macroneura*) *vesicularis* (Fig. 12h) and *E.* (*Macroneura*) *falcatus* (Nikol'skaya). A few regional males considered likely to be males of *E.* (*Macroneura*), though not yet definitely associated with females, have a subclavate flagellum, including sometimes subquadrate apical funiculars, and these lack differentiated regions of setae ventrally on fu1–fu3. Males of *E.* (*Episolindelia*) either have a clavate or gracile-filiform flagellum, but none are known to have differentiated setae ventrally on any funicular. Consequently, features of both sexes indicate recognition of *E.* (*Eupelmus*) + *E.* (*Macroneura*) renders *E.* (*Episolindelia*) paraphyletic and subgenera probably should not be recognized in *Eupelmus* if based strictly on phylogenetic principles.

No single feature distinguishes males of *E.* (*Macroneura*) from those of *E.* (*Eupelmus*), though males of *E.* (*Macroneura*) have at least the basal half of the meso- and metatibiae pale whereas most *E.* (*Eupelmus*) males have

the tibiae more extensively darkened. Males of some *E*. (*Macroneura*) species also have at least a slight brownish tinge behind the marginal vein, whereas those *E*. (*Eupelmus*) males with an elongate-filiform flagellum that might be confused with *E*. (*Macroneura*) males always have hyaline fore wings. Except as noted above, males of *E*. (*Macroneura*) also have a filiform flagellum with fl2–fl8 (i.e., excluding anellus) each at least 1.5× as long as wide (except for *E. vesicularis*, Fig. 12h), and except for *E. falcatus* the tegulae variably dark brown (see further under *E. microzonus*). Males of *E*. (*Eupelmus*) sometimes have a clavate flagellum or sometimes one that is more robust-filiform with comparatively shorter flagellomeres, and more species have a white to yellowish tegula. Males of *E*. (*Macroneura*) also have the frontovertex comparatively finely sculptured, coriaceous to alutaceous, whereas *E*. (*Eupelmus*) males sometimes have a more coarsely reticulate frontovertex. However, most females of *E*. (*Eupelmus*) *atropurpureus* are brachypterous and males have a relatively gracile-filiform flagellum (Fig. 12a) with differentiated setae on fu1–fu3 (Fig. 12d) as well as tibiae that basally are widely pale (Fig. 12a). Males are thus very similar to males of *E*. (*Macroneura*) *vesicularis*. Males of *E. atropurpureus* are distinguished by their entirely dark scape (Fig. 12b) compared to the outer, ventral, longitudinal sensory region of the scape being pale in *E. vesicularis* males (Fig. 12g). However, the brachyptery of females and those features of males resembling *E. vesicularis* might indicate *E. atropurpureus* is more closely related to species of *E*. (*Macroneura*) than to other species of *E*. (*Eupelmus*). If so, inclusion of *E. atropurpureus* in *E*. (*Eupelmus*) renders this subgenus paraphyletic relative to *E*. (*Macroneura*).

List of described Palaearctic species of *Eupelmus*[1]

Eupelmus (*Episolindelia* Girault 1914)

E. (*Episolindelia*) *australiensis* (Girault 1913) (Gibson 1995)
E. (*Episolindelia*) *cavifrons* Bouček (1965b) **n. stat.** [subgeneric status based on examination of female holotype by LF]
E. (*Episolindelia*) *cicadae* Giraud (1872) **n. stat.** [subgeneric status based on examination of female syntype]
E. (*Episolindelia*) *clavicornis* Askew *in* Askew & Nieves-Aldrey (2000) **n. stat.** [subgeneric status based on examination of female holotype by LF and female paratype by GG]
E. (*Episolindelia*) *fuscipennis* Förster (1860) (Vikberg 2008)
E. (*Episolindelia*) *hartigi* Förster (1841) (Gibson 1995)
E. (*Episolindelia*) *juniperinus juniperinus* Bolívar y Pieltain (1934) **n. stat.** [subgeneric status based on identified specimens]
E. (*Episolindelia*) *juniperinus thuriferae* Askew *in* Askew & Nieves-Aldrey (2000) **n. stat.** [subgeneric status based on examination of female holotype by LF and female paratype by GG]
E. (*Episolindelia*) *linearis* Förster (1860) (Fusu 2008)
E. (*Episolindelia*) *mediterraneus* Kalina (1988) **n. stat.** [subgeneric status based on examination of female holotype and one paratype by GG]
E. (*Episolindelia*) *moroderi* Bolívar y Pieltain (1934) **n. stat.** [subgeneric status based on examination of female holotype by LF]
E. (*Episolindelia*) *pallicornis* Gijswijt (1993) **n. stat.** [subgeneric status based on examination of female paratypes]
E. (*Episolindelia*) *pullus* Ruschka (1921) **n. stat.** [subgeneric status based on examination of female holotype by LF]
E. (*Episolindelia*) *testaceiventris* (Motschulsky, 1863) **n. stat.** [subgeneric status based on identified specimens.]

Eupelmus (*Eupelmus*) Dalman 1820

E. (*Eupelmus*) *acinellus* Askew *in* Ribes Escolà & Askew (2009) (Al khatib *et al.* 2014)
E. (*Eupelmus*) *adustus* Gibson & Fusu **n. sp.**
E. (*Eupelmus*) *africanus* Kalina (1988) **n. stat.**
E. (*Eupelmus*) *angustifrons* Gibson & Fusu **n. sp.**
E. (*Eupelmus*) *annulatus* Nees (1834) (Askew & Nieves-Aldrey 2000)
E. (*Eupelmus*) *atropurpureus* Dalman (1820) (Askew & Nieves-Aldrey 2000)
E. (*Eupelmus*) *azureus* Ratzeburg (1844) (Al khatib *et al.* 2014)
E. (*Eupelmus*) *bicolor* Gibson & Fusu **n. sp.**
E. (*Eupelmus*) *brachypterus* Fusu & Gibson **n. sp.**
E. (*Eupelmus*) *brachystylus* Gibson & Fusu **n. sp.**
E. (*Eupelmus*) *brachyurus* Fusu & Gibson **n. sp.**
E. (*Eupelmus*) *bulgaricus* Kalina (1988) **n. stat.**
E. (*Eupelmus*) *ceroplastae* (Kalina 1984) (Gibson 1995)
E. (*Eupelmus*) *cerris* Förster (1860) (Askew & Nieves-Aldrey 2000)
E. (*Eupelmus*) *claviger* Nikol'skaya (1952) **n. stat.**

1. Reference following that of original description responsible for subgeneric status.

E. (*Eupelmus*) *confusus* Al khatib *in* Al khatib *et al.* (2015)
E. (*Eupelmus*) *curvator* Yang (1996) **n. stat.**
E. (*Eupelmus*) *fasciatus* Gibson & Fusu **n. sp.**
E. (*Eupelmus*) *flavicrurus* Yang (1996) **n. stat.**
E. (*Eupelmus*) *formosae* Ashmead (1904) (Gibson 2011)
E. (*Eupelmus*) *fulgens* Nikol'skaya (1952) **n. stat.**
E. (*Eupelmus*) *fulvipes* Förster (1860) (Askew & Nieves-Aldrey 2000)
E. (*Eupelmus*) *gelechiphagus* Gibson & Fusu **n. sp.**
E. (*Eupelmus*) *gemellus* Al khatib *in* Al khatib *et al.* (2015)
E. (*Eupelmus*) *hayei* Gibson & Fusu **n. sp.**
E. (*Eupelmus*) *infimbriatus* Gibson & Fusu **n. sp.**
E. (*Eupelmus*) *iranicus* Kalina (1988) **n. stat.**
E. (*Eupelmus*) *iris* Fusu & Gibson **n. sp.**
E. (*Eupelmus*) *janstai* Delvare & Gibson *in* Al khatib *et al.* (2015)
E. (*Eupelmus*) *kalinai* Gibson & Fusu **n. name** for *E.* (*E.*) *algiricus* Kalina (1988) **n. stat.** *nec E.* (*Macroneura*) *algiricus* (Kalina 1981)
E. (*Eupelmus*) *kamijoi* Gibson & Fusu **n. sp.**
E. (*Eupelmus*) *kiefferi* De Stefani 1898 (Al khatib *et al.* 2014)
E. (*Eupelmus*) *lanceolatus* Gibson & Fusu **n. sp.**
E. (*Eupelmus*) *levis* Nikol'skaya (1952) **n. stat.**
E. (*Eupelmus*) *longicalvus* Al khatib & Fusu *in* Al khatib *et al.* (2015)
E. (*Eupelmus*) *longicaudus* Kalina 1988 **n. stat.**
E. (*Eupelmus*) *luteipes* Fusu & Gibson **n. sp.**
E. (*Eupelmus*) *magdalenae* Fusu & Gibson **n. sp.**
E. (*Eupelmus*) *martellii* Masi (1941) (Gibson 2011)
E. (*Eupelmus*) *matranus* Erdős (1947) (Askew & Nieves-Aldrey 2000)
E. (*Eupelmus*) *mehrnejadi* Gibson & Fusu **n. sp.**
E. (*Eupelmus*) *melanostylus* Gibson & Fusu **n. sp.**
E. (*Eupelmus*) *memnonius* Dalman (1820) (Gibson 1995)
E. (*Eupelmus*) *microzonus* Förster (1860) (Askew & Nieves-Aldrey 2000)
E. (*Eupelmus*) *minozonus* Delvare *in* Al khatib *et al.* (2015)
E. (*Eupelmus*) *mirabilis* Kalina (1988) **n. stat.**
E. (*Eupelmus*) *nitidus* Nikol'skaya (1952) **n. stat.**
E. (*Eupelmus*) *opacus* Delvare *in* Al khatib *et al.* (2015)
E. (*Eupelmus*) *orientalis* (Crawford, 1913) **n. stat.**
E. (*Eupelmus*) *orthopterae* (Risbec 1951) (Fusu *et al.* 2015)
E. (*Eupelmus*) *peculiaris* Narendran *in* Narendran *et al.* (2011) **n. stat.**
E. (*Eupelmus*) *phragmitis* Erdős (1955a) (Fusu 2009)
E. (*Eupelmus*) *pini* Taylor (1927) (Gibson 2011)
E. (*Eupelmus*) *pistaciae* Al khatib *in* Al khatib *et al.* (2015)
E. (*Eupelmus*) *priotoni* Delvare *in* Al khatib *et al.* (2015)
E. (*Eupelmus*) *punctatifrons* Fusu & Gibson **n. sp.**
E. (*Eupelmus*) *purpuricollis* Fusu & Al khatib in Al khatib *et al.* (2015)
E. (*Eupelmus*) *saharensis* Kalina (1988) **n. stat.**
E. (*Eupelmus*) *setosus* Fusu & Gibson **n. sp.**
E. (*Eupelmus*) *simizonus* Al khatib *in* Al khatib *et al.* (2015)
E. (*Eupelmus*) *splendens* Giraud (1872) (Askew & Nieves-Aldrey 2000)
E. (*Eupelmus*) *stenozonus* Askew *in* Askew & Nieves-Aldrey (2000)
E. (*Eupelmus*) *stramineipes* Nikol'skaya (1952) (Gibson 2011)
E. (*Eupelmus*) *tachardiae* (Howard) *in* Howard & Ashmead (1896) **n. stat.**
E. (*Eupelmus*) *tanystylus* Gibson & Fusu **n. sp.**
E. (*Eupelmus*) *tetrazostus* Gibson & Fusu **n. sp.**
E. (*Eupelmus*) *tibicinis* Bouček (1963) (Al khatib *et al.* 2014)
E. (*Eupelmus*) *tremulae* Delvare *in* Al khatib *et al.* (2015)
E. (*Eupelmus*) *tryapitzini* Kalina (1988) **n. stat.**
E. (*Eupelmus*) *urozonus* Dalman (1820) (Gibson 1995)
E. (*Eupelmus*) *vanharteni* Fusu & Gibson **n. sp.**
E. (*Eupelmus*) *vindex* Erdős (1955b) (Fusu 2008)
E. (*Eupelmus*) *vuilleti* (Crawford 1913) (Fusu 2008)
E. (*Eupelmus*) *weilli* Fusu & Gibson **n. sp.**
E. (*Eupelmus*) *xenium* Fusu & Gibson **n. sp.**
E. (*Eupelmus*) *zebra* Fusu & Gibson **n. sp.**

***Eupelmus* (*Macroneura* Walker 1837)**

E. (*Macroneura*) *algiricus* (Kalina 1981) **n. comb.**, **n. stat.**
E. (*Macroneura*) *aseculatus* (Kalina 1981) (Askew & Nieves-Aldrey 2000)
E. (*Macroneura*) *coleophorae* (Kalina 1981) **n. comb.**, **n. stat.**
E. (*Macroneura*) *falcatus* (Nikol'skaya 1952) (Askew & Nieves-Aldrey 2000)
E. (*Macroneura*) *impennis* (Nikol'skaya 1952) **n. comb.**, **n. stat.**
E. (*Macroneura*) *karschii* Lindeman (1887) **n. stat.**
E. (*Macroneura*) *longicornis* (Kalina 1981) **n. comb.**, **n. stat.**
E. (*Macroneura*) *maculatus* (Ferrière 1954) (Askew & Nieves-Aldrey 2000)
E. (*Macroneura*) *muellneri* Ruschka (1921) (Askew & Nieves-Aldrey 2000)
E. (*Macroneura*) *pleuratus* (Kalina 1981) **n. comb.**, **n. stat.**
E. (*Macroneura*) *schmiedeknechti* Ruschka (1921) **n. stat.**
E. (*Macroneura*) *seculatus* (Ferrière 1954) (Askew & Nieves-Aldrey 2000)
E. (*Macroneura*) *sugonyaevi* (Kalina 1981) **n. comb.**, **n. stat.**
E. (*Macroneura*) *vesicularis* (Retzius 1783) (Gibson 1995)

Key to subgenera and Palaearctic species of *E.* (*Eupelmus*) based on females

1 Brachypterous, apex of fore wing extending at most to second gastral tergite (Figs 10c–e, 16a, b) 2
- Macropterous, apex of fore wing extending to apex of gaster 4
2(1) Metanotum transverse with convex dorsellum covering apex of scutellum; propodeum with broadly V- to U-shaped plical depression medially (Figs 10f, 16e); pronotal collar without transverse ridge (Figs 10f, 16e) . . . . . ***E.* (*Eupelmus*)** 3
- Metanotum large, flattened, and more-or-less concave posterior to apex of scutellum; propodeum very strongly transverse medially and with at most a flat, inconspicuously differentiated plical region (Gibson 1990, figs 18, 20–23); pronotal collar with transverse ridge or crest (Gibson 1990, fig. 34) . . . . . ***E.* (*Macroneura*)** (see Kalina 1981 for key to species)
3(2) Body, including usually most of legs and ovipositor sheaths, dark with only quite obscure, somewhat violaceous metallic luster (Fig. 10b–f), except often blue to greenish on frons along inner orbits (Fig. 10a); fore wing extending over base of gaster only slightly, flat and slightly emarginate to broadly rounded apically, and with basal cell bare and disc uniformly setose (Fig. 10c–e, g); venation with stv at a right angle to mv and pmv short to rudimentary (Fig. 10g) . . . ***E. atropurpureus* Dalman** (in part)
- Body with legs and ovipositor sheaths dark but head with evident metallic luster, variably green to coppery except frontovertex extensively bluish-green to blue and occipital margin with transverse blue to violet stripe (Fig. 16c, d), and mesosoma similar in colour to head but less brightly coloured (Fig. 16e); fore wing longer, extending at least to posterior margin of first gastral tergite (Fig. 16a), with subparallel margins and acutely rounded apically, and with basal cell setose and disc with evident linea calva (Fig. 16f); venation with stv at acute angle to comparatively long pmv (Fig. 16f) . . . . . ***E. brachypterus* Fusu & Gibson n. sp.**
4(1) Dorsellum posteriorly protuberant such that posterior margin essentially contiguous with emarginate anterior margin of propodeum; mesotarsus with yellowish to reddish pegs, the pegs often almost concolourous with tarsomeres and almost always in single even row on either side of tarsomeres; mesotibia apically with at most needle-like spines; fore wing with pmv more than 1.5× length of stv and if very rarely infuscate then completely infuscate . . . . . ***E.* (*Episolindelia*)**
- Dorsellum with posterior margin usually almost transverse though sometimes slightly protuberant over variably distinct V- to U-shaped plical depression (e.g. Figs 2e, 8c, 46e, 68d, 82g); mesotarsus sometimes densely setose without pegs ventrally (Figs 42f, 46g), but when present pegs usually dark and usually contrasting with whitish tarsomeres (e.g. Figs 2h, 6g, 11a), and basitarsus usually with pegs partly differentiated into double row or asymmetrically arranged on either side (e.g. Figs 2h, 35h, 86h); mesotibia apically usually with row of pegs similar to those on mesotarsus (e.g. Figs 2h, 6g, 35h); fore wing with pmv at most 1.5× length of stv (except some *E. memnonius*) and sometimes with infuscate bands or darkly infuscate only beyond level of base of parastigma or between parastigma and apex of pmv . . . . . ***E.* (*Eupelmus*)** 5
5(4) Middle leg without mesotibial apical pegs, but mesotarsus ventrally with distinct pegs (e.g. Figs 27h, 40d, 82h) 6
- Middle leg with mesotibial apical pegs, the pegs usually dark and contrasting distinctly with tibia (e.g. Figs 2h, 8d, 69g), but if yellowish to orange and only obscurely differentiated from tibia then mesotarsus ventrally without pegs (Figs 5h, 42f, 46g)..19
6(5) Flagellum bicoloured, at least fl1 (anellus) and fl2 brown and at least fl6–fl8 white (Fig. 82c); prepectus entirely, conspicuously setose (Fig. 82f); syntergum in dorsal view projecting V-like on either side of anal sclerite (Fig. 82j) . . . . . ***E. peculiaris* Narendran**
- Flagellum uniformly dark or at most with fl1 (anellus) white; prepectus often bare; syntergum not projecting on either side of anal sclerite, posteriorly flattened over sheaths to vertically truncate above sheaths 7
7(6) Fore wing without linea calva and distinctly bifasciate, with hyaline band having white setae behind about apical half of mv abruptly separating brownish-infuscate regions having dark setae behind parastigma and about basal half of mv, and behind stv and pmv (Figs 28f, g, 80i); mesosoma dark (Figs 28a, b, 80a–c); costal cell dorsally near leading margin with at most 4 setae apically, the setae not extending basally beyond parastigma 8
- Fore wing with linea calva and/or either hyaline or if variably infuscate then discal setae similarly dark in infuscate and more hyaline regions (Figs 15e, 19g, 27g, 62f); mesosoma sometimes distinctly bicoloured, mostly or entirely green dorsally but with one or more of prepectus, tegula and acropleuron yellowish to orangey-brown (Figs 15b–d, 19c–f); costal cell dorsally near leading margin usually with more numerous setae extending basally beyond parastigma 9
8(7) Ovipositor sheath uniformly dark, yellowish-brown to dark brown except often slightly paler apically (Fig. 28h); prepectus

with 1–8, though often inconspicuous setae (Fig. 28i) . . . . . ***E. fasciatus* Gibson & Fusu n. sp.**

- Ovipositor sheath with third valvula abruptly and extensively pale beyond dark second valvifer, though often darker brown along ventral margin and gradually darker brown apically (Fig. 80h); prepectus bare (Fig. 80g) . . . . . ***E. orthopterae* (Risbec)**

9(7) Mesoscutum with posteromedial depressed region usually mostly much smoother and shinier than convex part of medial lobe (Figs 62d, 102h), but at least inclined inner surface of lateral lobe much smoother if narrow band of sculpture extending mediolongitudinally to transscutal articulation (Fig. 19e); frons often almost polished (Figs 15a, 19b, 62a, 102f); fore wing often at least obscurely bifasciate (behind base of mv and often also behind stv) (Figs 19g, 62f, 102d), though sometimes similar to below (Fig. 15e); mesosoma sometimes quite distinctly bicoloured, mostly or entirely metallic green dorsally but with one or more of prepectus, tegula, acropleuron and axillae yellowish to orangey-brown (Figs 15b–d, 19c–f, 102b) [*splendens* group] 10

- Mesoscutum with posteromedial depressed region similarly meshlike coriaceous to reticulate as anteromedial convex region and scutellum; frons uniformly coriaceous to coriaceous-reticulate; fore wing hyaline to more-or-less uniformly infuscate from parastigma to wing apex; mesosoma dark with variably distinctly metallic green to bluish lusters except tegula sometimes bright yellow 13

10(9) Scutellar-axillar complex with axillae yellow, contrasting with green or at least dark scutellum (Fig. 19c–e) . . . . . ***E. bulgaricus* Kalina**

- Scutellar-axillar complex uniformly green (Figs 15d, 62d, 102h) 11

11(10) Fore wing with basal cell mostly bare behind smv except for a few setae basally (Fig. 15e, f); body conspicuously bicoloured with mesonotum bright green and pronotum (except paramedially), prepectus, tegula and acropleuron yellowish-orange (Fig. 15b–d) . . . . . ***E. bicolor* Gibson & Fusu n. sp.**

- Fore wing with basal cell entirely setose, though setae white and usually inconspicuous (Figs 62f, 102i); body sometimes with mesosoma more-or-less uniformly coloured or if conspicuously bicoloured similar to above then at least dorsal surface of pronotum greenish similar to mesonotum (Figs 62d, 102h). 12

12(11) Ovipositor sheath with third valvula about 0.8–1.0× length of metatibia and 1.2–1.3× length of mv (Fig. 102b, j); mesosoma sometimes distinctly bicoloured with acropleuron and/or lateral panel of pronotum, prepectus and tegula yellowish to orangey-brown in distinct contrast to much darker, metallic green mesonotum (Fig. 102b) . . . . . ***E. splendens* Giraud**

- Ovipositor sheath with third valvula about 0.5–0.7× length of metatibia and 0.7–1.0× length of mv (Fig. 62e); mesosoma similarly dark metallic green except sometimes tegula and/or prepectus (Fig. 62e). . . . . ***E. matranus* Erdős**

13(9) Ovipositor sheath uniformly dark or gradually paler apically, but very long with third valvula at least 3× length of mv (Fig. 68a, b); body, excluding legs, uniformly dark with at most slight greenish luster (Fig. 68a–e); fore wing hyaline (Fig. 68f) . . . . . ***E. memnonius* Dalman**

- Ovipositor sheath variable in colour, often abruptly pale beyond base or distinctly banded (dark-pale-dark), but at least apparent sheath length at most about 1.5× length of mv; body, excluding legs, sometimes with quite distinct metallic green luster or partly yellowish to orangey-brown; fore wing sometimes partly infuscate 14

14(13) Apparent length of ovipositor sheath slightly longer than metatibia and about 1.5× length of mv (Fig. 27d); head with interocular distance about 0.3× head width (Fig. 27a, b); legs with femora and tibiae mostly dark, the tibiae apically and knees narrowly pale (Fig. 27d). . . . . ***E. curvator* Yang**

- Apparent length of ovipositor sheath distinctly shorter than metatibia and at most as long as mv (Figs 24b, 40e, 55b, 84b, 106b); head with interocular distance at least 0.35× head width (Figs 40b, 55a, 84a, 106a); legs often more extensively light coloured, sometimes entirely or almost entirely pale (Fig. 106b). 15

15(14) Fore wing with marginal fringe absent beyond venation or at most present along posteroapical margin, and disc with white setae (Fig. 40f); propodeum with very broadly U-shaped plical depression extending to posterior margin, hence plical region linear medially posterior to depression (Fig. 40h); flagellum with anellus very small, but white (Fig. 40a, b); scrobal depression similarly finely meshlike as frontovertex (Fig. 40b). . . . . ***E. infimbriatus* Gibson & Fusu n. sp.**

- Fore wing with complete marginal fringe and disc with setae yellowish to yellowish-brown (Figs 24f, 55e, 84d); propodeum with V-shaped plical depression, often extending only about half distance to posterior margin such that distinct dorsal surface visible posterior to depression (Figs 24h, 84j, 106j); flagellum with anellus sometimes longer than wide, but at least similarly dark as rest of funicle; scrobal depression obviously more deeply punctate-reticulate than frontovertex (Figs 84a, 106a) . . . 16

16(15) Antenna with scape at least partly yellowish but flagellum brown; basal cell with inconspicuous white setae along mediocubital fold and apically, but mostly bare anteriorly behind smv (Fig. 24g); fore wing disc with distinct brownish infuscation from base of parastigma to about level of apex of pmv (Fig. 24f) . . . . . ***E. claviger* Nikol'skaya**

- Antenna with scape entirely dark (Figs 84g, h, 106i) and flagellum sometimes with clava distinctly lighter than funicle (Fig. 84g); basal cell completely, uniformly, similarly as setose as disc (Figs 55g, 84d); fore wing often uniformly hyaline (Figs 55e, 106b) [*stramineipes* group] 17

17(15) Fore wing dorsally with broad bare region (speculum) behind base of parastigma separating setae of basal cell and disc such that linea calva open basally (Fig. 55g) (with very short, inconspicuous setae over ventral surface of speculum); flagellum with fu1 obviously longer than wide and clava similarly dark as funicle (Fig. 55i); legs with pro- and metafemora extensively darkened, and mesofemur yellow; mv only about 2.3× length of stv . . . . . ***E. levis* Nikol'skaya**

- Fore wing dorsally with basal cell and disc uniformly setose except for linea calva (Fig. 84d); flagellum sometimes with fu1 transverse or clava sometimes white or at least obviously lighter than funicle (Fig. 84g); legs sometimes with all femora similarly yellow (Fig. 106b); mv sometimes much longer relative to stv 18

18(17) Flagellum with fu1 longer than wide and clava similarly dark as funicle (Fig. 106i); body generally bright green and legs with all femora yellow (Fig. 106b, f); tegula obviously lighter in colour than prepectus and variably distinctly bicoloured, narrowly opaque yellow along much of inner margin adjacent to mesoscutal margin and more hyaline-yellowish to yellowish-brown lat-

erally and apically (Fig. 106e). . . . . ***E. stramineipes* Nikol'skaya**

- Flagellum with fu1 transverse (Fig. 84g, h) and clava usually white or at least conspicuously lighter than funicle (Fig. 84g) (colour difference often not apparent if clava strongly collapsed); body, particularly mesosoma, darker green to bluish-green and legs usually variably extensively but obviously darkened (Fig. 84b, c); tegula sometimes similarly dark brown as prepectus but at least uniformly brownish-yellow to yellow . . . . . ***E. phragmitis* Erdős**

19(5) Head and body extensively covered with obvious though variably broadly flattened, white lanceolate setae (Figs 53b–e, 77a–d), including along outer orbit where setae directed anteriorly so as to be almost parallel with outer orbit (Fig. 53b); flagellum with reflective white setae on anellus and on at least following two funiculars contrasting with dark setae of other flagellomeres (Figs 53a, b, 77c) [*orientalis* group] 20

- Head and body often with setae white but hairlike or only inconspicuously lanceolate, including behind outer orbit where directed toward orbit at right or strongly oblique angle (e.g. Figs 123a, 126c); flagellum with uniformly dark setae 22

20(19) Head with elongate-lanceolate white setae on lower face and gena, but hairlike, dark setae above level of scrobal depression (Fig. 53a–e); mesonotum with elongate-lanceolate white setae except scutellar-axillar complex and most or all of convex part of anteromedial mesoscutal lobe with dark hairlike setae (Fig. 53e); head and mesosoma uniformly dark with dull reddish to coppery luster (Fig. 53a–e) . . . . . ***E. lanceolatus* Gibson & Fusu n. sp.**

- Head and mesonotum completely covered with comparatively broadly lanceolate white setae (Fig. 77a–d); head and at least acropleuron mesally with quite distinct metallic green luster (Fig. 77a–d) 21

21(20) Fore wing basal cell often with some brown setae basally (Figs 77g, 78a, d), though usually mostly covered with white to yellowish-white setae (Figs 77g, 78a) in contrast to dark brown setae beyond about level of middle of parastigma or base of mv, and often distinctly infuscate behind venation (Fig. 77e) (sometimes brown setae extending through much of basal cell, but at least separated from brown discal setae by yellowish-white to white setae apically in basal cell and basally on disc behind base of parastigma, Fig. 78d); mesotarsus sometimes with a 2/1 or 2/2 peg pattern on second tarsomere and/or third tarsomere without pegs (Fig. 78f) . . . . . ***E. orientalis* (Crawford)**

- Fore wing basal cell often with a few white setae basally (Figs 77h, 78b,c) though usually mostly or entirely covered with brownish setae (Figs 77h, 78b) similar to discal setae and hyaline or with only a slight yellowish to brownish tinge behind venation (Fig. 77f) (sometimes whitish setae extending apically within basal cell for variable extent, but at least apically with brown setae extending continuously onto disc except often for more-or-less circular isolated region of white setae behind parastigma, Fig. 78b, c); mesotarsus usually with at least a 3/3–5/5 peg pattern on second tarsomere of both legs and third tarsomere with at least a 1/1 peg pattern (Fig. 78g) . . . . . ***E. vuilleti* (Crawford)**

22(19) Mesotarsus densely setose without pegs ventrally, though basitarsus with row of 2–4 longer, yellowish to slightly reddish, setalike spines (Figs 5h, 42f, 46g) [*iranicus* group] 23

- Mesotarsus ventrally usually with complete row of pegs along either side but at least with a few pegs arranged in asymmetrical pattern on either side of basitarsus, and one or more subsequent tarsomeres also with pegs (Fig. 69g) 25

23(22) Tegula brownish, not contrasting with surrounding sclerites (Fig. 5c, d); mesosoma mostly brownish with variably extensive coppery to reddish-violaceous lusters (Fig. 5a–d), though mesonotum sometimes partly green; acropleuron with sculpture delineated by only very slightly raised ridges, almost coriaceous posteriorly (Fig. 5d); fore wing with at least slight, though variably distinct brownish infuscation behind mv and stv (Fig. 5f, g) . . . . . ***E. africanus* Kalina**

- Tegula yellow, contrasting distinctly with surrounding sclerites (Figs 42h, 46d); mesosoma usually mostly bright green to bluish (Figs 42b–d, g, h); acropleuron quite distinctly reticulate, including posteriorly (Figs 42h, 46d); fore wing hyaline (Fig. 46h) 24

24(22) Ovipositor sheaths banded, pale medially (Fig. 42b, c, g); legs entirely pale or at most posterior surface of profemur with diffuse brown region (Fig. 42c, g) . . . . . ***E. iranicus* Kalina**

- Ovipositor sheaths entirely dark (Fig. 46b, c, f); legs usually with at least metafemur and sometimes other femora variably extensively dark brown (Fig. 46c), though rarely entirely pale . . . . . ***E. kalinai* Gibson & Fusu n. name**

25(22) Mesotarsus ventrally with asymmetrical pattern of 4–9 pegs along anterior margin and 1–4 pegs on posterior margin of basitarsus, and subsequent tarsomeres without pegs or second tarsomere with only 1 or rarely 2 pegs apically on either side (Fig. 69g, i); tegula usually noticeably bicoloured, with at least about basal two-thirds of inner margin variably broadly pale but brown apically and/or laterally (Fig. 69d) (pattern not obvious if almost entirely yellow or if pale band very narrow and overlain by mesoscutal margin) . . . . . ***E. microzonus* Förster**

- Mesotarsus ventrally with numerous pegs arranged in symmetrical pattern along both sides of basitarsus, and subsequent two or three tarsomeres with pegs on either side; tegula usually completely dark 26

26(25) Scutellum strongly arched with tuft of long dark bristles mesally (Fig. 20b, f); fore wing mostly infuscate with dark setae except for hyaline band with white setae behind about apical half of smv basal to parastigma, and basal cell infuscate with tuft of long dark setae basal to hyaline band (Fig. 20g, i) . . . . . ***E. ceroplastae* (Kalina)**

- Scutellum variably broad and highly convex, but setae either uniformly distributed or more lateral so as to be bare mediolongitudinally; fore wing often hyaline, but if extensively infuscate (Figs 57d, 97f) then basal cell lacking tuft of long dark setae 27

27(26) Ovipositor sheaths more-or-less uniformly dark, often becoming somewhat paler apically but at most with only tip abruptly pale (Figs 10h, 57a, 66h, 125a, b) 28

- Ovipositor sheath colour pattern variable, usually distinctly banded or variably pale beyond basal dark region, but if mostly dark then at least with a short pale region extending across sheath submedially 33

28(27) Fore wing disc without linea calva and strongly infuscate from base of parastigma to somewhat beyond level of pmv (Fig. 57d; Kalina 1988, plate II, fig. 1); tarsi fuscous (Fig. 57a); mesoscutum with anteromedial lobe finely reticulate but posteromedial depressed region smooth and shiny except narrowly mediolongitudinally (Fig. 57f) . . . . . ***E. longicaudus* Kalina**

- Fore wing disc at least with distinct linea calva, and often hyaline; tarsi with at least meso- and metatarsi partly pale; mesoscu-

tum with posteromedial depressed region distinctly meshlike sculptured (e.g. Figs 10f, 60d, 126a) 29

29(28) Ovipositor sheaths short, second valvulae not extending beyond gastral apex and apparent sheath length at most only slightly longer than half length of metatibia (Figs 10b, 125a, b) 30

- Ovipositor sheaths obviously elongate, second valvulae extending distinctly beyond gastral apex and apparent sheath length at least as long as metatibia 31

30(29) Fore wing with mv at most about 2.5× as long as stv (Fig. 10b), and basal cell bare or with only a few setae basally (Fig. 10h); head with scrobal depression, including scrobes, distinctly sculptured, reticulate to transversely strigose-reticulate, and frons at least somewhat roughened, from transversely alutaceous to alutaceous-reticulate or coriaceous-reticulate (Fig. 10a); ocelli conspicuously small, OOL at least about 2× maximum posterior ocellus diameter (Fig. 10e); costal cell dorsally usually bare, without setae near leading margin . . . . . ***E. atropurpureus*** **Dalman** (in part)

- Fore wing with mv more than 3× as long as stv, and basal cell entirely setose; scrobal depression with almost subeffaced sculpture or at least scrobes smooth and shiny, and frons entirely meshlike coriaceous (Fig. 125d–f); ocelli not conspicuously small, OOL at most about 1.4× maximum posterior ocellus diameter (Fig. 125e, f); costal cell dorsally near leading margin with row of dark setae apically for distance at least equal to length of parastigma . . . . . ***E. weilli*** **Fusu & Gibson n. sp.** (in part)

31(29) Fore wing conspicuously infuscate from base of parastigma to about level of apex of pmv; costal cell dorsally bare, without setae near leading margin (Fig. 60a, h); mesonotum finely coriaceous-reticulate, quite shiny (Fig. 60d); callus with setae so dense as to form white reflective surface obscuring cuticle (Fig. 60f) . . . . . ***E. magdalenae*** **Fusu & Gibson n. sp.** (possibly in part, see under species)

- Fore wing hyaline (Figs 66b, 104g); costal cell dorsally near leading margin with row of setae apically for at least half length; mesonotum distinctly reticulate (Figs 66e, 104d); callus with comparatively sparse white setae not obscuring cuticle (Figs 66f, 104f) 32

32(31) Head and mesosoma dark- to bright-green with some coppery luster at least within posteromedial depressed region of mesoscutum (Fig. 104a–f); ovipositor sheath with third valvula at most about 1.4× length of mv . . . . . ***E. stenozonus*** **Askew** (in part)

- Head and mesosoma bluish to partly purple or if somewhat greenish under some angles of light at least without coppery luster (Fig. 66a–f); ovipositor sheath with third valvula typically 1.6× or greater, but at least 1.5× length of mv (Fig. 66a, b) **[**Arabian Peninsula**]** . . . . . ***E. melanostylus*** **Gibson & Fusu n. sp.**

33(27) Mesosoma mostly yellowish to orange except mesoscutum posterolaterally and laterally along margin, and scutellum green (Fig. 97a, b, e); fore wing bifasciate with more hyaline band behind about apical half of mv having paler to whitish setae separating infuscate regions with dark setae behind parastigma and base of mv, and behind stv and pmv (Fig. 97b, f) . . . . . ***E. saharensis*** **Kalina**

- Mesosoma usually entirely or mostly dark and fore wing often hyaline, but if scutellar-axillar complex with axillae variably distinctly yellowish and scutellum green (Fig. 118c) then fore wing uniformly infuscate with dark setae between about base of parastigma to somewhat beyond apex of pmv (Figs 33c, 57e, 60h, 117d), ... 34

34(33) Costal cell dorsally bare, without row of setae near leading margin (not to be confused with setae on fold adjacent to parastigma) (Figs 60i, 117e, f) and fore wing with brownish infuscation from base of parastigma to level somewhat beyond apex of pmv (sometimes also faintly brownish basally but most of basal cell and disc apically quite abruptly hyaline) (Figs 33c, 57e, 60h, 117d); mesoscutum with posteromedial depressed region often at least partly smoother and shinier than anteromedial convex region, usually at least with inclined inner surface of lateral lobe with much finer to subeffaced sculpture (Figs 33a, b, 57f), though mesoscutum sometimes almost uniformly, finely coriaceous-reticulate (Fig. 60d) 35

- Costal cell dorsally near leading margin with row of setae apically for distance at least equal to length of parastigma (setae sometimes white and then inconspicuous) or fore wing hyaline (if partly infuscate then not as strongly or as abruptly delineated as above); mesoscutum with posteromedial depressed region similarly strongly sculptured as anteromedial convex region, usually distinctly meshlike reticulate 37

35(34) Ovipositor sheaths slightly longer than metatibia (Fig. 60a) and with second valvifers projecting conspicuously beyond apex of gaster (Fig. 60g); prepectus setose (Fig. 60f); axillae with very sparse, inconspicuous, hairlike setae (Fig. 60d, f); posterior depressed region of mesoscutum with meshlike sculpture finer on inclined surface of lateral lobe than mediolongitudinally, but distinct (Fig. 60d) . . . . . ***E. magdalenae*** **Fusu & Gibson n. sp.** (in part)

- Ovipositor sheaths at most only slightly longer than half length of metatibia, and gaster extending over base of third valvulae, in dorsal view concealing second valvifers (Figs 32a, b, 117a, b); prepectus bare (Fig. 32h); axillae with slender-lanceolate, anteriorly projecting setae typically so dense as to form reflective patch over about posterior two-thirds (Figs 32e, 118d) (not obvious for some *E. tryapitzini*, Fig. 118b); posterior depressed region of mesoscutum entirely smooth and shiny or at least inclined surface of lateral lobe with at most subeffaced sculpture, smooth and shiny or almost so (Figs 33a, b, 118a, b) **[***fulgens* group, part**]** 36

36(35) Fore wing uniformly setose without linea calva; scutellar-axillar complex uniformly dark (Figs 32c, 33a, b) . . . . . ***E. fulgens*** **Nikol'skaya**

- Fore wing disc with at least very short and slender linea calva behind base of mv (Fig. 117f); scutellar-axillar complex sometimes with axillae variably extensively and distinctly paler, yellowish-orange, than dark scutellum (Fig. 118c) . . . . . ***E. tryapitzini*** **Kalina**

37(34) Fore wing disc uniformly setose without linea calva (Figs 72g, 86e) 38

- Fore wing disc with at least a short, slender, linea calva behind base of mv (e.g. Figs 2g, 35d) 39

38(37) Fore wing hyaline with uniformly dark setae (Fig. 86e); body green to greenish-blue with some blue or purple but at most obscure reddish luster (Fig. 86a–d); acropleuron posteriorly strongly meshlike reticulate (Fig. 86f, i); pronotum with admarginal setae dark . . . . . ***E. pini*** **Taylor**

- Fore wing with basal cell hyaline and with white setae except basally, and disc variably distinctly infuscate, at least behind base of mv and behind stv (Fig. 72g); body with variably extensive but distinct reddish-violaceous lusters, at least on frontovertex, pronotum and mesoscutum (Fig. 72c–e); acropleuron posteriorly finely, longitudinally strigose-reticulate (Fig. 72f); pronotum with admarginal setae white (Fig. 72e). . . . . ***E. mirabilis*** **Kalina**

39(37) Ovipositor sheath with third valvula at least as long as marginal vein and 0.85× length of metatibia; frons coriaceous (e.g. Figs 13h, 22a, b, 35a, 113a) unless sheaths at least 1.1× length of marginal vein and 0.9× length of metatibia (Figs 2d, 104e, 110c). 40

- Ovipositor sheath with third valvula usually at least slightly shorter than marginal vein and 0.85× length of metatibia or if slightly longer then frons at least slightly roughened, imbricate to reticulate-imbricate 55

40(39) Antenna with scape contrasting in colour with flagellum, usually yellow to orange or orangey-brown (Figs 22a, 92c, 122c), but at least with inner surface mediolongitudinally (Fig. 93f) or apically and basally (Fig. 93g) obviously lighter, orangey to orangey-brown, so as to contrast with flagellum 41

- Antenna with scape at least uniformly brown so as not to contrast with flagellum and usually entirely dark with variably distinct metallic lusters (e.g. Figs 2a, 35a, 104a, 110a) 43

41(40) Mesofemur similarly dark as pro- and metafemora, and mesotibia extensively dark (Fig. 22c); ovipositor sheaths with apical darker region extending neither completely to apex nor to dorsal and ventral margins of sheath, which are narrowly pale (Fig. 22h); frons entirely coriaceous (Fig. 22b); scutellum and axillae contrasting in colour, the scutellum greenish or green with coppery or reddish-coppery lusters but axillae mostly to entirely blue or purple (Fig. 22e) . . . . . ***E. cerris*** **Förster**

- Mesofemur and mesotibia both pale (Figs 92a, 122b); ovipositor sheath with apical dark region extending completely to apex and dorsal and ventral margins, thus with three distinct bands (Fig. 122h); frons noticeably roughened along inner orbits below posterior ocelli, imbricate to reticulate-imbricate (Figs 92c, 122e); scutellum and axillae similarly dark greenish-blue though scutellum with some coppery luster (Figs 92b, 122f) 42

42(41) Ovipositor sheaths with third valvula only about 0.9× length of metatibia 1.1× length of mv (Fig. 122h); pronotum with brown to dark admarginal setae (Fig. 122f); head in frontal view mostly dark, including scrobal depression and frons mesally below anterior ocellus, except for greenish band along inner orbits (Fig. 122c, e); metafemur with about basal two-thirds entirely dark (Fig. 122b). . . . . ***E. vanharteni*** **Fusu & Gibson n. sp.**

- Ovipositor sheaths with third valvula about 1.1× length of metatibia and 1.3× length of mv (Fig. 93e); admarginal setae pale, whitish (*cf* Fig. 37e) (setae mesally may appear light brownish if in shadow of head, Fig. 92d); head in frontal view usually quite extensively green, with some coppery luster in scrobal depression, and more bluish to purple on frons along inner orbits (Fig. 92c); metafemur often pale (Fig. 92a) but at least pale along dorsal margin (Fig. 93b) . . . . . ***E. punctatifrons*** **Fusu & Gibson n. sp.**

43(40) Costal cell dorsally bare, without row of setae near leading margin (not to be confused with setae on fold adjacent to parastigma) (Fig. 35f); fore wing basally with white, relatively inconspicuous setae of basal cell separated from discal setae by bare oblique band (speculum) extending from base of parastigma through cubital fold (Fig. 35d, f); mesosoma and usually head mostly reddish-coppery to reddish-violaceous with only limited green luster under some angles of light (Fig. 35a, e, g); prepectus with at most 7 setae within dorsal half (Fig. 35g). . . . . ***E. gelechiphagus*** **Gibson & Fusu n. sp.**

- Costal cell dorsally near leading margin with row of setae at least apically anterior to parastigma and often for half or more length of costal cell (e.g. Figs 8a, b, 13f, 64f); fore wing basally with setae sometimes dark but at least basal cell and disc uniformly setose; mesosoma and head usually mostly green to blue or purple with only limited reddish-coppery luster (e.g. Figs 45b, g, 113b, 115c, e); prepectus sometimes much more extensively to almost entirely setose. 44

44(43) Frons reticulate, the meshlike sculpture delineated by variably distinctly raised ridges (Figs 2b, 104b, 110b) and ovipositor sheath with second valvifer extending obviously beyond gastral apex such that apparent sheath length at least 1.5× length of mv and 1.1× length of metatibia (Figs 2d, 104e, 110c). 45

- Frons coriaceous, the meshlike sculpture delineated by engraved lines (e.g. Figs 7f, 13h, 64d, 113a), and/or ovipositor sheath with second valvifer extending only slightly beyond gastral apex such that apparent sheath length obviously shorter than described above. 47

45(44) Scrobal depression punctate-reticulate to transversely reticulate-rugulose (Fig. 2b); head and mesosoma mostly bluish to purple (if mesoscutum indistinctly greenish in part then without coppery luster) (Fig. 2a–f); hind leg with femur and tibia basally uniformly dark or with knee at most only very slightly lighter in colour, not distinctly contrasting (Fig. 2d). . . . . ***E. acinellus*** **Askew**

- Scrobal depression quite shiny and variably extensively smooth to finely coriaceous or at most very shallowly reticulate dorsally (Figs 104b, 110b); head and mesosoma mostly dark to bright green (at least mesoscutum sometimes with some coppery to reddish-violaceous luster) (Figs 104a–f, 110a–f); hind leg with knee pale in distinct contrast to most of femur and tibia (Figs 104c, 110c) 46

46(45) Ovipositor sheath with third valvula at most about 1.4× length of mv (Fig. 104e); middle leg with femur almost always brownish to similarly dark as pro- and metafemora, and tibia usually with variably conspicuous and extensive brownish region subbasally to mesally (Fig. 104e) [western Palaearctic]. . . . . ***E. stenozonus*** **Askew** (in part)

- Ovipositor sheath with third valvula at least about 1.5× length of mv (Fig. 110c); middle leg with femur and tibia similarly pale, yellowish to orangey except for paler knee, and obviously lighter than pro- and metafemora (Fig. 110c) [far eastern Palaearctic] . . . . . ***E. tanystylus*** **Gibson & Fusu n. sp.**

47(44) Middle and hind legs pale beyond coxa except anterior (outer) surface of metafemur sometimes partly brown (Fig. 45c–f); scrobal depression smooth and shiny (Fig. 45a, b); prepectus sparsely setose (few known females with up to 5 setae). . . . . ***E. janstai*** **Delvare & Gibson**

- Middle and hind legs often with femora similarly dark and/or one or both of tibiae partly dark (Figs 13c, 64b, 113b); scrobal

depression variable, but sometimes meshlike coriaceous to reticulate over at least dorsal half, excluding scrobes (Figs 7f, 48a, 64c, 115e); prepectus sometimes much more extensively setose 48

48(47) Gaster elongate-slender, length excluding ovipositor sheaths at least 1.15× combined length of head + mesosoma and about 2.4× length of metatibia (Fig. 113b); head with at least vertex and occiput plus mesonotum mostly dark blue to purple (Fig. 113b–d) (face and/or posteromedial depressed region of mesoscutum sometimes more distinctly green); metatibia with medial dark band obviously longer than apical pale band . . . . . ***E. tibicinis*** **Bouček**

- Gaster shorter and more robust, length excluding ovipositor sheaths at most about as long as combined length of head + mesosoma and only about twice as long as metatibia; head and mesonotum usually variably greenish to greenish-blue with some coppery luster, to almost entirely reddish-coppery; metatibia sometimes mostly pale except subbasally 49

49(48) Scrobal depression smooth and shiny except possibly along extreme dorsal margin (Fig. 13g, h); mesofemur extensively dark similar to pro- and metafemora (Fig. 13c); fore wing hyaline (Fig. 13e) . . . . . ***E. azureus*** **Ratzeburg**

- Scrobal depression reticulate to at least about level of interantennal prominence (Figs 7f, 48a, 64c, 115e); mesofemur colour variable, but often similarly pale as tibia or at least conspicuously lighter than pro- and/or metafemora; fore wing sometimes variably distinctly infuscate behind mv and/or stv (Figs 7c, 8b) 50

50(48) Head in dorsal view with sometimes fine, but definite transverse carina behind posterior ocelli differentiating vertex from occiput (e.g. Figs 17d, 29i, 48b, e, 50f); ovipositor sheaths sometimes with four distinct bands, the sheath pale apically beyond a relatively short dark region subapically, and with a longer pale band between subapical and basal dark bands (Fig. 48h) . . 51

- Head in dorsal view uniformly curved into occiput behind posterior ocelli, at most with sculpture transversely aligned into fine, concentric, obscurely raised lines; ovipositor sheaths sometimes almost uniformly pale beyond basal dark band or only gradually darkened apically, but at most with three distinct bands composed of a dark basal and apical band on either side of medial pale band 52

51(50) Ovipositor sheaths with four distinct bands, the sheath pale apically beyond a relatively short, dark subapical band, and with a longer pale band between subapical and basal dark bands (Fig. 48h); interorbital distance usually conspicuously less than 0.4× head width (Fig. 48a, b); distance between inner ventral margin of torulus and oral margin subequal to distance between inner mesal margins of toruli [far eastern Palaearctic; parasitoid of Cynipidae] . . . . . ***E. kamijoi*** **Gibson & Fusu n. sp.** (in part)

- Ovipositor sheaths with three distinct bands composed of a dark basal and a dark apical band on either side of medial pale band (Fig. 115a, b); interorbital distance about 4.0× head width (Fig. 115e); distance between ventral inner margin of torulus and oral margin at least 1.2× distance between inner mesal margins of toruli [western Palaearctic; parasitoid of Cecidomyiidae] . . . . . ***E. tremulae*** **Delvare** (possibly in part, see under species)

52(50) Metatibia entirely pale (Fig. 115a, b); distance between oral margin and inner ventral margin of torulus at least 1.2× distance between inner mesal margins of toruli; fore wing hyaline and with basal cell uniformly setose (Fig. 115f) . . . . . ***E. tremulae*** **Delvare** (in part)

- Metatibia almost always partly darkened mesally to submesally at least dorsally (Figs 7g, h, 64b); distance between oral margin and inner ventral margin of torulus at most equal to distance between inner mesal margins of toruli; fore wing sometimes partly infuscate (Figs 7c, 8b) or sometimes with basal cell extensively bare (Fig. 64f) 53

53(52) Scrobal depression strongly reticulate to reticulate-rugulose (Figs 7b, 64c); mesofemur distinctly lighter than and contrasting with dark pro- and metafemora, and/or fore wing partly infuscate; ovipositor sheaths usually uniformly pale beyond dark base or only gradually darker yellowish- to orangey-brown apically without abruptly delineated apical dark band (Figs 7g, h, 64b); frons entirely coriaceous (Figs 7b, 64d) (common) 54

- Scrobal depression comparatively weakly meshlike reticulate and/or femora similarly dark; fore wing always hyaline; ovipositor sheaths with quite abruptly and distinctly delineated dark apical band; frons usually with at least some slightly raised ridges delineating some sculpture, often most evident laterad anterior ocellus toward inner orbit (best observed from oblique angle) (rare) 74

54(53) Ovipositor sheath with third valvula at least 1.25× length of mv; fore wing comparatively inconspicuously setose basally, the basal cell variably sparsely setose with white setae, and with broad, posteriorly open bare region behind apex of smv and base of parastigma separating basal cell from discal setae (Fig. 64f); smv with at most light yellowish-white setae in contrast to darker brown setae on disc and discal veins (Fig. 64f); disc at most with only very slight brownish infuscation behind venation . . . . . ***E. mehrnejadi*** **Gibson & Fusu n. sp.**

- Ovipositor sheath with third valvula at most 1.2× length of mv; other features variable, but usually basal cell, disc and all veins with similarly brown setae, and/or fore wing continuously setose from basal cell onto disc (Fig. 8a, b) (though sometimes with circular bare region behind base of parastigma or rarely with even more extensive bare region as described above) . . . . . ***E. annulatus*** **Nees**

55(39) Scrobal depression shiny and appearing smooth except sometimes along margins (Figs 71a, 73c, 75a, 90a, 95a, 100a, 120a); ovipositor sheaths not conspicuously short, apparent length at least about 0.7× length of mv; vertex uniformly curved into occiput though typically with transversely alutaceous-imbricate to somewhat imbricate-strigose sculpture because sharp edges of sculpture transversely aligned; scape dark [western Palaearctic] 56

- Scrobal depression variably distinctly (e.g. *cf* Fig. 125e, f) but usually quite obviously reticulate (e.g. Figs 4c, 25d, 43c); ovipositor sheaths sometimes quite conspicuously short such that apparent sheath length only about 0.6× or less length of mv (e.g. Fig. 125a, b); vertex sometimes with variably distinct transverse carina or ridge (e.g. Figs 17d, 29i, 50f); scape sometimes at least partly pale, yellowish to orange [western or far eastern Palaearctic] 63

56(55) Legs with all femora and tibiae extensively and similarly dark, the tibiae with medial dark regions obviously longer than basal or apical pale regions at least in dorsal view (Fig. 73a, b); mesotarsus similar in length to mesotibia, at least about 0.8× length of tibia; mesosoma dorsally often with variably extensive, bright reddish-violaceous to reddish-coppery lusters, most commonly laterally on pronotum and sometimes extensively on mesonotum (Fig. 73f, g); pronotum with admarginal setae white (*cf*

Fig. 37e) . . . . . ***E. nitidus* Nikol'skaya**

- Legs variably extensively dark, but if all femora similarly dark then at least mesotibia with subbasal dark region, if present, shorter than more extensive apical pale region (Figs 71d, 75f, 90c, h, 95d, 100d), and protibia with apical pale region obviously extending more basally along anterior and posterior surfaces; mesotarsus distinctly shorter, less than 0.75× length of mesotibia; mesosoma dorsally usually mostly green (e.g. Figs 71f, g, 90e, 100e), and then often with some coppery luster, or bluish to purple, including pronotum laterally (e.g. Figs 75h, 90d, 95e); pronotum with admarginal setae sometimes brownish to dark (e.g. Figs 25g, 120e) [*urozonus* group] 57

57(56) Pronotum with admarginal setae all white (Fig. 119h) and mesoscutum and pronotum similarly coloured (usually mostly greenish to bluish-green and often with variably distinct and extensive coppery luster, Figs 119h, 120, c, d), but at least pronotum laterally not distinctly contrasting in colour with mesoscutum (Figs 119h, 120b) . . . . . ***E. urozonus* Dalman** (in part, common)

- Pronotum with admarginal setae brownish to dark (e.g. Figs 90f, 91d–f, 95e) and/or laterally dark blue, purple to reddish-violaceous, in contrast to more distinctly greenish mesoscutum (e.g. Figs 75h, 90d, 95f, g). 58

58(57) Pronotal collar in dorsolateral view extensively to entirely purple to blue or reddish-violaceous laterally on collar and dorsally on panel so as to contrast distinctly with mostly greenish mesonotum (Figs 75h, 90d, 91d–f, 95e, 96c, 101f, h). 59

- Pronotal collar in dorsolateral view more-or-less greenish or if variably distinctly blue or even if with some purple or reddish-violaceous luster along posterolateral margin then mesonotum similarly coloured so as not to contrast distinctly in colour (Figs 71f, g, 120d–h) 62

59(58) Legs usually with both meso- and metatibiae distinctly dark within about basal half, though sometimes reduced to only distinct, dark annulus subbasally on mesotibia (Figs 75f, 90c, h), and often mesofemur similarly dark as pro- and metafemur; pronotum with admarginal setae dark; vertex green or with some coppery luster, but not contrasting distinctly with frons (Figs 75b, 90b) 60

- Legs not as extensively dark, usually at least meso- and metatibiae pale and mesofemur, at least in dorsal view, also much paler than pro- and metafemora (Figs 96a, d, 100d, 101a) (if both tibiae or only metatibia darkened subbasally and/or mesofemur dark then pronotal admarginal setae extensively pale or vertex extensively purple to reddish-violaceous between orbits so as to contrast distinctly with mostly green frons) 61

60(59) Prepectus with at most 4 setae; head in dorsal view with interocular distance about 0.45× head width . . . . . ***E. opacus* Delvare**

- Prepectus with at least 7 setae; head in dorsal view with interocular distance usually about 0.4×, though rarely up to about 0.45× head width. . . . . ***E. priotoni* Delvare**

61(59) Pronotum with admarginal setae white at least laterally, though mesal setae usually pale apically and darker basally (Fig. 101f, h); prepectus with less than 9 setae; head with vertex green with slight coppery luster (Figs 100b, 101d) or at most with slight purplish luster under some angles of light and mesoscutal lateral lobe in lateral view green with bluish luster at most within posterior half (Figs 100f, 101f, h); costal cell dorsally near leading margin often with two definite rows of setae, including row along most of length and shorter row of at least a few setae mesally (Figs 100g, h, 101c) . . . . . ***E. simizonus* Al khatib**

- Pronotum with admarginal setae dark (Figs 95e, 96c, f, h); prepectus with at least 9 setae; head with vertex quite distinctly though variably extensively purple to reddish-violaceous, at least laterally and often more extensively (Figs 95b, 96b), and mesoscutal lateral lobe in lateral view usually extensively blue to purple along margin (Figs 95e, 96c); costal cell dorsally near leading margin with only one distinct row of setae over at most about apical two thirds . . ***E. purpuricollis* Fusu & Al khatib**

62(58) Pronotum with admarginal setae brownish to dark (Fig. 71g); eye comparatively small (Fig. 71a), height at most about 1.6× length of malar space; distance between oral margin and inner ventral margin of torulus at least about 1.15× distance between inner mesal margins of toruli; metatibia pale, at most orangey between paler basal and apical regions, and mesofemur either pale or if partly brownish then definitely lighter in colour than pro- and mesofemora . . . . . ***E. minozonus* Delvare**

- Pronotum with at least some pale admarginal setae laterally (Fig. 120d) or if all setae brownish to dark (Fig. 120e) then eye larger, height at least 1.65× length of malar space; distance between oral fossa and inner ventral margin of torulus at most 1.15× distance between inner mesal margins of toruli; metatibia sometimes distinctly brown to dark between paler basal and apical regions, and mesofemur sometimes similarly dark as pro- and metafemora . . . . . ***E. urozonus* Dalman**

63(55) Fore wing with conspicuously elongate linea calva extending at least to level of base of parastigma and often more-or-less obviously to basal and cubital folds (Fig. 56e); pmv at least noticeably and usually obviously (1.3–1.4×) longer than stv (Fig. 56f, g); legs with all femora dark except narrowly apically, and tibiae extensively dark, including mesotibia at least subbasally (Fig. 56a, b); scape similarly dark as flagellum; head comparatively dark, usually bluish-green to blue except lateral surface of scrobe often violaceous to purple (Fig. 56h); mesosoma dorsally comparatively dark with dull bluish to greenish lusters (Fig. 56a–d) . . . . . ***E. longicalvus* Al khatib & Fusu** (in part)

- Fore wing with linea calva extending to level only about equal with apex or middle of parastigma and distinctly separated from basal and cubital folds (e.g. Figs 4g, 58i, 99f); pmv usually at most only slightly longer than stv (e.g. Figs 4g, 58i, 99f); legs sometimes with one or more of femora and/or tibiae mostly to entirely pale; scape sometimes yellowish to orange; head sometimes with distinct reddish-violaceous luster on parascrobal region, interantennal prominence and scrobal depression (e.g. Fig. 89c–e); mesosoma dorsally sometimes with bright metallic lusters. 64

64(63) Body with tegula, legs beyond coxae and scape yellow, contrasting with comparatively bright green to bluish-green head and mesonotum having quite conspicuous though only slightly lanceolate white setae (Fig. 99a–e); frons distinctly reticulate (Fig. 99c) and vertex evenly curved into occiput; gaster extending over base of third valvulae, the latter almost 0.9× length of mv, but apparent sheath length only about 0.75× mv; ovipositor sheaths dark basally but mostly pale beyond gaster, somewhat darker, yellowish to brownish-yellow apically but not distinctly banded (Fig. 99g, h) [Arabian peninsula]. . . . . ***E. setosus* Fusu & Gibson n. sp.**

- Body with at least tegula dark and often legs variably extensively and/or scape dark, and with less conspicuous, hairlike setae

at least on mesonotum; frons sometimes coriaceous or only partly reticulate-imbricate and/or vertex and occiput differentiated by variably developed transverse carina or ridge; gaster usually extending only to base of third valvulae or ovipositor sheaths with different colour pattern 65

65(64) Ovipositor sheaths short, apparent sheath length at most about 0.5× length of mv and almost entirely dark, with only very short pale region subbasally (Fig. 125a, b); legs with all femora extensively and tibiae at least partly dark (Fig. 125b); head in lateral view comparatively highly convex (Fig. 126c) and in frontal view scrobal depression with fine, almost subeffaced sculpture or at least scrobes entirely smooth and shiny (Fig. 125c, d); syntergum with posterolateral angles inflexed anteromesally toward base of sheaths such that anal sclerite appears more-or-less Ω-like 'flattened' over sheaths (Fig. 126d, f) or in dorsal view somewhat V-like protuberant on either side of anal sclerite . . . . . ***E. weilli* Fusu & Gibson n. sp.** (in part)

- Ovipositor sheaths usually distinctly longer and/or more extensively pale; legs often less extensively dark with one or more femora or tibiae pale; head in lateral view usually lenticular and in frontal view usually with scrobal depression more distinctly sculptured; syntergum sometimes with posterolateral angles abruptly inflexed such that in dorsal view syntergum V-like angulate on either side of anal plate (Fig. 123h), but usually recurved at nearly right-angle to midline to form vertical or obliquely angled but truncate surface between anal sclerite and ovipositor sheaths 66

66(65) Syntergum with posterolateral angles abruptly inflexed anteromesally to form V-like angle on either side of anal sclerite (Fig. 123h); gaster extending over base of comparatively short and thick third valvulae such that line of division between second valvifers and third valvulae, if visible in ventral view, obviously basal to gastral apex (Fig. 123g); head in lateral view distinctively flat-lenticular to subtriangular with frontovertex and most of parascrobal region forming slightly convex, relatively long surface angled to much shorter combined surface of ventral-most part of parascrobal region and lower face (Fig. 123b); head and mesosoma mostly comparatively dark green to bluish-green but usually legs extensively and often scape pale (Fig. 123a–e) . . . . . ***E. vindex* Erdős**

- Syntergum with posterolateral angles recurved at nearly right-angle to midline to form vertical to obliquely angled but almost truncate surface between ovipositor sheaths and anal sclerite; apex of gaster usually extending only to base of third valvulae; head in lateral view lenticular to more convexly triangular; colour pattern of head, mesosoma, legs and scape variable. 67

67(66) Scape dark with metallic luster to uniformly brown but similar to and not contrasting with flagellum. 68

- Scape at least not uniformly, similarly coloured as flagellum, often mostly or entirely yellow to orange (Figs 29c, i, 34c, 43c, 108a, 112c, 127a, b), though sometimes paler only apically or somewhat paler, orangey-brown, only on inner surface mediolongitudinally compared to darker dorsal and ventral margins (Figs 43d, 108b, 93f) 85

68(67) Ovipositor sheath with third valvula at most 0.6× length of mv (Fig. 17a); legs with pro- and metafemora extensively dark but metatibia entirely pale or at most light brownish mesally (Fig. 17a); mesonotum mostly blue or with some purple luster (Fig. 17e), except sometimes dark violaceous anteriorly and scutellum sometimes with slight greenish luster; vertex differentiated from occiput by fine but usually distinct U-shaped carina (Fig. 17d); frons uniformly, finely meshlike coriaceous (Fig. 17c) . . . . . ***E. brachystylus* Gibson & Fusu n. sp.**

- Ovipositor sheath with third valvula at least 0.6× length of mv, and usually obviously longer; legs sometimes with pro- and/or metafemur pale or metatibia dark mesally; mesonotum sometimes bright or at least distinctly green; occiput sometimes smoothly rounded into occiput; frons sometimes roughened, at least in part reticulate-imbricate to reticulate laterally along inner orbits. 69

69(68) Legs sometimes with all femora extensively darkened, but at least pro- and metafemora extensively dark and metatibia partly darkened 70

- Legs often either entirely pale beyond coxa or only profemur extensively dark, but if both pro- and metafemur partly dark then metatibia pale 81

70(69) Vertex differentiated from occiput by a variably distinct, often somewhat irregular transverse or arcuate ridge or carina (e.g. Figs 17d, 29i, 48b, 50f) 71

- Vertex uniformly rounded into occiput, the margins of reticulate-imbricate sculpture often sharp and sometimes more-or-less aligned, but not coalesced into differentiated ridge or carina 74

71(70) Ovipositor sheaths less than 0.8× length of mv (Fig. 128a, b) and with four distinct bands, including basal and subapical dark regions and subbasal and apical pale regions (Fig. 128i) [South Korea] . . . . . ***E. zebra* Fusu & Gibson n. sp.** (in part)

- Ovipositor sheaths at least 0.9× length of mv or with only three distinct bands, a dark basal, extensively pale mesal, and dark apical band (apical dark region sometimes somewhat lightened in colour at extreme tip) 72

72(71) Ovipositor sheaths at least 0.9× length of mv and with four distinct bands: dark basally, extensively pale subbasally, variably dark brown subapically, and pale apically (Fig. 48h) . . . . . ***E. kamijoi* Gibson & Fusu n. sp.** (in part)

- Ovipositor sheaths only about 0.8× length of mv or less and often with only three distinct bands: dark basally, extensively pale mesally, and dark apically (e.g. Figs 25a, b, 37a, b, 39b), though extreme tip sometimes also somewhat lighter to pale (e.g. Figs 4a, 6i, 112i) 73

73(72) Scape uniformly and completely dark with metallic luster (Fig. 50c); frons uniformly coriaceous (Fig. 50e) [trans-Palaearctic] . . . . . ***E. kiefferi* De Stefani** (in part)

- Scape brownish (Fig. 108c) or at least slightly lighter mediolongitudinally than along dorsal and ventral margins (Fig. 108b); frons at least very finely reticulate along inner orbits below posterior ocelli, the sculpture formed by slightly raised though fine ridges (Fig. 108i) [far eastern Palaearctic only] . . . . . ***E. tachardiae* (Howard)** (in part)

74(53, 70)Pronotum with admarginal setae brownish to black at least mesally, though laterally often with some setae white (Fig. 25g) and sometimes with dark mesal setae paler apically; pronotum blue or violet to purple dorsolaterally, at least along posterior margin, so as to usually contrast quite distinctly with variably dark green to coppery-green or bluish-green mesonotum (e.g. Figs 25e, g, 39e, 50h, 128g) 75

- Pronotum with admarginal setae uniformly pale (Fig. 37e); pronotum dorsolaterally not distinctly contrasting with mesoscu-

tum, usually both similarly green to coppery-green or bluish-green (e.g. Figs 6b, e, 18h, 37f) or, more rarely, bluish (e.g. Figs 4e, 37e) 79

75(74) Ovipositor sheaths at most only about 0.75× length of mv (Fig. 128b) and with four distinct bands, a short dark region basally, a longer pale region subbasally, a shorter brown region subapically, and an even shorter but distinct pale region apically (Fig. 128i); fore wing with basal cell setae white relative to darker, yellowish to brown discal setae (Fig. 128h). . . . . ***E. zebra* Fusu & Gibson n. sp.** (in part)

- Ovipositor sheaths distinctly longer than 0.75× length of mv and/or with only three distinct bands, a pale region medially between dark basal and apical dark regions (Figs 25a, b, 50a), though apical dark region often with extreme tip lighter; fore wing sometimes with setae uniformly yellowish to brownish 76

76(75) Protibia dark except narrowly basally and apically; face mostly dark green to bluish-green except more distinctly bluish to partly purple in scrobal depression (Fig. 56h); fore wing with uniformly dark brown setae (Fig. 56e, g). . . . . ***E. longicalvus* Al khatib & Fusu** (in part)

- Protibia paler antero- and posterolongitudinally for all or most of length so as to usually differentiate separated or at least largely separated dorso- and ventrolongitudinal dark bands; face more-or-less extensively green to bluish-green except at least interantennal prominence and parascrobal region contrastingly dark to bright reddish-violaceous or very rarely purple or coppery, and scrobal depression similarly coloured or often partly green under some angles of light (commonly on lateral wall of scrobe) (Figs 25c, d, 39c, 50c–f, 128c, d); fore wing often with pale to white setae, at least within basal cell 77

77(76) Ovipositor sheath with posterior margin of medial pale region extending only to about half length of sheath, the pale region shorter than basal dark band and only about half as long as apical dark band (Fig. 39g); mesofemur pale (Fig. 39a, b); frons uniformly coriaceous (Fig. 39d) . . . . . ***E. hayei* Gibson & Fusu n. sp.**

- Ovipositor sheath with posterior margin of medial pale band extending obviously beyond half length of sheath, the pale region longer than basal dark band and at least as long as more apical band(s) (Figs 25a, b, 50a, b, 128b); mesofemur sometimes similarly dark as pro- and metafemora (Fig. 128b); frons usually with meshlike sculpture at least obscurely defined by slightly raised ridges and often variably distinctly reticulate to reticulate-imbricate (e.g. Fig. 25c, d), at least laterad anterior ocellus toward inner orbit 78

78(77) Mesofemur always pale (Fig. 50a); head in dorsal to posterodorsal view with vertex and occiput differentiated by at least an obscure, fine, transverse or arched ridge; scrobal depression with scrobes usually mostly reticulate or at least with quite distinct sculpture along most of length (Fig. 50c); frons uniformly coriaceous (Fig. 50e); fore wing setae uniformly yellowish to brownish . . . . . ***E. kiefferi* De Stefani** (in part, uncommon)

- Mesofemur varying from pale to similarly dark as pro- and metafemora; head with vertex uniformly curved into occiput with transverse reticulate-imbricate sculpture forming irregular concentric lines; scrobal depression less distinctly and extensively sculptured than above, the scrobes mostly to entirely shiny with at most slight indication of subeffaced meshlike sculpture (Fig. 25c); frons with meshlike sculpture usually at least obscurely defined by slightly raised ridges and often variably distinctly reticulate to reticulate-imbricate (Fig. 25c, d), at least laterad anterior ocellus toward inner orbit; fore wing often with basal cell setae white or at least obviously paler compared to darker discal setae (Fig. 25f). . . . . ***E. confusus* Al khatib** (common)

79(74) Front and middle legs almost entirely pale, at most posterior surface of profemur somewhat brownish and protibia at most dorsally dark subbasally (Fig. 89a, b); head (Fig. 89c, d) and mesosoma often with extensive coppery luster but at least pronotum laterally greenish with a slight coppery luster (Fig. 89e, f); scape usually with at least extreme base somewhat lighter in colour . . . . . ***E. pistaciae* Al khatib** (in part)

- Legs with at least pro- and metafemora extensively dark and protibia with dorso- and ventrolongitudinal dark bands, and often mesofemur also variably extensively dark (Figs 37b, g, 61b, c); head and mesosoma often blue to bluish-green (Fig. 37f, h), though sometimes similar to above (Fig. 37d, g); scape always uniformly dark 80

80(79) Head blue to purple at least along inner orbits and sometimes extensively on mesonotum, though mesonotum often only bluish-green to green and then often with at least slight coppery luster (Fig. 37c–h) . . . . . ***E. gemellus* Al khatib**

- Head and mesonotum greenish without distinct bluish luster (Fig. 61a–f). . . . . ***E. martellii* Masi**

81(69) Ovipositor sheaths at least 0.9× length of mv and with four distinct bands composed of an extensive pale region between a dark basal region and variably dark brown subapical region, and a pale apical region (Fig. 48h); pronotum with admarginal setae dark (Fig. 48b, f); legs with pro- and mesofemora extensively dark and protibia at least with dark band ventrolongitudinally (Fig. 48f) . . . . . ***E. kamijoi* Gibson & Fusu n. sp.** (in part)

- Ovipositor sheaths conspicuously shorter than above (Figs 18b, 50a, 58a) and/or with only three distinct bands composed of a dark basal, extensively pale mesal, and dark apical band (extreme tip often somewhat paler but not as distinct region, Figs 6i, 18i); pronotum sometimes with admarginal setae pale; legs sometimes more extensively pale, including protibia entirely . . 82

82(81) Mesosoma in dorsal view with pronotum laterally blue to purple or reddish-violaceous (Figs 50g, 58e, g), and mesoscutum anteriorly sometimes also bluish to purple or at least differentiated in colour from otherwise mostly green to bluish-green mesoscutum; head with frontovertex often variably extensively multicoloured with dark reddish-violaceous, blue to bluish-green and/or coppery lusters (Fig. 50e, f) 83

- Mesosoma in dorsal view with pronotum and mesoscutum mostly to entirely bright green or green with coppery luster, the mesonotum at most with very limited bluish luster under some angles of light (Figs 6b, 18a); head with frons green to bluish-green with coppery luster (Figs 6c, 18c) but vertex and occiput more distinctly blue (Figs 6d, 18d) under some angles of light 84

83(82) Frons quite obviously roughened, at least shallowly and usually distinctly reticulate to reticulate-imbricate (Fig. 58f) [far eastern Palaearctic] . . . . . ***E. luteipes* Fusu & Gibson n. sp.** (in part)

- Frons smooth or virtually so, the meshlike sculpture usually engraved (coriaceous) or at most delineated by only very fine, slightly raised ridges (Fig. 50e) [trans-Palaearctic] . . . . . ***E. kiefferi* De Stefani** (in part, see 'Remarks' for species)

84(82) Ovipositor sheath with third valvula about 0.6× length of mv (Fig. 18b); pro- and metafemora extensively dark and protibia basally dark dorso- and ventrolongitudinally (Fig. 18b) . . . . . ***E. brachyurus* Fusu & Gibson n. sp.**

- Ovipositor sheath with third valvula at least about 0.8× length of mv (Fig. 6a); profemur pale or with posterior surface only light brownish in part, metafemur with only anterior surface variably distinct brownish mesally, and protibia uniformly pale (Fig. 6a) . . . . . ***E. angustifrons* Gibson & Fusu n. sp.**

85(67) Body with at least slight coppery to reddish-coppery luster on pronotum laterally (Fig. 89f) and within scrobal depression (Fig. 89c, d), and typically much more extensively on mesosoma and head (Fig. 89a–f); pronotum with admarginal setae usually pale (Fig. 89e, f); frons always quite distinctly roughened (Fig. 89d); head with vertex uniformly curved into occiput and transversely alutaceous-imbricate to imbricate-strigose, the sharp edges of sculpture typically aligned transversely but not differentiated into ridge or carina (Fig. 89e) [western Palaearctic] . . . . . ***E. pistaciae* Al khatib** (in part)

- Body usually mostly green to bluish-green or blue to purple with very limited coppery to reddish-coppery lusters, including within scrobal depression (e.g. Figs 29h, 34c, d, 50c), but at least pronotum laterally blue to purple or violaceous (Figs 4e, 43g, 112f, 127d); pronotum with admarginal setae dark at least mesal to level of spiracles (Figs 43h, 112f); frons sometimes similar to above but often entirely coriaceous (e.g. Figs 4d, 127e, f) or only comparatively narrowly roughened along inner orbit (e.g. Fig. 29f); head sometimes with vertex differentiated from occiput by variably distinctly differentiated transverse carina or irregular ridge (Figs 29i, 48b, 50f) 86

86(85) Ovipositor sheath with third valvula slightly less than 0.6× less than length of mv and with four distinct bands, including subbasal and apical pale regions that are shorter than basal and subapical dark regions (Fig. 112i); head and mesosoma dorsally mostly dark blue to purple (Fig. 112a–f); head with vertex smoothly rounded into occiput; legs with pro- and metafemora partly dark . . . . . ***E. tetrazostus* Gibson & Fusu n. sp.**

- Ovipositor sheath with third valvula at least slightly longer than 0.6× length of mv and if with four distinct bands, including apical pale region, then subbasal pale region obviously longer than basal dark region (e.g. Fig. 4a, b); head sometimes with at least frons and mesonotum sometimes mostly greenish, and then often with some coppery luster; head sometimes with vertex and occiput distinguished by transverse carina or ridge (e.g. Figs 29i, 50f); legs sometimes with profemur and/or metafemur entirely pale 87

87(86) Legs essentially or entirely pale beyond coxae (Fig. 34b) or if posterior surface of profemur partly brownish then metafemur pale or at most with similarly brownish tinge as profemur 88

- Legs often with pro- and metafemora both extensively dark (Figs 108d–f, 127a, c), but if profemur pale or mostly pale then at least metafemur obviously darkened within basal half (Figs 4a, b, 43b, 31c, d) 92

88(87) Frons smooth, uniformly meshlike coriaceous (Fig. 50c); scape at most dark orangey with some metallic luster (Fig. 50d). . . . . ***E. kiefferi* De Stefani** (in part, extremely rare)

- Frons at least partly roughened, sometimes extensively reticulate (Fig. 58f) but at least imbricate to reticulate-imbricate laterally along inner orbit below level of posterior ocellus (Figs 29f, 31i, 34d); scape usually extensively pale (e.g. Figs 29i, 34c) 89

89(88) Frons entirely or almost entirely reticulate to reticulate-imbricate between level of posterior ocelli and scrobal depression, somewhat more finely sculptured only in narrow band below anterior ocellus (Fig. 58f); head with vertex rounded into occiput with at most only obscurely differentiated vertexal carina [far eastern Palaearctic] . . . . . ***E. luteipes* Fusu & Gibson n. sp.** (in part)

- Frons often more finely but at least less extensively sculptured, usually most conspicuously reticulate to reticulate-imbricate only laterally along inner orbit below posterior ocellus, often not completely to scrobal depression, and more finely sculptured, coriaceous to coriaceous-imbricate in broad band below anterior ocellus (Figs 29f, 31i, 34d); head usually with vertex and occiput differentiated by quite obvious vertexal carina (e.g. Figs 29i, 50f) 90

90(89) Western Palaearctic . . . . . ***E. fulvipes* Förster**

- Far eastern Palaearctic. 91

91(90) Ovipositor sheath with third valvula at least about 0.8× length of mv . . . . . ***E. flavicrurus* Yang**

- Ovipositor sheath with third valvula only about 0.75× or less length of mv . . . . . ***E. formosae* Ashmead** (in part, rare)

92(87) Front leg entirely or mostly yellow, at most posterior surface of femur partly brownish mesally (Fig. 29e). . . . . ***E. formosae* Ashmead** (in part, most)

- Front leg with profemur dark except narrowly apically and basally (e.g. Figs 108d–f, 127a, c) 93

93(92) Fore wing disc slightly but distinctly brownish beyond hyaline basal cell (Fig. 4g, h); ovipositor sheaths less than 0.65× length of mv; legs with pro- and metafemora extensively dark except apically, and metatibia with elongate brownish region at least along posterior margin (Fig. 4a, b) . . . . . ***E.* (*Eupelmus*) *adustus* Gibson & Fusu n. sp.**

- Fore wing disc and basal cell uniformly hyaline; ovipositor sheaths sometimes more than 0.7× length of mv; legs sometimes with metafemur much less extensively dark and/or metatibia pale 94

94(93) Vertex uniformly rounded into occiput, often with sharp edges of transverse-imbricate sculpture obvious but not coalesced into apparent ridge or carina (Fig. 43g); mesonotum mostly bright green, usually posteromedial depressed region with some coppery luster but at most with bluish luster only anteriorly on anteromedial lobe and posterolaterally on lateral lobe above tegula (Fig. 43f); ovipositor sheaths at most 0.7× length of mv and usually shorter [Far eastern Palaearctic]. . . . . ***Eupelmus iris* Fusu & Gibson n. sp.**

- Vertex often differentiated from occiput by at least slightly though variably distinctly developed, often somewhat irregular, transverse or arcuate ridge or carina (e.g. Figs 29i, 50f); mesonotum more extensively blue to purple, usually over most of anteromedial lobe and along length of lateral lobe above tegula and prepectus (Figs 108h, 127d); ovipositor sheaths sometimes greater than 0.7× length of mv 95

95(94) Western Palaearctic . . . . . ***E. xenium* Fusu & Gibson n. sp**.

- Far eastern Palaearctic 96
96(95) Protibia subbasally with differentiated darker region ventro- and/or dorsolongitudinally (Fig. 108d, f) . . . . . ***E. tachardiae* (Howard)** (in part)
- Protibia pale, lacking distinctly darker region subbasally (Fig. 31e) . . . . . ***E. formosae* Ashmead** (possibly in part, see under species)

Key to Palaearctic species of *E.* (*Eupelmus*) based on males

1 Fore wing uniformly setose through basal cell and disc (Fig. 81h); disc bifasciate, with hyaline region behind about apical half of mv having white setae separating brownish regions with dark setae behind stv and behind base of mv and parastigma (Fig. 81e) . . . . . ***E. orthopterae* (Risbec)** and likely ***E. fasciatus* Gibson & Fusu n. sp**. (see under species)
- Fore wing dorsally usually with broad bare region (speculum) behind parastigma that extends obliquely behind mv (e.g. Figs 3g, 9e, 12f), though sometimes some setae interrupting region (e.g. Figs 83e, 87f) or rarely with only slender bare band (Fig. 21f) similar to linea calva of female; disc hyaline or rarely slightly infuscate behind discal venation (Fig. 21f) but not bifasciate 2
2(1) Antenna with anellus transverse but a distinct, dull, setose segment having at least two rows of setae (Fig. 87e insert) and flagellum more-or-less filiform with conspicuous, decumbent, curved setae surrounding all funiculars (Fig. 87e); pedicel about 2.5× as long as apical width and ventrally with row of 7–10 mostly straight, long setae (Fig. 87e); costal cell dorsally near leading margin with setae over almost entire length, including more than one row over apical half (Fig. 87f); lower face and gena posterior to malar sulcus with similarly long setae (Fig. 87c, d); middle and hind legs with femora and tibiae dark, and basal one or two tarsomeres pale (Fig. 87a, b) . . . . . ***E. pini* Taylor**
- Antenna with anellus very strongly transverse (discoidal), shiny, and smooth with at most one row of inconspicuous setae, and pedicel much shorter, subovoid, and with fewer setae (e.g. Figs 26g, 38f, 47e, 83d) or, if anellus and pedicel similar to above, then flagellum more distinctly clavate with relatively inconspicuous, short, recumbent setae (e.g. Figs 9f, 14d, 63c, 85c, 103e, 107e); costal cell dorsally with row of setae not extending so extensively along leading margin, and gena posterior to malar sulcus usually with one seta obviously longer and differentiated from other setae (e.g. Figs 12b, 30c, 47d, 63b); leg colour variable 3
3(2) Anellus sometimes subquadrate but if distinctly transverse then similarly dull and setose as subsequent flagellomeres (e.g. Figs 9g, 21e, 23e, 36f, 63e, 65g) and/or flagellum conspicuously clavate (Figs 63c, 98e, 103e); pedicel elongate-triangular, usually about 2× as long as apical width; flagellum variably distinctly clavate with comparatively inconspicuous, short, recumbent setae and funiculars increasing in width to clava, the clava obviously broader and apical funiculars relatively shorter than basal funiculars (e.g. Figs 9f, 14d, 21e, 63c, 66e, 85c, 103e, 107e) 4
- Anellus very strongly transverse (discoidal), smooth and shiny, with at most one, usually inconspicuous, row of setae along extreme apical margin (e.g. Figs 3c, 12d, 26g, 30d, 41f); pedicel subovoid, at most about 1.5× as long as apical width; flagellum usually elongate-filiform (e.g. Figs 12a, 47a, 54a, 79a) to robust-filiform (e.g. Figs 26e, 30e, 38e, 41e), with flagellomeres about same width such that clava not distinctly differentiated except in length, and usually conspicuously setose with erect to strongly curved decumbent setae (except males of *E. melanostylus*, Fig. 67g–i and *E. iris*, Fig. 44d) 15
4(3) Fore wing with mv at most about 2.2× length of stv (Figs 63d, 103f) or tegula white to yellowish (Fig. 107b); scape sometimes partly pale basally or along outer, ventral, longitudinal sensory region (Figs 103e, 107c); maxillary and labial palps usually white to yellowish-brown 5
- Fore wing with mv at least 2.5× and usually about 3× length of stv; tegula uniformly brown or dark; scape usually entirely dark (except *E. ceroplastae*); maxillary and labial palps at most with apical palpomeres pale 9
5(4) Legs entirely yellow or at most following distinctly darkened: mesofemur along ventral length in part, anterior surface of metafemur in ventral half, and meso- and metatibiae in apical half (Fig. 98b); head with short but conspicuous white lanceolate setae on parascrobal region and lower face, and gena with slightly more slender but subequally short setae (Fig. 98d); pedicel ventrally without apically curved or numerous distinct setae (Fig. 98d, e); flagellum with fl1 strongly discoidal, all funiculars transverse, and clava obviously longer than half length of funicle (Fig. 98e) . . . . . ***E. saharensis* Kalina**
- Legs more extensively dark, including front leg; head usually with more slender, hairlike setae on parascrobal region and lower face, but at least gena with one longer, differentiated seta; pedicel ventrally either with apically curved setae or several distinct, long setae; flagellum different than above, fl1 usually subquadrate or at least distinctly setose, funicle sometimes with some oblong funiculars, and clava at most about half length of funicle 6
6(5) Mesofemur with anterior surface longitudinally pale similar to profemur [*stramineipes* group] 7
- Mesofemur dark except basally and apically, similar to metafemur [*splendens* group] 8
7(6) Flagellum with anellus quadrate, virtually or fully as long as wide, and at least 0.75× length of fl2 (Fig. 107f); stv at angle of at least 40° relative to pmv, and length only about 1.4× distance between posterior margin of stigma and posterior margin of pmv (Fig. 107d) . . . . . ***E. stramineipes* Nikol'skaya**
- Flagellum with anellus sometimes obviously transverse but at least only about half as long as fl2 (Fig. 85c); stv at comparatively more acute angle, about 30° relative to pmv, and length about twice distance between posterior margin of stigma and posterior margin of pmv (Fig. 85d) . . . . . ***E. phragmitis* Erdős**
8(6) Mesotarsus with basal two tarsomeres white (Fig. 103c); lower face and gena on either side of malar sulcus near oral margin at most with relatively sparse apically curved setae (Fig. 103b); funicle with all funiculars uniformly cylindrical and setose (Fig. 103e) . . . . . ***E. splendens* Giraud**
- Mesotarsus with only basitarsus white in distinct contrast to subsequent brown tarsomeres (Fig. 63a); lower face and gena on

either side of malar sulcus near oral margin with obviously longer and denser, apically curved to sinuate setae usually forming quite conspicuous tufts of setae (Fig. 63b); funicle with at least fu2–fu4 and sometime fu1 appearing ventrally flat and asetose (Fig. 63e) . . . . . ***E. matranus* Erdős**

9(4) Protibia dark except narrowly basally and apically (Fig. 23b) . . . . . *Eupelmus* sp. nr ***E. cerris* Förster** (see under species)

- Protibia pale or at least longitudinally pale along anterior and often posterior surfaces (e.g. Figs 9b, 14b, 54a, 74b) 10

10(9) Costal cell dorsally near leading margin without or at most with one seta apically, and ventrally with inconspicuous white setae mostly in single line (Fig. 36d); basal cell at least with inconspicuous white setae (Fig. 36d) and sometimes sparsely setose to almost bare . . . . . ***E. gelechiphagus* Gibson & Fusu n. sp.**

- Costal cell dorsally near leading margin with several to numerous dark setae apically, and ventrally with conspicuous dark setae along length (Figs 9e, 14h, 21f, 65f, 74g); basal cell uniformly setose with distinct dark setae 11

11(10) Lower face sometimes with somewhat longer setae toward malar sulcus, but setae uniformly distributed and comparatively sparse, with longer setae straight to uniformly curved (Figs 14e, 21c, 74c); mesotibia dark (Figs 14g, 21b, 74a) 12

- Lower face in region between torulus and malar sulcus with region of conspicuously longer, apically sinuately to hook-like curved setae forming denser tuft with convergent or overlapping apices (Figs 9c, d, 65c); mesotibia variably extensively pale with at least anterior surface longitudinally pale to or almost to base (Fig. 9b) 14

12(11) Fore wing with speculum as slender bare band separated from parastigma and marginal vein by several rows of setae (Fig. 21f); pedicel with straight setae projecting at strongly acute angle relative to ventral margin (Fig. 21e); scrobal depression entirely reticulate (Fig. 21c); scape extensively yellowish basally (Fig. 21c); mesotarsus with basal tarsomere brown except apically (Fig. 21b) . . . . . ***E. ceroplastae* (Kalina)**

- Fore wing with speculum as broad bare region behind parastigma and base of marginal vein (Figs 14h, 74g); pedicel with several long, apically curved setae projecting ventrally (Figs 14d, 74e, f); scrobal depression extensively smooth and shiny; scape dark (Figs 14d, 74e); mesotarsus with at least basal tarsomere white 13

13(12) Costal cell dorsally near leading margin setose apically for distance only slightly greater than length of parastigma, and ventrally with single row of setae over most of length (Fig. 74g); speculum open posterobasally (Fig. 74g); frons finely but distinctly meshlike reticulate, quite obviously roughened (Fig. 74d) . . . . . ***E. nitidus* Nikol'skaya**

- Costal cell dorsally near leading margin with numerous dark setae over about apical half to two-thirds, and ventrally with setae at least indistinctly aligned into 2 rows basal to parastigma (Fig. 14h); speculum closed or almost closed posterobasally by row of setae (Fig. 14h); frons meshlike coriaceous, the surface not roughened (Fig. 14c) . . . . . ***E. azureus* Förster**

14(11) Funicle with differentiated region of setae ventrally on fu1, fu2, and fu3 at least basally, under lower magnification in ventral view visible as smoother, paler region among decumbent setae (Fig. 9f insert); legs with protarsus sometimes entirely infuscate and meso- and metatarsus with at most basal two tarsomeres uniformly pale, at least third and subsequent tarsomeres darker yellowish to infuscate (Fig. 9a, b) . . . . . ***E. annulatus* Nees**

- Funicle with differentiated region of setae ventrally on only fu1 and fu2 basally (Fig. 65h); legs with basal three tarsomeres of all tarsi uniformly pale, whitish. . . . . ***E. mehrnejadi* Gibson & Fusu n. sp.**

15(3) Head with variably conspicuous white lanceolate setae on at least parascrobal region and lower face (Figs 54b–d, 79c, d), and setae behind eye directed anteriorly or at least at an acute angle relative to orbit and sometimes subparallel with orbit (Figs 54d, 79d); flagellum conspicuously elongate-filiform (Figs 54a, 79a), length of flagellum + pedicel at least about twice head width and fl2 at least about 3× as long as wide (Fig. 54e); maxillary and labial palps brown; legs with at least femora extensively dark; mv only about 2× length of stv (Figs 54f, 79, f) [*orientalis* group] 16

- Head with hairlike setae and setae behind eye directed toward orbit; flagellum often distinctly more robust-filiform with shorter funiculars; maxillary and labial palps sometimes white; legs beyond coxae sometimes entirely or almost entirely pale, white to orange; mv sometimes about 3× length of stv. 18

16(15) Legs with tibiae yellowish to orange or at most metatibia with obscure subapical infuscate region in about apical third (Fig. 54a); head and mesosoma mostly dark with variably distinct reddish-coppery luster but at most very limited and obscure green luster (Fig. 54a–d) . . . . . ***E. lanceolatus* Gibson & Fusu n. sp.**

- Legs with at least meso- and usually metatibia having subapical infuscate region in about apical third (Fig. 79a); head and mesosoma often bright green or at least extensively greenish, though head and mesonotum sometimes with variably extensive reddish-coppery luster mesally (Fig. 79a–d). 17

17(16) Fore wing with white setae throughout basal cell and disc at least basally or mv at least 1.9× length stv (Fig. 79f); costal cell ventrally with pale, whitish setae and dorsally near leading margin often with setae over apical half or less (Fig. 79h) . . . . . ***E. orientalis* (Crawford)**

- Fore wing with conspicuous dark setae throughout basal cell and disc (Fig. 79g); mv often only about 1.6× or less, but at least less than 1.9× length of stv (Fig. 79e); costal cell ventrally usually with dark setae and dorsally near leading margin usually with setae over most of length (Fig. 79g) . . . . . ***E. vuilleti* (Crawford)**

18(15) Legs beyond coxae sometimes entirely pale but at least all tibiae entirely white to yellowish or orange (Figs 41b, 47a, 70a, 83a, 124a) and/or tegula pale, white to yellowish (often narrowly opaque yellow along inner margin adjacent to mesoscutum and more extensively hyaline apicolaterally) (Figs 41a, b, 47a, 70a); scape with at least extreme base and outer, ventral, longitudinal sensory region white to orange (Figs 41c, 70d, 124b); head with vertex uniformly curved into occiput; lower face with uniformly distributed and comparatively short, straight white setae (Figs 41c, 47c, d, 70c, d, 124b) 19

- Legs with femora and at least meso- and metatibiae at least partly dark apically, and tegula brown to dark; scape usually entirely dark, though rarely outer, ventral, longitudinal sensory region paler; head sometimes with transverse carina differentiating vertex from occiput (e.g. Figs 30e, 51e, 59c); lower face sometimes with conspicuously differentiated denser region of longer and apically abruptly curved or sinuate, usually dark setae (e.g. Figs 30c, 44e, 51d, 59d). 23

19(18) Flagellum robust-filiform with all funiculars only about as long as wide (Fig. 41e) and fl2 shorter than pedicel (Fig. 41f); pedi-

cel ventrally with short, straight setae (Fig. 41f); gena posterior to malar sulcus without distinctly differentiated long seta (Fig. 41c); legs pale except following dark: apical tarsomeres, usually mesofemur ventrally along much of length, and about basal three-quarters of metafemur (Fig. 41b) . . . . . ***E. infimbriatus* Gibson & Fusu n. sp.**

- Flagellum conspicuously elongate-filiform with all funiculars obviously longer than wide (Figs 47a, 70a, 83d, 124a) and fl2 longer than pedicel (Figs 47e, 70e, 83d, 124f); pedicel ventrally with at least 3 long, apically curved setae (Figs 47e, 70e, 83d, 124f); gena posterior to malar sulcus with an obviously longer, differentiated seta (Figs 47d, 70d, 83c, f, 124b); legs with different colour pattern 20

20(19) Fore wing with mv at least about 3× as long as stv (Figs 83e, 124e); scape sometimes almost entirely pale but at least inner (mesal) surface extensively orangey to yellowish-brown (Figs 83c, f, 124b); tegula yellowish-orange to brown 21

- Fore wing with mv only about 2× as long as stv (Fig. 70f); scape with inner (mesal) surface mostly or entirely dark, though longitudinal sensory region pale (Fig. 70d); tegula always pale 22

21(20) Head with white setae, including one obviously longer seta on gena near base of mandible (Fig. 124b); head and mesosoma dark green (Fig. 124a–c) to bright bluish-green; fore wing broadly setose to base of mv and sometimes partly along parastigma such that speculum more-or-less L-shaped, broad behind parastigma and more elongate-narrow apically behind base of mv (Fig. 124d, e); head with OOL obviously greater than MPOD [western Palaearctic] . . . . . ***E. vindex* Erdős**

- Head with dark setae, and those on gena subequally short (Fig. 83f); head and mesosoma often dark, but at most with slight bluish luster (Fig. 83a, c, f) except usually for propodeum (Fig. 83b, g); fore wing bare along parastigma and with at least a couple of setae mesally within speculum and commonly with 1–3 rows of setae extending obliquely at least partly through speculum (Fig. 83e); head with OOL usually obviously less than MPOD (Fig. 83b) (except for small individuals) [far eastern Palaearctic] . . . . . ***E. peculiaris* Narendran**

22(20) Antenna with length of flagellum + pedicel at most only about 1.8× head width, and fl2 less than 2.5× as long as wide (Fig. 70a, e); costal cell dorsally near leading margin with row of setae over at least apical third (Fig. 70f); legs usually with mesotibia and sometimes metatibia darkened apically and usually with one or more femora partly dark (Fig. 70a) . . . . . ***E. microzonus* Förster**

- Antenna conspicuously elongate-filiform with length of flagellum + pedicel at least 2× head width, and fl2 at least about 3× as long as wide (Fig. 47a, e); costal cell dorsally bare, without setae near leading margin (Fig. 47f); legs (excluding apical tarsomeres) entirely whitish-yellow to bright yellow beyond coxae except sometimes metafemur partly dark (Fig. 47a) . . . . . ***E. kalinai* Gibson & Fusu** and possibly ***E. iranicus* Kalina** (see under species)

23(18) Legs with at least basal half of tibiae yellow (Fig. 12a, c); flagellum conspicuously elongate-filiform with combined length of pedicel + flagellum at least about 1.5× head width, and fl2–fl8 at least 1.5× as long as wide (Fig. 12a, d) . . . . . ***E. atropurpureus* Dalman**

- Legs with at least meso- and metatibiae much more extensively dark than described above; flagellum more robust-filiform with shorter flagellomeres 24

24(23) Head with vertex uniformly curved into occiput, though sometimes with quite strongly, transversely aligned reticulate sculpture 25

- Head with definite transverse ridge or carina delimiting vertex from occiput (Figs 30d, 49d, 51e, 59c) [*fulvipes* group] 36

25(24) Lower face with setae often obviously longer toward malar sulcus than mesally, but uniformly arranged, straight to evenly curved, and usually whitish (e.g. Figs 2a, 25c, 66c); meso- and metatarsus with at least basitarsus and often basal 2 or 3 tarsomeres of at least mesotarsus white 26

- Lower face toward malar sulcus with obviously differentiated region of much longer, usually brownish, but at least apically sinuately to abruptly hook-like curved setae with partly overlapping or convergent apices to form tuft of setae that appears flattened apically (Figs 44e, 76b, 114d, 121c); mesotarsus usually and metatarsus often entirely infuscate to dark (Fig. 121a) or almost so (Figs 76a, c, e, 121b), but at most both with basal 2 tarsomeres white 33

26(25) Maxilla with apical palpomere pale or mostly so (Fig. 89b); pedicel ventrally with 6–8 setae forming row of apically curved setae (Fig. 89f, left insert) and exterior to these with 5–8 shorter, straight, dark setae in row along most of length (Fig. 89f, right insert); costal cell ventrally with two complete rows of setae along length (Fig. 89e) . . . . . ***E. pistaciae* Al khatib**

- Maxilla with apical palpomere similarly dark as preceding palpomeres (e.g. Figs 3d, 26d, 111f, 116b); pedicel ventrally usually with fewer setae forming row of apically curved setae but at least with fewer, most often unobvious, dark setae not extending along length of pedicel; costal cell ventrally sometimes with only single row of setae, at least mesally if not more extensively within basal half 27

27(26) Pedicel ventrally with row of 6 or 7 long setae (Fig. 26g); pronotum with neck almost vertical (Fig. 26a); costal cell ventrally with single row of setae at least mesally (Fig. 26h) and sometimes over basal half; meso- and metatarsi with at least basal two and often three tarsomeres white in contrast to subsequent tarsomeres (Fig. 26b) . . . . . ***E. confusus* Al khatib**

- Pedicel ventrally with row of 4 or 5 long setae (e.g. Figs 3c, 38f, 105g); pronotum often with neck sloping at about a 45° angle relative to mesonotum (e.g. Figs 3a, 38b, 94a, 111a); costal cell ventrally often with two complete rows of setae (Fig. 38g); meso- and metatarsi sometimes with only basitarsus white in contrast to subsequent darker, yellowish-brown to dark brown tarsomeres 28

28(27) Flagellum subclavate, the funiculars increasing slightly in width to clava such that basal funiculars oblong but apical funiculars quadrate to slightly transverse, and with subappressed setae removed only slightly from surface (Fig. 67g); clava with broadly oval micropilose sensory region occupying entire ventral surface, and with similarly short setae ventrally on apical two funiculars (Fig. 67h, i) . . . . . ***E. melanostylus* Gibson & Fusu n. sp.**

- Flagellum robust-filiform, the funiculars of similar length and width to clava, and with dense, outstanding, curved setae (e.g. Figs 38e, 94f, 105f, 111e); clava with micropilose sensory region not extending to base, and apical two funiculars uniformly covered with curved setae similar to previous funiculars (e.g. Figs 94f, 111g) 29

29(28) Frons meshlike coriaceous to slightly imbricate, at most with a few cells slightly depressed centrally but sculpture not delin-

eated by raised ridges (Fig. 94e); scrobal depression, including scrobes, with distinct meshlike sculpture . . . . . ***E. punctatifrons*** **Fusu & Gibson n. sp. /E. cerris Förster [***E. cerris* added at page proof stage; however, males of the two species differ in leg color pattern and costal cell setal pattern, see under respective species.**]**

- Frons variably distinctly reticulate, the sculpture delineated by raised ridges (Figs 3e, 38d, 105d); scrobal depression with at least scrobes extensively smooth and shiny (e.g. Figs 105d, 111c) 30

30(29) Fore wing with speculum completely open posteriorly except for at most 1 seta on cubital fold adjacent to basal fold (Fig. 3g); meso- and metatarsi with only basitarsus white in contrast to subsequent yellowish-brown to dark brown tarsomeres (Fig. 3a); costal cell ventrally with only one row of setae over most of about basal third to half of cell (Fig. 3g) . . . . ***E. acinellus*** **Askew**

- Fore wing with speculum often more extensively closed posterobasally by setae (Figs 38g, 105e), but if widely open then at least mesotarsus and often metatarsus with basal two or three tarsomeres white in contrast to more apical brown tarsomeres (Figs 38b, 105a, b); costal cell ventrally often with two complete rows of setae or at least for distinct length basally (Fig. 38g) 31

31(30) Far eastern Palaearctic; pedicel ventrally with five long setae of which at least basal four curved apically (Fig. 111e); costal cell dorsally near leading margin with less than 12 setae apically; body comparatively dark bluish-green (Fig. 111a–f) with frontovertex usually variably conspicuously bicoloured, dark or with slight violaceous luster mesally and more distinctly bluish-green along orbits (Fig. 111c); meso- and metatarsi with only apical two tarsomeres similarly dark (Fig. 111a) . . . . . ***E. tanystylus*** **Gibson & Fusu n. sp.**

- Western Palaearctic; pedicel ventrally almost always with only four long setae ventrally (Fig. 105g), but if with five (Fig. 38f) then costal cell dorsally near leading margin with more than 12 setae apically (Fig. 38g); body usually brighter and more uniformly green to bluish-green (Figs 38a–d, 105a–d); meso- and metatarsi sometimes with apical three or four tarsomeres similarly dark 32

32(31) Costal cell dorsally near leading margin with at least 12 and usually more setae apically, and ventrally with two complete rows of uniformly dark and conspicuous setae (Fig. 38g); meso- and metatarsi often with only one or two basal tarsomeres white (Fig. 38a, b) . . . . . ***E. gemellus*** **Al khatib/*E. martellii* Masi**

- Costal cell dorsally near leading margin with at most 14 and usually much fewer setae apically (Fig. 105e), and ventrally with a single row of setae for at least a short distance mesally and often more extensive basally, and sometimes paler and therefore less conspicuous basally than apically (Fig. 105e); mesotarsus usually and metatarsus often with basal three tarsomeres white (Fig. 105a, b) . . . . . ***E. stenozonus*** **Askew**

33(25) Head and mesosoma dorsally green to somewhat bluish-green with some coppery luster (Fig. 44a–c); flagellum with fl2 nearly twice as long as wide, much longer than fl3 and slightly longer than fl4 (Fig. 44d, e); speculum at least mostly open posterobasally, at most with single seta mesally within bare region; mesotarsus dark (Fig. 44b) **[**Far eastern Palaearctic**]** . . . . . ***E. iris*** **Fusu & Gibson n. sp.**

- Head and mesosoma dorsally varying from dark blue or purple to black without green luster (Figs 76a, b, 114a–d, 121a–d); flagellum with fl2 subquadrate to slightly longer than wide, subequal in length to fl3 and shorter than fl4 (Figs 76d, 114g, 121f); speculum closed posterobasally by setae (Fig. 121h); mesotarsus sometimes partly white (Figs 76c, e, 114a, b, 121b) **[**Western Palaearctic**]** 34

34(33) Legs with meso- and metatarsi with basal two tarsomeres white and contrasting with subsequent tarsomeres (Fig. 114a, b) . . . . . ***E. tibicinis*** **Bouček**

- Legs with at least mesotarsus having at most basitarsus white (Figs 76c, e, 121b) and often mesotarsus and sometimes metatarsus entirely or almost entirely infuscate to dark (Fig. 121a) 35

35(34) Legs with both meso- and metatarsi entirely infuscate (Fig. 121a) or at least mesobasitarsomere pale only within about basal half, though metatarsus more commonly with basitarsomere entirely white . . . . . most ***E. urozonus*** **Dalman** and possibly some ***E. opacus*** **Delvare** (see under species)

- Legs with both meso- and metabasitarsi entirely white, and metatarsus usually with basal two or three tarsomeres white or at least distinctly paler than more apical tarsomeres (Fig. 121b) . . . . . ***E. opacus*** **Delvare** and some ***E. urozonus*** **Dalman** (see under species)

36(24) Mesotibial spur dark (Fig. 116f) . . . . . ***E. tremulae*** **Delvare**

- Mesotibial spur white 37

37(36) Scape with ventral margin distinctly angulate subapically (Fig. 49c, d); lower face with somewhat longer setae toward malar sulcus, but the setae relatively sparse and uniformly distributed and curved (Fig. 49d, e) . . . ***E. kamijoi*** **Gibson & Fusu n. sp.**

- Scape ovoid, the ventral and dorsal margins evenly curved (e.g. Figs 34e, 109a, b); lower face usually with more-or-less tuft-like region of denser, apically abruptly curved or sinuate setae (Figs 30c, 51a, b, 59d, 109c) 38

38(37) Propodeum variably sculptured, with or without complete median carina, but at least comparatively finely sculptured without irregular transverse carinae interrupting median carina medially (Figs 34g, h, 52e–h); metacoxa in lateral view usually widest near middle to apical two-thirds where dorsal margin more-or-less angulate or denticulate and more apically with dorsal margin usually raised into irregular carina or slender flange (Figs 34f, 51f) (structure not conspicuous in smaller individuals); flagellum with fl2 at most as long as wide and as long as pedicel; mesotarsus usually with basal two or three tarsomeres pale (Figs 34e, 51a) . . . . . ***E. kiefferi*** **De Stefani /*E. fulvipes* Förster**

- Propodeum almost always with one or more irregular, transverse carinae interrupting median carina so as to be variably distinctly rugose mesally (Figs 30f, g, 59g, 109f, h); metacoxa in lateral view with dorsal margin sometimes finely carinate, but evenly curved and narrowed apically so as to be broadest within basal half (e.g. Figs 44f, 49f); flagellum with fl2 noticeably oblong, at least about 1.2× as long as wide, and usually definitely longer than pedicel (Figs 30d, 59h, 100g); mesotarsus with at most basitarsus pale or at least subsequent tarsomeres darker yellow to brown (Figs 30a, 109e) . . . . . ***E. flavicrurus*** **Yang /*E. formosae* Ashmead /*E. luteipes* Fusu & Gibson n. sp. /*E. tachardiae* (Howard)**

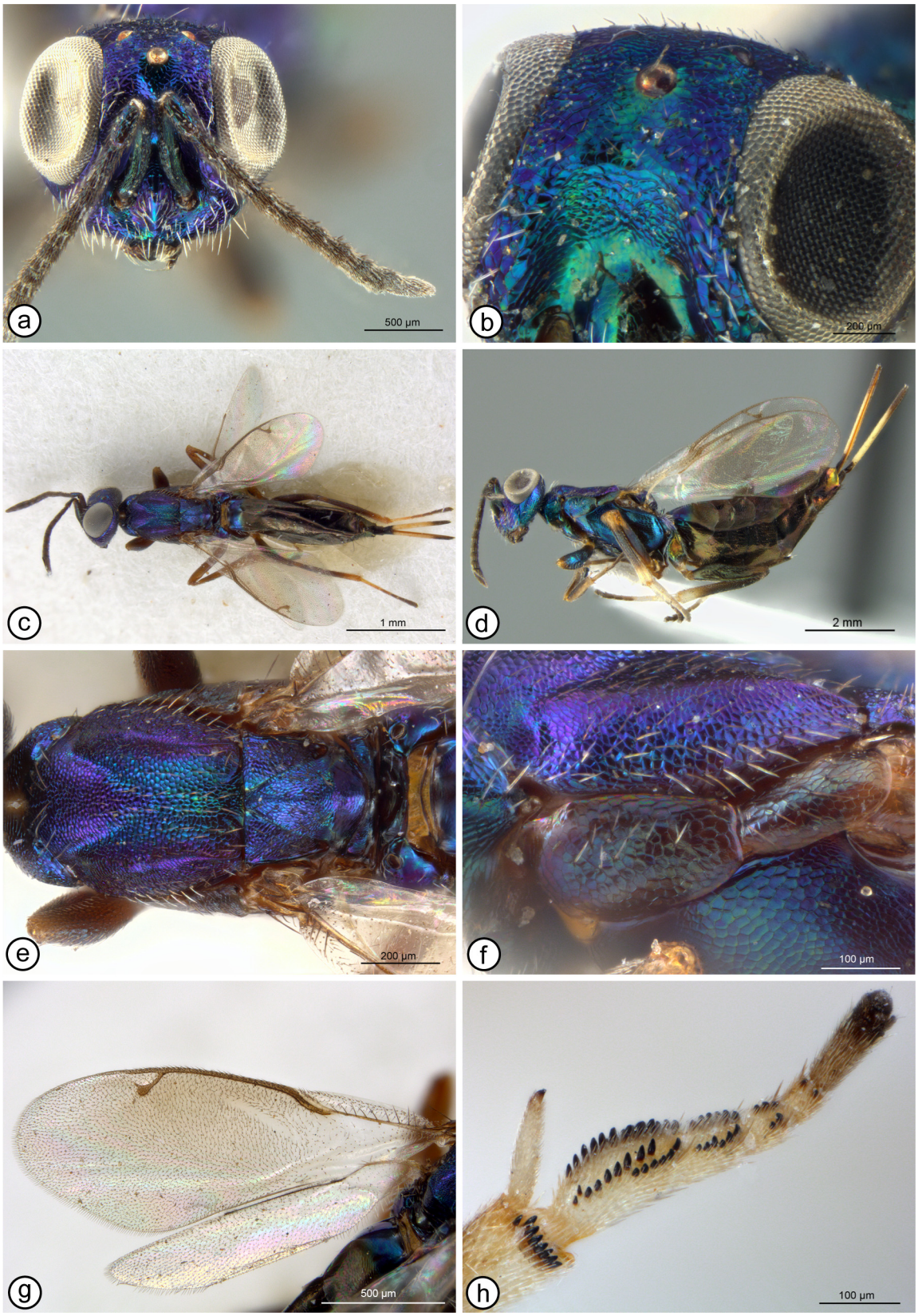

FIGURE 2. *Eupelmus acinellus*, ♀. **a**, head, frontal (2013-1). **b**, frontovertex (2012-63). **c**, dorsal habitus (2010-37). **d**, lateral habitus (2013-1). *e–g* (2010-37): **e**, mesosoma, dorsal; **f**, prepectus and tegula; **g**, wings. **h**, apex of mesotibia and mesotarsus (paratype, 2012-64).

Palaearctic species of *Eupelmus* (*Eupelmus*)

E. (*Eupelmus*) *acinellus* Askew

Figs 2a–h (♀), 3a–g (♂)

Eupelmus acinellus Askew *in* Ribes Escolà & Askew, 2009: 110–112. Holotype ♀, MNCN, not examined (3♀ & 4♂ paratypes examined by GG). Type data: Spain, Lleida, Juncosa, alt. 790 m, UTM 31T CF17, ex. fruit of *Juniperus phoenicea* collected 28.X.2006, emerged 25.III.2007 (forced), A. Ribes.

Eupelmus (*Eupelmus*) *acinellus*; Al khatib *et al.*, 2014: 813 (♀ keyed), 822 (♂ keyed).

Description. FEMALE (habitus: Fig. 2c, d). Length = 2.4–3.2 mm [2.4–4.1 mm]. Head mostly blue to purple (Fig. 2a, b) or with more greenish luster near ocelli and sometimes on lower face and gena under some angles of light; with slightly lanceolate white setae on lower face and parascrobal region to at least dorsal level of scrobal depression and often on frons along inner orbit compared to less conspicuous hairlike setae on vertex and medially on frons. Maxillary and labial palps brown. Antenna (Fig. 2a) dark with metallic lusters similar to head on scape and pedicel. Mesosoma (Fig. 2c–f) blue to purple similar to head though posteromedial depressed region of mesoscutum sometimes with limited greenish luster, acropleuron sometimes with greenish or coppery luster mesally under some angles of light, and tegula and prepectus often somewhat more brownish with variably distinct metallic lusters. Pronotum with admarginal setae white; mesonotum with hairlike to slightly lanceolate, pale to brownish setae; prepectus (Fig. 2f) with up to 9 comparatively inconspicuous setae in about two longitudinal rows within dorsal half; callus with moderately dense white setae laterally not concealing cuticle. Macropterous; fore wing (Fig. 2g) hyaline or disc with at most faint brownish infuscation behind mv and pmv anterior to cubital fold, but all setae dark; costal cell dorsally near leading margin with at least 1 or 2 partial rows of setae near over about apical half to two-thirds, and ventrally with about 3 rows along length; basal cell and disc entirely setose except for linea calva. Front leg dark with metallic luster except knee pale, tibia variably extensively pale apically and along anterior surface, and tarsus pale to brown but at least with apical tarsomere dark. Middle leg sometimes almost uniformly yellowish-brown beyond coxa except for dark mesotibial apical pegs and mesotarsal pegs but more commonly with similar colour pattern as front leg except darker regions variably dark brown with at most slight metallic luster. Hind leg with 1 or 2 basal tarsomeres and apex of tibia pale, otherwise dark though tibia sometimes with extreme base slightly lighter in colour. Gaster with hairlike setae; brown except basal tergite anteriorly blue to purple; ovipositor sheaths (Fig. 2c, d) distinctly banded, with elongate medial pale band at least about twice length of basal dark band, and obviously longer than either basal or apical dark bands.

Head in dorsal view with interocular distance about 0.4× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; vertex more alutaceous-imbricate posteriorly, but frons at least very shallowly meshlike reticulate (Fig. 2b); scrobal depression punctate-reticulate to transversely reticulate-rugulose (Fig. 2b); OOL: POL: LOL: MPOD = 0.7–1.0: 2.1–2.6: 1.3–1.8: 1. Mesoscutum (Fig. 2e) meshlike reticulate except medial lobe more transversely reticulate-imbricate anteriorly and lateral lobe with mediolongitudinal band of minute coriaceous sculpture. Scutellum and axillae low convex in same plane; axilla mostly meshlike reticulate anteriorly to obliquely reticulate-imbricate posteriorly; scutellum longitudinally reticulate-imbricate laterad midline and frenal area meshlike coriaceous or with subeffaced sculpture. Acropleuron more-or-less isodiametric meshlike anteriorly and posteriorly and much more minutely sculptured mesally, the larger meshlike sculpture coriaceous-reticulate, at most delineated by only slightly raised lines. Fore wing (Fig. 2g) with cc: mv: pmv: stv = 3.9–5.0: 3.9–4.7: 1.0–1.2: 1.0. Middle leg (Fig. 2h) with row of 5–8 mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus and pegs clearly differentiated into two rows apically, second tarsomere with 4–6 pegs, third tarsomere with 2 or 3 pegs, and fourth tarsomere with 1 peg apically on either side (Fig. 2h). Propodeum with broadly U-shaped plical depression extending to posterior margin (Fig. 2e). Gaster (Fig. 2c, d) similar in length to combined length of head and mesosoma (Fig. 2c, d); not atypically modified; not extending to apex of second valvifer, the latter extending quite obviously beyond gastral apex, with apparent sheath length about 1.2–1.3× length of metatibia and 1.6–1.8× length of mv, and third valvula about 1.1–1.2× length of metatibia and 1.4–1.6× length of mv; hypopygium extending about two-thirds length of gaster.

MALE (habitus: Fig. 3a, b). Length = 1.7–[2.2] mm. Head bluish-green to more distinctly blue and sometimes with quite extensive purple luster (Fig. 3d); frontovertex meshlike reticulate (Fig. 3e), with vertex uniformly curved into occiput; scrobal depression extensively meshlike reticulate to reticulate-rugulose excluding shiny

scrobes (Fig. 3e); setae hairlike to very slightly lanceolate, white; lower face toward malar sulcus with somewhat longer but evenly distributed setae, the longer setae uniformly curved (Fig. 3d); gena posterior to malar sulcus with 1 longer seta differentiated from others, and posterior to eye with apices of setae directed toward orbit. Antenna (Fig. 3a, b) with scape entirely dark; length of pedicel + flagellum 1.2–1.3× head width; pedicel subglobular, at most about 1.5× as long as wide, ventrally with row of 4 long white setae, of which basal 3 are hook-like curved (Fig. 3c); anellus very strongly transverse, discoidal, shiny, with at most inconspicuous sparse setae at extreme apical margin (Fig. 3c); flagellum robust-filiform, fu1 about as long as pedicel, with all funiculars longer than wide but at most 1.4× as long as wide, and clava subequal in length to apical two funiculars; funicle and clava uniformly covered with decumbent, curved setae, the basal funiculars without evident regions of differentiated setae ventrally (Fig. 3c). Maxillary and labial palps light to dark brown. Mesosoma (Fig. 3a, b) similar in colour to head, greenish-blue to bluish-green except propodeum more distinctly blue to purple and often pronotum and mesonotum laterally purple; setae hairlike, brown to pale brownish on pronotum and mesonotum and more distinctly white on propodeal callus; tegula dark. Front leg (Fig. 3a) with femur almost entirely dark with distinct blue to purple luster on at least posterior surface, and tibia with dorso- and ventrolongitudinal dark bands, but knee narrowly and tibia narrowly apically and longitudinally on anterior and posterior surfaces pale; tarsus mostly infuscate though usually basitarsus pale or at least lighter brownish than subsequent tarsomeres. Middle leg entirely dark except knee, tibia apically, and basitarsus pale, the subsequent tarsomeres light brownish to dark brown but at least contrasting with basitarsus. Hind leg (Fig. 3a, b) similar in colour to middle leg except knee and tibia apically not distinctly pale. Fore wing with mv about 3.0× length of stv; costal cell (Fig. 3g) dorsally near leading margin with row of numerous dark setae over apical half to two-thirds, and ventrally with only single row of setae within about basal third to half; basal cell (Fig. 3g) uniformly setose with dark setae; speculum broadly open posteriorly, with at most single seta on cubital fold adjacent to basal fold and setae forming distal margin of speculum in straight line. Propodeum (Fig. 3g) with complete median carina, quite shiny, only very finely meshlike coriaceous.

Distribution. France [34 [Hérault], Vallarques, 1984, Mills, CIBC, CNC Photo 2012-64 (NMPC: 1♀)], Spain, **Croatia*** [Biograd na m., Bouček, 12.VII.1968, CNC Photo 2010-37 (NMPC: 1♀)].

The records from France and Croatia are based on females identified originally as *E. tibicinis* by Z. Bouček prior to the description of *E. acinellus*.

Biology. A primary parasitoid of *Mesophleps oxycedrella* (Millière) (Lepidoptera: Gelechiidae) in seeds of *Juniperus phoenicea* L. (Ribes Escolà & Askew 2009, Al khatib *et al.* 2014) and *J. oxycedrus* L. (Al khatib *et al.* 2014) (Cupressaceae).

Remarks. *Eupelmus acinellus* was described from 26 females and 27 males reared from *J. phoenicea*, of which only some were designated as paratypes. Photographs were provided of the larva as well as the mesotibial apical and mesotarsal peg pattern of females and the lateral habitus, antennae and fore wings of both sexes (Ribes Escolà & Askew 2009, fig. 2a–h). Our description is based on just 12 females and 4 males, of which two of the males and three of the females are paratypes.

Individuals of *E. acinellus* are most similar to those of *E. stenozonus,* as noted by Ribes Escolà & Askew (2009), who discussed the best features to distinguish both sexes of the two species. In addition, females of *E. acinellus* are typically somewhat larger and have the scrobal depression much more extensively and strongly sculptured, punctate-reticulate to reticulate-rugulose (*cf* Figs 3e, 104b). Females of *E. stenozonus* have the scrobal depression distinctly sculptured at most within about its dorsal half, and there more shallowly meshlike reticulate to coriaceous. Because of their comparatively long, banded ovipositor sheaths and sparsely setose prepectus, females of *E. acinellus* are also similar to females of *E. tibicinis* and *E. janstai*, but the latter have brown to black pronotal admarginal setae, and the frons coriaceous to smooth rather than reticulate (*cf* Figs 3e, 45a). The latter sculptural difference can be subtle and requires careful observation with proper lighting to appreciate. Females of *E. tibicinis* are most similar to *E. acinellus* in size and body colour, being primarily dark blue to purple (Fig. 113b–d), but they have at least the hind leg more extensively pale and the scrobal depression only very finely sculptured (Fig. 113a), more similar to *E. stenozonus*. This combination of features can assist correct identification.

Males of *E. acinellus* are distinguished by the combination of features given in the key. A single basal white tarsomere for the middle and hind legs (Fig. 3a) likely is characteristic of *E. acinellus* males based on our observations and the description of Ribes Escolà & Askew (2009), but additional specimens are required to confirm all males have as widely open speculum (Fig. 3g) as we describe.

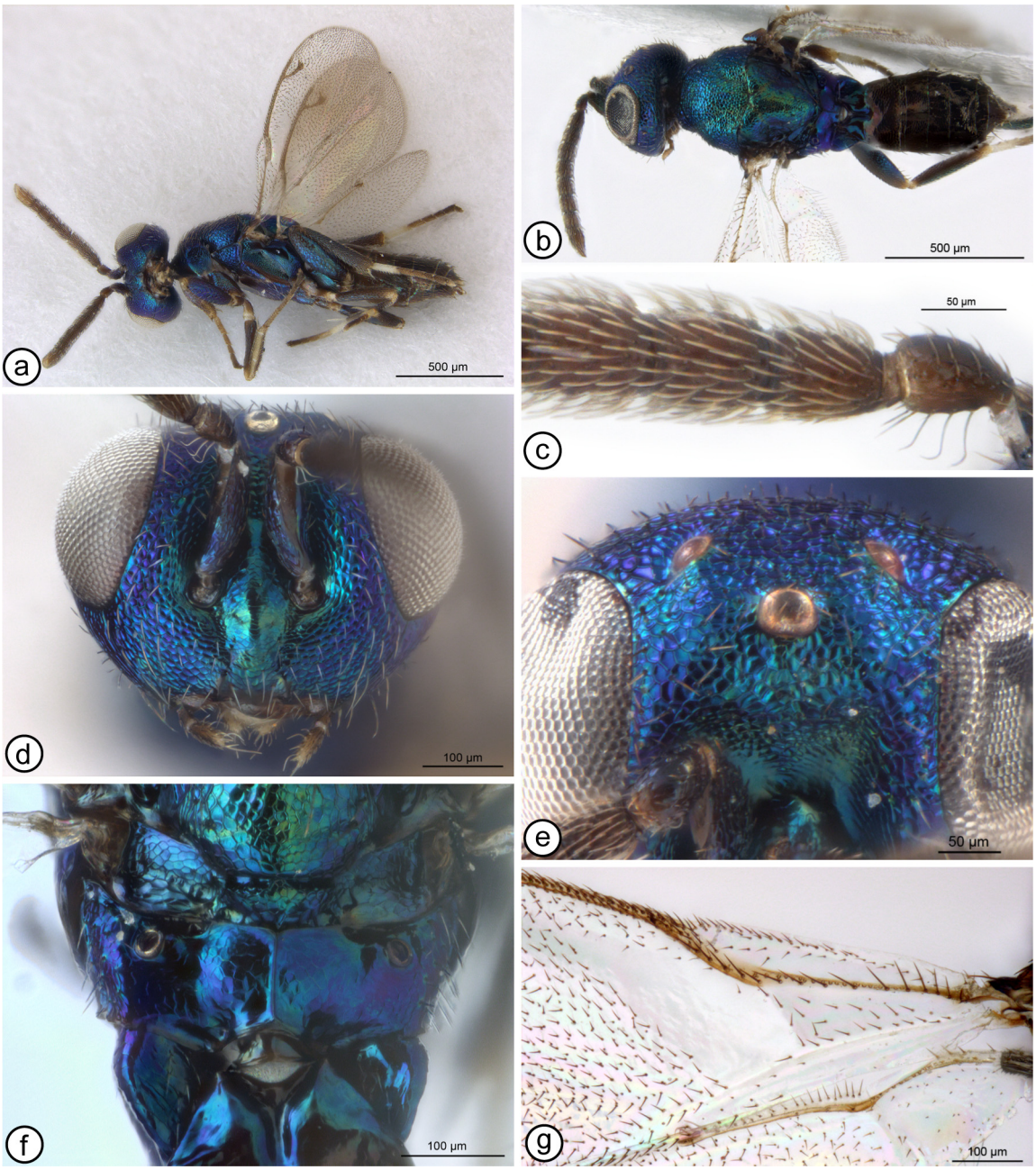

FIGURE 3. *Eupelmus acinellus*, ♂. *a, c, d* (2013-84): **a**, lateral habitus; **c**, pedicel and basal flagellomeres; **d**, head, frontal. *b, f, g* (2013-85): **b**, dorsal habitus; **f**, metanotum and propodeum; **g**, fore wing base. **e**, frontovertex (2014-121).

***E.* (*Eupelmus*) *adustus* Gibson & Fusu n. sp.**
Fig. 4a–h (♀)

Type material. Holotype ♀ (ELKU). JAPAN: KYUSHU, Mt. Koura, Kurume, Fukuoka Pref., 1 May 1998, Y. Higashiura leg. / HOLOTYPE ♀ *Eupelmus* (*Eupelmus*) *adustus* Gibson & Fusu, det. G. Gibson 2015. Condition: glued by right side on triangular card; uncontorted; entire except right antenna beyond pedicel and left antenna entirely missing.

Paratype. **Japan**: (Kyushu), Cape Sata., Kagoshima Pref., 29.IV.1962, A. Nakanishi (ELKU: 1♀, CNC Photo 2014-92).

Etymology. The Latin word *adustus* (tanned, brown), in reference to the slightly brownish fore wing disc of females.

Description. FEMALE (habitus: Fig. 4a, b). Length = 2.4–2.9 mm. Head with face (Fig. 4c) multicoloured, with frons (Fig. 4c, d) and interantennal prominence variably green to reddish-violaceous, but at least parascrobal region extensively reddish-violaceous, and lower face, scrobal depression and vertex more distinctly green to bluish-green (Fig. 4c) or vertex sometimes blue to purple (Fig. 4f)*;* with white hairlike to slightly lanceolate setae on lower face and parascrobal region but mostly more brownish hairlike setae on frons. Maxillary and labial palps brown. Antenna with scape partly yellow (Fig. 4a), dark basally or along dorsal and ventral margins (Fig. 4c), but conspicuously contrasting with dark pedicel and flagellum. Pronotum mostly dark with variably distinct metallic lusters laterally depending on angle of light (Fig. 4e, f); admarginal setae dark. Mesonotum (Fig. 4f) partly green, but convex part of mesoscutal medial lobe mostly dark with variably distinct reddish-violaceous luster, the depressed posteromedial region with variably distinct coppery luster in part, and outer surface of lateral lobe at least partly blue under some angles of light; scutellar-axillar complex, particularly scutellum, with distinct coppery to reddish-violaceous luster; with hairlike brownish setae. Prepectus brown with blue to purple luster anteriorly under some angles of light; with 3–5 setae (Fig. 4e). Tegula dark. Acropleuron, depending on angle of light, dark brown (Fig. 4a) with variably distinct green, coppery, blue or reddish-violaceous lusters, though mesopectus anterior to acropleural sulcus more distinctly blue to purple. Macropterous; fore wing (Fig. 4g) lightly infuscate with brown setae over extreme base of basal cell and extensively behind discal venation, contrasting with mostly hyaline basal cell with white setae (Fig. 4h); costal cell dorsally near leading margin with row of setae along about apical half to two-thirds, and ventrally with at least 3 rows along length (Fig. 4h); basal cell and disc entirely setose except for elongate linea calva. Front leg with femur and tibia dorso- and ventrolongitudinally extensively dark, but trochanter, knee, tibia more extensively apically and antero- and posteroventrally pale; tarsus pale to dark apically. Middle leg with trochanter pale, femur variably distinctly brownish except paler apically, tibia extensively pale but at least with short, darker brown annulus subbasally and with dark mesotarsal pegs, and tarsus pale except for mesotarsal pegs. Hind leg with trochanter, knee, tibia apically and tarsus pale, but femur mostly dark and tibia extensively dark mesally. Propodeum (Fig. 4f) with callus bright green, with hairlike to slightly lanceolate, much denser and longer white setae than on mesonotum. Gaster (Fig. 4a, b) with hairlike setae; mostly brown or with variably distinct coppery to slightly reddish-violaceous lusters under some angles of light, but at least basal tergite bright green to bluish-green basally; ovipositor sheaths distinctly banded with dark region basally, much longer white region medially, short brown region subapically, and paler apical region.

Head in dorsal view with interocular distance about 0.41–0.44× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; vertex evenly rounded into occiput, with vertex and occiput not differentiated by transverse carina, though carinate margins of transverse sculpture variably distinctly aligned in part; frons meshlike coriaceous (Fig. 4c, d); scrobal depression distinctly reticulate to transversely reticulate-strigose, with scrobes mostly reticulate or at least with evident meshlike sculpture (Fig. 4c); OOL: POL: LOL: MPOD = 1.0–1.2: 2.2–2.4: 1.5–1.6: 1.0. Mesoscutum (Fig. 4f) mostly meshlike reticulate except medial lobe more reticulate-imbricate to transversely imbricate anteriorly and lateral lobe with mediolongitudinal band of minute coriaceous sculpture. Scutellum and axillae low convex in same plane; axilla mostly obliquely and scutellum longitudinally reticulate-imbricate laterad midline anterior to meshlike coriaceous frenal area. Acropleuron more-or-less isodiametric meshlike anteriorly and posteriorly and much more minutely sculptured mesally, the larger meshlike sculpture at most delineated by only slightly raised ridges. Fore wing (Fig. 4g) with cc: mv: pmv: stv = 4.5–4.7: 4.6–4.9: 1.0–1.1: 1.0. Middle leg with row of 4 mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus and pegs clearly differentiated into two rows apically; second tarsomere with 4 or 5 pegs, third tarsomere with 2 or 3 pegs, and fourth tarsomere with 1 peg apically on either side. Propodeum with broadly U-shaped plical depression extending to posterior margin (Fig. 4f). Gaster (Fig. 4a, b) similar in length to combined length of head and mesosoma; not atypically modified; extending to or slightly over base of third valvula, the latter about 0.67−0.69× length of metatibia and 0.60−0.64× length of mv; hypopygium extending about two-thirds length of gaster.

MALE. Unknown.

Distribution. Japan.

Biology. Unknown.

Remarks. Females of *E. adustus* are distinguished in part by a combination of partly pale scape (Fig. 4a, c) and lightly infuscate fore wings (Fig. 4g, h). Although the brownish fore wing infuscation is quite light it is obvious because the basal cell is hyaline with white setae compared to its base and disc, which have dark setae in addition

to being slightly infuscate (Fig. 4h). The two known females lack a vertexal carina, but the pale scape suggests a possible relationship with the *fulvipes*-group. It remains to be shown whether males or some females might have a vertexal carina.

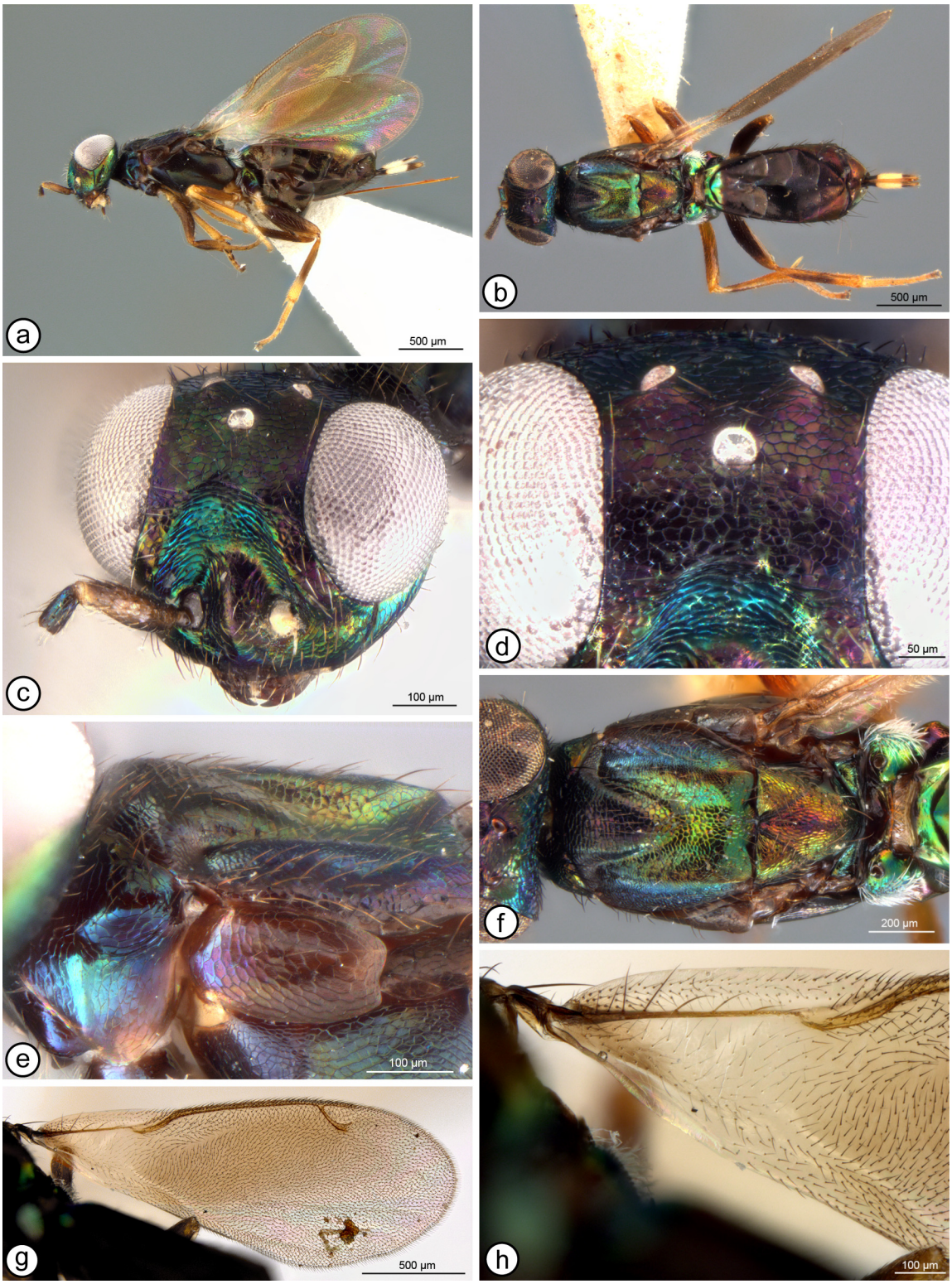

FIGURE 4. *Eupelmus adustus*, ♀. *a, c–e* (holotype): **a**, lateral habitus; **c**, face, frontolateral; **d**, frontovertex, **e**, pronotum, tegula and mesonotum, lateral. *b, f–h* (2014-92): **b**, dorsal habitus; **f**, head and mesosoma, dorsal; **g**, fore wing; **h**, fore wing base.

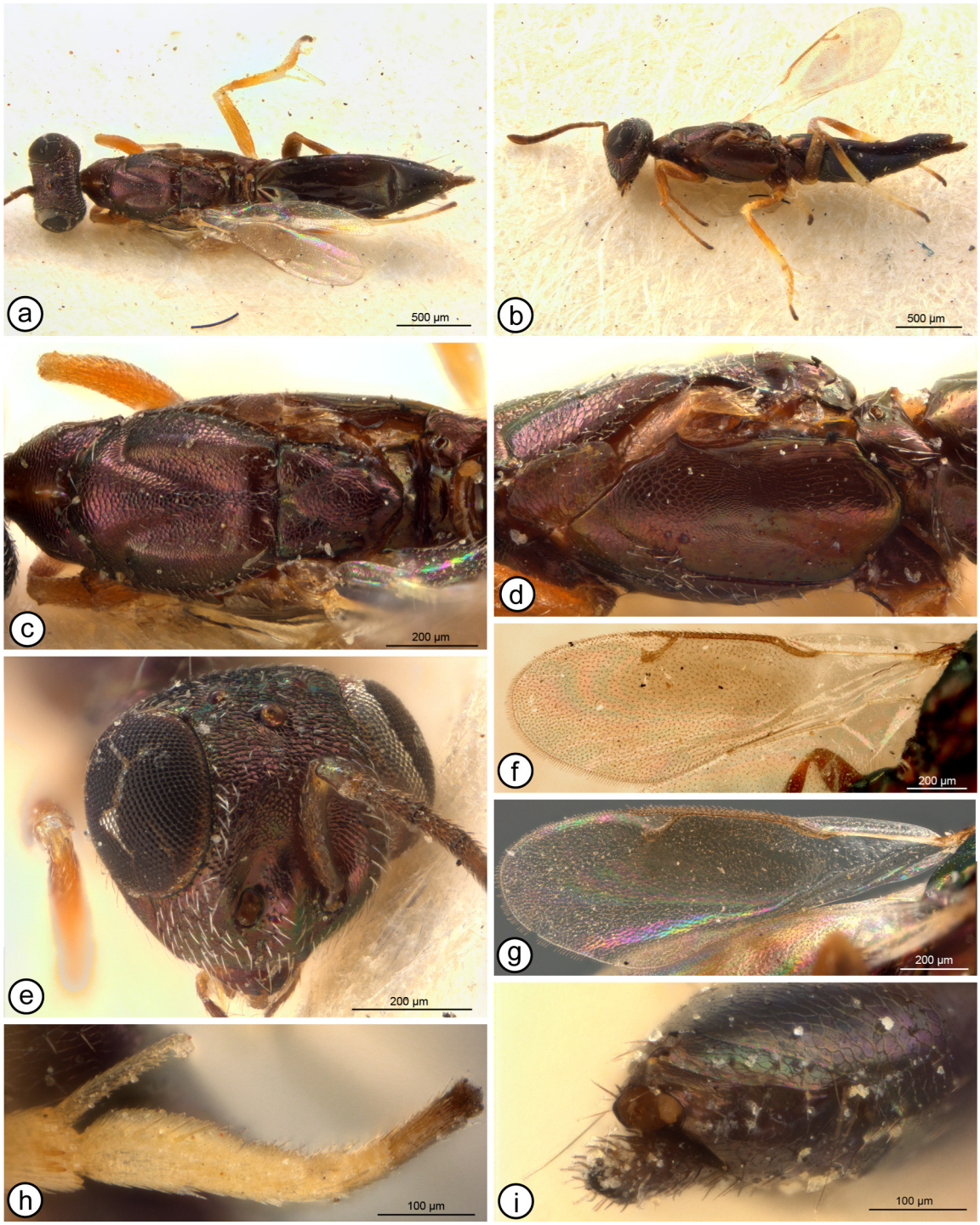

FIGURE 5. *Eupelmus africanus*, ♀. *a–f, i,* (holotype): **a**, dorsal habitus; **b**, lateral habitus; **c**, mesosoma, dorsal; **d**, mesosoma, lateral; **e**, head, frontolateral; **f**, fore wing on card; **i**, syntergum and ovipositor sheaths, posterolateral. **g**, fore wing on grey background (paratype 2015-10). **h**, apex of mesotibia and mesotarsus (paratype 2015-9).

E. (*Eupelmus*) *africanus* Kalina n. stat.

Fig. 5a–i (♀)

Eupelmus africanus Kalina, 1988: 20–22. Holotype ♀, IAEE, examined by GG. Type data: Africa sept.: Algeria, Hamman Salihine, 28.V.1971, A. Hoffer et J. Horák / Kreslený [= drawn].

Description. FEMALE (habitus: Fig. 5a, b). Length = 2.3–2.9 mm. Head (Fig. 5e) mostly brown with reddish-violaceous lusters except under some angles of light with variably distinct and extensive greenish luster on one or

more of frontovertex, frons along inner orbits, scrobal depression, and interantennal prominence; with conspicuous, slightly lanceolate white setae on lower face, parascrobal region and frons along inner orbit relative to shorter, less conspicuous hairlike setae on vertex and mesally on frons. Maxillary and labial palps with at least apical palpomeres brown (Fig. 5e). Antenna with scape brownish-yellow to light brown and often at least slightly lighter than pedicel and flagellum. Mesosoma (Fig. 5c, d), including tegula, mostly brownish with reddish-violaceous luster similar to head, except mesonotum under some angles of light with variably distinct and extensive greenish luster; mesonotum and prepectus with comparatively inconspicuous short white setae, the prepectus sparsely setose and callus with longer and therefore more conspicuous but comparatively sparse white setae (Fig. 5d). Macropterous; fore wing (Fig. 5f, g) hyaline except for variably distinct though light brownish infuscation extending from behind parastigma to level of stigmal vein anterior to mediocubital fold, the costal and basal cell setae white but discal setae brown; costal cell dorsally near leading margin with 1 row of inconspicuous setae along about apical two-thirds, and ventrally with about 3 rows of relatively inconspicuous setae; basal cell and disc entirely setose except for elongate linea calva. Front leg yellow to orangey-yellow beyond coxa except posterior surface of femur slightly darker mesally and pulvillus brown. Middle leg mostly pale beyond coxa with most of femur and tibia subbasally somewhat darker, orangey, and trochantellus, knee and tibia apically lighter, more yellow, and apical tarsomere or at least pulvillus brown. Hind leg with femur and tibia subbasally more distinctly brownish than for middle leg. Gaster (Fig. 5a) with hairlike setae; similar in colour to mesosoma or somewhat darker brown; ovipositor sheaths entirely brown (Fig. 5a, b, i).

Head in dorsal view with interocular distance about 0.45× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; vertex more transversely alutaceous-imbricate posteriorly, but at least frons and scrobal depression distinctly reticulate to reticulate-imbricate (Fig. 5e); OOL: POL: LOL: MPOD = 1.4–1.5: 2.7–3.1: 1.6–1.7: 1.0. Mesoscutum (Fig. 5c) shallowly meshlike reticulate except lateral lobe with mediolongitudinal band of minute coriaceous sculpture. Scutellum and axillae (Fig. 5c) low convex in same plane; similarly shallowly meshlike reticulate as mesoscutum. Acropleuron (Fig. 5d) comparatively finely sculptured, more-or-less isodiametric meshlike reticulate anteriorly, much more minutely coriaceous mesally, and with larger, more elongate reticulations posteriorly, but sculpture delineated by only very slightly raised ridges. Fore wing with cc: mv: pmv: stv = 4.0–4.2: 2.9–3.0: 1.2: 1.0. Middle leg with about 3 mostly pale and therefore comparatively inconspicuous mesotibial apical pegs; mesotarsus ventrally densely setose without pegs, though basitarsus with row of 3 or 4 longer, seta-like spines somewhat closer to anterior margin (Fig. 5h). Propodeum with comparatively large, rectangular to broadly subcircular plical depression extending to posterior margin (Fig. 5c). Gaster similar in length to combined length of head and mesosoma (Fig. 5a, b); syntergum with posterolateral angles abruptly, obliquely angled anteromesally toward base of ovipositor sheaths below anal sclerite, in posterior view syntergal margin appears transversely to subcircularly Ω-like over sheaths without distinct surface between anal sclerite and sheaths (Fig. 5i); extending over base of third valvula such that division between second valvifer and third valvula not visible, with sheaths only extending just beyond apex, the apparent sheath length only about 0.2× length of metatibia and less than 0.33× length of marginal vein; hypopygium extending a little beyond half length of gaster.

MALE. Unknown.

Distribution. Algeria.

Biology. Host unknown, but type series swept from *Tamarix* (Tamaricaceae) (Kalina 1988).

Remarks. Kalina (1988) described *E. africanus* from four females, of which we examined the holotype and two paratypes. The holotype (Fig. 5a, b) is card-mounted in an uncontorted state; it lacks its right antenna and right set of wings, but these were removed by Kalina to illustrate the original publication (Kalina 1988, fig. 39 and plate VI, figs 1, 2, 6, 7), as indicated by the type labels. One of the paratypes (CNC Photo 2015-9) is entire, but contorted, whereas the other (CNC Photo 2015-10) lacks its head and prothorax. We include *E. africanus* in the *iranicus* species-group along with *E. kalinai* and *E. iranicus*, as discussed under the latter species. Kalina (1988: 21) distinguished *E. africanus* from the latter two species primarily by the fore wing being "tinged with yellow" (*cf* Figs 5f, g and 46h) and the "mesopleuron more shiny, with more superficial sculpture" (*cf* Figs 5d with 42h, 46d). Although both are true, easier recognition features appear to be differences in body colour. The body, including the tegula, is mostly brownish with limited green luster for *E. africanus* females (Fig. 5a–e), whereas *E. kalinai* and *E. iranicus* females have a yellow tegula (Figs 42h, 46d) that contrasts conspicuously with a comparatively bright green to bluish-green body (see also under 'Remarks' for *E. iranicus*).

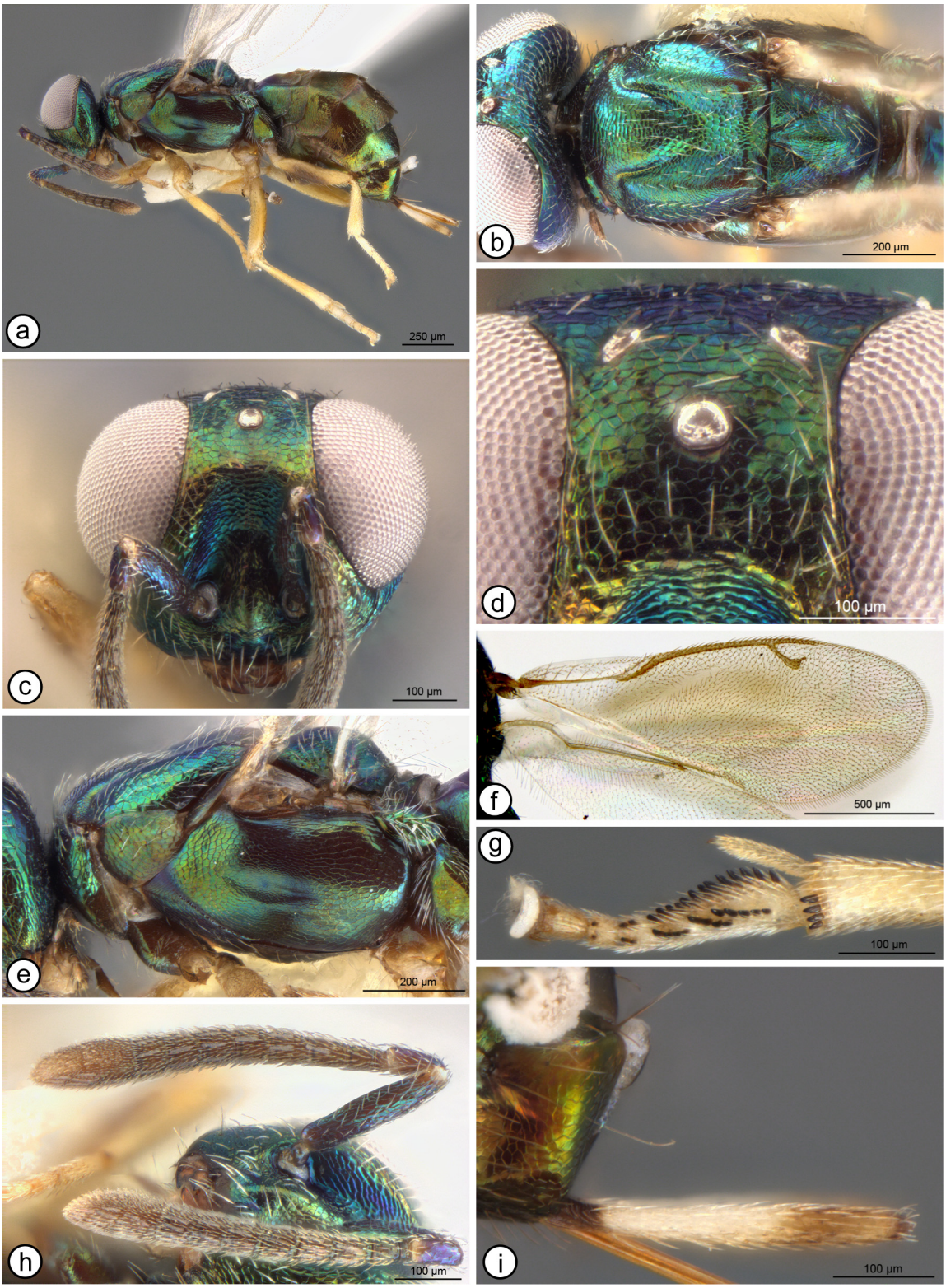

FIGURE 6. *Eupelmus angustifrons*, ♀. *a–e, g, h* (holotype): **a**, lateral habitus; **b**, head and mesosoma, dorsal; **c**, head, frontal; **d**, frontovertex; **e**, mesosoma, lateral; **g**, apex of mesotibia and mesotarsus; **h**, antennae. *f, i* (2013-57): **f**, fore wing [hyaline, apparent colour on membrane due to other set of wings beneath]; **i**, ovipositor sheaths.

***E.* (*Eupelmus*) *angustifrons* Gibson & Fusu n. sp.**
Fig. 6a–i (♀)

Type material. Holotype ♀ (CNC). JAPAN: Aichi Pref., Misawa, Seto, 29.VIII-2.X.1989, A. Takano /

HOLOTYPE ♀ *Eupelmus* (*Eupelmus*) *angustifrons* Gibson & Fusu, det. G. Gibson 2015. Condition: point-mounted; uncontorted; entire.

Paratypes (2♀). **Japan**: same data as holotype except collected 3-30.X.1989 (CNC: 1♀, CNC Photo 2013-57). **South Korea**: Chungnam, Keum-San, Nami-myeon, Seokdong, Pohyeonsa, 36º03.494'N 127º27.225'E, 24.VI-21.VII.2005, Tripotin rec, 5 Malaise tr. forest, DNA extracted 23.IV.2014, Fusu, ug.KO 28 (AICF: 1♀).

Etymology. The species name is formed from the Latin words *angustus* (narrow or slender) and *frons* (brow or forehead), in reference to the comparatively narrow interocular area that in part differentiates females of the species.

Description. FEMALE (habitus: Fig. 6a). Length = 1.9–2.1 mm. Head (Fig. 6c) primarily bright green except parascrobal region at least dorsally with coppery luster, occiput more bluish-green to blue (Fig. 6d) under some angles of light, and scrobal depression bluish-green to blue with variably distinct longitudinal purple band within scrobe (Fig. 6c, h); with white hairlike to very slightly lanceolate setae. Maxillary and labial palps brown. Antenna (Fig. 6h) uniformly dark brown except scape with bluish-green luster and pedicel with more bluish-purple luster. Mesosoma (Fig. 6b, e) almost uniformly bright green similar to head or only slightly more bluish-green dorsally, and tegula, prepectus and acropleuron under some angles of light more brownish with less distinct metallic luster (Fig. 6e). Pronotum with admarginal setae pale (Fig. 6e); mesonotum and prepectus with similar hairlike to slightly lanceolate white setae, the prepectus extensively setose with 6–8 setae (Fig. 6e); callus with somewhat longer and denser setae, but not obscuring cuticle (Fig. 6e). Macropterous; fore wing (Fig. 6f) hyaline with setae whitish basally to light yellowish on disc; costal cell dorsally near leading margin with row of setae over about apical half, and ventrally with 2 rows along length; basal cell and disc entirely setose except for elongate linea calva. Front leg almost entirely pale beyond coxa, the posterior surface of femur at most slightly, inconspicuously brownish and protibia at most with ventral margin narrowly and inconspicuously brown subbasally. Middle leg entirely pale beyond coxa except for dark mesotibial apical and mesotarsal pegs. Hind leg pale beyond coxa except anterior surface of femur variably extensively and distinctly brownish medially, but at least pale apically, basally and along dorsal and ventral margins. Gaster (Fig. 6a) with hairlike setae; mostly brown with variably distinct greenish luster laterally and dorsoapically, but dorsally with basal tergite strongly bluish-green anteriorly and apex of basal tergite and at least subsequent three tergites brown with coppery luster; ovipositor sheaths either with three or four distinct bands, dark basally and with longer pale band medially, but either with almost uniformly light brownish apical band or with this region differentiated into short subapical brownish band and short pale apical band (Fig. 6i).

Head in dorsal view with interocular distance only about 0.35× head width, subequal to or less than width of eye such that frons less strongly transverse than normal, with interocular distance measured at ventral margin of anterior ocellus 2.4–2.7× distance between anterior ocellus and scrobal depression (Fig. 6d); in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; frontovertex with transverse alutaceous-imbricate sculpture but ridge-like margins of sculpture not coalesced into distinct carina or margin differentiating vertex from occiput (Fig. 6b); frons entirely meshlike coriaceous (Fig. 6d); scrobal depression meshlike reticulate (Fig. 6e); OOL: POL: LOL: MPOD = 0.6–0.7: 2.2–2.4: 1.5–1.7: 1.0. Mesoscutum (Fig. 6b) mostly meshlike reticulate except medial lobe more transversely alutaceous to alutaceous-imbricate anteriorly and lateral lobe with mediolongitudinal band of minute coriaceous sculpture. Scutellum and axillae low convex in same plane; axilla meshlike coriaceous to alutaceous and scutellum mesally meshlike coriaceous to more longitudinally alutaceous laterally anterior to meshlike coriaceous frenal area. Acropleuron (Fig. 6e) more-or-less isodiametric meshlike anteriorly and posteriorly and much more minutely sculptured mesally, the larger meshlike sculpture posteriorly coriaceous-reticulate, the cells at most delineated by only slightly raised ridges. Fore wing (Fig. 6f) with cc: mv: pmv: stv = 4.3–4.7: 3.2–3.9: 1.1–1.2: 1.0. Middle leg (Fig. 6g) with row of 4 mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus and pegs clearly differentiated into two rows apically; second tarsomere with 4 or 5 pegs, third tarsomere with 2 pegs, and fourth tarsomere with 1 peg apically on either side. Propodeum with broadly U-shaped plical depression extending to posterior margin (Fig. 6b). Gaster (Fig. 6a) similar in length to combined length of head and mesosoma; not atypically modified; extending to base of third valvula, the latter about 0.75–0.78× length of metatibia and about 0.81–0.86× length of mv; hypopygium extending about two-thirds length of gaster.

MALE. Unknown.

Distribution. Japan, South Korea.

Biology. Unknown.

Remarks. Although the three known *E. angustifrons* females lack a vertexal carina this may be correlated with their comparatively small body size. Ovipositor sheath colour pattern (Fig. 6i) resembles that of *E. kamijoi* (Fig. 48h) and *E. zebra* (Fig. 128i) females, but females of the three species otherwise differ in several other colour pattern features described above and given in the key. DNA was extracted from the paratype from South Korea for barcoding, but the PCR failed.

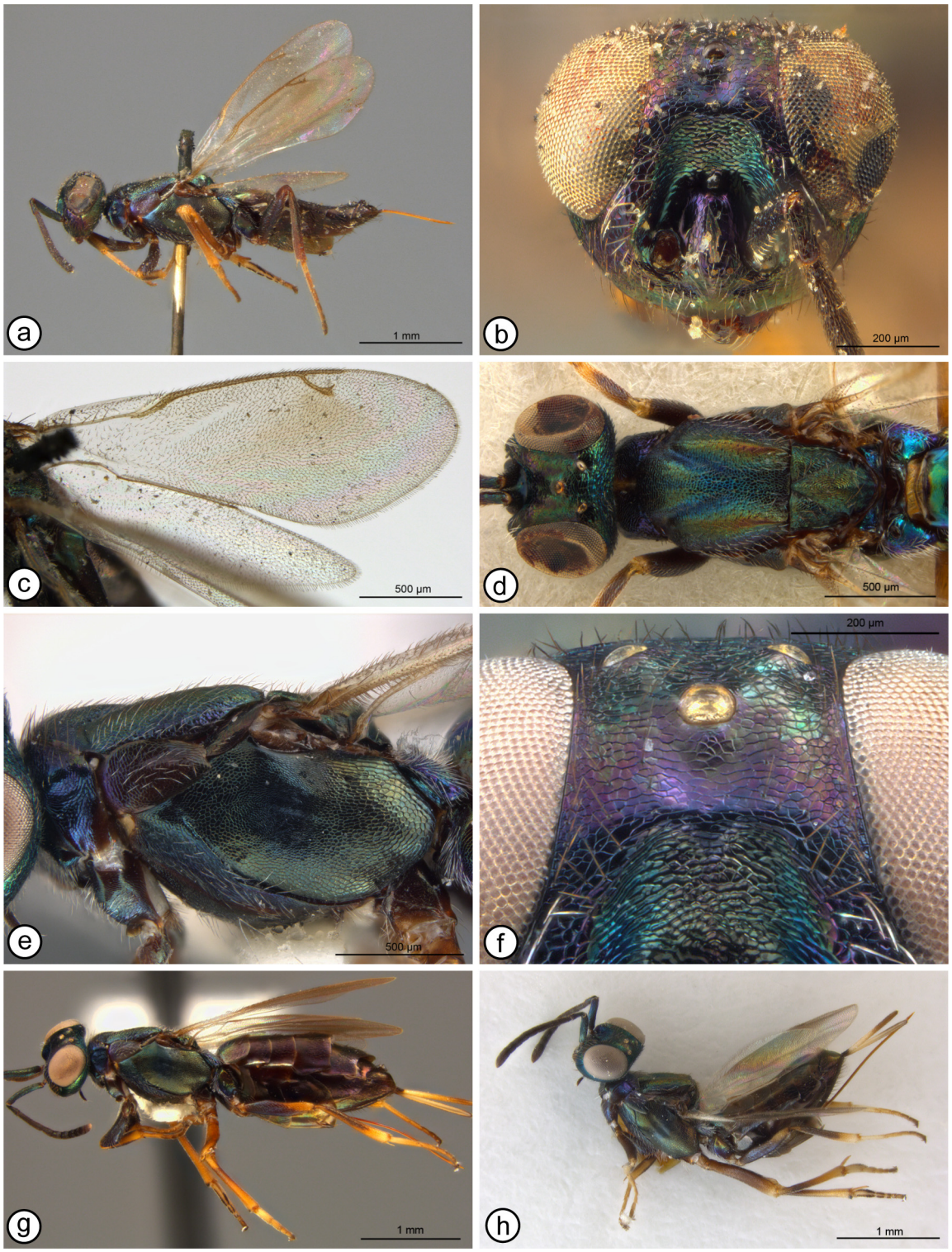

FIGURE 7. *Eupelmus annulatus*, ♀. *a–c* (*E. nubilipennis* lectotype): **a**, lateral habitus; **b**, head, frontal; **c**, wings. **d**, head and mesosoma, dorsal (2012-71). *e–g* (2012-70): **e**, mesosoma, lateral; **f**, upper part of scrobal depression and frontovertex; **g**, lateral habitus. **h**, lateral habitus (2013-82).

E. (*Eupelmus*) *annulatus* Nees

Figs 7a–h (♀), 8a–d (♀), 9a–h (♂)

Diplolepis (*Callimomus*) *albicauda* Spinola, 1811: 148 (*nomen nudum*).

Diplolepis (*Callimomus*) *annulata* Spinola, 1811: 148 (*nomen nudum*).

Eupelmus annulatus Nees, 1834: 75−76. Lectotype ♀, OXUM, designated by Graham, 1988: 24, not examined. Type data: [Germany]; 6; 11. Augt. 08; reared from pupa of *Cryptocephalus duodecimpunctatus*.

Eupelmus nubilipennis Förster, 1860: 121−122. Lectotype ♀, NHMW, designated by Ruschka, 1921: 282, examined by GG. Type data: Germany, region around Aachen. Synonymy by Graham, 1988: 24.

Eupelmus spongipartus ssp. *hyperparasiticus* Andriescu, 1974: 171, 185 (*nomen nudum*).

Eupelmus (*Eupelmus*) *annulatus*; Askew & Nieves-Aldrey, 2000: 50; Gibson, 2011: 22; Al khatib, 2014: 816 (♀ keyed), 819 (♂ keyed).

Description. FEMALE (habitus: Fig. 7a, g, h). Length = 2.5–4.7 mm. Head (Fig. 7b) with at least vertex and occiput green to bluish-green or partly purple, and often with variably extensive and distinct coppery luster, but face at least partly, variably extensively blue to purple or violaceous, most commonly mesally on frons, interantennal prominence and variably extensively on parascrobal region (Fig. 7f); with white, slightly lanceolate setae on lower face and parascrobal region compared to thinner, more hairlike setae on frontovertex. Maxillary and labial palps brown. Antenna dark except scape and usually pedicel with green to bluish-green luster similar to head. Pronotum (Fig. 7d, e) blue to purple at least dorsolaterally; admarginal setae dark at least mesal to level of spiracles. Mesonotum (Fig. 7d) with mesoscutum extensively green to bluish-green, but convex part of medial lobe with at least some coppery luster and lateral lobe dorsolongitudinally with variably distinct and extensive coppery to reddish-coppery or reddish-violaceous luster, scutellar-axillar complex with at least some coppery luster mesally, the scutellum usually extensively so; mesonotum with hairlike to slightly lanceolate white setae. Prepectus (Fig. 7e) with some blue to purple luster similar to pronotum dorsolaterally; extensively setose but setal apices not extending over prepectal margins. Tegula dark, though often with some metallic lusters under some angles of light. Acropleuron (Fig. 7e) green to bluish-green with variably extensive coppery luster. Propodeum (Fig. 7d) usually mostly bright green to blue or purple, at least lateral of spiracle; callus with white setae obviously denser than on mesoscutum but not concealing cuticle (Fig. 7e). Macropterous; fore wing hyaline or variably conspicuously and extensively infuscate behind stv (Fig. 7c) to behind entire discal venation (Fig. 8b), but setae of basal cell, disc and venation all similarly yellowish-brown to dark brown (Figs 7c, 8a, b); costal cell dorsally near leading margin with row of setae over at least apical half, and ventrally with at least 3 rows along length; basal cell and disc entirely setose except for linea calva (Fig. 8a) or sometimes basal cell with small bare region behind base of parastigma (closed anteriorly and posteriorly by setae) or rarely with larger bare region if disc partly infuscate (Fig. 8b). Front leg with femur dark except narrowly pale apically; tibia partly dark dorso- and ventrolongitudinally, but base narrowly, apex more widely, and usually entire anterior and posterior surfaces pale similar to tarsus. Middle leg more-or-less pale beyond coxa except for dark mesotibial apical and mesotarsal pegs, sometimes mostly yellow except for more whitish knee and basal tarsomeres, though usually with somewhat darker, brownish subbasal annulus on tibia, and if femur more orange to orangey-brown then at least distinctly lighter than dark pro- and mesofemur. Hind leg with at least about basal three-quarters of femur dark but pale apically; tibia almost always partly darkened mesally to subbasally at least dorsally, though rarely entirely pale; tarsus pale. Gaster (Fig. 7a, g, h) with hairlike setae; brown except basal tergite anteriorly green to bluish-green; ovipositor sheaths uniformly pale beyond dark base or variably distinctly brownish within apical third to half, but darker apical region always lighter brown than base and graduated rather than abruptly delineated.

Head in dorsal view with interocular distance about 0.35–0.4× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; vertex alutaceous-imbricate, frons meshlike coriaceous and scrobal depression reticulate to transversely reticulate-rugulose (Fig. 7f); OOL: POL: LOL: MPOD = 0.5–0.9: 2.2–2.7: 1.5–1.9: 1.0. Mesoscutum (Fig. 7d) meshlike reticulate with medial lobe shallower reticulate to somewhat reticulate-imbricate anteriorly and lateral lobe with mediolongitudinal band of minute coriaceous sculpture. Scutellum and axillae low convex in same plane; axilla mostly meshlike reticulate anteriorly to obliquely reticulate imbricate posteriorly; scutellum longitudinally reticulate-imbricate lateral midline and frenal area coriaceous-imbricate. Acropleuron (Fig. 7e) shallowly reticulate anteriorly and posteriorly of much more minutely sculptured mesal region, the reticulations meshlike anteriorly but somewhat elongated and longitudinally aligned posteriorly. Fore wing (Fig. 7c) with cc: mv: pmv: stv = 3.4–4.2: 3.2–4.0: 1.0–1.2: 1.0.

Middle leg (Fig. 8d) with row of 4–6 mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus and pegs clearly differentiated into two rows apically, second tarsomere with 5–7 pegs, third tarsomere with 2–4 pegs, and fourth tarsomere with 1 peg apically on both sides. Propodeum with broadly U-shaped plical depression extending to posterior margin (Fig. 8c). Gaster (Fig. 7g, h) similar in length to combined length of head and mesosoma; not atypically modified; not quite extending to apex of second valvifer, which projects slightly beyond gastral apex, with third valvula 0.85–1.0× length of metatibia and 1.0–1.2× length of mv; hypopygium extending about two-thirds length of gaster.

MALE (habitus: Fig. 9a, b). Length = 1.4–2.7 mm. Head (Fig. 9a–d) sometimes dark or brown in smaller individuals, but usually partly dark greenish-blue to bluish-green, with vertex and often lower face in part brighter metallic than face and frons; frons meshlike coriaceous; vertex uniformly curved into occiput, reticulate or in larger individuals with transverse sculpture having sharp, raised edges, but not aligned into transverse ridge or carina; scrobal depression extensively meshlike reticulate to reticulate-rugulose excluding shiny scrobes (Fig. 9c, d); setae hairlike, pale brownish to brown; lower face in region between torulus and malar sulcus with region of long setae, of which at least some are sinuately to abruptly curved apically (Fig. 9c, d); gena posterior to malar sulcus with 1 or sometimes 2 obviously longer setae differentiated from other variably long setae, and posterior to eye with apices of setae directed toward orbit. Antenna (Fig. 9f) with scape entirely dark; pedicel about twice as long as wide, ventrally usually with row of 6 (more rarely 5 or 7) long white setae, with all but usually apical seta apically hook-like curved (Fig. 9f, g); length of pedicel + flagellum 1.0–1.3× head width; flagellum usually quite distinctly clavate (Fig. 9f) with funiculars at least increasing in width and usually decreasing in length apically to broader, differentiated clava having ventrally flat or collapsed micropilose sensory region; anellus often quite strongly transverse, but dull and setose similar to subsequent flagellomeres (Fig. 9g); funicle with fu1 subequal in length or slightly shorter than pedicel and variably distinctly longer than wide (less so in smaller individuals), and apical funiculars quadrate to slightly transverse; fu1–fu3 in ventral view each with region of short lanceolate setae visible under lower magnifications as elongate, smoother, shinier regions surrounded by decumbent setae (Fig. 9f insert). Maxillary and labial palps usually brown though apical maxillary palpomere sometimes paler apically. Mesosoma (Fig. 9a, b) similarly greenish-blue to bluish-green as head except propodeum (Fig. 9h) often brighter blue and pronotum laterally and/or propodeum laterally often partly purple to violaceous; setae hairlike, entirely dark on pronotum, brownish to dark on mesonotum, and whitish on propodeal callus; tegula dark brown. Front leg with femur dark; tibia with at least anterior and usually posterior surface longitudinally pale; tarsus pale to brownish. Middle leg with femur dark; tibia with at least posterior and usually anterior surface longitudinally pale; tibial spur white; tarsus with basal 1–3 tarsomeres pale, but at most basal 1 or 2 tarsomeres white. Hind leg with both femur and tibia dark; tarsus with similar colour pattern as middle leg. Fore wing (Fig. 9e) with mv about 2.7–3.3× length of stv; costal cell dorsally near leading margin with dark setae over about apical half to two-thirds, and ventrally with dark setae at least indistinctly aligned into 2 rows basal to parastigma; basal cell uniformly setose with dark setae; speculum closed posterobasally by row of setae. Propodeum (Fig. 9h) with complete median carina, sometimes indistinctly longitudinally rugulose posteriorly near foramen in larger individuals, but panels mostly smooth to variably extensively meshlike coriaceous or sometimes very shallowly reticulate posteriorly.

Type material examined. ***Eupelmus annulatus.*** We did not examine the female lectotype of *E. annulatus*, and our interpretation of the name is based on information given in Gibson (2011: 19).

Eupelmus nubilipennis. Lectotype ♀ (NHMW) (Fig. 7a–c): Aach. Först. [printed] / Collect. G. Mayr [printed] / *Eup. nubilipennis Type* [hand written] Förster [printed] / TYPUS [red printed label].

Paralectotype ♀ (NHMW): Collect. G. Mayr [printed] / *Eup*. *nubilipennis* [hand written] Förster [printed] Type [hand written] / Heyden [hand written, green label] … aus den holzigen ♀ Blüten Gallen … *Salix caprea* [hand written] / *Eupelmus nibilipenis* [sic] m. [hand written] / Typus [red printed label].

According to ICZN Article 74.6 and 74.6.1, the female in NHMW from Aachen should be regarded as the lectotype of *E. nubilipennis* because it was considered to be the unique type specimen by Ruschka (1921: 282). There is also another specimen in NHMW identified by Förster as *E*. *nubilipennis* and it should be regarded as paralectotype. This specimen comes from Heyden, whereas Förster stated only that *E*. *nubilipennis* is very rare in the region of Aachen. Three additional specimens, two of them lacking the gaster, were identified as *E. annulatus* by Förster, but as *E*. *nubilipennis* by Ruschka.

Distribution. NEARCTIC. Canada, USA (Gibson 2011, map 4). **PALAEARCTIC**. Recorded from about 25 countries in the Palaearctic by Noyes (2014). Koponen & Vikberg (2014) additionally reported *E. annulatus* from

Finland. We confirm the following Palaearctic records through examination of specimens: Austria, Bulgaria, Croatia, Czech Republic, England, France, Germany, Greece, Hungary, Italy, **Morocco*** (CNC, ISNB), Netherlands, **Norway*** (CTPC), Romania, Russia, Spain, **Saudi Arabia*** (CNC), Sweden, Switzerland, Turkey.

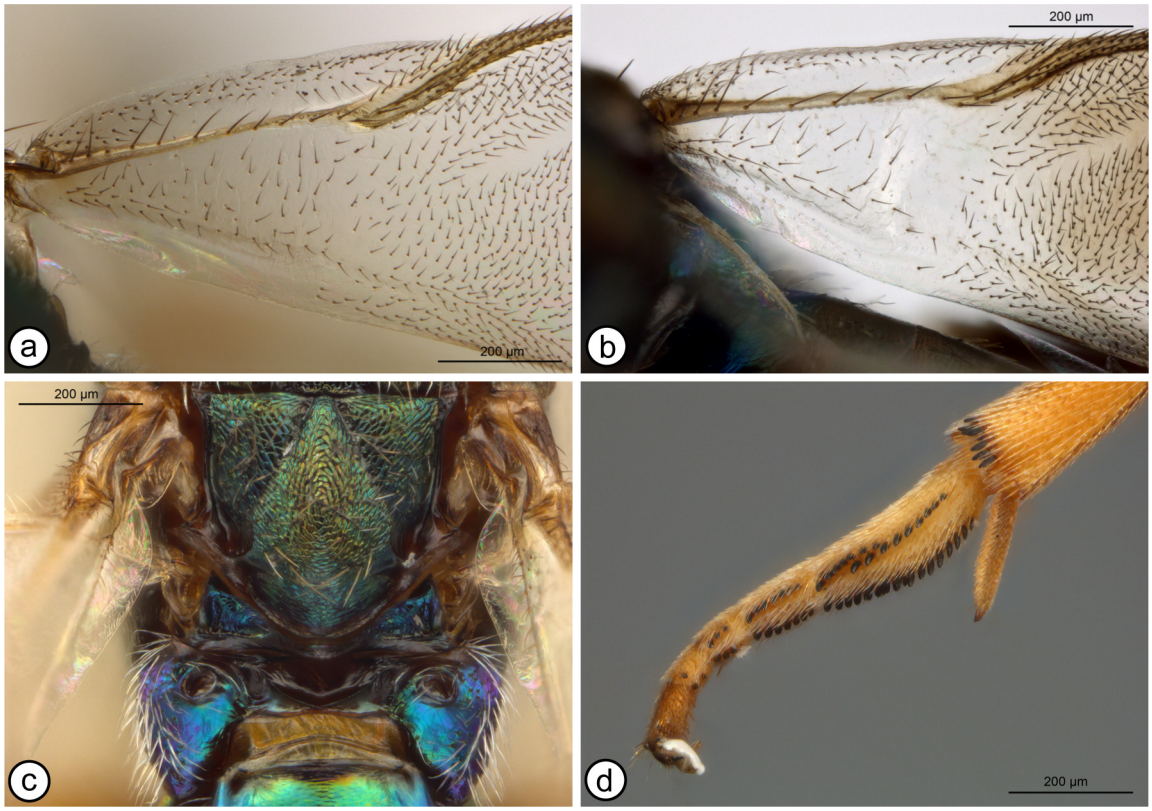

FIGURE 8. *Eupelmus annulatus*, ♀. *a, b* (fore wing base): **a**, 2012-71; **b**, 2013-82. **c**, scutellar-axillar complex to propodeum (2012-71). **d**, apex of mesotibia and mesotarsus (2012-70).

Biology. Noyes (2014) listed *E. annulatus* parasitizing species of Coleoptera (Buprestidae, Curculionidae, Scolytidae), Diptera (Tephritidae), Hymenoptera (Cynipidae, Diprionidae), and Lepidoptera (Gelechiidae, Lymantriidae, Momphidae, Psychidae, Pyralidae, Tortricidae) in the Palaearctic and Nearctic regions as well as Braconidae, Ichneumonidae and Eupelmidae (Hymenoptera) when as a facultative hyperparasitoid. Most of the Palaearctic and older Nearctic literature used the name *E. spongipartus* (= *E. azureus*) when originally recording the hosts. Further, *E. annulatus* and *E. azureus* females have not always been correctly differentiated. However, most of the host records listed by Noyes (2014) are likely correct except probably for some that refer to Cynipidae hosts, which are also hosts of *E. azureus*. Both species are reported as parasitoids of *Dryocosmus kuriphilus* Yasumatsu (Cynipidae) by Quacchia *et al.* (2013) and Al khatib *et al.* (2014) (see further under *E. azureus*).

Andriescu (1974) listed "*Eupelmus spongipartus hyperparasiticus* ssp. nov. in litt." as reared from *Apanteles* sp. (Braconidae) and *Theronia atalantae* (Poda) (Ichneumonidae) on *Aporia crataegi* (L.) (Pieridae), and from *Brachymeria intermedia* Nees (Chalcididae). Although the subspecies name was never validated, there are in ANCO one *E. annulatus* female and fragments of a male with the correct locality and date (according to an unpublished manuscript by I. Andriescu), though without host data. We further confirm through observed specimens that *E. annulatus* is sometimes a hyperparasitoid through Braconidae and Ichneumonidae as well as apparently a primary parasitoid of Cynipidae, Curculionidae, Diprionidae, Psychidae and Tortricidae. We saw specimens labelled as reared from *Apanteles* sp. (Braconidae) cocoon (USNM), *Coeloides sordidator* (Ratzeburg)* (Braconidae) cocoons from *Pissodes castaneus* (DeGeer)* (Curculionidae) on *Pinus nigra* Arnold* (Pinaceae) (CNC), and *Dolichomitus* (= *Pimpla*) *terebrans* (Ratzeburg)* (ZMAN) and *Phobocampe* sp.* (MHNG) (Ichneumonidae). At least some records of this species from Cynipidae galls might be in fact associated with Lepidoptera pupae inside old, empty galls. We saw one female (BMNH) labelled "from *Andricus kollari* gall" pinned to a pith block together with the silken cocoon of a moth.

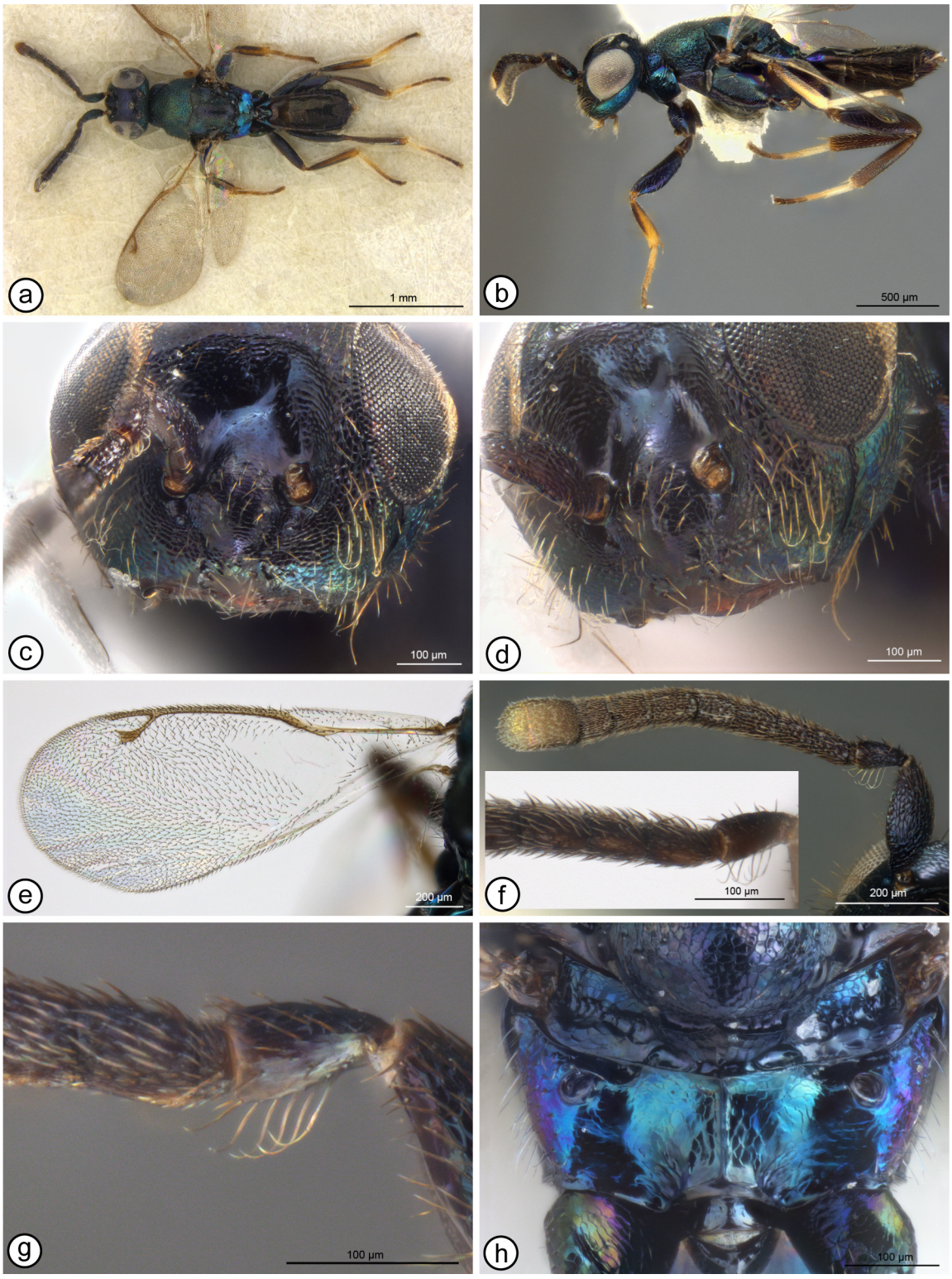

FIGURE 9. *Eupelmus annulatus*, ♂. **a**, dorsal habitus (2013-83). **b**, lateral habitus (2010-23). *c, d* (scrobal depression and lower face, 2013-141): **c**, frontal; **d**, oblique. *e–g* (2010-23): **e**, fore wing; **f**, antenna, inner view [insert (2013-140): pedicel to base of fl5, outer view]; **g**, pedicel to base of fl3, inner view. **h**, scutellar apex to propodeum (2013-83).

We also saw specimens reared from the following Orders. **Coleoptera**: COCCINELLIDAE—*Chilocorus bipustulatus* (L.)* (ISNB). CURCULIONIDAE—*Pissodes castaneus* (DeGeer) (= *P. notatus* Fab.) (MNHN); *Pityogenes pennidens* (Reitter)* (BMNH). **Hymenoptera**: CYNIPIDAE—*Andricus kollari* (Hartig) galls (CTPC, HNHM), *A. lignicola* (Hartig) (CTPC), *A. quercuscalicis* (Burgsdorff)* (= *Cynips calicis* Hartig) (ZSMC); *Biorhiza pallida* (Olivier)* galls on *Quercus faginea* Lamarck (ARPC); *Diplolepis** gall (AICF, MNHN).

DIPRIONIDAE—*Diprion pini* L. (BMNH); *Janus compressus** (Fabricius) (HNHM) (Cephidae). **Lepidoptera**: GELECHIIDAE—*Amblypalpis olivierella* Ragonot* on *Tamarix aphylla* (L.) H. Karst (Tamaricaceae)* galls (CNC); *Gelechia senticetella* (Staudinger)* (CTPC). PSYCHIDAE—*Luffia ferchaultella* (Stephens)* (MHNG); *Apterona helix* (Siebold)* (MHNG). TORTRICIDAE—*Grapholita molesta* (Busck) larva (USNM); *Lobesia botrana* (Denis & Schiffermüller)* (CTPC); *Rhyacionia buoliana* (Denis & Schiffemüller) (USNM); *T.*[*ortrix*] *viridana* L.* (NMPC). As discussed below, we also saw specimens of an unusual morphotype from Israel (USNM) reared from *Chrysopa* Leach (Neuroptera: Chrysopidae), but whose correct species identity relative to *E. annulatus* and *E. mehrnejadi* needs testing with further rearings and molecular analyses.

Less definitive plant and insect associations include: *Euphorbia dendroides* L.* (Euphorbiaceae) (ZSMC); *Juniperus* sp.* (Cupressaceae) with *Phloeosinus rudis* Blandford* (Curculionidae) (ZMAN); *Pistacia lentiscus* L.* fruits (Anacardiaceae) (ARPC); *Populus** (Salicaceae) logs with *Anobium** (Anobiidae) and *Passaloecus** (Crabronidae) (MHNG); *Quercus cerris* L.* (Fagaceae) (HNHM); *Pinus sylvestris* L. (CTPC) (Pinaceae); *Salix caprea* L.* (ZSMC) and *S. cinerea* L.* (HNHM) (Salicaceae); twigs of *Sorbus aucuparia* L.* (Rosaceae) with beetles (CNC); and *Ulmus* sp.* (Ulmaceae) (ZSMC).

Remarks. Females of *E. annulatus* and *E. mehrnejadi* are distinguished by the features given in the key and discussed under *E. mehrnejadi*. However, the validity of *E. mehrnejadi* as a distinct species requires testing with additional reared specimens and molecular analyses, particularly because of a series of five females and one male from Israel reared from *Chrysopa* (see 'Biology'). The five reared females and another two morphologically similar females collected in Greece (AICF, ZMAN) have quite a large and conspicuous bare region behind the apex of the submarginal vein and base of the parastigma (Fig. 8b) like *E. mehrnejadi* females (Fig. 64f), though the region is sometimes closed anteriorly by setae and all the setae are similarly brown. However, other *E. annulatus* females sometimes have a smaller, typically circular bare region closed anteriorly and posteriorly by setae behind the base of the parastigma. The females from Israel and Greece also have extensive though variably distinct brownish discal infuscation (Fig. 8b), but other females we include in *E. annulatus* have anywhere from completely hyaline fore wings to a very slight brownish infuscation behind the stigmal vein, as for the lectotype of *E. nubilipennis* (Fig. 7c), to much more extensive infuscation behind the discal venation similar to some *fulgens*-group females (e.g. Fig. 33c). However, the infuscation is not as dark or as abruptly delimited from the hyaline regions. The Israel specimens are also unusually small, only about 2.5–2.9 mm, whereas other *E. annulatus* females we observed are at least 3 mm in length, but the third valvula is shorter than the metatibia and at most about 1.15× the length of the marginal vein, which falls within the range of other *E. annulatus* females. The observed variation suggests either intraspecific variation or possibly cryptic species correlated with different hosts, but we currently include the females from Israel and Greece in *E. annulatus* because of the length of their third valvulae and their fore wing setal colour pattern.

Females of *E. annulatus* with hyaline fore wings are similar to those of *E. azureus* but the latter are easily distinguished by having a smooth and shiny scrobal depression (Fig. 13h) and all the femora similarly dark. Females are more likely to be confused with some *E. confusus* or *E. gemellus* females because of variation in length of the ovipositor sheaths relative to the metatibia and marginal vein. The upper limit of third valvula length in the latter two species slightly overlaps the lower limit of *E. annulatus*, which makes keying all females correctly through couplet 39 difficult. However, those *E. confusus* and *E. gemellus* females with similarly long third valvulae as some *E. annulatus* should key to their respective species through the second half of couplet 53, particularly because of having the ovipositor sheaths quite abruptly banded apically and the frons at least slightly roughened in part.

Eupelmus annulatus and *E. azureus* are the two most common species within the *urozonus* complex whose males have a clavate flagellum (Figs 9f, 14d). They are most readily differentiated by different setal pattern on the lower face. Although both have longer setae toward the malar sulcus, in *E. azureus* they are straight to evenly curved (Fig. 14e), whereas in *E. annulatus* they are sinuate to abruptly hook-like curved apically (Fig. 9c, d). This is most conspicuous for larger males in which they often appear to form a denser tuft of setae with convergent or slightly overlapping apices so that the tuft sometimes appears to be somewhat truncate apically. Males of *E. annulatus* also have a more extensively sculptured scrobal depression, always quite distinctly transverse anellus, and fu1–fu3 have differentiated regions of setae normally visible in ventral view (Fig. 9f insert), though this depends on how clean and well preserved the antennae are. Differentiation from *E. mehrnejadi* males is discussed under the latter species.

In addition to the specimens in Al khatib *et al*. (2014), six more specimens were successfully sequenced for COI, including three from Europe (CNCHYM 015149, Switzerland; CNCHYM 015150, Sweden; CNCHYM 015148, England) and three from Canada (CNCHYM 015145 and CNCHYM 015147, Ontario; CNCHYM 015146, British Columbia). One specimen from Ontario has a sequence identical to that of the specimen from Switzerland, whereas the other two sequences from Canada form part of a clade that includes also specimens from England, France, Netherlands, and Sweden. The absence of phylogeographic structuring between the Nearctic and western Palaearctic specimens adds support to the hypothesis that the species was introduced accidentally to North America from Western Europe (Gibson 2011).

E. (*Eupelmus*) *atropurpureus* Dalman

Figs 10a–h (♀), 11a–b (♀), 12a–f (♂)

Eupelmus atropurpureus Dalman, 1820: 381−382. Lectotype ♀, NHRS, designated by Graham, 1969a: 89, examined. Type data: [Sweden] Vestrogothia.

Cleonymus hemipterus Fonscolombe, 1832: 298−299. Neotype ♀, BMNH, designated by Graham, 1992: 1102, examined by LF. Type data: France: Bouches du Rhône, Bois de Valfère, nr Rognes. Synonymy by Nees, 1834: 421.

Urocryptus atropurpureus; Blanchard, 1840: 275.

Eupelmus atrocoeruleus; Thomson, 1876: 106.

Eupelmus vindex; Kalina 1988 (in part, brachypterous females).

Eupelmus (*Eupelmus*) *atropurpureus*; Askew & Nieves-Aldrey, 2000: 50; Gibson, 2011: 19, 22.

Description. FEMALE (habitus: Fig. 10b–d). Length = 2.8–3.7 mm (macropterous), 1.7–3.7 mm (brachypterous). Head (Fig. 10a) mostly dark brown to slightly violaceous or coppery except frons usually with quite distinct though variably extensive blue to greenish region along inner orbit, and vertex and outer orbit sometimes with similar metallic lusters under some angles of light; with slightly lanceolate white setae on lower face and parascrobal region at least to dorsal level of scrobal depression and often variably extensively on frons along inner orbit compared to less conspicuous hairlike setae on frontovertex. Maxillary and labial palps brown. Antenna usually dark with variably distinct green to bluish lusters on scape and pedicel, but scape or inner surface of scape very rarely yellowish-orange (see 'Remarks'). Mesosoma (Fig. 10b–f) similar in colour to head, mostly dark brown to somewhat violaceous though often with slight green to blue or purple lusters, particularly on scutellar-axillar complex; mesonotum with comparatively inconspicuous, mostly dark hairlike setae similar to frontovertex, prepectus sometimes apparently bare though usually variably extensively and conspicuously setose, and callus laterally with sparse white setae not obscuring cuticle. Usually brachypterous (Fig. 10c–e), but rarely macropterous (Fig. 10b). Macropterous fore wing (Fig. 10b, h) hyaline to variably extensively infuscate with dark setae; costal cell dorsally bare or with a few inconspicuous setae near leading margin in front of parastigma, and ventrally with 2 or 3 complete rows along length; basal cell bare or with only a few setae basally, but disc setose with elongate linea calva closed basally by setae (Fig. 10h). Brachypterous fore wing (Fig. 10g) extending only slightly over base of gaster (Fig. 10c–e), flat, and usually with apical margin slightly emarginate to broadly truncate (Fig. 10g) or rarely broadly rounded; disc (Fig. 10g) sometimes hyaline with white setae but usually variably extensively and darkly infuscate with dark setae; costal cell dorsally bare but ventrally setose along length; basal cell bare and disc variably densely though quite uniformly setose beyond level of parastigma or base of mv, or rarely with short, vestigial linea calva below distal end of parastigma and base of mv. Front leg rarely mostly orangey except posterior surface of femur and tibia subbasally somewhat more distinctly brownish, but usually femur mostly dark except narrowly pale apically, tibia dark at least basally on posterior surface and usually much more extensively except apically, and tarsus pale to yellowish-brown. Middle leg rarely almost entirely orangey similar to front leg, but usually dark except at least for anteroapical spot on femur, tibia apically, and sometimes knee pale such that tibia variably extensively dark subbasally to mesally, mesotibial apical pegs orange to dark, and tarsus usually with basal four tarsomeres pale with orange to dark mesotarsal pegs. Hind leg rarely almost entirely orangey similar to middle legs, but usually much more extensively dark with only tibia apically, sometimes knee, and at least basitarsus pale. Gaster (Fig. 10b–d) with hairlike setae; dark brown or with faint green to bluish-green luster basally; ovipositor sheaths dark (Figs 10b, 11b) or brachypterous female rarely with medial pale band (Fig. 10c, d, see 'Remarks').

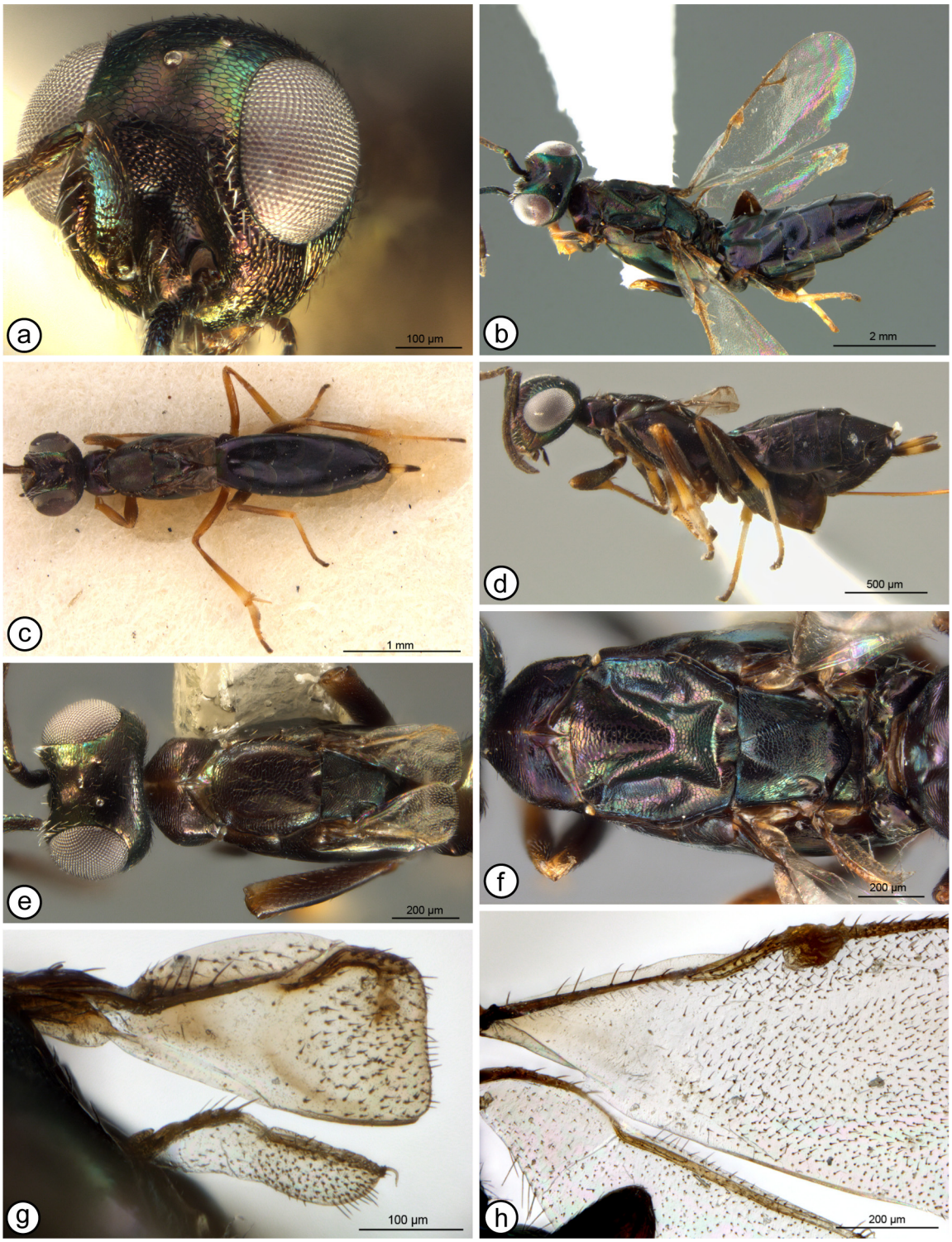

FIGURE 10. *Eupelmus atropurpureus*, ♀. **a**, head, frontolateral (2012-34). **b**, lateral habitus, macropterous form (2010-43). *c, d* (habitus, brachypterous form): **c**, dorsal (2015-20); **d**, lateral (2012-36). **e**, head and mesosoma, dorsal, brachypterous form (2012-34). **f**, mesosoma, dorsal, macropterous form (2010-43). **g**, wings, brachypterous form (2012-36). **h**, base of fore wing, macropterous form (2010-43).

Head in dorsal view (Fig. 10e) with interocular distance about 0.45× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; vertex alutaceous to slightly alutaceous-imbricate; frons (Fig. 10a) meshlike coriaceous-reticulate to variably extensively alutaceous or alutaceous-imbricate; scrobal depression (Fig. 10a) transversely strigose-reticulate; ocelli comparatively small (Fig. 10e), OOL: POL: LOL: MPOD = 2.0–2.3: 3.6–4.7: 2.1–2.8: 1.0. Mesoscutum (Fig. 10f) meshlike coriaceous

to very shallowly reticulate. Scutellum and axillae comparatively flat and in same plane, sometimes almost uniformly meshlike coriaceous though axillae usually extensively obliquely alutaceous to alutaceous-imbricate and frenal area shinier than scutellum. Acropleuron more-or-less isodiametric meshlike anteriorly and posteriorly and much more minutely sculptured mesally, coriaceous or with larger cells defined by at most very slightly raised ridges, passing to alutaceous with strongly transverse cells on a comparatively reduced area below hind wing insertion. Macropterous fore wing (Fig. 10b) with cc: mv: pmv: stv = 2.6–3.6: 1.9–2.4: 1.0–1.2: 1.0; brachypterous fore wing (Fig. 10g) with distinct submarginal, marginal and comparatively long stv virtually at right angle to mv, usually with short but distinct pmv, and all veins conspicuously thick. Middle leg (Fig. 11a) with mesotibial pegs variable in number, but at least 4 present; mesotarsus with symmetrical peg pattern, pegs usually differentiated into two rows apically though not distinctly so in some small individuals, second and third tarsomeres sometimes with only single peg apically (small individuals) but usually second tarsomere with 3–5 pegs, third tarsomere with 1 or 2 pegs, and fourth tarsomere without or with 1 peg apically on either side. Propodeum with broadly U-shaped plical depression extending to posterior margin (Fig. 10f). Gaster (Fig. 10b–d) similar in length to combined length of head and mesosoma; syntergum (Fig. 11b) with posterolateral angles obliquely to almost horizontally inflexed anteromesally above sheaths, in dorsal view not V-like protuberant on either side of anal sclerite but in posterior or lateral view anal sclerite appearing more-or-less flattened, Ω-like, over sheaths; extending over base of third valvula, the latter about 0.47–0.54× length of metatibia and, in macropterous female, about 0.9× length of mv (superficially less if true basal limit of third valvula concealed by syntergum); hypopygium extending to or somewhat beyond middle of gaster.

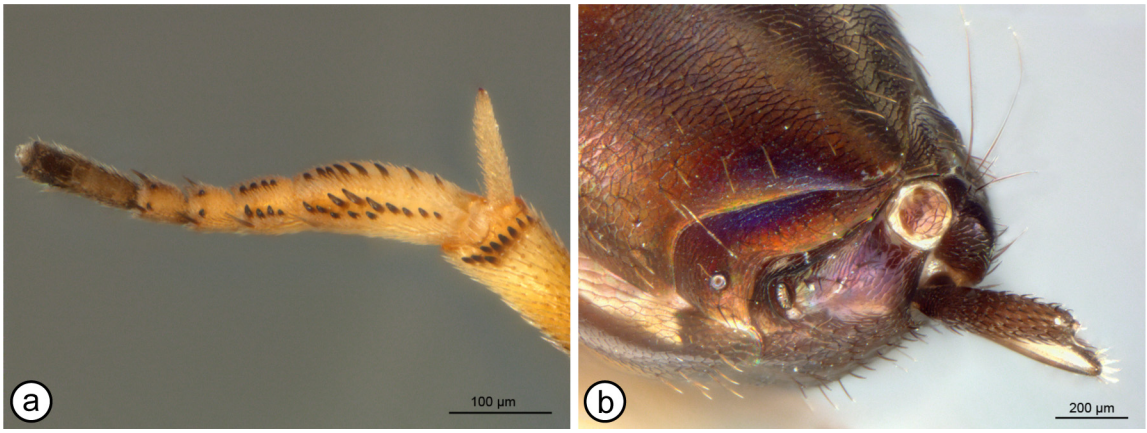

FIGURE 11. *Eupelmus atropurpureus*, ♀: **a**, mesotibial and tarsal peg pattern (2012-35); **b**, apex of gaster, posterodorsal view (2012-34).

MALE (habitus: Fig. 12a, c). Length = 1.2–2.3 mm. Head (Fig. 12b) sometimes dark brown but more commonly with variably distinct green luster on lower face and partly along inner orbits and vertex and upper face mesally below level of posterior ocelli dark or with slight coppery luster; frons shallowly reticulate to reticulate-imbricate; vertex uniformly curved into occiput, alutaceous to alutaceous-imbricate; scrobal depression extensively meshlike coriaceous to reticulate; setae hairlike, white; lower face (Fig. 12b) toward malar sulcus with longer, but evenly distributed, straight to only slightly, evenly curved setae; gena posterior to malar sulcus with 1 much longer seta differentiated from others, and posterior to eye with apices of setae directed toward orbit. Antenna (Fig. 12a) with scape entirely dark; pedicel (Fig. 12d) about 1.3× as long as wide, ventrally with row of 4 or rarely 5 long white setae, of which all but apical seta hook-like curved; length of flagellum plus pedicel about 1.6–1.8× head width; flagellum elongate-filiform with clava subequal in length to apical two funiculars and about 2.7–3.3× as long as wide; anellus (Fig. 12d) very strongly transverse, discoidal, shiny, bare; funicle with fu1 about 1.0–1.5× length of pedicel and about 1.7–2.4× as long as wide, with funiculars gradually decreased in length apically so sometimes only about 1.4× as long as wide but with conspicuous decumbent curved setae about as long as half width of funicular; one or more of fu1–fu3 usually with differentiated setae ventrally such that in lateral view (Fig. 12d) ventral margin of fu1 often convex to subapically angulate but at least with a few to several shorter, straight, stronger or more spine-like dark setae, and fl3 and fl4 with similar though fewer in number and usually less obvious setae. Maxillary and labial palps brown to pale brownish. Mesosoma (Fig. 12e) similar in colour to head

except usually more distinctly green and often partly with slight coppery luster; setae hairlike, pale brownish on pronotum and mesonotum and more distinctly white on propodeal callus; tegula dark. Front leg with femur variably extensively pale apically, but at least basal half dark; tibia often almost entirely pale, yellowish, but tarsus somewhat darker yellowish-brown to brownish. Middle leg with similar colour pattern as front leg, with at least basal half of tibia pale, yellowish, but usually with at least inconspicuous very light brownish and often more conspicuous dark brown subapical annulus, frequently broken into one anterior and one posterior subapical diffuse spot, and tarsus with 1–3 basal tarsomeres yellowish and at least apical two tarsomeres variably darker brown. Hind leg usually with femur dark except for extreme apex, but otherwise with similar colour pattern as middle leg except tibia sometimes without dark markings and tarsus less commonly with up to basal three tarsomeres pale. Fore wing (Fig. 12f) with mv about 1.9–2.5× length of stv; costal cell dorsally near leading margin with row of dark setae over about apical third to half, and ventrally with dark setae in 1 or 2 rows basal to parastigma; basal cell uniformly setose with dark setae; speculum closed posterobasally by variable number of setae. Propodeum (Fig. 12e) with complete median carina and uniformly meshlike coriaceous.

Distribution. Noyes (2014) listed over 20 countries from the Palaearctic, including North Africa. Additional countries based on observed specimens are **Azerbaijan*** (IAEE), **Bulgaria*** (AICF, CTPC, IBER, PUPB, UCRC), **China*** (IZCAS: Hebei and Jiangsu provinces), **Kyrgyzstan*** (UCRC, AICF), **Portugal*** (BMNH), **Turkey*** (MKUI, USNM).

Presence in the Nearctic region, as cited by Noyes (2014), is based on incorrect literature records (Gibson 2011).

Biology. Noyes (2014) listed *E. atropurpureus* as a primary parasitoid of Chrysomelidae and Curculionidae (Coleoptera), Cecidomyiidae and Chloropidae (Diptera), Cynipidae and Eurytomidae (Hymenoptera), and Coleophoridae and Zygaenidae (Lepidoptera) or as a hyperparasitoid of these through Braconidae, Eulophidae, Eurytomidae and Pteromalidae (Hymenoptera).

ARPC contains specimens from Spain labelled with the following new* plant and/or insect associates: ex. Coccoidea on *Ephedra distachya* L. (Ephedraceae) stems; ex. *Coleophora* sp. (Coleophoridae) on *Suaeda vera* Forssk. (Amaranthaceae); ex. *Isocolus lichtensteini* (Mayr) (Cynipidae) galls on *Centaurea aspera* L. (Asteraceae); ex. *Lasioptera eryngii* (Vallot) (Cecidomyiidae) galls on *Eryngium campestre* L. (Apiaceae); ex. *Atriplex halimus* L. (Amaranthaceae) infrutescences with Cecidomyiidae/Coleophoridae; ex. *Artemisia herba-alba* Asso (Asteraceae) infrutescences with Cecidomyiidae; ex. *Cichorium intybus* L. (Asteraceae) stems with *Timaspis cichorii* (Kieffer) (Cynipidae); ex. *Helichrysum stoechas* (L.) (Asteraceae) heads with Gelechiidae; ex. *Scorzonera angustifolia* L. heads with Tephritidae/Cynipidae?; ex. *Dorycnium hirsutum* (L.) and *D. pentaphyllum* Scopoli (Fabaceae) fruits with *Bruchophagus* sp. (Eurytomidae); and ex. *Dactylis glomerata* L., *Hordeum vulgare* L. and *Stipa parviflora* Desf. (Poaceae) stems with *Tetramesa* sp. (Eurytomidae).

Other new* Hymenoptera hosts recorded are: CEPHIDAE—*Cephus pygmaeus* L. (CNC: Russia). CYNIPIDAE—*Barbotinia oraniensis* (Barbotin) on *Papaver rhoeas* L. (AICF: Romania), *Iraella* sp. [*ionescui* Pujade-Villar & Schiopu] on *Papaver* sp. (AICF: Romania), *Liposthenes* (= *Aylax*) *glechomae* (L.) (BMNH: England), and *Panteliella bicolor* (Ionescu & Roman) on *Phlomis tuberosa* L. and *Timaspis lampsana*e (Perris) (AICF: Romania). DIPRIONIDAE—*Neodiprion sertifer* (Geoffroy) (CNC: Hungary, USNM: Czech Republic). EURYTOMIDAE—*Tetramesa brevicornis* (Walker) on *Festuca sulcata* (Hack.) (Poaceae) (SIZK: Ukraine), *T. hyalipennis* (Walker) galls on *Elymus farctus* (Viv.) (Poaceae) (RMNH: Netherlands), *T. scheppigi* (Schlechtendal), and *Tetramesa* sp. in stem of *Stipa pulcherrima* K. Koch (Poaceae) (SIZK: Ukraine).

We also saw a single female reared from canola pods infested with *Ceutorhynchus obstrictus* (Marsham) (Curculionidae) and *Dasineura brassicae* (Winnertz) (Cecidomyiidae) (CNC: France), though the exact host is uncertain, as well as individuals labelled as reared from seeds of *Medicago sativa* L. (USNM: France, Russia), *M. falcata* L. (Fabacaeae) (USNM: Russia), and *Agropyron cristatum* (L.) (Poaceae) (USNM: Russia).

Remarks. Gahan (1933, fig. 11 A–C) provided line drawings of the dorsal habitus of a brachypterous female and of the antennae for both sexes, as well as describing both sexes and reviewing the early interpretation of the name and the species. We saw 14 macropterous females (3 AICF, 3 BMNH, 1 CTPC, 1 IBER, 1 NHMW, 3 SIZK, 1 UCRC, 1 USNM), all with entirely dark ovipositor sheaths. One brachypterous and one macropterous female (SIZK) were reared from the same host, which is unidentified but pinned together with the two specimens. The USNM female is the one cited by Gahan (1933: 49) as labelled "aus *Isos*. [= from *Isosoma*] *rossicum*. Rimsky" [= *Tetramesa rossica* (Rimsky-Korsakov)]. The other eleven are from Austria, Bulgaria, Czechoslovakia (no other locality given), Romania, Sweden and Ukraine.

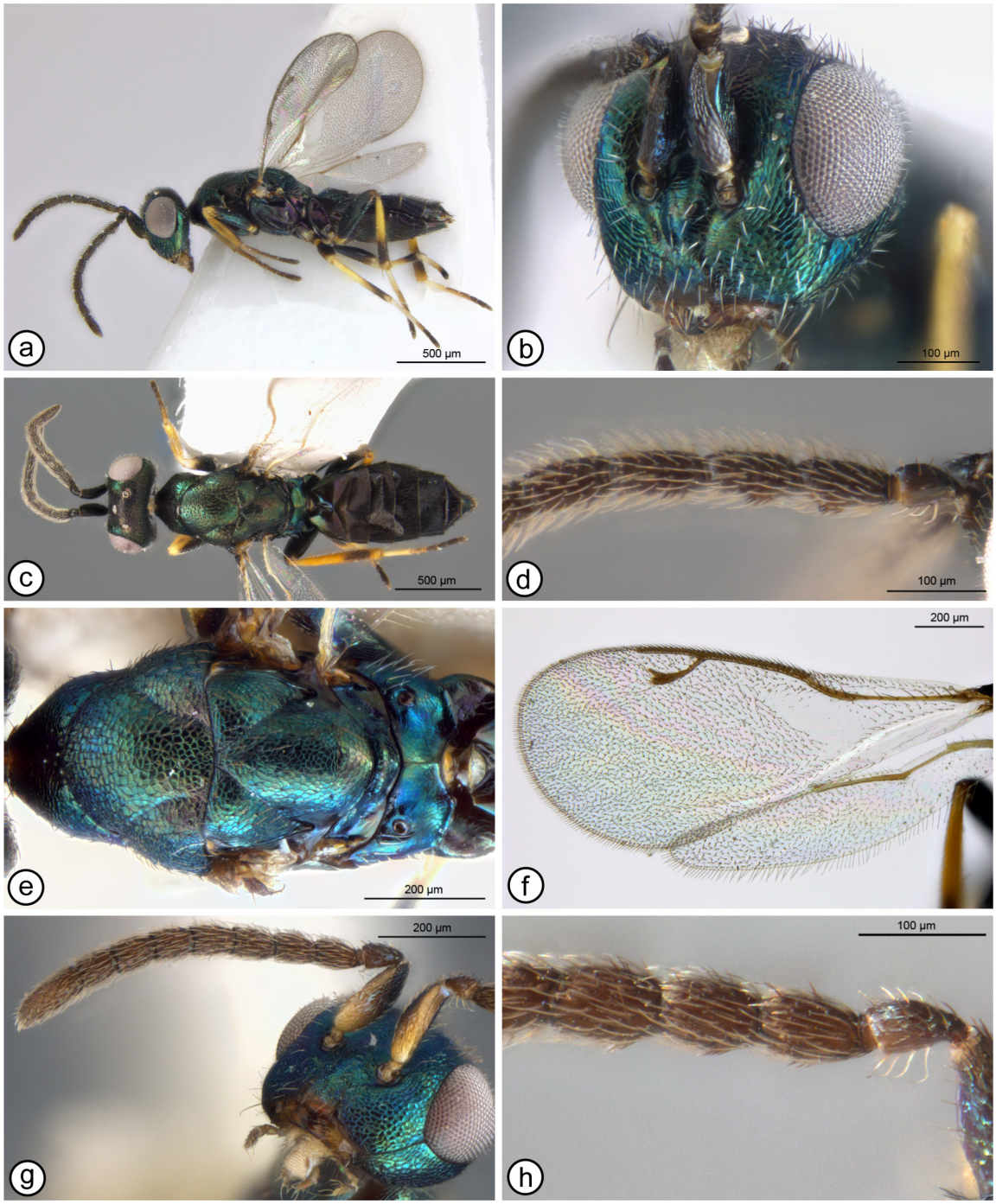

FIGURE 12. *a–f*, *Eupelmus atropurpureus*, ♂: **a**, lateral habitus (2013-86); **b**, head, frontolateral (2013-86); **c**, dorsal habitus (2013-88); **d**, pedicel through fl5, outer view (2013-86); **e**, mesosoma, dorsal (2013-89); **f**, wings (2013-88). *g* and *h*, *Eupelmus* (*Macroneura*) *vesicularis*, ♂ (2013-90): **g**, lower face and antenna, inner view; **h**, pedicel to base of fl5, inner view.

Kalina (1984, plate V, figs 3–5) included photographs of the brachypterous fore and hind wings of *E. atropurpureus* as well as the brachypterous wings of a female he identified as *E. vindex* (Kalina 1984, plate V, figs 1, 2). In his key to Palaearctic species, Kalina (1988) keyed both macropterous and brachypterous females of *E. vindex* in addition to those of *E. atropurpureus*. He differentiated brachypterous females of *E. vindex* from those of *E. atropurpureus* by the former having medially banded rather than entirely dark ovipositor sheaths. We saw a single brachypterous female labelled "Primorsk / Apšeron, Azerb. SSR, 16.7.67, Bouček" (CNC Photo 2015-20) from Kalina's collection that bears his identification label with *E. vindex*. This is not the female illustrated in Kalina (1984) because it has both fore wings, but the sheaths are distinctly and abruptly banded as he described for *E. vindex*, with somewhat more than the basal half of the third valvulae being yellowish (Fig. 10c). This female

also has all the legs mostly orange to somewhat orangey-brown (Fig. 10c). We saw an additional 16 brachypterous females from various localities in Kyrgyzstan (1 AICF, 14 UCRC, 1 USNM) with variably distinctly banded sheaths that also key to *E. vindex* using Kalina (1988). All these females, unlike the Azerbaijan female, have the legs much more extensively darkened (Fig. 10d) as is typical of other brachypterous and macropterous (Fig. 10b) *E. atropurpureus*. Some of the Kyrgyzstan females have hyaline fore wings with white setae whereas others have variably infuscate fore wings with brown setae, as for different brachypterous females with entirely dark ovipositor sheaths. However, all the brachypterous females with banded sheaths have the same fore wing structure, setal pattern, and venation as brachypterous females with entirely dark sheaths (Fig. 10g). They are also otherwise more similar to macropterous *E. atropurpureus* females than to *E. vindex* females in having a bare rather than setose basal cell (Fig. 10g), a more hemispherical (Fig. 10d) rather than flat-subtriangular (Fig. 123b) head in lateral view, and comparatively small ocelli and long OOL (Fig. 10e). Finally, the brachypterous females with banded ovipositor sheaths have syntergal structures more similar to other *E. atropurpureus* than to *E. vindex*. Females of both species have the posterolateral angles of the syntergum strongly inflexed anteromesally. In *E. vindex*, the posterolateral margins of the syntergum in dorsal view protrude V-like on either side of the anal sclerite (Fig. 123h). This structure is not as evident for *E. atropurpureus* females, in which the inflexed regions of the syntergum lie more horizontally at an abrupt angle above the sheaths so that the anal sclerite appears somewhat 'flattened', Ω-like, above the sheaths (Fig. 11b). We do not believe the brachypterous females with banded ovipositor sheaths are brachypterous individuals of *E. vindex*, but rather represent a variant of *E. atropurpureus*, the one from Azerbaijan also with abnormally pale legs. A single brachypterous female from Kyrgyzstan and two from China were seen with entirely dark sheaths, which at least shows that banded sheaths are not characteristic of all brachypterous females from east of the Ural mountains. Two females from Kyrgyzstan, both lacking their gaster, also have at least the inner surface of the scape yellowish-orange. Sequences of 627 and 626 base pairs were obtained for two females with dark sheaths from Hungary (CNCHYM 015151 and CNCHYM 015153), respectively, and a macropterous female from Romania (voucher ATR.RO 02; AICF) was successfully sequenced and showed a sequence identical to that of one brachypterous female from Hungary.

Other than *E. atropurpureus*, the only other described regional species of *E*. (*Eupelmus*) with brachypterous females is *E. brachypterus* (Fig. 16a, b). Females of *E. atropurpureus* differ in having finer sculpture, a mostly dark body with only quite obscure metallic luster, and shorter fore wings having the basal cell bare, the disc uniformly setose, and conspicuously thick venation with the stigmal vein at a right angle to the marginal vein and the postmarginal vein rudimentary. However, *E. rexonus* was also described by Narendran & Anil (1998) from a single brachypterous female from India. We saw two other females from Thailand (CNC) that appear similar to *E. rexonus* based on the description and illustrations in Narendran & Anil (1998, figs 1, 12, 23, 34), but which have a flagellum with longer funiculars and much shorter, entirely dark ovipositor sheaths. The Thailand females and *E. rexonus* are readily distinguished from *E. atropurpureus* females by several features, including a much more coarsely sculptured body (head and mesonotum strongly reticulate), completely setose fore wings and, at least for the Thailand specimens, lack of mesotibial apical pegs, a propodeum with a comparatively narrow, inwardly curved V-shaped plical depression, and in dorsal view with the syntergum posteriorly projecting V-like on either side of the anal sclerite. Several brachypterous females from South Africa (BMNH, CNC) represent another undescribed species that is similar to the Thailand species in lacking mesotibial apical pegs, having entirely setose, infuscate fore wings and, though less conspicuously, a V-like projecting syntergum. They differ by having less coarsely reticulate mesonotal sculpture, a broadly V-shaped, flat-bottomed propodeal plical depression, and an abrupt undulation across the parascrobal region at about its midheight similar to *E. pini*.

As discussed under 'Remarks' for *Eupelmus*, males of *E. atropurpureus* are very similar to those of *E*. (*Macroneura*) *vesicularis sensu lato*, especially those that Fusu (2010) informally named '*E. vesicularis* dark species'. However, males of this unnamed species differ from those of *E. atropurpureus* in having the scape with the outer, ventral, longitudinal sensory region pale (Fig. 12g) rather than entirely dark (Fig. 12b), the head and mesosoma darker and less distinctly green, the meso- and metatibiae with more extensive dark markings (metatibia never entirely pale), the femora frequently completely dark, and the fore wings at least slightly infuscate. Males of *E. vesicularis sensu stricto* additionally have slightly shorter funiculars with more adpressed setae, though this is a more subtle difference (*cf* Fig. 12d, h), with numerous multiporous plate sensilla arranged in several rows (Gibson 1990, fig. 6) instead of a single row as in *E. atropurpureus*.

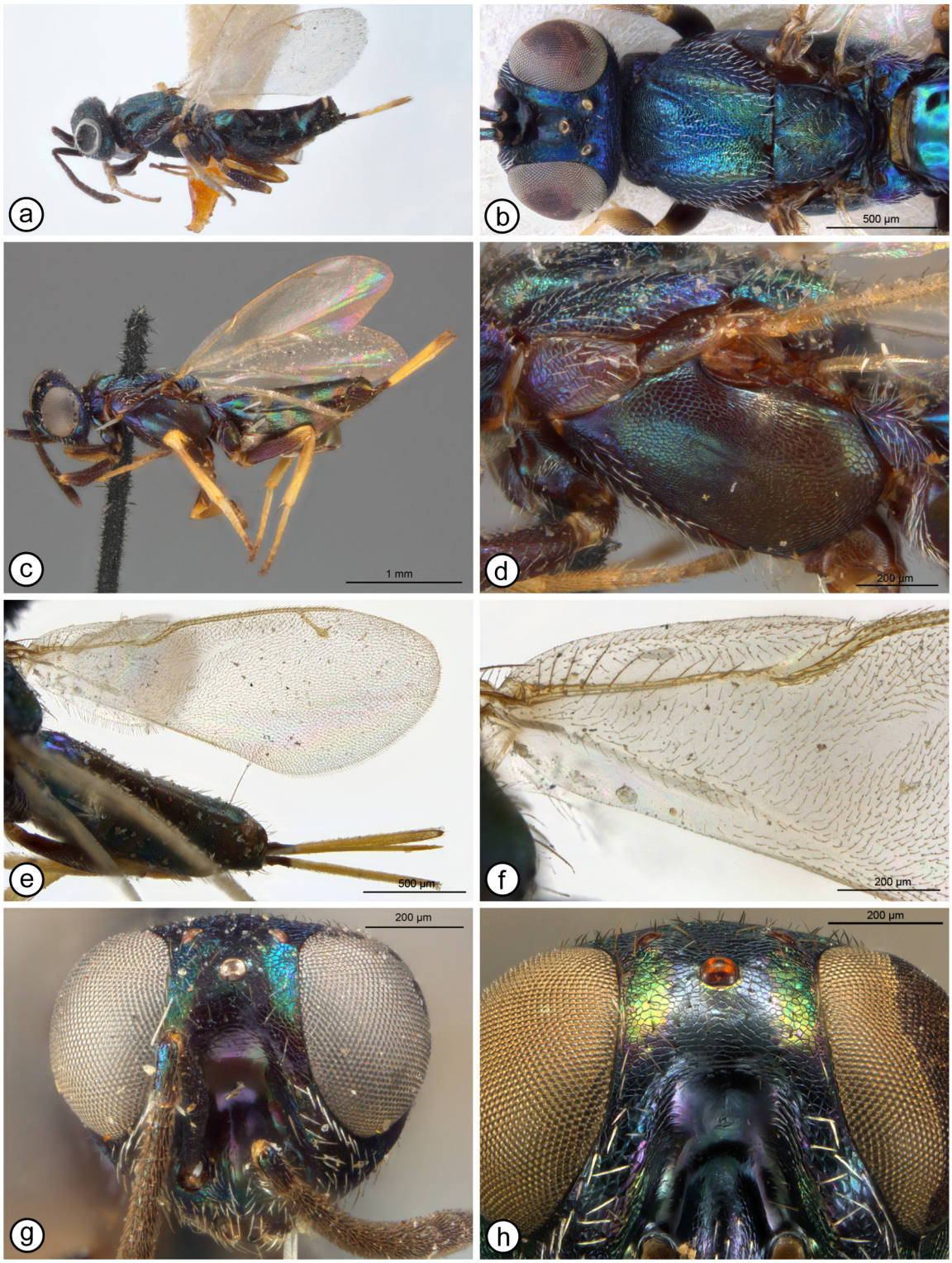

FIGURE 13. *Eupelmus azureus*, ♀. **a**, *E. azureus* lectotype, lateral habitus (L. Fusu image). **b**, head and mesosoma, dorsal (2012-67). *c–g* (*E. spongipartus* syntype, 2012-68): **c**, lateral habitus; **d**, lateral mesosoma; **e**, gaster and fore wing; **f**, fore wing base; **g**, head, frontal. **h**, scrobal depression and frontovertex (2012-69).

E. (*Eupelmus*) *azureus* Ratzeburg

Figs 13a–h (♀), 14a–h (♂)

Eupelmus azureus Ratzeburg, 1844: 158. Lectotype ♀, NHMW, here designated, examined by LF. Type data: [Germany], syntypes reared from "*Microgaster disparis*" cocoons and galls of *Cynips terminalis* [= *Biorhiza pallida*].

Pteromalus Cordairii Ratzeburg, 1844: 205–206. Lectotype ♂, NHMW, here designated, examined by LF. Type data: [Germany], reared from galls of *Cynips terminalis* [= *Biorhiza pallida*]. Synonymy by Al khatib *et al.*, 2014: 806.
Eupelmus spongipartus Förster, 1860: 123−125. Syntypes, ♀ & ♂, NHMW, 1♀ (var. α) examined by GG. Type data: [Germany], reared from galls of *Teras* (*Cynips*) *terminalis* [= *Biorhiza pallida*]. Synonymy by Al khatib *et al.*, 2014: 806.
Eupelmus Cordairii; Giraud, 1863: 1270.
Pteromalus cordairii; Dalla Torre, 1898: 278 (as synonym of *E. urozonus*).
Eupelmus cordairii; Erdős, 1955a: 35.
Eupelmus spongipartus ssp. *ponticus* Andriescu, 1974: 165, 185 (*nomen nudum*).
Eupelmus annulatus; Bouček, 1970: 81 (in part, as senior synonym of *E. spongipartus*).
Eupelmus (*Eupelmus*) *spongipartus*; Gibson, 2011: 3, 19.
Eupelmus (*Eupelmus*) *azureus*; Al khatib *et al.*, 2014: 816 (♀ keyed), 819 (♂ keyed).

Description. FEMALE (habitus: Fig. 13a, c). Length = 1.5–4.0 mm. Head (Fig. 13b, g) dark with variable metallic lusters, but at least vertex, occiput, and frons variably extensively along inner orbit usually quite distinctly blue to purple or violaceous under different angles of light, though frons and lower face sometimes more bluish-green to green (Fig. 13h); with white, hairlike to slightly lanceolate setae on lower face and at least ventral two-thirds of parascrobal region compared to less conspicuous hairlike setae dorsally on frontovertex and parascrobal region dorsally. Maxillary and labial palps brown. Antenna dark except often scape and sometimes pedicel with metallic lusters similar to head. Pronotum sometimes mostly variably dark brown, particularly when lateral lobes also extensively brownish with limited metallic luster, but usually blue to purple or violaceous at least laterally; admarginal setae dark, brown to black, at least mesal to level of spiracles. Mesonotum (Fig. 13b) sometimes almost uniformly green, and then often with some coppery luster, particularly on scutellum, but usually more distinctly bluish to purple, the mesoscutum rarely mostly brown with limited metallic lusters but usually at least partly bluish mediolongitudinally and outer surface of lateral lobe often variably extensively purple under some angles of light; mesonotum with hairlike to slightly lanceolate white setae contrasting with admarginal setae. Prepectus (Fig. 13d) often with quite distinct violaceous to purple lusters under some angles of light, but sometimes dark brown or with similar but less distinct metallic lusters than mesonotum; extensively setose but setal apices not extending over prepectal margins; prepectus. Tegula dark. Acropleuron (Fig. 13d) dark with variably distinct and extensive metallic lusters similar to mesonotum. Macropterous; fore wing (Fig. 13e, f) hyaline or at most with extreme base of basal cell variably darkly infuscate, and with uniformly brown setae or setae of basal cell lighter, yellowish to white; costal cell dorsally near leading margin with row of setae over at least apical two-thirds, and ventrally with about 3 rows along length; basal cell and disc entirely setose except for elongate linea calva. Legs with all femora similarly dark with pale apices; protibia variably extensively dark, but pale basally, apically, and longitudinally at least on anterior and sometimes posterior surfaces; meso- and metatibia basally and apically to sometimes entirely pale, though mesotibia usually with at least a short, subbasal, light brownish annulus and metatibia often dark within at least dorsally within at least basal half; protarsus sometimes entirely brownish, but mesotarsus with basal 3 or 4 and metatarsus with basal 1–4 tarsomeres pale. Propodeum similar in colour to mesonotum; callus with white hairlike setae, with these most commonly somewhat denser and longer than on mesoscutum (Fig. 13d). Gaster (Fig. 13a, c) with hairlike setae; brown or with slight violaceous or coppery lusters except basal tergite anteriorly distinctly purple or blue to bluish-green and sometimes more extensively with similar, variably distinct metallic lusters, particularly laterally; ovipositor sheath with second valvifer and transversely striated part of third valvula dark, but third valvula otherwise usually almost uniformly pale (Fig. 13e) or gradually darker to light brown apically (Fig. 13a, c), or if with quite abruptly delineated and similarly dark apical as basal region then medial pale region at least 1.5× length of apical darker region.

Head in dorsal view (Fig. 13b) with interocular distance about 0.35–0.4× head width; in lateral view lenticular with face almost evenly convex; vertex alutaceous-coriaceous to alutaceous-imbricate or slightly reticulate; frons meshlike coriaceous (Fig. 13h); scrobal depression completely smooth and shiny (Fig. 13g, h); parascrobal region uniformly convex; OOL: POL: LOL: MPOD about 0.6–0.8: 2.3–2.9: 1.4–2.0: 1.0. Mesoscutum (Fig. 13b) at least shallower meshlike reticulate to more transversely reticulate- or alutaceous-imbricate anteriorly on anteromedial convex region compared to more uniform meshlike reticulation posteriorly; lateral lobe with mediolongitudinal band of minute coriaceous sculpture. Scutellar-axillar complex with axilla shallowly meshlike reticulate to obliquely alutaceous- or reticulate-imbricate posteriorly; scutellum low convex, longitudinally imbricate-strigose to reticulate-imbricate laterad midline anterior to much finer coriaceous to very finely coriaceous-reticulate frenal area. Acropleuron (Fig. 13d) more-or-less isodiametric meshlike anteriorly and posteriorly and much more

minutely sculptured mesally, the larger meshlike sculpture coriaceous-reticulate, the cells at most delineated by only slightly raised lines. Fore wing (Fig. 13e) with cc: mv: pmv: stv about 3.7–4.8: 3.1–3.9: 1.0–1.2: 1.0. Middle leg with row of 3–7 mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus and pegs differentiated into two rows apically; second tarsomere with 3–6 pegs, third tarsomere with 2 or 3 pegs, and fourth tarsomere with 1peg apically on either side. Propodeum with broadly U-shaped plical depression extending to posterior margin (Fig. 13b). Gaster (Fig. 13a, c) similar in length to combined length of head and mesosoma; usually not quite extending to apex of second valvifer, the latter usually extending at least slightly beyond apex (Fig. 13e), with third valvula 0.93–1.08× length of metatibia and 1.02–1.27× length of mv; hypopygium extending about two-thirds to three-quarters length of gaster.

MALE (habitus: Fig. 14a, b). Length = 1.0–3.0 mm. Head with face dark at least mesally from about level of anterior or posterior or ocelli through interantennal prominence, but lower face (Fig. 14e), vertex (Fig. 14f), and usually variably extensively along inner orbits above level of scrobal depression (Fig. 14c) green or bluish-green to blue or purple or with some coppery luster, at least in larger individuals; frons meshlike coriaceous, the surface not roughened (Fig. 14c); vertex uniformly curved into occiput (Fig. 14f), reticulate or in larger individuals with transverse sculpture having sharp, raised edges, but not aligned into transverse ridge or carina; scrobal depression mostly smooth and shiny except along margins; setae hairlike, pale brownish to brown; lower face with setae somewhat longer toward malar sulcus, but evenly distributed and longer setae straight to uniformly curved (Fig. 14e); gena posterior to malar sulcus with 1 seta somewhat longer than others, but not conspicuously differentiated, and posterior to eye with apices of setae directed toward orbit. Antenna (Fig. 14d) with scape entirely dark; pedicel about twice as long as wide, ventrally with row of 5 or 6 long white setae, of which all but sometimes apical setae are apically hook-like curved; length of pedicel + flagellum 1.0–1.1× head width; flagellum distinctly clavate with funiculars obviously increasing in width to broadly oval clava having ventrally flat or collapsed micropilose sensory region; anellus sometimes almost quadrate but at least a distinct, dull, setose segment similar to subsequent flagellomeres; funicle with fu1 variably distinctly shorter than pedicel and quadrate to distinctly longer than wide, and apical funiculars variably distinctly transverse; basal funiculars without evident differentiated region of setae ventrally. Maxillary and labial palps brown though apical maxillary palpomere sometimes paler apically. Mesosoma (Fig. 14a, b, f) with similar, variable metallic lusters as head though sometimes more distinctly purple to blue laterally compared to bluish or somewhat greenish-blue mesally, and with propodeum usually brighter blue or partly violaceous to purple; setae hairlike, entirely dark on pronotum, brownish to dark on mesonotum, and whitish on propodeal callus; tegula dark brown. Front leg with femur dark; tibia with at least anterior and usually posterior surface longitudinally pale; tarsus pale to brownish. Middle leg with femur and tibia dark; tibial spur white; tarsus usually with basal 3 tarsomeres pale, but smaller individuals sometimes with tarsomeres increasingly darkly infuscate from basal pale tarsomere. Hind leg with similar colour pattern as middle leg. Fore wing (Fig. 14h) with mv about 2.5–3.6× length of stv; costal cell dorsally near leading margin with numerous dark setae over almost apical half to two-thirds, and ventrally with dark setae at least indistinctly aligned into 2 rows basal to parastigma; basal cell uniformly setose with dark setae; speculum closed or almost closed posterobasally by row of setae. Propodeum (Fig. 14f) with complete median carina, sometimes indistinctly longitudinally rugulose posteriorly near foramen, but panels mostly variably extensively meshlike coriaceous to very shallowly reticulate.

Type material examined. ***Eupelmus azureus*.** Lectotype ♀ (here designated, NHMW, Fig. 13a): Rtz. [black ink on small rectangular label of about 2:4 mm] / *E. spongip.* Fö. [printed in blue ink] det. Ruschka [printed in black ink] / Lectotype [red printed label] / Lectotype *Eupelmus azureus* Ratzeburg Det. Fusu L. 2011.

Paralectotype ♀ (NHMW): Rtz. [black ink on small rectangular label of about 2:4 mm] / 246 [black ink on small rectangular label of about 4:7 mm] / [small white label of about 2:2 mm] / F. [black ink on rhomboidal label of 4:4 mm] / *E. spongip.* Fö. [printed in blue ink] det. Ruschka [printed in black ink] / Paralectotype [red printed label] / Paralectotype *Eupelmus azureus* Ratzeburg Det. Fusu L. 2011.

The lectotype is glued by the right side to a small triangular card and is entire but the eyes are collapsed and the right ovipositor sheath is broken. The paralectotype is glued to a similar card by the right middle leg and mesopleuron and is entire except the apex of the left antenna is missing and both eyes are collapsed.

Ratzeburg (1844) described *E. azureus* from two females, one stated as reared from "*Microgaster disparis*" cocoons and the other from galls of *Cynips terminalis* Hartig [= *Biorhiza pallida* (Olivier)]. However, according to Cees van Achterberg and Dicky Yu (*in litt.*) the purported braconid host is a *lapsus calami* of *Protapanteles liparidis* (Bouché). Ratzeburg's collection, deposited in DEIC, was destroyed during WW II (Bouček 1967,

Guerrieri & Noyes 2005), but the females we designate as lectotype and paralectotype in the NHMW originated from the Ratzeburg collection, as was reported by Ruschka (1921). Both agree with the original description of *E. azureus*, which states that the ovipositor was equal to nearly half the length of the gaster and had a sharply dark metallic base but a brownish apex, the body metallic greenish and bluish and all the femora largely bluish metallic. The specific name chosen by Ratzeburg also implies that the species described by him is bluish. Ratzeburg (1852) gave a subsequent description of *E. azureus* that does not fit with the original description and our interpretation but rather of one of the species with shorter ovipositor sheaths. This probably influenced Ruschka (1921) to consider *E. azureus* as synonym, in part, of both *E. spongipartus* (p. 283) and *E. urozonus* (p. 286) and not using the name although it is a senior synonym of *E. spongipartus*.

Pteromalus cordairii. Lectotype ♂ (here designated, NHMW, Fig. 14a): Rtz. [black ink on small rectangular label of about 2:4 mm] / F. [black ink on rhomboidal label of 4:4 mm] / [small black label of about 2:2 mm] / *E. spongip.* Fö. [printed in blue ink] det. Ruschka [printed in black ink] / Lectotype [red printed label] / Lectotype ♂ *Pteromalus cordairii* Ratze. Det. Fusu L. 2011.

Paralectotypes (2♂, NHMN). 1♂: Rtz. [black ink on small rectangular label of about 2:4 mm] / *term*. [*Cynips terminalis*?] über… [?] Fischb. [black ink] / *Pterom*. *cordairii* Rtz [black ink] / *E. spongip.* Fö. [printed in blue ink] det. Ruschka [printed in black ink] / Paralectotype [red printed label] / Paralectotype ♂ *Pteromalus cordairii* Ratze Det. Fusu L. 2011.

1♂: Rtz. [black ink on small rectangular label of about 2:4 mm] / 259. [black ink on small rectangular label of about 4:7 mm] / [small white label of about 2:2 mm] / F. [black ink on rhomboidal label of 4:4 mm] / *Pterom. cordairii* Rtz. [black ink] / *E. spongip.* Fö. [printed in blue ink] det. Ruschka [printed in black ink] / Paralectotype [red printed label] / Paralectotype ♂ *Pteromalus cordairii* Ratze. Det. Fusu L. 2011.

Ratzeburg (1844) described *P. cordairii* from an unstated number of specimens reared from *Cynips terminalis* galls, as for one of the two females he described as *E. azureus.* It is evident that Ratzeburg did not recognize *Eupelmus* males because after seeing a large series of reared *E. azureus* females he asked the question "wo sind die ♂ zu dieser Species?" (Ratzeburg 1852: 199). Three males in NHMW originate from Ratzeburg's collection, two of which are mentioned by Ruschka (1921), agree reasonably well with the original description of *P. cordairii* and represent the opposite sex of *E. azureus*. Ratzeburg (1844) mentions in his description the head, mesosoma and base of the metasoma being blue, the radial [stigmal] vein being one-third the length of the marginal vein, and the first tarsomere of the hind tarsus being white. He also states the legs are otherwise brown or metallic-brown, and does not mention the basal tarsomeres of the mid tarsi being white. The male we designate as lectotype is glued by its ventral surface to a small triangular card and is in good shape except the right fore wing and left antenna beyond fu3 are missing and half of the right metafemur is gnawed by booklice. One of the male paralectotypes has the most detailed labels of all three specimens, but both middle legs are missing and it is covered in mould. The second paralectotype is glued dorsal surface down and both antennae are broken, the right beyond the scape and the left beyond fu1.

Eupelmus spongipartus. GG examined the female syntype Förster (1860: 250) described as "Var. *α*" (NHMW, Fig. 13c–g). It has the five labels: Var. α & *Teras term.* [= *Teras* (*Cynips*) *terminalis*] [hand written, line along lower margin of label] / Collect. G. Mayr / *Eup. spongipartus* Type [hand written] Förster / TYPUS [red card stock] / CNC Photo 2012-68.

Distribution. Noyes (2014) listed 16 countries in the Palaearctic, but his interpretation was in the sense of *E. annulatus* (see 'Remarks'). We saw specimens from Austria, Bulgaria, Cyprus, Czech Republic, France, Germany, Greece, Hungary, Iran, Israel, Italy, Lebanon, Portugal, Romania, Spain, Sweden, and Turkey.

Biology. Based on our observations, a parasitoid in galls of Cynipidae, primarily on *Quercus* but more rarely also on *Rosa* and recently *Castanea.* All the *Castanea* records are from *Dryocosmus kuriphilus* (Quacchia *et al.* 2013 [as *E. spongipartus*] and Al khatib *et al.* 2014) an invasive species introduced only recently to Europe (Quacchia *et al.* 2013). One of the two females described as *E. azureus* was reared from *Protapanteles liparidis* (Bouché) (Braconidae) (Ratzeburg 1844, as "*Microgaster disparis*"), but it is possible that the type series of *E. azureus* consisted of more than one species. If so, it could have been a female of *E. annulatus*, a species comparatively frequently reared as a hyperparasitoid through Braconidae in Lepidoptera. Nevertheless, we also saw two females of *E. azureus* labelled as "*Phobocampe*?" Förster (Ichneumonidae) (MHNG). Another anomalous record is *Gra*[e or c?]*i loridae* [= Gracillariidae?] on *Quercus coccifera* L. (MHNG).

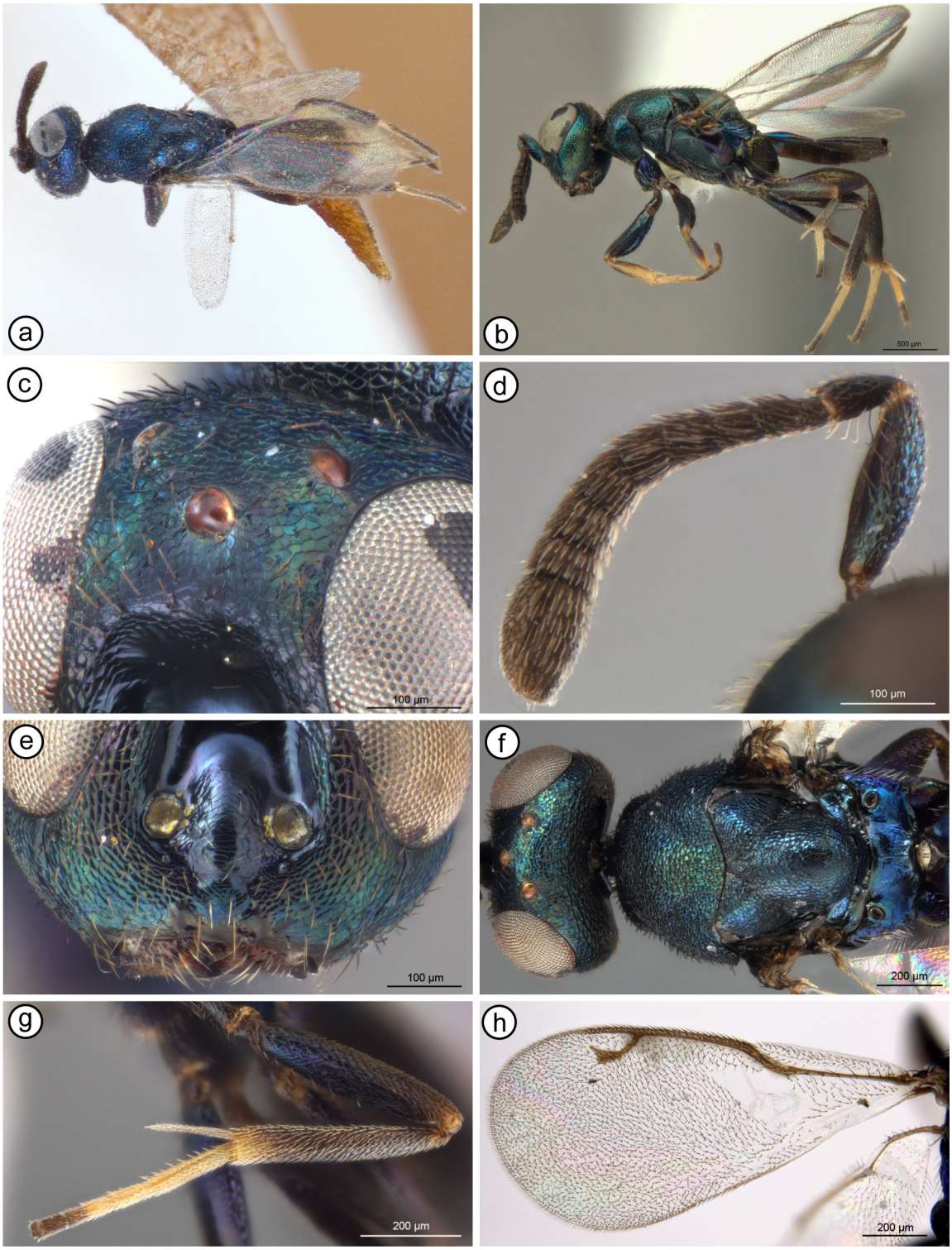

FIGURE 14. *Eupelmus azureus*, ♂. **a**, *E. cordarii* lectotype, dorsal habitus (L. Fusu image). *b, c* (2010-33): **b**, lateral habitus; **c**, frontovertex, oblique. **d**, antenna, outer view (2013-92). **e**, lower face (2010-33). **f**, head and mesosoma, dorsal (2012-100). **g**, middle leg colour pattern (2010-33). **h**, fore wing (2013-91).

Andriescu (1974) listed "*Eupelmus spongipartus ponticus* ssp. nov. in litt." as reared from *Dryocosmus cerriphilus* Giraud (Cynipidae), but the subspecies name was never validated. There are three *E. azureus* females and one male in ANCO with the correct date (according to an unpublished manuscript by I. Andriescu), though without locality and host data except labelled as reared from jar nr 2. We also saw specimens labelled as reared from: *Andricus caputmedusae* (Hartig) gall (ZSMC) on *Quercus pubescens* Willdenow (1♀ Eann053, CNC), *A.*

conglomeratus (Giraud) (CTPC, USNM), *A. coriarius* (Hartig) (CTPC, HNHM, MNCN), *A. fecundator* (Hartig) (CTPC, USNM), *A. glutinosus* (Giraud) gall (CTPC) on *Q. cerris* L. (ZSMC), *A. grossulariae* Giraud sexual galls (AICF), *A. hartigi* (Hartig) (CTPC), *A. hispanicus* (Hartig) (ARPC), *A. hungaricus* (Hartig) (CTPC), *A. kollari* (Hartig) (CTPC, ZMAN) on *Quercus robur* L. (HNHM, ZSMC) and *Quercus* sp. (NMPC; 1♂ Eann080, CNC), *A. lignicola* (Hartig) (IBER, PUPB), *A. lucidus* (Hartig) (CTPC, HNHM, IBER, USNM), *A. multiplicatus* Giraud (CTPC), *A. polycerus* (Giraud) galls (ZMAN) on *Quercus* sp. (UCRC), *A. quercuscalicis* (Burgsdorff) galls on *Quercus* sp. (AICF), *A. quercusramuli* (L.) (ARPC, PUPB), *A. quercustozae* (Bosc) gall on *Q. pyrenaica* Willd. (1♂ Eann071, CNC; as *E. annulatus* in Kaartinen *et al*. (2010) in supplementary table S1), *A. sadeghii* Melika *et al.* galls on *Q. infectoria* Olivier (1♀ Eann082, CNC), *A. solitarius* (Boyer de Fonscolombe) (CTPC) on *Q. petraea* (Mattuscka) (NMPC), *A. sternlichti* Bellido *et al.* galls on *Q. infectoria* (1♂ Eann037, CNC); *Aphelonyx persica* Melika *et al.* gall on *Q. cerris* L. (1♂ Eann078, CNC); *Biorhiza pallida* (Olivier) galls (BMNH, CTPC) on *Q. faginea, Q. petraea* and *Quercus* sp. (AICF, ARPC); *Cynips quercus* (Fourcroy) (1♂ Eann072, CNC; as *E. annulatus* in Kaartinen *et al*. (2010) in supplementary table S1); *Diplolepis rosae* (L.) galls (CTPC) on *Rosa* sp. (ARPC); *Neuroterus lanuginosus* Giraud (ZSMC), *N. minutulus* Giraud (HNHM) and *N. quercusbaccarum* (L.) (ARPC) (some from galls on *Quercus faginea*).

Remarks. The material we consider as syntypes of *E. azureus* and *P. cordairii* is in accordance with Bouček (1967), who also considered Ratzeburg's specimens in NHMW as types. Our interpretation of synonymy is also in accordance with Ruschka (1921) except that with designation of the lectotype of *E. azureus* we consider this as the senior rather than junior synonym of *E. spongipartus*, as per Al khatib *et al*. (2014). Noyes (2014) included *E. azureus* as a synonym of *E. urozonus*, following Dalla Torre (1898). As noted under the discussion of type material for *E. urozonus*, the type series of *E. urozonus* consists of at least two species, including *E. urozonus* as established through lectotype designation (Graham 1969a) and at least one female paralectotype that is *E. azureus*. Bouček (1970) synonymized *E. spongipartus* under *E. annulatus*, but Gibson (2011) showed that the latter name encompassed two distinct species characterized by females with long ovipositor sheaths but different sculpture patterns of the scrobal depression. He used *E. spongipartus* for the one with a smooth and shiny scrobal depression and *E. annulatus* for the one with a reticulate scrobal depression. Only *E. annulatus* occurs in North America, which shows the records for *E. spongipartus* in Noyes (2014) refer to *E. annulatus* and not *E. spongipartus*. Our designation of the lectotype of *E. azureus* for this species resolves the confusion created by the incorrect synonymy of *E. spongipartus* under *E. annulatus* by Bouček (1970), as opposed to Graham's (1988) synonymy of *E. nubilipennis* under *E. annulatus*, and the listing of the various names by Noyes (2014).

Females of *E. azureus* are most similar to those of *E. gelechiphagus* because they share comparatively long ovipositor sheaths, a coriaceous frons and a smooth and shiny scrobal depression, but are easily differentiated by the features given in the key and discussed under the latter species. Females of the six recognized *urozonus*-group species also have a smooth and shiny scrobal depression, but all have shorter ovipositor sheaths, the third valvula being at most being only about as long as the length of the marginal vein compared to at least as long as the marginal vein for *E. azureus* females. Colour differences, particularly in combination, can often also help differentiate females, though because of intraspecific variation these are unreliable by themselves. As its name implies, typical *E. azureus* females are bluish or partly purple, particularly the vertex and occiput and the mesoscutum at least mediolongitudinally. Also, *E. azureus* females always have the mesofemur similarly darkly coloured as the pro- and metafemora, whereas *urozonus*-group females often have a femoral colour pattern more similar to *E. annulatus* females, that is, with the mesofemur distinctly lighter brown to yellowish compared to darker pro- and mesofemora. Females of *E. azureus* usually also have almost uniformly pale sheaths beyond the basal dark region or the sheaths gradually darker brown apically, but even if quite abruptly and dark brown apically then the apical region is always obviously shorter than the medial pale region, whereas *urozonus*-group females much more commonly have the apical region abruptly delineated and quite dark so the sheaths are more distinctly banded and often with the apical and medial regions being similar in length.

We saw two females (USNM) from the Oriental part of China (Kashing = Jiaxing, Zhejiang) reared from *Baris deplanata* Roelofs (Curculionidae) that would key to *E. azureus*, but differ most conspicuously in having the scrobal depression carinately margined as well as the posterior depressed region of the mesoscutum comparatively finely meshlike coriaceous, the third valvula more extensively dark basally and somewhat longer (at least 1.2× as long as metatibia and 1.5× as long as marginal vein), and the interocular distance somewhat narrower (only about 0.3× head width and POL less than 2× MPOD). However, additional specimens may well show greater intraspecific variation in the various ratios.

Among *urozonus*-complex species, males of *E. azureus* are distinguished by a combination of features. The flagellum is distinctly clavate and typically has a somewhat longer anellus (Fig. 14d) than for other *urozonus*-complex species (e.g. Figs 9g, 65g) except for *E. gelechiphagus* (Fig. 36f). It is possible that one or more basal funiculars have a few differentiated setae ventrally, but these are at least not evident as distinctly differentiated regions under the magnifications we used, unlike for example for *E. annulatus* males (Fig. 9f insert). Also, the lower face has comparatively sparse and uniformly curved setae (Fig. 14e), the scrobal depression is extensively smooth and shiny, and the protibia is longitudinally pale (Fig. 14b) but the mesotibia is dark (Fig. 14g). Differentiation from *E. gelechiphagus* and *E. annulatus* males is discuss under these latter two species.

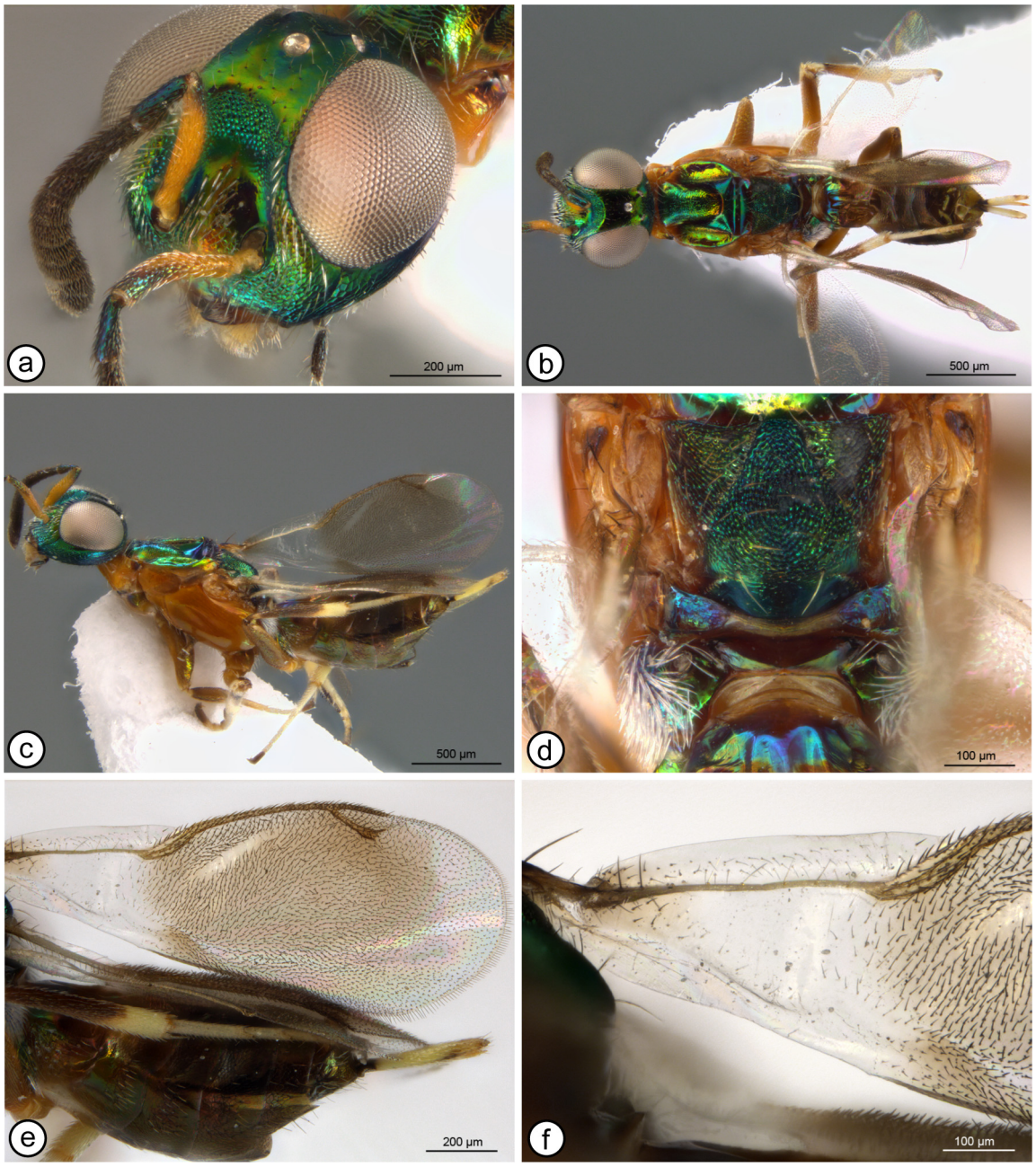

FIGURE 15. *Eupelmus bicolor*, holotype ♀: **a**, head, dorsolateral; **b**, dorsal habitus; **c**, lateral habitus; **d**, scutellar-axillar complex to propodeum; **e**, fore wing and gaster, lateral; **f**, fore wing base.

***E.* (*Eupelmus*) *bicolor* Gibson & Fusu n. sp.**
Fig. 15a–f (♀)

Type material. Holotype ♀ (HNHM). IRAN: Kermanshah, Gahvareh, coll. early spring, M. Tavakoli, ex. galls of

Andricus cecconii [sic] on *Quercus brantii*, 2006, LOR17 / LOR17 *Eupelmus cerris* / *Eupelmus urozonus* (Dalman, 1820) ♀ det. László Z. 2005 / HOLOTYPE ♀ *Eupelmus* (*Eupelmus*) *bicolor* Gibson & Fusu, det. G. Gibson 2015. Condition: glued by right side on triangular card; uncontorted; entire.

Paratype. **Iran**: Lorestan, Ghelaie, coll. early spring, M. Tavakoli, ex. galls of *Andricus cecconii* [sic] on *Quercus brantii*, 2006, LOR68, LOR68 *Eupelmus cerris*, *Eupelmus urozonus* (Dalman, 1820) ♀ det. László Z. 2005 (HNHM: 1♀).

Etymology. The species name is in reference to the conspicuously bicoloured mesosoma of females.

Description. FEMALE (habitus: Fig. 15b, c). Length about 1.7–2.5 mm. Head (Fig. 15a–c) bright green with slight coppery luster on frons paramedially and more distinctly on interantennal and parascrobal regions under some angles of light; with slightly lanceolate white setae on lower face and parascrobal region to dorsal level of scrobal depression compared to much less conspicuous hairlike setae on frontovertex. Maxillary and labial palps brown. Antenna (Fig. 15a, c) with scape mostly yellow but dark dorsoapically, pedicel and flagellum dark with metallic luster on pedicel and dark part of scape under some angles of light. Mesosoma (Fig. 15b–d) bicoloured; prothorax extensively yellow but pronotum with posterolateral margin adjacent to spiracle dark and lighter brown dorsomedially, and prosternum dark with green luster; mesonotum bright green except extreme lateral margin of mesoscutum orange; prepectus, tegula and acropleuron orange; mesopectus dark with slight greenish luster at least ventrally between transepisternal sulci and sometimes variably extensively between transepisternal sulcus and acropleural sulcus; metanotum dark with metallic luster laterally but dorsellum yellowish; propodeum brown to variably distinctly green, particularly callus; prepectus bare; pronotum with admarginal setae white; mesonotum, including axillae, with comparatively inconspicuous hairlike setae similar to frontovertex; callus laterally with dense white setae forming reflective surface. Macropterous; fore wing (Fig. 15e) with costal and basal cells mostly hyaline with white setae, but at least basal-most setae in both cells and submarginal vein dark, and sometimes membrane also brownish basally; disc with all setae dark and with variably distinct brownish infuscation between base of parastigma and about midway between apex of stv and wing apex, at least within about anterior half, but hyaline apically and sometimes posteriorly; costal cell dorsally near leading margin with 2 (holotype, Fig. 15f) to 5 (paratype) setae in row anterior to parastigma, and ventrally with about 3 rows along length; basal cell bare except for a few setae basally and variably extensively along mediocubital fold, but disc setose except for linea calva, the latter closed basally by setae (Fig. 15f). Front leg brown except at least apical two-thirds of coxa, anterior surface of femur, anterior surface and extreme base of tibia, and basal four tarsomeres pale. Middle leg extensively pale, but lateral surface of coxa sometimes brown, femur variably extensively orange to brown dorsoapically but with anteroapical angle contrastingly white similar to base of tibia, the tibia otherwise brown subbasally and extensively pale apically, and mesotarsus pale except for dark mesotarsal pegs and apical tarsomere. Hind leg more extensively brownish but coxa apically, trochanter, femur ventrally, small subbasal spot and about apical quarter to third of tibia, and basal four tarsomeres pale. Gaster (Fig. 15b, c) with hairlike setae; mostly brown with slight metallic lusters under some angles of light except basal tergite anteriorly more distinctly green to bluish or purple and white or at least lighter in colour ventrobasally; ovipositor sheaths (Fig. 15e) at least with base and tip dark, and sometimes also with subapical brownish region.

Head in dorsal view with interocular distance about 0.3× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; vertex meshlike coriaceous to more alutaceous posteriorly; frons (Fig. 15a, b) shiny and smooth or with at most subeffaced meshlike sculpture, most distinctly along inner orbit; scrobal depression (Fig. 15a) reticulate to reticulate-rugulose; OOL: POL: LOL: MPOD = 0.6: 2.1: 1.7: 1.0. Mesoscutum (Fig. 15b) with posteromedial depressed region much shinier and smoother than rest of mesoscutum, at most with only obscure subeffaced meshlike sculpture compared to comparatively finely meshlike coriaceous outer surface of lateral lobe and much more strongly meshlike to alutaceous-imbricate convex part of medial lobe. Scutellum and axillae low convex in same plane, similarly punctate-reticulate except frenal area virtually smooth. Acropleuron (Fig. 15c) shiny and almost smooth though inconspicuously meshlike coriaceous anteriorly and posteriorly. Fore wing (Fig. 15e) with cc: mv: pmv: stv = 4.2–4.4: 3.0: 1.1–1.2: 1.0. Middle leg without mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus, the pegs differentiated into two rows apically primarily by differences in length; second tarsomere with 5 or 6 pegs, third tarsomere with 2 pegs, and fourth tarsomere with 1 apical peg on either side. Propodeum with broadly V-shaped to shallowly U-shaped plical depression extending to posterior margin (Fig. 15d). Gaster (Fig. 15b, c) about as long as mesosoma; not atypically modified, though Gt5 concealing spiracle in both females; extending about to apex of second

valvifer, with third valvula about 0.6× length of metatibia or about 0.9–1.0× length of mv; hypopygium extending at least about three-quarters length of gaster.

MALE. Unknown.

Distribution. Iran.

Biology. Reared from galls of *Andricus cecconi* Kieffer (Hymenoptera: Cynipidae) on *Quercus brantii* Lindl. (Fagaceae).

Remarks. *Eupelmus bicolor* is one of four species assigned to the *splendens* species-group, as discussed under *E. splendens*. A mostly bare basal cell (Fig. 15f) in addition to other colour, structural and sculptural features differentiates females from those of the other three species. The two type females originally lacked collection data, being labelled only with LOR17 or LOR68 and two previous identification labels, one by an unknown individual. The two specimens were discovered to be rearings by George Melika (Plant Health and Molecular Biology Laboratory, Budapest, Hungary), who provided us the collection data associated with the code numbers and we labelled the specimens accordingly.

The paratype is definitely smaller than the holotype, but its head is missing and for this reason the smaller measurement given above is an estimate. The two females differ in various sculpture and colour differences that likely are correlated with size, including the fore wings of the smaller female being much less obviously infuscate behind the venation, though uniformly infuscate rather than more-or-less bifasciate as in other *splendens*-group females. The description given above undoubtedly does not adequately encompass intraspecific variation, but one unusual feature of both observed females is that the gaster is white or at least light-coloured ventrobasally similar to species of *Anastatus* Motschulsky and many species of *Eupelmus* (*Macroneura*).

E. (*Eupelmus*) *brachypterus* Fusu & Gibson n. sp.

Fig. 16a–g (♀)

Type material. Holotype ♀ (HNHM). [NORTH] KOREA, Prov. South Pyongan, De-sang san, 12 km NE from Pyongyan / No.267. 18 July 1975 leg. J. Papp et A. Vojnits / HOLOTYPUS ♀ *Eupelmus* (*Eupelmus*) *brachypterus* Det. Fusu L. 2013. Condition: glued by right side on rectangular card; uncontorted; entire.

Paratypes (5♀). **North Korea**: Prov. Ryanggang, Hyesan, 2.X.1978, Dr. A. Vojnits et L. Zombori (HNHM: 1♀). Tesson, 35 km SW Pyongyan, water-basin, 4.VII.1977, No. 343 – netting in grasses, Dely & Draskovits (HNHM: 2♀). Prov. South Pyongan, Sa-gam, 45 km N. from Pyongyan, 12.VIII.1971, No. 164, S. Horvatovich et J. Papp (HNHM: 1♀). Prov. S. Pyongan, Taesong-ho, 26.IX.1978, Dr. A. Vojnits et L. Zombori No. 406 (AICF: 1♀, with permission from HNHM).

Etymology. From the Greek words *brachys* (short) and *pteron* (wing), in reference to the shortened wings in females of this species.

Description. FEMALE (habitus: Fig. 16a, b). Length = 2.4–3.0 mm. Head (Fig. 16c, d) with scrobal depression and frons medially to level of anterior ocellus dark brown with coppery and green reflections to golden-green, ocellar triangle sometimes coppery with golden reflections, frons and vertex extensively bluish-green to blue, with a transverse blue to violet stripe along occipital margin, lower face, gena, and temples variably green to coppery; with dense, slightly lanceolate white setae on lower face and parascrobal region to dorsal level of scrobal depression and variably extending on frons along inner orbit. Maxillary and labial palps brown. Antenna dark with indistinct green luster on scape and pedicel. Mesosoma (Fig. 16a, b, e) similar in colour to head but less brightly coloured, mostly dark brown to golden-green or blue, mesoscutum brighter golden-green to blue on median depressed area and coppery on lateral lobes, and scutellar-axillar complex greenish-blue to almost non-metallic in some small specimens; mesonotum with inconspicuous, mostly dark hairlike setae similar to frontovertex, prepectus with a few setae, and callus laterally with sparse white setae not obscuring cuticle. Brachypterous (Fig. 16a, b); fore wing (Fig. 16f) similar in shape to a macropterous wing, though comparatively narrow with subparallel leading and posterior margins, with acutely rounded apex extending to posterior margin of first gastral tergite or slightly surpassing posterior margin of second tergite; disc faintly infuscate with dark setae; costal cell dorsally near leading margin with brown setae in front of parastigma, and ventrally setose along length; basal cell sparsely, uniformly setose, and disc variably setose beyond level of parastigma except for short linea calva below mv, with setation denser and shorter toward apex of wing. Front leg with femur entirely dark, tibia dark except narrowly pale basally and apically, and tarsus pale to yellowish-brown with last tarsomere darker. Middle leg dark

with an anteroapical spot on femur, tibia basally and apically pale such that tibia extensively dark mesally, mesotibial apical pegs dark, and tarsus with basal four tarsomeres pale with dark mesotarsal pegs. Hind leg with femur entirely dark, tibia dark except slightly paler knee and narrowly pale apically, and tarsus pale to yellowish-brown with last tarsomere darker. Gaster (Fig. 16a, b) with hairlike setae; dark brown with strong green to bluish-green luster basally; ovipositor sheaths dark.

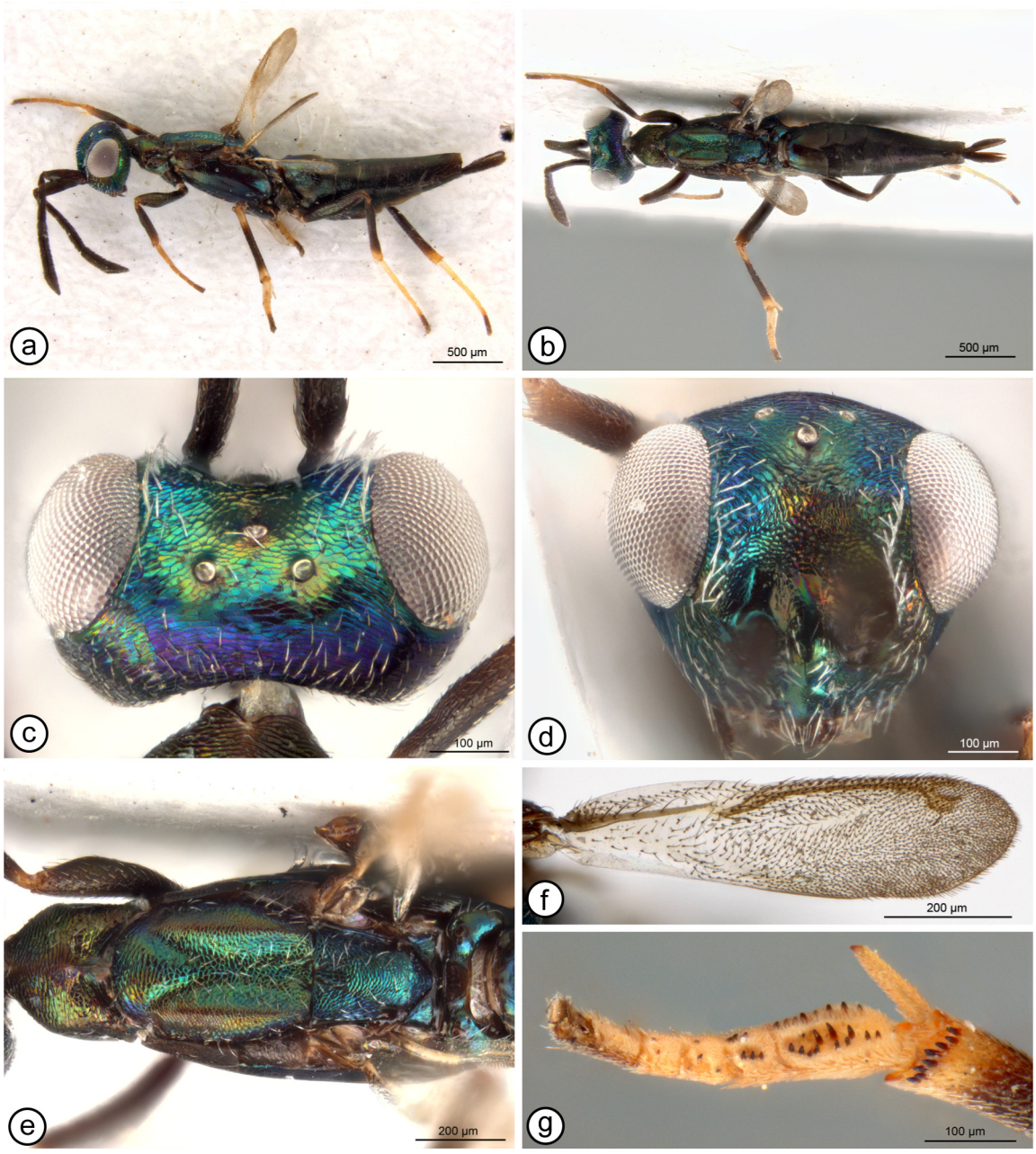

FIGURE 16. *Eupelmus brachypterus*, holotype ♀: **a**, lateral habitus; **b**, dorsal habitus; **c**, head, dorsal; **d**, head, frontal; **e**, mesosoma, dorsal, **f**, fore wing; **g**, apex of mesotibia and mesotarsus.

Head in dorsal view (Fig. 16c) with interocular distance about 0.5× head width; in lateral view hemispherical with face almost evenly convex and parascrobal region smoothly merged with frons; vertex (Fig. 16c) alutaceous to alutaceous-imbricate passing to strigose toward temples and occiput; frons (Fig. 16c, d) reticulate-imbricate to variably extensively reticulate toward scrobal depression, parascrobal area, and along orbit; scrobal depression (Fig. 16d) reticulate with small mesh size; ocelli comparatively small (Fig. 16c), OOL: POL: LOL: MPOD = 2.1–2.8: 2.7–3.3: 1.5–1.8: 1.0. Antenna with scape subrectangular, 2.9–3.1 as long as wide, and with a wide ventral lamina. Mesoscutum (Fig. 16e) meshlike reticulate passing to alutaceous-imbricate on outer side of lateral lobes.

Scutellum and axillae comparatively flat and in same plane, scutellum reticulate to alutaceous-imbricate posteriorly and frenal area coriaceous, axillae extensively obliquely alutaceous to alutaceous-imbricate. Acropleuron more-or-less isodiametric meshlike anteriorly and posteriorly and much more minutely sculptured mesally, coriaceous or with larger cells defined by at most very slightly raised ridges, passing to alutaceous with strongly transverse cells on a comparatively reduced area below hind wing insertion. Fore wing (Fig. 16f) with distinct venation similar to that of a macropterous wing, with stv at acute angle to pmv. Middle leg (Fig. 16g) with 6–8 mesotibial apical pegs; mesotarsus with symmetrical peg pattern, pegs differentiated into two rows apically though not distinctly so in all individuals, second tarsomere with 3 or 4 pegs, third tarsomere with 1 or rarely 2 pegs, and fourth tarsomere without or with 1 inconspicuous peg apically on either side. Propodeum with broadly U-shaped plical depression extending to posterior margin (Fig. 16e). Gaster (Fig. 16a, b) similar in length to combined length of head and mesosoma; syntergum with posteroventral angles obliquely inflexed anteromesally between anal sclerite and ovipositor sheaths so in posterior view appearing more-or-less Ω-like over sheaths; extending over base of third valvula, the latter about 0.54–0.55× length of metatibia (superficially less if true basal limit of third valvula concealed by syntergum) and in some specimens comparatively broad, with third valvula convex in dorsal view; hypopygium extending to or somewhat beyond middle of gaster.

MALE. Unknown.

Distribution. North Korea.

Biology. Unknown.

Remarks. Females are most similar to *E. atropurpureus* because of their brachypterous fore wings and dark, short ovipositor sheaths. Interestingly, females of both species also have comparatively small ocelli. The differences between females of the two species are given in the key and discussed under the latter species. *Eupelmus brachypterus* differs from *E. rexonus* in the reduced fore wing having an acutely rounded apex and a linea calva (Fig. 16f), the stigmal vein at an acute angle to a long postmarginal vein, and in having completely dark ovipositor sheaths (Fig. 16a, b). Females of *E. rexonus* have the basal cell setose as in *E. brachypterus*, but the wing lacks a linea calva, the apex is broadly rounded, the stigmal vein is at a nearly right angle to the marginal and short postmarginal veins, and the ovipositor sheaths have a wide yellowish-white band (Narendran & Anil 1998).

E. (*Eupelmus*) *brachystylus* Gibson & Fusu n. sp.

Fig. 17a–i (♀)

Type material. Holotype ♀ (CNC). JAPAN: Honshu, Aomori, Ajigasawa, near Mt. Shiragami, 29.IX.1992, K. Yamagishi, s.s. [screen sweep] / HOLOTYPE ♀ *Eupelmus* (*Eupelmus*) *brachystylus* Gibson & Fusu, det. G. Gibson 2015. Condition: point-mounted; uncontorted; entire.

Paratypes (7♀, all CNC). **Japan**: same data as holotype, one with CNC Photo 2013-56, one with DNA voucher CNCHYM 015255 and CNC Photo 2013-55, and one with DNA voucher CNCHYM 015256 and CNC Photo 2014-77).

Etymology. From the Greek words *brachys* (short) and *stylos* (pillar), in reference to the comparatively short ovipositor sheaths of females.

Description. FEMALE (habitus: Fig. 17a). Length = 1.7–2.7 mm. Head (Fig. 17b–d) dark purplish-brown with variably distinct and extensive green to bluish-green lusters under different angles of light, except scrobal depression dark purplish-brown without distinct metallic lusters and vertex and occiput sometimes more distinctly purple to blue; with mostly brownish, hairlike setae. Maxillary and labial palps brown. Antenna (Fig. 17h) entirely brown except at least pedicel dorsally with slight metallic lusters similar to head. Pronotum brown or sometimes with variably distinct violaceous luster, at least laterally. Mesonotum (Fig. 17e) partly blue to bluish-green at least within posteromedial depressed region of mesoscutum, scutellar-axillar complex, propodeal callus, and sometimes metanotum laterally, but mesoscutal medial lobe anteriorly and often outer and sometimes inner surfaces of lateral lobes darker, more similar to pronotum, or partly purple under some angles of light; tegula and prepectus brown with at most slight metallic luster under some angles of light. Mesonotum, prepectus and callus with similar white to brownish hairlike setae, the prepectus with 1–5 setae in one or two rows. Pronotum with admarginal setae dark. Macropterous; fore wing (Fig. 17f) hyaline with yellowish to brown setae; costal cell dorsally near leading margin with row of setae over about apical half to two-thirds, and ventrally with at least 2 rows along length; basal cell and disc entirely setose except for linea calva extending basally to at least base of mv. Front leg with knee, at least apical

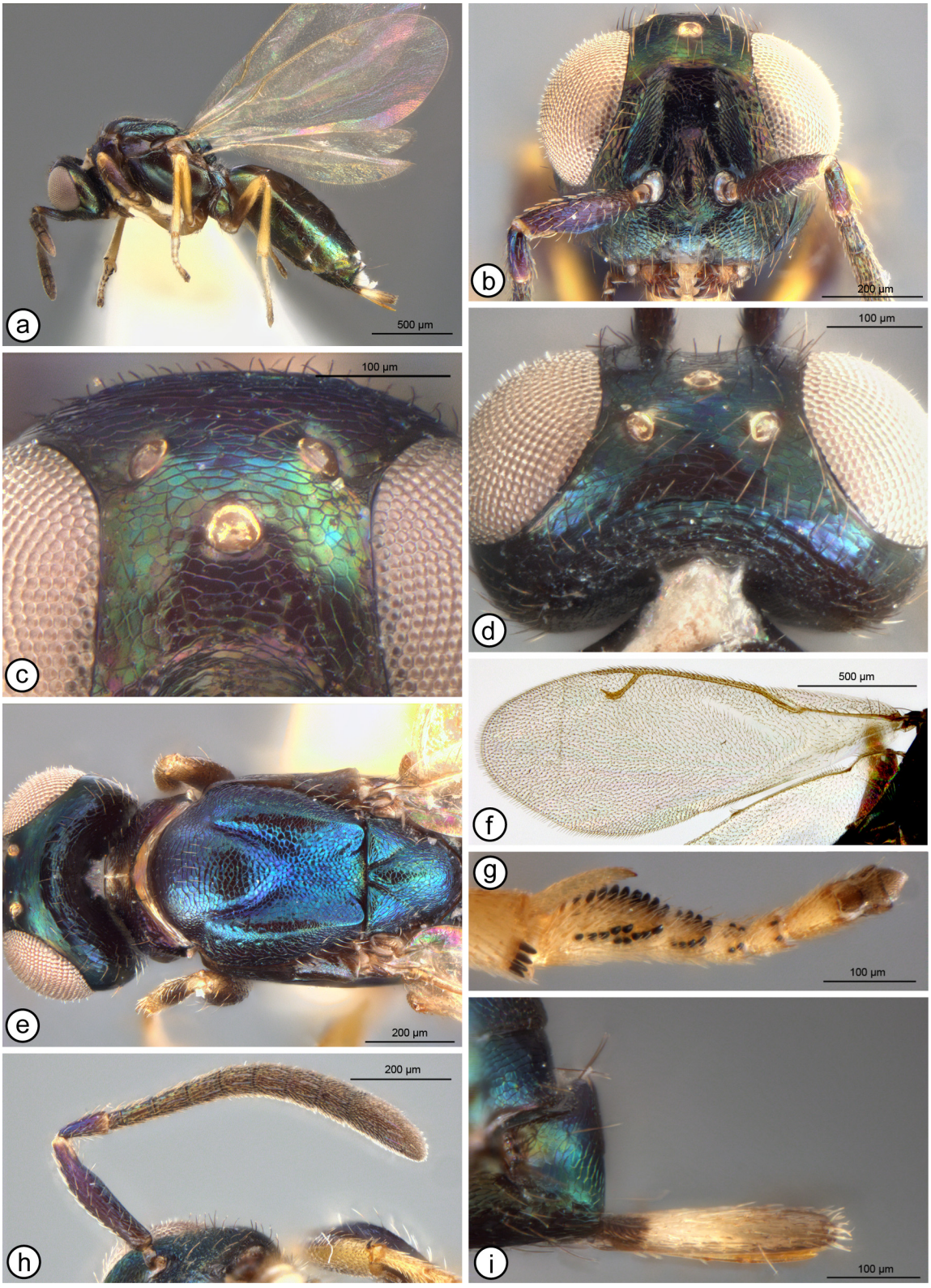

FIGURE 17. *Eupelmus brachystylus*, ♀. *a–d* (holotype): **a**, lateral habitus; **b**, head, frontal; **c**, frontovertex; **d**, head, dorsal. *e*, *f* (2013-56): **e**, head and mesosoma, dorsal; **f**, wings. *g, h* (2013-55): **g**, mesotibial and tarsal peg pattern; **h**, antenna. **i**, ovipositor sheaths (2014-77).

third of tibia, and tarsus pale, the femur otherwise dark and up to about basal two-thirds of tibia brownish to similarly dark as femur along posterodorsal and/or anteroventral surfaces. Middle leg usually entirely pale beyond coxa except for dark mesotibial apical and mesotarsal pegs, but single female with longitudinal brownish band on

posteroventral surface of femur. Hind leg pale beyond coxa except about basal half to three-quarters of femur dark and one female with tibia brownish except basally and more extensively apically. Gaster (Fig. 17a) with hairlike setae; variably extensively brown to green to bluish-green, with at least basal tergite blue to green anteriorly and with at least some metallic lusters apically, much more extensively so in larger individuals; ovipositor sheaths (Fig. 17i) almost uniformly pale beyond basal dark region or variably distinctly brownish apically so as to differentiate medial pale band, but without distinct margin.

Head in dorsal view (Fig. 17d) with interocular distance 0.4–0.44× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; frontovertex finely, transversely alutaceous but vertex differentiated from occiput by broadly arched carina or more obscure margin in smaller individuals (Fig. 17d); frons entirely meshlike coriaceous (Fig. 17c); scrobal depression (Fig. 17b) very finely meshlike coriaceous to shallowly coriaceous-reticulate in larger individuals; OOL: POL: LOL: MPOD = 0.8: 2.3–2.5: 1.4–1.6: 1.0. Mesoscutum (Fig. 17e) mostly meshlike reticulate except medial lobe more transversely alutaceous-imbricate anteriorly and lateral lobe with mediolongitudinal band of minute coriaceous sculpture. Scutellum and axillae low convex in same plane; axilla meshlike reticulate mesally to obliquely reticulate-imbricate laterally and scutellum longitudinally reticulate-imbricate laterad midline anterior to meshlike coriaceous frenal area. Acropleuron more-or-less isodiametric meshlike anteriorly and posteriorly and much more minutely sculptured mesally, the larger meshlike sculpture coriaceous-reticulate, the cells at most delineated by only slightly raised ridges. Fore wing (Fig. 17f) with cc: mv: pmv: stv = 3.9–4.4: 3.5–4.2: 1.0–1.2: 1.0. Middle leg (Fig. 17g) with row of 3 or 4 mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus and pegs clearly differentiated into two rows apically; second tarsomere with 3 or 4 pegs, third tarsomere with 1 or 2 pegs, and fourth tarsomere with 1 peg apically on either side. Propodeum with broadly U-shaped plical depression extending to posterior margin. Gaster (Fig. 17a) similar in length to combined length of head and mesosoma; not atypically modified; extending to or slightly over base of third valvula, the latter (measured in ventral view) about 0.48–0.58× length of metatibia or mv; hypopygium extending about two-thirds length of gaster.

MALE. Unknown.

Distribution. Japan.

Biology. Unknown.

Remarks. Females of *E. brachystylus* share comparatively short ovipositor sheaths (Fig. 17a), at most only about 0.6× the length of the metatibia or marginal vein, with females of *E. brachyurus* (Fig. 18b) and *E. tetrazostus* (Fig. 112a). This differentiates them from other far eastern Palaearctic species that also have a sculptured scrobal depression and partly dark front and hind but pale middle legs, though one paratype of *E. brachystylus* does have the posterior surface of the mesofemur quite distinctly brownish ventrolongitudinally. As discussed under *E. fulvipes*, *E. brachystylus* is included as one of ten species within the *fulvipes* species group because of the presence of a vertexal carina. This differentiates females of *E. brachystylus* from those of *E. brachyurus* and *E. tetrazostus*. However, males are unknown for all three species and the latter two species are based only on singleton females. Hence, limits of intraspecific variation are unknown and putative differential features such as described colour pattern differences of the ovipositor sheaths and the presence or absence of a vertexal carina or other sculptural features of the head might prove unreliable for all females. Different sculpture patterns of the frontovertex and scrobal depression appear to form a grade. Known females of *E. brachystylus* have the most effaced sculpture with the frons meshlike coriaceous (Fig. 17c) and the scrobal depression very finely meshlike coriaceous to shallowly coriaceous-reticulate (Fig. 17b), whereas *E. brachyurus* has the frons slightly roughened, very slightly imbricate (Fig. 18d), and the scrobal depression shallowly reticulate (Fig. 18c), and *E. tetrazostus* has the frons more distinctly roughened, quite obviously imbricate (Fig. 112d), and the scrobal depression transversely strigose to punctate-reticulate (Fig. 112c). *Eupelmus brachyurus* additionally differs by its comparatively more distinct, brighter green colour with strong coppery reflections (Fig. 18a–e), whereas both *E. brachystylus* (Fig. 17a–e) and *E. tetrazostus* (Fig. 112a–f) have darker, more extensively blue to purplish or violaceous bodies. Although not detailed in the description, the unique holotype of *E. tetrazostus* also differs from females of the other two species in having an obviously longer propodeal plical region such that the plical depression appears almost semicircular, only slightly wider than long. Females of the other two species have an obviously transverse, somewhat V-shaped to almost lunate plical depression. Additional females are necessary to determine whether this or other differences, such as relative length of the marginal vein and number of mesotarsal pegs, are reliable differential features or simply reflect differences in body size. Although DNA was sequenced from two females for COI, neither was successful.

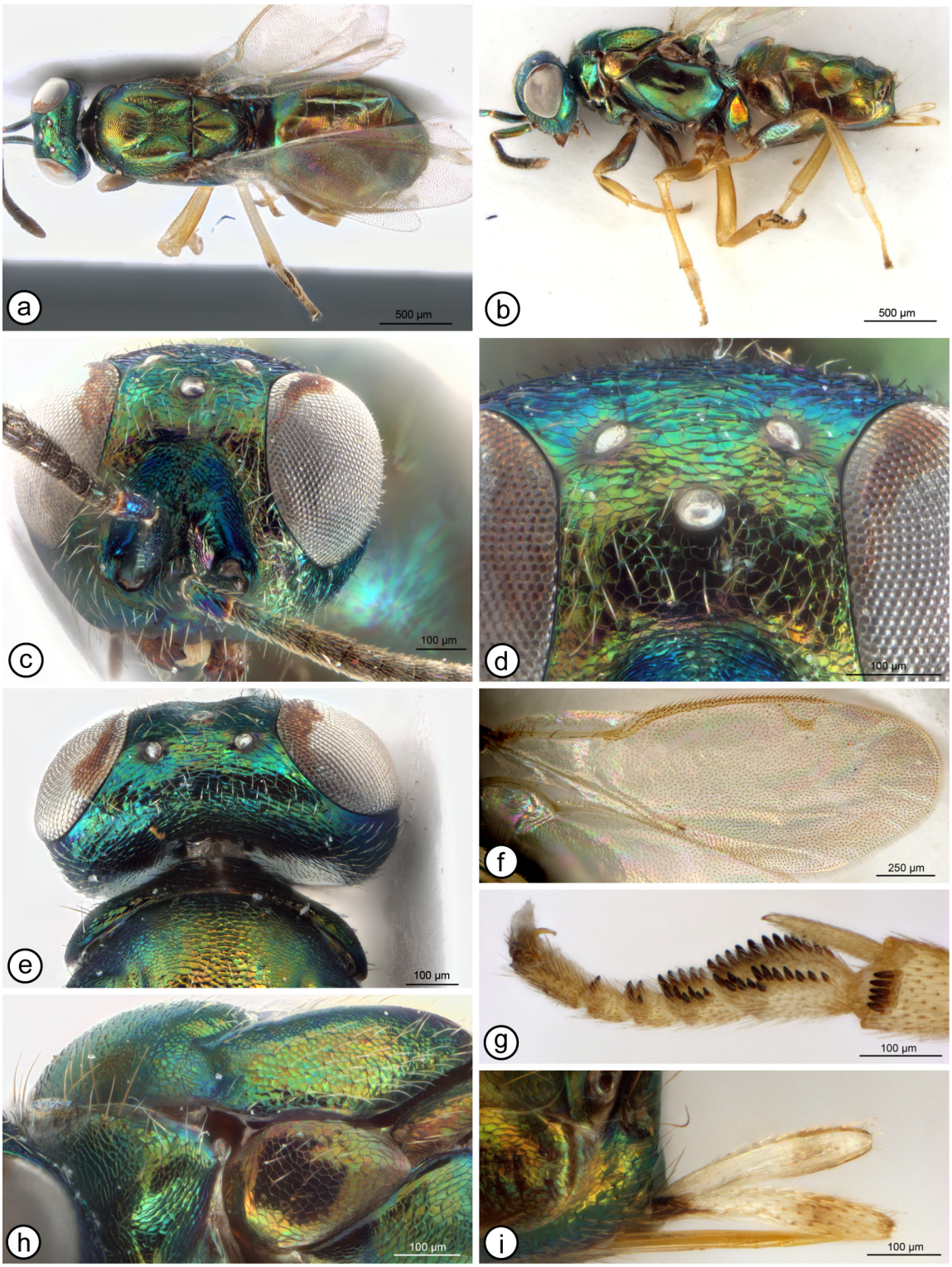

FIGURE 18. *Eupelmus brachyurus*, holotype ♀: **a**, dorsal habitus; **b**, lateral habitus; **c**, head, frontal; **d**, frontovertex; **e**, head and pronotum, dorsal, **f**, fore wing; **g**, apex of mesotibia and mesotarsus; **h**, pronotum, mesoscutum and tegula, lateral; **i**, ovipositor sheaths.

***E.* (*Eupelmus*) *brachyurus* Fusu & Gibson n. sp.**
Fig. 18a–i (♀)

Type material. Holotype ♀ (AICF). DNA extracted, 12.vi.2014 Fusu, ug.KO 40 / S. [SOUTH] KOREA: Chungnam, Daejeon, Wadong, tombs & gardens on small forested hills, 3MT, 24.iv-20.v.2007, P. Tripotin rec. /

HOLOTYPUS ♀ *Eupelmus* (*Eupelmus*) *brachyurus* Det. Fusu L. 2015. Condition: glued by right side on rectangular card; empty exoskeleton with internal tissue digested during DNA extraction; uncontorted; entire, but gaster partly collapsed dorsomesally and basal tergites reflexed laterally.

Etymology. From the Greek words *brachys* (short) and *ouros* (tail), in reference to the comparatively short ovipositor sheaths of females.

Description. FEMALE (habitus: Fig. 18a, b). Length = 2.8 mm. Head (Fig. 18a–e) green to partly bluish-green or blue or purple under some angles of light, particularly scrobes and vertex, and with variably extensive coppery luster on parascrobal region, dorsad scrobal depression, interantennal prominence and lower face under different angles of light; with hairlike to slightly lanceolate white setae. Maxillary and labial palps brown. Antenna with scape similarly dark as flagellum, the scape and pedicel with green to bluish luster. Pronotum green or with inconspicuous bluish luster along extreme posterolateral margin and slight coppery luster on panel under some angles of light, but not contrasting with mesonotum (Fig. 18e, h); admarginal setae pale to light brownish (Fig. 18h). Mesonotum (Fig. 18a) green with coppery luster; with hairlike to slightly lanceolate white setae. Prepectus (Fig. 18h) brownish with less distinct green luster than mesonotum, with 11 setae on left prepectus. Tegula dark. Acropleuron green with some bluish and more extensive coppery lusters under some angles of light (Fig. 18b). Propodeal callus similarly green as mesonotum; with hairlike to slightly lanceolate, but longer and denser setae than on mesoscutum. Macropterous; fore wing (Fig. 18f) hyaline with basal cell setae white but discal setae yellowish to brown; costal cell dorsally near leading margin with row of setae along about apical half, and ventrally with at least 3 rows along length; basal cell and disc entirely setose except for elongate linea calva extending to level about equal with middle of parastigma. Front leg with trochanter, femur except narrowly apically, and tibia dorso- and ventrolongitudinally subbasally dark, otherwise pale except terminal tarsomere brownish. Middle leg pale beyond coxa except for dark mesotibial apical pegs and tarsal pegs and slightly brownish terminal tarsomere. Hind leg with about basal two-thirds of femur dark, otherwise pale beyond coxa except for slightly brownish terminal tarsomere. Gaster (Fig. 18a, b) with hairlike setae; dorsally collapsed part of gaster bright brownish with coppery luster, remaining mostly green to similarly brownish depending on angle of light; ovipositor sheaths (Fig. 18i) mostly pale beyond short dark basal region, but with slightly darker, ill-defined brownish region subapically.

Head in dorsal view with interocular distance about 0.4× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; vertex evenly rounded into occiput, transversely imbricate to reticulate-imbricate with sharp margins of sculpture not coalesced into transverse ridge or carina (Fig. 18e); frons coriaceous-imbricate, the meshlike sculpture with only some cells delineated by slightly raised ridges, most distinctly within ocellar triangle where imbricate (Fig. 18d); scrobal depression more distinctly meshlike reticulate except scrobes smoother with subeffaced sculpture (Fig. 18c); OOL: POL: LOL: MPOD = 1.0: 2.4: 1.8: 1.0. Mesoscutum (Fig. 18a) mostly meshlike reticulate except lateral lobe with mediolongitudinal band of minute coriaceous sculpture. Scutellum and axillae low convex in same plane; axilla mostly obliquely and scutellum longitudinally imbricate laterad meshlike coriaceous midline anterior to more finely meshlike coriaceous frenal area. Acropleuron (Fig. 18b) with larger meshlike sculpture anteriorly and posteriorly relative to much more minutely sculptured region mesally, with larger meshlike sculpture at most delineated by only slightly raised ridges. Fore wing (Fig. 18f) with cc: mv: pmv: stv = 4.0: 3.1: 1.0: 1.0. Middle leg (Fig. 18g) with row of 5 mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus and pegs clearly differentiated into two rows apically; second tarsomere with 5 or 6 pegs, third tarsomere with 2 pegs, and fourth tarsomere with 1 peg apically on either side. Propodeum with broadly U-shaped plical depression extending to posterior margin. Gaster (Fig. 18a, b) similar in length to combined length of head and mesosoma; not atypically modified; extending slightly over base of third valvula, the latter about 0.57× length of metatibia and 0.63× length of mv; hypopygium extending about two-thirds length of gaster.

MALE. Unknown.

Distribution. South Korea.

Biology. Unknown.

Remarks. Although this newly described species is represented by only a single female, it is described as new in part based on COI evidence, which will be presented in a subsequent publication. The holotype is not noticeably affected by DNA extraction except for its partly collapsed gaster. The only known female of *E. brachyurus* shares comparatively short ovipositor sheaths with those of *E. tetrazostus* and *E. brachystylus*, but is differentiated by features discussed under the latter species.

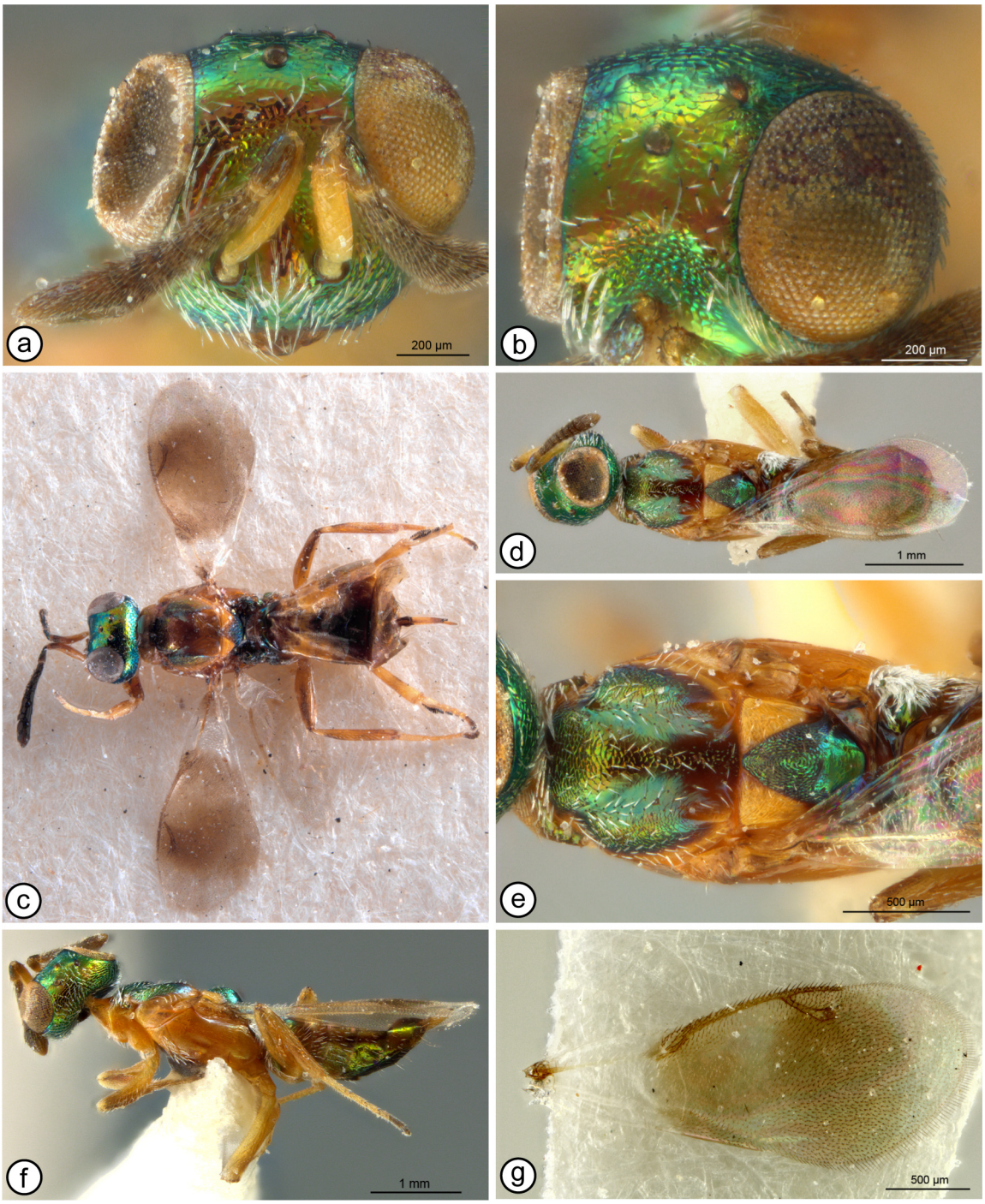

FIGURE 19. *Eupelmus bulgaricus*, *a, b, d–g* (2013-11): **a**, head, frontal; **b**, scrobal depression and frontovertex; **d**, dorsal habitus; **e**, mesosoma, dorsal; **f**, lateral habitus; **g**, fore wing. **c**, dorsal habitus with wings (L. Fusu image).

E. (*Eupelmus*) *bulgaricus* Kalina n. stat.

Fig. 19a–g (♀)

Eupelmus bulgaricus Kalina, 1988: 15–17. Holotype ♀, IAEE, examined by GG. Type data: Bulgaria orient., Slančev Brjag, 18.VI.66, Hoffer / Lesostep, na jv. úpatí St. planiny, rídké Quercetum.

Description. FEMALE (habitus: Fig. 19c, d, f). Length = 1.65–2.4 mm. Head (Fig. 19a, b) bright green with coppery to reddish-coppery luster under some angles of light; with comparatively conspicuous white lanceolate setae on lower face, parascrobal region to dorsal limit of scrobal depression (Fig. 19a), and vertex compared to

somewhat thinner, more hairlike, sparser setae on frons (Fig. 19b). Maxillary palps and apical labial palpomere dark brown. Antenna (Fig. 19a) with scape yellow except dorsoapically brownish for distance less than length of pedicel, pedicel and flagellum brown with green metallic luster on pedicel under some angles of light or rarely extreme apex of pedicel and anellus lighter, more yellowish. Mesosoma bicoloured (Fig. 19c–f); prothorax at least partly yellowish-orange, variably extensively brownish or with slight greenish luster dorsomesally to dorsolaterally and prosternum usually brown to green; mesoscutum primarily green dorsally, but lateral lobe yellow laterally along mesoscutal margin and inner inclined surface of lateral lobes sometimes also yellowish-orange to yellowish-brown posteriorly, and with depressed posterior region of mesoscutum and convex medial part of mesoscutum posteriorly sometimes also brownish-yellow or under some angles of light with variably strong blue, reddish-coppery or violaceous lusters; scutellar-axillar complex with axillae yellowish-orange and scutellum green to partly dark brown with greenish luster but at most only extreme anterior angle of scutellum yellowish; prepectus and tegula yellowish-orange; acropleuron yellowish-orange but ventrally mesopectus mostly dark except yellowish-orange anteriorly toward procoxa, prepectus and acropleuron; metanotum and propodeum similarly dark brown with callus more distinctly green and often metanotum with dorsellum yellow or at least lighter brown; prepectus bare; pronotum with admarginal setae white; mesonotum with slightly lanceolate white setae on mesoscutum but less conspicuous hairlike setae on scutellar-axillar complex; callus laterally with dense white setae forming reflective surface (Fig. 19e). Macropterous; fore wing (Fig. 19c, g) with costal cell hyaline or infuscate basally and apically, basal cell hyaline or infuscate basally similar to costal cell and with entirely white setae if hyaline or with dark setae basally if infuscate basally, and disc at least obscurely bifasciate, more-or-less distinctly infuscate from about base of parastigma to level somewhat beyond level of apex of pmv, but hyaline apically and only slightly infuscate to hyaline behind mv so as to separate more conspicuously infuscate regions behind parastigma and base of mv and behind pmv and stv, with hyaline or less darkly infuscate regions having yellowish to white setae and more conspicuously infuscate regions having darker brown setae; costal cell dorsally near leading margin with row of setae over at most about apical third (setae brown if distal area infuscate but white and less conspicuous if distal area hyaline), and ventrally with setae along length; basal cell and disc entirely setose except for linea calva. Front leg, including coxa, similarly yellowish-orange as acropleuron except apical tarsomere dark and posterior surface of profemur apically and tibia narrowly subbasally slightly darker such that knee or extreme base of tibia obviously lighter, more yellow. Middle leg with coxa at least partly brown and mesotarsal pegs dark, otherwise pale with trochanter, trochantellus, tibia basally and much more widely apically, and tarsus except for apical tarsomere lighter, more yellowish than yellowish-orange, and tibia with short dark region subbasally. Hind leg with coxa brown except apically, otherwise yellowish-orange except for dark apical tarsomere or, more commonly, tibia with extreme base yellowish and immediately beyond variably extensively brown within basal two-thirds or less. Gaster (Fig. 19c, f) with hairlike setae; variably distinctly lighter orangey-brown subbasally to mesally compared to darker brown base and apex, with greenish luster anteriorly on basal tergite and with greenish-coppery luster laterally over darker brown region under some angles of light; ovipositor sheaths variably extensively pale, but at least extreme tip and base dark and sometimes up to about apical third variably dark.

Head in dorsal view with interocular distance about 0.4× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; vertex meshlike coriaceous to alutaceous-imbricate posteriorly; frons sometimes with subeffaced meshlike sculpture (Fig. 19a, b), though usually smooth and shiny at least along inner orbits and often entirely between anterior ocellus and distinctly reticulate scrobal depression; parascrobal region uniformly convex; OOL: POL: LOL: MPOD about 1.2–1.3: 2.8–2.9: 2.0: 1.0. Mesoscutum with posterior depressed region and inner inclined surface of lateral lobes entirely smooth and shiny, mirror-like, or sometimes meshlike coriaceous-reticulate mediolongitudinally (Fig. 19e); outer surface of lateral lobe meshlike coriaceous-reticulate, and convex part of medial lobe mostly transversely reticulate-imbricate. Scutellum distinctly convex and above plane of low convex axillae (Fig. 19f); sculpture of axillae indistinct because of light colour, but scutellum reticulate-imbricate to reticulate-rugose and frenal area shiny with subeffaced meshlike sculpture. Acropleuron shiny with obscure sculpture because of light colour, but finely meshlike anteriorly, smooth or virtually smooth mesally, and with larger, more elongate, longitudinally aligned meshlike sculpture posteriorly. Fore wing (Fig. 19c, g) with cc: mv: pmv: stv about 2.8–3.6: 1.8–2.3: 0.96–1.0: 1.0. Middle leg without mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus and pegs clearly differentiated into two rows apically, second tarsomere with 3 to 5 pegs, third tarsomere with 2 or 3 pegs and fourth tarsomere without or with 1 or 2 pegs apically on either side. Propodeum with broadly V- to U-shaped plical

depression extending to posterior margin. Gaster (Fig. 19c, f) about as long as mesosoma; apparently not atypically modified, though apical syntergal structure not evident in available specimens and extending over base of third valvula or not depending on preservation of gaster, with third valvula 0.5–0.6× length of metatibia and 0.8–0.94× length of mv; hypopygium extending about two-thirds length of gaster.

MALE. Unknown.

Distribution. Bulgaria, **Israel*** [Nahal, Neqarot, N Sappir, 6.IV.1998, I. Yarom & V. Kravchenko, on *Tamarix*, CNC Photo 2013-11 (TAUI: 1♀)], **Jordan*** [Wadi Sir b. Amm[an], 600 m, 1.VI.1956, J. Klapperich (HNHM: 1♀)].

Biology. Unknown, but based on presumed relationships with *E. bicolor*, *E. matranus* and *E. splendens* likely a parasitoid in galls; the female from Israel collected on *Tamarix* (Tamaricaceae).

Remarks. Kalina (1988) described *E. bulgaricus* from three females, all of which we examined. The holotype is card-mounted in an uncontorted state and is entire except that the apical funicular and clava of the right antenna is missing and the wings are slightly damaged. Images provided in the original description by Kalina (1988, figs 28–31 and plate IV, figs 3–6) were taken from a paratype.

The female from Israel differs from the other examined females most conspicuously by having the mesoscutum narrowly, though quite distinctly, meshlike reticulate mediolongitudinally to the transscutal articulation (Fig. 19e) as well as having somewhat more distinct, subeffaced meshlike sculpture on the frons (Fig. 19b) and more transverse funiculars with fl1 pale. Although the Israel female is one of the smallest individuals, the differences are not likely size-correlated because one paratype is almost as small and it is similar to other specimens. Females of *E. bulgaricus* are differentiated from those of the three other species assigned to the *splendens*-group (see under *E. splendens*) by their bicoloured scutellar-axillar complex (Fig. 19d, e). Females of *E. saharensis* (Fig. 97a, e) and some *E. tryapitzini* females (Fig. 118c) have a similarly bicoloured scutellar-axillar complex, but these have mesotibial apical pegs (Figs 97e, 118d) as well as relatively shorter ovipositor sheaths. Females of *E. saharensis* also have a more distinctly bifasciate fore wing with whitish setae behind the marginal vein apically and a smaller, less conspicuous linea calva (Fig. 97f).

E. (*Eupelmus*) *ceroplastae* (Kalina)

Figs 20a–i (♀), 21a–f (♂)

Cocceupelmus ceroplastae Kalina, 1984: 17–18. Holotype ♀, IAEE, not examined (2♀ paratypes from same series as holotype examined by GG). Type data: Africa sept.: Algeria, Tassili-N-Ajjer, Djanet, VI.1972, Dr. A. Hoffer.

Eupelmus (*Eupelmus*) *ceroplastae*; Gibson, 1995: 318.

Description. FEMALE (habitus: Fig. 20a, b). Length = 2.0–3.3 mm. Head (Fig. 20d) with at least lower face and usually occiput and temples entirely or mostly green, but frontovertex, parascrobal region, scrobal depression and interantennal prominence entirely or mostly reddish-coppery to reddish-violaceous, with gena green to variably extensively reddish depending on angle of light; with white lanceolate setae restricted to along oral margin, otherwise face with short, white, inconspicuous setae except for some longer, denser, dark setae on lower face and gena above base of mandible (Kalina 1984, fig. 46). Maxillary and labial palps brown. Antenna (Fig. 20c) with scape yellow except apex brown dorsoapically, pedicel and flagellum brown with slight coppery to reddish-violaceous luster on pedicel under some angles of light. Mesosoma (Fig. 20e, f) with strong metallic lusters: pronotum green with coppery to bronze lusters under some angles of light except posterolateral margin adjacent to spiracle bright green to blue or purple; mesoscutum variably extensively green to dark reddish with some coppery luster, particularly medially within posterior depressed region, except inner surface of lateral lobe posteriorly blue to purple or violaceous under different angles of light (Fig. 20f); scutellar-axillar complex dark green with variable golden or reddish-coppery lusters; prepectus and tegula pale, yellowish-orange, except tegula apically variably distinctly darker brown; acropleuron (Fig. 20e) extensively green but with regions of varying colour and luster, blue, reddish-violaceous and coppery; metanotum and propodeum dark with slight reddish-violaceous to purplish luster. Pronotum with admarginal setae white; mesoscutum with shorter, more hair-like white setae on convex part of medial lobe compared to longer and more conspicuous, slightly lanceolate white setae within posterior depressed region and on lateral lobes, except inner surface of lateral lobe dorsally near carinate margin of lobe with a few stronger, dark lanceolate setae; axillae bare anteriorly except for a few dark, inconspicuous setae along anterolateral margin, but with conspicuous, adpressed, white, lanceolate setae within at least mesal one-third;

scutellum anteriorly with white lanceolate setae similar to those on axillae, the setae becoming longer and denser posteriorly, and mesally with dense tuft of long, black, lanceolate to apically curved setae (Fig. 20f) anterior to shorter dark setae within posterior half of scutellum; prepectus with 3–5 white setae; mesopectus between acropleural and transepisternal sulcus with dense white setae (Fig. 20e) and callus with shorter white setae, the setae lateral to spiracle denser and more conspicuous than those posterior to spiracle. Macropterous; fore wing (Fig. 20g, i) with costal cell infuscate basally, dorsally with line of conspicuous dark setae near leading margin basally within infuscate region and with dark setae apically adjacent to parastigma but not near leading margin anterior to parastigma, and ventrally with 2–4 rows of relatively inconspicuous white setae mesally but more conspicuous, darker setae basally and apically; basal cell infuscate within about basal half and hyaline within apical half, the infuscate portion apically with tuft of longer, slightly lanceolate black setae adjacent to smv but much shorter white setae basal to tuft, and hyaline portion with short white setae beyond basally bare region; smv with long, black, lanceolate setae basally in infuscate region and white setae in hyaline region; disc abruptly and rather uniformly darkly infuscate from base of parastigma to beyond level of stv medially, but mediocubital fold and wing apically along posterior, apical and anteroapical margins more hyaline, but with dark setae throughout, including somewhat longer and denser black setae on parastigma and along apical half of anterior margin of comparatively short and narrow linea calva (Fig. 20i). Legs with pro- and metacoxae sometimes brownish with green luster under some angles of light, otherwise mostly uniformly brownish to yellowish-brown except as follows: extreme base of meso- and metatibiae dark brown; dorsal margins of tibiae more-or-less distinctly brownish, the protibia more broadly and with slight greenish to reddish luster; profemur with posterior surface apically somewhat darker with slight greenish to reddish luster; protarsus usually brownish, mesotarsus with apical tarsomere brown, and metatarsus more-or-less distinctly tricoloured with basitarsus variably extensively brown basally and yellowish apically, one or two subsequent tarsomeres yellowish, and apical tarsomeres brown; mesotibial and mesotarsal pegs dark. Gaster (Fig. 20a) with sparse hairlike setae; dark brown with some green luster on Gt5; ovipositor sheaths with third valvulae pale or variably distinctly darker brown within apical half (Fig. 20b).

Head in dorsal view with interocular distance slightly less than 0.4× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons, though ventral, carinate margin of scrobal depression raised above torulus and curved slightly toward inner orbit; vertex and ocellar triangle meshlike coriaceous to slightly imbricate or reticulate-imbricate; frons lateral to ocellar triangle and about dorsal half of parascrobal region similarly meshlike coriaceous to somewhat granular, the surface of some cells sometimes slightly concave, and ventral half of parascrobal region with larger meshlike sculpture; scrobal depression (Fig. 20d) comparatively elongate, extended to within one ocellar diameter or less of anterior ocellus, sinuately L-shaped with carinate lateral margins, the scrobes strongly reticulate but depression above interantennal prominence with subeffaced sculpture, almost smooth and mirror-like; interantennal prominence (Fig. 20d) comparatively elongate-triangular and flat, and similarly meshlike coriaceous to coriaceous-imbricate as lower half of parascrobal area; lower face and gena more distinctly reticulate-imbricate to reticulate; OOL: POL: LOL: MPOD about 0.7–0.8: 1.8–2.2: 1.1–1.4: 1.0. Mesoscutum (Fig. 20f) with anteromedial lobe strongly punctate-reticulate, the sculpture continued through posterior depressed region as broad mediolongitudinal band of larger meshlike reticulation; lateral lobes strongly raised and carinately margined in posterior half, the inner inclined surface with much larger effaced-reticulate to coriaceous meshlike sculpture than mediolongitudinally, and outer surface similarly meshlike coriaceous to coriaceous-imbricate as lower half of parascrobal region and interantennal prominence. Scutellum distinctly convex and above plane of low convex axillae; axillae strongly reticulate and scutellum reticulate-rugose mesally but reticulate-imbricate to imbricate lateral of setal tuft. Acropleuron (Fig. 20g) with deep, elongate reticulation anterior of much more minutely sculptured region mesally, and with gradually larger and deeper sculpture posterior of mesal region, graduating from punctulate to deeply meshlike reticulate before abruptly smoother and shiner within about posterior one-quarter or less of acropleuron. Fore wing (Fig. 20g) with cc: mv: pmv: stv about 4.6–5.0: 3.8–4.0: 1.0–1.2: 1.0. Middle leg (Fig. 20h) with 5–7 mesotibial apical pegs; mesotarsus with symmetrical peg pattern with pegs in single row on either side of tarsomeres, basitarsus with pegs differentiated slightly in length over about apical half so as form single serrate row along either side (Fig. 20h), second tarsomere with 5–8 pegs, third tarsomere with 3 or 4 pegs and fourth tarsomere with 1 peg on either side. Propodeum with broadly U-shaped plical depression extending to posterior margin (Kalina 1984, fig. 50). Gaster (Fig. 20a) about as long as mesosoma, though mesosoma arched in available specimens to prevent accurate measurement; apparently not atypically modified, though Gt5 covering penultimate tergum and all but extreme

dorsal margin of syntergum; extending to base of third valvula, the latter about 0.6–0.65× length of metatibia and 0.9–1.0× length of mv; hypopygium extending about three-fourths length of gaster.

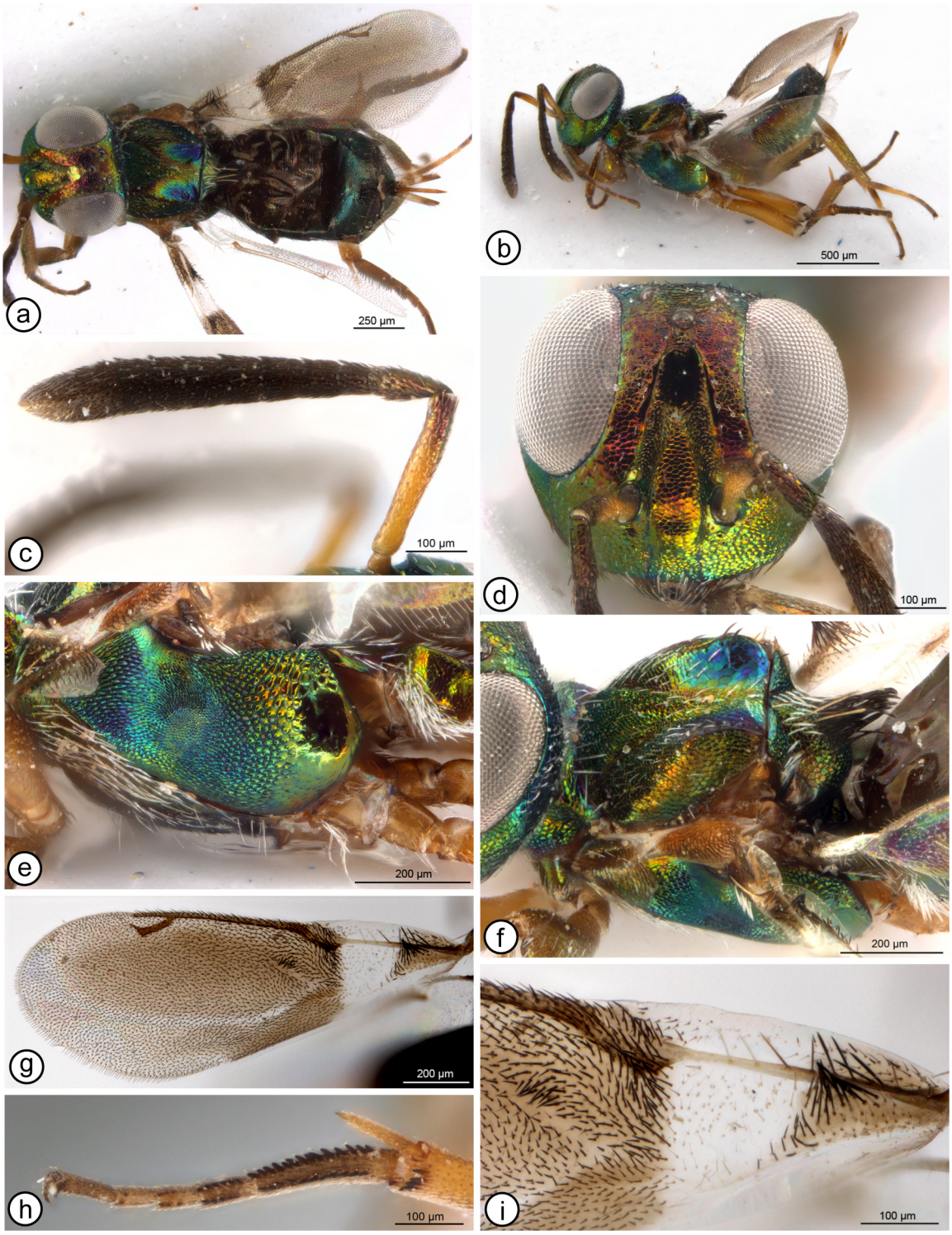

FIGURE 20. *Eupelmus ceroplastae*, ♀ (2014-52): **a**, dorsal habitus; **b**, lateral habitus; **c**, antenna; **d**, head, frontal; **e**, mesosoma, lateral; **f**, mesosoma, dorsolateral; **g**, fore wing; **h**, apex of mesotibia and mesotarsus; **i**, base of fore wing.

MALE (habitus: Fig. 21a, b). Length = 2.1 mm. Head green or with reddish luster similar to female under some angles of light (Fig. 21c); structure similar to female, including sinuately L-shaped, laterally carinate scrobal depression extending to within about one ocellar diameter of anterior ocellus; sculpture similar to female though frons slightly roughened, partly coriaceous-imbricate to coriaceous-reticulate, about ventral half of parascrobal region, interantennal prominence and lower face mesally between shallow furrows delimiting clypeus more

regularly coriaceous to coriaceous-imbricate than frons and dorsal half of parascrobal region, lower face lateral to furrows distinctly reticulate to reticulate-imbricate, and scrobal depression entirely sculptured, punctate-reticulate ventrally near toruli but with shallower, larger, more transverse reticulation dorsally; setal pattern similar to female, with somewhat longer and more conspicuous white setae along oral margin, and with somewhat longer, stronger, dark setae laterally above base of mandible, but these not conspicuously long (Fig. 21c). Antenna (Fig. 21e) with scape (Fig. 21c, e) yellow basally and ventrally but brown dorsoapically and apicolaterally; pedicel about 2.5× as long as wide, ventrally with line of straight, comparatively short setae projecting at acute angle relative to ventral margin of pedicel (Fig. 21e insert); length of pedicel + flagellum almost 1.2× width of head; flagellum (Fig. 21e) distinctly clavate with funiculars obviously increasing in width to clava having large, collapsed micropilose sensory region ventrally; anellus (Fig. 21e insert) transverse, but dull and setose similar to subsequent flagellomeres; basal funiculars without differentiated region of setae ventrally. Maxillary and labial palps brown. Mesosoma (Fig. 21d) with pronotum variably green mesally to reddish-violaceous laterally under different angles of light; mesonotum dark green to variably extensively and distinctly reddish-coppery to reddish-violaceous or darker purple under different angles of light; tegula dark; metanotum with dorsellum reddish-coppery, but laterally bright bluish-green to purple depending on angle of light; propodeum mostly bright violaceous. Mesosoma with pronotal admarginal setae white and those on mesoscutum short and pale, but scutellum with longer dark setae mesally within about anterior half (Fig. 21d). Legs mostly pale, yellowish to yellowish-brown, though tibiae darker brown; tarsi with basitarsi mostly brown but paler, more yellowish apically, the protarsus otherwise almost uniformly brownish, mesotarsus with mesal two tarsomeres yellow and apical two tarsomeres brown, and metatarsus with second tarsomere yellow but subsequent tarsomeres increasingly darker brown. Fore wing (Fig. 21f) with slight brownish infuscation basally within basal cell and behind discal venation, with all setae dark except submarginal vein white and with a couple of white setae basal to parastigma; submarginal vein with basal setae obviously broader, slender-lanceolate, than more hairlike setae apically, and basal cell with obviously longer and stronger setae basally than within about apical half of cell; mv 2.75× length of stv (excluding uncus); costal cell dorsally near leading margin with line of dark setae anterior to parastigma and with a few, much sparser dark setae along length basal to parastigma, and ventrally with 1 to 2 rows of relatively inconspicuous white setae except apically behind parastigma setae more numerous and dark; speculum very slender, separated from parastigma and base of marginal vein by several rows of setae, but open posteriorly to setose mediocubital fold. Propodeum with complete median carina, the panels with subeffaced meshlike sculpture.

Distribution. Algeria, Egypt, **Libya*** [Messak, Settafet, 4.III.2010, Patrick Weill, CNC Photo 2014-52 (AICF: 1♀)].

Biology. A parasitoid of *Ceroplastes africanus* Green (Hemiptera: Coccidae) on *Tamarix* sp. (Tamaricaceae) (Kalina 1984).

Remarks. Kalina (1984) described his new genus and species *Cocceupelmus ceroplastae* from 12 females, of which we examined two contorted paratypes from the same collecting event as the holotype. Although the male was stated as unknown in the original description, we received with the paratypes one male (CNC Photo 2015-11) from the same rearing event that is obviously conspecific, and which was labelled as the male by Kalina. Both sexes are highly unusual within *Eupelmus*. Kalina (1984: 16) noted that *Cocceupelmus* is "near *Eupelmus*", but differentiated the genus based on the scutellum being highly arched with a conspicuous tuft of long black setae (Fig. 20f; Kalina 1984, fig. 48), and the fore wing having a tuft of black setae below the base of the submarginal vein (Fig. 20i; Kalina 1984, plate I, fig. 2). Gibson (1995) considered these two features were species rather than generic features and synonymized *Cocceupelmus* under *Eupelmus* based on shared syntergal and propodeal structures. Although the newly described male has only a very slender, oblique bare band behind the parastigma and base of the marginal vein (Fig. 21f), which resembles a linea calva of females (Fig. 20i), it is open posteriorly to the mediocubital fold as for any other, more typically broad speculum (e.g. Figs 23d, 26h). Consequently, presence of a speculum in the male, although unusually modified, further supports synonymy of *Cocceupelmus* under *Eupelmus*. The only known male is also atypical for *E.* (*Eupelmus*) in not having apically curved pedicular setae (Fig. 21e insert), and although both sexes have some longer and more conspicuous dark setae above the base of the mandible, the male apparently lacks one distinctly differentiated genal seta (Fig. 21c). The male also resembles females is several other features, including structure of the scrobal depression and facial sculpture (*cf* Figs 20d, 21c), presence of denser dark setae on the scutellum (Fig. 21d), though these are much shorter and thus less conspicuous than for the female (Fig. 20f), and presence of somewhat longer dark setae basally within the

basal cell (Fig. 21f). The male does differ from the female in having a distinct line of dark setae dorsally within the costal cell near the leading margin anterior to the parastigma (Fig. 21f). As remarked by Kalina (1984), females have a unique acropleural sculpture pattern (Fig. 20e). They also have somewhat longer and denser dark setae along the anterior margin of the linea calva apically (Fig. 20g, i; Kalina, 1984, plate I, fig. 1), and a somewhat similar sculpture pattern on the frons as for *E. mirabilis* females (Fig. 72d), being quite distinctly coriaceous but with a few cells slightly depressed mesally.

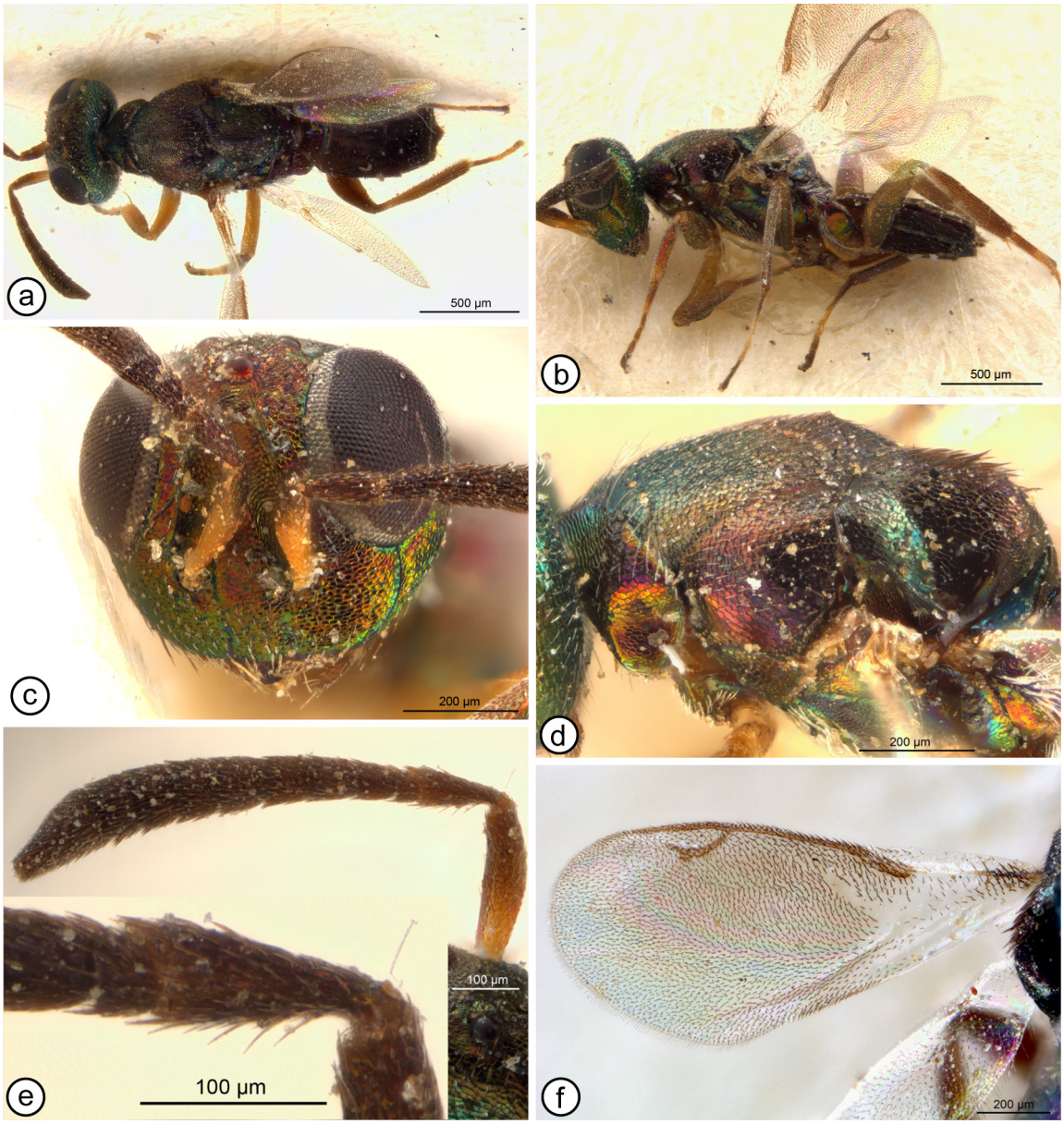

FIGURE 21. *Eupelmus ceroplastae*, ♂ (2015-11): **a**, dorsal habitus; **b**, lateral habitus; **c**, head, frontal; **d**, mesosoma, dorsolateral; **e**, antenna [insert: pedicel and fl1 enlarged]; **f**, fore wing.

E. (*Eupelmus*) *cerris* Förster

Figs 22a–h (♀), 23g–j (♂)

Eupelmus cerris Förster, 1860: 128−129. Holotype ♀, NHMW, lost *vide* Ruschka, 1921: 281. Type data: [Austria], reared from galls on *Quercus cerris*.

Eupelmus synophri De Stefani, 1898: 173. Unknown type status, ♀, unknown depository. Type data: Italy, Sicily, Castelvetrano, reared from galls of *Synophrus politus* on *Quercus suber*. Synonymy by Ruschka, 1921: 280.

Eupelmus Olivieri Kieffer, 1899: 368. Syntypes, 3♀, unknown depository. Type data: Algeria, reared from galls of *Synophrus olivieri* Kieffer. Synonymy by Ruschka, 1921: 280.

Eupelmus (*Eupelmus*) *cerris*; Askew & Nieves-Aldrey, 2000: 50; Gibson, 2011: 43; Al khatib *et al.*, 2014: 814 (♀ keyed).

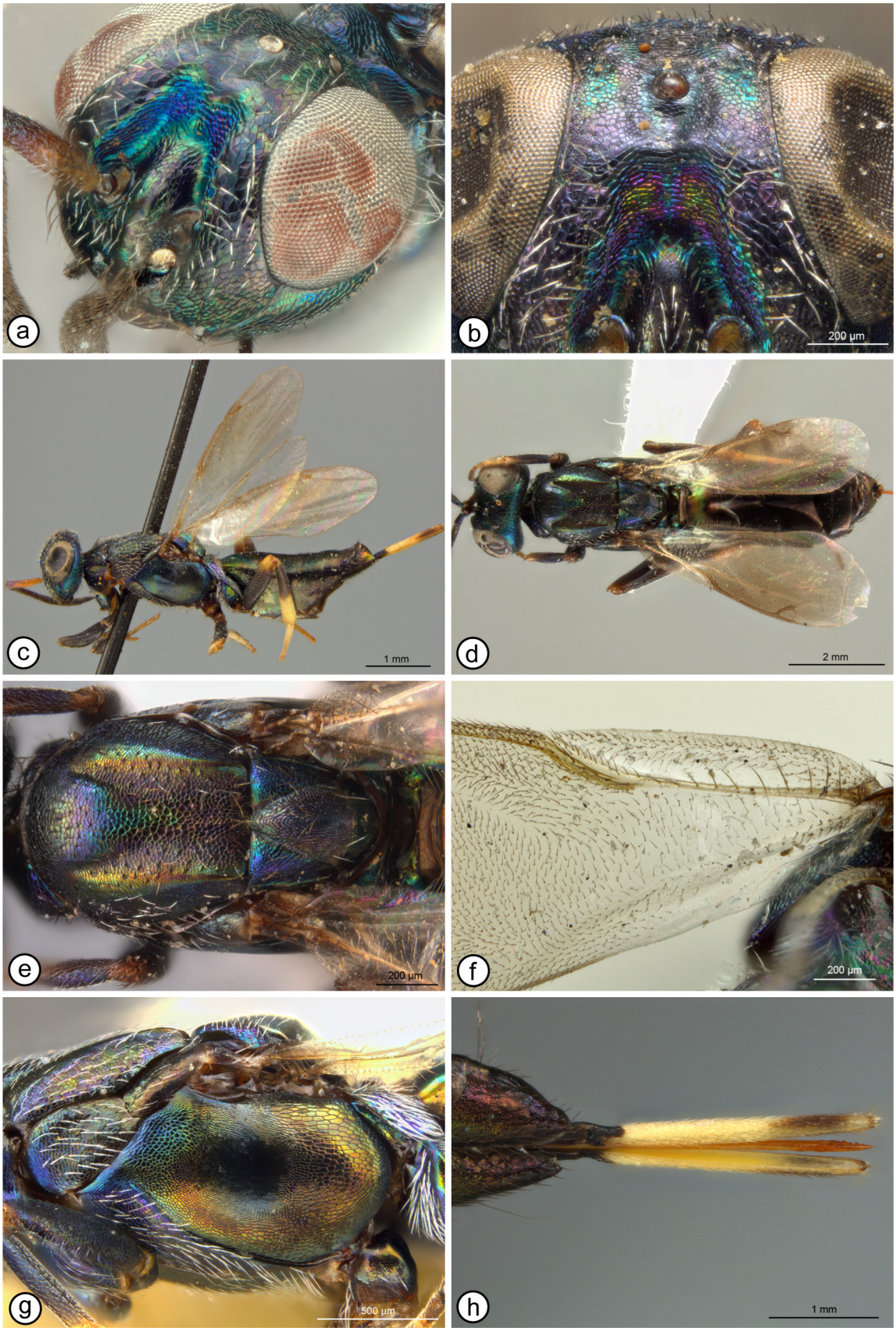

FIGURE 22. *Eupelmus cerris*, ♀. **a**, head, frontolateral (2010-35). *b, c* (2012-72): **b**, scrobal depression and frontovertex; **c**, lateral habitus. *d, e* (2013-12): **d**, dorsal habitus; **e**, mesosoma, dorsal. **f**, fore wing base (2012-73). **g**, mesosoma, lateral (2012-74). **h**, ovipositor sheaths (2013-13).

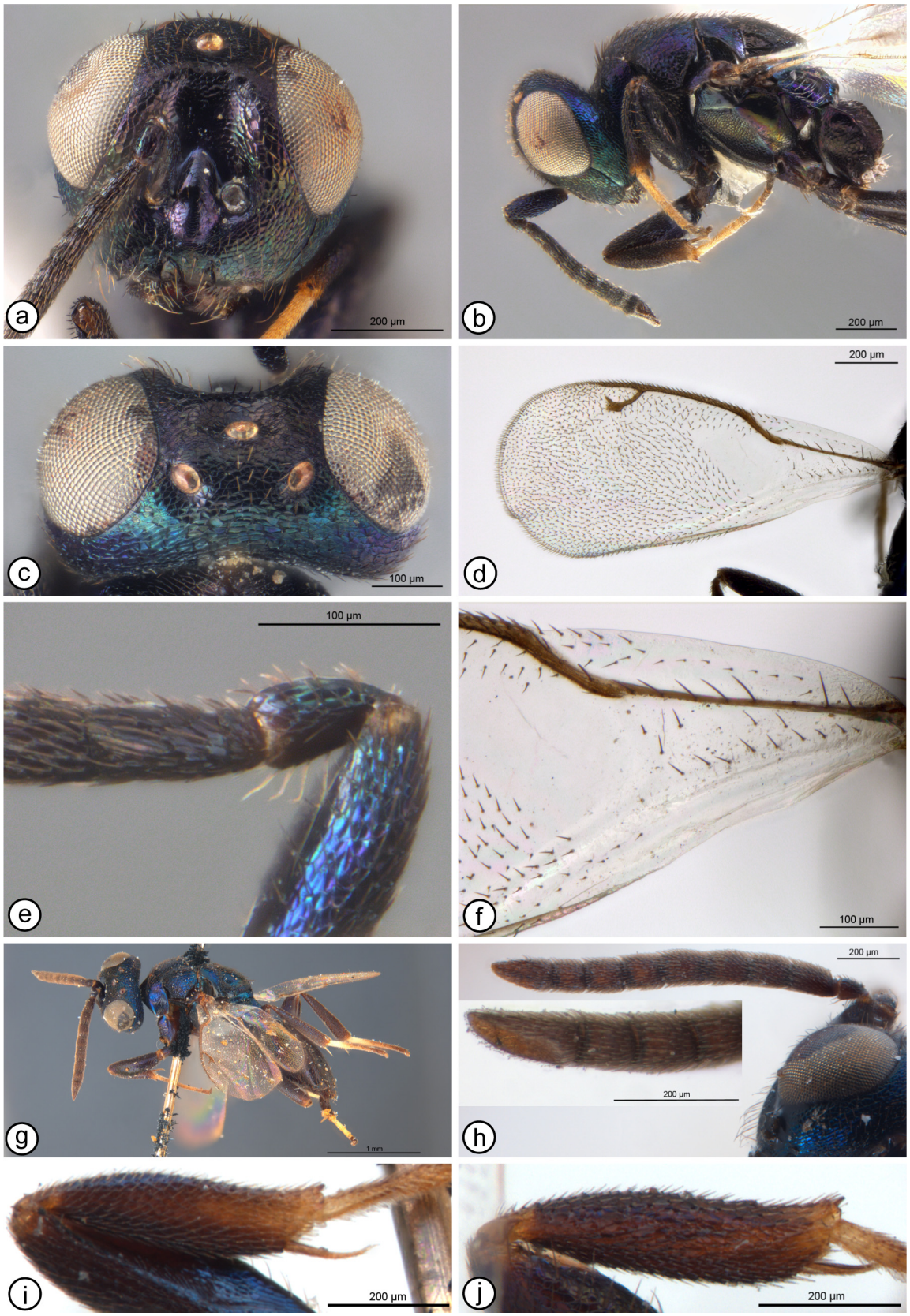

FIGURE 23. *a–f*, *Eupelmus* sp. nr *cerris*, ♂ (Iran): **a**, head, frontal (2013-97); **b**, head and mesosoma, lateral (2013-97); **c**, head, dorsal (2013-97); **d**, fore wing (2013-98); **e**, pedicel to base of fl3, outer view (2013-97); **f**, fore wing base (2013-98). *g–j*, *Eupelmus cerris*, ♂ (Austria, L. Fusu images): **g**, habitus, dorsolateral; **h**, antenna, dorsolateral view (insert: clava and apical three funiculars, ventrolateral view); **i**, protibia, anterior view; **j**, protibia, posterior view.

Description. FEMALE (habitus: Fig. 22c, d). Length = 2.6–5.5 mm. Head (Fig. 22a, b) varicoloured with vertex and occiput more strongly bluish-green to blue, purple or violaceous and frons usually partly green or bluish-green along inner orbit under some angles of light; with slightly lanceolate white setae on lower face and parascrobal region to at least level of dorsal margin of scrobal depression compared to less conspicuous hairlike setae on vertex or frontovertex. Maxillary and labial palps brown. Antenna with scape sometimes entirely dark though more commonly variably extensively orange to orangey-brown (Fig. 22a, c) basally and darker with blue to purple lusters dorsoapically, and pedicel and sometimes flagellum dorsobasally with similar metallic lusters. Pronotum blue to purple at least laterally; admarginal setae dark at least mesal to level of spiracles. Mesosoma (Fig. 22c–g) similar in colour to head, mesonotum sometimes dark brown with only limited metallic lusters, but usually (Fig. 22e) convex part of mesoscutal medial lobe and lateral surface of lateral lobe dark or with purplish luster, and axillae mostly and often acropleuron anteriorly blue to purple, but posteromedial depressed region of mesoscutum, scutellum, acropleuron partly, sometimes outer surface of lateral lobe, and metanotum and propodeum green or with some coppery to reddish-coppery lusters; mesonotum and prepectus with similar hairlike to slightly lanceolate white setae, the prepectus completely setose with apices of numerous setae sometimes extending over at least ventral margin (Fig. 22g); callus with denser setae though not completely obscuring cuticle (Fig. 22g). Macropterous; fore wing with extreme base of basal cell sometimes variably darkly infuscate but disc hyaline (Fig. 22c, f) (except one female from Hungary and one from Israel, Fig. 22d), with setae uniformly brown to variably extensively white within costal cell and/or basal cell; costal cell dorsally near leading margin with at least 1 row of dark setae over at least apical half (except females from Iran, see 'Remarks'), and ventrally with at least 3 rows along length; basal cell and disc entirely setose except for linea calva (Fig. 22f). Legs similarly coloured with femora and tibiae extensively dark except knees, tibiae apically, and tarsi pale except for one or two apical tarsomeres. Gaster (Fig. 22c, d) with hairlike setae; brown or with slight greenish or coppery lusters under some angles of light except basal tergite anteriorly usually much more distinctly greenish to bluish-green or partly blue; ovipositor sheaths (Fig. 22h) dark basally but pale subbasally and apically (extreme tip sometimes variably distinctly brown) with variably long light to dark brown preapical region having paler dorsal and ventral margins.

Head in dorsal view with interocular distance about 0.4× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; vertex alutaceous-coriaceous to alutaceous-imbricate; frons meshlike coriaceous (Fig. 22a, b); scrobal depression reticulate to transversely reticulate-strigose (Fig. 22a, b); OOL: POL: LOL: MPOD = 0.5–0.8: 2.5–3.3: 1.6–1.9: 1.0. Mesoscutum (Fig. 22e) mostly meshlike reticulate except medial lobe more alutaceous to reticulate-imbricate anteriorly and lateral lobe with mediolongitudinal band of minute coriaceous sculpture. Scutellum and axillae low convex in same plane; axilla mostly obliquely and scutellum longitudinally reticulate-imbricate laterad midline and frenal area meshlike coriaceous-reticulate. Acropleuron (Fig. 22g) more-or-less isodiametric meshlike anteriorly and posteriorly and much more minutely sculptured mesally, the larger meshlike sculpture coriaceous-reticulate, the cells at most delineated by only slightly raised lines. Fore wing with cc: mv: pmv: stv = 3.8–5.6: 3.0–4.2: 1.0–1.1: 1.0. Middle leg with row of 5–7 mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus and pegs clearly differentiated into two rows apically; second tarsomere with 6 or 7 pegs, third tarsomere with 2 or 3 pegs, and fourth tarsomere with 1 peg apically on either side. Propodeum with broadly U-shaped plical depression extending to posterior margin (Fig. 22e). Gaster (Fig. 22c, d) similar in length to combined length of head and mesosoma; not atypically modified; usually not extending to apex of second valvifer, the latter usually extending at least slightly beyond apex, with third valvula 0.88–1.36× length of metatibia and 1.20–2.08× length of mv; hypopygium extending from about half to two-thirds length of gaster.

MALE. Length = 2.4–2.8 mm. Head mostly dark (*cf* Fig. 23a) but vertex and lower face with slight, and temple and gena behind eye with more conspicuous, bluish to purple lusters (*cf* Fig. 23b, c); frons meshlike coriaceous; vertex uniformly curved into occiput, alutaceous-imbricate; scrobal depression extensively meshlike reticulate; setae hairlike, pale brownish to brown; lower face with longer setae toward malar sulcus but setae evenly distributed and longer setae uniformly curved; gena posterior to malar sulcus with 1 seta conspicuously longer than others, and posterior to eye with apices of setae directed toward orbit. Antenna with scape entirely dark; pedicel about 1.5–1.6× as long as wide, ventrally with 5 long white setae, of which all but apical seta hook-like curved (*cf* Fig. 23e); length of pedicel + flagellum about 1.4× head width; flagellum robust-filiform with clava slightly shorter than apical two funiculars (Fig. 23h); anellus very strongly transverse, discoidal, shiny, with inconspicuous row of setae; funicle with dense appressed setae only slightly removed from surface of funicle (Fig. 23h),with fu1 1.3–

1.4× as long as pedicel and about 1.5–1.6× as long as wide, and apical funiculars only slightly longer than wide; fu1 and fu2 in ventral view with region of short lanceolate setae basally, visible under lower magnifications as elongate, smoother, shinier regions surrounded by decumbent setae. Maxillary and labial palps dark brown. Mesosoma similarly as dark as head (Fig. 23g) but with slight blue to bluish-green or purple lusters on pronotum and mesonotum, particularly laterally, except propodeum much more distinctly and brighter bluish-green to blue or purple; setae hairlike, brown on pronotum and mesonotum but white on propodeal callus; tegula dark brown. Front leg dark except extreme apex of tibia and at least basal tarsomere pale, yellowish to yellowish-brown (Fig. 23i, j). Middle leg dark except tibial spur and basal three tarsomeres white (Fig. 23g). Hind leg dark except spurs and at least basal two-thirds of basitarsus white, subsequent tarsomeres increasingly darker to dark brown apical two tarsomeres (Fig. 23g). Fore wing with mv about 2.9× length of stv; costal cell dorsally near leading margin with numerous dark setae over almost apical half to two-thirds, and ventrally with dark setae aligned into 2 rows at mid-length and on several rows in front of parastigma; basal cell uniformly setose with dark setae; speculum closed posterobasally by row of setae. Propodeum with complete median carina, with panels finely meshlike reticulate.

Type material examined. The type material of *Eupelmus cerris* is lost (Ruschka 1921), but the NHMW has 5 males and 18 females (two labelled CNC Photo 2012-72, 2012-73), and the USNM 1 female from Mayr's collection. They were reared from *Synophrus politus* Hartig and *Synophrus pilulae* Giraud galls from 1869 to 1886 (later than the publication of the original description by Förster) or are without collecting data. Of the five males in NHMW, two were obtained on loan and served for the description above: *Syn* [*ophrus*]. *polit* [*us*]. Mai / Collect. G. Mayr / *E. cerris* Först. det. G. Mayr (1♂), and [*Synophrus*] *pilulae* 5.7.[18]70, plus the other two labels as above (1♂). At least the male from *S. pilulae* is from Austria because prior to Pujade-Villar *et al.* (2003) this was the only known country record for this species of *Synophrus*. The type material of *E. olivieri* and *E. synophri* is also presumed lost. Noyes (2014) listed both as valid Palaearctic names, but they were synonymized under *E. cerris* by Ruschka (1921). We agree with Ruschka's (1921) synonymies based on the original descriptions of the species and the hosts the types were reared from (see 'Biology'). The description of *E. olivieri* states, in part, that the scape is yellowish-white below, the ovipositor is two-thirds the length of the gaster, and the sheaths are yellow except black basally and with another, larger, brown region a little before the end, and the type material was reared from *Synophrus olivieri* Kieffer. The description of *E. synophri* is much briefer without description of the length of the ovipositor sheaths, but does state that the scape is ferruginous below, and that the type material was reared from galls of *Synophrus politus* on *Quercus suber*, one of the known hosts of *E. cerris*.

Distribution. Algeria, Austria, Bulgaria, Hungary, Iran, **Israel*** [Mt. Hermon, 1650m., 2.VII.1980, D. Furth (TAUI: 1♀); Palestine, Alonim, 1-8.VI.1946, gall on *Quercus ithaburensis*, Bylinski-Salz (BMNH: 1♀)], Romania, Spain, Tunisia.

Noyes (2014) also listed Moldova and Sweden, but these records are erroneous. The Moldavian record is based on Bouček (1961) and Talitskii (1961), who recorded the species as a parasitoid of the peach weevil, *Rhynchites bacchus* L. (Coleoptera: Rhynchitidae). The two records, based on the same reared specimen, result from a misidentification of an "aberrant male of *E. urozonus* Dalm." according to Bouček (1966) and the species was not included in the list of chalcidoid wasps from Moldova by Bouček (1965b). His record of Sweden was based on Hedqvist (2003), but three females we saw from Sweden identified as *E. cerris* by Hedqvist (BMNH) are *E. annulatus*. Noyes (2014) did not include Algeria, Italy, Iran and Tunisia, but the former two records result from the synonymy of *E. olivieri* and *E. synophri* under *E. cerris* by Ruschka (1921), Iran was recorded by Sadeghi *et al.* (2009), and Tunisia by Pujade-Villar *et al*. (2010). The Iranian record might represent a morphologically similar but molecularly distinct species from *E. cerris* (see 'Remarks'), and the TAUI female from Israel (Mt. Hermon, 1650m, 2.VII.1980, D. Furth) is aberrant in fore wing colour pattern (see 'Remarks').

Biology. Excluding the erroneous record of *Rhynchites bacchus* (see above), Noyes (2014) lists galls of Cynipidae. We saw specimens reared from *Synophrus politus* Hartig galls (CTPC, HNHM, MHNG, NHMW) on *Quercus cerris* (1♀ Ecer07, CNC; HNHM) and *Q. suber* L. (MNCN, NHMW) and from *Synophrus pilulae* Giraud (NHMW), likely on *Q. cerris* because this is the only known associated plant for this species (Pujade-Villar *et al*. 2003). One female from Israel (BMNH) is labelled as being reared from a gall on *Q. ithaburensis* Decaisne.

If the single anomalous record from *Andricus caputmedusae* (Hartig) by Tudor (1969), which was questioned by Askew *et al.* (2013), is disregarded, then *E. cerris* is restricted to only *Aphelonix cerricola* (Giraud) and *Synophrus* spp., both hosts being associated exclusively with *Quercus* species in the section *Cerris* (among which are *Q. cerris, Q. ithaburensis,* and *Q. suber*) (Melika *et al*. 2002b; Pujade-Villar *et al.* 2003).

Remarks. Females are quite easily identified by their comparatively long ovipositor sheaths (Fig. 22h) in combination with four colour features—the protibia being dark except basally and apically rather than having longitudinal pale bands separating dorso- and ventrolongitudinal dark regions, the scape being at least extensively orangey (Fig. 22a, c), the ovipositor sheaths having a subapical dark region that is developed as a longitudinal streak rather than a complete band (i.e., dorsal and ventral margins of sheath pale above and below longitudinal dark region, Fig. 22h), and the axilla being blue to purple in contrast to a green scutellum or one with coppery to reddish-coppery lusters (Fig. 22e). The prepectus of females is also one of the most extensively setose of all the species (Fig. 22g), though because of size variation this is difficult to quantify. All observed females have hyaline wings except for one from Hungary (Al khatib *et al.* 2014, supplement fig. 37E) and one from Israel (Fig. 22d) that have distinct infuscation behind the marginal and postmarginal veins and therefore a colour pattern similar to *fulgens*-group females except the infuscate region is not as abruptly delineated basally and apically. The Israel female lacks its ovipositor sheaths but has the colour patterns of the scape, protibia, and axillae (Fig. 22e) typical of the species and is otherwise similar to western European females.

Ruschka (1921, fig. 19) illustrated the male antenna of what he identified as *E. cerris*. Although flagellar setae were not included it appears to be a drawing of a filiform flagellum, particularly when compared to the obviously clavate flagellum included for what he identified as *E. spongipartus* (Ruschka 1921, fig. 21). The two NHMW males that we describe above as *E. cerris* most likely are those that served for Ruschka's description and they have a robust-filiform flagellum (Fig. 23h). See also under *E. punctatifrons*.

We saw a single specimen from Iran (GDPC) that has the head of a male but the rest of the body of a female. The flagellum is of the clavate type and the lower face has somewhat longer and therefore more obvious but evenly curved brownish setae laterally toward the malar sulcus. Another five males from Iran (CNC) reared from *Pseudoneuroterus macropterus* (Hartig) galls on *Quercus brantii* (section *Cerris*) by G. Melika have head structures similar to the gynandromorph. Graham Stone and G. Melika sequenced these males (Euro 60, Euro 76, Euro 72, Euro 84, Euro 172) during an unpublished molecular study of *Eupelmus* associated with oak galls. In their results, the males are retrieved as a separate clade genetically most similar to a single female of *E. cerris* from Hungary (Ecer07). In newer, unpublished analyses that also include sequences from Al khatib *et al*. (2014), these males are no longer retrieved as the sister group of *E. cerris* but of *E. simizonus*, and therefore most likely are not males of *E. cerris* but of a related species. However, the protibial colour pattern of the Iranian males (Fig. 23b) is like that of western European females and the two NHMW males we identify as *E. cerris* (Fig. 23i, j), i.e. lacking the longitudinal pale band characteristic of males of other species. We do not describe these males as a new species because we do not have similar molecular results indicating the female of the species. However, because of their shared protibial colour pattern we compare their morphological attributes with what we consider as true *E. cerris* males and key them at couplet 9. The Iranian males differ from *E. cerris* males in fore wing setal pattern, antennal structure and size. The costal cell dorsally has a maximum of 5 setae along the leading margin for a short distance apically and ventrally only a single row of setae over much of its length (Fig. 23f), whereas the two NHMW males have numerous setae dorsally over at least the apical half of the costal cell and two rows of setae ventrobasally. A reduced number of costal setae is also characteristic of *E. gelechiphagus* males, but the latter are readily differentiated by the costal cell and basal cell setae being white rather than dark and thus comparatively inconspicuous. Also in contrast to the two *E. cerris* males, the Iranian males have a clavate flagellum (Fig. 23b) with the pedicel (Fig. 23e) about 1.8–2.0× as long as wide, the anellus a transverse though distinct, dull, setose segment (Fig. 23e), and the basal funiculars without distinct regions of differentiated setae ventrally (at most with an inconspicuous region on fu1). They are also smaller (length = 1.7–1.9 mm) than *E. cerris* males, though similar to them in colour. The two females from Iran are also slightly smaller (2.8–3.3 mm) than most observed *E. cerris* females from Western Europe. They may be the opposite sex of the Iranian males and thus incorrectly associated with *E. cerris*. However, the resolution of this and whether the Israeli female might also belong to another species that is morphologically but molecularly different from *E. cerris* requires further collecting and molecular analyses.

E. (*Eupelmus*) *claviger* Nikol'skaya n. stat.

Fig. 24a–h (♀)

Eupelmus claviger Nikol'skaya, 1952: 501 (Russian), 1963: 514–515 (English). Holotype ♀, ZIN, examined. Type data: Kazakhstan. Holotype label: Койлибай, N M. Барсуки, Тург. о, Луппова [Koylibay, N M[alye] Barsuki, Turg. o, Luppova] 6.VI.931 / *Eupelmus claviger* sp. n. M. Nikolskaja det. / Holotypus ♀.

Eupelmus claviger; Kalina, 1988: 11–12 (misidentification of *E. tryapitzini*).

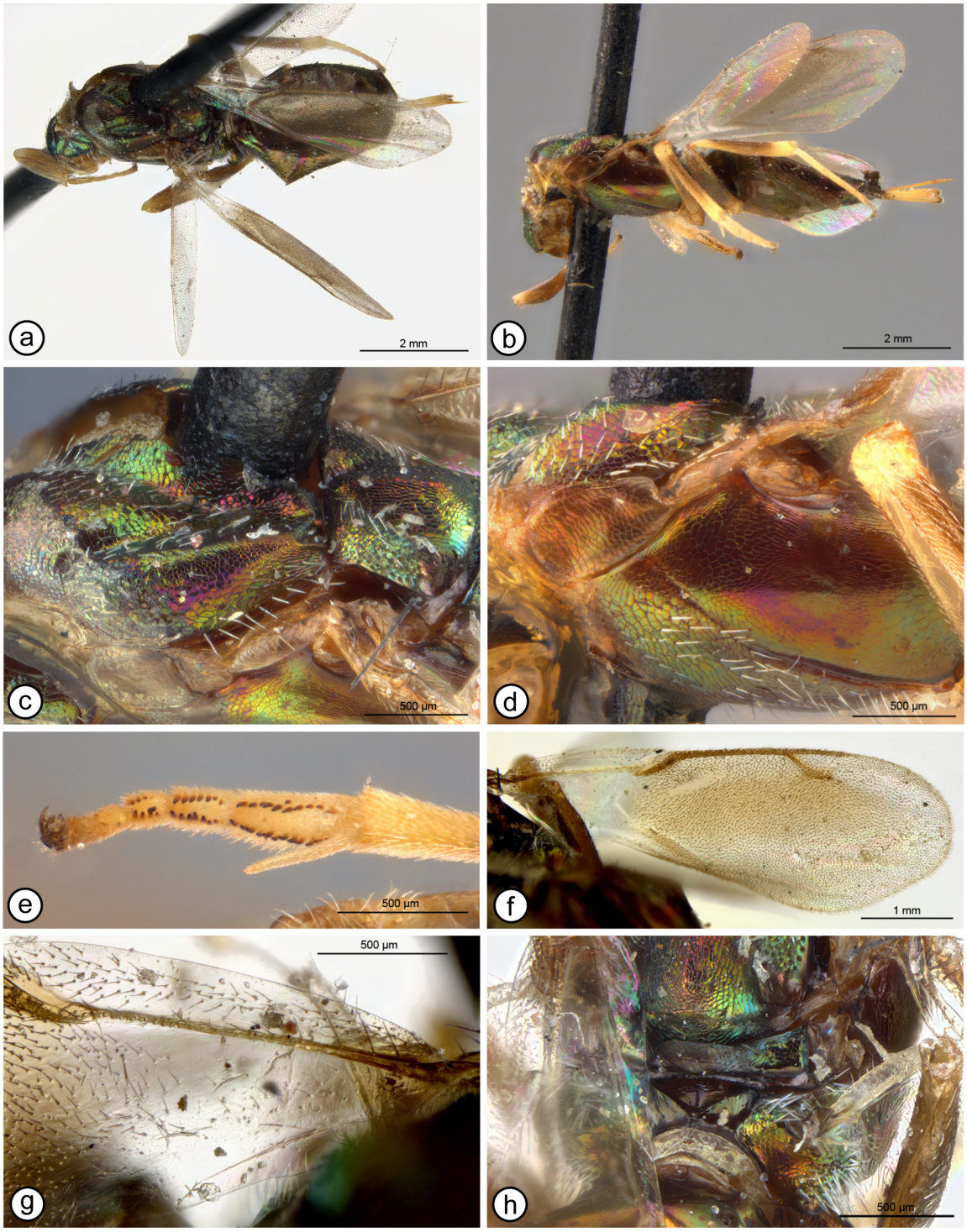

FIGURE 24. *Eupelmus claviger*, holotype ♀: **a**, dorsal habitus; **b**, lateral habitus; **c**, mesonotum, dorsolateral; **d**, mesosoma, lateral; **e**, apex of mesotibia and mesotarsus; **f**, right fore wing; **g**, left fore wing base; **h**, scutellar-axillar complex to propodeum.

Description (based on incomplete holotype, except features between square brackets from original description)**.** FEMALE (habitus: Fig. 24a, b). Length from anterior margin of mesonotum to posterior margin of syntergum = 2.6 mm [3.5 mm, likely includes also ovipositor sheaths]. Head missing, but apparently similar to rest of body in being [golden-green with red cast]. Antennae missing [scape yellowish]. Mesosoma with tegula uniformly yellowish-brown (Fig. 24c, d), but otherwise dorsally dark metallic green with slight reddish-coppery lusters on mesonotum under some angles of light (Fig. 24c), and prepectus and acropleuron more brownish or with reddish-coppery

lusters under some angles of light and only limited greenish lusters (Fig. 24d); mesonotum with comparatively inconspicuous hairlike to slightly lanceolate white setae, prepectus bare (Fig. 24d), and callus with conspicuously longer and denser white setae. Macropterous; fore wing (Fig. 24f) disc with broad band of light brownish infuscation from base of parastigma to apex of stv posterior to stv, the region tapered apically beyond stv and posteroapically separated from another infuscate region along posterior margin of wing by more hyaline region similar to behind mv and distal to level of pmv [fore wings slightly and evenly darkened]; costal cell (Fig. 24g) dorsally near leading margin with row of setae only apically anterior to parastigma, and ventrally with at least 3 rows ventrally along length; basal cell (Fig. 24g) partly bare behind length of smv, with brownish setae basally and more whitish setae along mediocubital fold and apically near basal fold, and disc setose except for linea calva. Front leg pale, including coxa, orangey-yellow except trochanter, knees, tibia apically and tarsi somewhat paler yellow. Middle leg similar to front leg except tibia with more distinct though pale broad brownish region medially. Hind leg with coxa dark and femur and tibia brownish except knee and tibia apically pale (basal pare region of tibia more extensive ventrally than dorsally). [Legs light brown, hind femurs with slight metallic luster; knees, apex of tibias, tarsi, whitish.] Gaster (Fig. 24b) with hairlike setae; dorsally mostly brown to dark brown apically with slight coppery or reddish-coppery luster [abdomen dark bronze]; ovipositor sheaths (Fig. 24b) pale except for extreme base and posterior margin.

Antenna with [first 3 funiculars slightly longer than wide]. Mesoscutum shallowly meshlike reticulate, including posteromedial depressed region (Fig. 24c). Scutellum and axillae low convex in same plane; axilla shallowly reticulate anteriorly to obliquely reticulate-imbricate posteriorly; scutellum alutaceous-imbricate lateral to more coriaceous midline and frenal are more uniformly meshlike coriaceous. Acropleuron (Fig. 24d) more-or-less isodiametric meshlike anteriorly and posteriorly and much more minutely sculptured mesally, coriaceous-reticulate with cells defined by at most very slightly raised ridges. Fore wing with cc: mv: pmv: stv = 4.0: 2.8: 1.3: 1.0; stv expanded apically and anterior margin slightly curved into stigma. Middle leg (Fig. 24e) without mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus but pegs at most only indistinctly differentiated into two rows, second tarsomere with 7 pegs, third tarsomere with 3 or 4 pegs, and fourth tarsomere without pegs on either side. Propodeum with broadly V-shaped plical depression extending almost to posterior margin (Fig. 24h). Gaster slightly longer than mesosoma; not atypically modified; extending slightly over base of third valvula so constriction not clearly evident, but apparent length of third valvula 0.63× length of metatibia and 0.9× length of mv.

MALE. Unknown.

Distribution. Kazakhstan.

Biology. Unknown.

Remarks. Kalina (1988) stated that type material of *E. claviger* was not located in ZIN at the time of his study. A female labelled as the holotype was obtained on loan for our study, as described above. Because Nikol'skaya (1952) did not give a range in body size it is likely that there was only a single female and the specimen is the holotype. This specimen is minutien-pinned through the posteromedial depressed region of the mesoscutum (Fig. 24a, b), but the region can still be seen to be entirely sculptured similar to the rest of the mesoscutum (Fig. 24c). Furthermore, the mesotibia lacks apical pegs (Fig. 24e). Two females seen from Kalina's collection collected in Azerbaijan by Z. Bouček and identified, described and illustrated in Kalina (1988) as *E. claviger* have mesotibial apical pegs (Kalina 1988, fig. 22), and have the posteromedial depressed region of the mesoscutum virtually smooth and shiny (Fig. 118c), as he described. Consequently, *E. claviger* in the sense of Kalina (1988) represents a misidentification. Kalina (1988) stated that his new species *E. tryapitzini* was very similar to what he interpreted as *E. claviger*, and we believe the specimens are conspecific (see under *E. tryapitzini*).

E. (*Eupelmus*) *confusus* Al khatib

Figs 25a–h (♀), 26a–h (♂)

Eupelmus (*Eupelmus*) *confusus* Al khatib *in* Al khatib *et al.*, 2015: 139–141. Holotype ♀, MHNG, examined. Type data: France: Var, Fayence, [Alpes Maritimes], 43.61774°N 06.69774°E, 17.iii.2012, emerged 25.iii.2012, ex. *Diplolepis rosae* on *Rosa canina*, [F. Al khatib &] N. Ris (FAL1195/10206).

Eupelmus (*Eupelmus*) *confusus* Al khatib *in* Al khatib *et al.*, 2014: 822–828 (unavailable name; original description, keyed, illustrated).

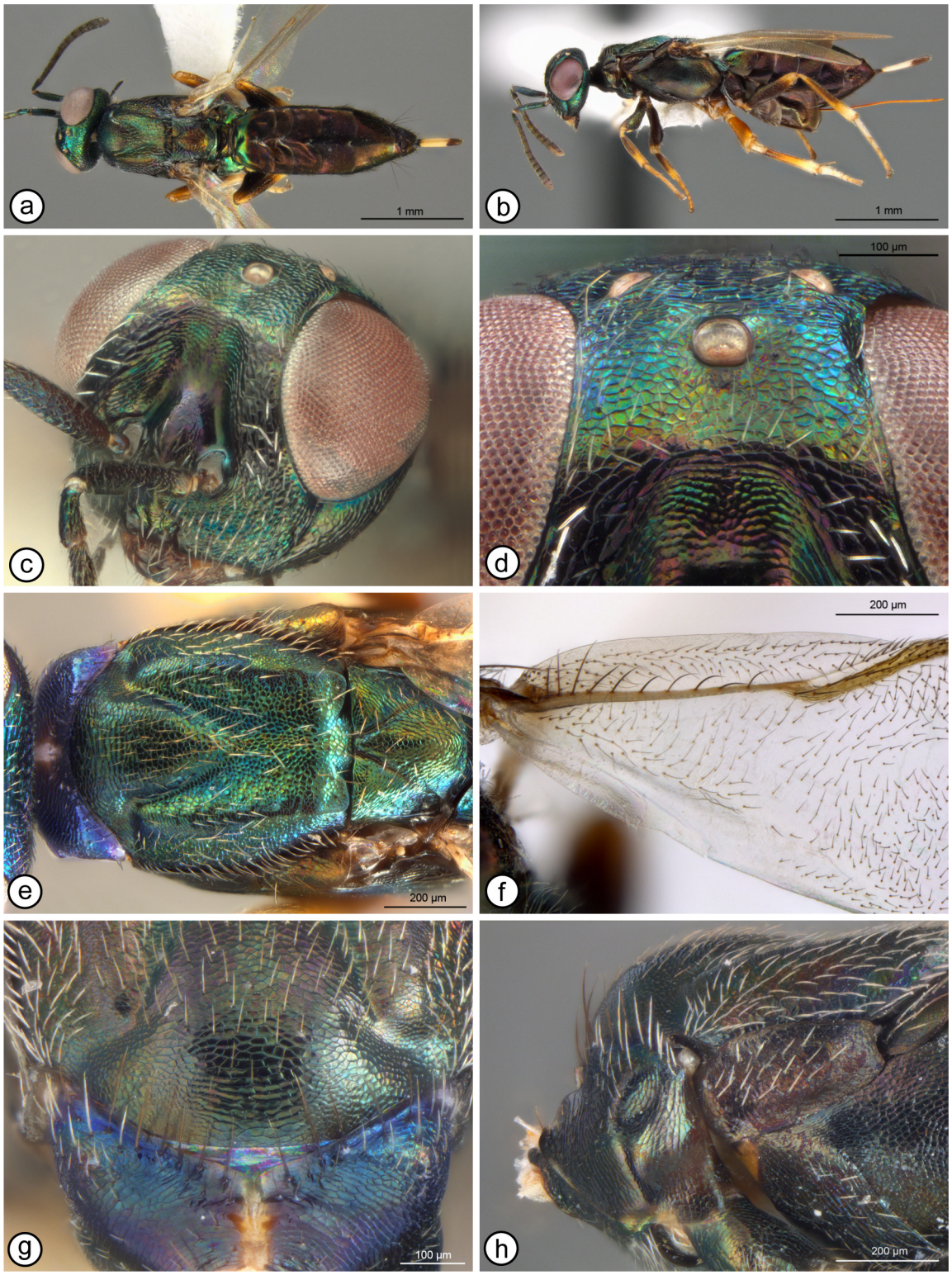

FIGURE 25. *Eupelmus confusus*, ♀. **a**, dorsal habitus (2012-77). *b–d* (2010-38): **b**, lateral habitus; **c**, head, frontolateral; **d**, upper part of scrobal depression and frontovertex. **e**, mesosoma, dorsal (2013-101). **f**, fore wing base (2013-100). *g, h* (2013-99): **g**, pronotum and mesoscutal medial lobe, anterior view; **h**, pronotum, mesoscutum and tegula, lateral view.

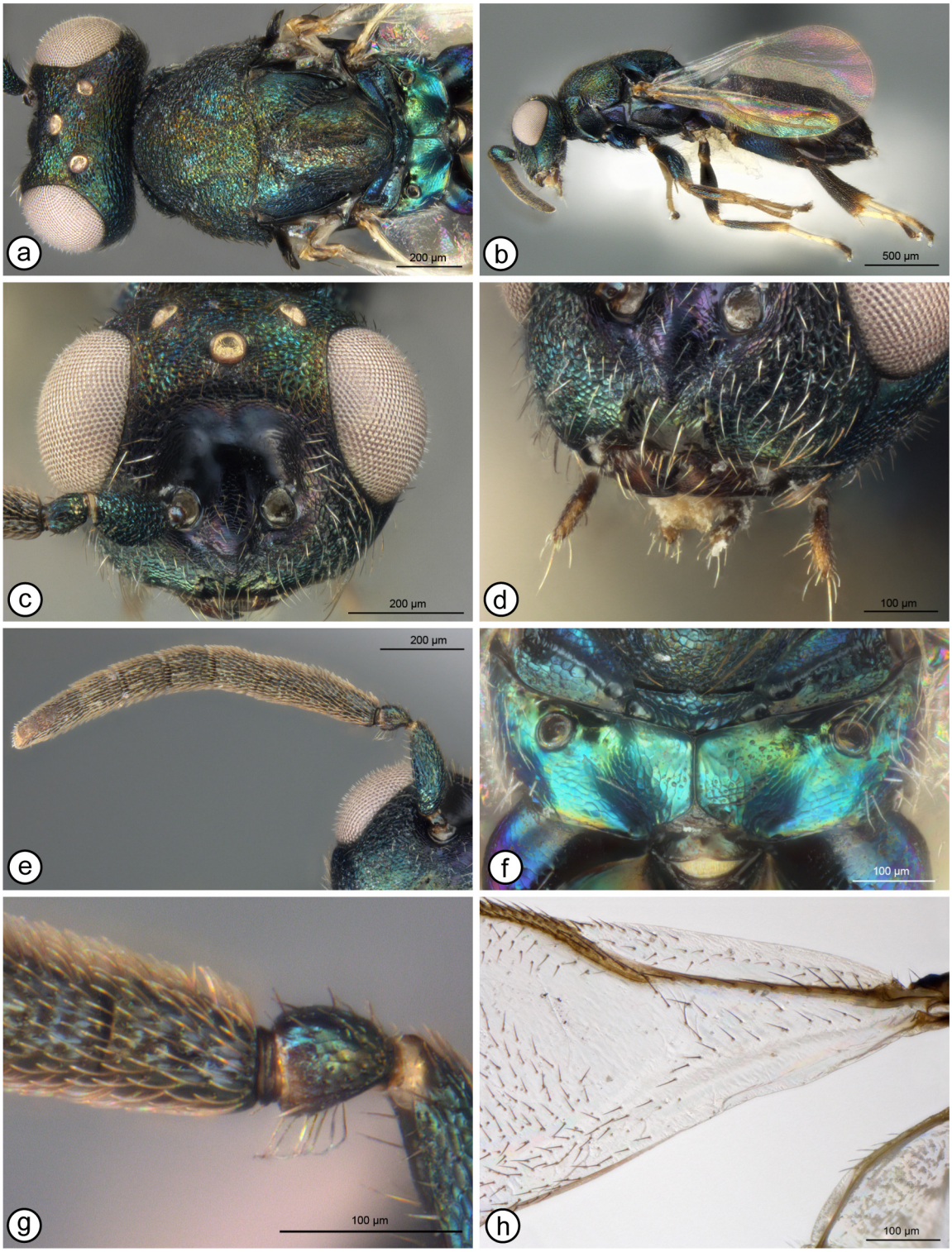

FIGURE 26. *Eupelmus confusus*, ♂. *a–g* (2010-39): **a**, head and mesosoma, dorsal; **b**, lateral habitus; **c**, head, frontal; **d**, lower face; **e**, antenna, inner view; **f**, propodeum; **g**, pedicel to base of fl3, inner view. **h**, fore wing base (2013-102).

Description. FEMALE (habitus: Fig. 25a, b). Length = 1.9–4.6 mm. Head (Fig. 25c, d) usually mostly green to bluish-green except at least interantennal prominence and parascrobal region variably extensively dark to bright reddish-violaceous or much more rarely purple or coppery, the scrobal depression often and sometimes frons variably extensively also similarly coloured, though scrobal depression usually partly greenish, most often at least lateral walls under some angles of light, and occiput sometimes and frontovertex along inner orbits rarely blue to purple, though smaller individuals often with head more brownish with less distinct metallic lusters; with slightly

lanceolate white setae at least on lower face and parascrobal region to level of dorsal margin of scrobal depression compared to more hairlike setae on vertex. Maxillary and labial palps brown. Antenna with scape almost always similarly dark as flagellum with green to bluish luster, only very rarely (few females from Iran) more-or-less orangey-brown mediolongitudinally. Pronotum (Fig. 25g) usually blue to violaceous or purple laterally, at least linearly along posterior margin so as to contrast in colour with mesonotum (Fig. 25e), though sometimes more-or-less uniformly coloured and similarly coloured as mesonotum (Fig. 25h); admarginal setae dark at least mesally, though usually some or all setae pale laterally (Fig. 25g, h) and sometimes mesal dark setae paler apically. Mesosoma sometimes mostly brownish with limited metallic luster in smaller individuals, but dorsally (Fig. 25e) usually variably distinctly green except mesonotum often with variably extensive coppery to dark brownish or reddish-violaceous lusters, mostly often on scutellum and sometimes mesoscutum, particularly anteriorly on medial lobe and longitudinally on lateral lobes; mesonotum with hairlike to slightly lanceolate white setae. Prepectus (Fig. 25h) sometimes with similar greenish metallic luster as mesonotum under some angles of light, but usually more-or-less brown; usually extensively setose with setae similar to mesonotum, but at least with a couple of rows within dorsal half. Tegula dark. Acropleuron sometimes with metallic luster similar to mesonotum, though usually darker with less distinct metallic lusters. Propodeal callus with hairlike to slightly lanceolate white setae, often somewhat denser and more conspicuous than on mesoscutum but not obscuring cuticle. Macropterous; fore wing hyaline with more-or-less uniformly yellowish to brownish setae or, commonly, with setae of basal cell white or at least noticeably paler compared to yellowish to brown setae on disc (Fig. 25f); costal cell dorsally near leading margin with row of setae at most over little more than apical half, and ventrally with at least 2 rows along length; basal cell and disc entirely setose except for elongate linea calva usually extending to level about equal with middle of parastigma (Fig. 25f). Front leg with knee, tibia apically and tarsus pale except often apical tarsomere brown, but femur otherwise dark and tibia either with separate dorso- and ventrolongitudinal dark bands or bands only narrowly joined basally, the pale anterior and posterior bands narrowed basally but extending most or all of length. Middle leg at least with mesotibial apical and tarsal pegs dark, and often with femur extensively and tibia with at least short subbasal dark annulus, though sometimes femur and tibia mostly conspicuously paler than pro- and metafemora, orangey-brown to yellowish except for paler knee, and tarsus pale except often for brown apical tarsomere. Hind leg with femur dark except variably extensively apically, and tibia variably extensively dark except narrowly basally and more widely apically, though often lighter or entirely pale ventrolongitudinally and sometimes dark region reduced only to dorsolongitudinal dark band within about basal half, and tarsus pale except often for brown apical tarsomere. Gaster (Fig. 25a, b) with hairlike setae; sometimes mostly brown or with variably distinct coppery luster, but usually at least somewhat and often distinctly greenish to bluish-green dorsobasally, dorsoapically and laterally, but at least basal tergite dorsoapically and subsequent three tergites dorsally brown or with coppery to reddish-violaceous lusters; ovipositor sheaths distinctly banded with dark basal band, much longer medial pale band and abruptly delineated, usually obviously shorter, light to dark brown apical band.

Head in dorsal view with interocular distance about 0.37–0.43× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; vertex evenly rounded into occiput, transversely reticulate to reticulate-imbricate with sharp margins of sculpture often more-or-less aligned transversely, but forming irregular concentric lines rather than coalesced into transverse ridge or carina; frons with at least some sculptural cells delineated by slightly raised ridges (Fig. 25d), often most evident laterad anterior ocellus toward inner orbit, and often more distinctly and extensively reticulate to reticulate-imbricate; scrobal depression distinctly reticulate to transversely reticulate-strigose (Fig. 25d), except scrobes mostly to entirely shiny with at most slight indication of subeffaced meshlike sculpture (Fig. 25c); OOL: POL: LOL: MPOD = 0.6–0.8: 2.1–2.9: 1.4–1.7: 1.0. Mesoscutum (Fig. 25e) mostly meshlike reticulate except medial lobe more reticulate-imbricate to transversely imbricate anteriorly and lateral lobe with mediolongitudinal band of minute coriaceous sculpture. Scutellum and axillae low convex in same plane; axilla mostly obliquely and scutellum longitudinally reticulate-imbricate laterad midline anterior to meshlike coriaceous or coriaceous-reticulate frenal area. Acropleuron more-or-less isodiametric meshlike anteriorly and with larger meshes more-or-less longitudinally aligned posteriorly, but much more minutely sculptured mesally and larger meshlike sculpture at most delineated by only slightly raised ridges. Fore wing with cc: mv: pmv: stv = 4.5–5.3: 4.2–4.9: 1.0: 1.0. Middle leg with row of 4–7 mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus and pegs clearly differentiated into two rows apically; second tarsomere with 4–6 pegs, third tarsomere with 2 or 3 pegs, and fourth tarsomere with 1 peg apically on either side. Propodeum with broadly U-shaped plical depression extending to posterior

margin. Gaster (Fig. 25a, b) similar in length to combined length of head and mesosoma; not atypically modified; extending to or slightly over base of third valvula, the latter about 0.7−0.82× length of metatibia and 0.73−1.0× length of mv; hypopygium extending about two-thirds length of gaster.

MALE (habitus: Fig. 26b). Length = 1.3–2.8 mm. Head (Fig. 26a–d) sometimes quite dark with indistinct green to blue luster, but usually quite distinctly green to blue with vertex and/or occiput often and frons sometimes partly purple, the parascrobal regions and/ or scrobal depression often dark or with slight violaceous luster, and frons sometimes more greenish-blue along inner orbit; frontovertex at least slightly meshlike reticulate to reticulate-imbricate in smallest individuals and usually distinctly reticulate; vertex uniformly curved into occiput; scrobal depression (Fig. 26c) sometimes almost completely smooth in smaller individuals, but usually with obvious meshlike sculpture at least dorsomesally and dorsally on outer wall of depression, though continuously smooth and shiny in scrobes and above interantennal prominence; setae hairlike, mostly white except often more brownish and thus less conspicuous on frontovertex; lower face lateral to torulus with region of longer setae toward malar space, but all setae straight to uniformly or only slightly curved apically (Fig. 26c, d); gena posterior to malar sulcus with 1 conspicuously longer curved seta and 3 or 4 shorter setae between it and oral margin, and posterior to eye with apices of setae directed toward orbit. Antenna (Fig. 26e) with scape entirely dark, 1.9–2.4× width; pedicel (Fig. 26g) at most 1.5× as long as wide and with 6 or 7 long, comparatively closely spaced, apically hooked setae, and exterior to these with at most 2 or 3 shorter, straight dark setae not forming definite line along length; length of pedicel + flagellum about 1.3–1.5× head width; flagellum robust-filiform (Fig. 26e) with clava subequal in length to apical two funiculars; anellus very strongly transverse, discoidal, shiny, with at most inconspicuous, sparse setae at extreme apical margin (Fig. 26g); funicle with fu1 about 1.0–1.2× as long as pedicel and about 1.1–1.4× as long as wide, with subsequent funiculars all longer than wide and of similar length or only slightly shorter apically, and uniformly covered with decumbent, curved setae except in lateral view fu1 and usually fu2 at least basally with more conspicuous decumbent setae dorsally than ventrally (Fig. 26g) and in ventral view with what appears as less setose longitudinal region of differentiated, shorter, more lanceolate setae. Maxillary and labial palps usually uniformly dark though rarely apical maxillary palpomere somewhat paler apically. Mesosoma similarly coloured as head, sometimes quite dark with only limited green to blue lusters (Fig. 26a), but usually more distinctly green to blue, with mesoscutal medial lobe sometimes more greenish and lateral lobes and axillae more distinctly blue to purple, and scutellum sometimes dark or with slight coppery luster mediolongitudinally; setae hairlike, white to brownish; tegula dark. Pronotum with neck strongly sloping, almost vertical. Front leg with trochantellus pale; femur dark except narrowly apically; tibia dark at least dorso- and ventrolongitudinally but partly pale basally, apically and antero- and posterolongitudinally, usually more broadly apically but narrowed basally to extend partly or entirely along length; tarsus pale except usually apical tarsomere brown. Middle leg similar in colour pattern to front leg, with knee and apex of tibia distinctly pale, but trochantellus sometimes dark, mesotibia commonly mostly dark except basally and apically, and up to apical two tarsomeres dark. Hind leg dark except trochantellus sometimes and at least basal two tarsomeres pale (third tarsomere often and fourth tarsomere sometimes pale to variably distinctly brownish-yellow), but tibia mostly dark except apex and base slightly paler, dark yellowish-brown, only very rarely as distinctly pale as for middle leg. Fore wing with mv about 2.8–4.3× length of stv and pmv subequal in length or only slightly longer than stv; costal cell (Fig. 26h) dorsally near leading margin with dark setae apically usually extending for distance obviously greater than length of parastigma, sometimes up to about apical two-thirds, and ventrally with setae arranged in row for at least a very short distance mesally and usually more extensively over about basal half; speculum closed by setae posterobasally (Fig. 26h) or partly bare mesally but at least with setae along mediocubital fold basally and apically. Propodeum with complete median carina, the panels variably distinctly meshlike coriaceous (Fig. 26f).

Distribution. Armenia* (CTPC), Bulgaria, **Canary Islands*** (BMNH), **Crimea*** (SIZK), **Croatia*** (MHNG), Cyprus, **Czech Republic*** (CNC), **England*** (NMPC), **Egypt*** (RMNH, USNM), France (Corsica), **Germany*** (MHNG), Greece (**Crete***: BMNH, CNC, MHNG), **Hungary*** (CNC, HNHM), Iran, **Israel*** (TAUI, USNM), Italy (**Sardinia***: CNC, NMPC; **Sicily***: CTPC, RMNH), **Jordan*** (NMPC), **Lebanon*** (BMNH, CNC, MHNG), **Macedonia*** (ZMAN) **Montenegro*** (CNC), **Netherlands*** (RMNH), **Romania*** (ANCO), Spain (**Mallorca***: BMNH, ZMAN), Sweden, **Switzerland*** (MHNG), **Turkey*** (HNHM, MHNG, MKUI), **United Arab Emirates*** (CNC).

Biology. Al khatib *et al.* (2014) reported the species as a parasitoid of Cecidomyiidae and Tephritidae (Diptera), including the olive fruit fly, *Bactrocera oleae* (Rossi), as well as of Cynipidae and Eurytomidae

(Hymenoptera) gall makers, and possibly of *Apomyelois ceratoniae* (Zeller) (Lepidoptera: Pyralidae). We also saw specimens labelled as reared from seeds of *Cuscuta monogyna* Vahl (Convolvulaceae) along with *Eurytoma strigifrons* Thomson (Eurytomidae), *Pronotalia hungarica* (Erdős) (Eulophidae), and *Periscelis* sp. (Diptera: Periscelidae) (UCRC). Other hosts based on label data include the following. **Diptera:** CECIDOMYIIDAE—*Asphondylia borzi* (Stefani) on *Rhamnus* sp. (Rhamnaceae) (ARPC). **Hymenoptera:** BRACONIDAE—par. of *Bracon* (=*Microbracon*) *piger* (Wesmael) (USNM). CYNIPIDAE—*Andricus quercuscalicis* (Burgsdorff) gall (Euro 134) (CNC); *Aphelonyx* sp. gall on *Quercus cerris* L. (Euro 137) (CNC); *Cynips* (= *Dryophanta*) *longiventris* Hartig (HNHM); *Pseudoneuroterus* (= *Neuroterus*) *saliens* (Kollar) gall on *Quercus suber* L. (Euro 185) (CNC). **Lepidoptera:** GELECHIIDAE—*Amblypalpis* sp. on *Tamarix* (Tamaricaceae) gall (ARPC). TINEIDAE—ex. *Kermania pistaciella* Amsel (CNC).

We also saw a single female from Crimea (SIZK) reared along with three females and two males of *E. pistaciae* from seeds of *Pistacia atlantica* Desfontaines (= *P. mutica* Fischer & C. A. Meyer) (Anacardiaceae). Additional plant associates seen other than those given by Al khatib *et al.* (2014) are as follows: seeds of *Amorpha fruticosa* L. (PUPB), seeds of *Mimosa* L. (RMNH), pods of *Robinia pseudoacacia* L. (PUPB) (Fabaceae); ex. leaf gall on *Rosa* L. (Rosaceae) (CTPC, GDPC); ex. *Asphodelus cerasiferus* J. Gay, *A. ramosus* L. fruits (Xanthorrhoeaceae) (ZSMC). Less reliable plant associates, apparently derived through collecting, include the following: on *Euphorbia characias* L. (Euphorbiaceae) (ZMAN); *Vaccinium myrtillus* L. (Ericaceae) (HNHM); on *Calicotome spinosa* (L.) (ZMAN), *Quercus robur* L. (HNHM) (Fagaceae); *Asphodelus aestivus* Brot. (Xanthorrhoeaceae) (ZSMC).

Remarks. The holotype of *E. confusus* is entire and not noticeably affected by DNA extraction. This species was included within *E. urozonus* prior to Gibson (2011), who restricted *E. urozonus* for *urozonus*-group females with comparatively short ovipositor sheaths and a smooth and shiny scrobal depression, and recognized *E. martellii* for similar females with a reticulate scrobal depression. The molecular results of Al khatib *et al.* (2014) differentiated additional species within both morphological forms. They differentiated *E. confusus* from *E. martellii* and *E. gemellus* using several key features, of which colour of the admarginal setae of the pronotum appears to be the most reliable although museum specimens demonstrate more variation than originally stated. Females of *E. martellii* and *E. gemellus* have uniformly pale admarginal setae, whereas those of *E. confusus* are dark, at least mesally, though the setae are often pale laterally (Fig. 25g, h) and sometimes even the dark mesal setae are paler apically. For this reason, correct colour of the setae can sometimes be difficult to determine in contorted females with the posterior of the head appressed to the pronotum. However, often a second differential is that the dorsolateral angle of the pronotum, at least along its extreme posterior margin, is blue to violaceous or purple and therefore contrasts with a largely green to coppery-green mesonotum (Fig. 25e). Females of *E. martellii* and *E. gemellus* lack this contrasting colour pattern, usually having both the pronotum and mesonotum green to variably extensively coppery-green unless the mesonotum is extensively bluish in which case the pronotum laterally can also be bluish. The other features given by Al khatib *et al.* (2014) are more variable and even in combination may not differentiate all females. Relative length of the ovipositor sheaths overlap, with some females of *E. confusus* having sheaths that are as long or virtually as long as the marginal vein, and rare *E. gemellus*/*E. martellii* females having sheaths only about 0.93× length of the marginal vein. However, those *E. confusus* females that lack an obviously contrasting pronotal colour pattern typically have comparatively short sheaths. Variation in colour of the fore wing setae, and particularly the difference in width of the bare band along the anterior margin of the costal cell, are even less reliable to differentiate females

Some females of *E. confusus* can also be difficult to distinguish from some *E. kiefferi* females because although all *E. confusus* females have the metafemur and metatibia partly dark, some have a pale mesofemur, and although *E. kiefferi* females always have the mesofemur pale, they sometimes have both the metafemur and metatibia partly dark similar to *E. confusus* females. Further, not all *E. kiefferi* females have a distinct vertexal carina and some *E. confusus* females have the frons only very obscurely reticulate. Al khatib *et al.* (2014) used the difference in sculpture pattern of the scrobes to differentiate *E. confusus* and related species from *E. kiefferi* and related species, the scrobes being less extensively sculptured in *E. confusus* (Fig. 25c) and related species compared to *E. kiefferi* (Fig. 50c) and related species. However, like other sculptural features, scrobal sculpture is variable and differences sometimes are subtle, particularly between different sized females, with very small females of *E. kiefferi* tending to have only indistinctly sculptured scrobes (Al khatib *et al*. 2014, supplement fig. 39E). Further, the relevant area is small and the feature often difficult to observe without displacing the scapes from

the scrobal depression. Further molecular analyses are required to more confidently establish morphological limits and determine the best features to differential *E. confusus* and *E. kiefferi* females. For example, a relatively large female (about 3.5 mm) from Iran (CNC) reared from *Diplolepis* on *Rosa canina*, has pale mesofemora, a uniformly coriaceous frons and uniformly dark brown fore wing setae similar to some *E. kiefferi*, but the vertex is evenly rounded into the occiput and the scrobes are shiny and smooth ventrally, and with only subeffaced sculpture dorsally similar to *E. confusus* females. It is evidently the latter species because it was reared along with other more typical *E. confusus* females having the frons variably distinctly reticulate and fore wing setae or at least the basal cell setae white. Some other small females with a mixture of features are only questionably identified to either species.

Atypical *E. confusus* females with unusually long sheaths similar in length to the marginal vein might be keyed through the first half of couplet 39, and then possibly confused with *E. annulatus*, but the latter have the frons uniformly coriaceous and the mesofemur is always distinctly lighter than the pro- and metafemora in addition to other, less conspicuous colour features noted. We also saw a couple of females from Iran with atypically pale, orangey-brown scapes that were reared along with other normal females from *Diplolepis* sp. on *Rosa canina* (CNC). We make note of this in the description, but this feature would conflict with that given in the first half of couplet 67.

In their key, Al khatib *et al.* (2014) differentiated males of *E. confusus* from those of similar species by the slope of the pronotum, number of long, curved setae on the pedicel, and number of pores on the scape. Of these features, the number of pedicular setae appears to be the most reliable. Regardless of their size, *E. confusus* males have 6 or 7, comparatively closely spaced, long setae (Fig. 26g) compared to 4 or rarely 5 long setae in *E. gemellus*/*E. martellii*. The pronotum is always strongly sloping so as to be almost vertical, but to some degree the pronotum is movable relative to the mesonotum and some observed males of *E. gemellus*/*E. martellii* also have a strongly sloped pronotum. Similarly, males of *E. confusus* often have more numerous and more distinctly delineated, pin-prick like pores on the scape than *E. gemellus*/*E. martellii* males. The latter usually have fewer pores that are less well defined, but smaller males of *E. confusus* have less numerous and less distinct pores and some *E. gemellus*/*E. martellii* males have a similar number, arrangement and development of pores as for *E. confusus* males. Usually more reliable supplemental features to differentiate *E. confusus* from *E. gemellus*/*E. martellii* males are the ventral setal pattern of the costal cell in combination with the colour pattern of the meso- and metatarsi. Males of *E. gemellus*/*E. martellii* also always have the dorsal costal cell setae extending at least about half the length of the cell and sometimes have a distinctive head colour pattern as described under *E. gemellus*, but variation is such that these are not a reliable differential features. Some males of *E. confusus* and *E. pistaciae* can also be confused because of a similar number of pedicular setae and variability in colour of the apical maxillary palpomere, but questionable males are distinguished by differences in the number and arrangement of the secondary setae on the pedicel and by one or both of the dorsal and ventral setal patterns of the costal cell, as discussed under *E. pistaciae*.

In addition to the sequences of Al khatib *et al.* (2014), G. Stone and G. Melika sequenced one female and two males (Euro 134, 137, 185) of *E. confusus* during a yet unpublished molecular study of *Eupelmus* associated with oak galls. We also successfully sequenced for COI two females (CNCHYM 015219, 015236) and one male from Italy (CNCHYM 015237) as well as one female from Iran (CNCHYM 015234).

E. (*Eupelmus*) *curvator* Yang n. stat.

Fig. 27a–h (♀)

Eupelmus curvator Yang, 1996: 216–217, 326. Holotype ♀, NWCF, not examined (1♀ paratype examined). Type data: Peoples' Republic of China, Shaanxi, 11.IX.1991, collected on logs of a broadleaf tree attacked by bark beetles.

Description. FEMALE (habitus: Fig. 27c, d). Length = [2.6–3.0 mm]. Head (Fig. 27a, b) dark brown with slight green luster under some angles of light, particularly lower face; with comparatively short, slightly lanceolate white setae on lower face and about ventral half of parascrobal region compared to longer, dark, hairlike setae dorsally on parascrobal region and frontovertex. Maxillary and labial palps brown. Antenna dark with slight greenish luster on scape and pedicel. Mesosoma (Fig. 27c–f) similar in colour to head, mostly dark brown with slight greenish to bluish-green lusters under some angles of light, particularly posteromedial depressed region of mesoscutum, or coppery to reddish-violaceous lusters on acropleuron; mesonotum with brown hairlike setae, prepectus bare (Fig. 27f), and callus with comparatively dense white setae but not entirely obscuring cuticle (Fig. 27e). Macropterous;

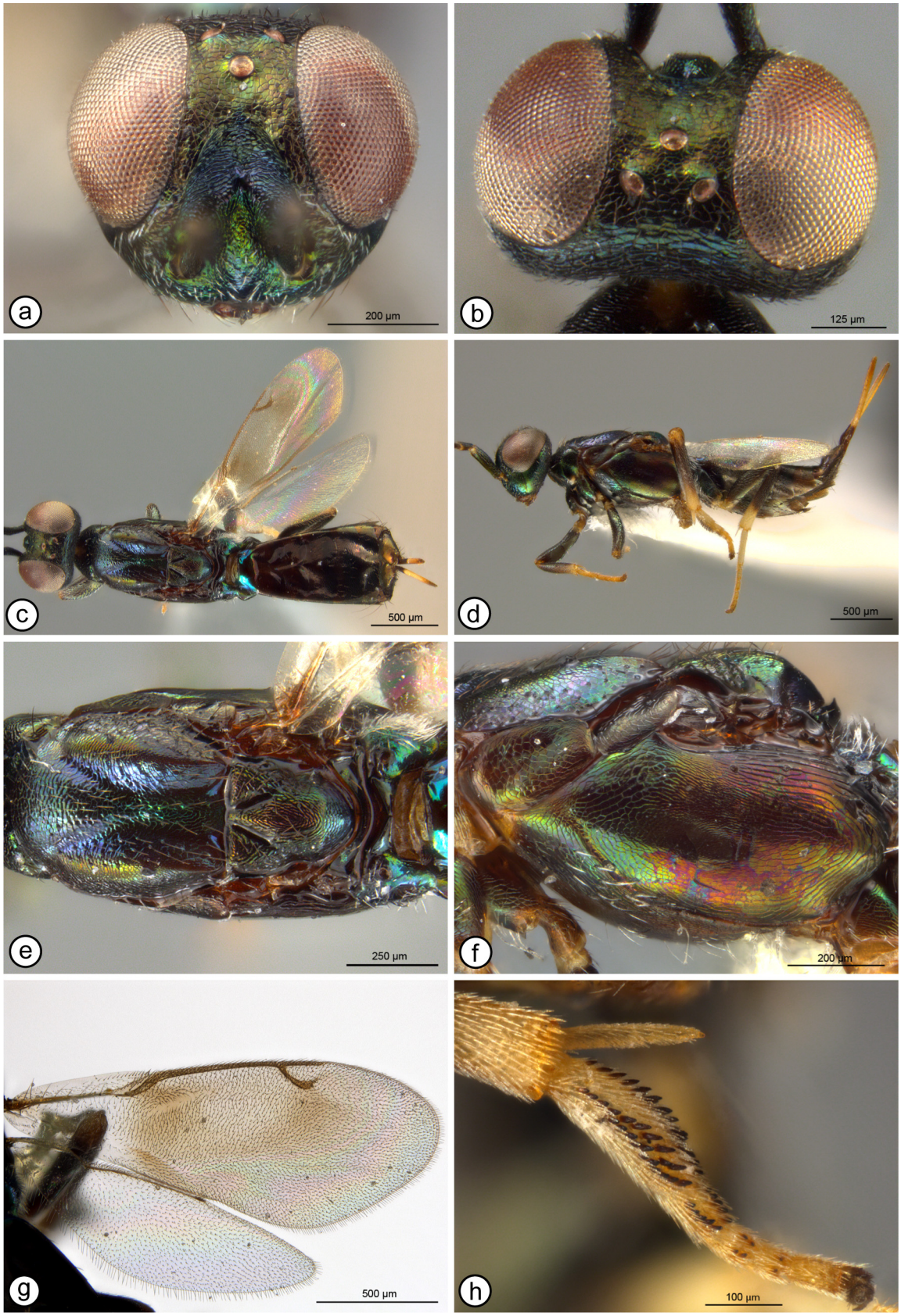

FIGURE 27. *Eupelmus curvator*, paratype ♀: **a**, head, frontal; **b**, head, dorsal; **c**, dorsal habitus; **d**, lateral habitus; **e**, mesosoma, dorsal; **f**, mesosoma, lateral; **g**, wings; **h**, apex of mesotibia and mesotarsus.

fore wing (Fig. 27g) with costal cell hyaline, basal cell hyaline with white setae except extreme base light brownish with brown setae, and disc with more-or-less distinct brownish infuscation between base of parastigma and about apex of venation and with all setae dark, the infuscation weaker behind most of mv anteriorly and with stronger, U-like infuscate region between parastigma and stv; costal cell dorsally near leading margin with row of dark setae within about apical third to half, and ventrally with about 3 rows along length; basal cell and disc entirely setose except for linea calva. Front leg with femur and tibia mostly dark, but knee and apex of tibia pale; tarsus pale. Middle leg similar in colour pattern to front leg except trochanter and trochantellus, and knee somewhat more broadly pale; mesotarsal pegs dark. Hind leg with similar colour pattern as middle leg except knee at most obscurely lighter in colour. Gaster (Fig. 27c, d) with hairlike setae; brown with basal tergite anteriorly greenish-blue; ovipositor sheaths with second valvifer and base of third valvula dark, but most of third valvula abruptly pale to more orange apically.

Head in dorsal view (Fig. 27b) with interocular distance about 0.3× head width; in lateral view lenticular, the face almost evenly convex with parascrobal region smoothly merged with face; vertex mostly alutaceous-imbricate; frons meshlike coriaceous (Fig. 27a); scrobal depression strongly punctate-reticulate to transversely reticulate-strigose (Fig. 27a) and quite distinctly, carinately margined except dorsomedially; OOL: POL: LOL: MPOD = 0.5: 2.25: 1.25: 1.0. Mesoscutum (Fig. 27e) variably meshlike coriaceous to reticulate except convex part of medial lobe more distinctly reticulate-imbricate and lateral lobe with mediolongitudinal band of minute coriaceous sculpture. Scutellum and axillae low convex in same plane; axilla mostly obliquely and scutellum longitudinally reticulate-imbricate laterad more coriaceous midline and frenal area meshlike coriaceous. Acropleuron (Fig. 27f) more-or-less meshlike anterior to much more minutely sculptured mesal region and posteriorly with somewhat larger, more elongate sculpture that is longitudinally aligned and therefore more strigose dorsally, but delineated by at most only very slightly raised ridges. Fore wing (Fig. 27g) with cc: mv: pmv: stv = 4.0: 3.6: 1.1: 1.0. Middle leg (Fig. 27h) without mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus and pegs clearly differentiated into two rows over most of length, second tarsomere with 5 or 6 pegs, third tarsomere with 2 pegs, and fourth tarsomere with 1 peg apically on either side. Propodeum with broadly V-shaped plical depression extending to carinately raised posterior margin (Fig. 27e). Gaster (Fig. 27d) similar in length to combined length of head and mesosoma; not atypically modified; not extending to apex of second valvifer, the latter extending quite obviously beyond apex, with apparent sheath length about 1.1× length of metatibia and about 1.5× length of mv, and third valvula subequal in length to metatibia and about 1.3× length of mv; hypopygium extending at least two-thirds length of gaster.

MALE. Unknown.

Distribution. China (Shaanxi).

Biology. A parasitoid of unidentified bark beetles (Coleoptera: Scolytidae) on a broadleaf tree (Yang 1996).

Remarks. The above description is based on one paratype of the five females that constitute the type series of *E. curvator*. As a result, intraspecific variation undoubtedly is not adequately described. However, females are easily recognized by the combination of features given in the key, including absence of mesotibial apical pegs (Fig. 27h), an unusually narrow frons (Fig. 27a, b), and long ovipositor sheaths that are dark basally but yellowish over most of their length without a distinct medial pale band (Fig. 27d). The single female seen also has the scrobal depression quite distinctly carinately margined except dorsomedially.

E. (*Eupelmus*) *fasciatus* Gibson & Fusu n. sp.

Fig. 28a–i (♀)

Type material. Holotype ♀ (CNC). YEMEN: Sana'a, V.1992, A. van Harten, Malaise-trap, #1121 / HOLOTYPE ♀ *Eupelmus* (*Eupelmus*) *fasciatus* Gibson & Fusu, det. G. Gibson 2015. Condition: point-mounted; uncontorted; entire.

Paratypes (24♀, CNC and AICF). **Yemen:** same data as holotype (3♀, one with CNC Photo 2014-65) or collected XII.1990 (1♀, #18), I.1991 (1♀, #78), IX.1991 (1♀, #488, CNC Photo 2014-64), III.1992 (1♀, #1051), VIII.1992 (1♀, 1198, DNA voucher CNCHYM 015245), IX.1992 (1♀, 1299). Ar Rujum, 24.VII-17.IX.2001 (1♀), 09.IX-05.XII.2001 (9♀, one with DNA voucher CNCHYM 015244), A. van Harten, MT. 12 km NW of Manakhah, 03.VIII.2001, A. van Harten, MT (2♀). Near Hammam Ali, 19.VIII.1998, #3229, A. van Harten (1♀). Sana'a gov. Wadi Dhahr, wasted gardens, 15º26.4'N 44º07.5'E, 2.XI.2010, sweep, 2255 m, J. Bezděk (2♀).

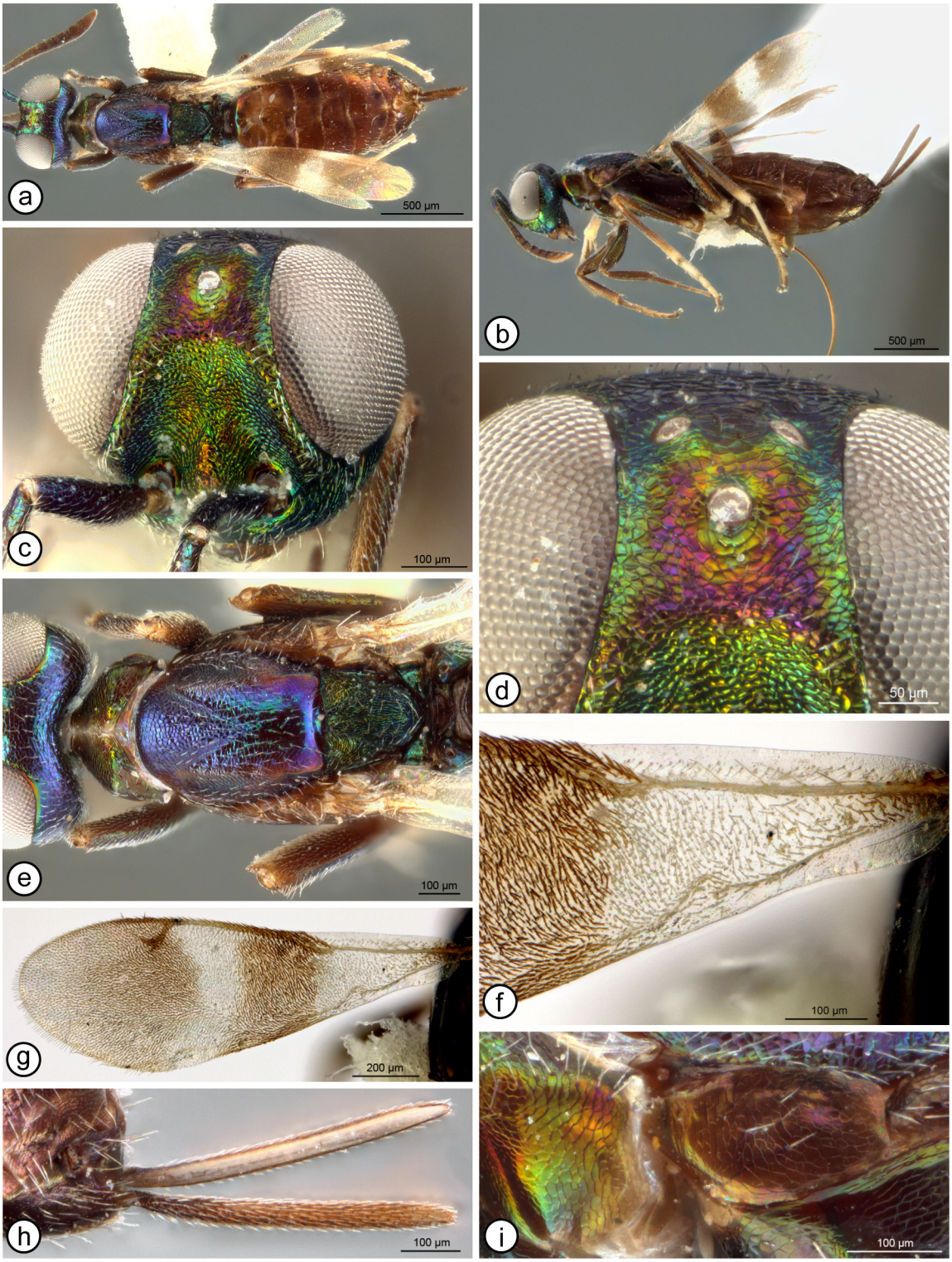

FIGURE 28. *Eupelmus fasciatus*, ♀. **a**, dorsal habitus (2014-65). **b**, lateral habitus (holotype). *c–e* (2014-65): **c**, head, frontal; **d**, upper part of scrobal depression and frontovertex; **e** vertex/occiput and mesosoma, dorsal. *f, g* (2014-64): **f**, fore wing base; **g**, fore wing. *h, i* (holotype): **h**, ovipositor sheaths; **i**, prepectus.

Etymology. The Latin word *fasciatus* (banded), in reference to the banded fore wings of females.

Description. FEMALE (habitus: Fig. 28a, b). Length = 2.4–2.9 mm. Head with face (Fig. 28c) mostly bright green or under some angles of light partly bluish, but at least with coppery to reddish-violaceous U-like or oval region extending from scrobal depression to either side or completely surrounding anterior ocellus (Fig. 28d), or sometimes with entire frontovertex between scrobal depression and posterior ocelli coppery to reddish-violaceous

except narrowly green along inner orbits, and with scrobal depression and interantennal prominence usually also variably extensively coppery-green to reddish-violaceous, but vertex, occiput and temples dark purple to blue (Fig. 28d, e); with slightly lanceolate white setae on lower face and parascrobal region compared to less conspicuous hairlike setae on frontovertex. Maxillary and labial palps brown. Antenna dark with distinct purple to blue or greenish lusters on scape, pedicel and basal funiculars. Pronotum (Fig. 28e) mostly brown or with variably extensive and distinct greenish luster; admarginal setae pale. Mesoscutum (Fig. 28e) variably extensively purple to reddish-violaceous except often more blue to bluish-green within posterior depressed region, contrasting with mostly dark green scutellar-axillar complex, the scutellum and axillae often with variably distinct coppery luster under some angles of light; mesonotum with hairlike to slightly lanceolate white setae. Prepectus (Fig. 28i) brown or dark with variably distinct green or coppery lusters; with 1–8 setae. Tegula dark. Acropleuron often mostly brown or with slight reddish-violaceous lusters, but usually with some green or coppery-green luster, at least anteriorly. Propodeal callus purple or blue to greenish but much more densely and conspicuously setose with slightly lanceolate white setae than mesoscutum. Macropterous; fore wing (Fig. 28g, f) with basal cell hyaline with white to yellowish setae except basally narrowly infuscate with dark setae; disc bifasciate, with broad, slightly curved hyaline band behind about apical half of marginal vein having white setae abruptly separating infuscate regions with dark setae behind parastigma and about basal half of marginal vein, and behind stigmal and postmarginal veins, the apical infuscate region gradually lightened to hyaline apically but with dark setae; costal cell dorsally bare near leading margin, and ventrally with mostly 2 rows along length, though sometimes only 1 row mesally; basal cell and disc entirely setose (Fig. 28f), without linea calva (Fig. 28g). Front leg dark brown except trochantellus and tibia very narrowly pale basally, and protibia variably distinctly lighter to pale longitudinally along anterior and posterior surfaces. Middle leg with femur dark or sometimes pale apically, tibia basally and variably extensively apically pale, and basal four tarsomeres pale to white except for mesotarsal pegs. Hind leg colour similar to middle leg except coxa sometimes pale apically and tibia sometimes variably extensively pale along ventral margin. Gaster (Fig. 28a, b) with hairlike setae; mostly brown or with slight coppery luster except basal tergite usually with at least slight bluish to purple luster dorsobasally; ovipositor sheaths (Fig. 28h) uniformly yellowish-brown to dark brown except often slightly paler apically.

Head in dorsal view with interocular distance about 2.8–3.1× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; vertex smoothly rounded into occiput, finely meshlike alutaceous to coriaceous-imbricate; frons (Fig. 28d) quite strongly and conspicuously imbricate to reticulate-imbricate; scrobal depression punctate-reticulate to reticulate-rugulose; OOL: POL: LOL: MPOD = 0.6–1.0: 1.2–1.7: 1.3–1.9: 1.0, and ocellar triangle equilateral to slightly elongate rather than obviously transverse. Mesoscutum (Fig. 28) with posterior depressed region obviously less strongly sculpture than reticulate anteromedial lobe, though usually completely smooth and shiny only posteromedially near transscutal articulation but increasingly more distinctly coriaceous to coriaceous-imbricate anteriorly and laterally. Scutellum and axillae low convex; axilla obliquely strigose to strigose-imbricate; scutellum longitudinally strigose anterior to much smoother, shiner frenal area. Acropleuron meshlike coriaceous anteriorly, much more minutely sculptured to virtually smooth mesally, and posteriorly with larger, longitudinally aligned meshlike coriaceous sculpture. Fore wing (Fig. 28) with cc: mv: pmv: stv = 5.6–6.2: 4.4–5.0: 1.3–1.4: 1.0. Middle leg without mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus and peg clearly differentiated into two rows along much of length, second tarsomere with 5–7 pegs, third tarsomere with 1–3 pegs, and fourth tarsomere without or with 1 peg apically on either side. Propodeum with V- to U-shaped plical depression extending to posterior margin (Fig. 28e). Gaster (Fig. 28a, b) similar in length to combined length of head and mesosoma; not atypically modified; extending to base of third valvula, the latter about 0.70–0.79× length of metatibia and about 1.2–1.3× length of mv; hypopygium extending about half or slightly more length of gaster.

MALE. Unknown.

Distribution. Yemen.

Biology. Unknown.

Remarks. Females of *E. fasciatus* and *E. orthopterae* possess a unique fore wing colour and setal pattern within *E.* (*Eupelmus*), the only ones with two infuscate regions abruptly separated medially by a hyaline band having white setae (Figs 28g, 80i). This pattern is most similar to females of many species of *Anastatus* Motschulsky. Although females of some other species of *E.* (*Eupelmus*) have variably infuscate fore wings, even if the disc is more-or-less bifasciate the setae of the more hyaline intervening region are similarly dark as on the

infuscate regions. However, we did see a single female of an undescribed species of *E*. (*Episolindelia*) from South Africa (CNC) with the same fore wing setal and colour pattern and with comparatively long, dark ovipositor sheaths similar to *E. fasciatus*. Among other features, it is easily differentiated by having the frons and scrobal depression smooth and shiny, the mesotarsus with a single row of pale pegs on either side, and bidentate mandibles.

Females of *E. fasciatus* are distinguished readily from those of *E. orthopterae* by their darker ovipositor sheaths. The third valvulae of *E. orthopterae* are at least extensively, abruptly pale beyond a short dark basal region, being at most darker brown apically and along the ventral margin (Fig. 80h). The sheaths of *E. fasciatus* are more uniformly dark, from yellowish- to dark-brown (Fig. 28h). Females of *E. fasciatus* also have a setose prepectus (Fig. 28i), with at least one and usually three or more setae, whereas *E. orthopterae* females have a bare prepectus (Fig. 80g). Although the presence of setae may not be very obvious or even apparent on both prepecti of a single individual if reduced to one or abraded in museum specimens, we conclude there are two species based on the correlated prepectal setal and sheath colour patterns. This hypothesis is supported by a 421bp COI sequence retrieved from a single female (CNCHYM 015244) that is most similar to sequences retrieved from three *E. orthopterae* females (CNCHYM 015196, 015246, 015193), but with a large pairwise distance between the two species (10.7%).

Males of *E. fasciatus* are unknown, but likely are very similar to those of *E. orthopterae*. If so, they also lack a fore wing speculum (*cf* Fig. 81h) and apically curved pedicular setae (*cf* Fig. 81f) and do not have an obviously differentiated, longer genal seta (*cf* Fig. 81b).

E. (*Eupelmus*) *flavicrurus* Yang n. stat.

Figs 29a–i (♀), 30a–g (♂)

Eupelmus flavicrurus Yang, 1996: 215, 325−326. Holotype ♀, NWCF, not examined (1♀ labelled as paratype examined, but with different collecting date, see 'Remarks'). Type data: Peoples' Republic of China, Shaanxi, 13.VIII.1989, reared from pupae in galleries of *Cryphalus exiguus* in *Morus alba*.

Description. FEMALE (habitus: Fig. 29a, b, g). Length = 2.6–4.1 mm. Head with face sometimes mostly dark violaceous to brighter reddish-violaceous on frontovertex, parascrobal region and interantennal prominence (Fig. 29c), but lower face greenish under most angles of light (Fig. 29h) and scrobal depression with variably extensive green to bluish or purple luster (Fig. 29c, h), and frons sometimes variably extensively and distinctly green to bluish, most commonly with a variably distinct green band below posterior ocellus (Fig. 29f), and vertex (Fig. 29i) at least partly purple to violaceous or reddish-violaceous laterally along inner orbit and usually variably broadly along vertexal carina; with white hairlike to slightly lanceolate setae. Maxillary and labial palps brown. Antenna with scape pale, yellowish to yellowish-orange with at most carinate ventral margin dark (Fig. 29c, i); pedicel and flagellum dark except pedicel dorsally and sometimes flagellum basally with some metallic lusters. Pronotum blue to purple or violaceous laterally; admarginal setae dark. Mesonotum (Fig. 29b) with hairlike to slightly lanceolate setae, the setae white except sometimes anteriorly; variably dark violaceous similar to head at least anteriorly on convex medial lobe, but posteromedial depressed region of mesoscutum, lateral lobes and scutellar-axillar complex variably extensively, sometimes almost entirely greenish except axillae usually with some purple to violaceous luster under at least some angles of light and scutellum sometimes with some coppery luster. Prepectus brown or with variably extensive blue to purple lusters similar to pronotum laterally; with 3–22 white, hairlike setae. Tegula dark brown or with some greenish luster. Acropleuron sometimes usually mostly green with variably distinct and extensive coppery luster. Metanotum and propodeum mostly green but callus laterally often purple to reddish-violaceous; callus with white setae similar to mesoscutum. Macropterous; fore wing hyaline with uniformly yellowish to brownish setae; costal cell dorsally near leading margin with setae in 1 to partial 2 rows over about apical one-third to almost two-thirds, and ventrally with at least 3 rows along length; basal cell and disc entirely setose except for elongate linea calva extending to level equal with apex or about middle of parastigma. Legs except for mesotibial apical pegs and mesotarsal pegs often entirely pale beyond coxae (Fig. 29g), though sometimes profemur variably extensively brownish with slight metallic luster, usually only on posterior surface mesally or mediolongitudinally (Fig. 29a, d) but rarely almost entirely dark except basally and apically, and then protibia sometimes also brownish subbasally on ventral but not dorsal surface, but hind leg entirely pale or only extremely rarely brown with slight metallic luster subbasally within basal half to two-thirds (Fig. 29a, e). Gaster (Fig. 29a, b) with hairlike setae; mostly brown to coppery-brown except basal tergum usually more-or-less

distinctly green basally and apical terga usually also with some greenish luster; ovipositor sheaths sometimes almost uniformly pale beyond dark basal band, but usually also with distinct darker apical region, though this is lighter brown than basal dark band.

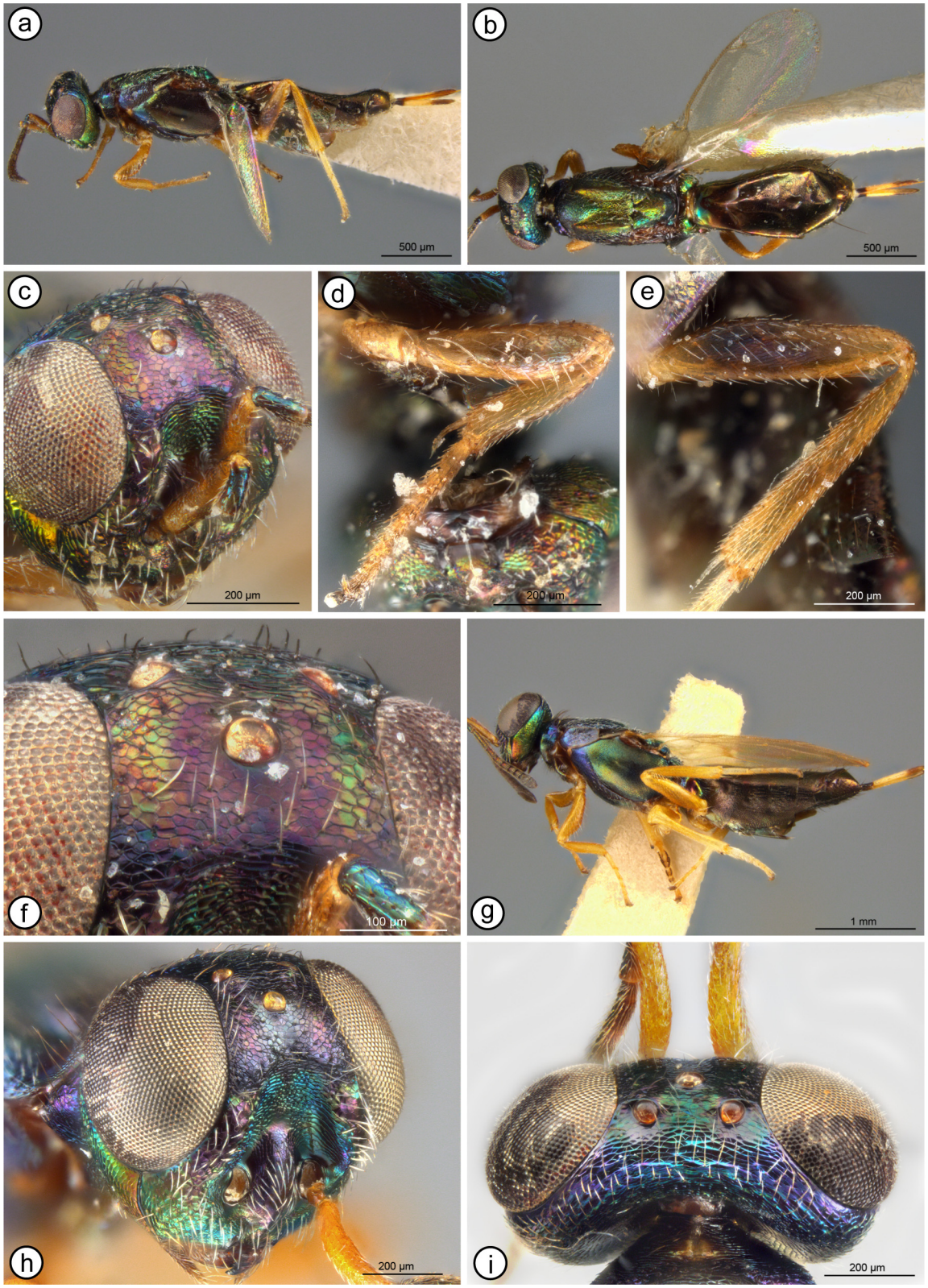

FIGURE 29. *Eupelmus flavicrurus*, ♀. *a–f* (paratype): **a**, lateral habitus; **b**, dorsal habitus; **c**, head, frontolateral; **d**, right front leg, posterior; **e**, left hind leg, posterior; **f**, upper part of scrobal depression and frontovertex. *g, i* (2012-86): **g**, lateral habitus; **i**, head, dorsal. **h**, head, frontolateral (2012-87).

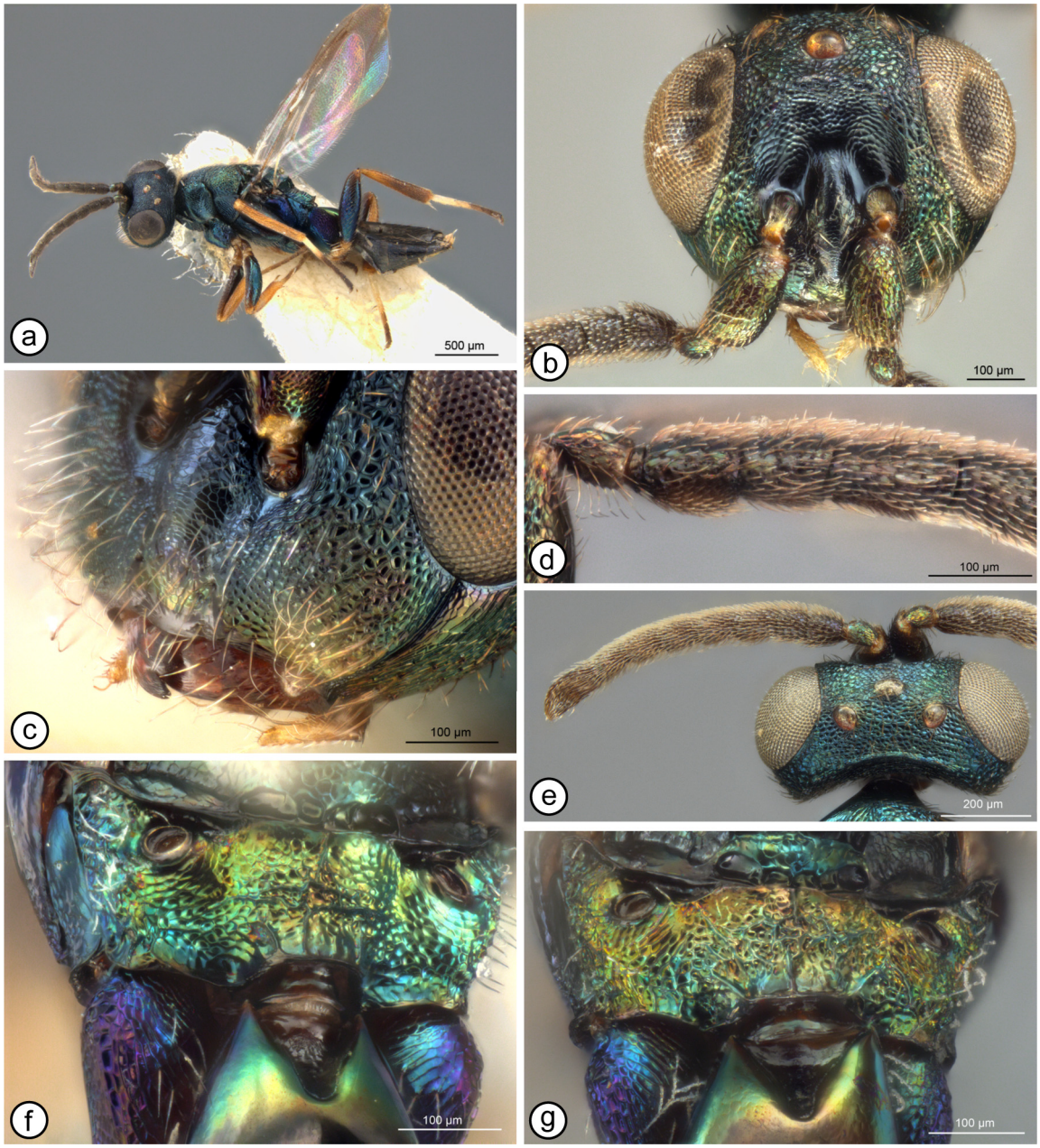

FIGURE 30. *Eupelmus flavicrurus*, ♂. *a–d* (2014-123): **a**, lateral habitus; **b**, base of antennae and head, frontal; **c**, lower face, frontolateral; **d**, pedicel to base of fl5. *e, f* (2012-122): **e**, left antenna and head, dorsal; **f**, propodeum. **g**, propodeum (2012-124).

Head in dorsal view with interocular distance about 0.4× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; vertex transversely reticulate-imbricate and differentiated from occiput by variably, sometimes only obscurely developed (Fig. 29i) transverse ridge or carina; frons sometimes almost uniformly meshlike coriaceous, but usually at least partly reticulate-imbricate to reticulate along inner orbit below posterior ocellus, though often not completely to scrobal depression (Fig. 29f); scrobal depression distinctly reticulate to transversely reticulate-rugulose, including most of scrobes (Fig. 29c, h); OOL: POL: LOL: MPOD = 0.6–0.8: 2.1–2.3: 1.4–1.5: 1.0. Mesoscutum meshlike reticulate except medial lobe extensively reticulate-imbricate and lateral lobe with mediolongitudinal band of minute coriaceous sculpture. Scutellum and axillae low convex in same plane; axilla variably extensively meshlike coriaceous to reticulate anteriorly but more reticulate-imbricate posteriorly; scutellum coriaceous medially and longitudinally reticulate-imbricate laterally anterior to meshlike coriaceous frenal area. Acropleuron meshlike anteriorly and posteriorly of much more minutely sculptured mesal region, the sculpture often larger and more distinctly reticulate posteriorly

than anteriorly. Fore wing with cc: mv: pmv: stv = 4.6–5.9: 4.5–5.5: 1.0–1.1: 1.0. Middle leg with row of 5–9 mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus and pegs clearly differentiated into two rows apically, second tarsomere with 4–7 pegs, third tarsomere with 2 or 3 pegs, and fourth tarsomere with 0–2 pegs apically on either side. Propodeum with broadly U-shaped plical depression extending to posterior margin. Gaster (Fig. 29a, b) similar in length to combined length of head and mesosoma; not atypically modified; extending to or almost to apex of second valvifer, the latter sometimes extending slightly beyond gastral apex, with third valvula 0.72–0.83× length of metatibia and 0.75–0.95× length of mv.

MALE (habitus: Fig. 30a). Length = 1.4–2.3 mm. Head (Fig. 30b) dark or with variably distinct bluish-green to green luster, the lower face and/or gena often somewhat more distinctly green (Fig. 30c); frontovertex distinctly meshlike reticulate (Fig. 30b); vertex differentiated from occiput by distinct transverse carina (Fig. 30e); scrobal depression similarly sculptured as frons, the sculpture sometimes shallower but extending ventrally through scrobes to near toruli (Fig. 30b); setae hairlike, white ventrally to brown dorsally; lower face in region between torulus and malar space with tuft-like region of longer setae, of which at least some abruptly curved, hook-like, or sinuate apically (Fig. 30c); gena posterior to malar sulcus with 1 conspicuously long seta and ventral to this with tuft of at least 6 progressively shorter setae, and posterior to eye with apices of setae directed toward orbit. Antenna (Fig. 30e) with scape entirely dark, ovoid, about 1.7–1.8× as long as wide; pedicel (Fig. 30d) at most about 1.5× as long as wide, ventrally with 7–9 long setae, of which all hooked except usually apical-most seta; length of pedicel + flagellum about 1.3× head width; flagellum robust-filiform (Fig. 30e) with clava subequal in length to apical two funiculars; anellus very strongly transverse, discoidal, shiny, with at most inconspicuous, sparse setae at extreme apical margin (Fig. 30d); funicle with fu1 noticeably oblong, at least as long as pedicel and about 1.2–1.3× as long as wide, with fu2 quadrate to similarly oblong as fu1, but at least very slightly shorter than fu1 (Fig. 30d), and subsequent funiculars all distinctly oblong, up to about 1.6×, as long as wide, uniformly covered with decumbent, curved setae except fu1–fu3 in ventral view with elongate regions of differentiated, shorter, straighter setae, the region sometimes occupying entire ventral surface so as to be conspicuously differentiated as flattened or slightly concave region (Fig. 30d). Maxillary and labial palps dark brown except apical palpomeres pale. Mesosoma (Fig. 30a) quite distinctly blue to bluish-green or green and sometimes with slight coppery luster under some angles of light; setae hairlike, brownish; tegula dark. Legs with metacoxa sometimes entirely dark purple or violaceous but often at least linearly green to bluish-green ventrally and more distinctly blue to purple or violaceous dorsally, and in lateral view distinctly reticulate but dorsal margin evenly curved and narrowed to apex; knees pale, with pro- and metafemora otherwise dark or at least brown with bluish luster but mesofemur usually obviously paler, yellowish-brown to brown without metallic luster except sometimes dark along ventral margin; protibia usually pale but sometimes with dorso- and ventrolongitudinal dark bands, mesotibia similarly or lighter brownish than mesofemur, and metatibia similar in colour to mesotibia or only slighter darker; mesotibial spur pale; protarsus uniformly brownish-yellow to yellow, mesotarsus at least mostly brown, the basitarsus pale basally but sometimes almost or entirely white, but metatarsus with at least basal two tarsomeres pale and apical two tarsomeres variably dark brown, the third tarsomere varying from similarly pale as basal two tarsomeres to similarly dark as apical two tarsomeres. Fore wing with mv about 4.0–4.8× length of stv and pmv subequal in length or only slightly longer than stv; costal cell dorsally near leading margin with dark setae apically for distance slightly more than length of parastigma, and ventrally with 2 or 3 rows apically but mostly aligned in single row at least within about basal half. Propodeum variably distinctly rugose with median carina interrupted by at least one and usually more transverse, irregular carinae medially or within posterior half (Fig. 30f, g), and with one or two paralateral carinae on either side of median carina extending anteriorly from foramen and joining with transverse carinae.

Distribution. China [Beijing (Peiping), Rec'd 1.X.1936, C.L. Liu, expt. 10 sub.14, CNC Photo 2013-165 (USNM: 1♀)], **Japan*** [Honshu, Akita-shi, 6.VII.1976, T. Sunose (EIHU: 1♀); Kisakata, Akita-ken, 25.VI.1976 (EIHU: 2♀, 4♂), 27.VI.1976 (EIHU: 2♀, 1♂; 1♀ with CNC Photo 2014-123); Kamihobara, Fukushima-ken, VIII.1934 (USNM: 1♀); Mantomi-mura, Okayama-ken, IX.1935 (USNM: 1♀); Masubayashi, Saitama-ken, 27.VIII.1932 (USNM: 1♀); Mitsuoka, Nagano-ken, 2 (USNM: 1♀), 3 (USNM: 1♀, 1♂), 6 (USNM: 2♀), 10 (USNM: 2♂), 11 (USNM: 1♂), 12 (USNM: 1♀), 14 (USNM: 2♀), 16 (USNM: 2♀, 1♂), 20 (USNM: 1♂), 22 (USNM: 1♀, 1♂), 23(USNM: 1♀, 1♂).VIII.1933; Motosumiyoshi, Kanagawa-ken, 2 (USNM: 1♀), 18 (USNM: 1♀ CNC Photo 2012-87).VIII.1933; Shindenbara, Fukuoka-ken, 1.X.1935 (USNM: 1♀); Takatsu, Kanagawaa-ken, 29.VI.1933 (USNM: 1♀), 9.VII.1933 (USNM: 1♀). Shikoku, (Kôchi)[-ken], (Tosa-shimizu)[-shi], Ashizuri[-misaki/Cape Ashizuiri], (Hideo Takenaka leg.), 31.VII.1963, ex. (from larva of) *Chlamisus lewisii* Baly [information in parentheses in Japanese] (ELKU: 1♀)], **South Korea*** [Chungnam, Daejon-si, Wadong,

86º24.02'N 127º25.88'E, 16.VII-8.VIII.2006, P. Tripotin, MT, for. edge, wild rose patch, DNA voucher CNCHYM 015238 (CNC: 1♀); Keikido, Sosha, 26.VIII.1933 (USNM: 2♀), IX.34 (USNM: 3♀), IV.1935 (USNM: 1♀, 1♂); Suigen, 12 (USNM: 2♀, one with CNC DNA voucher CNCHYM 015230), 14 (USNM: 2♀), 16 (USNM: 2♀), 18 (USNM: 2♀, 1♂), 20 (USNM: 1♀, 1♂ with CNC Photo 2012-124), 25 (USNM: 1♀ CNC Photo 2012-86), 26 (USNM: 1♂ CNC Photo 2012-123), 27 (USNM: 1♀), 28 (USNM: 4♂, one with CNC Photo 2012-122).VIII.1933 (USNM: 1♀)].

Biology. Coleoptera: *Chlamisus lewisii* (Baly) (Chrysomelidae); *Cryphalus exiguus* Blandford (Curculionidae) on *Morus alba* L. (Moraceae) (Yang 1996). **Diptera:** *Hasegawaia sasacola* Monzen (Cecidomyiidae) on *Sasa* spp. (Poaceae) (Sunose 1978). **Hymenoptera**: *Phanerotoma grapholithae* Muesebeck (Braconidae) (Haeussler 1940); *Eriborus* (= *Inareolata*) *molestae* (Uchida), *Mastrus* (= *Aenoplex*) sp., *Pristomerus vulnerator* (Panzer) (Ichneumonidae) (Haeussler 1940). **Lepidoptera**: *Grapholita molesta* (Busck) (Tortricidae) (Haeussler 1940).

The specimens listed under 'Distribution' from EIHU are all reared from *H. sasacola*, undoubtedly as part of the study of Sunose (1978) even though this did not indicate a *Eupelmus* had been reared. The USNM specimens from Japan and South Korea are reared from *G. molesta*, either as a primary parasitoid or hyperparasitoid through Braconidae and Ichneumonidae (Haeussler 1940). Haeussler (1940) reported parasitoidism rates of 2.7–3.5% with the species either being solitary larval or pupal parasitoids, and primary parasitoids 55.7% and hyperparasitoids 44.3% of the time; females constituted 93.6% of reared individuals.

Remarks. As discussed under *E. fulvipes*, *E. flavicrurus* is included as one of ten species within the *fulvipes* species group because of the presence of a vertexal carina in at least males. Typical females are very similar to those of *E. fulvipes*, which we restrict to the western Palaearctic, and to those of *E. formosae*, which, like *E. flavicrurus*, we restrict to the far eastern Palaearctic. Males of *E. flavicrurus* are differentiated from those of *E. fulvipes* by the features given in the key, but we cannot satisfactorily differentiate them from those of *E. formosae* or those of *E. luteipes* and *E. tachardiae*. COI molecular evidence indicates that both *E. luteipes* and *E. tachardiae* are valid species, and are most similar molecularly to each other but distant from *E. fulvipes*. One successfully sequenced female (CNCHYM 015238) we identify as *E. flavicrurus* is indicated as basal to *E. luteipes* + *E. tachardiae*, but we have failed to sequence females of *E. formosae* for comparison. Our concept of *E. flavicrurus* is based primarily on the two reared series housed in EIHU and USNM. In the series of five females reared from *H. sasacola* all specimens have the metafemora entirely pale, but the profemora variably extensively darkened, and ovipositor sheaths about 0.8–0.9× the length of the marginal vein. The head is comparatively dark without distinct green bands along the inner orbits or within the scrobal depression, which has more bluish to purple lusters (Fig. 29h). Most of the 36 females reared either as primary or hyperparasitoids of *G. molesta* have a variably distinct green region on the frons (sometimes as a vertical band occupying entire region between anterior ocellus and each inner orbit, Fig. 29f) and sometimes within the scrobal depression (Fig. 29c), the legs either entirely pale or at most with only a small, light brownish area on the posterior surface of the profemur, and ovipositor sheaths about 0.8–0.95× the length of the marginal vein (Fig. 29g). However, one female from South Korea (#547 B) has both the pro- and metafemora distinctly dark, in part, in combination with sheaths about 0.9× the length of the marginal vein. Another female (#12093-C) has only the metafemur somewhat darkened basally (Fig. 31f) and the profemur entirely pale except for a slight metallic luster under some angles of light (Fig. 31e) in combination with ovipositor sheaths about 0.75× the length of the marginal vein (Fig. 31d). The latter female therefore has the characteristic leg colour pattern and relative sheath length of females we include in *E. formosae*. It either represents a single *E. formosae* reared from *G. molesta* or indicates morphological limits of the two species sometimes overlap. We suspect the former because it was the only individual reared from Shikoku, Zota-mui-a, and other instances are known of different *fulvipes*-group species having the same host species (see 'Biology' for *E. kiefferi*).

In addition to uncertainty over limits of intraspecific variation, we are uncertain as to correct nomenclature for the taxon. The types of both *E. annulicaudis* and *E. scolyti* have the metafemur distinctly darkened within the basal half but the profemur pale as well as relatively short ovipositor sheaths only about 0.7× the length of the marginal vein. The ovipositor sheaths of the examined *E. flavicrurus* paratype are obviously longer than for the *E. annulicaudis* and *E. scolyti* holotypes, being slightly longer than 0.8× the length of the marginal vein. Also, although the original description of *E. flavicrurus* states that both the pro- and metafemora are yellow, the female labelled as paratype we examined (Shaanxi, QiShan GaoDian, 1985.8.10, Mulberry tree bark beetle, Yang Zhong-Qi leg.) (Fig. 29a–f) has the metafemur quite distinctly brown with a slight metallic luster over about the basal two-

thirds (Fig. 29e) and the profemur very slightly brownish mediolongitudinally (Fig. 29d). This latter colour pattern is similar to the South Korean 547B female reared from *G. molesta* so that the type series of *E. flavicrurus* likely also consisted of both pale and partly brownish leg colour patterns. We therefore apply the name based on the original description rather than on the examined paratype. The examined paratype is at the lower size limit of females we include in *E. flavicrurus* and the frons is finely reticulate only in a narrow band over part of the green region along the inner orbits.

E. (*Eupelmus*) *formosae* Ashmead

Fig. 31a–i (♀)

Eupelmus formosae Ashmead, 1904: 154. Holotype ♀, USNM, examined. Type data: Formosa, A. Koebele.
Eupelmus cyaniceps scolyti Liao *in* Liao *et al.*, 1987: 194–195. Holotype ♀, IZAS, examined. Type data: Peoples' Republic of China, Beijing, 5-22.X.1972, reared from *Scolytus seulensis* Mur. **n. syn.**
Eupelmus (*Eupelmus*) *formosae*; Gibson, 2011: 4, 51.
Eupelmus (*Eupelmus*) *scolyti*; Gibson, 2011: 51.

Description. FEMALE. As described for *E. flavicrurus* except metafemur variably brownish to dark within at least about basal third compared to entirely pale profemur or at least obviously darker than profemur if posterior surface of profemur slightly brownish mesally (*cf* Fig. 31e, f) or rarely even extensively brown, and protibia subbasally without differentiated darker regions dorso- and ventrolongitudinally (Fig. 31e) (*cf E. kiefferi*, Fig. 50b insert), though metatibia rarely partly darkened; vertex smoothly rounded into occiput or with variably distinct vertexal carina; ovipositor sheaths usually 0.68–0.75× length of mv, but rarely up to 0.85× (see 'Remarks').

MALE. As described for *E. flavicrurus*.

Distribution. ORIENTAL. **China*** [Hunan, Changsha, 10.VIII.1983, D.X. Liao (IZCAS: 1♀)], Taiwan. **PALAEARCTIC**. **China*** [Changping, Beijing, 1.V.1980 (IZCAS: 1♀); NW Beijing, Fragrant Hills, 1.VII.1992, C.W. & B. O'Brian (CASC: 1♀)], **Japan** [Honshu, Ibaraki, Tsukuba, NIAES, 6-21.V.1989, M. Sharkey (CNC: 1♀); Honshu, Osaka Pref., Osaka city, Yakeno, 32º42'49"N 135º35'11"E, 14.II.2005, R. Matsumoto, ex. *Chrysis shanghaiensis* in *Monema flavescens* cocoon (AICF: 1♀); Honshu, Tokyo, Edogawa ward, Koiwa-machi, 8.V.1962, N. Tamaki, ex. pupa of Tachinidae pars. on *Canephora asiatica* (ELKU: 1♀); Honshu, Urawa, Saitama-ken, em. II.1979, S. Usuba, ex. galls of *Neuroterus vonkuenburgi* Dettmer on *Quercus acutissima* (EIHU: 1♀); Honshu, Wakayama, 14.V.1964, K.K., PA1 (1♀, CNC Photo 2014-124 (USNM: 1♀); Honshu, Yatabe, Ibaraki-ken, 20 (1♀), 27(1♀).VI.1987, 12.VIII.1981 (1♀), A. Otake, *Dryocosmus kuriphilus* Yasumatsu (all EIHU); Honsu, Yoshida, Yamaguchi, Yamaguchi Pref., 10.VIII.2004, Y. Higashiura (ELKU: 1♀); Kyushu, Hakozaki, Fukuoka, 13.V.2007, K. Matsuo, *Celticecis japonica* on *Celtis sinensis* var. *japonica* (C-202 of Yukawa & Masuda, 1996), em. 16.V.2007, ug.JP 07 (ELKU: 1♀); same data except em. 10.VI.2007 and ug.JP 08 and ug.JP 10 (ELKU: 2♀); same data except em. 14.VI.2007 and ug.JP 09 (ELKU: 1♀); Kyushu, Momiki, Izumi, Kumamoto Pref., 30.VII.1994, Y. Higashiura (ELKU: 1♀); Kyushu, Okinoshima, Chikuzen, 25-28.VII.1958, Mirashuma, Murakami & Y. Miyatake (ELKU: 3♀); Kyushu, Saitsu, Amakusa, 10.V.1960, K. Morioto, CNC Photo 2014-125 (ELKU: 1♀); Kyushu, Seto, Nagasaki, 13.XI.1961, Y. Hirashima, H. Kajita (ELKU: 1♀); *?*Shikoku, Zota-mui-a, Kagawa-ken, IX.1935, reared from *G. molesta* (#12093-C), CNC Photo 2014-122 (USNM: 1♀)], **South Korea** [Mokpo, 1928, T. Kambe, ex. *Pectinophora gossypiella* (USNM: 2♀)].

Biology. The hosts listed under *E. formosae* by Noyes (2014) are for the reared specimens of Haeussler (1940), which we treat and discuss under *E. flavicrurus*. We saw females labelled as reared from the following. **Coleoptera**: *Scolytus seulensis* Murayama (Scolytidae) (Liao *et al.* 1987). **Diptera:** *Celticecis japonica* Yukawa & Tsuda* (Diptera: Cecidomyiidae) on *Celtis sinensis* var. *japonica* (Planch.) (Ulmaceae). Unidentified Tachinidae* parasitizing *Canephora asiatica* Staudinger* (Lepidoptera: Psychidae). **Hymenoptera**: *Dryocosmus kuriphilus* galls* (Cynipidae) on *Castanea* sp. (Fagaceae) (EIHU: 3♀), *Neuroterus vonkuenburgi* Dettmer* (Cynipidae) on *Quercus acutissima* Carruth. (Fagaceae) (EIHU: 1♀). *Praestochrysis* (= *Chrysis*) *shanghaiensis* (Smith)* (Chrysididae) in *Monema flavescens* Walker* cocoon (Lepidoptera: Limacodidae) [we are sure that *E. formosae* was a hyperparasitoid on this occasion because the cocoon that is pinned under the specimen has the characteristic oviposition hole (Yamada 1987) of *P. shanghaiensis* (Pierre Tripotin, currently unaffiliated, pers. comm.)]. **Lepidoptera**: *Pectinophora gossypiella* (Saunders)* (Gelechiidae). ? *Grapholita molesta* (Busck) (Tortricidae).

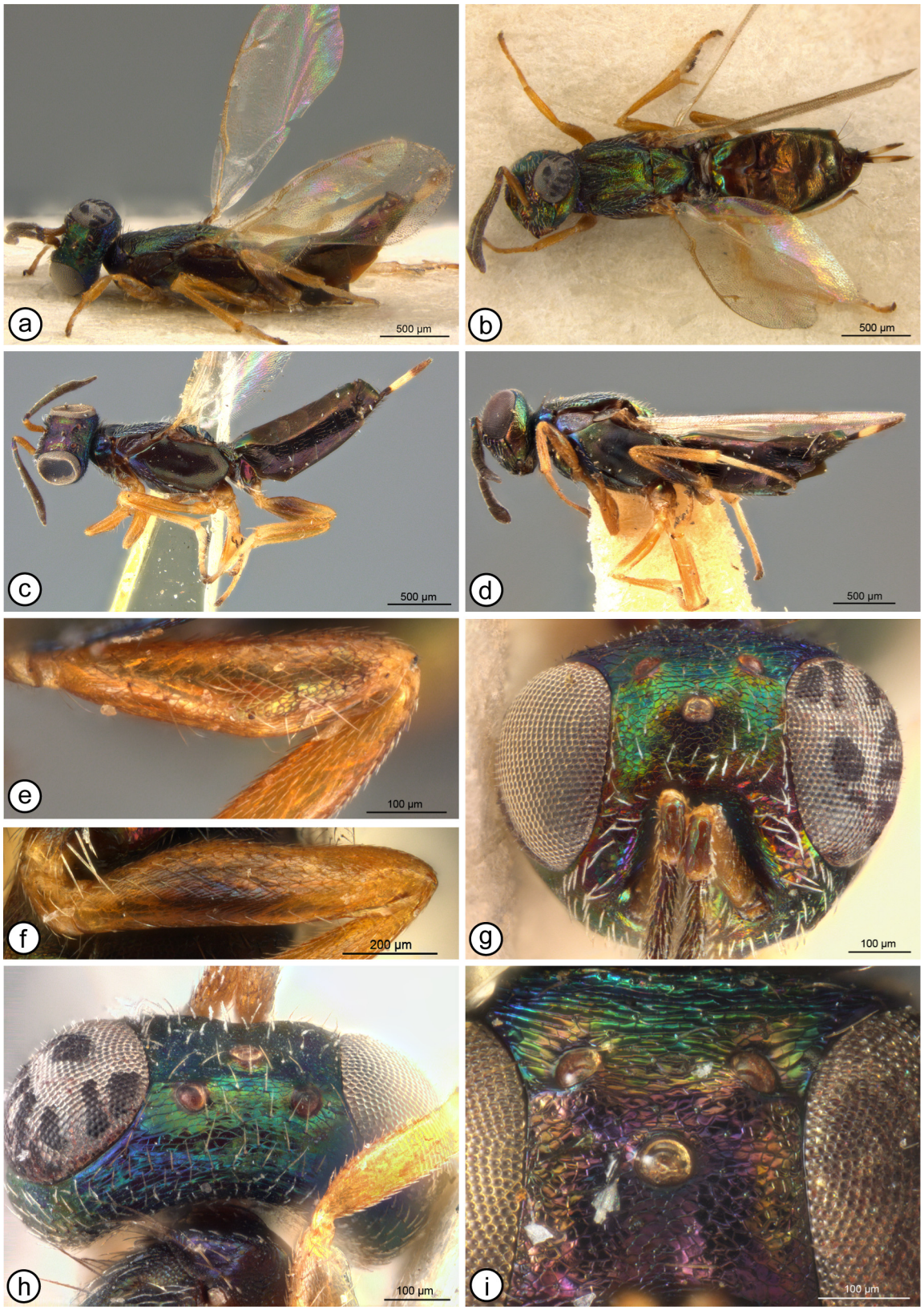

FIGURE 31. *Eupelmus formosae*, ♀. *a, b, g, h* (*E. scolyti* holotype): **a**, lateral habitus; **b**, dorsal habitus; **g**, head, frontal; **h**, head, dorsal. **c**, lateral habitus (2014-122). *d–f* (2014-125): **d**, lateral habitus; **e**, profemur and base of protibia, posterior; **f**, metafemur, anterior. **i**, *E. formosae* holotype, frontovertex.

Remarks. As discussed under *E. fulvipes*, *E. formosae* is included as one of ten species within the *fulvipes* species group because of the presence of a vertexal carina in at least some females. We have not seen any males of *E. formosae* definitively associated with females through rearing, but presumably they are similar to *E. flavicrurus* and *E. tachardiae* males. We therefore key them with males of these latter two species and those of *E. luteipes*, which we cannot presently differentiate. Females of the four species and *E. fulvipes* are differentiated primarily only by different leg colour patterns in combination with either being restricted to the western (*E. fulvipes*) or far eastern Palaearctic (other four species). Initial unpublished molecular results indicate at least *E. flavicrurus*, *E. luteipes* and *E. tachardiae* are valid species within the far eastern Palaearctic, but we are not entirely certain as to the validity of our present concepts and correct application of nomenclature. We include in *E. formosae* those *fulvipes*-group females from the far eastern Palaearctic that have an obviously pale scape and essentially pale legs except for the metafemur being variably extensively and conspicuously darkened (Fig. 31a, c, d, f), though the posterior surface of the profemur sometimes also has a slight brownish or metallic luster (Fig. 31e). Females we include in *E. tachardiae* have the profemur much more extensively, almost entirely dark, and the protibia with a variably dark but at least differentiated darker region ventro- and/or dorsolongitudinally subbasally, as well as the metafemur darkened basally (Fig. 108d, f, g). Females we include in *E. flavicrurus* usually have the legs entirely pale (Fig. 29g) or with just the profemur variably darkened (i.e. the same colour pattern as the West Palaearctic *E. fulvipes*). Rarely, both the pro- and metafemora are somewhat darkened (Fig. 29a, d, e), but then more-or-less similarly so, and the ovipositor sheaths are at least 0.8× the length of the marginal vein.

The questionable record cited in distribution from Japan (Shikoku) is based on a single female (Fig. 31d) reared from *G. molesta* that fits within our concept of *E. formosae*, but was reared with numerous *E. flavicrurus* from the same host (see under latter species), though from a different site. As discussed under 'Biology' for *E. kiefferi*, other examples are known of *fulvipes*-group species being reared from the same host species, even sometimes from the same gall. However, the presence of this single female brings into question the validity of *E. formosae* and *E. flavicrurus* as separate species, particularly because of variability of females we currently include in *E. formosae*. Some females have only quite a small and therefore relatively inconspicuous darker region on the metafemur (Fig. 31c) so that the legs are almost entirely pale, though such females have comparatively short ovipositor sheaths typical of *E. formosae*. Others have the posterior surface of the profemur noticeably brownish, sometimes with a slight metallic luster (Fig. 31e), though obviously less extensively dark than the metafemur (Fig. 31f) and with short sheaths. However, a couple of included females (China: Changsha and Fragrant Hills) have the metafemur variably distinctly but at least noticeably brownish basally to mesally in contrast to an entirely pale profemur, and ovipositor sheaths at least 0.8× the length of the marginal vein. We do not know whether these latter are *E. formosae* females with atypically long ovipositor sheaths, *E. flavicrurus* females with an atypical leg colour pattern, or perhaps even a new species.

The legs of the unique holotype of *E. formosae* are pale except the metafemur is dark beyond the trochantellus for almost the basal two-thirds, as given in the original description; the reticulate-imbricate to very finely reticulate frons as well as the parascrobal regions are mostly comparatively bright reddish-violaceous (Fig. 31i) except under different angles of light the frons is variably extensively green (at least along the inner orbits ventral to the posterior ocelli) and the ventrolateral margin of the parascrobal region and inner lateral surface of the scrobal depression are more obviously bright green (the scapes lie within and conceal most of the scrobal depression); the base of the third valvulae are slightly overlain by the gastral apex, but the sheaths are slightly longer than 0.7× the length of the marginal vein (see images of frontal head and dorsal and lateral habitus for holotype at http://www.usnmhymtypes.com). It is difficult to observe the vertex of the holotype of *E. formosae* because the female is contorted and the way it is mounted, but there does appear to be a vertexal carina. The holotype of *E. cyaniceps scolyti* (Fig. 31a, b) also has the metafemur extensively dark but the profemur pale, and similarly short ovipositor sheaths slightly less than 0.7× the length of the marginal vein, but the frons is more extensively green to bluish-green except below the anterior ocellus under some angles of light (Fig. 31g), the scrobal depression, though mostly concealed by the scapes, appears to be partly blue to purple under at least some angles of light and with green luster only along the lateral margins. The holotype is again mounted in such a manner that a direct dorsal view of the vertex is not possible, but it appears to be evenly curved into the occiput with some transversely aligned sculpture but at most only the slightest indication of an obscure vertexal carina developed in part.

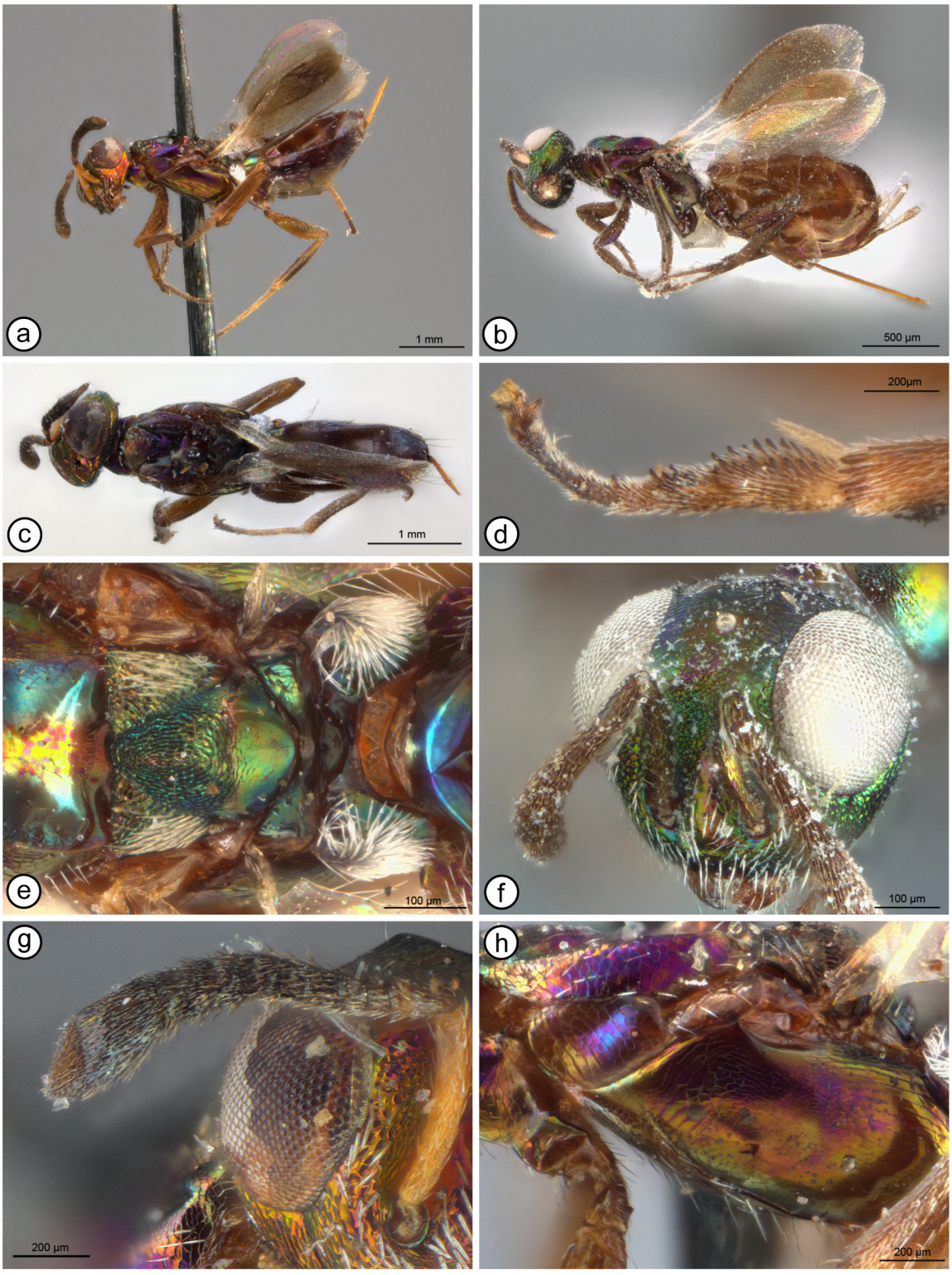

FIGURE 32. *Eupelmus fulgens*, ♀. *a, c, d, g, h* (syntype): **a**, lateral habitus; **c**, dorsal habitus; **d**, apex of mesotibia and mesotarsus; **g**, right antenna; **h**, mesosoma, lateral. *b, f* (2013-50): **b**, lateral habitus; **f**, head, frontolateral. **e**, scutellar-axillar complex to base of gaster (2015-21).

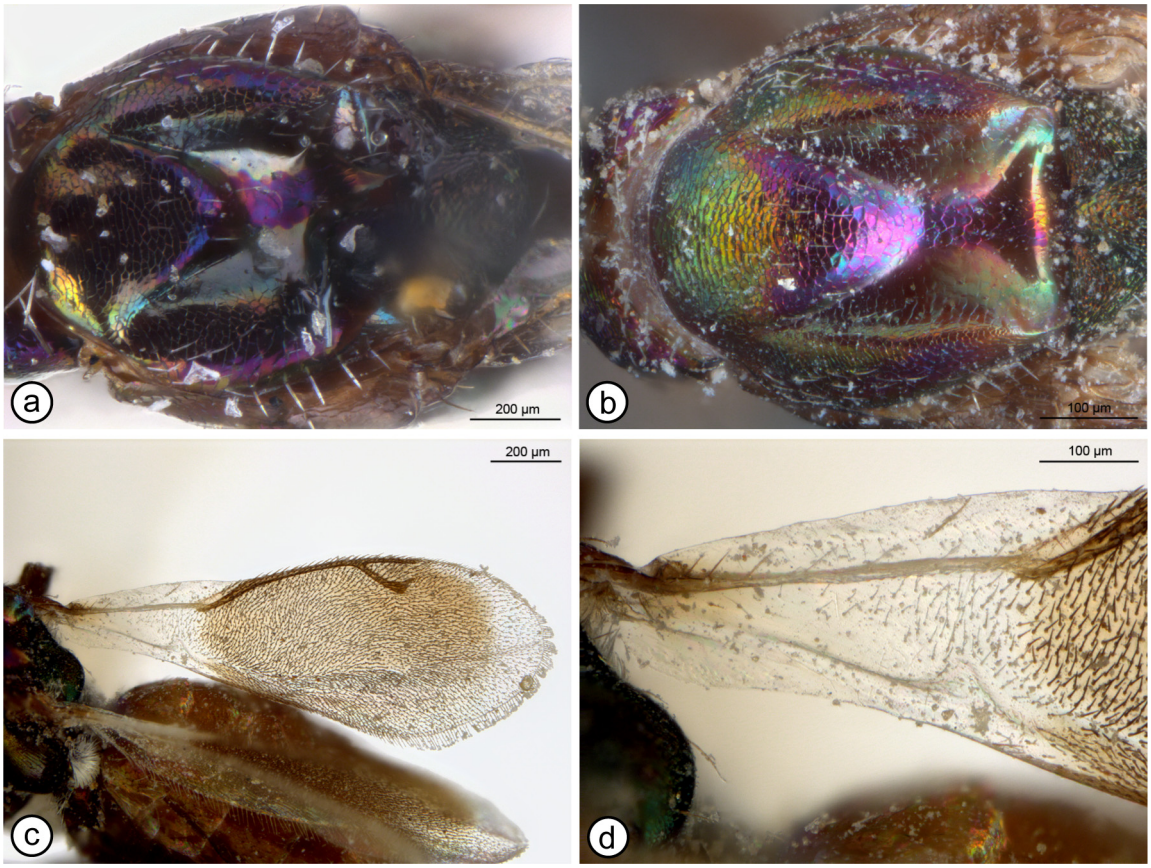

FIGURE 33. *Eupelmus fulgens*, ♀. **a**, mesonotum, dorsal (syntype). *b–d* (2013-50): **b**, mesoscutum, dorsal; **c**, fore wing; **d**, fore wing base.

***E.* (*Eupelmus*) *fulgens* Nikol'skaya n. stat.**
Figs 32a–h (♀), 33a–d (♀)

Eupelmus fulgens Nikol'skaya, 1952: 501 (Russian), 1963: 514 (English). Syntypes, ♀, ZIN, 1♀ examined. Type data: USSR, Soviet Central Asia. Syntype examined label: Курган-тюбе, дол. р. Вахш, Таджик. [Kurgan-Tyube (currently Qurghonteppa), Vakhsh river valley, Tajikistan] 29.VIII.35, Гуссаковский [Gussakovskiy] / Paratypus ♀ *Eupelmus fulgens* Nik. [recent red label].

Description. FEMALE (habitus: Fig. 32a–c). Length = 1.8–2.4 mm. Head (Fig. 32f) primarily green except frons more brownish-coppery to yellowish-green mesally in region between posterior ocelli and scrobal depression and with some reddish-coppery luster on interantennal prominence ventrally between toruli, to extensively reddish-coppery to reddish-violaceous under different angles of light, the genae and temples also with variably distinct and extensive reddish-violaceous lusters; with slightly lanceolate white setae on lower face and parascrobal region to level of dorsal margin of scrobal depression compared to less conspicuous hairlike setae on vertex or frontovertex. Maxillary and labial palps brown or labial palp somewhat lighter in colour. Antenna with scape entirely bright orange (Fig. 32g) to primarily brownish (Fig. 32f) except more orangey-brown basally and with slight metallic green luster apically, but pedicel and flagellum dark brown, the pedicel with slight metallic green luster. Mesosoma with tegula brown (Fig. 32h) to brownish-yellow, with at most only a slender, more yellowish band along inner margin; otherwise dorsally with variably extensive bright reddish-violaceous to reddish-coppery lusters (Fig. 32c, e) on at least pronotum and mesoscutum under different angles of light, though median mesoscutal lobe anteriorly and scutellar-axillar complex variably distinctly and extensively metallic green (Fig. 33a, b), prepectus brown with variably distinct reddish-violaceous lusters similar to mesoscutum, and acropleuron brown with metallic green or coppery-green lusters at least anteriorly and sometimes slight reddish-violaceous lusters mesally (Fig. 32h); prepectus bare (Fig. 32h); pronotum with admarginal setae white; mesonotum with comparatively inconspicuous hairlike to slightly lanceolate white setae except axilla over about posterior half to two-thirds with dense white

setae forming reflective surface (Fig. 32e); callus with conspicuously long and dense white setae forming reflective surface (Fig. 32e). Macropterous; fore wing sometimes with faint brownish infuscation at extreme base of basal cell (Fig. 33d), but at least uniformly though variably darkly infuscate from base of parastigma to somewhat beyond midway between pmv and wing apex (Fig. 33c); costal cell dorsally bare near leading margin (Fig. 33d) (sometimes with dark setae adjacent to parastigma), but ventrally with 1 (within at least basal half) to 2 (apically) rows of white setae; basal cell at least partly bare posteromesally, sometimes with a few brownish setae basally and with variably extensive white setae apically or setae sometimes extending along smv as basally tapered setose region (Fig. 33d); disc entirely setose with brown setae, without linea calva (Fig. 33c). Legs yellowish-orange to dark brown with some coppery to reddish-violaceous lusters on femora (knees sometimes slightly lighter in colour) except mesotibial spur pale and mesotibial apical pegs and mesotarsal pegs dark reddish. Gaster (Fig. 32a, b) with hairlike setae; brown except sometimes with metallic green luster dorsobasally; ovipositor sheaths pale except tip variably distinctly darker apically to subapically (Fig. 32b).

Head in dorsal view with interocular distance about 0.4× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; vertex transversely alutaceous-coriaceous to alutaceous-imbricate; frons (Fig. 32f) sometimes comparatively shiny but completely meshlike coriaceous-alutaceous to in part very slightly imbricate; scrobal depression much more strongly reticulate to reticulate-rugulose; OOL: POL: LOL: MPOD = 1.0–1.1: 2.7: 1.7–2.0: 1.0. Mesoscutum (Fig. 33a, b) with anteromedial lobe mostly alutaceous-imbricate to very finely meshlike reticulate, but sculpture becoming finer posteriorly and sometimes continued to posterior margin of mesoscutum as median band of finer meshlike coriaceous sculpture, with at least inclined surfaces of lateral lobes with less conspicuous subeffaced sculpture and often depressed region almost entirely smooth and shiny (Fig. 32e). Scutellum and axillae (Fig. 32e) low convex, in same plane; axilla reticulate to reticulate-strigose laterally; scutellum reticulate-punctate mesally to reticulate-imbricate laterally anterior to much smoother and shinier, only obscurely sculptured frenal area. Acropleuron (Fig. 32h) more-or-less distinctly meshlike anteriorly, much more minutely sculptured to shiny and virtually smooth mesally, and posteriorly with larger, longitudinally aligned meshlike coriaceous sculpture. Fore wing (Fig. 33c) with cc: mv: pmv: stv = 3.3–3.9: 2.2–2.8: 1.3: 1.0. Middle leg (Fig. 32d) with mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus, the pegs of uniform length or at most only inconspicuously differentiated in length and in single serrate line or only obscurely differentiated into two rows apically, second tarsomere with 4 or 5 pegs, third tarsomere with 1–3 pegs, and fourth tarsomere without pegs on either side. Propodeum with broad plical depression extending to posterior margin, somewhat V- to U-shaped (Fig. 32e). Gaster (Fig. 32a, b) similar in length to combined length of head and mesosoma; not atypically modified, though air-dried specimens usually with syntergum more-or-less flattened over sheaths; extending to or almost to base of third valvula, the latter about 0.52× length of metatibia and slightly shorter to about as long as mv, though apparent sheath length usually much less; hypopygium extending about half or slightly more length of gaster.

MALE. Unknown.

Distribution. Azerbaijan [Mingečaur, Kura, 4.VII.1967, Bouček (Kalina 1988, IAEE: 2♀, one with CNC Photo 2015-21)], Tajikistan, Turkmenistan (Noyes 2014), **Yemen*** [San'a, II.1991, A. van Harten, CNC Photo 2013-50 (CNC: 1♀)].

Biology. Unknown.

Remarks. Although not recorded in Noyes (2014), Kalina (1988) reported *E. fulgens* from Azerbaijan and we saw two females we confirm as this species in his collection. The above description is based on a single syntype (labelled as paratype, Fig. 32a) and the other three females cited above. The female from Yemen is only provisionally identified as *E. fulgens*. The examined syntype lacks its ovipositor sheaths, but these were described as yellow with the tip dark and less than one-half the length of the metatibia. The latter measurement reflects apparent sheath length because measurement of the length of the third valvulae of the other females indicates this as slightly more than half the length of the metatibia. The Yemen female differs from the others in having the basal cell much more extensively setose and is generally darker with the scape mostly dark with slight metallic green luster except somewhat more brownish-orange basally (Fig. 32f), the legs uniformly dark (Fig. 32b), and the head more extensively green with the frontovertex less shiny (Fig. 32f), though the ovipositor sheaths are less distinctly darker apically than for the other females. The syntype is pinned through the posterior depressed region of the mesoscutum, though this appears to be mostly smooth and shiny (Fig. 33a). The Yemen female has a comparatively distinct band of meshlike sculpture medially through the depressed region, with the inclined surfaces of the lateral

lobes shinier and smooth or with subeffaced sculpture that becomes increasingly more obvious dorsally (Fig. 33b). The Azerbaijan females have a similar sculpture pattern or the depressed region with only very fine and obscure, subeffaced meshlike sculpture mediolongitudinally (Fig. 32e). Nikol'skaya (1952) described the legs as light brown with bronze luster and the abdomen as violet-blue. At least the latter does not match the examined syntype (Fig. 32a), though the discrepancy may result from fading. Additional females from Central Asia and Yemen are necessary to better estimate whether the observed differences could reflect interspecific rather than intraspecific variation, though similar variation in the features is also observed within *E. tryapitzini*.

Eupelmus fulgens, E. longicaudus and *E. tryapitzini* comprise the *fulgens* species-group, which is characterized by females sharing the following combination of six features: 1) mesotibial apical pegs present (Figs 32d, 57e, 118d); 2) prepectus bare (Figs 32h, 57g); 3) costal cell dorsally lacking setae along leading margin (Fig. 33d); 4) axillae with slender-lanceolate, anteriorly projecting white setae usually so dense as to form reflective surface over about posterior two-thirds (Figs 32e, 118d) (not conspicuous for some *E. tryapitzini* females, Fig. 118b); 5) posteromedial depressed region of mesoscutum or at least inclined inner surfaces of lateral lobes much smoother and shinier than more strongly sculptured anteromedial convex region (Figs 32e, 33a, b, 57f, 118a, b); and 6) fore wing disc uniformly and comparatively darkly infuscate with dark setae from base of parastigma to about midway between apex of postmarginal vein and wing apex (Figs 33c, 57d, 117d). Of these features, all are putatively derived within *E.* (*Eupelmus*) except for the presence of mesotibial apical pegs. However, all the derived features except for the axillar setal pattern are shared also with some other species. For example, *splendens*-group females share the same putatively derived mesoscutal sculpture pattern (Figs 19d, 62d, 102h) and bare prepectus with *fulgens*-group females, but they lack mesotibial apical pegs (Fig. 102c), a putatively derived feature, and retain the putatively symplesiomorphic features of sparsely setose axillae (Figs 15d, 19e, 62d, 102h) and costal cell dorsally with setae near the leading margin (Figs 15f, 62f, 102i). As such, shared mesoscutal sculpture pattern and a bare prepectus could support the two as monophyletic sister groups, with monophyly of the *fulgens* group indicated by axillar and costal cell setal patterns and that of the *splendens* group by the loss of mesotibial apical pegs. Females of the two groups also have at least partly infuscate fore wings, though differing somewhat in colour pattern. Most *splendens*-group females differ from the described *fulgens*-group fore wing colour pattern in having more-or-less distinctly bifasciate wings, being more hyaline behind the marginal vein in part (Figs 19g, 62f, 102d). The fore wing colour pattern of *E. bicolor* is more similar to *fulgens*-group females except that the infuscation is not as dark (Fig. 15e). Hypotheses of relationships within and between the *fulgens* and *splendens* groups are complicated by at least two species, *E. saharensis* and *E. magdalenae*. Females of *E. saharensis* share a bare prepectus, similar mesoscutal sculpture pattern (Fig. 97e), mesotibial apical pegs (Fig. 97g), and a dorsally bare costal cell with *fulgens*-group females. However, they have a bifasciate fore wing colour pattern (Fig. 97b, f) more similar to most *splendens*-group females (Figs 19g, 62f, 102b), and a more similar mesosomal colour pattern perhaps indicates *E. saharensis* is most closely related to *E. bulgaricus* within the *splendens* group. Because of its character-state combination *E. saharensis* is not assigned to either the *fulgens* or *splendens* group. The unique female of *E. magdalenae* lacks setae dorsally from the costal cell (Fig. 60i), has mesotibial apical pegs (Fig. 60e), and has a similar fore wing colour pattern to *fulgens*-group females, though the infuscation does not extend as far apically, only slightly beyond the apex of the postmarginal vein (Fig. 60h). However, the prepectus is setose (Fig. 60f), the axillae are similarly as sparsely and inconspicuously setose as the scutellum (Fig. 60d, f), and although the inner inclined surfaces of the lateral lobes are more finely sculptured than mediolongitudinally through the posterior depressed region of the mesoscutum the sculpture is more distinct (Fig. 60d) than for *fulgens*-group females. All of these latter features are putatively symplesiomorphic, though the mesoscutal sculpture pattern (Fig. 60d) may represent an intermediate state toward further loss of sculpture from the posterior depressed region of the mesoscutum characteristic of *fulgens*- and *splendens*-group females.

Among the three *fulgens*-group species, *E. fulgens* and *E. tryapitzini* are very similar except for the absence of a linea calva in *E. fulgens* (Fig. 33c) compared to a short linea calva in *E. tryapitzini* (Fig. 12d, f). Males are not known for any *fulgens*-group species; those of *E. saharensis* differ conspicuously from those of *E. matranus* and *E. splendens* in the pedicel lacking apically hooked setae (Fig. 98d, e) and the gena lacking a differentiated, long seta (Fig. 98d). Consequently, associating males with *fulgens*-group females could provide valuable information on the relationships and validity of the *fulgens* and *splendens* groups as presently delineated.

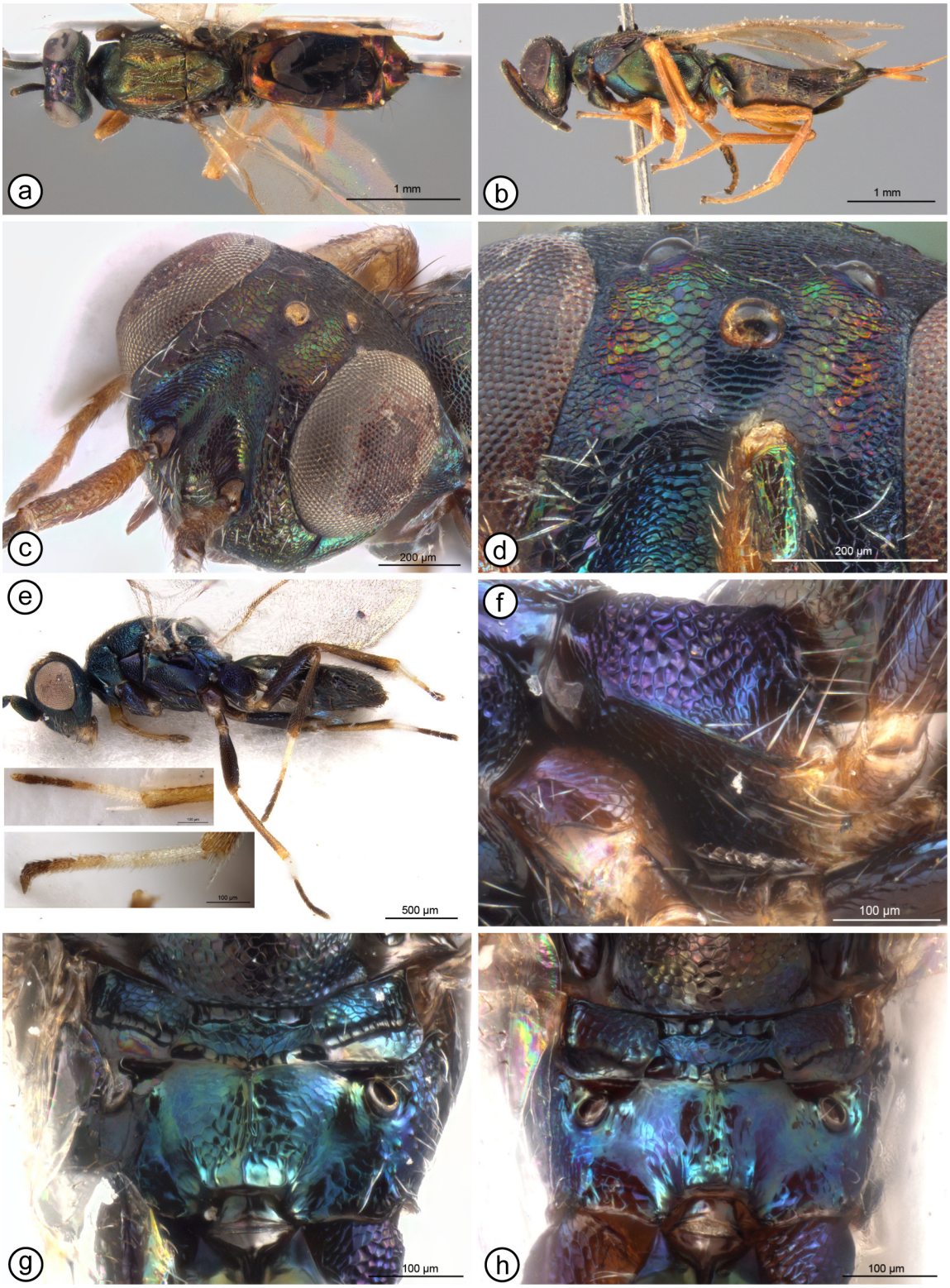

FIGURE 34. *Eupelmus fulvipes. a–d* (female): **a**, dorsal habitus (2013-59); **b**, lateral habitus (2013-58); **c**, head, frontolateral (2013-59); **d**, scrobal depression and frontovertex (2013-58). *e–h* (male): **e**, lateral habitus (2014-127) [insert: 2013-163—mesotarsus (upper), metatarsus (lower)]; **f**, metacoxa, lateral (2014-127); **g**, propodeum (2014-127); **h**, propodeum (2013-163).

E. (*Eupelmus*) *fulvipes* Förster

Fig. 34a–d (♀), e–h (♂)

Eupelmus fulvipes Förster, 1860: 127−128. Unknown type status, ♀, NHMW, lost *vide* Ruschka, 1921: 280. Type data: [Austria].
Eupelmus (Eupelmus) fulvipes; Askew & Nieves-Aldrey, 2000: 52 (misidentification of *E. kiefferi*).
Eupelmus (Eupelmus) fulvipes; Al khatib *et al.*, 2014: 816 (♀ keyed), 819 (♂ keyed).

Description. FEMALE (habitus: Fig. 34a, b). Length = 2.7–3.9 mm. Head with face (Fig. 34c) usually mostly dark violaceous to reddish-violaceous or, particularly along parascrobal region and inner orbit, more coppery, but under some angels of light often lower face and frons in at least narrow band below posterior ocelli often variably extensively greenish (Fig. 34d), and scrobal depression often with some bluish to purple luster (Fig. 34c, d); with white hairlike to slightly lanceolate setae. Maxillary and labial palps brown. Antenna with scape usually mostly yellowish to orange (Fig. 34c), though sometimes darker brown dorsoapically or rarely more extensively dark with metallic luster dorsally and ventrally, but at least distinctly orange mediolongitudinally; pedicel and flagellum dark except pedicel dorsally and sometimes flagellum basally with some metallic lusters. Pronotum blue to purple laterally; admarginal setae dark. Mesonotum (Fig. 34a) with hairlike to slightly lanceolate setae, the setae white except sometimes anteriorly; usually mostly green except often for some coppery luster on scutellum and/or dorsolongitudinal ridge of lateral lobe, and sometimes more-or-less extensively along lateral margin of lateral lobe, though sometimes with some bluish luster, most commonly within depressed posteromedial region of mesoscutum or rarely more extensively under some angles of light. Prepectus brown or with variably extensive blue to purple lusters similar to pronotum laterally; extensively setose, with white, hairlike setae. Tegula dark brown or with some greenish luster. Acropleuron sometimes more brownish in smaller individuals, but usually mostly green with variably distinct and extensive coppery luster. Metanotum and propodeum variably distinctly green at least laterally, though dorsellum and plical depression often darker without distinct metallic luster; callus with white setae similar to mesoscutum. Macropterous; fore wing hyaline with uniformly yellowish to brownish setae; costal cell dorsally near leading margin with setae in 1 to partial 2 rows over at least apical half to three-quarters, and ventrally with at least 3 rows along length; basal cell and disc entirely setose except for elongate linea calva extending to level equal with apex or about middle of parastigma. Legs except for mesotibial apical pegs and mesotarsal pegs often entirely pale beyond coxae (Fig. 34b), though sometimes posterior surface of profemur variably brownish to dark over about mesal or ventromesal one-third, and then metafemur sometimes also with slight brownish tinge on posterior surface, but not distinctly dark. Gaster (Fig. 34a, b) with hairlike setae; mostly brown to coppery-brown except basal tergum usually more-or-less distinctly green basally and apical terga usually also with some greenish luster; ovipositor sheaths variably distinctly banded, sometimes almost uniformly pale beyond dark basal band, but at least with apical band lighter brown than basal dark band.

Head in dorsal view with interocular distance about 0.4× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; vertex transversely reticulate-imbricate and differentiated from occiput by transverse ridge; frons variable, but usually variably distinctly reticulate-imbricate to reticulate, at least laterally toward inner orbit (Fig. 34d); scrobal depression distinctly reticulate to transversely reticulate-rugulose, including most of scrobes (Fig. 34c); OOL: POL: LOL: MPOD = 0.7–0.8: 2.2–2.6: 1.2–1.3: 1.0. Mesoscutum (Fig. 34a) meshlike reticulate except medial lobe extensively reticulate-imbricate and lateral lobe with mediolongitudinal band of minute coriaceous sculpture. Scutellum and axillae low convex in same plane; axilla variably extensively meshlike coriaceous to reticulate anteriorly but more reticulate-imbricate posteriorly; scutellum coriaceous medially and longitudinally reticulate-imbricate laterally anterior to meshlike coriaceous frenal area. Acropleuron meshlike anteriorly and posteriorly of much more minutely sculptured mesal region, the sculpture often larger and more distinctly reticulate posteriorly than anteriorly. Fore wing with cc: mv: pmv: stv = 4.5–5.2: 4.2–5.3: 1.2–1.3: 1.0. Middle leg with row of 4–8 mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus and pegs clearly differentiated into two rows apically, second tarsomere with 4–6 pegs, third tarsomere with 2–4 pegs, and fourth tarsomere with 1 or 2 pegs apically on either side. Propodeum with broadly U-shaped plical depression extending to posterior margin. Gaster (Fig. 34a, b) similar in length to combined length of head and mesosoma; not atypically modified; extending to or almost to apex of second valvifer, the latter sometimes extending slightly beyond gastral apex, with third valvula 0.59–0.75× length of metatibia and 0.64–0.75× length of mv.

MALE (based on two specimens, one (GDEL4011/3702bis, GDPC) with an associated DNA sequence, labelled "France, Hérault, Riols ND Trédos, 580m, 43 30 08N 02 50 47E, ex. *Diplolepis rosae* sur *Rosa canina*, Gérard Delvare", and a second (CTPC) labelled "[Hungary] Pécs, 1971.vii.26, Szalay, Rózsalevél [rose leaf]"). Similar to males of *E. kiefferi*, including metacoxa distinctly angulate at about middle to apical two-thirds and with dorsoapical margin beyond angulation raised into irregular, slender flange (Fig. 34f); propodeum at least without strong median carina, mesally with fine, irregular longitudinal striae (Fig. 34h, Hungary) to more distinctly striate-reticulate (Fig. 34g, France), but without transverse carinae and therefore not distinctly rugose; mesotarsus with only basitarsus white, the subsequent tarsomeres either similarly dark brown (Fig. 34e, France) or second tarsomere paler, more yellowish, intermediate in colour between white basitarsus and apical three, similarly dark tarsomeres (Fig. 34e, upper insert, Hungary); metatarsus with at least basal tarsomere white and apical two (Fig. 34e, lower insert, Hungary) or three (Fig. 34e, France) tarsomeres dark, the remaining tarsomeres white to intermediate in colour between basal and apical tarsomeres.

Distribution. **Azerbaijan*** (SIZK), France (**San Rafael***: MNCN), Germany, **Hungary*** (CTPC, HNHM), Iran (Lotfalizadeh *et al*. 2007), **Montenegro*** (CTPC), Romania, **Turkey*** (MKUI).

Biology. Apparently restricted to *Diplolepis* galls on *Rosa.* **Hymenoptera**: CYNIPIDAE—*Dipolepis mayri* (Schlechtendal)* (MKUI, SIZK, ZMAN), *Diplolepis rosae* (L.) on *Rosa canina*, and *Diplolepis eglanteriae* (Hartig)* (AICF), *D. rosae* on *Rosa* sp. (CTPC), and *Diplolepis spinosissimae* (Giraud) on *Rosa* sp. (Al khatib *et al.* 2014).

We saw a single female of *E. fulvipes* and *E. kiefferi* from Turkey mounted on the same card that were reared from *D. mayri*, and thus likely reared together from the same gall or the same lot of galls.

Remarks. Prior to Al khatib *et al.* (2014), the name *E. fulvipes* was misinterpreted by authors in the sense of *E. kiefferi* (see under latter species), including Askew & Nieves-Aldrey (2000), who were the first to classify the name in *E*. (*Eupelmus*). However, Lotfalizadeh *et al.* (2007) correctly interpreted the species because they keyed it out based on the legs being entirely pale beyond the coxae and the scape being brownish (compared to blackish in *E. urozonus*); the given host (Rose gall wasps) is also the correct one for the species. Because of the change of concept, the distribution and hosts listed above are only those given in Al khatib *et al.* (2014) and seen by us rather than those listed by Noyes (2014).

Eupelmus fulvipes is included in the *fulvipes* species-group along with *E. brachystylus, E. flavicrurus, E. formosae, E. kamijoi, E. kiefferi, E. luteipes, E. tachardiae, E. tremulae* and *E. xenium* because at least males of these nine species share a vertexal carina. Our concept of *E. fulvipes* is as a strictly western Palaearctic species that currently is known as far east as Azerbaijan. Females are characterized by an obviously pale scape (at least mediolongitudinally) in combination with entirely or almost entirely pale legs (profemur with posterior surface sometimes brownish or even dark mesally, but metafemur at most with slight brownish tinge and protibia and metatibia pale) and a variably extensively but at least partly roughened frons along the inner orbits (Fig. 34d). Under this concept the species is also uniquely associated with various *Diplolepis* species on *Rosa*. However, because females exhibit at least some variation in scape and leg colour patterns we are not entirely confident of our current concept or the distributional limits of the species (see under *E. kiefferi*). In the western Palaearctic *E. fulvipes* females are most likely to be confused with some *E. pistaciae* females because of their scape and leg colour patterns, but the latter lack a vertexal carina and at least the pronotum laterally has a coppery (Fig. 88e, f) rather than blue to purple luster. Females are even mores similar to those of some species we restrict to the far eastern Palaearctic, particularly *E. flavicrurus, E. luteipes* and some *E. formosae* (see under latter species).

We have seen only two males we include in *E. fulvipes*, one definitively identified through sequencing, though both reared from *Diplolepis*. Because of the same metacoxal structure the two males resemble *E. kiefferi* males (*cf* Figs 34f, 51f), and the two are insufficient to determine whether their tarsal colour or propodeal sculpture patterns (*cf* Figs 34g, h with 52e–h) might differentiate males of the two species, particularly because what we currently interpret as intraspecific variation in *E. kiefferi* overlaps that of the two *E. fulvipes* males. Host alone is insufficient to differentiate reared males because both species have been reared from *Diplolepis* species. The male from France has a more strongly sculptured propodeum (Fig. 34g) and a darker tarsal colour pattern (Fig. 34e) than the male from Hungary (Fig. 34e, upper and lower inserts), and is the larger individual, about 2.2 *versus* 1.9 mm.

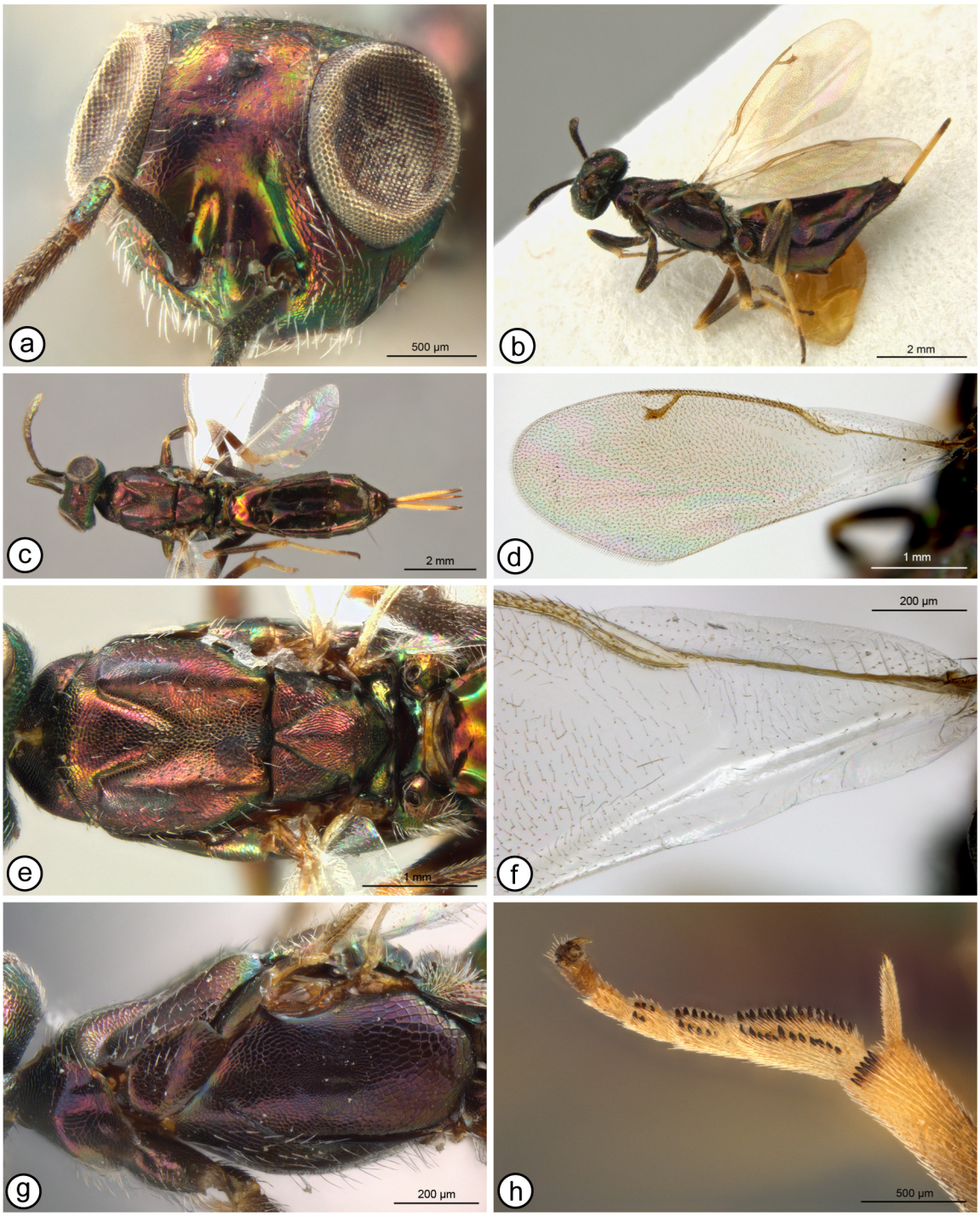

FIGURE 35. *Eupelmus gelechiphagus*, ♀. *a, c, e* (2013-26): **a**, head, frontal; **c**, dorsal habitus; **e**, mesosoma, dorsal. **b**, lateral habitus (2013-27). **d**, fore wing (2013-28). **f**, fore wing base (2013-93). **g**, mesosoma, lateral (2013-29). **h**, apex of mesotibia and mesotarsus (2013-26).

***E.* (*Eupelmus*) *gelechiphagus* Gibson & Fusu n. sp.**
Figs 35a–h (♀), 36a–f (♂)

Type material. Holotype ♀ (CNC). SAUDI ARABIA: Aseer, Khamis Mushayt, Wadi bin Heshbel, 9.viii.2002, H. A. Dawah / Ex. Gelechiid gall, *Amblypalpus* [sic] *olivierella* on *Tamarix aphylla* / HOLOTYPE ♀ *Eupelmus* (*Eupelmus*) *gelechiphagus* Gibson & Fusu, det. G. Gibson 2015. Condition: point-mounted; uncontorted; entire, but eyes collapsed.

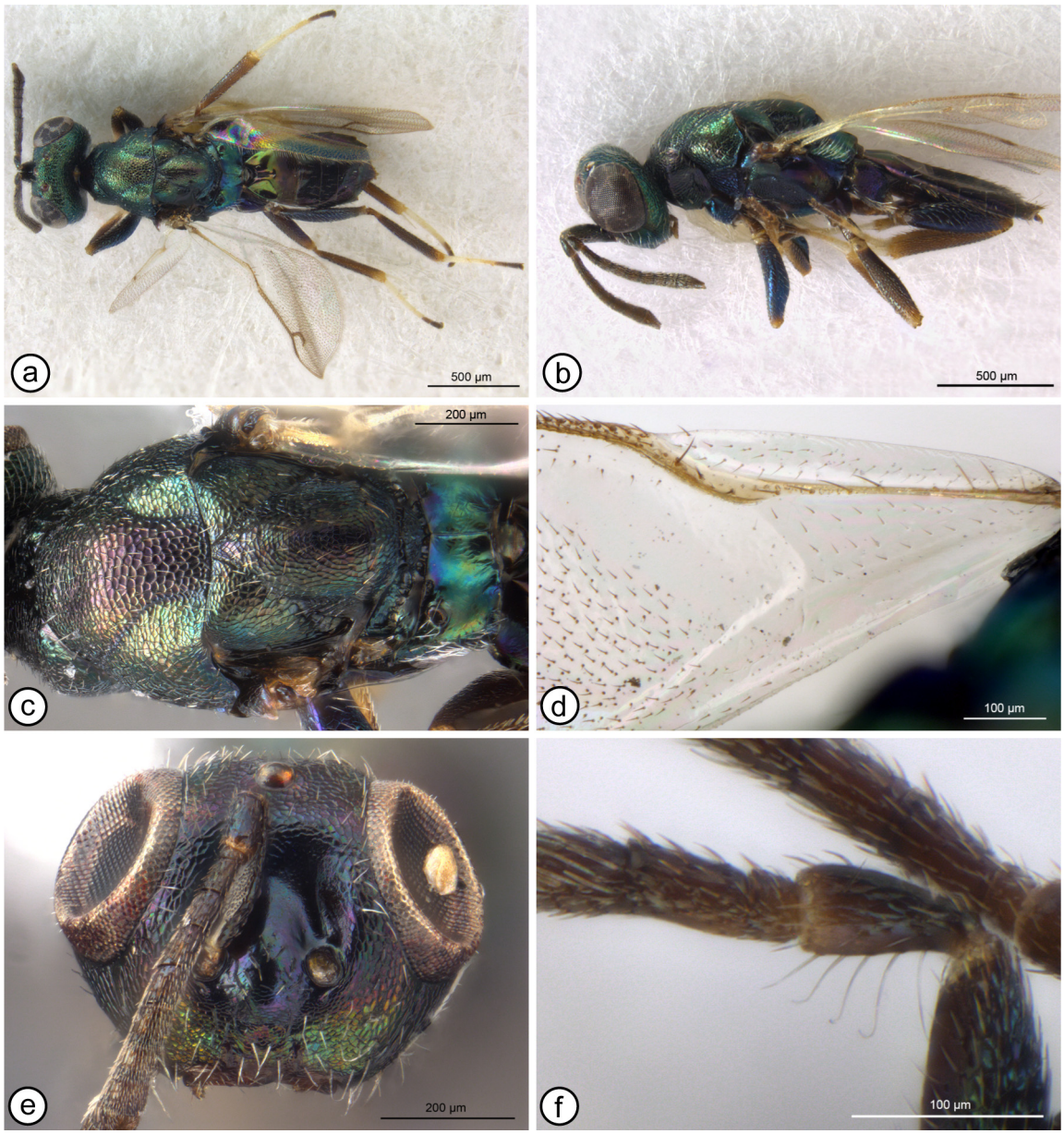

FIGURE 36. *Eupelmus gelechiphagus*, ♂. *a, d* (2013-94): **a**, dorsal habitus; **d**, fore wing base. **b**, lateral habitus (2014-129). *c, e* (2013-96): **c**, mesosoma, dorsal; **e**, head, frontal. **f**, pedicel to base of fl3, outer view (2013-95).

Paratypes (24♀ & 10♂). **Iran**: Kerman prov., Bardsir, Bidkhan, N29°40'31.8" E56°31'32.9", 2462 m, col. 13.VI.2012, em. VII.2012, Asma Moeinadini, gall on *Tamarix* (AICF: 1♀, SBUK: 1♀); same data except N29°40.661' E56°35.042', 2361 m, col. 25.IV.2012, em. VII.2012 (1♀, 1♂: AICF, SBUK: 2♀). **Israel**: VIII.1982, Gerling leg, *Amblypalpus oliviella* [sic] on *Tamarix*, collectie Zoölogisch Museum Amsterdam (RMNH: 4♀, three with CNC Photo 2013-27, 2013-28 and 2013-29; 1♂, CNC Photo 2013-94). Holon, 15.VIII.1971 (3♀), 10.IX.1971 (4♀, one with CNC Photo 2013-26), 25.IX.1972 (1♂), A. Lupo (all TAUI). Nahal Ze'elim, 12 km S. Ein Gedi, 19.VII.1971, D. Gerling, ex/on *Amblypalpis olivierella* gall, plant col. on 1.VI.1971 (NMPC: 1♀, 2♂ on two cards on single pin). Nahal Ze'elim, gall of *Amblypalis olivierella* collected 5.VII.1982, opened 17.X.1982, 11414 (1♀, 3♂ TAUI). **Saudi Arabia**: same data as holotype except collected 20.VIII.2002 (2♀, 1♂ with CNC Photo 2014-129), 25.VIII.2002 (3♀, one with CNC Photo 2013-93; 2♂, CNC Photo 2013-95 and 2013-96) (all CNC).

Etymology. A combination of the host family name, Gelechiidae, and the Greek word *phagos* (eating), in reference to the host association.

Description. FEMALE (habitus: Fig. 35b, c). Length = 2.6–3.9 mm. Head, including vertex and occiput, usually mostly reddish-coppery to reddish-violaceous with limited green luster under some angles of light (Fig.

35a), though rarely extensively green with only limited reddish-violaceous luster; with hairlike to slightly lanceolate white setae on lower face and parascrobal region to or slightly above dorsal level of scrobal depression compared to less conspicuous hairlike setae over most of frontovertex. Maxillary and labial palps brown. Antenna dark, but scape and pedicel with at least slight green to bluish-green luster. Mesosoma (Fig. 35e, g), including pronotum at least laterally, reddish-coppery to reddish-violaceous with very limited green to bluish-green lusters, most commonly on acropleuron mesally and in narrow region between apex of acropleural sulcus and prepectus, and sometimes anteriorly on anteromedial lobe, extreme posterolateral surface of mesoscutal lateral lobe, lateral and posterior margins of mesonotum or scutellar-axillar complex, metanotum, and margins of prepectus under some angles of light; mesonotum with hairlike to slightly lanceolate white setae. Pronotum with admarginal setae pale; prepectus with 4–7 setae in dorsal half (Fig. 35g); callus with obviously longer and denser white setae than on mesoscutum but not obscuring cuticle (Fig. 35g). Macropterous; fore wing hyaline or with slight yellowish tinge behind discal venation (Fig. 35d), the disc with yellowish to brown setae; costal cell (Fig. 35f) with a variable number of setae immediately adjacent to parastigma but bare near leading margin except sometimes for 1 or 2 setae at extreme apex associated with setae along parastigma, and ventrally with about 3 rows of comparatively inconspicuous white setae along length; basal cell (Fig. 35f) entirely setose with white setae and disc setose except for linea calva, but setae of basal cell and disc separated by posteriorly open, oblique bare band (speculum) behind base of parastigma. Front leg dark except trochantellus, knee, tibia apically, and at least basitarsus pale. Middle leg with similar colour pattern as front leg except tarsus with all but apical tarsomere and often trochanter also pale, but mesotibial apical pegs and mesotarsal pegs dark. Hind leg similar to middle leg except basal three or four tarsomeres pale. Gaster (Fig. 35b, c) brown with similar reddish-coppery luster as mesosoma except basal tergite anteriorly often with more distinct green luster at least laterally and apices of tergites often with variably distinct greenish luster; ovipositor sheaths distinctly banded, but medial pale band elongate with basal dark region consisting only of transversely crenulated part of sheaths and apical, usually light brown region only about 0.2 length of third valvulae.

Head in dorsal view with interocular distance about 0.4× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; vertex alutaceous-coriaceous to alutaceous-imbricate; frons meshlike coriaceous (Fig. 35a) to inconspicuously meshlike reticulate, the sculpture delineated by at most very slightly raised lines; scrobal depression smooth and shiny (Fig. 35a); OOL: POL: LOL: MPOD = 0.8–0.9: 2.5–2.6: 1.6: 1.0. Mesoscutum (Fig. 35e) almost uniformly meshlike reticulate except reticulations slightly deeper within posteromedial depressed region and lateral lobe with variably distinct mediolongitudinal band of minute coriaceous sculpture. Scutellum and axillae low convex in same plane; axilla mostly meshlike reticulate or reticulate-imbricate to diagonally imbricate posteriorly; scutellum longitudinally reticulate-imbricate and frenal area meshlike coriaceous-reticulate. Acropleuron (Fig. 35g) more-or-less isodiametric meshlike anteriorly and posteriorly and much more minutely sculptured mesally, the larger meshlike sculpture coriaceous-reticulate, the cells at most delineated by only slightly raised lines. Fore wing (Fig. 35d) with cc: mv: pmv: stv = 4.0–4.9: 3.3–4.2: 1.0–1.3: 1.0. Middle leg (Fig. 35h) with row of 4–6 mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus, the pegs variably distinctly differentiated into two rows apically; second tarsomere with 5–7 pegs and third tarsomere with 2 or 3 pegs apically on either side, but fourth tarsomere without or at most with 1 dark spine on one side. Propodeum with broadly U-shaped plical depression extending to posterior margin (Fig. 35e). Gaster similar (Fig. 35b, c) in length to combined length of head and mesosoma; not atypically modified; usually extending to base of third valvula, the latter about 1.0–1.12× length of metatibia and 1.3–1.5× length of mv [apparent sheath length measured in original description]; hypopygium slightly over half length of gaster.

MALE (habitus: Fig. 36a, b). Length = 2.1–2.4 mm. Head (Fig. 36e) with face dark or with violaceous to reddish-coppery lusters from level of anterior or posterior ocelli through interantennal prominence, but lower face, vertex, and usually variably extensively along inner orbit above level of scrobal depression green to slightly bluish-green; frons meshlike coriaceous to very shallowly reticulate; vertex uniformly curved into occiput, reticulate to reticulate-imbricate with transverse sculpture having sharp, raised edges partly aligned transversely but not into transverse ridge or carina; scrobal depression variably conspicuously sculptured but smooth and shiny at least ventrally through scrobes and interantennal prominence; setae hairlike, white; lower face with setae somewhat longer toward malar sulcus, but evenly distributed and longer setae straight to uniformly curved (Fig. 36e); gena posterior to malar sulcus with 1 seta conspicuously longer than others though only slightly longer than longest setae of lower face, and posterior to eye with apices of setae directed toward orbit. Antenna with scape entirely

dark; pedicel (Fig. 36f) about twice as long as wide, ventrally with row of 5 long white setae, of which all but usually apical seta hook-like curved apically; length of pedicel + flagellum about 1.1× head width; flagellum distinctly clavate with funiculars obviously increasing in width to clava having ventrally flat or collapsed micropilose sensory region; anellus usually almost quadrate but at least a distinct, dull, setose segment similar to subsequent flagellomeres (Fig. 36f); funicle with fu1 about 0.6–0.7× as long as pedicel 1.7–1.8× as long as wide, and apical funiculars slightly transverse; basal funiculars without differentiated region of setae ventrally. Maxillary and labial palps brown though apical maxillary palpomere sometimes paler apically. Mesosoma (Fig. 36b, c) with pronotum and mesonotum green to slightly bluish-green at least laterally, more commonly variably extensively and distinctly reddish-coppery or violaceous mesally (Fig. 36c), and propodeum bright bluish-green to green (Fig. 36c); setae hairlike, white; tegula dark brown. Front leg dark except following pale: femur narrowly apically, tibia basally, apically and longitudinally on anterior and posterior surfaces, and at least basitarsus. Middle leg dark except knee, tibia at least apically, tibial spur and basal 3 tarsomeres pale, with tibia usually lighter yellowish-brown than femur at least longitudinally along ventral length or anterior surface. Hind leg with similar colour pattern as middle leg except tibia more uniformly dark other than basally and apically. Fore wing with mv about 2.7–3.0× length of stv; costal cell dorsally usually bare near leading margin, but at most with 1 seta apically, and ventrally with multiple setae apically but with only single row of comparatively inconspicuous white setae basal to parastigma (Fig. 36d); basal cell delineated by inconspicuous white setae on mediocubital and basal folds and almost bare to evenly setose but with white setae (Fig. 36d); speculum open posterobasally (Fig. 36d). Propodeum (Fig. 36c) with complete median carina, panels variably extensively meshlike coriaceous to very finely reticulate at least posteriorly.

Distribution. Iran, Israel, Saudi Arabia.

Biology. A gregarious parasitoid of *Amblypalpis olivierella* Ragonot (Lepidoptera: Gelechiidae) on *Tamarix aphylla* (L.) (Tamaricaceae). From 3 to 16 individuals can be found within a single gall of *A. olivierella* (Hassan Dawah, Jazan University, Saudi Arabia, pers. comm.).

Remarks. Because of their comparatively long ovipositor sheaths (Fig. 35b), coriaceous frons and smooth and shiny scrobal depression (Fig. 35a), females are most similar to those of *E. azureus*. However, females of *E. gelechiphagus* have a different colour pattern, including having pale rather than dark pronotal admarginal setae. Among those species characterized by relatively long ovipositor sheaths and a distinctly sculptured mesoscutum, females are unique in lacking a line of setae along the leading margin of the costal cell dorsally (Fig. 35f, not to be confused with setae on fold adjacent to parastigma). The absence of costal cell setae is shared with *fulgens*-group females, but *E. gelechiphagus* female have hyaline to only slightly yellowish wings (Fig. 35d) and a more coarsely sculptured mesoscutum (Fig. 35e).

The paratype from Nahal Ze'elim, particularly its head, is much more extensively greenish than for the other paratypes, but even so the body is partly reddish-coppery. Sculpture of the frons is somewhat variable, definitely coriaceous in some females but with the meshlike sculpture at least partly defined by very slightly raised lines in others so as to be reticulate by definition, though very inconspicuously so, similar to different males.

Males of *E. gelechiphagus* are also similar to those of *E. azureus*, but like females the setae of the basal and costal cells are whitish, obviously lighter in colour than the discal setae (Fig. 36d), and the costal cell dorsally is essentially bare, with at most one or two setae near the leading margin (Fig. 36d) rather than being setose near the leading margin for a distance at least equal to the length of the parastigma (see also under *E. cerris*). Available males also have the setae of the head and mesosoma more distinctly white (Fig. 36e) than *E. azureus* males and the mesonotum usually is variably distinctly bicoloured, being variably distinctly reddish-coppery to violaceous mesally and greenish to bluish-green laterally (Fig. 36c). Males of *E. azureus* have the mesonotum uniformly blue to somewhat greenish-blue or somewhat darker blue to purple laterally, and darker, brownish setae on the head, pronotum and mesonotum. Further, males of *E. azureus* have the mesotibiae more uniformly dark than those of *E. gelechiphagus*, which have the ventral or anterior surfaces of the mesotibiae longitudinally at least somewhat lighter in colour.

E. (*Eupelmus*) *gemellus* Al khatib

Figs 37a–h (♀), 38d, g (♂)

Eupelmus (*Eupelmus*) *gemellus* Al khatib *in* Al khatib *et al.*, 2015: 141–142. Holotype ♀, MHNG, examined. Type data:

France, Haute-Corse, Calenzana, 11.ix.2012, F. Ceccaldi, ex. *Bactrocera oleae* on *Olea europaea*, emerged 18.ix.2012 (FAL1515/10408).

Eupelmus (*Eupelmus*) *gemellus* Al khatib *in* Al khatib *et al.*, 2014: 828–837 (unavailable name; original description, keyed, illustrated).

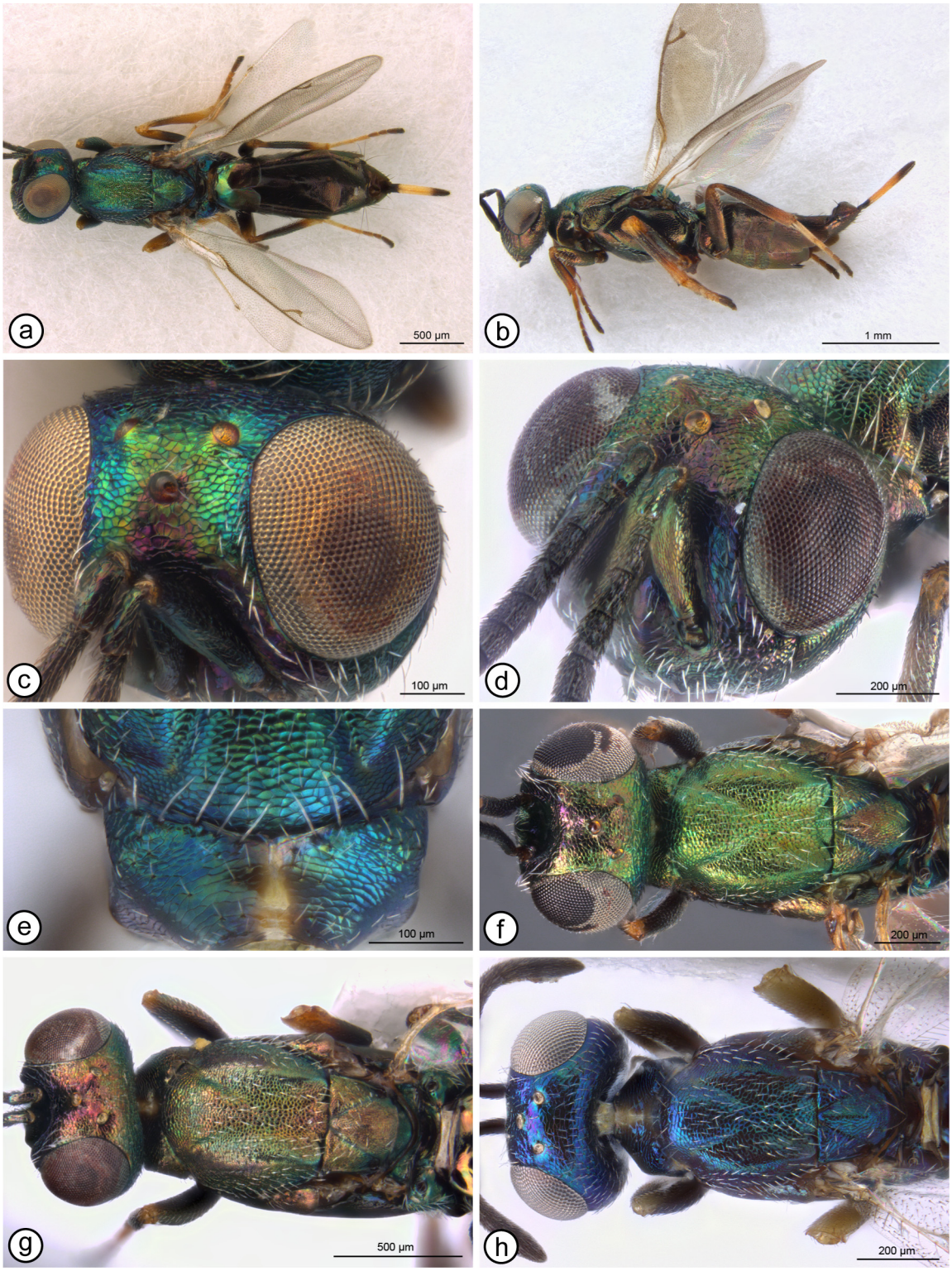

FIGURE 37. *Eupelmus gemellus*, ♀. *a, c* (2013-170): **a**, dorsal habitus; **c**, frontovertex. **b**, lateral habitus (2013-171). **d**, head, frontolateral (2013-173). **e**, pronotum, anterior view (2013-169). *f–h* (head and mesosoma, dorsal): **f**, 2013-174; **g**, 2013-173; **h**, 2013-172.

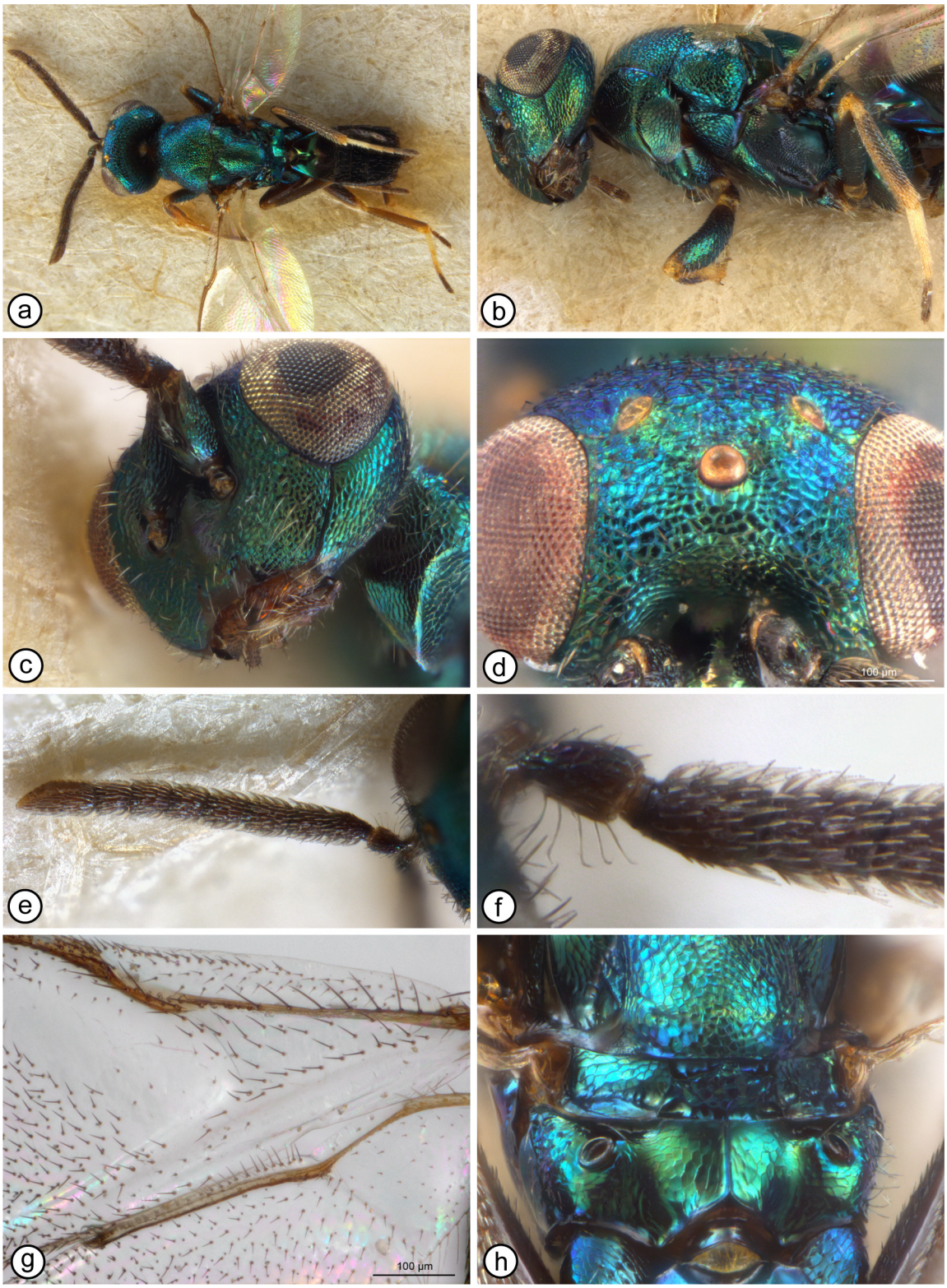

FIGURE 38. *Eupelmus gemellus/martellii*, ♂. *a–c, e, f, h* (MNHN *E. martellii* syntypes): **a**, dorsal habitus; **b**, head and mesosoma, lateral; **c**, lower face and gena; **e**, flagellum; **f**, pedicel to base of fl4; **h**, scutellum to propodeum. *d, g* (*E. gemellus*, 2013-115): **d**, upper part of scrobal depression and frontovertex; **g**, fore wing base.

Description. FEMALE (habitus: Fig. 37a, b). Similar to *E. confusus* except as follows. Pronotum with admarginal setae entirely, uniformly pale (Fig. 37e); not contrasting in colour with mesoscutum, usually green (Fig. 37f) to bluish green with coppery to slightly reddish-coppery luster laterally (Fig. 37g), though sometimes blue to partly purple if mesonotum also rarely mostly blue to purple (Fig. 37e, h); mesonotum usually green to bluish-green and

then sometimes with some coppery luster (Fig. 37f, g), usually most distinctly on scutellar-axillar complex (Fig. 37f), but sometimes mostly blue to purple (Fig. 37h). Ovipositor sheaths with third valvulae 0.70–0.96× length of metatibia and 0.93–1.24× length of marginal vein.

MALE (habitus: *cf* Fig. 38a). Similar to *E. confusus* except as follows. Pedicel ventrally with 4 or rarely 5 long setae of which all but usually apical-most seta curved (*cf* Fig. 38f). Fore wing costal cell ventrally usually with two complete rows along length (Fig. 38g), though sometimes in single row basally, and dorsally near leading margin with at least 12 dark setae apically for at least about half length. Pronotum usually with neck at angle of about 45° relative to mesonotum (*cf* Fig. 38b). Head (Fig. 38d) commonly with frontovertex or at least frons more distinctly blue or purple along orbits compared to dark or somewhat more greenish to greenish-coppery mesal region from scrobal depression to ocelli or continuously through frontovertex. Middle and/or hind legs often with only basitarsus white in contrast to more distinctly yellowish-brown to increasingly darker subsequent tarsomeres.

Distribution. Croatia* (MHNG, NMPC), France, Italy, **Portugal*** (RMNH), Spain, **Turkey*** (USNM).

Biology. Al khatib *et al.* (2014) reared *E. gemellus* from species of Tephritidae (Diptera), Cynipidae, Tenthredinidae, and Torymidae (Hymenoptera) and Gelechiidae (Lepidoptera). We also saw specimens labelled as reared from the following Orders. **Coleoptera**: ? ex. *Exapion* (= *Apion*) *fuscirostre* (Fab.) (Brentidae) + ? ex. curclionid & *Bruchus* (Chrysomelidae)? from *Calicotome spinosa* (L.) (Fabaceae) (USNM). **Hymenoptera**: EURYTOMIDAE—ex. *Eurytoma gallephedrae* Askew (ARPC); ex. stem gall *Eurytoma* sp. on *Ephedra nebrodensis* Tineo (Ephedraceae) (MNCN).

Additional plant associates from those given by Al khatib *et al.* (2014) are as follows: ex. *Pistacia lentiscus* L.* fruits (Anacardiaceae) (AICF, ARPC); sweeping *Juniperus oxycedrus* L. (ARPC, ZMAN), on *Juniperus thurifera* L. (ZMAN), with *Juniperus* fruit (USNM) (Cupressaceae); on *Euphorbia antiquorum* L. (= *E. arborescens*) (ZMAN) (Euphorbiaceae); sweeping *Ephedra fragilis* Desf. seeds (ARPC); galls on *Rhamnus alaternus* L. (Rhamnaceae) (ZMAN);

Remarks. The holotype of *E. gemellus* is entire and not noticeably affected by DNA extraction.

The molecular results of Al khatib *et al.* (2014) support three separate species in what Gibson (2011) had differentiated as *E. martellii*. Females of *E. confusus* are distinguished from those of *E. gemellus* and *E. martellii* by having the pronotal admarginal setae dark at least mesally (*cf* Figs 25g, 37e), typically having a contrasting pronotal-mesoscutal colour pattern (*cf* Figs 25e, 37f–h), and usually having somewhat shorter ovipositor sheaths (*cf* Figs 25b, 37b). As suggested by the results of Al khatib *et al.* (2014), we found *E. gemellus* to be much less common in Europe than *E. confusus*.

Al khatib *et al.* (2014) distinguished females of *E. gemellus* from those of *E. martellii* by the former having bluish reflections laterally on the frontovertex (Fig. 37c) and on the mesoscutum, and the mesonotum only sometimes having slight coppery reflections (e.g. Fig. 37f), whereas females of *E. martellii* were stated to have the head and mesosoma entirely bronze greenish without bluish reflections (Fig. 61f, g). Although females we identify as *E. gemellus* often have at least a bluish-green luster if not being distinctly blue (Fig. 37h), colour appears to be more variable (Fig. 37f–h) than described by Al khatib *et al.* (2014), including sometimes being mostly green (Fig. 37f) or greenish with quite extensive coppery to reddish-coppery lusters (Fig. 37g), and thus more similar to that described for *E. martellii*. Two MNHN female syntypes of *E. martellii* have a mostly green mesonotum (Fig. 61a, d), but also have the frontovertex variably extensively bluish under some angles of light (Fig. 61b). Another 10 topotypic females (Fig. 61e) and 11 males (MHNG) from Tripoli, Libya, reared from the olive fruit fly we identify as *E. martellii* have the mesoscutum variably extensively green because they vary in the amount of coppery luster (Fig. 61g, h), and the frontovertex variably extensively green without or with a slight bluish luster under some angles of light (Fig. 61f). The more greenish females of *E. gemellus* that lack distinct bluish luster from either the frontovertex or mesonotum are very similar to those Tripoli females of *E. martellii* with relatively little coppery luster (*cf* Figs 37f, 61g). Additional sequenced material is required to more confidently establish morphological limits for correct identifications. Correct identification of the three putative species is made more difficult by all being reared from the same or taxonomically similar hosts, including both *E. gemellus* and *E. confusus* from the Oriental chestnut gall wasp and all three from the olive fruit fly. Females of *E. microzonus* mounted in such a manner that the mesotarsal peg pattern is not observable can also be easily mistaken for *E. gemellus*, but the former have a bicoloured (Fig. 69d) rather than a uniformly dark (Fig. 25e) tegula.

Some females we identify as *E. gemellus* have ovipositor sheaths equal to or exceeding the length of the marginal vein, and could be confused with *E. annulatus* females, but should key through the second half of couplet

53 because of the frons being as least slightly roughened in part and the ovipositor sheaths quite abruptly banded apically.

Males of *E. gemellus* and *E. martellii* are similar to those of *E. confusus* except for having fewer pedicular setae (*cf* Figs 38f, 26g) and a few other less conspicuous differences discussed under *E. confusus*, and are also similar to males of *E. acinellus*, *E. stenozonus* and *E. tanystylus* because of their uniformly rounded occiput and uniformly distributed and curved setae on the lower face. We cannot presently distinguish males of *E. gemellus* from *E. martellii* and most of the images presented for the species pair are from syntype males of *E. martellii*.

***E.* (*Eupelmus*) *hayei* Gibson & Fusu n. sp.**
Fig. 39a–g (♀)

Type material. Holotype ♀ (CNC). SWITZERLAND: Jura; Courroux, 9.vi.2008, leg. T. Haye / sweep net sample from *Capsella bursa-pastoris* meadow / HOLOTYPE ♀ *Eupelmus* (*Eupelmus*) *hayei* Gibson & Fusu, det. G. Gibson 2015. Condition: point-mounted; uncontorted; entire.

Etymology. Named in honour of Tim Haye, CABI, Delémont, Switzerland, who has reared and collected many chalcid species during investigation of potential biological control agents for insect pests.

Description. FEMALE (habitus: Fig. 39a). Length = 2.4 mm. Head (Fig. 39c) mostly dark but with slight bluish luster under some angles of light, particularly occiput and lower face, and frons with setae originating from small, coppery to somewhat reddish-violaceous spots; with slightly lanceolate white setae at least on lower face and parascrobal region to level of dorsal margin of scrobal depression compared to more hairlike setae on vertex. Maxillary and labial palps brown. Antenna with scape similarly dark as flagellum, and with slight bluish luster. Pronotum dorsolaterally with extreme posterior margin violaceous posterior to more purple anterolateral angle and dorsal part of lateral panel (Fig. 39e), and contrasting in colour with more greenish mesonotum; admarginal setae dark (Fig. 39e). Mesosoma with mesonotum mostly green to bluish-green except anteromedial lobe darker anteriorly and with some coppery luster under some angles of light on lateral lobes and scutellum (Fig. 39b); mesonotum with hairlike to slightly lanceolate white setae. Prepectus dark (Fig. 39e) with slight purple to violaceous lusters under some angles of light; with 6 (right) or 8 (left) white setae mostly arranged in two rows in anterodorsal quarter. Tegula dark. Acropleuron dark with bluish-green luster mesally and coppery luster around margins under some angles of light. Propodeal callus green with hairlike to slightly lanceolate white setae somewhat longer than on mesoscutum. Macropterous; fore wing (Fig. 39f) hyaline with brownish setae; costal cell dorsally near leading margin with row of setae over about two-thirds to three-quarters, and ventrally with at least 2 rows along length; basal cell and disc entirely setose except for elongate linea calva extending to about level equal with middle of parastigma. Front leg dark except following pale: knee, tibia apically and longitudinally along anterior and posterior surfaces, and basal four tarsomeres. Middle leg mostly pale, orangey-yellow except knee, tibia apically and tarsus lighter whitish-yellow, and tibia with darker brown region subbasally, particularly dorsally and ventrally, and mesotibial apical and mesotarsal pegs and apical tarsomere dark. Hind leg mostly pale but femur (excluding trochantellus) dark except apically; tibia extensively dark except pale basally, more widely apically, and along entire ventral surface; tarsus pale except for apical tarsomere. Gaster (Fig. 39a) with hairlike setae; dark brown with coppery luster dorsally except for greenish luster under some angles of light on basal tergite, tergites laterally, and dorsoapically; ovipositor sheaths (Fig. 39g) mostly dark with short medial pale band shorter than basal dark band, only about half length of apical dark band, and extending only about half length of sheath, with apical dark band somewhat paler apically.

Head in dorsal view with interocular distance about 0.45× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; vertex evenly rounded into occiput, transversely alutaceous to alutaceous-imbricate; frons entirely meshlike coriaceous (Fig. 39d); scrobal depression distinctly reticulate to transversely reticulate-strigose (scapes concealing sculpture of scrobes); OOL: POL: LOL: MPOD = 1.0: 2.8: 1.8: 1.0. Mesoscutum (Fig. 39b) mostly meshlike reticulate except medial lobe more reticulate-imbricate to transversely imbricate anteriorly and lateral lobe with mediolongitudinal band of minute coriaceous sculpture. Scutellum and axillae low convex in same plane; axilla mostly obliquely and scutellum longitudinally reticulate-imbricate laterad midline anterior to meshlike coriaceous or coriaceous-reticulate frenal area. Acropleuron more-or-less isodiametric meshlike anteriorly and with larger meshes more-or-less longitudinally aligned posteriorly, but much more minutely sculptured mesally and larger meshlike sculpture at most delineated by only slightly raised ridges. Fore wing (Fig. 39f) with cc: mv: pmv: stv = 4.4: 4.4: 1.2: 1. Middle leg with row of

4 or 5 mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus clearly differentiated into two rows apically; second tarsomere with 4 pegs along anterior margin and 5 pegs along posterior margin, third tarsomere with 2 pegs along anterior margin and 3 pegs along posterior margin, and fourth tarsomere with 1 peg apically on either side. Propodeum with broadly U-shaped plical depression extending to posterior margin. Gaster (Fig. 39a) similar in length to combined length of head and mesosoma; not atypically modified; extending to base of third valvula, the latter about 0.73× length of metatibia and 0.86× length of mv; hypopygium extending about two-thirds length of gaster.

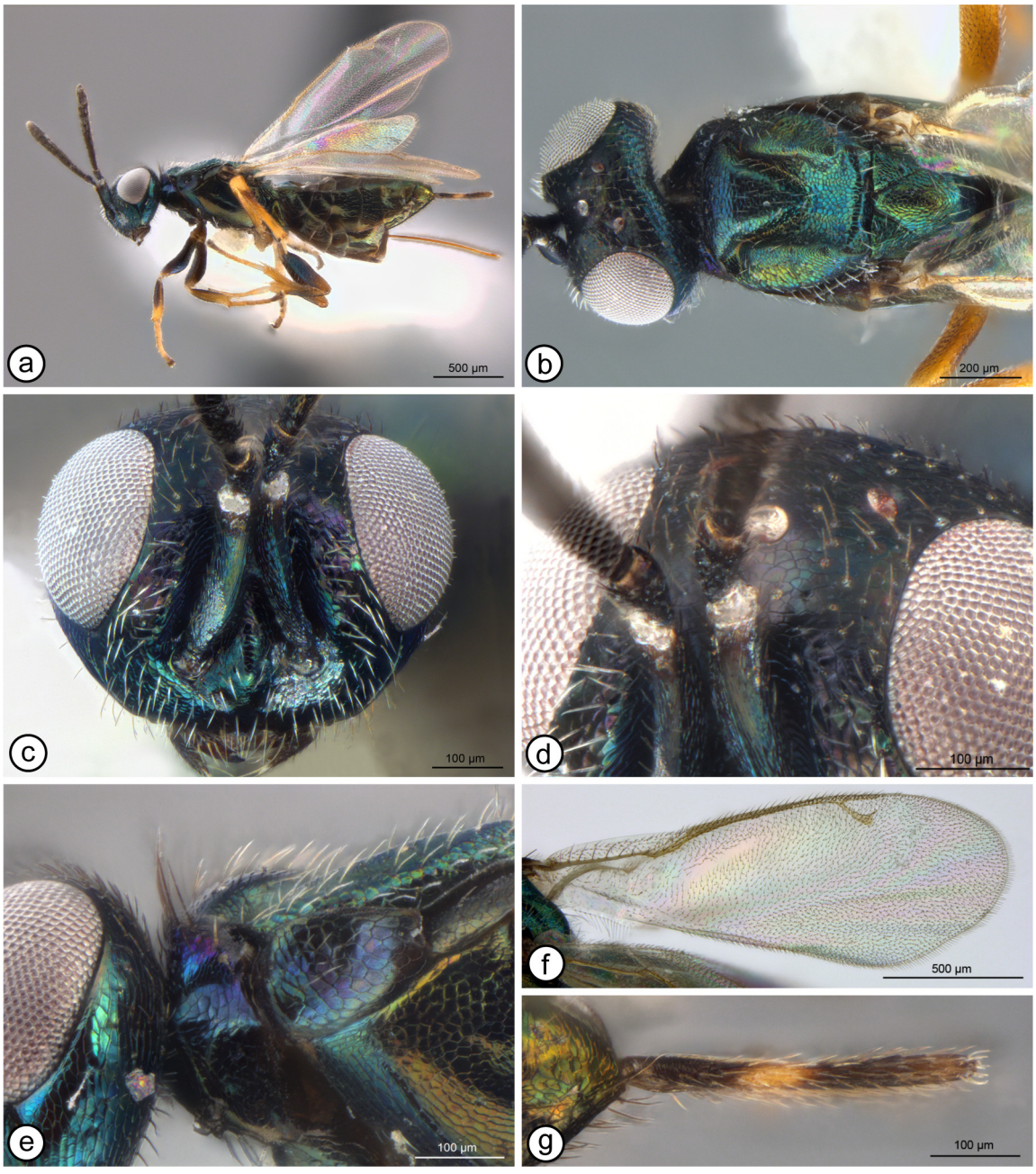

FIGURE 39. *Eupelmus hayei*, holotype ♀: **a**, lateral habitus; **b**, head and mesosoma, dorsal; **c**, head, frontal; **d**, frontovertex, frontodorsal; **e**, pronotum and prepectus, lateral; **f**, fore wing; **g**, ovipositor sheaths.

MALE. Unknown.

Distribution. Switzerland.

Biology. Host unknown, but swept in a meadow of shepherd's purse, *Capsella bursa-pastoris* (L.) (Brassicaceae).

Remarks. The unique female of *E. hayei* is morphologically most similar to females of *E. confusus* because of the combination of relatively short ovipositor sheaths, reticulate scrobes, pro- and metafemora and metatibia dark but mesofemur pale, and admarginal setae dark. However, among species of the *urozonus* complex with comparatively short ovipositor sheaths it is unique in having these mostly dark with only a comparatively short medial pale band that is shorter than either the basal or apical dark bands (Fig. 39g). This colour pattern is most similar to most females of *E. stenozonus* (Fig. 104c, e). The holotype is unusual in having the setae on the frons originating from small, mostly coppery spots that contrast with the dark blue head colour (Fig. 39d), though this may be an artefact of this single individual.

***E.* (*Eupelmus*) *infimbriatus* Gibson & Fusu n. sp.**
Figs 40a–h (♀), 41a–f (♂)

Type material. Holotype ♀ (UCRC). Turkmenistan, Mary region, Kara Kum desert, on *Salsola richteri*, 15.VI.1992, S. Trjapitzin, 24(7), 20.VII.1992, Coll. #125 / HOLOTYPE ♀ *Eupelmus* (*Eupelmus*) infimbriatus Gibson & Fusu, det. G. Gibson 2015. Condition: point-mounted; uncontorted; entire except left antenna missing beyond fl6.

Paratypes (2♀ & 3♂). ??? [sic] 40 km NW Dzhanginzdy, 12.VI.1965, leg.?, Azonositó 278 [crossed out]-1, Project, No. 26 (TCPC: 1♀). **Turkmenistan**: same data as holotype except Coll. #126 (1♀, CNC Photo 2012-46), Coll. #127 (1♂), Coll. #129 (1♂, CNC Photo 2012-115), and Coll. #130 (1♂, CNC Photo 2012-114) (all UCRC).

Etymology. From the Latin prefix *in-* (not or without) and infimbriatus (fringed), in reference to the largely absent fore wing marginal fringe of females.

Description. FEMALE (habitus: Fig. 40c, e). Length about 1.3–2.0 mm. Head (Fig. 40a, b) sometimes mostly bluish-green, but at least most of frontovertex and narrowly along orbits bluish-green, with frons mesally below anterior ocellus, scrobal depression, and sometimes parascrobal region, lower face, gena and posterior surface of head variably extensively and variably bright coppery to reddish-violaceous (Fig. 40b); with comparatively short and sparse white hairlike setae, only slightly more conspicuous on lower face than parascrobal region than frontovertex. Maxillary and labial palps white. Antenna with anellus and apical clavomere white (Fig. 40a, b), otherwise brown with variably distinct greenish to blue lusters on scape. Mesosoma with tegula brown except for slender opaque yellowish region along inner margin not extending to apical margin (Fig. 40g); otherwise mostly green to bluish-green except mesonotum with some coppery to reddish lusters, particularly mesoscutum mesally, and acropleuron (Fig. 40e) more brown or with slight coppery to reddish lusters mesally under some angles of light; mesonotum with short, sparse white setae similar to face, prepectus bare, and callus with much longer and denser white setae. Macropterous; fore wing hyaline with white setae (Fig. 40f), except marginal fringe lacking beyond venation other than usually along posteroapical margin; costal cell dorsally near leading margin with at least 1 row of inconspicuous setae along most of length, and ventrally with 2 or 3 rows of setae; basal cell and disc entirely setose except for comparatively short, obscure linea calva. Front leg with at least trochanter and basal three-quarters of femur dark, and sometimes tibia variably extensively basally, but trochantellus, knee, tibia apically and tarsus pale. Middle leg entirely pale beyond coxa or femur sometimes variably extensively orangey to light brownish basally to mesally, and mesotarsal pegs pale basally but darker apically. Hind leg entirely pale beyond coxa except sometimes femur with about basal two-thirds to three-quarters dark. Gaster (Fig. 40c, e) with hairlike setae; dorsally more distinctly bluish than mesosoma; ovipositor sheaths with base and extreme tip dark, and sometimes with ventral margin variably extensively brownish along length, but not distinctly banded.

Head in dorsal view with interocular distance about 0.4–0.45× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; vertex alutaceous to finely alutaceous-imbricate; frons comparatively finely meshlike coriaceous-reticulate, the cells defined by at most slightly raised, inconspicuous ridges; scrobal depression similarly finely sculptured; OOL: POL: LOL: MPOD = 0.6–1.2: 2.0–3.0: 1.6–2.4: 1.0. Mesoscutum (Fig. 40g) similarly though more distinctly meshlike reticulate than frons except lateral lobe with mediolongitudinal band of minute coriaceous sculpture. Scutellum and axillae low convex in same plane; axillae mostly meshlike reticulate to reticulate-imbricate laterally; scutellum longitudinally reticulate-imbricate laterad midline and frenal area finely meshlike coriaceous. Acropleuron more-or-less isodiametric meshlike anteriorly and posteriorly and much more minutely sculptured mesally, the larger meshlike sculpture delineated by only very slightly raised lines. Fore wing (Fig. 40f) with cc: mv: pmv: stv about = 4.0–5.3: 2.4–2.8: 1.0–1.1: 1.0.

Middle leg (Fig. 40d) without mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus and pegs clearly differentiated into two rows apically, second tarsomere with 2–4 pegs and third tarsomere with 1 or 2 pegs apically on either side, but fourth tarsomere without pegs. Propodeum with broadly U-shaped plical depression extending to posterior margin, and sometimes comparatively very short medially with plical depression partly overlain by somewhat protuberant dorsellum (Fig. 40h). Gaster (Fig. 40c, e) similar in length to combined length of head and mesosoma; syntergum with posteroventral angles abruptly angled inward between anal sclerite and ovipositor sheaths so in lateral view syntergum obliquely Ω-like over sheaths; extending over base of third valvula, with visible length of third valvula about 0.6× length of metatibia and subequal in length to mv; hypopygium extending about two-thirds length of gaster.

MALE (habitus: Fig. 41b). Length = 1.2–1.3 mm. Head (Fig. 41a, c) blue to purple or sometimes more greenish mesally but at least blue to purple along orbits and on vertex under some angles of light; frons and vertex reticulate, with vertex uniformly curved into occiput (Fig. 41a); scrobal depression and scrobes meshlike coriaceous to reticulate (Fig. 41c); setae hairlike, white; lower face with short, straight to evenly curved setae (Fig. 41c); gena posterior to malar sulcus with similarly short setae as on lower face (Fig. 41c), and posterior to eye with apices directed toward orbit. Antenna (Fig. 41e) with scape pale basally and outer, ventral, longitudinal sensory region at least lighter in colour if not distinctly pale (Fig. 41c); pedicel subglobular (Fig. 41e), only about 1.4× as long as wide, and ventrally without row of long, apically curved setae (Fig. 41f); length of pedicel + flagellum about 1.1× head width; flagellum robust-filiform (Fig. 41e) with clava about 1.2× as long as apical two funiculars; anellus very strongly transverse, discoidal, with at most inconspicuous sparse setae at extreme apical margin (Fig. 41f); funicle with fu1 slightly transverse to subquadrate and about 0.5–0.75× as long as pedicel, with subsequent funiculars all slightly transverse to subquadrate with conspicuous, white, curved setae, the setae subparallel with funicular over most of their length (Fig. 41e, f); basal funiculars without differentiated regions of modified setae ventrally (Fig. 41). Maxillary and labial palps pale. Mesosoma (Fig. 41a, b) similar in colour to head, mostly greenish or bluish-green to mostly blue with some purple luster; setae hairlike, white; tegula pale. Front leg entirely pale beyond coxa except for brown apical tarsomere. Middle leg pale except for elongate dark band ventromesally on femur and apical tarsomere brown. Hind leg pale except about basal three-quarters of femur dark with bluish luster and apical tarsomere brown. Fore wing (Fig. 41d) with mv about 2× as long as stv; costal cell dorsally near leading margin with very inconspicuous, pale setae over up to apical half, and ventrally with inconspicuous pale setae in 2 rows basal to parastigma; basal cell with variably conspicuous pale setae; speculum closed posterobasally by at least a couple of pale setae apically and basally. Propodeum with complete median carina and panels very shallowly, finely meshlike reticulate (Fig. 41a).

Distribution. Turkmenistan.

Biology. Host unknown, but associated with *Salsola richteri* (Moq.) (Chenopodiaceae).

Remarks. The exact locality of the "Dzhanginzdy" paratype is unknown, but according to notes of Csaba Thuróczy (pers. comm.) it was obtained as a gift and originally had a label in Russian with "Джангинзди". We have been unable to find this location, though there is a Dzhanga (= Jangnga) in Turkmenistan.

Females of *E. infimbriatus* are easily distinguished from other Palaearctic species by their fore wings, which mostly lack a marginal fringe and have pure white setae (Fig. 40f). The female labelled as Dzhanginzdy is considerably larger than the other two and lacks both antennae beyond the anellus. It is therefore unknown whether the clava had the apical segment white like the two smaller specimens (Fig. 40a, b) or perhaps had the clava even more extensively white, though all three have a white anellus. The larger female has relatively larger ocelli than the two smaller females, a more typical, less strongly transverse plical region that unlike the two smaller females is completely exposed behind the dorsellum, entirely pale middle and hind legs and the head much more extensively and bright reddish-coppery.

The three available males appear to have quite short, straight setae ventrally on the pedicel (Fig. 41f) and the gena lacks a conspicuously longer seta posterior to the malar sulcus (Fig. 41c), which are diagnostic of *E.* (*Episolindelia*) males. The association of these males as the opposite sex of the females is based primarily on the common collection record and thus might be incorrect. However, the propodeal structure of the two associated females is also quite similar to females classified in *E.* (*Episolindelia*). Our classification of the species in *E.* (*Eupelmus*) is based on the presence of two distinct rows of dark mesotarsal pegs in females (Fig. 40d).

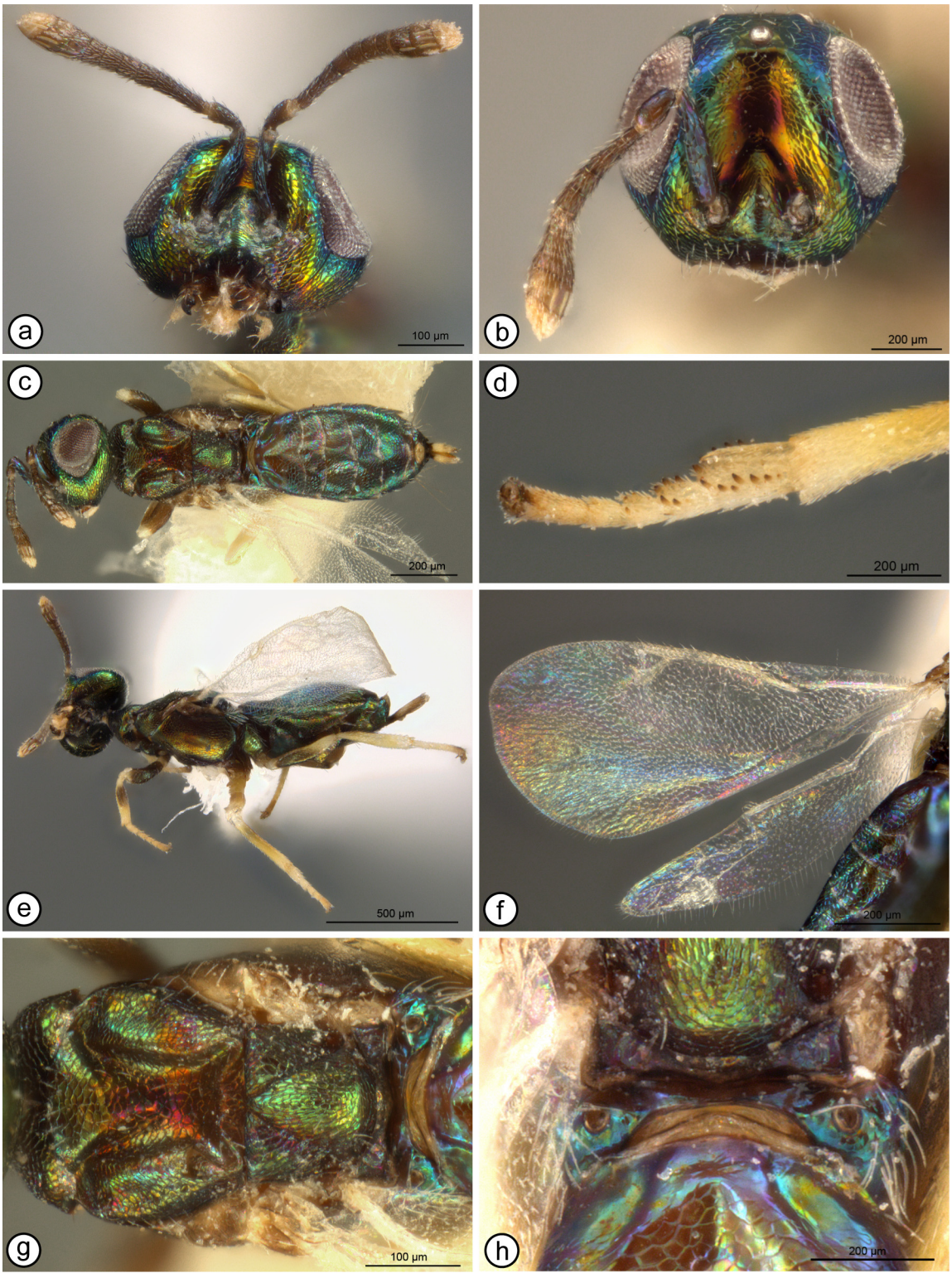

FIGURE 40. *Eupelmus infimbriatus*, ♀. *a, d, e* (holotype): **a**, head and antennae; **d**, apex of mesotibia and mesotarsus; **e**, lateral habitus. *b*, *c, f–h* (2012-46): **b**, head, frontal; **c**, dorsal habitus; **f**, wings; **g**, mesosoma, dorsal; **h**, apex of scutellum to propodeum.

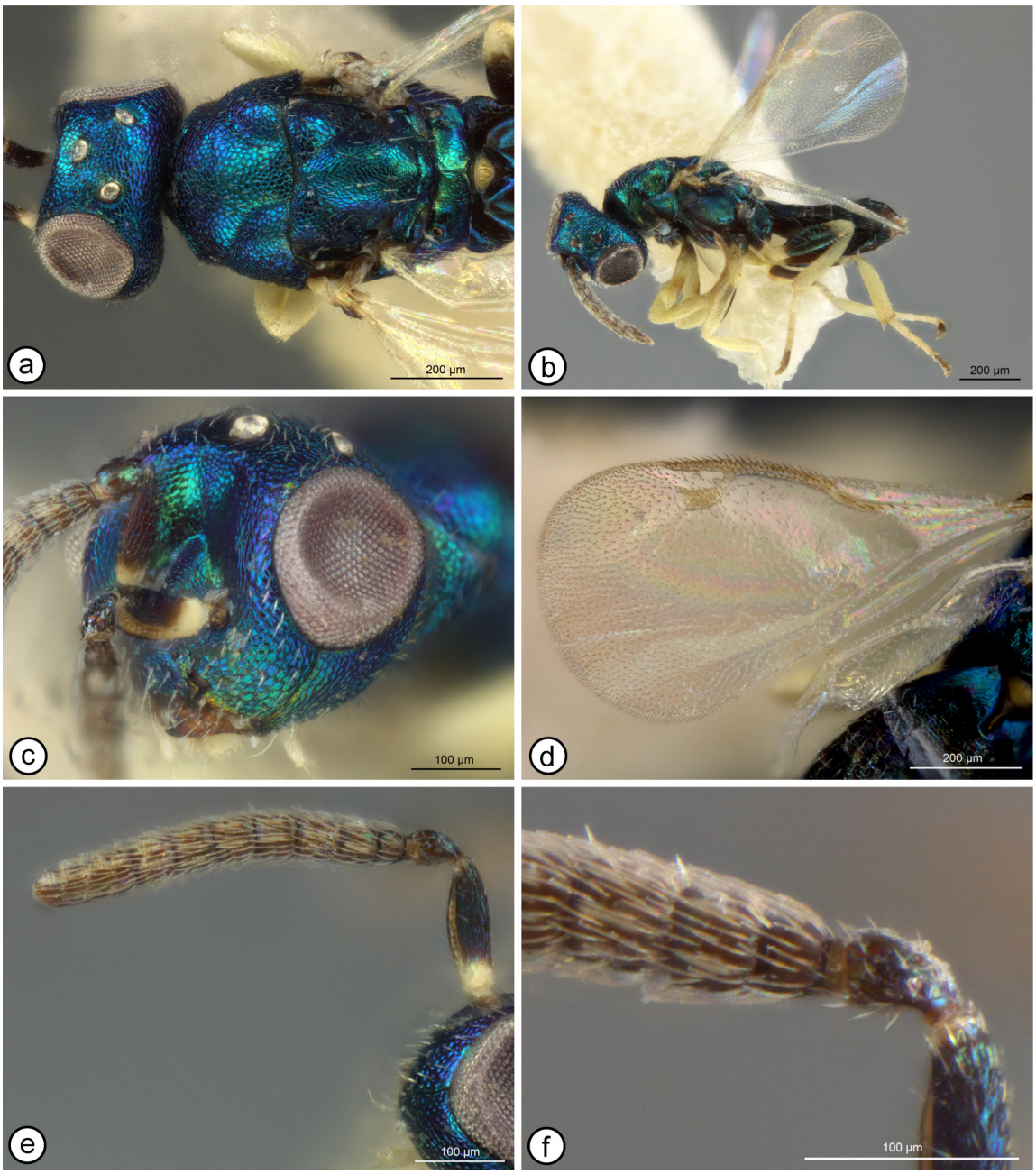

FIGURE 41. *Eupelmus infimbriatus*, ♂. **a**, head and mesosoma, dorsal (2012-115); **b**, lateral habitus (2012-114). *c–f* (2012-115): **c**, head, frontolateral; **d**, fore wing; **e**; antenna, outer view; **f**, pedicel to base of fl5, outer view.

E. (*Eupelmus*) *iranicus* Kalina n. stat.

Fig. 42a–i (♀)

Eupelmus iranicus Kalina, 1988: 19–20. Holotype ♀, NMPC, examined by GG. Type data: N Iran, Aliabad, 28.6.70 / Loc. no. 32, Exp. Nat. Mus. Praha.

Description. FEMALE (habitus: Fig. 42b, c, g). Length = 2.4–5.0 mm. Head comparatively bright green to bluish-green (Fig. 42a) or sometimes with variably extensive and conspicuous coppery luster (Fig. 42b), particularly on frons at least along inner orbit; with conspicuous, slightly lanceolate white setae on lower face, parascrobal region and frons along inner orbit relative to shorter, less conspicuous hairlike setae on vertex and mesally on frons (Fig. 42a). Maxillary and labial palps white to yellow (Fig. 42c) with apical labial and sometimes maxillary palpomere brown. Antenna dark with similar metallic lusters as face on scape and pedicel, at least in part, except inner surface of scape often somewhat paler, orangey-brown (Fig. 42a) to yellowish basally. Mesosoma with tegula yellow (Fig.

42b, c, h), usually more opaque along inner margin or anteriorly and more translucent laterally (Fig. 42b), otherwise mesosoma usually similar in colour to head, mostly comparatively bright green (Fig. 42b, g) to bluish-green (Fig. 42c) with some coppery luster on mesonotum (Fig. 42b) and acropleuron, or acropleuron sometimes more blue to purple (Fig. 42c) and sometimes smaller individuals more brownish with less distinct and extensive metallic green luster; mesonotum, prepectus entirely and somewhat more densely setose than callus, with slightly lanceolate white setae. Macropterous; fore wing hyaline with setae white or discal setae sometimes more yellowish; costal cell (Fig. 42e) with at least 2 or 3 rows of setae (often inconspicuous) along length both dorsally and ventrally; basal cell (Fig. 42e) and disc entirely setose except for linea calva. Legs entirely pale beyond coxae except apical tarsomeres sometimes dark, posterior surface of profemur mesally sometimes with brownish region, and mesotibial pegs sometimes dark orange, at least apically. Gaster (Fig. 42b, c) with hairlike setae; dark with variably distinct greenish or bluish-green luster under some angles of light; ovipositor sheaths banded, pale medially (Fig. 42c, i).

Head in dorsal view with interocular distance about 0.45× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; vertex posteriorly more transversely alutaceous-imbricate but at least frons and scrobal depression distinctly meshlike reticulate to punctate-reticulate (Fig. 42a); OOL: POL: LOL: MPOD = 1.1–1.2: 2.4–2.7: 1.2–1.4: 1.0. Mesoscutum (Fig. 42b) distinctly meshlike reticulate except lateral lobe with mediolongitudinal band of minute coriaceous sculpture. Scutellum and axillae (Fig. 42d) low convex in same plane; axilla meshlike reticulate to more reticulate-imbricate posterolaterally and scutellum longitudinally reticulate-imbricate laterad midline, but frenal area quite uniformly meshlike reticulate. Acropleuron (Fig. 42h) more-or-less isodiametric meshlike reticulate anteriorly and posteriorly, the sculpture usually delineated by quite distinct ridges even posteriorly, though much more minutely coriaceous to punctate. Fore wing with cc: mv: pmv: stv = 4.2–4.4: 3.0–3.4: 1.0–1.4: 1.0. Middle leg (Fig. 42f) with 3–5 (only 1 on one leg of holotype), sometimes mostly pale and therefore comparatively inconspicuous mesotibial apical pegs; mesotarsus ventrally densely setose without pegs, though basitarsus with row of 3 or 4 longer, seta-like spines somewhat closer to anterior margin. Propodeum with comparatively large, rectangular plical depression extending to posterior margin, the lateral margins subparallel (Fig. 42d). Gaster (Fig. 42b, c) similar in length to combined length of head and mesosoma; syntergum with posterolateral angles abruptly, obliquely angled anteromesally toward base of ovipositor sheaths below anal sclerite, in posterior view syntergal margin appears transversely to subcircularly Ω-like over sheaths without distinct surface between anal sclerite and sheaths (Fig. 42i); extending over base of third valvula such that division between second valvifer and third valvula often not visible, but third valvula at most about 0.6× length of metatibia and about 0.75× length of mv (apparent sheath length (Fig. 42b, c, g) much less if basal limit of third valvula concealed by syntergum); hypopygium extending a little beyond half length of gaster.

MALE. Unknown (see 'Remarks').

Distribution. Greece* [Kerkini lake, Pumping St. Site, 20-26.VI.2007, MT, G. Ramel (AICF: 1♀); Kos, 5 km E. Kos town, Pasalidi, 26.VIII.1994, off *Phragmites communis*, J. Noyes, CNC Photo 2012-54 (CNC: 1♀)], Iran, **Israel*** [Elat, 4.V.1986, A. Freidberg or F. Kaplan (TAUI: 9♀); Ein Gev, 20.X.1973, Dr. Furth (TAUI: 1♀); Neot HaKikar, 20.V.1974, A. Freidberg (TAUI; 2♀)], **Libya*** [Aziziyah, 8.V.2009, tree and bush beating, P. Weill (AICF: 5♀)], **Somalia*** [Mogadiscio, Afgoi-Shabelli Valley, 6-20.III.1977, F. Bin, M. trap, CNC Photo 2012-53 (CNC: 1♀)].

Biology. Host unknown, but type material of the morphologically similar species *E. longicorpus* Girault from Australia was reared from unidentified Cecidomyiidae (Diptera) galls on *Andropogon* L. (Poaceae) (Bouček, 1988) (see 'Remarks'), and *E. kalinai* was reared from the same host on *Hyparrhenia hirta* (L.) (Poaceae).

Remarks. Kalina (1988) described *E. iranicus* from four females, all of which we examined. Although Kalina (1988) stated that the holotype was to be deposited in NMPC it was obtained on loan from him. It is card-mounted (Fig. 42g) and entire, though contorted such that the plical depression is not visible. Images provided in the original description by Kalina (1988, figs 35–38 and plate V, figs 1, 5, 7) were taken from a paratype.

The description and distribution given above do not include a single female from Mozambique (Maputo, 1-30.V.1985, M. Olmi, Mal. tr.) (CNC) that is about 5 mm in length. This female is very similar to described females of *E. iranicus* except the third valvulae are longer, about 0.7× the length of the metatibia and about as long as the marginal vein, and almost uniformly pale beyond the gaster except for the extreme tip being dark. Further, there are six or seven dark mesotibial apical pegs and the head and body are mostly blue to purple except for the mediolongitudinal microsculptured bands on the mesoscutal lateral lobes forming parallel green bands. This female very possibly represents a separate species.

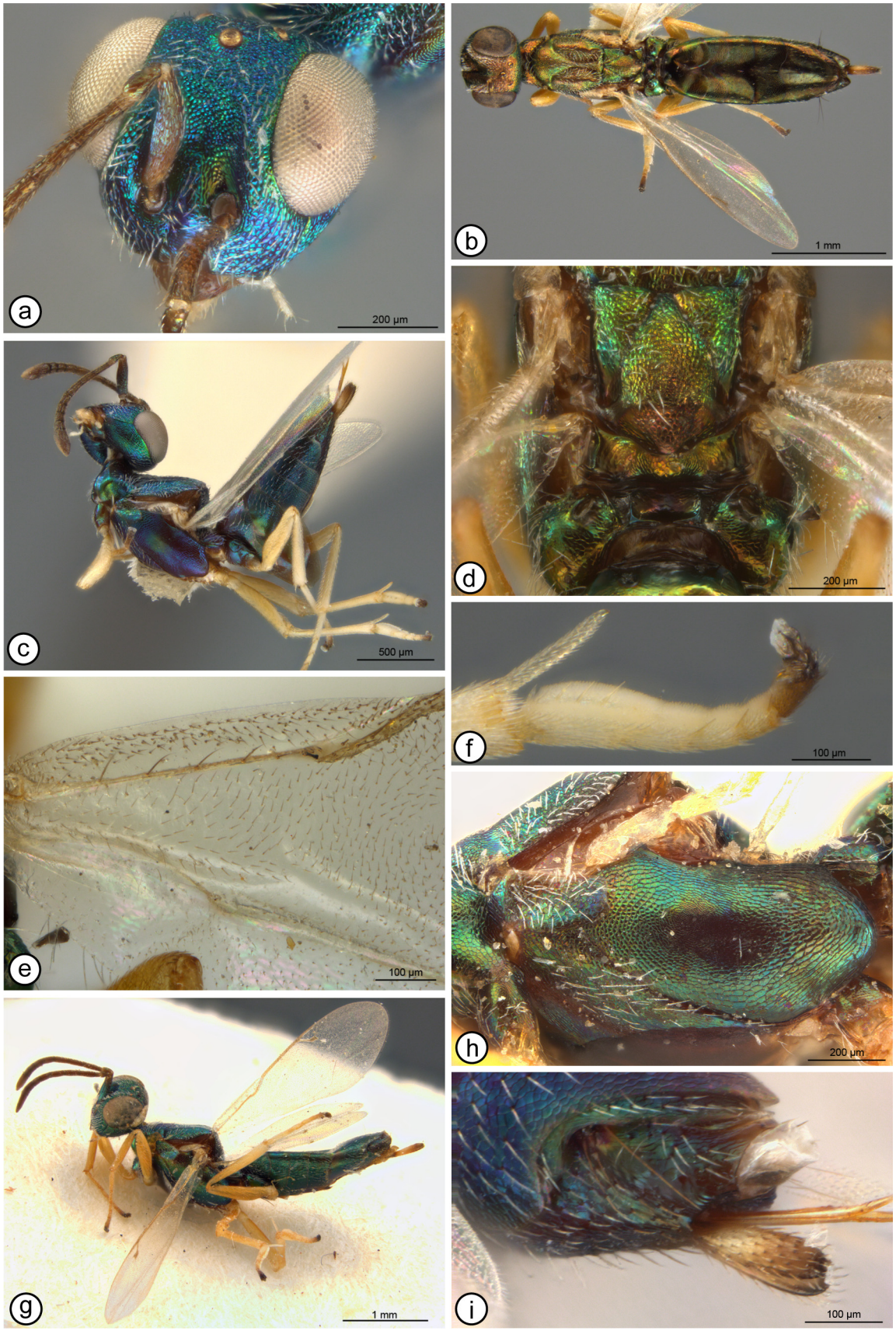

FIGURE 42. *Eupelmus iranicus*, ♀. *a, c, f, i* (2012-53): **a**, head, frontolateral; **c**, lateral habitus; **f**, apex of mesotibia and mesotarsal peg pattern; **i**, ovipositor sheaths, syntergum and two preceding tergites, posterolateral. *b*, *d, e* (2012-54): **b**, dorsal habitus; **d**, scutellar-axillar complex to propodeum; **e**, fore wing base. **g**, lateral habitus (holotype). **h**, lateral mesosoma (paratype 2015-8).

Eupelmus iranicus, E. kalinai and *E. africanus* comprise the *iranicus* species-group, which is characterized by the unique combination of absence of mesotarsal pegs and presence of mesotibial apical pegs, though the latter are often mostly pale and therefore quite easy to overlook (Figs 5h, 42f, 46g). Females also share a comparatively large, rectangular to broadly subcircular propodeal plical depression (Figs 5c, 42d, 46e) and a modified syntergum with the posterolateral angles obliquely angled under the anal sclerite so that there is little or no (air-dried specimens) separation between the anal sclerite and sheaths (Figs 5i, 42i, 46f). Females of *E. iranicus* and *E. kalinai* are more similar to each other than to *E. africanus*, sharing also a primarily metallic green to bluish-green body contrasting with a yellow tegula (Figs 42b, c, h, 46b–d), and an entirely and quite conspicuously setose prepectus (Figs 42h, 46d). These latter features are also characteristic of females of *E. longicorpus* Girault (1915), which was described from Australia and subsequently reported from Spain, India and Zimbabwe by Bouček (1988). We examined five females from Queensland, Australia (one AICF, four CNC) that we identify as *E. longicorpus*. They range in length from about 2.4–3.0 mm and otherwise are very similar to *E. iranicus* and *E. kalinai* except the ovipositor sheaths are either completely dark or at least have a much smaller and less distinct medial pale region. They have mostly pale legs, though the posterior surface of the profemur is at least slightly darkened, and sometimes both the posterior surface of the profemur and the anterior surface of the metafemur are variably extensively and distinctly darkened. The ovipositor sheath and leg colour patterns thus resemble those of *E. kalinai* or *E. iranicus* or are intermediate between the two. The few observed Australian females suggest that the difference in ovipositor sheath and metafemoral colour pattern between *E. iranicus* and *E. kalinai* could represent intraspecific variation and, possibly, that both names are junior synonyms of *E. longicorpus*. Such a Palaearctic-Australasian distribution pattern is certainly unusual, but *E*. (*Episolindelia*) *australienesis* Girault, a parasitoid of Cecidomyiidae in stems of various grasses (Poaceae), has an even wider world distribution (Gibson 2011; Noyes 2014), most likely through introduction by man. Although we have not seen the specimen(s) on which Bouček (1988) based his record of *E. longicorpus* from Spain, we suspect this refers to what we interpret as either *E. iranicus* or *E. kalinai*. We therefore exclude *E. longicorpus* from the Palaearctic fauna, and retain *E. iranicus* and *E. kalinai* as valid species until molecular analyses that include *E. longicorpus* from Australia indicate otherwise.

In addition to molecular analyses, more specimens are required to adequately distinguish intra- from interspecific variation. For example, the photograph of the stigmal vein of the single female described under the name *E. algiricus* by Kalina (1988, plate V, fig. 7) shows the stigma as very slender, virtually undifferentiated from the stigmal vein, whereas that of the specimen of *E. iranicus* photographed by Kalina (1988, plate V, fig. 6) is distinctly differentiated and quadrate. We initially considered this to be a possible differential feature for females of the two species, but additional specimens show that development of the stigma is variable in both species and the difference, if it exists, is much less discriminatory than suggested by the images in Kalina (1988).

Of the three regional species included in the *iranicus* species-group, males are recognized for only *E. kalinai*, as discussed under this latter species.

E. (*Eupelmus*) *iris* Fusu & Gibson n. sp.

Figs 43a–h (♀), 44a–h (♂)

Type material. Holotype ♀ (EIHU). [JAPAN] Kyoto, Honshu, V.1969, F. Takahashi / Host *Aiolomorphus rhopaloides* Walker / HOLOTYPUS ♀ *Eupelmus* (*Eupelmus*) *iris* Det. Fusu L. 2015. Condition: glued by left side from mesocoxa through gaster on a card triangle; uncontorted; entire.

Paratypes (7♀ & 3♂). **JAPAN**: Honshu, same data as holotype (EIHU: 4♀, two with CNC Photo 2014-100 and 2014-101; 2♂, CNC Photo 2014-103 and 2014-104); Nagoya city, 1999, E. Shibata, Host *Aiolomorphus rhopaloides* Walker (EIHU: 1♂, CNC Photo 2014-102); Yamada-chô, Kita-gun, Kagawa-ken, 30.VII.1963, Shigeyuki Yamada, ex. from gall of *Aiolomorphus rhopaloides* Walker (Eurytomidae) [label in Japanese] (ELKU: 1♀); Yamaguchi Pref., Yamaguchi, Mt. Kounomine, 20.VI.2004, H. Higashiura leg. (ELKU: 1♀).

Excluded from type series. **ORIENTAL**. **Japan**: Ryukyu, Okinawa Pref., Naha, Sueyoshi Park, 16.III.1996, N. Takahasi (ELKU: 1♀, CNC Photo 2014-118).

Etymology. From the Latin *iris*, meaning rainbow, in reference to the multicoloured metallic luster present in both males and females.

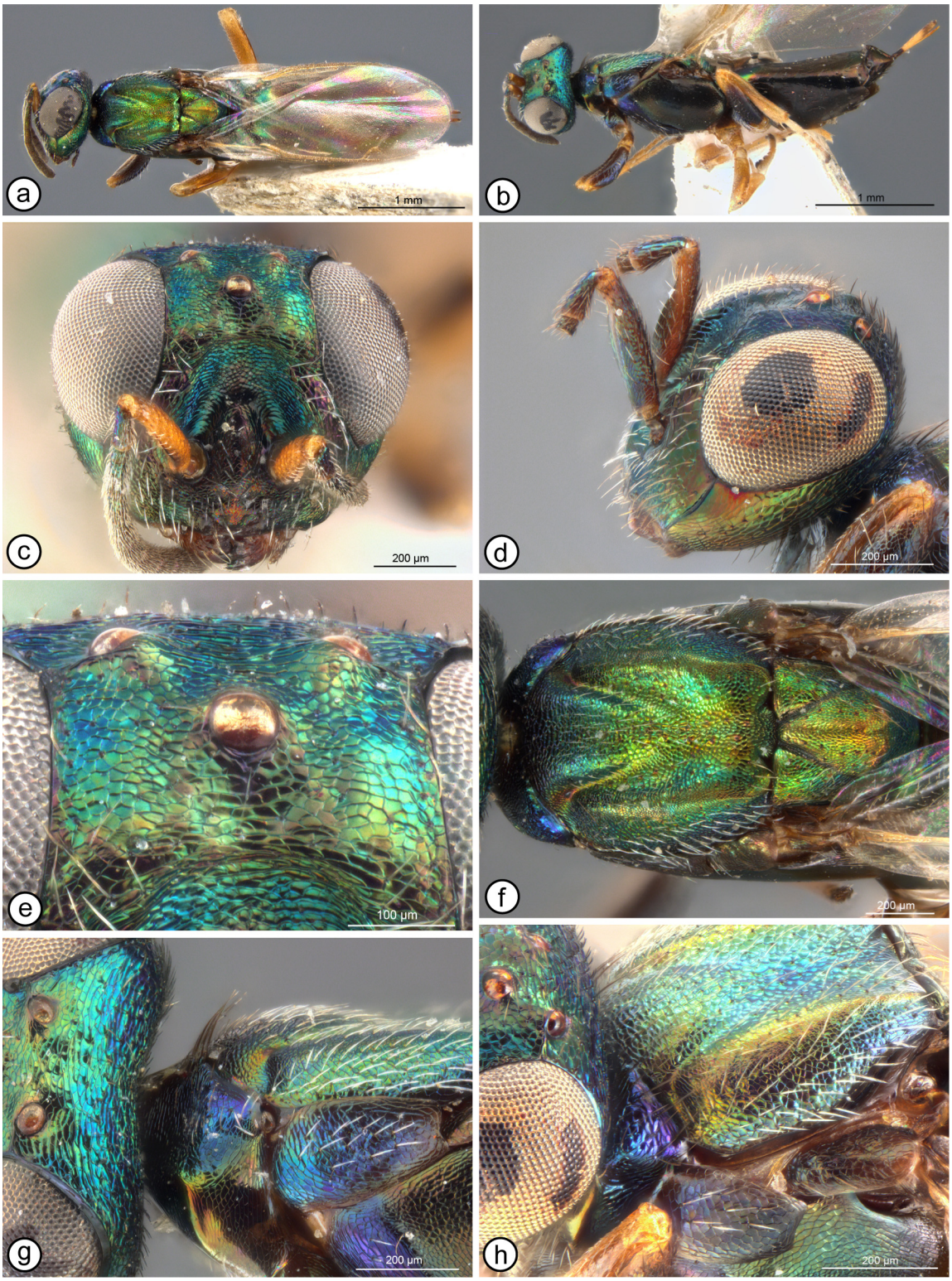

FIGURE 43. *Eupelmus iris*, ♀. *a, f* (holotype): **a**, dorsal habitus; **f**, mesosoma, dorsal. *b, g* (2014-101): **b**, lateral habitus; **g**, vertex/occiput (dorsal) and pronotum and prepectus (lateral). *c*, *e* (2014-100): **c**, head, frontal; **e**, frontovertex. *d, h* (2014-118): **d**, head, lateral; **h**, pronotum, mesoscutum and prepectus, dorsolateral.

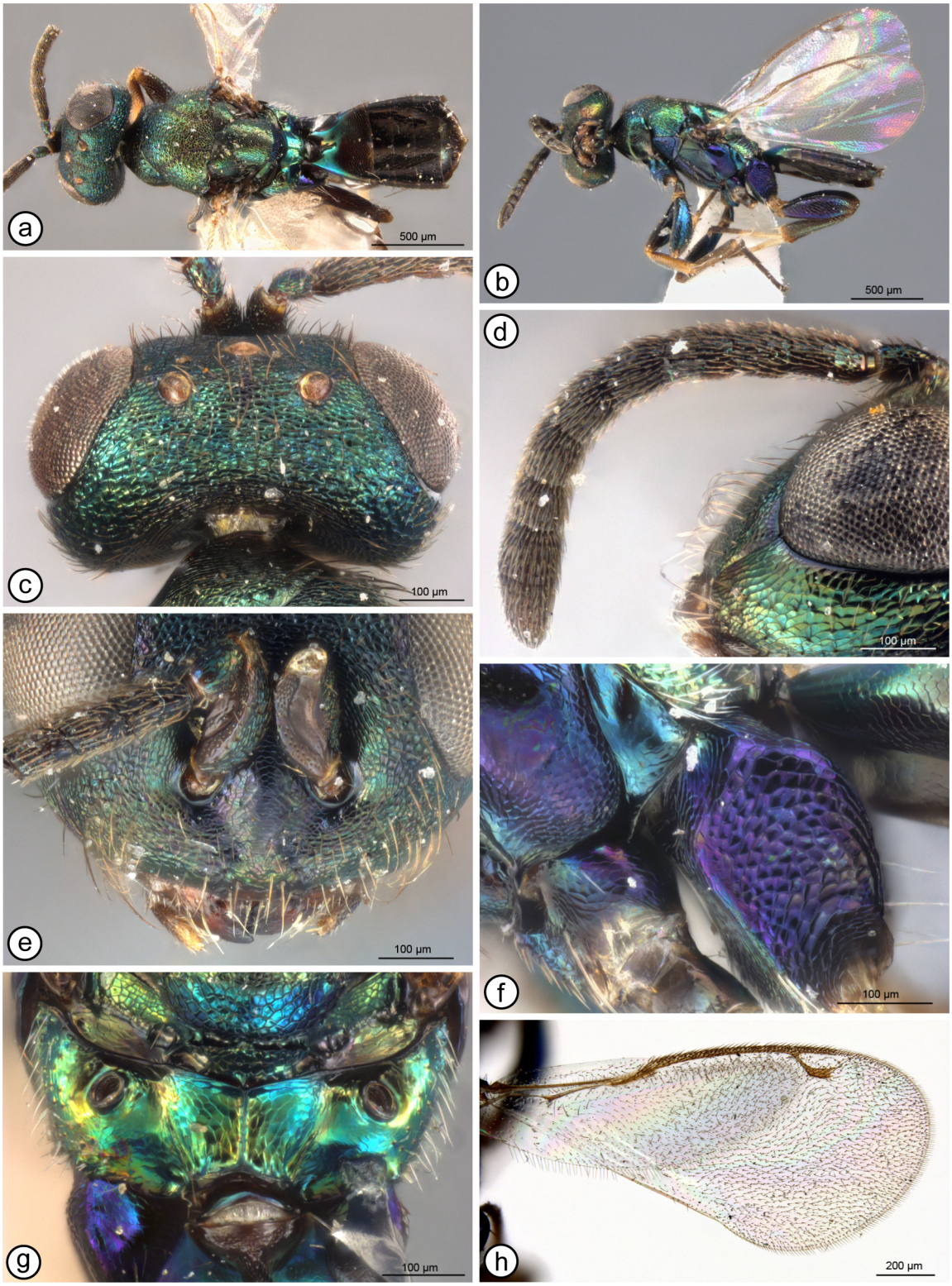

FIGURE 44. *Eupelmus iris*, ♂. *a, c, g, h* (2014-103): **a**, dorsal habitus; **c**, head, dorsal; **g**, propodeum; **h**, fore wing. *b, d, f* (2014-102): **b**, lateral habitus; **d**, lower face and flagellum, lateral; **f**, metacoxa, lateral. **e**, lower face (frontal) and scapes (2014-104).

Description. FEMALE (habitus: Fig. 43a, b). Length = 2.5–3.5 mm. Head sometimes with face dark violaceous except for greenish lower face, but more commonly (Fig. 43c) frontovertex also mostly bright green to bluish-green or partly blue to purple except under some angles of light frons usually with coppery to reddish-violaceous luster paramedially, as vertical band on either side of anterior ocellus from scrobal depression to or

partly toward posterior ocellus, and then interantennal prominence and parascrobal region with variably extensive but quite bright reddish-violaceous luster, the latter sometimes extending also over lower face and within scrobal depression, and vertex often more bluish under some angles of light; with slightly lanceolate white setae on lower face and parascrobal region extending along inner orbit to level of anterior ocellus compared to more hairlike setae on frontovertex. Maxillary and labial palps brown. Antenna with scape usually contrasting conspicuously with flagellum (Fig. 43c), entirely yellowish or with only carinate ventral margin partly dark, though sometimes with metallic luster at least basally, and rarely almost entirely dark with metallic luster, only partly orangey-brown mediolongitudinally on inner surface (Fig. 43d); pedicel and flagellum dark, the pedicel and basal flagellomeres usually with some metallic green to bluish luster. Pronotum laterally purple to blue (Fig. 43f) or sometimes more reddish-violaceous along extreme posterolateral margin (Fig. 43h), but contrasting conspicuously with mostly greenish mesoscutum (Fig. 43f–h); admarginal setae dark. Mesonotum under most angles of light with anteromedial lobe anteriorly near pronotum and usually lateral lobe posterolaterally above tegula bluish to purple (Fig. 43f, h), but otherwise mostly greenish with often variably extensive coppery luster, most commonly within depressed posteromedial region of mesoscutum and on scutellum (Fig. 43f); with white, hairlike to slightly lanceolate setae. Prepectus (Fig. 43g, h) variably green to blue or purple depending on angle of light; with about 5–20 white setae depending on size of individual. Tegula dark. Acropleuron mostly dark (Fig. 43b) or variably distinctly greenish under different angles of light or with some coppery to reddish-violaceous lusters. Propodeal callus bright green with at most slight bluish luster. Macropterous; fore wing (Fig. 43a) hyaline, usually with lighter, more whitish setae within basal cell and somewhat darker, more yellowish to brown setae on disc; costal cell dorsally near leading margin with row of setae over about apical half to two-thirds, sometimes with some offset setae forming partial second row subapically, but ventrally with 2 or 3 rows along length; basal cell and disc entirely setose except for elongate linea calva extending to level about equal with middle of parastigma. Front leg with femur dark except apically and tibia with dorso- and ventrolongitudinal bands subapically, but otherwise pale beyond coxa. Middle leg entirely pale except for dark mesotibial apical and mesotarsal pegs. Hind leg with about basal two-thirds to three-quarters of femur dark with metallic luster, otherwise usually pale though rarely [Ryukyu] metatibia with anterior and posterior surfaces partly dark mesally, the tibia pale basally, apically, narrowly along dorsal margin, and somewhat more broadly along ventral margin. Gaster (Fig. 43b) with hairlike setae; mostly dark brown with variably distinct coppery luster except basal tergite basally bright green and often with slight greenish luster apically under some angles of light; ovipositor sheaths more-or-less distinctly tri-banded, with a short dark region basally, a much longer pale region medially, and a shorter but at least slightly darker, yellowish-brown to pale brown region apically, the latter region often paler toward apex but at least extreme apex dark brown.

Head in dorsal view with interocular distance 0.37–0.42× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; vertex evenly rounded into occiput, transversely reticulate-imbricate or imbricate but carinate margins of sculpture not coalesced into differentiated carina or ridge; frons almost coriaceous but slightly roughened, meshlike imbricate to reticulate-imbricate in part, at least laterally (Fig. 43e); scrobal depression, including scrobes, meshlike reticulate to transversely strigose-reticulate (Fig. 43c); OOL: POL: LOL: MPOD = 0.7–0.8: 2.0–2.8: 1.2–1.8: 1.0. Mesoscutum (Fig. 43f, h) meshlike reticulate except medial lobe with shallower or more transversely reticulate-imbricate sculpture anteriorly and lateral lobe with mediolongitudinal band of minute coriaceous sculpture. Scutellum and axillae low convex in same plane; axilla mostly obliquely and scutellum longitudinally imbricate to reticulate-imbricate on either side of midline. Acropleuron more-or-less isodiametric meshlike anteriorly and posteriorly, and much more minutely sculptured mesally, the meshlike sculpture at most delimited by slightly raised ridges. Fore wing with cc: mv: pmv: stv = 4.9–5.3: 4.6–5.3: 0.9–1.3: 1.0. Middle leg with row of 5–8 mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus and pegs differentiated into two rows apically; second tarsomere with 4–6 pegs, third tarsomere with 2 or 3 pegs, and fourth tarsomere with 1 or 2 pegs apically on either side. Propodeum with broadly U-shaped plical depression extending to posterior margin. Gaster (Fig. 43b) similar in length to combined length of head and mesosoma; not atypically modified; extending to or slightly over base of third valvulae, the latter about 0.61–0.67× length of metatibia and 0.62–0.68× length of mv (apparent length sometimes less if line of division with second valvifers concealed by gaster); hypopygium extending almost two-thirds length of gaster.

MALE (habitus: Fig. 44a, b). Length = 2.3–2.6 mm. Head (Fig. 44a, c) primarily greenish, but under some angles of light face partly dark (Fig. 44e) and lower face sometimes with slight coppery luster; frontovertex

distinctly meshlike reticulate; vertex smoothly rounded into occiput (Fig. 44c); scrobal depression similarly sculptured as frons; setae light brown; lower face in region between torulus and malar space with tuft-like region of longer, apically hook-like or sinuately curved setae (Fig. 44e); gena posterior to malar sulcus with 1 conspicuously long seta and ventral to this with 3 or 4 shorter setae, and posterior to eye with setae directed toward orbit. Antenna (Fig. 44d) with scape entirely dark (Fig. 44e); pedicel about 1.7× as long as wide, ventrally with 6 (?) long, apically curved setae; length of pedicel + flagellum about 1.2× head width; flagellum moderately clavate (Fig. 44d) and uniformly covered with short, recumbent setae except fu1–fu3 in ventral view with elongate regions of differentiated, shorter, straighter setae; anellus very strongly transverse, discoidal, shiny, bare (Fig. 44d); funicle with fu1 about 1.8–2.0× as long as wide, only slightly longer than fu3, but obviously longer than pedicel or any other funicular, the funiculars beyond fu3 increasingly shorter such that fu7 subquadrate; clava slightly wider and slightly longer than apical two funiculars. Maxillary and labial palps brown. Mesosoma dorsally (Fig. 44a) primarily green with some coppery luster, except frenal area more distinctly blue and propodeum with some bluish-green to bluish luster under some angles of light; setae hairlike, brownish; tegula dark. Front leg dark except femur narrowly pale apically; tibia dark dorso- and ventrolongitudinally but narrowly pale basally, somewhat more broadly apically, and along anterior and posterior surfaces; tarsus pale. Middle leg mostly dark except for tibial spur, and usually variably distinctly paler along anterior and posterior surfaces. Hind leg with coxa purple to somewhat reddish-violaceous, with posterior margin uniformly curved (Fig. 44f); otherwise dark except for tibial spurs, basal one or two tarsomeres, and trochanter and trochantellus at least in part. Fore wing (Fig. 44h) with mv about 3.2–3.8× length of stv and pmv subequal in length with stv; costal cell dorsally near leading margin with row of dark setae apically for distance at most equal to length of parastigma and ventrally with single row of setae mesally; speculum mostly open posteriorly. Propodeum with complete, straight median carina and on either side with variably distinct longitudinal carinae extending anteriorly from posterior margin for short distance, otherwise meshlike coriaceous to very finely reticulate, usually more distinctly so posteriorly.

Distribution. Japan.

Biology. Shibata & Ito (2005), Shibata (2006) and Takahashi & Mizuta (1971) reared this species, as *Eupelmus* sp., as a primary parasitoid of the larvae of *Aiolomorphus rhopaloides* Walker (Hymenoptera: Eurytomidae), the bamboo gall-maker. Adults emerge the same year the galls are induced, suggesting possibly more than one generation per year (Shibata & Ito 2005).

Remarks. Typical females are superficially most similar to those of *E. tachardiae* based on having a pale scape and both the pro- and metafemora extensively dark and the metatibia partly darkened mesally. Both sexes differ from *E. tachardiae* by the absence of a vertexal carina (Figs 43b, 44c) and females by their shorter third valvulae.

We exclude from the type series but provisionally include in *E. iris* a single female from Ryukyu, which has quite a dark scape with metallic luster, though noticeably lighter orangey-brown mediolongitudinally on the inner surface (Fig. 43d). Other females we include in the species have an obviously pale scape contrasting with the flagellum (Fig. 43c). If the Ryukyu female was interpreted as having a dark scape at couplet 67, it would key to couplet 77. Similarly, we include in *E. luteipes* a single female having atypically dark scape and leg colour patterns (see under latter species) and note that any female of *E. luteipes* with a comparatively dark leg colour pattern but pale scape would be very similar to typical *E. iris* females. The Ryukyu female has the frons more bluish to purple than other females as well as having the metatibiae atypically partly dark; the ovipositor sheaths are also the longest of measured females, but sculpture of the frons is typical for the species, partly meshlike reticulate-imbricate, only slightly roughened (Fig. 43e) so as to be less coarsely sculptured than for *E. luteipes* females (Fig. 58f).

Only one of the three males has complete antennae to show overall shape (Fig. 44d), but all have a strongly discoidal, smooth and shiny anellus, short, recumbent funicular setae, and a comparatively long fu2 that is obviously longer than the more quadrate apical funiculars. Consequently, the flagellum appears moderately clavate even though anellar structure is characteristic of a filiform flagellum. Antennal structure differentiates males of *E. iris* from those of other similar species characterized in part by the absence of a vertexal carina and presence of a tuft-like region of long, apically curved or sinuate setae on the lower face (Fig. 44e).

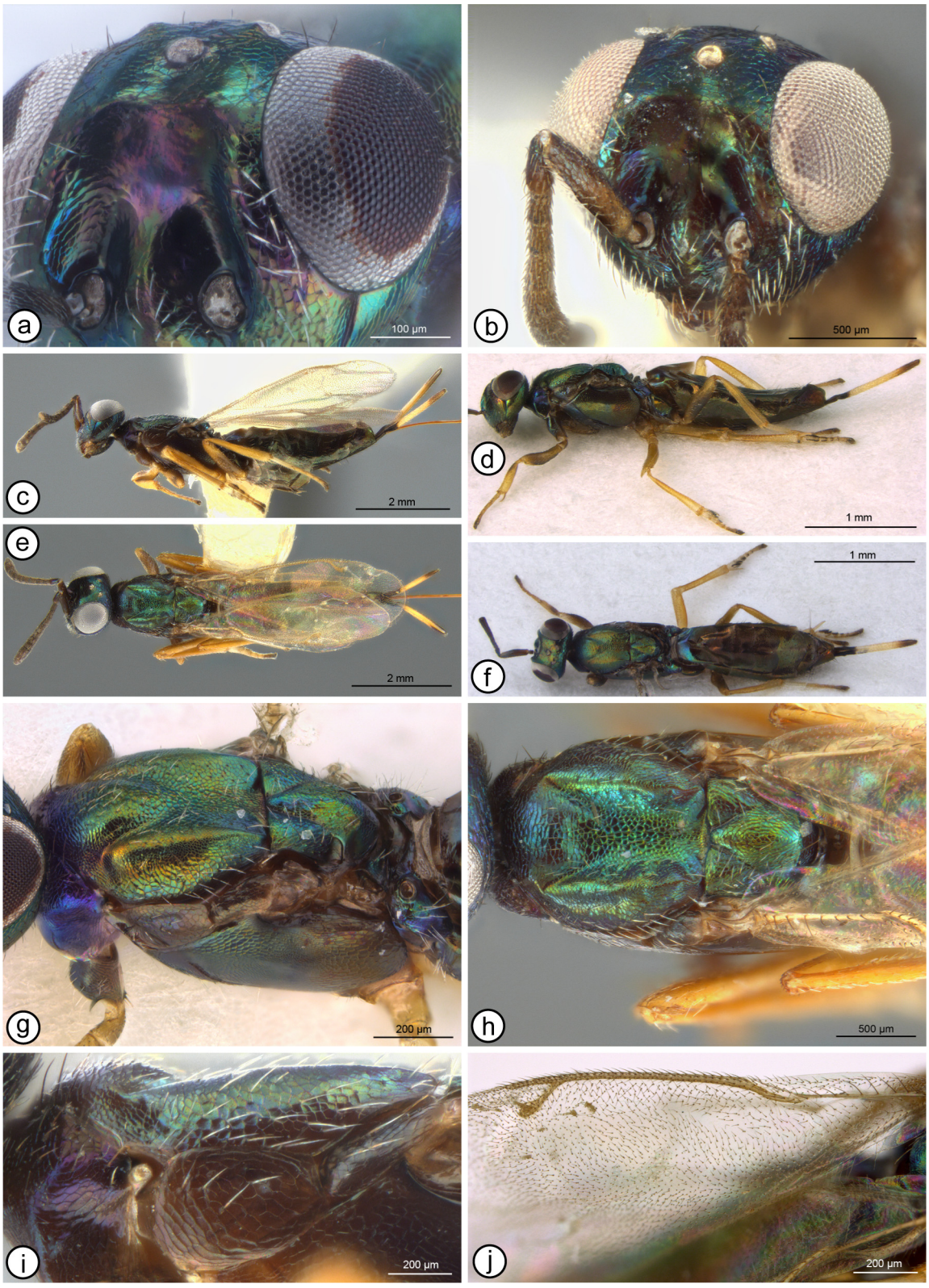

FIGURE 45. *Eupelmus janstai*, ♀. *a, d, f, g* (holotype) **a**, head, frontal; **d**, lateral habitus; **f**, dorsal habitus; **g**, mesosoma, dorsolateral. **b**, head, frontal (2013-31). *c, e, h–j* (2013-30): **c**, lateral habitus; **e**, dorsal habitus; **h**, mesosoma, dorsal; **i**, pronotum and prepectus, lateral; **j**, fore wing.

E. (*Eupelmus*) *janstai* Delvare & Gibson

Fig. 45a–j

Eupelmus (*Eupelmus*) *janstai* Delvare & Gibson *in* Al khatib *et al.*, 2015: 142. Holotype ♀, MHNG, examined. Type data: Czech Republic, Břeclav district, Pavlov, 48.86750°N 16.65416°E, 03.vii.2010, G[érard] Delvare, sweeping on *Tilia platyphyllos* (GDEL4046/10032).

Eupelmus (*Eupelmus*) *janstai* Delvare & Gibson *in* Al khatib *et al.*, 2014: 837–838 (unavailable name; original description, keyed, illustrated).

Description. FEMALE (habitus: Fig. 45c–f). Length = 2.3–3.15 mm. Head (Fig. 45a, b) mostly green to somewhat bluish-green, except frons sometimes with some coppery luster, vertex and occiput often more distinctly blue to purple, and scrobal depression and interantennal prominence variably extensively dark with limited greenish luster to more distinctly violaceous (Fig. 45a) under some angles of light; with slightly lanceolate white setae on lower face and at least ventral two-thirds of parascrobal region compared to less conspicuous hairlike setae on frontovertex and parascrobal region dorsally. Maxillary and labial palps brown. Antenna dark with at most slight bluish luster on scape and pedicel. Pronotum sometimes mostly brown but with at least slight violaceous luster to more extensively bluish or purple to violaceous laterally, including lateral panel (Fig. 45g, i); mesonotum (Fig. 45g, h) primarily greenish, sometimes with some coppery luster but at most with very limited bluish luster under some angles of light, most distinctly on axillae and anteriorly on anteromedial mesoscutal lobe; tegula, prepectus, acropleuron, metanotum and propodeum primarily brown or dark with variably distinct metallic lusters, particularly callus variably distinctly green to blue or violaceous laterally. Pronotum with admarginal setae dark; mesonotum with hairlike to slightly lanceolate white setae; prepectus with 1–5 setae (Fig. 45i); callus with comparatively sparse white setae similar to mesoscutum. Macropterous; fore wing hyaline with brown setae (Fig. 45j); costal cell dorsally near leading margin with 1 or 2 partial rows of setae over about apical two-thirds, and ventrally with about 3 rows along length; basal cell and disc entirely setose except for comparatively short, inconspicuous linea calva extending to about level with base of marginal vein. Front leg with at least posterior surface of femur mostly dark except apically; tibia mostly pale except subbasally narrowly dark dorso- and ventrolongitudinally; tarsus pale except sometimes for more brownish apical tarsomere. Middle leg entirely pale beyond coxa except for dark mesotibial apical pegs and mesotarsal pegs and sometimes for more brownish apical tarsomere. Hind leg entirely pale beyond coxa or at most anterior surface of femur variably distinctly brownish longitudinally over at most about ventral half, the femur at least pale dorsolongitudinally. Gaster (Fig. 45c, d, f) with hairlike setae; mostly brown with only slight metallic green to coppery lusters under some angles of light except basal tergite anteriorly more distinctly bluish-purple; ovipositor sheaths distinctly banded, with elongate medial pale band obviously longer than dark basal region or lighter brownish apical region.

Head in dorsal view with interocular distance about 0.41–0.44× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; vertex alutaceous to somewhat alutaceous-imbricate or carinate in part, the transversely aligned margins of sculpture slightly raised; frons meshlike coriaceous (Fig. 45a, b); scrobal depression smooth and shiny at least mesally (Fig. 45a, b) but variably distinctly alutaceous to alutaceous-imbricate laterally (Fig. 45a); OOL: POL: LOL: MPOD about 0.9–1.0: 2.4–2.5: 1.4–1.5: 1.0. Mesoscutum (Fig. 45g, h) meshlike reticulate except medial lobe more alutaceous to transversely reticulate-imbricate anteriorly and lateral lobe with mediolongitudinal band of minute coriaceous sculpture. Scutellum and axillar low convex in same plane; axilla coriaceous to somewhat reticulate anteriorly and obliquely alutaceous- to reticulate-imbricate posteriorly; scutellum longitudinally imbricate to reticulate-imbricate laterad more coriaceous midline and frenal area meshlike coriaceous. Acropleuron more-or-less isodiametric meshlike anteriorly and posteriorly and much more minutely sculptured mesally, the larger meshlike sculpture coriaceous-reticulate, the cells at most delineated by only slightly raised lines. Fore wing (Fig. 45j) with cc: mv: pmv: stv about 4.0–4.3: 3.8–4.3: 1.0: 1.0. Middle leg with row of 3 or 4 mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus and pegs differentiated into two rows apically; second tarsomere with 4 or 5 pegs, third tarsomere with 2 or 3 pegs, and fourth tarsomere with 1 peg apically on either side. Propodeum with broadly U-shaped plical depression extending to posterior margin (Fig. 45g, h). Gaster (Fig. 45c, d, f) about 1.1–1.2× as long as combined length of head and mesosoma; not atypically modified; not nearly extending to apex of second valvifer, the latter extending quite obviously beyond gastral apex (Fig. 45c, d), with apparent sheath length about 1.3–1.4× length of metatibia and 1.4–1.5× length of mv, and third valvula about 1.15–1.2× length of metatibia and 1.21–1.35× length of mv; hypopygium extending over half but less than two-thirds length of gaster.

MALE. Unknown.

Distribution. Czech Republic, **Romania*** [Iasi, Bârnova forest, glade near Slobozia, mesophilic grassland, *Salix*, *Populus*, *Crataegus*, 290m., 4.VII.2011, J.S. Noyes (AICF: 1♀)].

Biology. Unknown, but holotype collected sweeping *Tilia platyphyllos* Scopoli (Malvaceae) and the Romania specimen by sweeping various trees (*Salix*, *Populus*, *Crataegus*).

Remarks. The holotype of *E. janstai* (Fig. 45d, f) lacks most of the left wings and the right wings are dissected from the specimen and glued to the card mount, as is the right antenna; the left antenna is missing the clava. The setae are abraded in the region of the linea calva in the mounted fore wing, superficially resulting in a large bare region, but the setal pores show that the linea calva was similarly short as for the paratypes. The holotype is the largest specimen and has brighter and more distinct metallic colouration, particularly laterally on the pronotum and on the callus, as well as somewhat coarser or more distinct sculpture, particularly laterally within the scrobal depression. Because of treatment for DNA extraction the legs are empty and thus can be seen through.

Females of *E. janstai* are recognized by the following combination of features: frons uniformly coriaceous (Fig. 45a, b), scrobal depression smooth and shiny at least mesally to level of interantennal prominence (Fig. 45a), ovipositor sheaths with third valvulae longer than metatibia or marginal vein (Fig. 45c, d), and middle and hind legs entirely pale beyond coxa or at most metafemur partly dark ventromesally. The latter feature differentiates *E. janstai* females from those of the more common species *E. azureus*, which have more extensively dark legs, with at least all of the femora being similarly dark (Fig. 13a, c). Although superficially similar to *E. azureus* because of their scrobal depression sculpture pattern and long ovipositor sheaths, the molecular results of Al khatib *et al*. (2014) indicate *E. janstai* is most closely related to all but one of the species we include in the *urozonus* species group (Al khatib *et al*. 2014, figs 1, 2). If so, their extensively smooth and shiny scrobal depression likely was inherited from a common ancestor with other *urozonus*-group species excluding *E. simizonus*, whereas their long ovipositor sheaths are indicated to be secondarily derived independently of *E. azureus* and other species with comparatively long sheaths. Males are unknown for *E. janstai*, but if the molecular results of Al khatib *et al*. (2014) accurately represent relationships, males may resemble those of *E. urozonus* in such features as flagellar structure and setal pattern of the lower face (see further under 'Remarks' for *E. urozonus*).

E. (*Eupelmus*) *kalinai* Gibson & Fusu n. name

Figs 46a–h (♀), 47a–f (♂)

Eupelmus algiricus Kalina, 1988: 17–18. Holotype ♀, IAEE, examined by GG. Type data: Africa sept.: Algeria, Gr. Kabylia: Tiziouzou, 15.VI.1971, A. Hoffer et J. Horák / Kreslený [= drawn]. Secondary homonym of *Eupelmus* (*Macroneura*) *algiricus* (Kalina 1981: 106–107).

Description. FEMALE (habitus: Fig. 46b, c). Length = 2.1–3.0 mm. Head comparatively bright green to bluish-green (Fig. 46a) with at most only very limited coppery luster under some angles of light, but sometimes vertex and occiput purple; with slightly lanceolate white setae on lower face and parascrobal region to at least dorsal limit of scrobal depression and usually on frons along inner orbit compared to less conspicuous hairlike setae on vertex and mesally on frons. Maxillary and labial palps white except apical labial and sometimes maxillary palpomere brown. Antenna dark with similar metallic lusters as face on scape and pedicel, at least in part. Mesosoma with tegula yellow (Fig. 46b, d), usually more opaque along inner margin or anteriorly and more translucent laterally to posteriorly, otherwise mesosoma comparatively bright green to bluish-green similar in colour to head; mesonotum, prepectus entirely setose similar to callus, with slightly lanceolate white setae. Macropterous; fore hyaline (Fig. 46h) with white setae; costal cell with 1 or more rows of comparatively inconspicuous setae along length both dorsally and ventrally; basal cell and disc entirely setose except for linea calva. Front leg often entirely pale beyond coxa except for apical tarsomere, but sometimes posterior surface of femur variably extensively brownish. Middle leg usually pale beyond coxa except for dark apical tarsomere, though femur sometimes with up to basal three-quarters orange to brown, and mesotibial apical pegs sometimes dark orange. Hind leg pale beyond coxa except for apical tarsomere and usually about basal half to two-thirds of femur or at least anterior and ventral surfaces of femur dark brown. Gaster (Fig. 46b, c) with hairlike setae; dark with variably distinct greenish or bluish-green luster under some angles of light; ovipositor sheaths entirely dark (Fig. 46b, f).

Head in dorsal view with interocular distance about 0.45–0.5× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; vertex usually with shallower meshlike

reticulation or partly reticulate-imbricate but at least frons and scrobal depression distinctly meshlike reticulate to punctate-reticulate (Fig. 46a); OOL: POL: LOL: MPOD = 1.4–1.5: 3.0–3.2: 1.6–1.7: 1.0. Mesoscutum distinctly meshlike reticulate except lateral lobe with mediolongitudinal band of minute coriaceous sculpture. Scutellum and axillae low convex in same plane, meshlike reticulate to reticulate-imbricate posterolaterally on axilla and longitudinally on scutellum laterad midline but frenal area quite uniformly meshlike coriaceous-reticulate. Acropleuron (Fig. 46d) more-or-less isodiametric meshlike reticulate anteriorly and posteriorly, the sculpture delineated by quite distinct ridges, though much more minutely coriaceous to punctate mesally. Fore wing (Fig. 46h) with cc: mv: pmv: stv = 3.7–4.1: 2.8–3.3: 1.0–1.1: 1.0. Middle leg (Fig. 46g) with 3 or 4, sometimes relatively inconspicuous mesotibial apical pegs; mesotarsus ventrally densely setose without pegs, though basitarsus with row of 3 or 4 longer, seta-like spines somewhat closer to anterior margin. Propodeum with comparatively large, rectangular plical depression extending to posterior margin, the lateral margins subparallel (Fig. 46e). Gaster (Fig. 46b, c) similar in length to combined length of head and mesosoma; syntergum with posterolateral angles abruptly, obliquely angled anteromesally below anal sclerite, in posterior view syntergal margin appearing transversely to subcircularly Ω-like over sheaths without distinct surface between anal sclerite and sheaths (Fig. 46f); extending over base of third valvula such that division between second valvifer and third valvula usually not visible, but third valvula about 0.5× length of metatibia and about 0.75× length of mv (apparent sheath length (Fig. 46b, c) much less if basal limit of third valvula concealed by syntergum); hypopygium extending a little beyond half-length of gaster.

MALE (habitus: Fig. 47a). Length = 1.3–2.0 mm. Head (Fig. 47b–d) almost completely green except for some bluish luster on lower face to greenish-blue to almost completely blue or purple; frons distinctly meshlike reticulate to punctate-reticulate (Fig. 47c); vertex uniformly curved into occiput, similarly but more finely meshlike sculptured than frons, shallowly reticulate to coriaceous-reticulate in smaller individuals; scrobal depression excluding scrobes extensively meshlike or punctate-reticulate similar to frons (Fig. 47c); setae hairlike, white; lower face with mostly short setae, the setae sometimes somewhat longer toward malar sulcus, but straight to evenly curved and uniformly distributed (Fig. 47c, d); gena posterior to malar sulcus with 1 much longer seta differentiated from others (Fig. 47c, d), and posterior to eye with apices of setae directed toward orbit. Antenna (Fig. 47a) with scape pale basally and along outer, ventral, longitudinal sensory region (Fig. 47c, d); pedicel subglobular, only about as long as wide, and ventrally with row of 3 long, apically curved setae (Fig. 47e insert); length of pedicel + flagellum about 2.3× head width; flagellum elongate-filiform (Fig. 47a) with clava about 0.7–0.8× length of apical two funiculars; anellus very strongly transverse, discoidal, smooth and shiny (Fig. 47e insert), usually pale; funicle with fu1 about 2–3× as long as pedicel and 3.7–4.7× as long as wide, with all subsequent funiculars conspicuously longer than wide, the apical funicular at least twice as long as wide, and with outstanding white setae longer than width of funiculars (Fig. 47e); basal funiculars without regions of modified setae ventrally. Maxillary and labial palps pale. Mesosoma (Fig. 47a, b) similar in colour to head, green to slightly bluish-green or variably extensively, sometimes entirely blue to purple, with metanotum and/or propodeum sometimes variably extensively blue to purple (Fig. 47b) when pronotum and mesonotum entirely green; setae hairlike, white; tegula pale, yellowish (Fig. 47a). Legs entirely pale beyond coxae except for brown apical one or two tarsomeres and metafemur sometimes with anterior surface partly dark, though pale at least apically and along entire dorsal length. Fore wing with mv 2.2–2.6× length of stv; costal cell (Fig. 47f) dorsally near leading margin with only about 5 inconspicuous, white setae apically over distance about equal to length of parastigma, and ventrally with inconspicuous pale setae in row basal to parastigma; basal cell (Fig. 47f) with comparatively inconspicuous white setae and sometimes only sparsely setose, the mediocubital fold always with setae but basal fold sometimes without setae; speculum open posterobasally or partly closed by a few inconspicuous white setae. Propodeum with complete median carina and panels meshlike coriaceous to coriaceous-reticulate, at least posteriorly (Fig. 47b).

Distribution. Algeria, **Cyprus*** [6 km N Lemesos, 24-25.V.2009, Cecidomyiidae gall on *Hyparrhenia hirta*, Fusu & Popovici (AICF: 1♀)], **Greece*** [Crete, Chania, 9 km N. Elafonisi, 35º21'N 23º33'E, 50 m., 16-17.VIII.2001, J. Noyes (BMNH, CNC: 12♀, 6♂; 1♀ CNC Photo 2013-15 and 1♂ 2013-142); Ikaria, road between Xylosirtis & Chrisosomos, 2.IX.2002, sweep, Pucci, CNC Photo 2013-16 (CMNH: 1♀); Ikaria, Xylosirtis, 2.IX.2002 (1♀, CNC Photo 2013-14), ~1.5 km E, 30.VII.2002 (2♀), ~3 km SW, 6.IX.2002 (1♀), ~7 km SW, 29.VII.2002 (1♀), sweep, Pucci (all CMNH); Kos, 4 km W. Kos town, 20.VIII.1994, J. Noyes (CNC: 1♀); Pelop[onessus], Petalidion, 26.VIII.1979, Z. Bouček, CNC Photo 2012-110 (NMPC: 1♂); Rhodes, Ixia, 15-29.VIII.1984, M.C. Day (CNC: 2♂; CNC Photo 2012-111 and 2012-112)], **Italy*** [Gargano, 8.VIII.1979, Lars Huggert, CNC Photo 2012-56 (CNC: 1♀)], **Oman*** [Muscat, Qurm below Gulf hotel, 27.II.1986, J.T. Huber,

mangrove, CNC Photo 2013-143 (CNC: 3♀, 2♂)], **Spain*** 25 km Z.W. van Salou, 17.X.1952, Bär Blöte de Jong & Osse (RMNH: 3♀); Castellon, Benicasim, 22-24.VI.1974, Z. Bouček (BMNH: 1♀)], **United Arab Emirates*** [Wadi Wurayah farm, A. van Harten, MT, 17-24.III.2009 (CNC: 2♀), 31.V-16.VI.2009, (AICF:1♀, 3♂)].

Biology. One female from Cyprus was reared from an unidentified Cecidomyiidae gall on *Hyparrhenia hirta* (L.) (Poaceae).

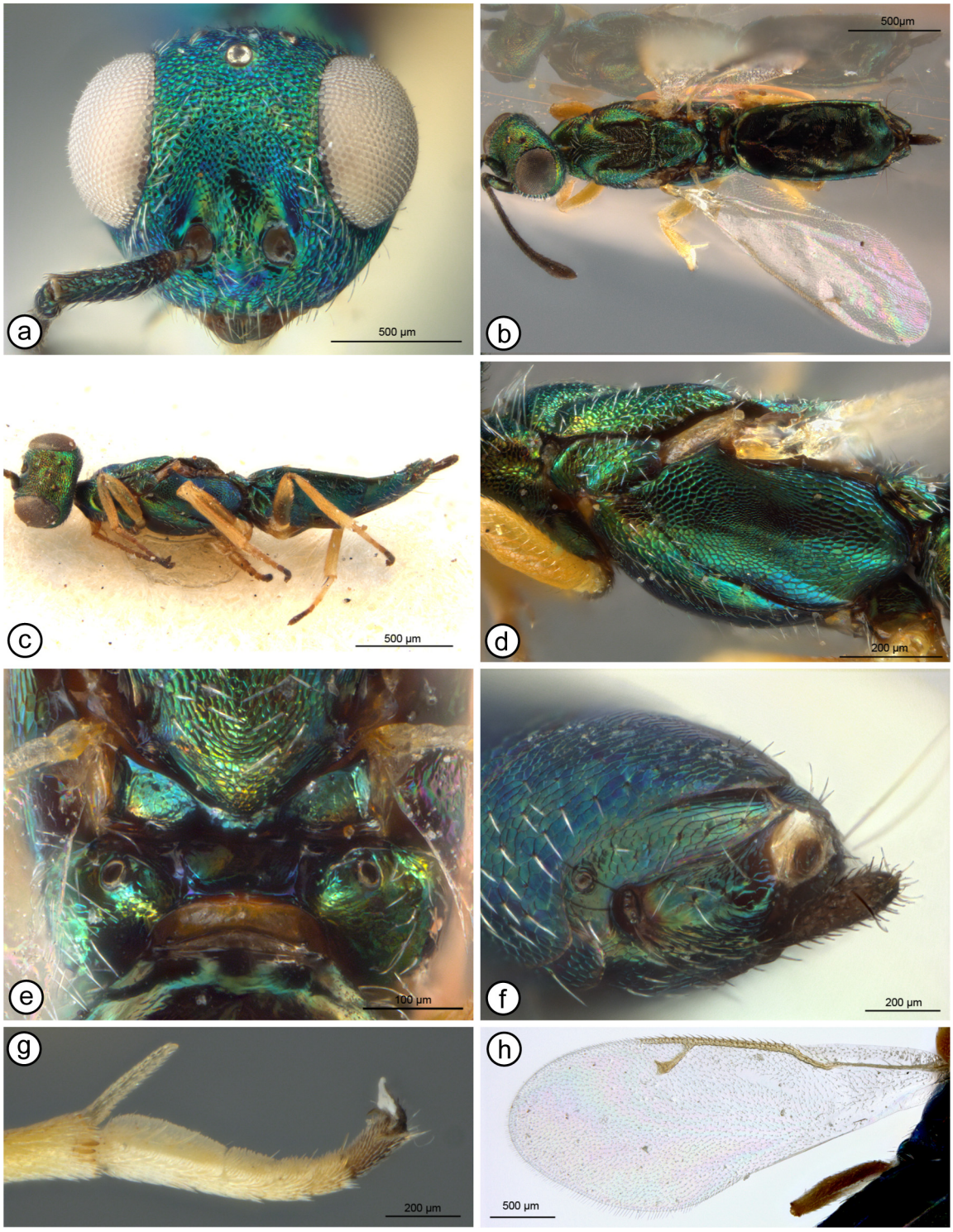

FIGURE 46. *Eupelmus kalinai*, ♀. **a**, head, frontal (2013-14). *b, d, e* (2012-56): **b**, dorsal habitus; **d**, mesosoma, lateral; **e**, apex of scutellum to propodeum. **c**, lateral habitus (holotype). *f, h* (2013-15): **f**, apex of gaster, posterolateral view; **h**, fore wing. **g**, apex of mesotibia and mesotarsus (2013-16).

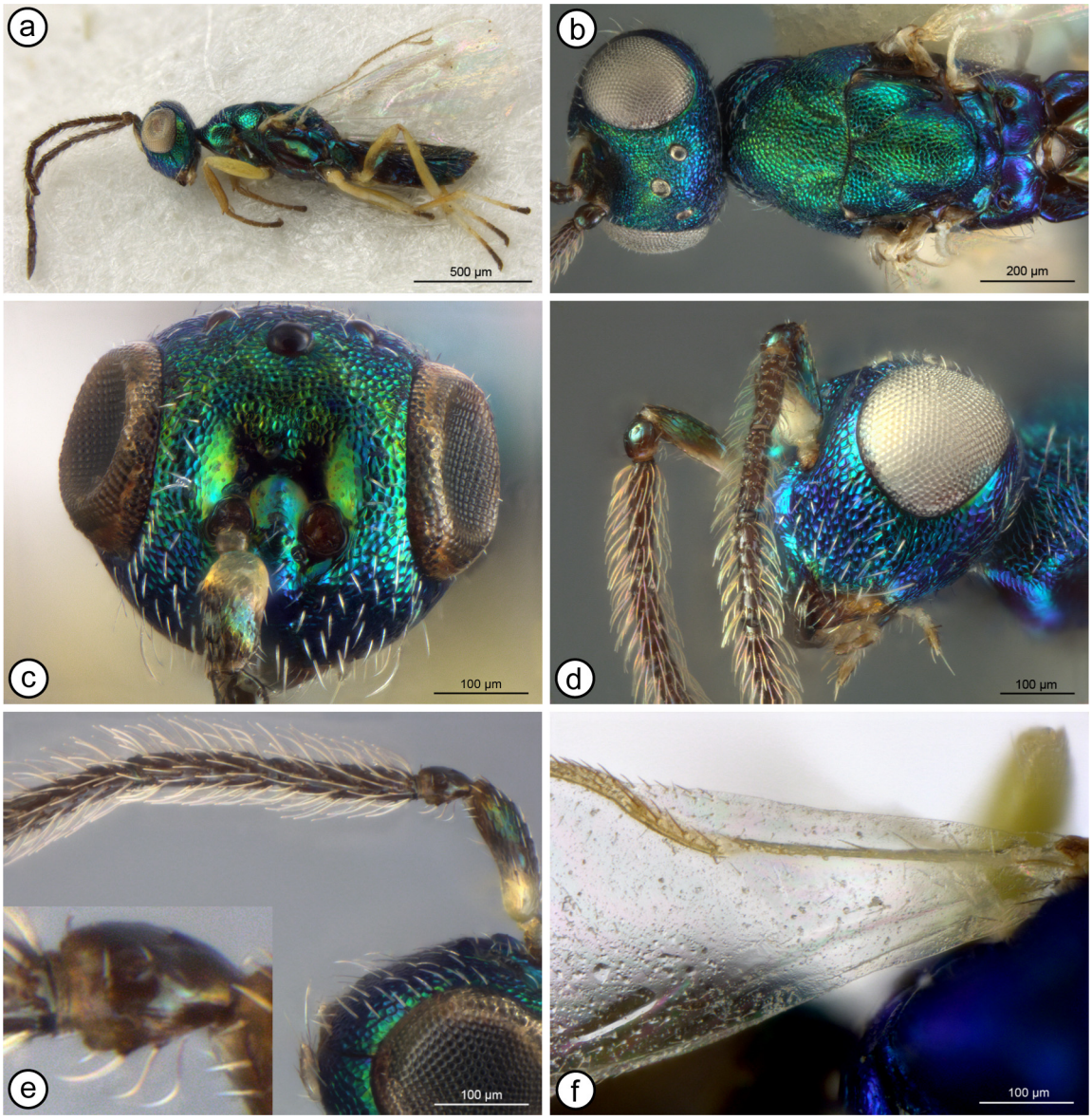

FIGURE 47. *Eupelmus kalinai*, ♂. **a**, lateral habitus (2012-110); **b**, head and mesosoma, dorsal (2012-111); **c**, head, frontal (2013-142); **d**, head, lateral (2012-112); **e**, scape, pedicel and basal four funiculars [insert: enlargement of pedicel] (2013-142); **f**, fore wing base (2013-143).

Remarks. Kalina (1981) described *E. kalinai* under the name *E. algiricus* from a single female. The holotype (Fig. 46c) is card-mounted in an uncontorted state; it lacks its right antenna and both sets of wings, but these were removed by Kalina to illustrate the original publication (Kalina 1988, fig. 32 and plate V, figs 2–4, 6), as indicated by the type labels. *Eupelmus kalinai* is one of three regional species we include in the *iranicus* species-group, as discussed under *E. iranicus*. Described differences between *E. kalinai*, *E. iranicus* and possibly *E. longicorpus* (see under *E. iranicus*) might simply represent intraspecific variation. Females of *E. kalinai* vary in how extensively dark are the femora and mesotibiae, with some females from Greece having the legs entirely pale beyond the coxae similar to *E. iranicus*, but all have the scape and ovipositor sheaths entirely dark, and have white setae on the fore wings (see also under *E. iranicus*).

The two males from Oman are much darker blue to purple than most of the males from Greece, most of which are primarily green, though some have the metanotum and/or propodeum blue to purple and one has both the head and mesosoma quite extensively bluish-green to blue. The fore wings have whitish setae similar to those of *E. infimbriatus* so that the setal patterns of the costal and basal cells are at best inconspicuous and depending on preservation and mounting of the specimen sometimes very difficult to observe (Fig. 47f). We expect at least males

of *E. iranicus* to be very similar to those of *E. kalinai* and thus likely to key out in the same couplet. Because of their gracile-filiform flagellum (Fig. 47a), ventrally pale scape (Fig. 47d) and extensively pale legs (Fig. 47a), males of at least *E. kalinai* are very similar to some *E.* (*Macroneura*) males, particularly those of *E. falcatus* because of their pale tegula. However, males of *E. falcatus* have at least the meso- and usually the metatibiae distinctly darkened apically as well as the basal cell conspicuously setose, though sometimes with pale setae.

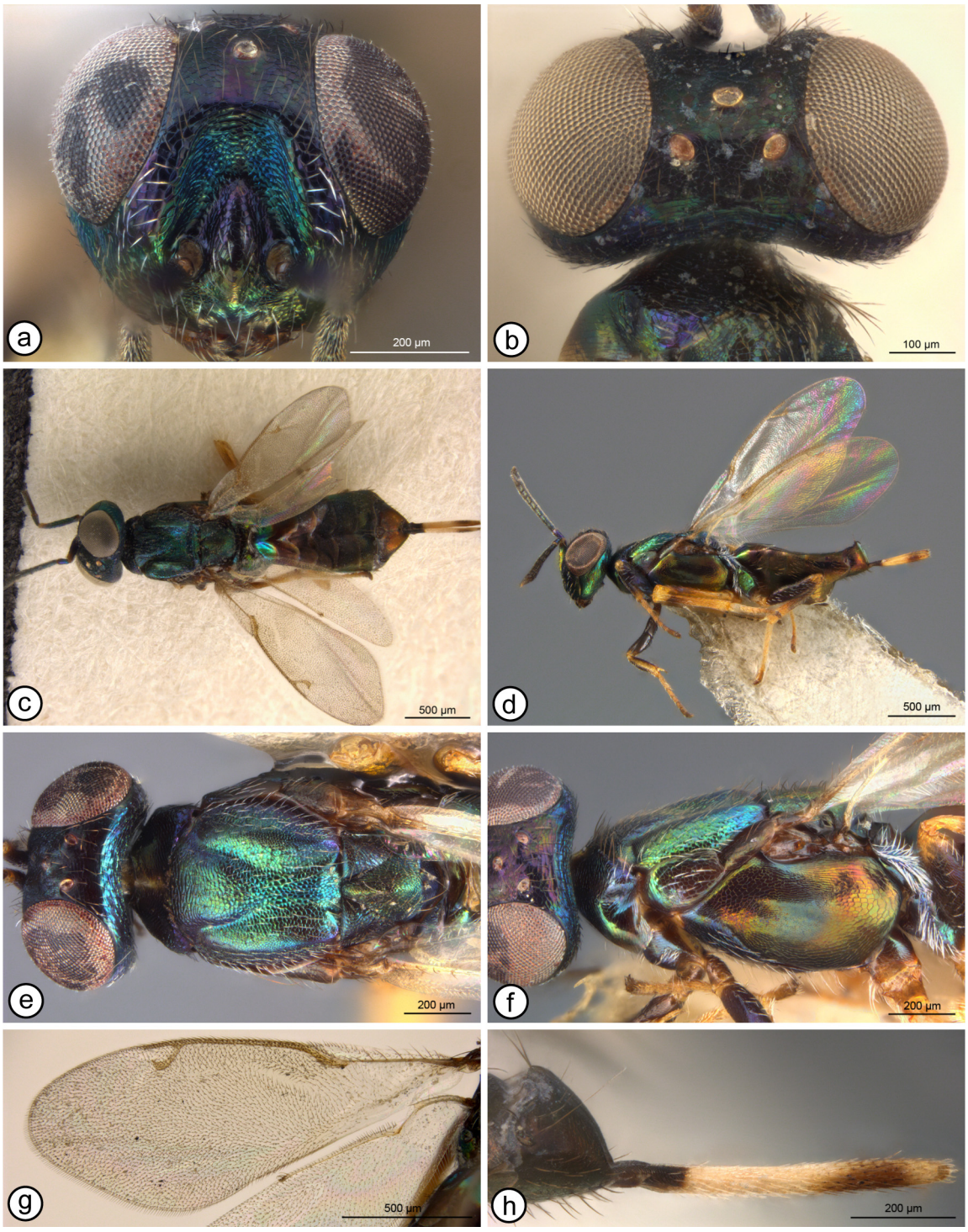

FIGURE 48. *Eupelmus kamijoi*, ♀. **a**, head, frontal (2014-24). *b, c, g, h* (2013-157): **b**, head, dorsal; **c**, dorsal habitus; **g**, fore wing; **h**, apex of gaster and ovipositor sheaths, lateral. **d**, lateral habitus (holotype). **e**, head and mesosoma, dorsal (2014-23). **f**, vertex/occiput (dorsal) and mesosoma (lateral) (2014-24).

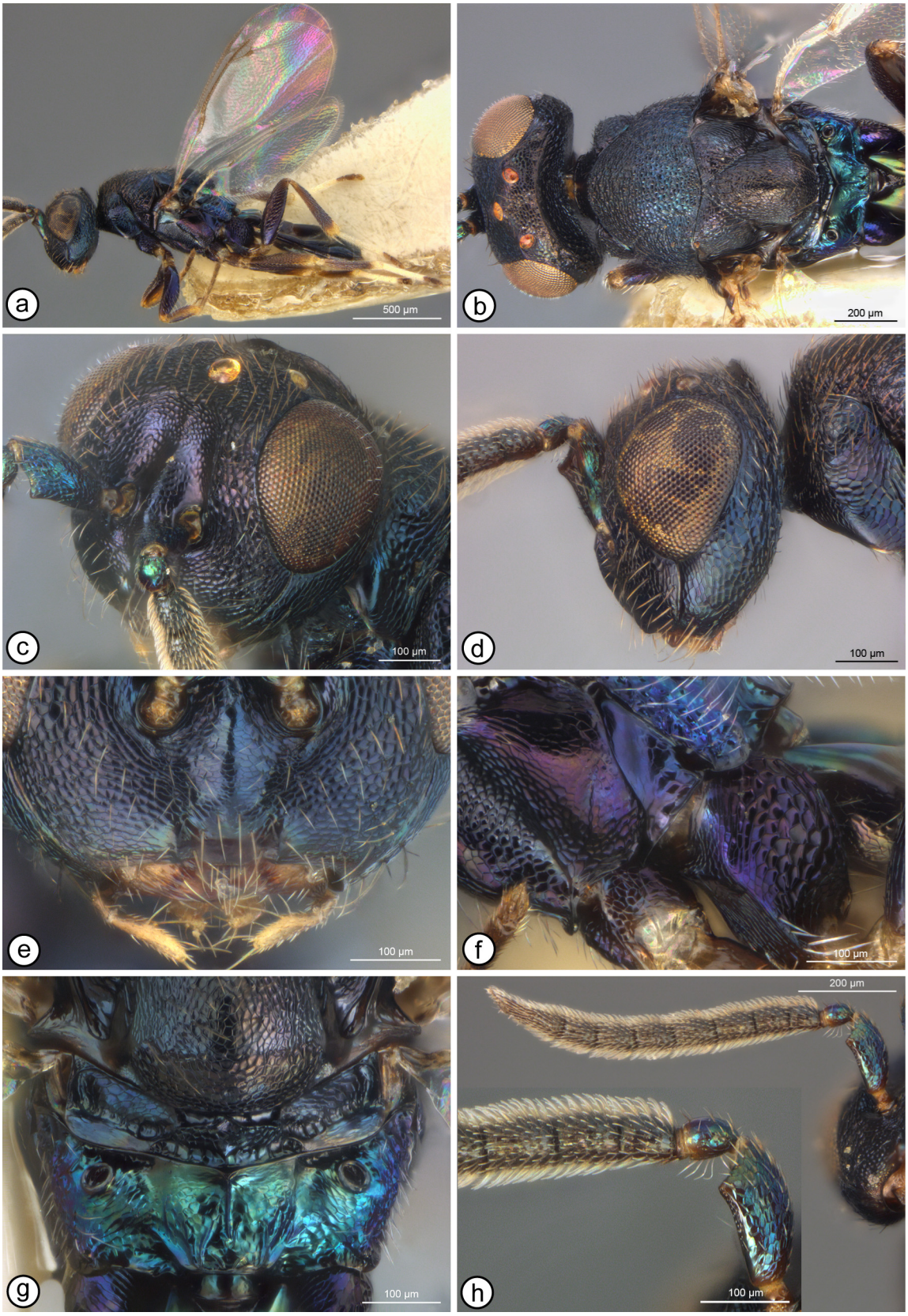

FIGURE 49. *Eupelmus kamijoi*, ♂. *a, d, f* (2014-27): **a**, lateral habitus; **d**, scape, head and pronotum, lateral; **f**, metapleuron and metacoxa, lateral. *b, g* (2014-128): **b**, head and mesosoma, dorsal; **g**, apex of scutellum to propodeum. **c**, head, frontolateral (2014-28). **e**, lower face, frontal (2014-26). **h**, antenna, inner view [insert: enlargement of scape, pedicel and basal funiculars] (2014-25).

***E.* (*Eupelmus*) *kamijoi* Gibson & Fusu n. sp.**
Figs 48a–h (♀), 49a–h (♂)

Type material. Holotype ♀ (EIHU). [JAPAN: Honshu] Yatabe, Ibaraki ken, 30.V.1980, A. Ootake / HOST *Dryocosmus kuriphilus* Yasumatsu / 127-129 / HOLOTYPE ♀ *Eupelmus* (*Eupelmus*) *kamijoi* Gibson & Fusu, det. G. Gibson 2015. Condition: glued by left side on triangular point; uncontorted; entire.

Paratypes (27♀ & 13♂). **ORIENTAL. China:** [Hupeh], West Hupeh, Lichuen District, Suisapa, 1000m, 24.VII.1948 (CASC: 1♀). [Jiangsu], Nanking, *Dryocosmus kuriphilus* gall, gall *Castanea mollissima* (USNM: 1♀).

PALAEARCTIC. China: Hebei, Changli, Fruit Tree Research Institute, 13.VIII.1979 [on opposite side of same label] number: 203, original number: 1, *Dryocosmus kuriphilus* Yasumatsu (IZCAS: 1♀), *Eupelmus* sp. ex. Cynipidae of chestnut, Hebei prov., IOZ(E)1653260 (IZCAS: 1♀, CNC Photo 2013-159). Hebei, 83-1453, Beijing, Shang-da-dui, Ping-gu-guan, Beijing; 5.V.1981, collector: Luo Wei-de, *Torymus sinensis* Kamijo, IOZ(E)1653416 [label written in Chinese] (IZCAS: 1♀, CNC Photo 2013-157). **Japan**: HONSHU: same data as holotype except some with various numbers and reared 22 (1♂), 23 (1♀), 26 (2♀).V.1980, 2.VI.1980 (2♀), V.1981 (1♀ CNC Photo 2014-24, 2♂), 25.V.1981 (1♂), 18.VI.1981 (1♂) (all EIHU); Nose, Osaka, K. Kamijo, *Dryocosmus kuriphilus* on *Castanea crenata* (C-106 of Yukawa & Masuda, 1996), 3 (1♂, CNC Photo 2014-25), 6 (1♂), 10 (2♀).IV.1982 (all ELKU); Nose-cho, Osaka-fu, em. III.1978, F. Komai, *Dryocosmus kuriphilus* Yasumatsu (EIHU: 2♂, with CNC Photo 2014-26 and 2014-128); Nose, Osaku-fu, 6 (1♀), 7 (3♂, two with CNC Photo 2014-27 and 2014-28), 10 (3♀).IV.1982, 12.VI.1982 (1♀), K. Kamijo, *Dryocosmus kuriphilus* Yasumatsu (all EIHU); Honshu, 4.VII.1953 (MHNG: 2♀, one with CNC Photo 2013-158); Honshu I., IX.1953 (MHNG: 1♀, CNC Photo 2013-156; 1♂, CNC Photo 2013-160), T. Muto, *Dryocosmus kuriphilus*, *Eupelmus urozonus* Dalm. Ch. Ferrière det.; Saitama, Ogose, ?.VII.1977, T. Nambu, *Dryocosmus kuriphilus* Yasumatsu (EIHU: 2♀, one with CNC Photo 2014-23); Saitama, Yorii, 29.VI.1977, T. Nambu, *Dryocosmus kuriphilus* Yasumatsu (EIHU: 1♀). KYUSHU: Ozu, Kumamoto, 26.I.1990, Y. Murakami, *Dryocosmus kuriphilus* on *Castanea crenata* (C-106 of Yukawa & Masuda, 1996), 15-19.V. 1990 em. (ELKU: 3♀).

Etymology. Named in honour of Dr. Kazuaki Kamijo, who collected part of the type series and was the first to recognize that more than one species of *Eupelmus* is a parasitoid of the chestnut gall wasp in Japan (Ôtake *et al.* 1982).

Description. FEMALE (habitus: Fig. 48c, d). Length = 1.9–2.8 mm. Head (Fig. 48a, b) with at least some greenish luster and sometimes extensively green, usually most distinctly on lower face and within scrobal depression, though frons commonly comparatively dark with less distinct metallic lusters, and parascrobal region usually and interantennal prominence sometimes similarly dark with reddish-violaceous or slight coppery lusters, but lateral surface of scrobe usually blue to bluish-purple under some angles of light (Fig. 48a); with mostly brownish to white, hairlike setae. Maxillary and labial palps brown. Antenna with scape usually dark with bright green to bluish or purple lusters under different angles of light, but at least brown with slight metallic luster rather than distinctly orange, and pedicel and flagellum brown except at least pedicel dorsally with slight bluish to purple luster. Pronotum mostly brown to extensively green but with variably distinct purple to violaceous luster dorsolaterally (Fig. 48e, f); admarginal setae dark except lighter, usually white, anterior and laterad spiracle (Fig. 48f). Mesonotum with hairlike to slightly lanceolate white setae; sometimes brownish with comparatively inconspicuous metallic lusters similar to frontovertex, but usually extensively green to mostly bluish to purple, and scutellum at most with very slight and inconspicuous coppery luster mesally. Prepectus mostly brown to variably extensively green or with some violaceous luster; with 5–14 setae (Fig. 48f). Tegula dark. Acropleuron (Fig. 48f) mostly brown to comparatively bright green with some coppery luster under some angles of light. Metanotum with at least slight metallic luster laterally, the propodeal callus often comparatively bright green to partly blue or purple; callus with longer and denser, much more conspicuous white setae than on mesonotum, though not entirely obscuring cuticle (Fig. 48f). Macropterous; fore wing (Fig. 48g) hyaline with setae of basal cell usually lighter in colour, white compared to somewhat darker yellowish to brown discal setae; costal cell dorsally near leading margin with row of setae over about apical half to two-thirds, and ventrally with at least 3 rows along length; basal cell and disc entirely setose except for linea calva extending basally to level at most about equal with middle of parastigma. Front leg with femur mostly dark and tibia variably distinctly brownish to dark dorso- and ventrolongitudinally, but femur apically, tibia basally, apically and longitudinally along anterior and posterior surfaces, and tarsus pale. Middle leg often entirely pale beyond coxa except for dark mesotibial apical and

mesotarsal pegs, but sometimes with variably distinct though short subbasal brownish region on tibia and rarely with short, subapical brownish region on posterior surface of femur opposite tibial brownish region when femur and tibia appressed. Hind leg sometimes entirely pale beyond coxa except for mostly dark femur, but tibia often also variably conspicuously and extensively darkened submesally, though always more widely pale apically than basally. Gaster (Fig. 48c, d) with hairlike setae; mostly brown with some coppery luster dorsally except basal tergite anteriorly green to blue, purple or violaceous under different angles of light and usually apical terga less distinctly green or with some coppery luster; ovipositor sheaths (Fig. 48h) dark basally followed by comparatively long pale region, shorter light brownish preapical region and short pale region apically.

Head in dorsal view (Fig. 48b) with interocular distance only about 0.30–0.39× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; in frontal view distance from oral margin to inner ventral margin of torulus subequal to distance between inner mesal margins of toruli; vertex coriaceous to transversely alutaceous-imbricate, and differentiated from occiput by broadly arched carina (Fig. 48b, e); frons (Fig. 48a, b) entirely meshlike coriaceous; scrobal depression meshlike reticulate; OOL: POL: LOL: MPOD = 0.4–0.8: 1.6–2.3: 1.3–1.6: 1.0. Mesoscutum (Fig. 48e) mostly meshlike reticulate except medial lobe more transversely imbricate-strigose to alutaceous-imbricate anteriorly and lateral lobe with mediolongitudinal band of minute coriaceous sculpture. Scutellum and axillae low convex in same plane; axilla meshlike reticulate mesally to obliquely reticulate-imbricate laterally and scutellum longitudinally reticulate-imbricate laterad midline anterior to meshlike coriaceous frenal area. Acropleuron (Fig. 48f) more-or-less isodiametric meshlike anteriorly and posteriorly and much more minutely sculptured mesally, the larger meshlike sculpture posteriorly coriaceous-reticulate, the cells at most delineated by only slightly raised ridges. Fore wing (Fig. 48g) with cc: mv: pmv: stv = 4.5–5.5: 3.5–4.5: 1.2–1.35: 1.0. Middle leg with row of 4–6 mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus and pegs clearly differentiated into two rows apically; second tarsomere with 3–5 pegs, third tarsomere with 2 or 3 pegs, and fourth tarsomere with 1 peg apically on either side. Propodeum with broadly U-shaped plical depression extending to posterior margin. Gaster (Fig. 48c, d) similar in length to combined length of head and mesosoma; not atypically modified; extending to base of third valvula, the latter about 0.74–1.0 length of metatibia and about 0.9–1.2× length of mv; hypopygium extending about two-thirds length of gaster.

MALE (habitus: Fig. 49a). Length = 1.8–1.9 mm. Head (Fig. 49a–e) dark or with very slight bluish to violaceous or purple lusters under some angles of light; frontovertex distinctly reticulate, though frons often more shallowly reticulate than vertex; vertex differentiated from occiput by well developed, high, almost laminar transverse carina (Fig. 49b, d); scrobal depression reticulate, including scrobes except just dorsad toruli (Fig. 49); setae hairlike, white to brownish; lower face with setae somewhat longer toward malar sulcus, but evenly distributed and longer setae straight to uniformly curved (Fig. 49d, e); gena posterior to malar sulcus with at least 1 conspicuously longer seta and apical to this 2 or 3 shorter, finer setae adjacent to oral margin, and posterior to eye with apices of setae directed toward orbit. Antenna with scape entirely dark, with ventral margin conspicuously angulate subapically (Fig. 49c, d), and about 2× as long as wide measured across level of angulation; pedicel (Fig. 49h) about 1.25× as long as wide and with 5 or 6 long setae, of which all but apical-most seta curved (Fig. 49h insert); length of pedicel + flagellum about 1.35–1.48× head width; flagellum robust-filiform (Fig. 49h) with clava slightly longer than apical two funiculars; anellus very strongly transverse, discoidal, shiny, with at most inconspicuous, sparse setae at extreme apical margin; funicle with fl1 about 1.1–1.2× as long as pedicel and about 1.2× as long as wide, with subsequent funiculars all oblong, quite distinctly longer than wide and of similar length, and uniformly covered with decumbent, curved setae except in lateral view fu1 and fu2 with more conspicuous decumbent setae dorsally than ventrally (Fig. 49h insert) and in ventral view with slender, longitudinal region of differentiated, shorter setae. Maxillary and labial palps brown except apical palpomeres pale, at least apically. Mesosoma (Fig. 49a, b) similarly dark with slight metallic lusters as head except propodeum much more distinctly blue, to purple laterally (Fig. 49g); setae hairlike, brownish; tegula dark. Legs with metacoxa similarly dark with slight metallic lusters as mesonotum, in lateral view widest basally and dorsal margin evenly curved apically, without projection dorsoapically (Fig. 49f); femora dark or apices, particularly mesofemur, narrowly pale; protibia pale except for dorso- and ventrolongitudinal dark bands, meso- and metatibiae mostly dark except pale basally and apically; mesotibial spur white; protarsus pale to yellowish-brown, meso- and metatarsi with basal 3 tarsomeres white, fourth tarsomere usually variably dark brown and apical tarsomere dark brown. Fore wing with mv about 3.2–3.4× length of stv and pmv slightly longer than stv; costal cell dorsally near leading margin with dark setae

apically for about half length, and ventrally with multiple rows apically though reduced to 2 rows within basal half. Propodeum (Fig. 49g) with complete, though sometimes posteriorly irregular median carina, and with oblique carina extending anterolaterally from foramen toward anterior margin for up to about half distance, and panels otherwise variably distinctly reticulate, with sculpture more distinct posteriorly than anteriorly.

Distribution. Oriental and Palaearctic parts of China as well as Japan and possibly South Korea. Yasumatsu & Kamijo (1979: 110) reported seven females of *E. kamijoi* under the name *E. urozonus* that were reared from *D. kuriphilus* from Susan, South Korea (see below). Pak (1963) and Yang (1966) also reported *E. urozonus* from *D. kuriphilus* in Korea and China, respectively. These records may also reflect misidentifications of *E. kamijoi*, though at least that of Pak (1963) more likely refers to *E. kiefferi* based on the colour pattern and relatively short ovipositor sheaths of the female given in the habitus drawing.

Biology. A parasitoid in galls of the Oriental chestnut gall wasp, *Dryocosmus kuriphilus* Yasumatsu (Cynipidae) on *Castanea crenata* Siebold & Zuccharini and *C. mollissima* Blume (Fagaceae), apparently sometimes as a hyperparasitoid through *Torymus sinensis* Kamijo (Torymidae).

Aebi *et al.* (2006) reviewed the literature relative to parasitoids reared from *D. kuriphilus* in China and other countries where the pest has been introduced. *Eupelmus kamijoi* is one of at least four species of *Eupelmus* reared from the Oriental chestnut gall wasp in the far eastern Palaearctic (plus *E. formosae*, *E. kiefferi* and *E. tachardiae*), but previously all specimens were unidentified or misidentified in the literature as *E. urozonus* (e.g. Pak 1963; Yasumatsu & Kamijo 1979; Ôtake *et al.* 1982; Yang 1996; Aebi *et al.* 2006). The MHNG females of *E. kamijoi*, which were identified as *E. urozonus* by Ch. Ferrière, undoubtedly represent voucher material from Yasumatsu & Kamijo (1979). They also reported three other hosts under the name *E. urozonus*, but we have not seen voucher material associated with these records and therefore we do not know whether they also are *E. kamijoi* or of some other species.

Remarks. As discussed under *E. fulvipes*, *E. kamijoi* is included as one of ten species within the *fulvipes* species group because of the presence of a vertexal carina (Figs 48b, e, 49b, d). Females are keyed three times (couplets 51, 72 and 81) because of variation in ovipositor sheath length and metatibial colour pattern, but within the *fulvipes* group are recognized by their comparatively long ovipositor sheaths that have four distinct bands, including an apical-most pale region (extreme tip often darker, Fig. 48h). The vertexal carina is often quite fine (Fig. 48b), though evident with proper lighting. The interorbital distance is also often conspicuously narrow (Fig. 48b), though this latter feature is variable. Females are most likely to be mistaken for those of *E. kiefferi*, particularly because females of the latter species sometime have the apical dark region of the ovipositor sheaths gradually lightened apically, but the sheaths are always much shorter relative to the length of the marginal vein than for *E. kamijoi*. Males are the much more easily identified sex of the species because they have a unique scape structure, being distinctly angulate apicoventrally (Fig. 49c, d, h). As well, the setae on the lower face are evenly distributed and curved (Fig. 49c–e) so as not to appear as a tuft-like region of setae, the metacoxa has the dorsal margin evenly curved and tapered apically (Fig. 49f) (*cf E. kiefferi* and *E. fulvipes*), and the propodeum is variably distinctly longitudinally carinate or rugulose but at least lacks transverse carinae or rugae (Fig. 49g) (*cf E. flavicrurus*, *E. formosae*, *E. luteipes* and *E. tachardiae*).

E. (*Eupelmus*) *kiefferi* De Stefani

Figs 50a–h (♀), 51a–f (♂), 52a–h (♂)

Eupelmus kiefferi De Stefani, 1898: 173. Unknown type status, ♀, unknown depository. Type data: Italy, Sicily, Castelvetrano, reared from galls of *Andricus glandium* [= *Callirhytis glandium* (Giraud)] (November), on *Quercus suber, A. mayri* Wachtl [=*A. grossulariae* Giraud] (April), *Cynips mayri* Kieffer [= *A. dentimitratus* (Rejto)] (March, May, August) and *Cynips tinctoria-nostras* Dest. [= *A. infectorius* (Hartig)] (April) on *Quercus robur* L. [= *Q. robus* Willd.].

Eupelmus kiefferi; Ruschka, 1921: 287 (synonym of *E. urozonus*).

Eupelmus (Eupelmus) fulvipes; Askew & Nieves-Aldrey, 2000: 52 (misidentification).

Eupelmus (Eupelmus) kiefferi; Al khatib *et al.*, 2014: 806 (removed from synonymy), 816 (♀ keyed), 819 (♂ keyed).

Description. FEMALE (habitus: Fig. 50a, b). Length = 1.7–4.0 mm. Head of smaller specimens sometimes mostly brown and scrobal depression often more-or-less distinctly blue under some angles of light (Fig. 50c, e), but at least frontovertex and usually parascrobal region variably extensively dark reddish-violaceous or multicoloured, partly blue or bluish-green and/or coppery (Fig. 50e, f); with slightly lanceolate white setae at least on lower face and parascrobal region to level of dorsal margin of scrobal depression compared to more hairlike setae on frontovertex.

Maxillary and labial palps brown. Antenna with scape usually similarly dark as flagellum (Fig. 50c) and with distinct metallic lusters, but at most more-or-less uniformly dark orangey-brown with at least slight metallic luster (see 'Remarks') (Fig. 50d). Pronotum dorsolaterally blue to purple or violaceous posterolaterally (Fig. 50f–h); admarginal setae dark. Smaller individuals with mesosoma sometimes mostly brown except for variably distinct metallic lusters on mesonotum, but dorsally usually (Fig. 50g) quite distinctly green to bluish-green, the mesoscutum anteriorly often bluish to purple and mesonotum sometimes with variably extensive and distinct coppery or more rarely reddish-violaceous lusters, and propodeal callus sometimes more distinctly blue to purple; mesonotum with hairlike to slightly lanceolate white setae. Prepectus (Fig. 50h) mostly brown or with variably extensive bluish to purple lusters similar to pronotum laterally; extensively setose with white setae similar to mesonotum. Tegula dark. Acropleuron (Fig. 50h) variably distinctly green and sometimes with variably extensive coppery to reddish-brown lusters under some angles of light. Propodeal callus with hairlike to slightly lanceolate white setae, the setae often somewhat longer and more conspicuous than on mesoscutum but not obscuring cuticle. Macropterous; fore wing hyaline with yellowish to brown setae; costal cell dorsally near leading margin with row of setae over at least apical half to three-quarters, and ventrally with at least 2 rows along length; basal cell and disc entirely setose except for elongate linea calva usually extending to level about equal with middle of parastigma. Front leg rarely entirely pale or with only posterior surface of profemur inconspicuously brownish mesally (see 'Remarks', Fig. 50b insert), but usually protibia also with at least light-brownish region subbasally and more commonly quite distinctly dark dorso- and ventrolongitudinally (Fig. 50a, b insert) in combination with distinctly dark profemur (Fig. 50a). Middle leg usually entirely pale beyond coxa except for dark mesotibial apical and mesotarsal pegs and sometimes variably distinctly brownish spot or diffuse annulus on tibia subbasally, though rarely variably extensively darkened (see 'Remarks'). Hind leg sometimes entirely pale beyond coxa (Fig. 50b), but often with femur variably extensively dark basally and more rarely tibia variably distinctly and extensively brownish to dark mesally or basally excluding knee (Fig. 50a). Gaster (Fig. 50a, b) with hairlike setae; sometimes mostly brown with variably distinct coppery lusters, but usually at least somewhat and often distinctly greenish to bluish-green dorsobasally, dorsoapically and laterally, but at least basal tergite dorsoapically and subsequent three tergites dorsally brown or with coppery to reddish-violaceous lusters; ovipositor sheaths distinctly banded with dark basal band, pale medial band and paler brownish to dark apical band usually having quite distinct basal margin.

Head in dorsal view with interocular distance about 0.4–0.46× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; vertex sometimes evenly rounded into occiput with uniform, transversely alutaceous-imbricate sculpture, but usually sculpture at least partly differentiated or coalesced into variably distinct and not always symmetrical transverse ridge or carina (Fig. 50f); frons comparatively smooth, meshlike coriaceous (Fig. 50e) or at most only obscurely imbricate to reticulate; scrobal depression distinctly reticulate to transversely reticulate-strigose, with scrobes mostly reticulate or at least with evident meshlike sculpture (Fig. 50c, e); OOL: POL: LOL: MPOD = 0.7–0.9: 2.4–2.8: 1.4–1.7: 1.0. Mesoscutum (Fig. 50g) mostly meshlike reticulate except medial lobe more reticulate-imbricate to transversely imbricate anteriorly and lateral lobe with mediolongitudinal band of minute coriaceous sculpture. Scutellum and axillae low convex in same plane; smaller specimens usually with somewhat finer sculpture, but usually axilla mostly obliquely and scutellum longitudinally reticulate-imbricate laterad midline anterior to meshlike coriaceous frenal area. Acropleuron (Fig. 50h) more-or-less isodiametric meshlike anteriorly and posteriorly and much more minutely sculptured mesally, the larger meshlike sculpture coriaceous-reticulate, the cells at most delineated by only slightly raised ridges. Fore wing with cc: mv: pmv: stv = 3.9–4.8: 3.8–4.6: 1.0–1.3: 1.0. Middle leg with row of 3–7 mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus and pegs clearly differentiated into two rows apically; second tarsomere with 3–6 pegs, third tarsomere with 2 or 3 pegs, and fourth tarsomere with 1 peg apically on either side. Propodeum with broadly U-shaped plical depression extending to posterior margin. Gaster (Fig. 50a, b) similar in length to combined length of head and mesosoma; not atypically modified; extending to or slightly over base of third valvula, the latter about 0.66−0.8× length of metatibia and 0.68−0.85× length of mv; hypopygium extending about two-thirds length of gaster.

MALE (habitus: Fig. 51a). Length = 1.2–2.5 mm. Head (Fig. 51a–e) dark brown to black or with at most slight bluish to violaceous luster except lower face and/or gena sometimes more distinctly greenish (Fig. 51b, c) to bluish-green under some angles of light; frontovertex noticeably roughened, reticulate to sometimes reticulate-imbricate in smaller individuals (Fig. 51c, e); vertex differentiated from occiput by distinct transverse carina (Fig. 51e); scrobal depression similarly to somewhat more distinctly reticulate except scrobes shiny (sometimes

continuously across interantennal prominence), with meshlike sculpture coriaceous to subeffaced if continued ventrally through scrobes to near toruli (Fig. 51c); setae hairlike, white ventrally to brown dorsally; lower face in region between torulus and malar space with tuft-like region of longer setae, of which at least some abruptly curved, hook-like, or sinuate apically (Fig. 51c, d); gena posterior to malar sulcus with at least 1, sometimes up to 3 conspicuously longer setae, though with variable number of usually progressively shorter setae toward oral margin, and posterior to eye with apices of setae directed toward orbit. Antenna (Fig. 52a, c) with scape entirely dark, ovoid (Fig. 52c), about 1.6–2.0× as long as wide; pedicel at most about 1.5× as long as wide, ventrally with 6 or 7 long setae, of which all but usually apical-most hooked (Fig. 52b); length of pedicel + flagellum about 1.2–1.4× head width; flagellum robust-filiform (Fig. 52a, c) with clava subequal in length to apical two funiculars; anellus very strongly transverse, discoidal, shiny, with at most inconspicuous, sparse setae at extreme apical margin (Fig. 52b, d); funicle with fu1 at most as long as pedicel, slightly transverse to about as long as wide and then often sides diverging so as to be noticeably wider apically than basally, with fu2 about as long as fu1 but quadrate to slightly oblong and subsequent funiculars more distinctly oblong, though at most only about 1.5×, as long as wide, uniformly covered with decumbent, curved setae except fu1–fu3 in ventral view with variably distinct less setose longitudinal region of differentiated, shorter, straighter setae (Fig. 52d). Maxillary and labial palps sometimes entirely dark brown, but usually apical palpomeres pale, at least apically. Mesosoma (Fig. 51a, b) similarly dark as head or with variably distinct greenish or, more rarely, bluish luster, most distinctly on propodeum (Fig. 51b); setae hairlike, brownish; tegula dark. Legs with metacoxa sometimes entirely dark purple or violaceous but often at least linearly green to bluish-green ventrally and more distinctly blue to purple or violaceous dorsally, and in lateral view widest near about apical half to two thirds where angulate or more-or-less distinctly denticulate, and usually more-or-less obviously raised into irregular carina or slender flange (Fig. 51f); knees pale, but femora otherwise similarly dark; protibia pale except for dorso- and ventrolongitudinal dark bands, mesotibia sometimes mostly dark but usually variably extensively pale mesally but darker basally and apically or sometimes almost entirely pale except along dorsal and ventral margins, and metatibia either similar to mesotibia or, more commonly, almost entirely dark; mesotibial spur pale; protarsus uniformly brownish-yellow to dark brown, but meso- and metatarsi almost always with at least basal two tarsomeres pale, the third tarsomere pale to similarly dark brown as apical two tarsomeres, though rarely only basitarsus pale or very rarely even basitarsus dark except variably extensively basally. Fore wing with mv about 3.0–3.7× length of stv and pmv subequal in length or only slightly longer than stv; costal cell dorsally near leading margin with dark setae apically for distance little more than length of parastigma, and ventrally with about 3 rows at least apically, though sometimes mostly aligned in single irregular row within about basal half. Propodeum (Fig. 52e–h) usually with complete median carina, though this sometimes fine, irregular and/or not extending entirely to posterior margin or more-or-less separated mesally (Fig. 52g, h), and often one or more carinae on either side extending partly toward anterior margin from propodeal foramen, with panels often quite shiny with very fine (Fig. 52e) to distinct meshlike sculpture (Fig. 52f) and sometimes even reticulate-roughened posteriorly (Fig. 52h), but without transverse carinae interrupting median carina and therefore not distinctly rugose.

Distribution. *Far eastern Palaearctic*: **China*** (IZCAS), **Japan*** (CNC, EIHU, ELKU), Russia (**Primorski Krai***) (SIZK, UCRC), **South Korea*** (AICF, CNC).

Western Palaearctic: Algeria, Austria, **Bulgaria*** (CTPC, IBER), **Crimea*** (SISK), Czech Republic, **England*** (CNC, NMPC), Estonia, France, Germany, **Greece*** (BMNH, ZMAN), Hungary, Italy, **Kazakhstan*** (SIZK), Lebanon, **Moldova*** (CNC), **Netherlands*** (ZMAN), **Norway*** (CTPC), Romania, **Russia*** (Rostov Oblast and Krasnodar krai: SIZK, Moscow Region: UCRC), **Saudi Arabia*** (CNC), Slovakia, Spain, Switzerland, **Turkey*** (MHNG), **Ukraine*** (SIZK).

Our new country records reflect an update of the known distribution of *E. kiefferi* after the revised concept by Al khatib *et al.* (2014) rather than Noyes (2014).

Biology. We saw specimens reared from the following insect orders. *Far eastern Palaearctic*: **Coleoptera:** CURCULIONIDAE—*Tachyerges dauricus* Faust* in gall of *Pemphigus matsumurai* Monzen (Aphididae) (EIHU). **Diptera**: CECIDOMYIIDAE—*Asteralobia sasakii* (Monzen)* on *Ilex crenata* Thunberg (Aquifoliaceae) (ELKU); *Rhabdophaga salicivora*? Shinji on *Salix jessoensis* Seemen. (ELKU), *Rhabdophaga yanagi* (Shinji)* on *Salix gilgiana* Seemen (Salicaceae) (ELKU); *Rhopalomyia giraldii* Kieffer & Trotter* on *Artemisia indica* var. *maximowiczii* (Nakai) (Asteraceae) (ELKU); midge gall* on *Fagus crenata* Blume (EIHU). **Hemiptera**: APHIDIDAE—*Pemphigus matsumurai* Monzen on *Populus maximowiczii* A. Henry (Salicaceae) (EIHU). **Hymenoptera**: CYNIPIDAE—*Diplolepis mayri* (Schlechtendal)* (SIZK); *Dryocosmus kuriphilus* Yasumatsu

galls on *Castanea* sp. (Fagaceae) (CNC, EIHU); *Neuroterus vonkuenburgi* Dettmer on *Quercus acutissima* Carruth. (EIHU); *Trichagalma serratae* (Ashmead)* on *Quercus acutissima* (ELKU); unknown cynipid galls* on *Quercus dentata* Thunb., *Q. mongolica* Fisch. ex Ledeb. and *Q. serrata* Murray (EIHU). DIPRIONIDAE—*Diprion nipponicum* Rohwer* (USNM).

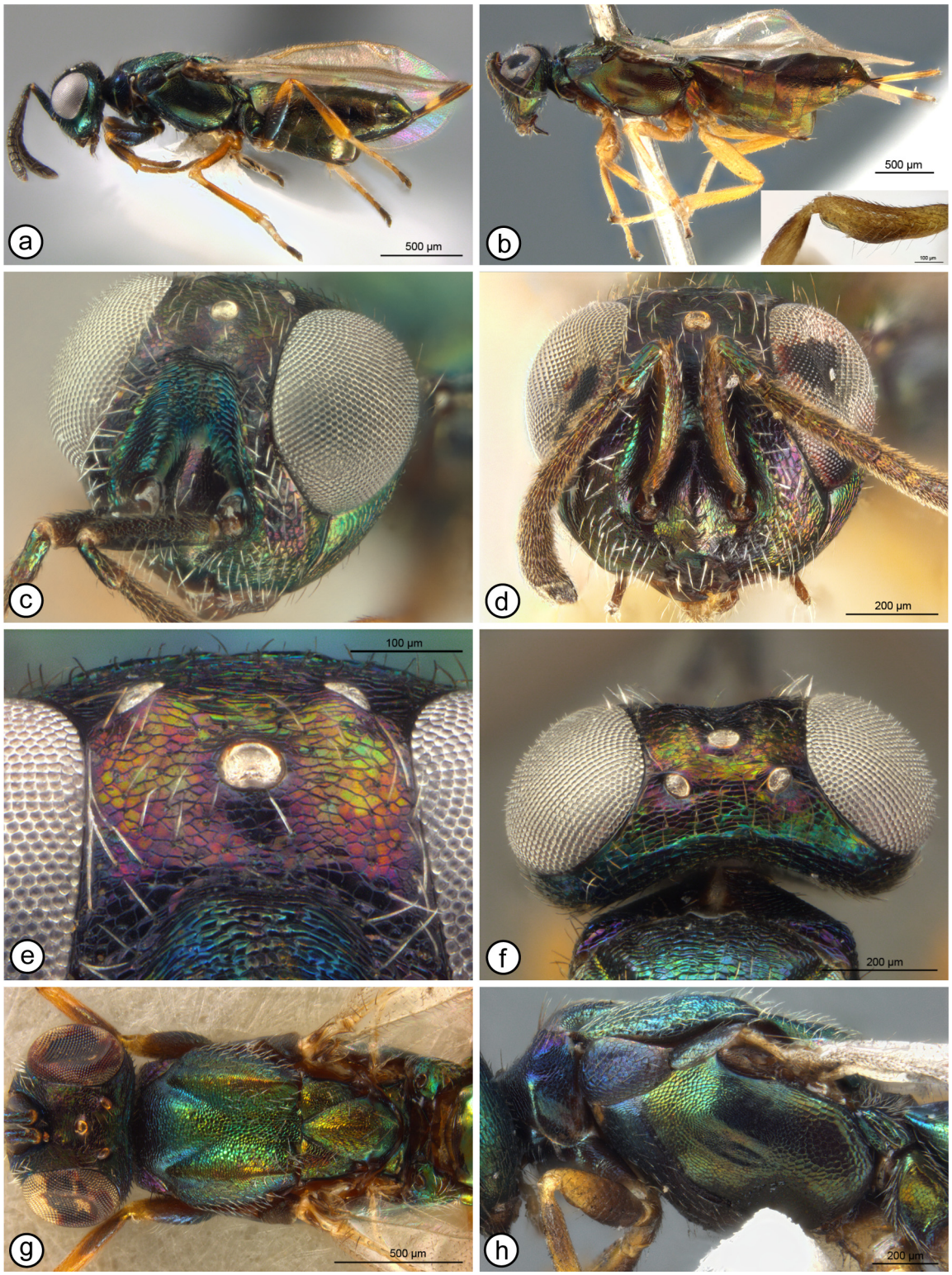

FIGURE 50. *Eupelmus kiefferi*, ♀. **a**, lateral habitus (2012-79). *b, d* (2013-164): **b**, lateral habitus [insert: profemur and base of protibia, posterior]; **d**, head, frontal. *c, e, f* (2010-40): **c**, head, frontolateral; **e**, upper part of scrobal depression and frontovertex; **f**, head, dorsal. **g**, head and mesosoma, dorsal (2012-80). **h**, mesosoma, lateral (2013-103).

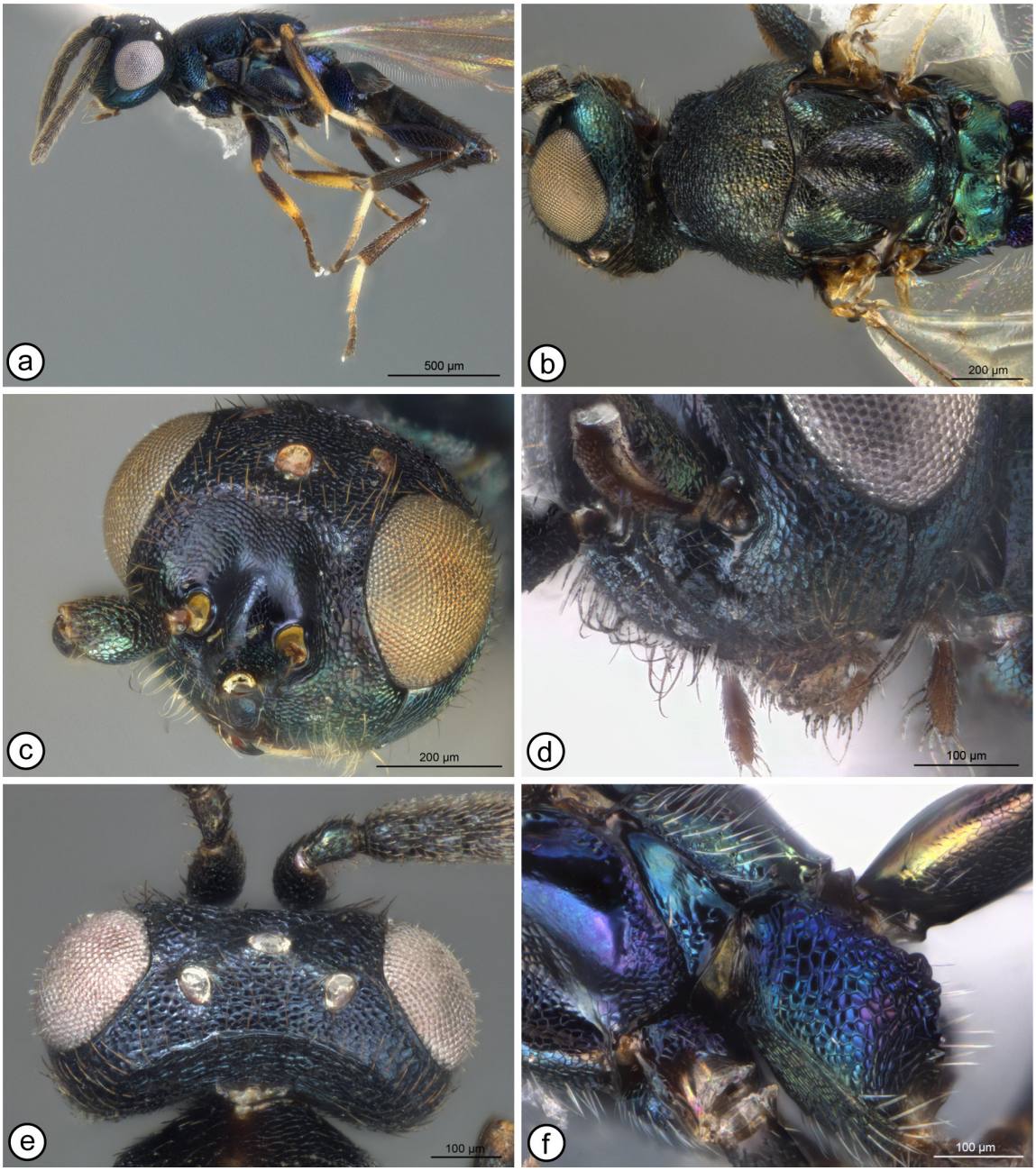

FIGURE 51. *Eupelmus kiefferi*, ♂. **a**, lateral habitus (2013-104). *b, c* (2010-42): **b**, head (lateral) and mesosoma (dorsal); **c**, head, frontolateral. *d, e* (2012-118): **d**, lower face, frontolateral; **e**, head, dorsal. **f**, metapleuron and metacoxa, lateral (2014-29).

Western Palaearctic: **Coleoptera**: BRUCHIDAE—*Bruchidius cisti* (Fab.)* (MHNG); ex. bruchid in S. [Scotch] broom = *Cytisus scoparius* (L.)* pod (USNM). COCCINELLIDAE—*Exochomus quadripustulatus* (L.)* pupae (CNC). CURCULIONIDAE—*Carpinus betulus* L.* (Betulaceae) seeds with *Apion** (MHNG); *Ceutorhynchus constrictus* (Marsham)* in *Alliaria petiolata* (Breb.)* seedpods (Brassicaceae)* (CNC); *Lotus corniculatus* L.* (Fabaceae) seeds with *Apion loti* (W. Kirby) (AICF); *Curculio crux* (Fab.) (SFMG). **Diptera**: CECIDOMYIIDAE— *Asphondylia melanopus* Kieffer (AICF), *A. sarothamni* (Loew)* [= *A. mayeri*] gall on *Cytisus* [= *Sarothamnus*] *scoparius* (CNC); *Craneiobia corni* (Giraud)* on *Cornus sanguinea* L.* (ZMAN); *Dasineura auritae* Rubsaamen* on *S.*[*alix*] *cinerea* L.* (SFMG), *D. brassicae* (Winnertz)* in canola* (CNC), *D. marginemtorquens* (Bremi)* on *S.*[*alix*] *viminalis* L.* (SFMG), *D. fraxini* (Bremi)* (HNHM); *Iteomyia capreae* (Winnertz)* on *S. cinerea* (SFMG); *Lasioptera rubi* (Schrank) (MHNG) on *Rubus* sp. (AICF); *Rabdophaga* [= *Dasineura*] *saliciperda* (Dufour)* on *Salix alba* L. (HNHM). TEPHRITIDAE—*Myopites* sp. galls* on *Dittrichia* (= *Inula*) *viscosa* (L.) (CNC) and *I. cretica* Sch. Bip. [?]. **Hemiptera**: COCCIDAE—super coc. *Physokermes*

piceae (Sch.)* (HNHM). **Hymenoptera**: CYNIPIDAE—*Andricus conglomeratus* (Giraud)* (USNM), *A. grossulariae* [= *mayri* Wachtl] Giraud* on *Quercus robur* L.* (CNC), *A. hungaricus* (Hartig)* gall (CTPC) on *Q. robur* (CNC), *A. lignicolus* (Hartig)* gall on *Q. robur* (CNC), *A. multiplicatus* Giraud* gall on *Q. cerris* L.* (CNC); *Biorhiza pallida* (Olivier) gall on *Quercus* sp. (AICF, CNC); *Diastrophus rubi* (Bouché)* on *Rubus* sp. (AICF); *Diplolepis mayri* (Schlechtendal)* (SIZK) gall on *Rosa canina* L.* (CNC), *D. rosae* (L.)* (AICF, ARPC, ZSMC) gall on *R. canina* (CNC) and on *R. corymbifera* Borkh.* (IBER). TENTHREDINIDAE—*Euura amerinae* (L.)* shoot gall on *S.*[*alix*] *pentandra* L.* (SFMG); *Pontania proxima* (Lepeletier)* (SFMG). **Lepidoptera**: GELECHIIDAE—*Amblypalpis olivierella* Ragonot* on *Tamarix aphylla* (L.)* (Tamaricaceae) (CNC), *Amblypalpis* sp.* on *Tamarix canariensis* Willd.* (ARPC). LASIOCAMPIDAE—*Dendrolimus pini* (L.) eggs (HNHM). GRACILLARIDAE—*Phyllonorycter* [=*Lithocolletis*] *manni* (Zeller)* on *Q. cerris* (ZSMC). TORTRICIDAE—*Epinotia* [=*Pelatea*] *festivana* (Hübner)* (MHNG), *Rhyacionia buoliana* (Denis & Schiffermüller)* (BMNH, CNC, CTPC).

We also saw specimens associated with the following plants: *Acer* sp.* galls (Aceraceae) (ZSMC); ex. *Vincetoxicum hirundinaria* Medik.* (Apocynaceae) fruits (CNC); *Dittrichia* (= *Inula*) sp. galls (ZSMC) and *Saussurea* sp.* stems (SIZK) (Asteraceae); *Betula pendula* [=*alba*] Roth (HNHM) and *B. pubescens* Ehrh. (ZSMC) (Betulaceae); *Cornus sanguinea* L.* (HNHM) (Cornaceae); seeds of *Thujopsis dolabrata* (Thunb. ex L. f.) (Cupressaceae) (EIHU); *Astragalus dahuricus* (Pall.) * seeds (SIZK) and *Genista tinctoria* L. (HNHM) (Fabaceae); *Fagus sylvatica* L. (HNHM) and *Quercus robur* L. (ZSMC) (Fagaceae); *Lythrum salicaria* L. infrutesc. (ARPC) (Lythraceae); *Althaea officinalis* L. infrutesc. (ARPC) (Malvaceae); *Picea abies* [=*excelsa*] (L.) (HNHM) (Pinaceae); *Rhamnus cathartica* L. (Rhamnaceae) (BMNH); *Salix alba* L. (HNHM, ZSMC) and *S. cinerea* L. (HNHM) (Salicaceae); *Tilia cordata* Mill. (HNHM) (Malvaceae).

Because of the confusion between *E. kiefferi* and *E. fulvipes*, Quacchia *et al.*'s (2013) host record of *Dryocosmus kuriphilus* for *E. fulvipes* likely refers to *E. kiefferi*. Published host records for *E. urozonus* from the far eastern Palaearctic are also incorrect through misidentification because *E. urozonus* is restricted to the western Palaearctic. For example, of the localities listed by Yasumatsu & Kamijo (1979) for *E. urozonus*, we saw specimens we identify as *E. kiefferi* reared from seeds of *Thujopsis dolabrata* (Aomori) (see 'Remarks') and unknown cynipid galls on *Q. dentata*, *Q. mongolica* and *Q. serrata* (Bibai, Ishikari-cho, and Okushiri), and specimens of both *E. kiefferi* and *E. kamijoi* from *D. kuriphilus* galls (Hakodate and Muroran). The accuracy of species identifications and associated host records is complicated by different *fulvipes*-group species not only having the same host but sometimes being reared together from the same galls. In addition to the *D. kuriphilus* example, we also saw at least two instances of *E. kiefferi* and *E. formosae*, one instance of *E. kiefferi* and *E. tachardiae*, and likely one instance of *E. kiefferi* and *E. fulvipes* (see 'Biology' for latter species) being co-reared from the same gall(s) based on co-mounting or identical label data.

Remarks. As discussed under *E. fulvipes*, *E. kiefferi* is included as one of ten species within the *fulvipes* species group because of the presence of a vertexal carina in at least males (Fig. 51e). It is one of only four species, including *E. atropurpureus*, *E. phragmitis* and *E. pini*, that we recognize from both the western and far eastern Palaearctic and is the only common species in both regions.

Prior to Al khatib *et al*. (2014), females of *E. kiefferi* with extensively pale legs were misinterpreted as *E. fulvipes* or those with dark legs included in *E. urozonus* because the difference in sculpture of the scrobal depression was not appreciated until Gibson (2011). However, as Al khatib *et al*. (2014) state in the supplemental file treatments of the two species, the original description of *E. fulvipes* states that females have entirely pale (reddish-yellow) legs beyond the coxae whereas the description of *E. kiefferi* states that the pro- and metafemora are black and the mesofemur is darkened in the middle. Though some females we include in *E. kiefferi* have entirely pale legs, females we include in *E. fulvipes* never have the pro- and metafemora dark as for typical *E. kiefferi* (see further below).

Typical *E. kiefferi* females are distinguished, in part, by a coriaceous frons (Fig. 50e), a more-or-less developed vertexal carina (Fig. 50f), a dark scape (Fig. 50c), and legs that have at least the profemur variably extensively dark and the protibia quite distinctly darkened dorso- and ventrolongitudinally (Fig. 50a). The metafemur sometimes and the metatibia less commonly can also be variably extensively darkened (Fig. 50a). However, we have seen females from throughout the Palaearctic with entirely pale legs except often for the posterior surface of the profemur being variably distinctly brownish mesally (Fig. 50b insert). A single female from Austria (BMNH) with pale legs (Fig. 50b) labelled "Vienna, 3.VIII.1964, ex. *Rhamnus cathartica*, C.I.E. coll. No. A 482, 2358" also has

the scapes noticeably paler than the flagellum, orangey-brown, though with some metallic green luster under some angles of light, particularly dorsally and ventrally (Fig. 50d). A second reared female from the same series has the same leg colour pattern but uniformly dark scapes and we therefore identify both as *E. kiefferi*. Both females have the frons very slightly and inconspicuously imbricate to reticulate, the meshlike sculpture at least in part defined by very slightly raised ridges. Another female (HNHM) from Hungary labelled "Bakony, 18.X.1951, dr. Erdős, *Quercus cerris* L." also has entirely pale legs and an even somewhat lighter brownish-orange scape with a slight metallic luster, though this female has the frons coriaceous and a more distinct vertexal carina than the other two females. Because of colour and sculpture variation we key females of what we interpret as *E. kiefferi* four times. Females with a scape that could be considered pale key out at couplet 88, whereas those with a dark scape are keyed at couplet 83 if with abnormally pale legs and at either couplet 73 or couplet 78 if with more typical dark legs depending on whether they have or lack, respectively, an evident vertexal carina. Apparent variability could result from the unusually wide distribution of the species, but also because our present concept includes more than one species. Until molecular evidence demonstrated the validity of *E. xenium*, we were uncertain based on morphology whether the specimens represented a new species or perhaps were females of *E. kiefferi* with entirely pale scapes or western Palaearctic specimens of *E. tachardiae* (see under *E. xenium*).

Differentiation of *E. kiefferi* and *E. tachardiae* females in the far eastern Palaearctic is sometimes questionable because of variation in scape colour and sculpture of the frons. Females we identify as *E. kiefferi* from the far eastern Palaearctic have uniformly dark scapes (Fig. 50a, c) and a coriaceous frons (Fig. 50e), whereas those of *E. tachardiae* usually have conspicuously pale scapes (Fig. 108a). However, as proven by molecular data, some females have the scape noticeably paler only apically or just lighter, dark orangey-brown, mediolongitudinally on the inner surface (Fig. 108b) or very rarely even essentially uniformly brown (Fig. 108c). Our concept of *E. tachardiae* females also includes the frons being at least very finely reticulate along inner orbits below posterior ocelli (Fig. 108i) compared to coriaceous for *E. kiefferi* (Fig. 50e), though this difference can be subtle and influenced by body size. Further molecular analyses are required to test our concept of these species and the validity of the various colour and sculptural features we use to differentiate females. Preliminary analyses based on numerous COI sequences of both species from South Korea and Japan show that two species are definitely present, even if some specimens cannot be confidently identified. The results also indicate specimens from South Korea are molecularly similar to some specimens of *E. kiefferi* from Western Europe and North Africa, though three specimens from Japan reared from *Dryocosmus kuriphilus* (Cynipidae) galls and sequenced by G. Stone and G. Melika (Euro 167, 168, 169, all CNC) plus a specimen reared from *Celticecis japonica* sequenced by us (ug.JP 12 in ELKU) cluster together basal to other western and far eastern Palaearctic specimens. The genetic distance between the Japanese *E. kiefferi* and those from the mainland is slightly greater than 5%, larger than the maximum intraspecific distance of 4.8% found for *E. annulatus* by Al khatib *et al*. (2014). Morphologically, these specimens fall within our concept of *E. kiefferi* having a completely sculptured scrobal depression and comparatively short ovipositor sheaths (i.e. they are not *E. tremulae*). They might represent a separate species or just a molecularly more divergent population correlated with island isolation.

According to Al khatib *et al.* (2014), *E. kiefferi* females rarely have the mesofemur partly darkened, especially for females reared from *Myopites stylata*. A series of four females (reared together with two males) from Japan labelled "Aomori, Honshu 10.IV, 20.IV, 27.V, 7.VI.1957, E. Kamijo ex. seeds of *Thujopsis dolabrata*" (EIHU) have all the femora extensively darkened, the mesotibia with a distinct dark region subbasally, and the metatibiae extensively darkened mesally. Although these females have atypically dark legs compared to European females, the two males are similar to European males we include in *E. kiefferi*. Females from Western Europe almost always have entirely pale mesofemora, including those females we saw reared from *M. stylata*, though a female from France (BMNH) (Var, St. Tropez, 10.VI.1980, Z. Bouček) has the anterior surface of the mesofemur darkened mesally over about its ventral half. Consequently, if we are correctly applying the name *E. kiefferi*, the original description must have been based on females with atypically dark middle legs. This seems somewhat unlikely because De Stefani (1898) described the species based on females reared from galls of apparently different *Andricus* and *Callirhytis* species in different months. It is therefore possible that his series consisted of more than one species, perhaps even including *E. azureus*, *E. confusus* and/or *E. urozonus*, other more-or-less similar species that are known parasitoids in *Andricus* galls. Al khatib *et al.* (2014) interpreted *E. kiefferi* in the current sense partly also because the original description of *E. kiefferi* states that the front of the head is blue and they stated the scrobal depression and parascrobal area are largely blue only in *E. kiefferi* (Fig. 50c, e) and *E. fulvipes* females. However,

females of some other species can have the parascrobal region and frontovertex blue to purple, even though the scrobal depression may not be. Because the antennal scapes often lie within and conceal the scrobal depression, the frontovertex and parascrobal regions may be the only areas clearly visible. However, De Stefani at least described the mesofemur as being lighter brown than the black pro- and metafemora, and females we include in *E. kiefferi* have been reared from *Andricus* galls. Therefore, the interpretation of *E. kiefferi* by Al khatib *et al.* (2014) is entirely reasonable until, and if, original type material can be located to show otherwise.

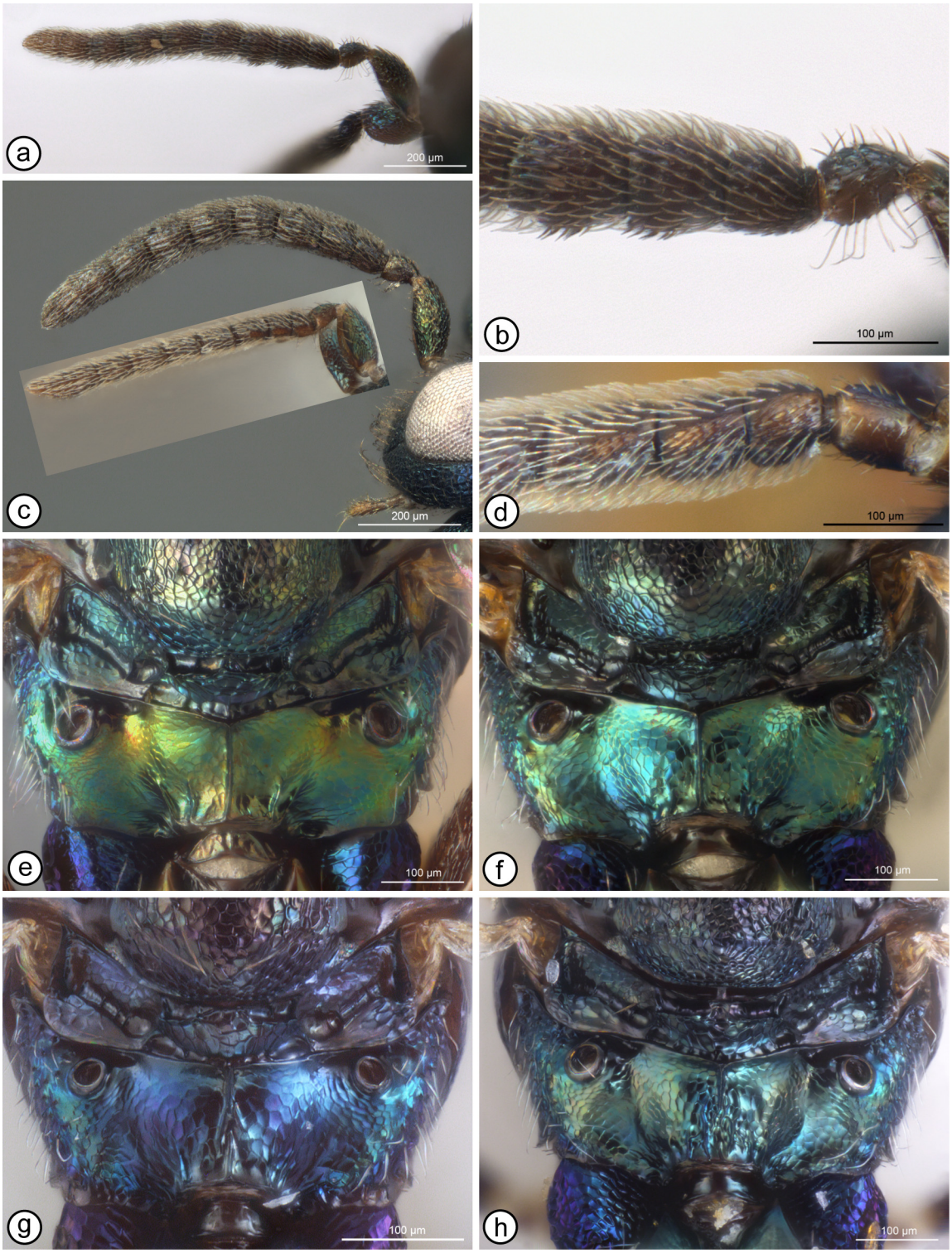

FIGURE 52. *Eupelmus kiefferi*, ♂. **a**, antenna, outer view (2013-106). **b**, pedicel to base of fl5, outer view (2013-106). **c**, antenna, inner view (2012-118) [insert: antenna, outer view (2010-41)]. **d**, pedicel to base of fl5, ventral view (2013-107). *e–h*, apex of scutellum to propodeum: **e**, 2012-125; **f**, 2010-42; **g**, 2013-162; **h**, 2013-161.

Males we identify as *E. kiefferi*, in addition to having a distinct vertexal carina (Fig. 51e), also have a dorsally denticulate to dorsoapically angulate metacoxa (Fig. 51f), though the structure is not always conspicuous for smaller males. The latter coxal structure is also shared with *E. fulvipes* males, as is a comparatively short fu1, at most as long as the pedicel and as long as wide (Fig. 52a–d), and a non-rugulose propodeum. Propodeal sculpture is quite variable, from comparatively smooth and shiny (Fig. 52e) to quite coarsely sculptured posteriorly (Fig. 52h), and with (Fig. 52e, f) or without (Fig. 52g, h) a complete median carina, but at least it lacks irregular transverse carinae and thus is not distinctly rugose (e.g. Figs 30f, g, 109f, h). Males of *E. kiefferi* usually also have the basal two or three tarsomeres of the mesotarsus pale (Fig. 51a), though we did see a very few males with only the basitarsus entirely or partly white, including two reared from the infructescence of *Lythrum salicaria* and two reared from galls in flowers of *Dittrichia* sp. Because of their mostly dark mesotarsi these males might be mistaken for the much more common males of *E. urozonus*, but the latter lack a vertexal carina. Some other males of *E. kiefferi* reared from *Dittrichia* galls have the normal mesotarsal colour pattern, which indicates mesotarsal colour pattern can be variable for males of the species.

***E.* (*Eupelmus*) *lanceolatus* Gibson & Fusu n. sp.**
Figs 53a–h (♀), 54a–f (♂)

Type material. Holotype ♀ (BMNH). GREECE: Kos, 4 kmW Kos town, 20.VIII.1994, J.S. Noyes / DNA voucher CNCHYM 015258 / HOLOTYPE ♀ *Eupelmus* (*Eupelmus*) *lanceolatus* Gibson & Fusu, det. G. Gibson 2015. Condition: point-mounted; uncontorted; complete except right middle leg beyond trochanter missing.

Paratypes (23♀ & 58♂). **Bulgaria**: E. Bulgaria, Sv. Vlas nr. Nesebar, c. 20 m, 1–31.VIII.1998, C. v. Achterberg, R. de Vries, P.V. Atanassova, Mal. tr. 3 (RMNH: 1♀). **Cyprus:** 6 km N. Lemesos, N34°43'37.3", E033°03'08.2", 25.V.2009, Fusu & Popovici, sweep net (AICF: 1♀). **France**: [Department] 83 [Var], Taradeau, 8.IX.1992, M.J. Gijswijt (ZMAN: 1♀). Hérault, Saint-Privat, 700 m, col du Vent, 19.VII.2004, G. Delvare (GDPC: 1♀). Hérault, Vic-la-Gardiole, bois des Aresquiers, 25.VII.2004, G. Delvare (GDPC: 1♀). **Greece**: same collection data as holotype (BMNH: 2♂; CNC: 1♀, 1♂). Crete, Chania, Laggos, 19.VIII.2001, 35º25'N, 23º53'E, 350 m, J.S. Noyes (BMNH: 1♂). Ikaria, Xylosirtis, 3-11.IX.2002 (CMNH: 1♂), 5.IX.2002 (CMNH: 1♂), Pucci. Kerkini lake nr Neo Petritsi, Midway Site, N41°18'49.8"; E23°16'35.6", 750m asl, 14.VII-21.VII.2008, Gordon Ramel, Malaise trap (AICF: 1♀). Lakonia [Laconia], 5 km S. Monemvasia, 19 (1♀, CNC Photo 2012-52), 17 (1♂), 28 (1♂), 29 (1♂), 30 (1♂).VIII.1985, 17 (1♀), 27 (1♂).IX.1985, Georg Chrstensen (all ZMUC). Peloponísos [Peloponnese], 5 km S. Monemvasia, 4.VII.1986 (1♀), 27 (1♀, 1♂), 31 (1♂).VIII.1983, 3 (1♀), 4 (1♂), 10 (1♂).IX.1986, Georg Chrstensen (all ZMUC). Pelop., Petalidion, 26 (6♂), 27 (2♂), 28 (1♂).VIII.79, Z. Bouček (all NMPC). Rhodes, Ixia, M.C. Day—15–29.VIII.1984 (BMNH: 2♀; CNC: 2♀, one with CNC Photo 2012-51, and one with DNA voucher CNCHYM 015257), 24♂ (BMNH: 5♂; CNC: 19♂, one with CNC Photo 2012-108, and one with DNA voucher CNCHYM 015260), 8-20.VIII.1985, YPT (CNC: 8♂, three with CNC Photo 2012-106, 2012-107 and 2012-109). **Israel**: 3 km E. Ashdod, 14.IX.1971, D. Gerling, ex/on flowers collected 22.IX.71, c.a—1-82-4-827, 11422 (TAUI: 1♀). **Italy**: Lazio, Roma Pr., 0.8 km W. Sasso, 265m, 42º2'24"N 12º7'19"E [sic], 9.VI.2003, Munroe *et al.* (UCRC: 1♀). **Malta**: Maltese Isles, Mellieha Bay, Ghadira, 19-31.VIII.1992, B. Petersen (ZMUC: 1♂). **Turkey**: Içel, Namrun, 25.IX.1979, A. Beyarslan (MKUI: 1♀). Mugla, Tlos, <300m, 28.VIII.1992, J.S. Noyes (BMNH: 1♀; CNC: 1♀, DNA voucher CNCHYM 015259). Pamphylia, W. of Alanya, 2–13.VI.1991, B. Petersen (ZMUC: 2♂). Cukurova, Adana, 22.VII.1996, G. Delvare (GDPC: 1♀).

Excluded from type series. **Kenya**: Rift Valley Prov., Tsavo West Natl. Pk, Riverine woodland, bank of Tsavo River, 464 m, 2.99615°S 38.45988°E, 12–26.VIII.2008, R. Copeland, Maliase trap, 13759-eupelmid B12 (National Museum of Kenya: 1♀). **Somalia**: Mogadiscio, Lower Shabelli Valley, 1–7.IV.1977 (2♀), 7–18.IV.1997 (1♀), F. Bin, Malaise trap (all CNC).

Etymology. From the Latin word *lanceolatus* (spear-like), in reference to the slender lanceolate setae on the female body.

Description. FEMALE (habitus: Fig. 53c, d). Length = 2.3–4.0 mm. Head (Fig. 53a, b, e) dark with mostly dull reddish-coppery to violaceous or purple lusters, though sometimes with very obscure and very limited dull, dark greenish luster (mostly on vertex) under some angles of light; with slightly lanceolate white setae on lower face (Fig. 53a, b) and sometimes posteriorly on vertex, and somewhat broader, more distinctly lanceolate setae on parascrobal region to about dorsal limit of interantennal prominence and gena behind outer orbit (Fig. 53b) compared to much more inconspicuous, white to dark hairlike setae on parascrobal region dorsally, frons and

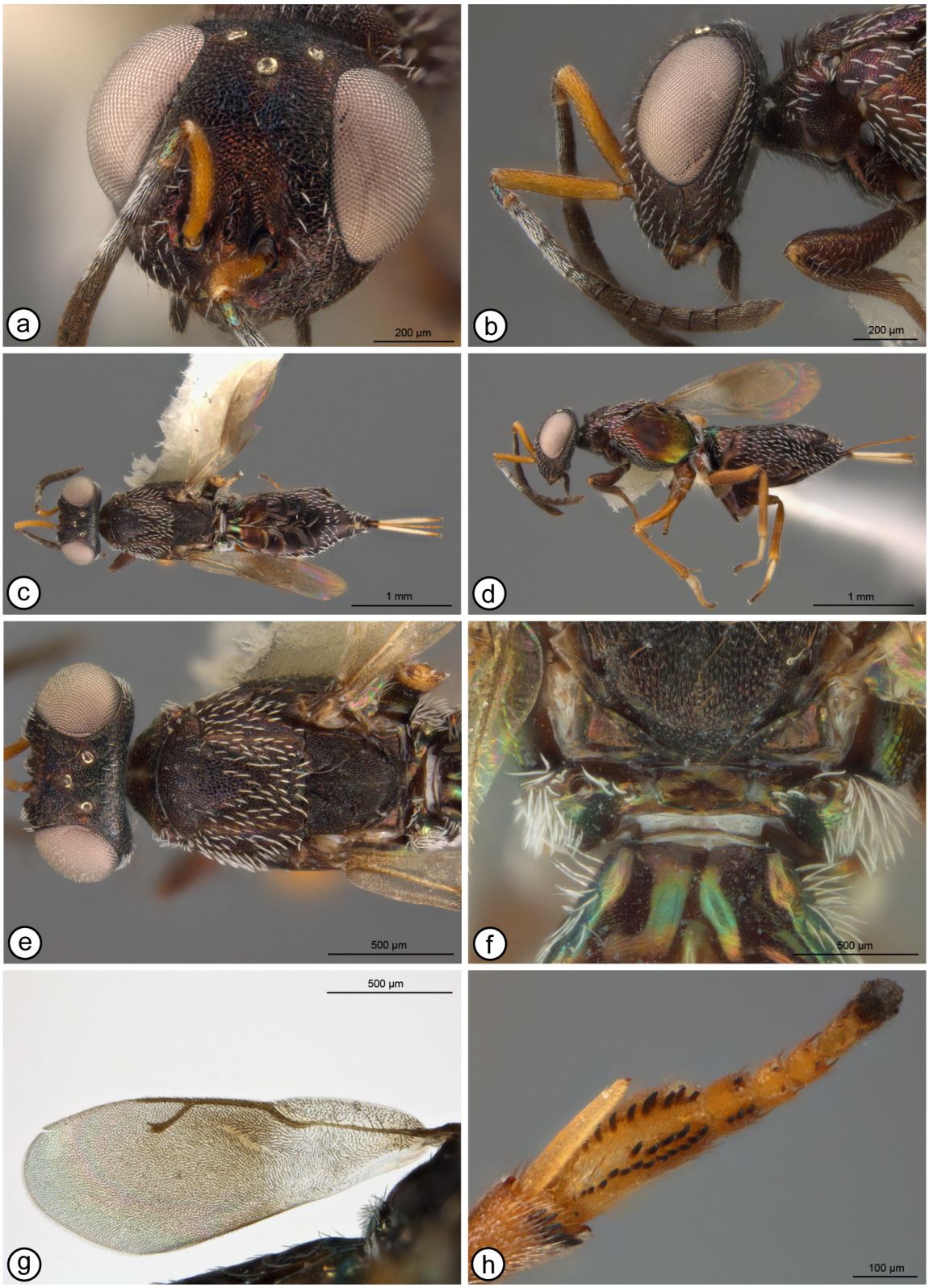

FIGURE 53. *Eupelmus lanceolatus*, ♀. *a–g* (2012-51): **a**, head, frontal; **b**, antennae and head, lateral; **c**, dorsal habitus; **d**, lateral habitus; **e**, head and mesosoma, dorsal; **f**, apex of scutellum to propodeum; **g**, fore wing. **h**, apex of mesotibia and mesotarsus (2012-52).

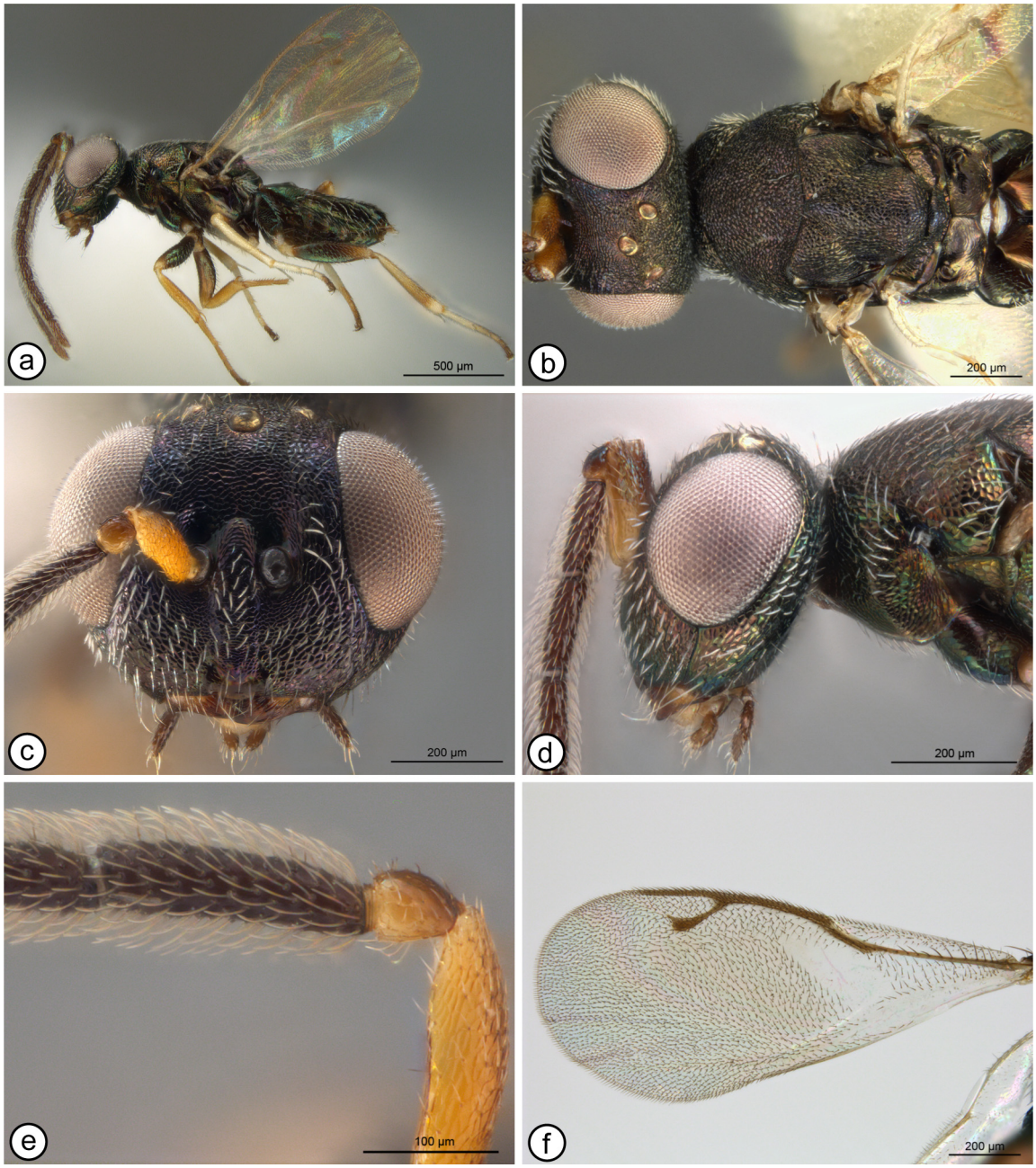

FIGURE 54. *Eupelmus lanceolatus*, ♂. *a, d* (2012-106): **a**, lateral habitus; **d**, base of antenna, head and pronotum, lateral. **b**, head and mesosoma, dorsal (2012-108). *c, e* (2012-107): **c**, head, frontal; **e**, scape to base of fl3, inner view. **f**, fore wing (2012-109).

vertex at least in part (Fig. 53a, e), and with conspicuous lanceolate setae behind outer orbit more-or-less directed anteriorly so at least closest row of setae parallel with orbit (Fig. 53b). Maxillary and labial palps brown. Antenna dark except scape and ventral surface of pedicel yellow to orangey (Fig. 53a–d), and flagellum with reflective white setae on anellus and at least basal two and part of third funicular (Fig. 53a, b). Mesosoma (Fig. 53c–e) similar in colour to head, mostly dark with dull reddish-coppery to violaceous lusters except sometimes up to posterior half of acropleuron distinctly green; with elongate, comparatively slender though more distinctly lanceolate white setae than on head except following bare: vertical surface of lateral panel of pronotum (Fig. 53b), acropleuron (Fig. 53d), metanotum and propodeal plical region (Fig. 53f), and pronotum posterodorsally with long, dark, hairlike to elongate-lanceolate setae, and convex part of anteromedial lobe and scutellar-axillar complex with much more slender, hairlike, white to dark setae (Fig. 53e) except sometimes scutellum with a few scattered, very slender but slightly lanceolate white setae. Macropterous; fore wing (Fig. 53g) with costal cell entirely setose both dorsally and

ventrally, variably distinctly infuscate with brown setae basally and often apically, but otherwise hyaline with brown to variably extensively white setae mesally; basal cell entirely setose, variably distinctly and extensively infuscate with brown setae basally, but apically hyaline with white to yellowish setae at least to level of base of parastigma; disc with linea calva, with brown setae beyond about base or apex of parastigma, and with at least slight brownish infuscation behind mv and sometimes more extensively. Legs with comparatively inconspicuous, white, hairlike setae except metacoxa with band of dense lanceolate white setae anteriorly and posteriorly; sometimes uniformly yellow or orange to dark brown beyond coxae but with at least mesotibial apical and mesotarsal pegs dark, and profemur and protibia usually darker than those of at least middle leg and when more orange to brown then extreme apex of mesofemur, one or more tarsomeres of middle leg, and at least basitarsus of hind leg lighter whitish-yellow, and sometimes front leg with knee, tibia dorsally and apically, and basal tarsomeres slightly lighter in colour to yellowish. Gaster (Fig. 53c, d) with conspicuous elongate-lanceolate white setae laterally and dorsally on apical three tergites; brown with similar dull metallic lusters as mesosoma except basal tergite anteriorly more distinctly green to bluish-green; ovipositor sheaths distinctly banded with extreme base of third valvula dark and apically with somewhat lighter brown region, and with medial pale region much longer than either basal or apical regions.

Head in dorsal view with interocular distance about 0.4× head width; in lateral view comparatively flat-lenticular, but face almost evenly convex with broad parascrobal region smoothly merged with frons; frontovertex meshlike reticulate; scrobal depression punctate-reticulate to transversely reticulate-strigose, the reticulations smaller and somewhat deeper than on frons or parascrobal region (Fig. 53a); OOL: POL: LOL: MPOD = 0.9–1.0: 2.4–2.8: 1.4–1.8: 1.0. Mesoscutum (Fig. 53e) meshlike reticulate similar to frons or parascrobal region except lateral lobe with comparatively inconspicuous mediolongitudinal band of minute coriaceous sculpture. Scutellum and axillae low convex in same plane; axilla punctate-reticulate anteriorly to longitudinally reticulate-strigose posteriorly; scutellum longitudinally reticulate-strigose except frenal area somewhat more uniformly meshlike reticulate. Acropleuron distinctly meshlike reticulate anteriorly and posteriorly of minutely punctate mesal region, posterodorsally with larger and variably distinctly longitudinally aligned reticulations. Fore wing with cc: mv: pmv: stv = 3.5–3.8: 2.2–2.3: 1.1–1.3: 1.0. Middle leg (Fig. 53h) with row of 6–9 mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus and pegs clearly differentiated into two rows apically, second tarsomere with unequal number of pegs on either side, either 3 or 4 pegs along anterior margin and 2 or 3 pegs along posterior margin (single specimen with only 1 peg on one leg, Fig. 53h), third tarsomere with 1 peg apically on either side, and fourth tarsomere without or with 1 minute peg on either side. Propodeum with comparatively large, rectangular plical depression extending to posterior margin, the lateral margins subparallel (Fig. 53f). Gaster (Fig. 53c, d) similar in length to combined length of head and mesosoma; not atypically modified; extending almost to or slightly over base of third valvula, the latter about 0.85–0.95× length of metatibia and about 1.6–2.1× length of mv; hypopygium extending about three-quarters length of gaster.

MALE (habitus: Fig. 54a). Length = 1.1–2.7 mm. Head (Fig. 54b–d) dark brown in smaller individuals but usually with some reddish-coppery to violaceous luster under some angles of light and at most slight greenish luster only on lower face near oral margin and sometimes on occiput and gena (Fig. 54d) under some angles of light; frons distinctly meshlike reticulate to punctate-reticulate; vertex uniformly curved into occiput, similarly or more minutely reticulate as frons to transversely imbricate; scrobal depression and scrobes similarly sculptured as frons (Fig. 54c); setae white, hairlike on frontovertex from about dorsal level of scrobal depression but usually quite distinctly lanceolate (except for smallest individuals) along most of parascrobal region, lower face, and gena (Fig. 54c, d); lower face with uniformly distributed, comparatively short setae at most increasing only slightly in length toward malar sulcus (Fig. 54c, d); gena posterior to malar sulcus with 1 conspicuously longer seta than others, and posterior to eye with apices of setae at least directed anteriorly at about a 45° angle to orbit and sometimes subparallel with orbit (Fig. 54d). Antenna (Fig. 54a) with scape at least pale basally and along outer, ventral, longitudinal sensory region (Fig. 54d), and usually more extensively or entirely yellowish to yellowish-orange (Fig. 54c); pedicel subglobular, only about as long as wide, and ventrally with row of 4 long, apically curved setae (Fig. 54e); length of pedicel + flagellum about 2.0–2.1× head width; flagellum elongate-filiform (Fig. 54a) with clava about 0.70–0.75× length of apical two funiculars; anellus very strongly transverse, discoidal, smooth and shiny (Fig. 54e); funicle with fu1 about 1.9–3.3× as long as pedicel and 2.9–3.9× as long as wide, with all subsequent funiculars conspicuously longer than wide, the apical funicular about 2.4–3.0× as long as wide, and with recumbent, curved white setae about as long as width of funiculars (Fig. 54e); basal funiculars without regions

of modified setae ventrally. Maxillary and labial palps brown. Mesosoma, including propodeum (Fig. 54b), similar in colour to head, dark with variably distinct reddish-coppery luster but at most very limited and obscure greenish luster; setae white, hairlike dorsally to similarly elongate-lanceolate as on gena laterally on pronotum and mesoscutum; tegula usually entirely yellowish but sometimes darker brownish apically. Legs with femora dark except pale apically, tibiae yellowish or, more commonly, somewhat darker orangey-yellow mesally and paler yellowish basally and apically, and rarely metatibia with subapical brownish region in about apical third; tarsi pale except apical two tarsomeres brown. Fore wing (Fig. 54f) with mv about 1.7–2.0× length of stv; costal cell dorsally near leading margin with dark setae over about apical two-thirds to three-quarters, and ventrally with 2 or 3 rows along length; basal cell uniformly setose with dark setae; speculum closed posterobasally by row of setae. Propodeum with complete median carina, with panels meshlike-coriaceous to alutaceous (Fig. 54b).

Distribution. Bulgaria, Cyprus, France, Greece, Italy, Malta, Turkey.

Biology. Host unknown, but likely Bruchidae and/or Curculionidae (Coleoptera) based on presumed relationships with *E. orientalis* and *E. vuilleti*.

Remarks. *Eupelmus lanceolatus* is included in the *orientalis* species-group along with *E. orientalis* and *E. vuilleti,* as discussed under *E. orientalis*.

Four females from the Afrotropical region listed above are excluded from the type series but possibly also belong to *E. lanceolatus*. They, particularly the females from Somalia, differ by having comparatively conspicuous white though very slender lanceolate setae on the areas lacking these in the Palaearctic specimens of *E. lanceolatus*. The difference may simply reflect intraspecific variation because the female from Bulgaria is more similar to the Afrotropical specimens in setal pattern, including having a few scattered, slender-lanceolate setae on the scutellum. The single female from Kenya was collected along with *E. orientalis* females in the same collecting event.

COI sequences were successfully obtained from the holotype (421bp) as well as female paratypes from Greece (CNCHYM 015257: 161bp), and Turkey (CNCHYM 015259: 421bp). Unfortunately, sequencing was unsuccessful for *E. orientalis* and largely unsuccessful for *E. vuilleti* (see under latter species). Molecular data show *E. lanceolatus* as the sister species of *E. vuilleti*, but definitely not conspecific because of a very large pairwise distance between the two (8.9%).

E. (*Eupelmus*) *levis* Nikol'skaya n. stat.

Fig. 55a–j (♀)

Eupelmus levis Nikol'skaya, 1952: 501 (Russian), 1963: 515 (English). Syntypes, ♀, ZIN, 1♀ examined. Type data: Tajikistan. Syntype examined label: Джили-куль на р. Вахш, Тадж. [Djilikul on river Vakhsh, Tajikistan] 15.VI.934. Гуссаковский [Gussakovskiy] / *Eupelmus levis* sp. n. ♀, M. Nikolskaja det. / Holotypus ♀ [recent red label].

Description (based on examined syntype except features given between square brackets from original description)**.** FEMALE (habitus: Fig. 55b, c). Length [2.8−3.2 mm] about 2.6 mm (about 2.9 mm including ovipositor sheaths). Head (Fig. 55a) metallic green to bluish-green under most angles of light except frons medially from about level of anterior ocellus to scrobal depression, band between anterior and posterior ocellus and between posterior ocellus and inner orbit and, less distinctly, gena behind eye partly dark with coppery luster; with comparatively inconspicuous hairlike to slightly lanceolate setae white setae on lower face and parascrobal region to about dorsal margin of parascrobal region and even less conspicuous hairlike setae on frontovertex. Maxillary and labial palps uniformly yellowish-brown. Antenna (Fig. 55i) with scape and pedicel brown with metallic green luster; flagellum uniformly brown. Mesosoma [pink-green with coppery luster] mostly metallic green to bluish-green (Fig. 55c, d) similar to head, but mesoscutum with limited coppery luster under some angles of light, tegula brownish-yellow, slightly darker brown basally and more translucent yellowish-brown apically but without opaque band along inner margin (Fig. 55d), and propodeum mostly brown with slight metallic green luster, most distinctly on callus, under some angles of light; mesonotum with comparatively inconspicuous white, hairlike setae, prepectus bare, and callus with longer and more conspicuous white setae than on mesonotum, but comparatively sparse. Macropterous; fore wing basal cell and disc hyaline (Fig. 55e, g), with yellowish-white setae except dorsally with broad bare region (speculum) behind base of parastigma separating setae of basal cell and disc such that linea calva open basally (Fig. 55g) (ventral surface of speculum with very short, inconspicuous setae); costal cell superficially bare dorsally, but with row of inconspicuous whitish setae near leading margin, and ventrally with 2 or 3 rows of more

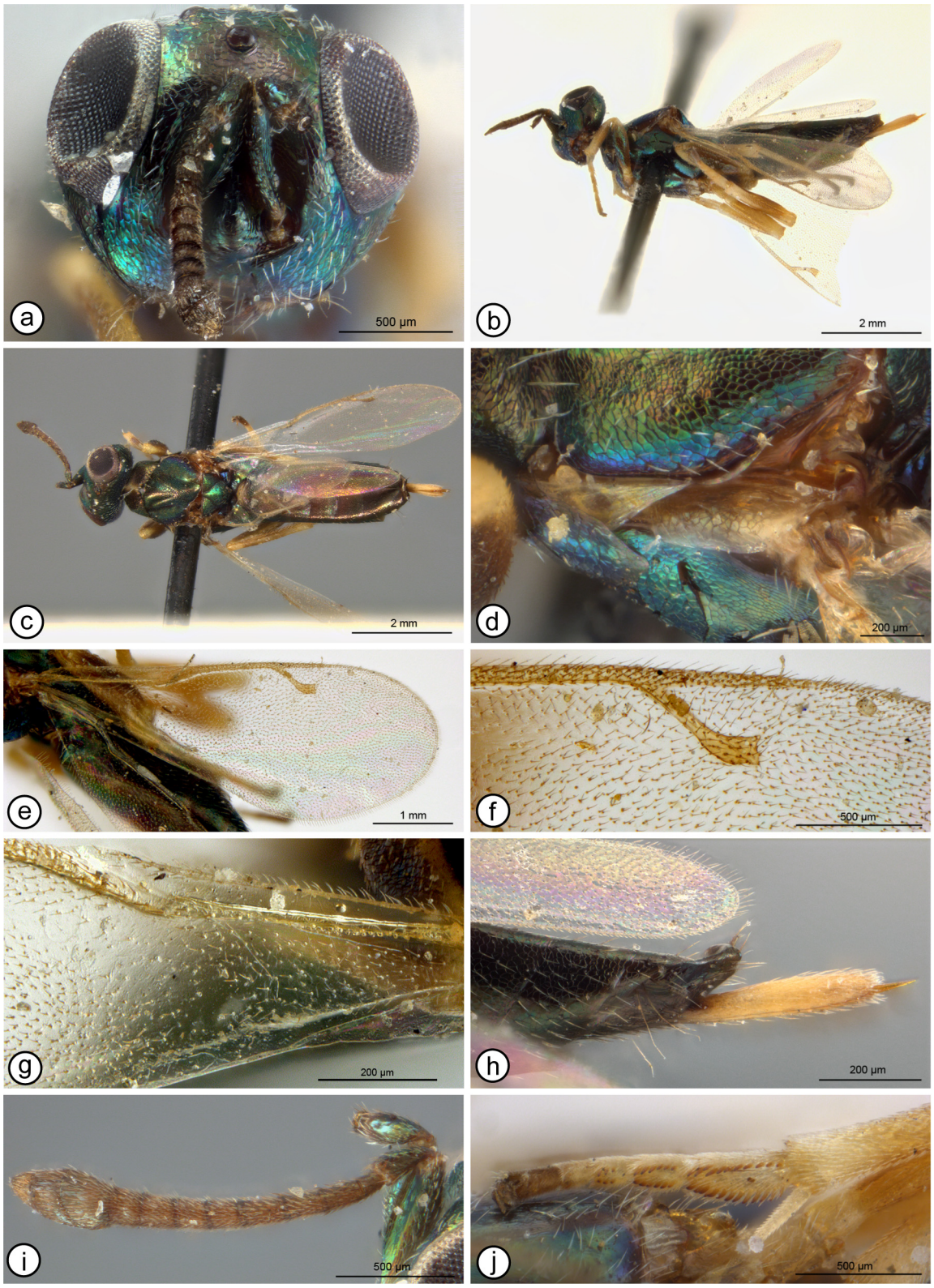

FIGURE 55. *Eupelmus levis*, syntype ♀: **a**, head, frontal; **b**, lateral habitus; **c**, dorsal habitus; **d**, tegula; **e**, fore wing; **f**, stigmal and postmarginal veins; **g**, fore wing base; **h**, apex of gaster and ovipositor sheaths, lateral; **i**, antenna; **j**, mesotibial and tarsal peg pattern.

obvious yellowish-white setae. [Legs brownish-yellow, femurs with green luster.] Font leg with coxa and most of posterior surface of femur brown with metallic green luster, trochanter light brownish with slight metallic luster, tibia slightly darker brown with obscure metallic luster subbasally, but trochanter, knee, tibia apically and tarsus

pale. Middle leg pale beyond coxa except apical tarsomere brownish and femur and tibia slightly darker orange compared to more whitish trochanter, knee, and basal four tarsomeres, and mesotarsal pegs rufous rather than black, darker red apically and lighter yellowish-orange basally. Hind leg similar in colour to middle leg except femur mostly darker brown with slight metallic green luster similar to profemur. Gaster (Fig. 55b, c) with hairlike setae; [dark bronze] mostly brown or brown with coppery luster except with metallic green luster laterally and obscurely apically on tergites; ovipositor sheaths (Fig. 55h) with extreme base dark but otherwise pale, unicolourous brownish-yellow.

Head in dorsal view with interocular distance about 0.43× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; frontovertex only slightly roughened, very shallowly meshlike reticulate, the cells defined by only inconspicuously raised ridges (Fig. 55a), but scrobal depression more distinctly reticulate; OOL: POL: LOL: MPOD = 0.7: 2.3: 1.3: 1.0. Antenna (Fig. 55i) with scape about 3.3× as long as maximum breadth; fu1 slightly but distinctly longer than wide, fu2−fu4 distinctly longer than wide, fu5−fu8 shorter and slightly widened apically, and clava elongate-oval, evenly tapered to acutely angled apex, with relative length (width) of pedicel, funiculars and clava = 2.0 (1.0): 0.7 (0.6): 1.2 (0.7): 1.2 (0.7): 1.2 (0.8): 1.0 (0.9): 1.0 (0.9): 1.0 (1.0): 1.0 (1.1): 35 (18). Mesoscutum mostly meshlike reticulate, the cells somewhat larger and more distinctly reticulate within posteromedial depressed region, except lateral lobe with mediolongitudinal band of smaller, meshlike coriaceous sculpture. Scutellum and axillae low convex in same plane; axillae and scutellum similarly, very finely meshlike reticulate to reticulate-imbricate (frenal area not clearly visible). Acropleuron partly damaged by minutien pin, but more-or-less isodiametric meshlike anteriorly and posteriorly and much more minutely sculptured mesally, the cells anteriorly and posteriorly defined by only very slightly raised ridges. Fore wing (Fig. 55e) with [marginal vein twice longer than radial] cc: mv: pmv: stv = 4.2: 2.3: 1.3: 1.0; stv at angle of about 40° relative to pmv and appearing straight, the stigma recurved longitudinally from vein in about apical third (Fig. 55f). Middle leg (Fig. 55j) without mesotibial apical pegs; mesotarsus with about 11−13 pegs in symmetrical pattern on basitarsus, the pegs essentially aligned into single row on either side, only very slightly irregularly positioned apically; second tarsomere with 5 or 6 pegs, third tarsomere with 3 pegs, and fourth tarsomere without pegs. Propodeum with broadly V-shaped plical depression not extending to posterior margin. Gaster (Fig. 55b, c) similar in length to combined length of head and mesosoma; syntype examined with posteroventral angles of syntergum horizontally angled inward between anal sclerite and ovipositor sheaths such that syntergum posteriorly flattened over sheaths with anal sclerite facing ventrally and covering base of ovipositor sheaths (Fig. 55h); apex overlying and concealing constriction between second valvifer and third valvula such that apparent sheath length about 0.4× length of metatibia and about 0.65× length of mv (length of third valvula likely actually about 0.7× length of metatibia and about 1.1× length of mv); hypopygium extending somewhat over half length of gaster.

MALE. Unknown.

Distribution. Tajikistan.

Biology. Unknown.

Remarks. A single female of *E. levis* labelled as holotype was obtained on loan for our study. Nikol'skaya (1952) did not state the number of females on which the species was described, but gave the length of the female as 2.8–3.2 mm. This range indicates the description was based on at least two females. Because Nikol'skaya (1952) did not select a holotype all specimens should have equal status as syntypes. The examined syntype is pinned with a minutien pin through the acroplurae (Fig. 55b, c) and the mesonotum is arched, but it is complete except that the left antenna is missing beyond the anellus and most of the left wing is missing beyond the level of the postmarginal vein.

Eupelmus levis is one of three species assigned to the *stramineipes* species group, as discussed under *E. stramineipes*. The examined syntype of *E. levis* more closely resembles most *E. phragmitis* than *E. stramineipes* in having the pro- and metafemur partly dark and the tegula uniformly coloured without a differentiated opaque yellowish band along the inner margin (Fig. 55d), but more closely resembles *E. stramineipes* in having a more elongate-oval, apically evenly tapered clava (Fig. 55i) and in having a more similar stigmal vein (Fig. 55f) than that of typical *E. phragmitis* (Fig. 84f). It differs from both *E. phragmitis* and *E. stramineipes* in having a distinct bare band (speculum) dorsally on the fore wing behind the base of the parastigma between the setation of the basal cell and disc such that the linea calva is open basally (Fig. 55g). The syntype is the only specimen we saw with such a fore wing setal pattern, but it is developed on both wings. Kalina (1988) separated *E. levis* from *E. stramineipes* in

part by the former having the marginal vein only about 2.3 times longer than stigmal *versus* the marginal vein being about 3.5 times longer than stigmal vein in *E. stramineipes*. Our measurements indicate 2.2× in *E. levis* and about 3.3–3.4× in E. *stramineipes*, and about 2.8–3.3× in *E. phragmitis*. The larger variation in *E. phragmitis* undoubtedly reflects that we have seen more females of this species than the other two.

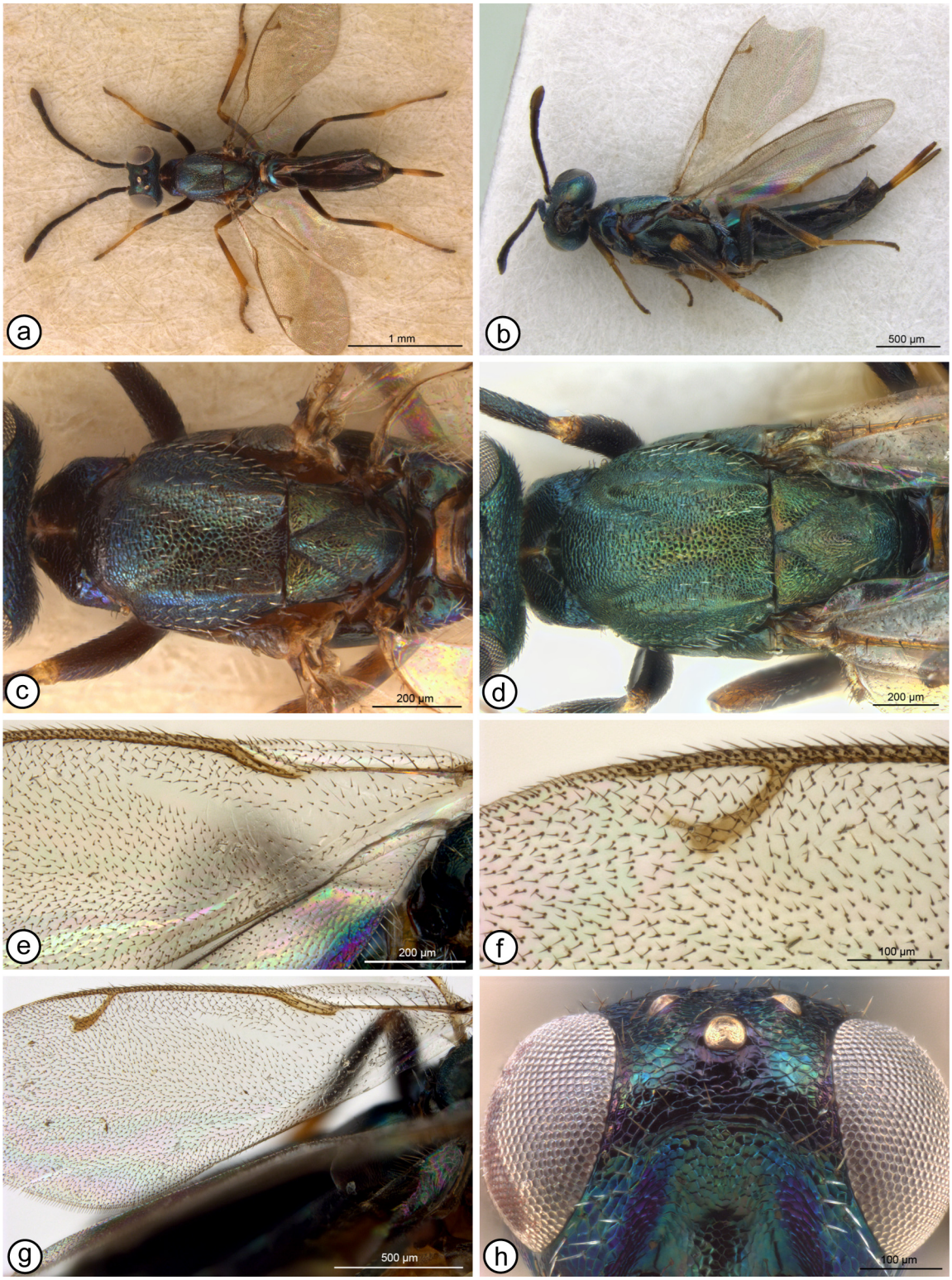

FIGURE 56. *Eupelmus longicalvus*, ♀. **a**, dorsal habitus (2013-153). **b**, lateral habitus (2013-154). *c, d* (mesosoma, dorsal): **c**, 2013-153; **d**, 2013-166. *e, f* (2013-155): **e**, fore wing base; **f**, stigmal and postmarginal veins. **g**, fore wing (2013-166). **h**, scrobal depression and frontovertex (2013-153).

E. (*Eupelmus*) *longicalvus* Al khatib & Fusu

Fig. 56a–h (♀)

Eupelmus (*Eupelmus*) *longicalvus* Al khatib & Fusu *in* Al khatib *et al.* 2015: 142–143. Holotype ♀, NHRS, examined by L. Fusu. Type data: Sweden, Gotlands, Go, Gotlands kommun, Roleks, grazed calcareous pine forest, 57°32.207'N, 18°20.273'E, 16.vii-02.viii.2004, Trap ID 28, Coll. event 1458, SMTP (LF.ma.SW 02/10429).

Eupelmus (*Eupelmus*) *longicalvus* Al khatib & Fusu *in* Al khatib *et al.*, 2014: 838–841 (unavailable name; original description, keyed, illustrated).

Description. FEMALE (habitus: Fig. 56a, b). Length 1.75–3.5 mm. Head mostly dark with variably distinct and extensive green to bluish luster except lateral surface of scrobal depression usually contrastingly violaceous to purple under some angles of light (Fig. 56h); with white, slightly lanceolate setae on lower face and parascrobal region compared to thinner, more hairlike, brownish setae on frontovertex. Maxillary and labial palps brown. Antenna dark except scape and usually pedicel with some green to bluish-green luster similar to head. Pronotum dark, similar in colour to head (Fig. 56c, d) except laterally variably distinctly blue to purple; admarginal setae dark at least mesally, but paler to almost white laterally. Mesonotum with hairlike to slightly lanceolate, usually mostly whitish setae; similar in colour to head (Fig. 56a, b), quite dark (Fig. 56c) to variably distinctly bluish-green to green except sometimes with some coppery luster mesally within posteromedial depressed region of mesoscutum and on scutellum (Fig. 56d). Prepectus brown or with variably extensive and distinct bluish to purple luster similar to pronotum laterally; with up to 12 white, hairlike to slightly lanceolate setae in 1–3 longitudinal rows usually mostly within dorsal half. Tegula dark. Acropleuron similar in colour to mesonotum (Fig. 56b) or more extensively dark brown. Metanotum and propodeum similar in colour to mesonotum except mesally usually with less distinct metallic lusters; callus with similar though longer and more conspicuous white setae than on mesoscutum. Macropterous; fore wing hyaline or with slight yellowish to brownish tinge and with brown setae; costal cell (Fig. 56e) dorsally near leading margin with setae arranged in 1 to 2 irregular rows usually over about apical three-quarters, but sometimes along almost entire length, and ventrally with about 3 rows along length; basal cell and disc entirely setose except with elongate linea calva almost always extending at least to about base of parastigma and often to basal and cubital folds except sometimes for 1 or 2 isolated setae within bare band (Fig. 56e), though rarely extending only to level about equal with middle of parastigma and then distinctly separated from basal and cubital folds by several rows of setae (Fig. 56g, see 'Remarks'). Front leg mostly dark brown except knee narrowly, tibia apically, and tarsus at least basally pale. Middle leg similar to front leg except trochantellus often at least partly pale and knee and usually tibia apically more extensively pale, with tibial spur pale and tibial and tarsal pegs dark. Hind leg similar in colour to middle leg except femur, tibia and usually tarsus more extensively dark, the knee sometimes only inconspicuously pale. Gaster (Fig. 56a, b) with hairlike setae; mostly brown to coppery-brown except basal tergite anteriorly bright green to blue; ovipositor sheaths variably distinctly banded with apical band usually much lighter brownish than basal dark band.

Head in dorsal view with interocular distance about 0.4× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; vertex transversely alutaceous to reticulate-imbricate but uniformly curved into occiput; frons at most obscurely reticulate or slightly imbricate, though meshlike sculpture usually partly defined by slightly, inconspicuously raised lines at least laterally (Fig. 56h); scrobal depression more distinctly reticulate to transversely reticulate-rugulose, including at least about dorsal half of scrobes (Fig. 56h); OOL: POL: LOL: MPOD = 0.8–1.0: 2.2–2.4: 1.1–1.3: 1.0. Mesoscutum (Fig. 56c, d) meshlike reticulate except medial lobe variably extensively reticulate-imbricate anteriorly and lateral lobe with mediolongitudinal band of minute coriaceous sculpture. Scutellum and axillae low convex in same plane; axilla variably extensively meshlike coriaceous to reticulate anteriorly but more reticulate-imbricate posteriorly; scutellum sometimes entirely reticulate-imbricate, but usually more-or-less distinctly coriaceous medially and longitudinally reticulate-imbricate laterally anterior to meshlike coriaceous to shallowly reticulate frenal area. Acropleuron meshlike anteriorly and posteriorly of much more minutely sculptured mesal region, the sculpture often larger and more distinctly reticulate posteriorly than anteriorly. Fore wing (Fig. 56g) with cc: mv: pmv: stv = 4.1–4.8: 3.5–4.6: 1.2–1.4: 1.0 (Fig. 56f). Middle leg with row of 3–6 mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus and pegs clearly differentiated into two rows apically, second tarsomere with 3–6 pegs, third tarsomere with 2 or 3 pegs, and fourth tarsomere without or with 1 or 2 pegs apically on either side. Gaster (Fig. 56a, b) similar in length to combined length of head and mesosoma; not atypically modified; extending

to or almost to apex of second valvifer, the latter sometimes extending slightly beyond gastral apex, with third valvula 0.75–0.88× length of metatibia and 0.8–0.98× length of mv; hypopygium extending about two-thirds length of gaster.

MALE. Unknown.

Distribution. Bulgaria* [Vitosha Mtn., Malinka hut area, 42º36'02"N 23º13'45"E, 1532m, 29.VII.2010, I. Todorov (PUPB: 1♀)], France [Vaucluse, Mont Ventoux, S. slope, 1200m, 1.IX.1990, M.J. Gijswijt, CNC Photo 2013-166 (ZMAN: 1♀)], **Germany*** [Petershagen, 52º24'N 08º58'E, 24.VII.1999, S. Schmidt (CNC: 1♀)], Italy, Montenegro [Durmitor, Žabljak env., Crna Gora, 25.VI-7.VII.1958, Bouček (NMPC: 1♀)], **Spain*** [Avila, Peguerinos, Barrido, 26.VIII.1994, *Pinus sylvestris*, J. L. Nieves, CNC Photo 2013-154 (MNCN: 1♀)], Sweden.

Biology. Unknown, but apparently associated with coniferous forests. The female from Spain was collected by sweeping *Pinus sylvestris* L., and according to Al khatib *et al*. (2014) the holotype was collected in a pine forest, the paratypes in pine or mixed forests, and one specimen from France in a *Larix decidua* Mill. (Pinaceae) forest.

Remarks. Of the females examined, the one from France is somewhat larger than the others, 3.5 mm in length and differs in another important aspect. The linea calva is not distinctively elongate as is characteristic of the species (e.g. Fig. 56e), but extends only to about the level of the middle of the parastigma and is separated from the basal cell by several rows of setae (Fig. 56g). It resembles other *E. longicalvus* females in other respects, including having extensively dark legs, in particular the protibiae being mostly dark except basally and apically rather than having segregated dorso-and ventrolongitudinal dark bands, having largely infuscate pro- and metatarsi, mostly dark green to bluish-green head except for a more bluish to partly purple scrobal depression, uniformly brown fore wing setae with the dorsal setae in the costal cell extending most of the length, and the postmarginal vein being obviously longer than the stigmal vein. It is possible that future collecting or molecular analyses may show that this female represents a morphologically similar but separate species from *E. longicalvus.* We prefer to be nomenclaturally conservative and include it in *E. longicalvus* until additional evidence proves otherwise. However, largely because of this female we key *E. longicalvus* twice, including at couplet 76 where females should key because of their protibial colour pattern if the length of the linea calva is not observed correctly or is abnormally short. A very few females are also atypical and differ from other *urozonus* complex females, except for some *E. annulatus* and rare *E. cerris*, in having slightly infuscate fore wings, with a yellowish to light brown tinge.

As noted by Al khatib *et al.* (2014), females of *E. longicalvus* have comparatively long ovipositor sheaths, the third valvula often almost equal in length to the marginal vein. However, even if keyed through the first half of couplet 39, females should key through the second half of couplet 53 to couplet 74 and subsequently to *E. longicalvus*.

E. (*Eupelmus*) *longicaudus* Kalina n. stat.

Fig. 57a–g (♀)

Eupelmus longicaudus Kalina, 1988: 10–11. Holotype ♀, NMPC, examined by GG. Type data: SE Iran, 13 km SSE Nikhshakr (riv.), 8-9.4.1973 / Loc. no. 152 Exp. Nat. Mus. Praha / Kreslený [= drawn].

Description. FEMALE (habitus: Fig. 57a). Length, about 2 mm. Head partly bright green, but with distinct reddish-violaceous luster on interantennal prominence and lower face (Fig. 57b), and variably extensively and conspicuously on parascrobal region and frontovertex depending on angle of light, but at least in band below posterior ocellus (Fig. 57b, c); with slightly lanceolate white setae on lower face and parascrobal region extending along inner orbit to level of anterior ocellus compared to less conspicuous hairlike setae on frontovertex. Maxillary and labial palps brown. Antenna brown (remaining antenna with extreme apex of pedicel and base of anellus yellowish). Mesosoma laterally mostly dark brown with slight reddish-luster (Fig. 57g), dorsally with at least scutellum dark green but mesoscutum variable depending on angle of light, with anteromedial lobe except posteriorly and inclined surfaces of depressed posterolateral region variably extensively green (Fig. 57f), and outer surface of lateral lobe (Fig. 57g) and depressed region of mesoscutum at least narrowly reddish-coppery to reddish-violaceous mediolongitudinally (Fig. 57f); prepectus bare (Fig. 57g); pronotum with admarginal setae white; mesonotum with short, sparse white setae except axillae with dense, anteriorly projecting, lanceolate white setae over about posterior two-thirds forming reflective surface (Fig. 57g); callus with dense, slender-lanceolate white setae forming reflective surface (Fig. 57g). Macropterous; fore wing (Fig. 57d) with basal cell hyaline with white setae, but disc with dark setae and uniformly darkly infuscate from base of parastigma to about midway between

apex of pmv and wing apex, abruptly hyaline apically and along posteroapical margin; costal cell entirely hyaline, dorsally bare, and ventrally with 2 to 3 rows of white setae along length; basal cell (Kalina 1988, plate II, fig. 5) and disc entirely setose (Fig. 57d; Kalina 1988, plate II, fig. 1). Legs dark brown (Fig. 57a) except about basal three mesotarsomeres somewhat paler, brownish-yellow, and mesotibial apical spur pale (Fig. 57e). Gaster (Fig. 57a) with hairlike setae; dark brown with slight violaceous luster, except basal tergite with some green to bluish luster basally; ovipositor sheaths (Fig. 57a) entirely dark brown.

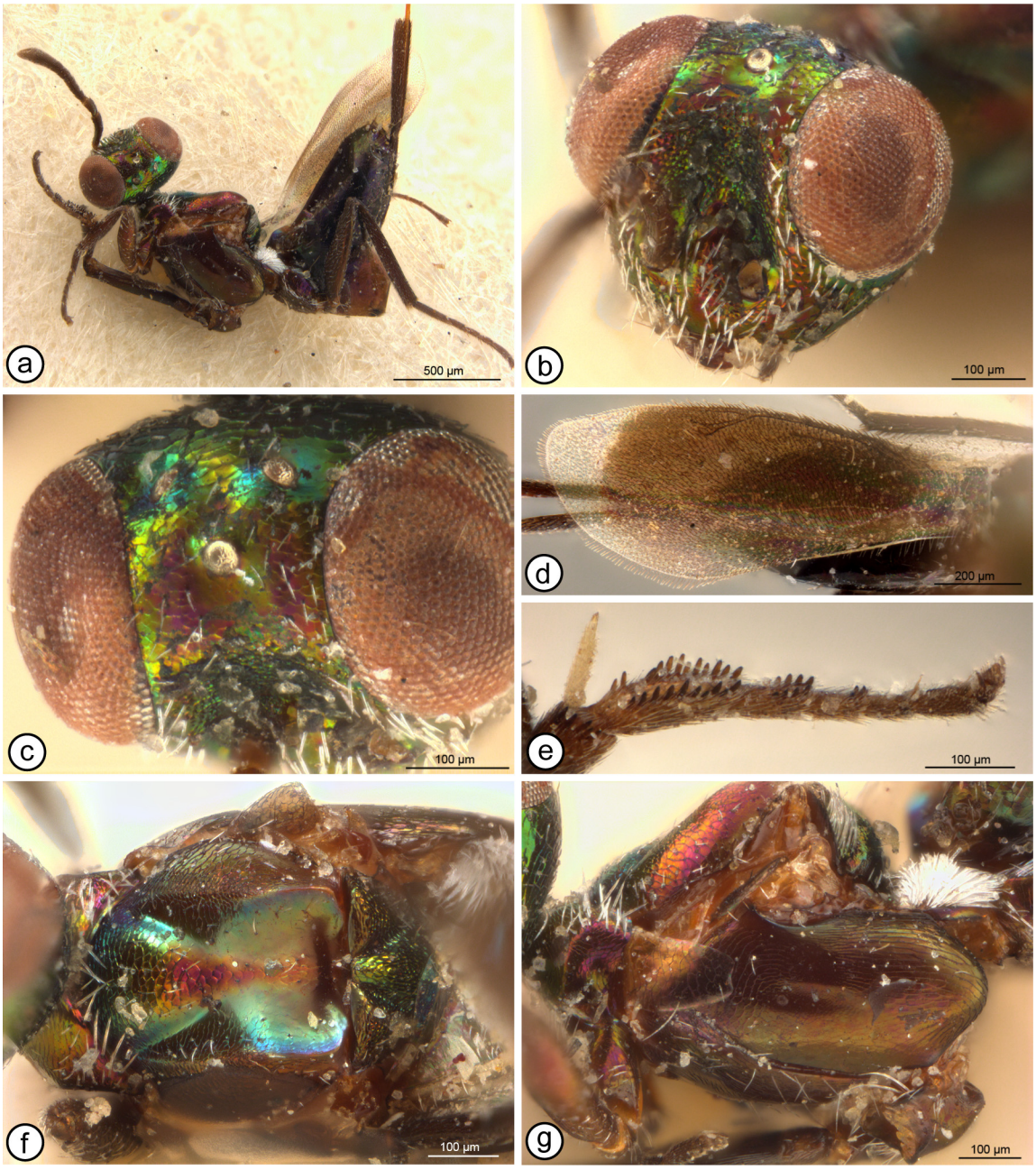

FIGURE 57. *Eupelmus longicaudus*, holotype ♀: **a**, lateral habitus; **b**, head, frontolateral; **c**, frontovertex, frontolateral; **d**, fore wing; **e**, apex of mesotibia and mesotarsus; **f**, mesonotum; **g**, mesosoma, lateral.

Head in dorsal view with interocular distance almost 0.4× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; vertex alutaceous and frons very finely meshlike coriaceous-reticulate except smooth mesally below anterior ocellus; scrobal depression reticulate; OOL: POL: LOL: MPOD = 1.3: 2.8: 2.2: 1.0. Mesoscutum (Fig. 57f) with anteromedial lobe very shallowly meshlike reticulate, the sculpture continued posteriorly through posterior depressed region as narrow band of even finer meshlike sculpture, but inclined inner surface of lateral lobe almost smooth, with only subeffaced meshlike sculpture. Scutellum and axillae low convex in same plane; axilla and scutellum apparently reticulate (difficult to

observe accurately because dorsal view not possible). Acropleuron (Fig. 57g) very finely sculptured, alutaceous to meshlike anteriorly, much more minutely sculptured mesally, and posteriorly with sculpture mostly longitudinally aligned as to appear strigose to very shallowly strigose-reticulate, the sculpture defined by only very slightly raised ridges. Fore wing (Fig. 57d) with exact measurement of cc: mv: pmv: stv not possible for specimen. Middle leg with row of 5 or 6 (Kalina 1988, fig. 11) mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus, with pegs differentiated in length so as to form serrate row on either side (Fig. 57e); second tarsomere with 4 or 5 pegs, third tarsomere with 2 pegs, and fourth tarsomere without peg on either side. Structure of propodeal plical depression not visible in specimen. Gaster (Fig. 57a) similar in length to combined length of head and mesosoma; not atypically modified; extending slightly over base of third valvulae, with latter about 0.95× length of metatibia and about 1.6× length of mv; hypopygium extending somewhat beyond half length of gaster.

MALE. Unknown.

Distribution. Iran.

Biology. Unknown.

Remarks. Although the validly published name is *E. longicaudus*, the holotype label has *Eupelmus longicauda*. Girault (1915) established *Eupelmus longicauda* from Australia, but neither he nor Kalina (1988) stated whether their species name was intended as an adjective or a noun in apposition. If adjectival then agreement in gender is required under ICZN article 31.2 and the two names would be homonyms, but not if treated as nouns. Further, because species names can differ by one letter under ICZN article 56.2, and "a" and "us" are not included under article 58 as variant spellings to be treated as identical, we treat both names as nouns in apposition and *E. longicauda* Girault and *E. longicaudus* Kalina as valid names in *Eupelmus*.

Kalina (1988) described *E. longicaudus* based on a single female stated to be deposited in NMPC; however, it was obtained on loan from him. The card-mounted holotype is in a contorted state (Fig. 57a), making accurate observation of some structures difficult from a dorsal view (Fig. 57f), including the one remaining set of wings (Fig. 57d). The holotype lacks the right set of wings, right antenna, and right middle leg beyond the coxa, which were dissected by Kalina to illustrate the original publication (Kalina 1988, figs 11–14 and plate II, figs 1, 2, 5, 7), as indicated by the type labels. The comparatively thick appearing setae within the infuscate region of Kalina (1988, plate II, fig. 1) is an artefact, as is evidenced by the holotype fore wing and comparison of the basal-most setae in his figures 1 and 5.

Eupelmus longicaudus is assigned to the *fulgens*-group along with *E. tryapitzini* and *E. fulgens*, as discussed under the latter species. Within the group, females resemble *E. fulgens* in the absence of a linea calva, but are easily differentiated by their much longer, entirely dark ovipositor sheaths. Females also superficially resemble *E. magdalenae* because of fore wing colour pattern and the length of their ovipositor sheaths, but they differ in several respects as discussed under *E. fulgens* and *E. magdalenae*.

E. (*Eupelmus*) *luteipes* Fusu & Gibson n. sp.

Figs 58a–i (♀), 59a–i (♂)

Type material. Holotype ♀ (AICF). DNA extracted 08.iv.2014, Fusu, ug.KO 21 / S. [SOUTH] KOREA: Chungnam, Daejeon, Changdon - 2 - gu, 3 MT on small forested hill, 20.v-19.vi.2007, P. Tripotin / HOLOTYPUS ♀ *Eupelmus* (*Eupelmus*) *luteipes* Det. Fusu L. 2015. Condition: glued by right side on a rectangular card; empty exoskeleton with internal tissue digested during DNA extraction; uncontorted; entire.

Paratypes (13♀ & 5♂). **ORIENTAL**. **Taiwan**: Pintung, Kenting Nat. Park, 210-230 m, 1-5.V.1991, C.K. Starr & S.M. Wu, second[ary] forest, PT (CNC: 1♀, CNC Photo 2014-88).

PALAEARCTIC. **China**: Beijing, Fengtai, Lugou Bridge, 6.IX.1957, IOZ(EO) 1653313 (IZCAS: 1♀). Liaoning Province, Panjin city, Panshan State Forestry Center nursery, N41°12.610', E122°05.364', coll. 22-24.X.2009, em. 14.V.2010, reared with *Tetrastichus planipennisi* Yang larvae dissected from *Agrilus planipennis* larva ex. *Fraxinus velutina* Torr. (CNC: 1f, 1♂ progeny). **Japan**: Honshu, Ibaraki, Tsuchiura, 18.IX-2.X.1989, M. Sharkey, marsh (CNC: 1♀); Nara Pref., Nara City, Toudaiji Temple, 28.VI.1963, Y. Higashiura (ELKU: 1♀). **South Korea**: Same collection data as holotype (AICF: 2♀, one with ug.KO 24 and one with ug.KO 01 and CNC Photo 2014-86); same except 2 MT, 24.IV-20.V.2007 (AICF: 1♀, ug.KO 04 and CNC Photo 2014-87); same except 2MT, 19.VI-24.VII.2007 (AICF: 1♀, ug.KO 35); same except 2M, 24.VII-21.VIII.2007 (AICF: 1♀, ug.KO 02 and CNC Photo 2014-85; 3♂, one with ug.KO 10m and CNC Photo 2014-90, one with ug.KO 12m, and one with ug.KO 14m and CNC Photo 2014-89). Chungnam, Daejeon, Wadong, tombs & gardens on small forested hills,

3MT, 24.IV-20.V.2007, P. Tripotin rec. (AICF, to be deposited in CNC: 1♂, ug.KO 49 and CNC Photo 2014-91). Jeollabukdo, Buangun, Dongjin-myeon, Dongjeonli, Dongjin estuary, 2MT, mud flat, 21.IV-27.V.2007, P. Tripotin (AICF: 1♀, ug.KO 34). Kangwon Chuncheon, Nam-myeon, Hudong-li, MT, pastured area trail close to forest edge, 14.VI-6.VII.2003 (CNC: 1♀, DNA voucher CNCHYM 015231 and CNC Photo 2014-84), 6-31.VII.2003 (CNC: 1♀).

Excluded from type series. **ORIENTAL. Taiwan**: Wushe, 22.V.1983, 1150m, H. Townes, flight trap (CNC: 1♀).

Etymology. From the Latin words *luteus* (yellow) and *pes* (foot), in reference to the entirely pale legs (beyond coxae) in most females.

Description. FEMALE (habitus: Fig. 58b, d). Length = 2.2–3.9 mm. Head sometimes mostly dark with reddish-violaceous to coppery lusters under some angles of light (Fig. 58e), but usually variably extensively green to partly bluish-green (Fig. 58c) and sometimes with some coppery to reddish-violaceous luster, often on parascrobal region (Fig. 58a) and sometimes on interantennal prominence, scrobal depression and/or lower face, though scrobal depression often partly blue (Fig. 58c) and vertex usually distinctly blue to purple; with slightly lanceolate white setae on lower face and parascrobal region extending along inner orbit to level of anterior ocellus compared to more hairlike white setae on frontovertex. Maxillary and labial palps brown. Antenna with scape usually contrasting distinctly with flagellum, entirely yellow to orangey-brown or at least paler mediolongitudinally if darker brown along dorsal and ventral margins (e.g. Figs 43d, 58a), though sometimes more uniformly brownish similar to flagellum (Fig. 58d); pedicel and flagellum dark, the pedicel often with green to bluish luster under some angles of light. Pronotum blue to purple laterally (Fig. 58f, g), sometimes more violaceous along posterolateral margin (Fig. 58h); admarginal setae dark. Mesonotum usually extensively green with some coppery luster on scutellum and/or posteriorly depressed part of mesoscutum except usually medial lobe at least anteriorly and lateral lobe variably broadly along outer surface dark blue to purple or violaceous (Fig. 58g), but sometimes mesoscutum or mesonotum almost entirely bluish to purple with only limited green luster (Fig. 58f); with white, hairlike to slightly lanceolate white setae. Prepectus variably coloured similar to mesonotum; with at least 3 and usually much more numerous setae (Fig. 58h). Tegula dark. Acropleuron green with some coppery luster to variably extensively bluish-green or blue, particularly anteriorly. Propodeal callus green to mostly blue or purple; with similar white setae as mesoscutum. Macropterous; fore wing (Fig. 58i) hyaline with whitish-yellow to brown setae; costal cell dorsally near leading margin with row of setae over at least apical half to two-thirds, and ventrally with 2 or 3 rows mesally along length; basal cell and disc entirely setose except for elongate linea calva often extending to level about equal with middle of parastigma. Legs beyond coxae usually entirely pale (yellowish) except for dark mesotibial apical and mesotarsal pegs (Fig. 58b), though sometimes profemur or both pro- and metafemora similarly though variably extensively brownish to dark, but protibia entirely pale (Fig. 58d). Gaster (Fig. 58b, d) with hairlike setae; variably extensively brown dorsomesally, but at least basal tergite basally blue or bluish-green to purple, and with variably distinct, often bright green to bluish luster laterally on tergites and dorsally on apical tergites; ovipositor sheaths distinctly tri-banded, with short dark region basally, much longer white region medially, and shorter brownish region apically.

Head in dorsal view with interocular distance about 0.35–0.45× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; vertex usually evenly or almost evenly rounded into occiput, transversely alutaceous to reticulate-imbricate or imbricate sculpture, with vertexal carina usually only obscurely evident under some angles of light; frons quite distinctly roughened, almost entirely meshlike reticulate to reticulate-imbricate except sometimes more finely sculptured in narrow band about width of anterior ocellus below ocellus (Fig. 58c, e); scrobal depression, including scrobes, meshlike reticulate to transversely strigose-reticulate (Fig. 58a, c, e); OOL: POL: LOL: MPOD = 0.5–1.0: 1.9–2.7: 1.5–1.8: 1.0. Mesoscutum (Fig. 58f, g) meshlike reticulate except medial lobe with shallower or more transversely imbricate sculpture anteriorly and lateral lobe with mediolongitudinal band of minute coriaceous sculpture. Scutellum and axillae low convex in same plane; axilla mostly obliquely and scutellum longitudinally reticulate-imbricate on either side of midline, at least in larger individuals. Acropleuron more-or-less isodiametric meshlike anteriorly and posteriorly, and much more minutely sculptured mesally, the meshlike sculpture shallowly though variably distinctly reticulate depending on body size. Fore wing (Fig. 58i) with cc: mv: pmv: stv = 3.9–5.3: 4.4–5.4: 1.0–1.3: 1.0. Middle leg with row of 5–7 mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus and pegs differentiated into two rows apically; second tarsomere with 5–7 pegs, third tarsomere with 2–4 pegs, and

fourth tarsomere with 1 or 2 pegs apically on either side. Propodeum with broadly U-shaped plical depression extending to posterior margin (Fig. 58f, g). Gaster (Fig. 58b, d) similar in length to combined length of head and mesosoma; not atypically modified; extending to or slightly over base of third valvulae, the latter about 0.58–0.7× length of metatibia and 0.63–0.77× length of mv; hypopygium extending almost two-thirds length of gaster.

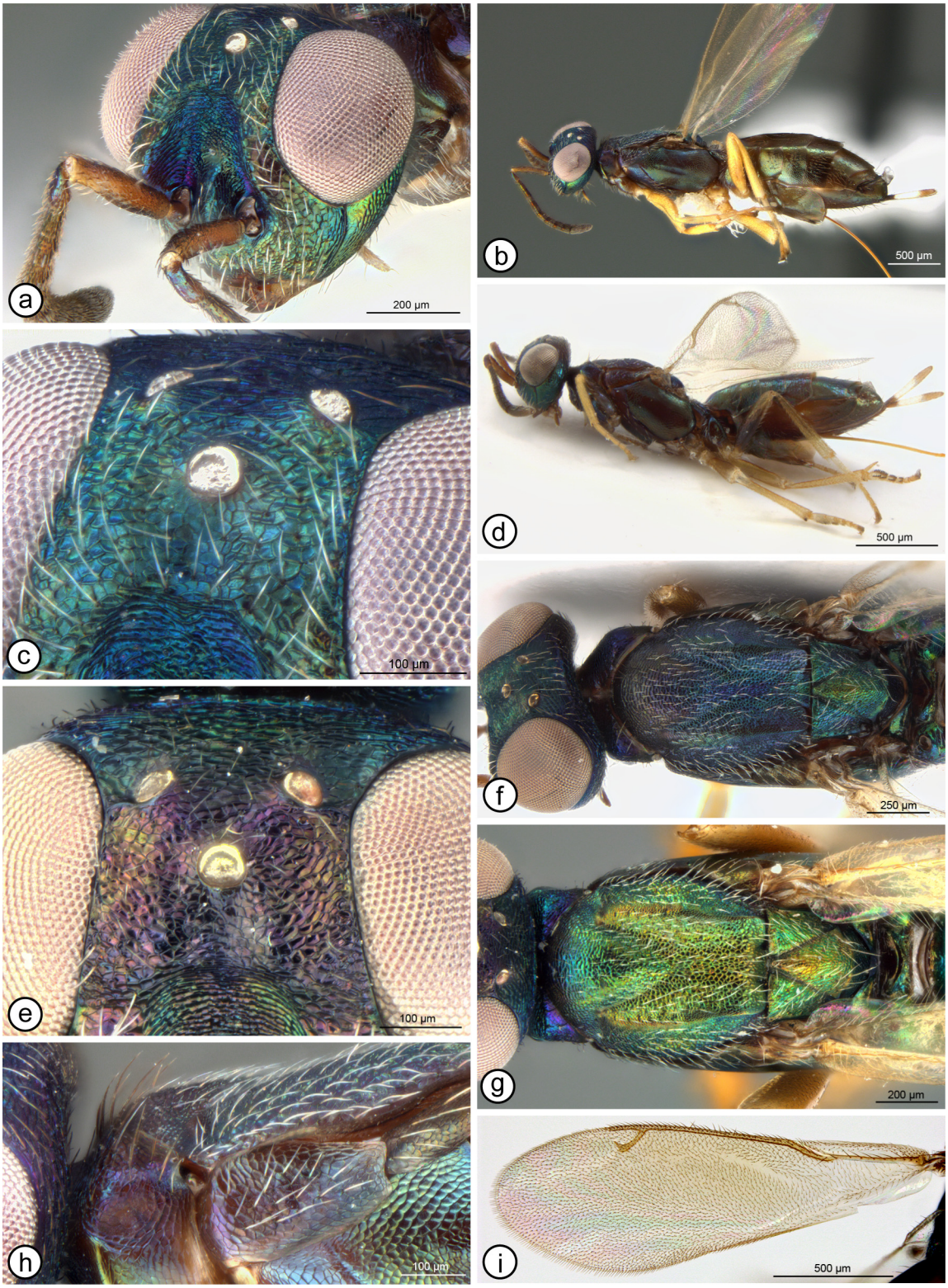

FIGURE 58. *Eupelmus luteipes*, ♀. *a–c, h* (2014-84): **a**, head, frontolateral; **b,** lateral habitus; **c**, upper part of scrobal depression and frontovertex; **h**, pronotum and prepectus, lateral. **d**, lateral habitus (2014-87). *e, g* (2014-88): **e**, upper part of scrobal depression and frontovertex; **g**, vertex/occiput and mesosoma, dorsal. **f**, head and mesosoma, dorsal (2014-85). **i**, fore wing (2014-86).

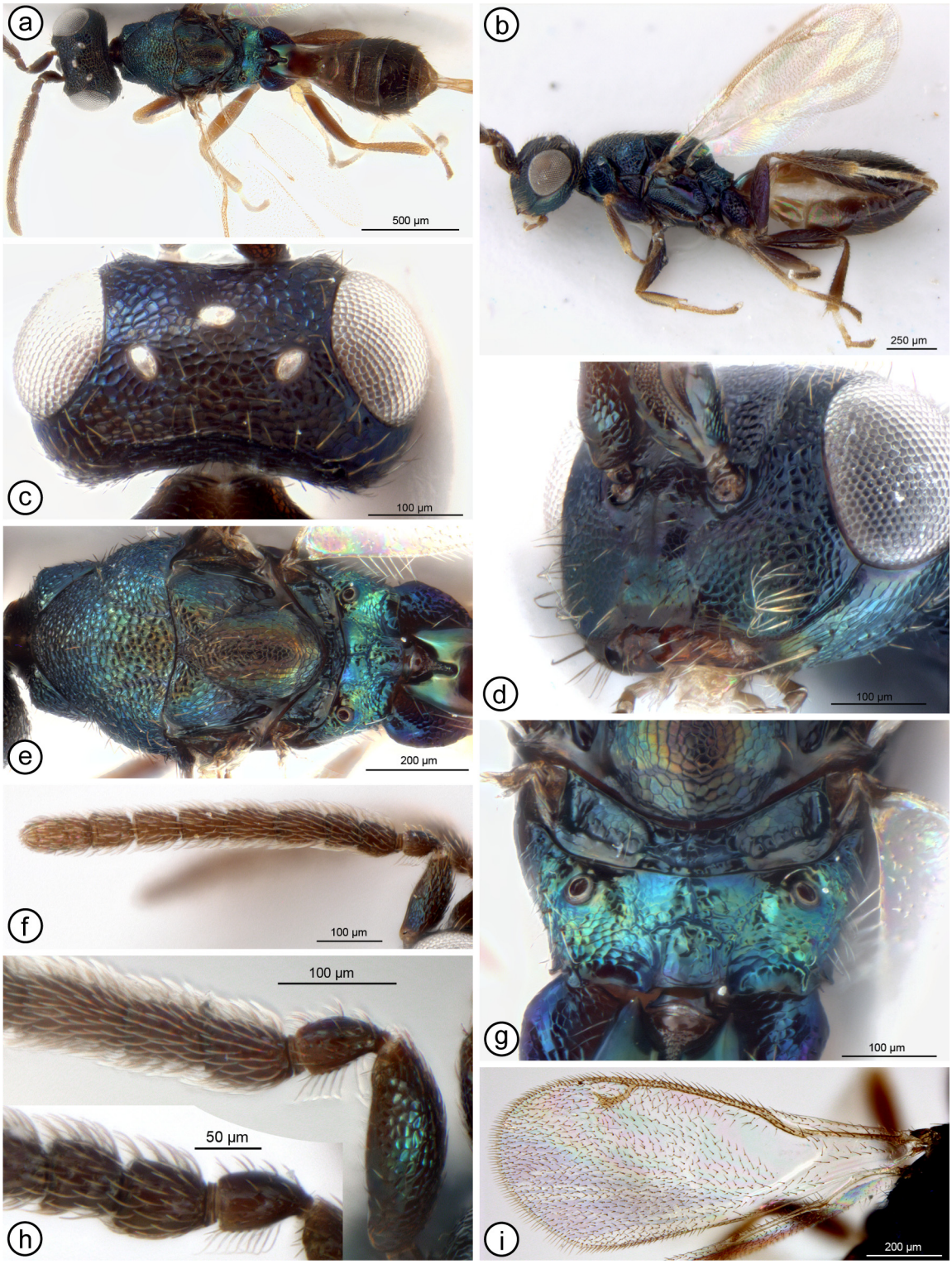

FIGURE 59. *Eupelmus luteipes*, ♂. *a, e, g, h* (2014-90): **a**, dorsal habitus; **e**, mesosoma, dorsal; **g**, apex of scutellum to propodeum; **h**, scape through fl4 [insert: pedicel to base of fl4 (2014-91)]. b, d (2014-91): **b**, lateral habitus; **d**, lower face, frontolateral. *c, f, i* (2014-89): **c**, head, dorsal; **f**, antenna; **i**, fore wing.

MALE (habitus: Fig. 59a, b). Length = 1.9–2.1 mm. Head (Fig. 59c, d) dark, usually with slight bluish luster except vertex under some angles of light sometimes with slight brownish or coppery luster; frontovertex distinctly meshlike reticulate (Fig. 59c); vertex differentiated from occiput by distinct transverse carina (Fig. 59c); scrobal depression similarly sculptured as frons (Fig. 59d); setae light brown; lower face in region between torulus and malar space with tuft-like region of longer, apically hook-like or sinuately curved setae (Fig. 59d); gena posterior to

malar sulcus with 1 or 2 conspicuously long seta and ventral to this with 3–5 shorter setae, and posterior to eye with setae directed toward orbit. Antenna (Fig. 59f) with scape entirely dark, ovoid, about 1.7–2.1× as long as wide; pedicel at most about 1.75× as long as wide, ventrally with 8 or 9 long setae, of which all hooked except possibly apical-most (Fig. 59h); length of pedicel + flagellum about 1.4–1.6× head width; flagellum variably elongate robust-filiform, with clava only slightly shorter than apical two funiculars, and uniformly covered with decumbent, curved setae except fu1–fu3 in ventral view with regions of differentiated, shorter, straighter setae, the differentiated setae over almost entire ventral surface of fu1, but forming narrower regions on fu2 and fu3; anellus very strongly transverse, discoidal, shiny, with at most inconspicuous, sparse setae at extreme apical margin (Fig. 59h); funicle sometimes with all funiculars, but at least fl3–fl7 obviously longer than wide, with fu1 subequal in length to pedicel though sometimes only slightly longer than wide, and fl2 sometimes quadrate, but longest funiculars about 1.6–2.2× as long as wide. Maxillary and labial palps brown. Mesosoma (Fig. 59e) often with slightly more distinct bluish or bluish-green luster than head, particularly propodeum (Fig. 59e, g), except scutellar-axillar complex broadly and sometimes mesoscutum posteriorly with slight coppery luster under some angles of light (Fig. 59e); setae hairlike, brownish; tegula dark. Legs with metacoxa uniformly dark purple, and in lateral view often distinctly reticulate but dorsal margin evenly curved and narrowed to apex; knees or just tibiae basally narrowly pale, pro- and mesotibiae sometimes entirely pale, though usually protibia partly dark dorso- and ventrolongitudinally in part and mesotibia variably extensively brownish to dark in part, but metatibia always almost entirely dark; protarsus pale to yellowish-brown; mesotarsus with at least basal half of basitarsus white, though at least extreme apex usually slightly darker, yellowish to brown similar to subsequent tarsomeres; metatarsus with basal 1–3 tarsomeres white, the tarsomeres often gradually darker beyond basitarsus but only apical 1 or 2 tarsomeres distinctly brownish. Fore wing (Fig. 59i) with mv about 3.8–4.6× length of stv and pmv subequal in length or only slightly longer than stv; costal cell dorsally near leading margin with row of dark setae apically for about length of parastigma, and ventrally with single row along most of length. Propodeum (Fig. 59g) variably rugulose to reticulate-rugulose within posterior half, with median carina extending posteriorly only to about middle where usually intersected by single, irregular transverse carina, and usually with other more-or-less vertical, irregular carinae or reticulations posterior to transverse carina but at least on either side of transverse carina.

Distribution. China, Japan, South Korea, Taiwan.

Biology. A female from China was reared from a larva of *Agrilus planipennis* Fairmaire (Buprestidae) along with *Tetrastichus planipennisi* Yang (Hymenoptera: Eulophidae), a gregarious larval endoparasitoid. According to Leah Bauer, Northern Research Station, USDA Forestry Service, USA (pers. comm.), the female was initially found as a larger hymenopteran larva among smaller, damaged larvae of *T. planipennisi*, and emerged several days later. The adult female was then exposed for two weeks to various stages of *T. planipennisi*-parasitized *A. planipennis* larvae inserted in ash logs. After 10 days the ashborer larvae were removed from the ash logs and a male was subsequently reared from one group of *T. planipennisi* larvae that appeared damaged. Consequently, both the female and the male likely acted as a hyperparasitoid of *A. planipennis* or, perhaps more properly, as a predator of *T. planipennisi* larvae parasitizing *A. planipennis*.

Remarks. As discussed under *E. fulvipes*, *E. luteipes* is included as one of ten species within the *fulvipes* species group based on at least males having a vertexal carina. Ten individuals of the type series from South Korea were sequenced for COI. Analyses indicate the sequenced specimens constitute a single species that molecularly is most similar to what we interpret as *E. tachardiae* (see further under latter species and *E. flavicrurus*). Inclusion of the other females in the species is based on similar morphology. The Taiwanese female does not differ conspicuously from typical South Korean females, though the two females from Japan have a mostly dark face (Fig. 58e), the frons lacking the bright green luster typical of other females (Fig. 58c). One of the two has a bright green mesonotum (Fig. 58g), whereas the other has a dark bluish to purple mesonotum similar to most females from South Korea (Fig. 58f). The two Chinese females have mostly orangey-brown scapes with metallic green luster in combination with entirely pale legs (excluding mesotibial and tarsal pegs) and a very fine vertexal carina. As noted in 'Type material', we exclude one female from Taiwan from the type series. Although the frons of this female is distinctly reticulate laterally, virtually to the level of the scrobal depression, it is more finely sculptured over at least the mesal third below the level of the anterior ocellus. It has quite a distinct vertexal carina, but although the scape entirely and the front and hind legs are extensively pale, the profemur is light brownish apically and the metafemur somewhat darker brownish with a slight metallic luster mesally. Other females we include in *E.*

luteipes have the frons more extensively sculptured, at most finely sculptured only in a narrow band about the width of the ocellus below the anterior ocellus (Fig. 58c, e). Included females are quite variable in scape and leg colour pattern. Most examined females have a mostly yellowish to orange scape, though usually variably extensively and distinctly darker brown dorsally and ventrally so sometimes to be pale only mediolongitudinally on the inner surface (Fig. 58a). Most also have the legs entirely pale beyond the coxae (Fig. 58b), though a female from Japan (Nara city) has the posterior surface of the profemur extensively darkened and another small female from South Korea (DNA voucher ug.KO 04) has all surfaces of both the pro- and metafemora extensively dark, though the protibia is entirely pale (Fig. 58d). Though not as dark as the head or pro- and metafemora, the scape of this latter female appears brownish to orangey-brown (Fig. 58d), but it is difficult to be certain of its natural colour intensity because the contents were digested during DNA analysis. Because of the more uniformly brown scape colour we key this female through the first half of couplet 67 and because the metatibiae are entirely pale though the second half of couplet 69. If keyed through the second half of couplet 67 it would key to *E. iris* at couplet 94. Females of *E. iris* also lack a vertexal carina and have a roughened frons (Fig. 43e) similar to that of *E. luteipes* females, and we are therefore uncertain as to the best features to differentiate such females. Males of the two species are differentiated by several features, including for *E. luteipes* the presence of a vertexal carina (Fig. 59c), a partly rugose-crenulate propodeum (Fig. 59g), an obviously filiform flagellum (Fig. 59f), partly pale mesotarsus (Fig. 59a, b), and darker bluish body colour (Fig. 59a, b). Additional females identified through molecular evidence are necessary to more confidently assess intraspecific variation for *E. luteipes*, particularly frons and vertexal sculpture, and scape and leg colour patterns.

***E.* (*Eupelmus*) *magdalenae* Fusu & Gibson n. sp.**
Fig. 60a–i (♀)

Type material. Holotype ♀ (AICF). LIBYA: Fezzan, Akakus, 01−03.III.2010, Leg. Patrick Weill / HOLOTYPUS ♀ *Eupelmus* (*Eupelmus*) *magdalenae* Det. Fusu L. 2013. Condition: glued by right side on a rectangular card; uncontorted; entire.

Etymology. Named after the Romanian coleopterist and the second author's other half, Maria-Magdalena Dascălu.

Description. FEMALE (habitus: Fig. 60a–b). Length = 3.1 mm. Head (Fig. 60c) metallic bluish-green with stronger metallic luster on frontovertex and gena, and with some coppery and bronze lusters under some angles of light and with strong reddish-coppery luster along parascrobal region, on frons medially below anterior ocellus, on interantennal prominence, and behind each ocellus; with slightly lanceolate white setae on lower face and parascrobal region extending along inner orbit to level of anterior ocellus compared to less conspicuous hairlike setae on vertex and middle of frons. Maxillary and labial palps brown. Antenna dark with at most slight metallic luster on scape, pedicel, and basal flagellomeres. Mesosoma (Fig. 60d, f) similar in colour to head, variably extensively green to reddish-coppery depending on angle of light; prepectus (Fig. 60f) with about 12 white setae in 4 rows medially similar to those on mesoscutum; pronotum with admarginal setae white; mesonotum, including axillae, with short, sparse white setae; callus with dense white setae forming reflective surface. Macropterous; fore wing (Fig. 60h) with basal cell hyaline with white setae (Fig. 60i), but disc with dark setae and rather uniformly infuscate from base of parastigma to level somewhat beyond apex of pmv, though quite abruptly hyaline apically and infuscation paler toward posterior margin (Fig. 60h); costal cell (Fig. 60i) entirely hyaline, dorsally bare, and ventrally with 2 rows of white setae along length; basal cell (Fig. 60i) and disc entirely setose except for linea calva. Front leg dark brown with coppery luster on femur except knee and base of first tarsomere paler. Middle leg including mesotibial apical pegs and mesotarsal pegs dark brown except knee paler and tibial spur and tarsus dirty yellowish-white except last tarsomere. Hind leg almost entirely dark brown with strong coppery luster on femur except tarsus dirty yellowish-white basally and gradually darkened apically. Gaster (Fig. 60a, b) with hairlike setae; with mixed green, red and coppery luster and basal tergite subbasally with a distinct bright green transverse band; ovipositor sheaths (Fig. 60g) continuously brown along ventral margin, but otherwise with elongate paler region mesally obviously longer than dark basal region and shorter than somewhat lighter brownish apical region.

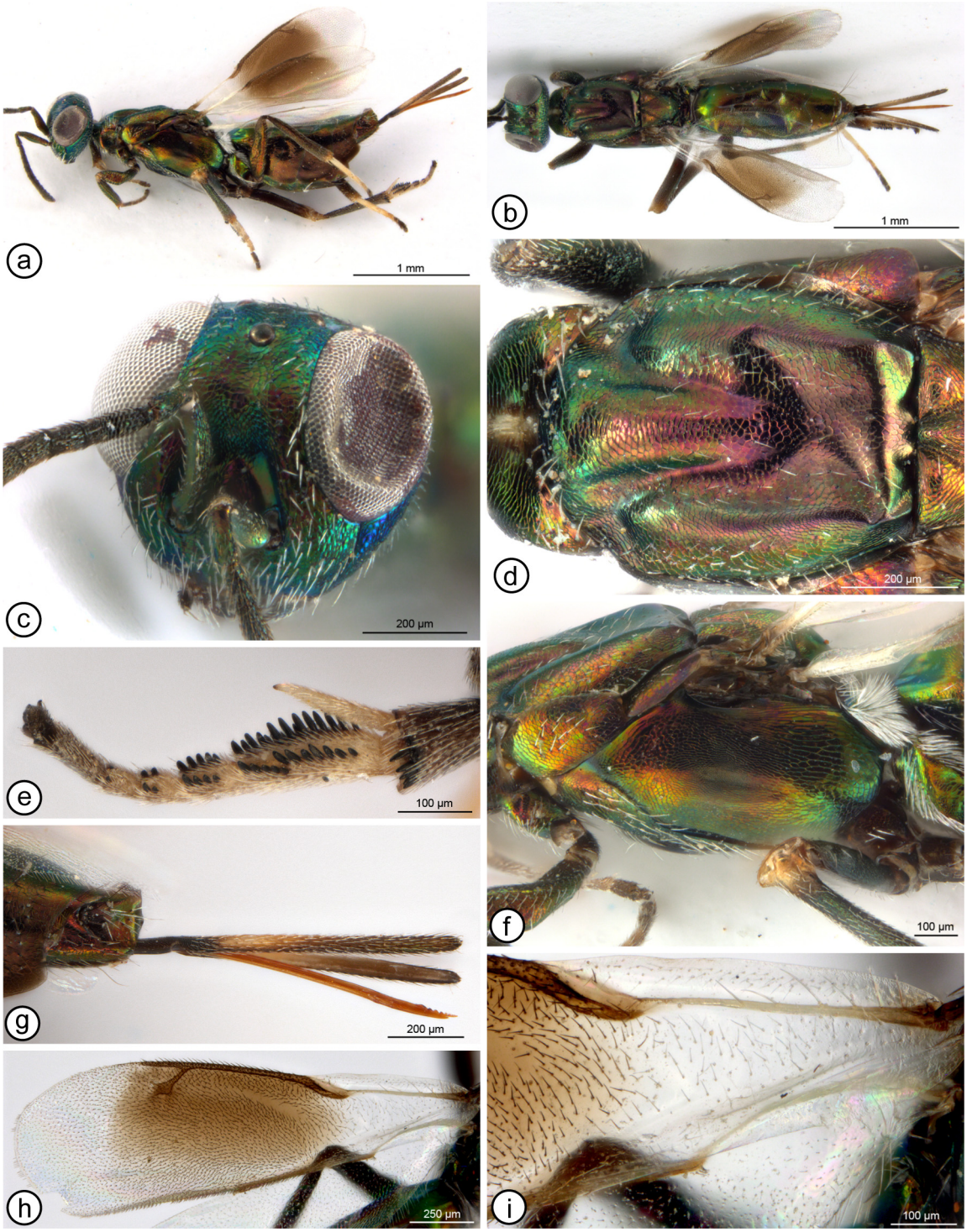

FIGURE 60. *Eupelmus magdalenae*, ♀ holotype: **a**, lateral habitus; **b**, dorsal habitus; **c**, head, frontolateral; **d**, pronotum and mesoscutum, dorsal; **e**, apex of mesotibia and mesotarsus; **f**, mesosoma, lateral; **g**, ovipositor sheaths; **h**, fore wing; **i**, fore wing base.

Head in dorsal view with interocular distance about 0.4× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; vertex alutaceous to alutaceous-imbricate and ocellar area somewhat reticulate-imbricate; frons (Fig. 60c) meshlike coriaceous to slightly reticulate-imbricate mesally; scrobal depression reticulate to reticulate-rugose except smooth above toruli (Fig. 60c); OOL: POL: LOL:

MPOD about 1.0: 2.7: 2.0: 1.0. Mesoscutum almost uniformly but finely meshlike coriaceous-imbricate to coriaceous-reticulate except lateral lobe with band of minute coriaceous sculpture mediolongitudinally (Fig. 60d). Scutellum and axillae low convex in same plane; axilla coriaceous-imbricate to reticulate anteriorly to obliquely alutaceous-imbricate posteriorly; scutellum longitudinally alutaceous-imbricate and frenal area very shallowly meshlike coriaceous-imbricate. Acropleuron (Fig. 60f) more-or-less isodiametric meshlike anteriorly and much more minutely sculptured mesally, posteriorly and dorsally alutaceous-reticulate with larger meshlike sculpture, with larger cells defined by at most very slightly raised ridges. Fore wing (Fig. 60h) with cc: mv: pmv: stv about 4.5: 3.5: 1.1: 1.0. Middle leg (Fig. 60e) with row of 6 mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus and pegs differentiated into two rows apically; second tarsomere with 4 pegs on one side and 5 pegs on the other side or with 6 pegs on one side and 5 pegs on the other side, third tarsomere with 2 pegs, and fourth tarsomere with 1 peg apically on either side. Propodeum with broadly U-shaped plical depression extending to posterior margin. Gaster (Fig. 60a, b) similar in length to combined length of head and mesosoma; not atypically modified; not extending to apex of second valvifer, the latter extending quite obviously beyond gastral apex (Fig. 60g), with apparent sheath length about 1.3× length of metatibia and 1.8× length of mv, and third valvula about 1.15× length of metatibia and 1.6× length of mv; hypopygium extending over three-fourths length of gaster.

MALE. Unknown.

Distribution. Libya.

Biology. Unknown.

Remarks. The only known female of *E. magdalenae* has the ovipositor sheaths gradually paler basally so that there is a distinct pale region subbasally, but not as an abruptly delineated band (Fig. 60g). This colour pattern suggests that the extent of the pale region likely varies and some females might have entirely dark sheaths. To account for this possibility we key out *E. magdalenae* twice, depending on whether the sheaths could be interpreted as entirely dark (couplet 31) or partly pale (couplet 35). Any females with entirely dark ovipositor sheaths would resemble those of *E. longicaudus* because of a similar length of the sheaths (*cf* Figs 57a, 60a) and similar fore wing colour patterns (*cf* Figs 57d, 60h); however, the apices of the second valvifers project conspicuously beyond the apex of the gaster (Fig. 60g) and the fore wing infuscate region extends only slightly beyond the apex of the postmarginal vein (Fig. 60h) in *E. magdalenae*. In *E. longicaudus*, the gaster extends to the apex of the second valvifers (Fig. 57a) and the fore wing infuscate region extends about midway between the apex of the postmarginal vein and the wing apex (Fig. 57d). Other differential features and features shared in common with *fulgens*-group species are discussed under *E. fulgens.*

E. (*Eupelmus*) *martellii* Masi

Figs 38a–c, e, f, h (♂), 61a–h (♀)

Eupelmus Martellii Masi, 1941: 109−111. Syntypes, ♀ & ♂, MCSN (8♀ & 18♂ examined) and MNHN (1♀ & 2♂ examined).
Type data: Cirenaica, vicinity of Misurata [Libya: Tripoli], G.M. Martelli, reared from *Dacus oleae* in olive.
E. (*Eupelmus*) *martellii*; Gibson 2011: 3; Al khatib *et al.*, 2014: 814, 816 (♀ keyed), 822 (♂ keyed).

Description. FEMALE (habitus: Fig. 61a, b, e). See 'Remarks' for *E. gemellus*.

MALE (habitus: Fig. 38a). See 'Remarks' for *E. gemellus*.

Distribution. Algeria, France?, Libya, Morocco, Spain?. The only sequenced specimen identified as *E. martellii* by Al khatib *et al.* (2014) was from Libya; they unsuccessfully attempted to sequence one female from Spain and one from southern France that they stated were identical in colour to examined syntypes.

Biology. A parasitoid of the olive fruit fly, *Bactrocera oleae*. Al khatib *et al.* (2014) also reported a non-sequenced female from France reared from *Timaspis phoenixopodos* Mayr (Cynipidae) on *Lactuca viminea* (L.) (Asteraceae) and one from Morocco caught sweeping *Retama sphaerocarpa* (L.) Fabaceae.

Remarks. As discussed under *E. gemellus*, females of *E. martellii* are very similar to those of *E. gemellus* and males of the two species cannot presently be distinguished.

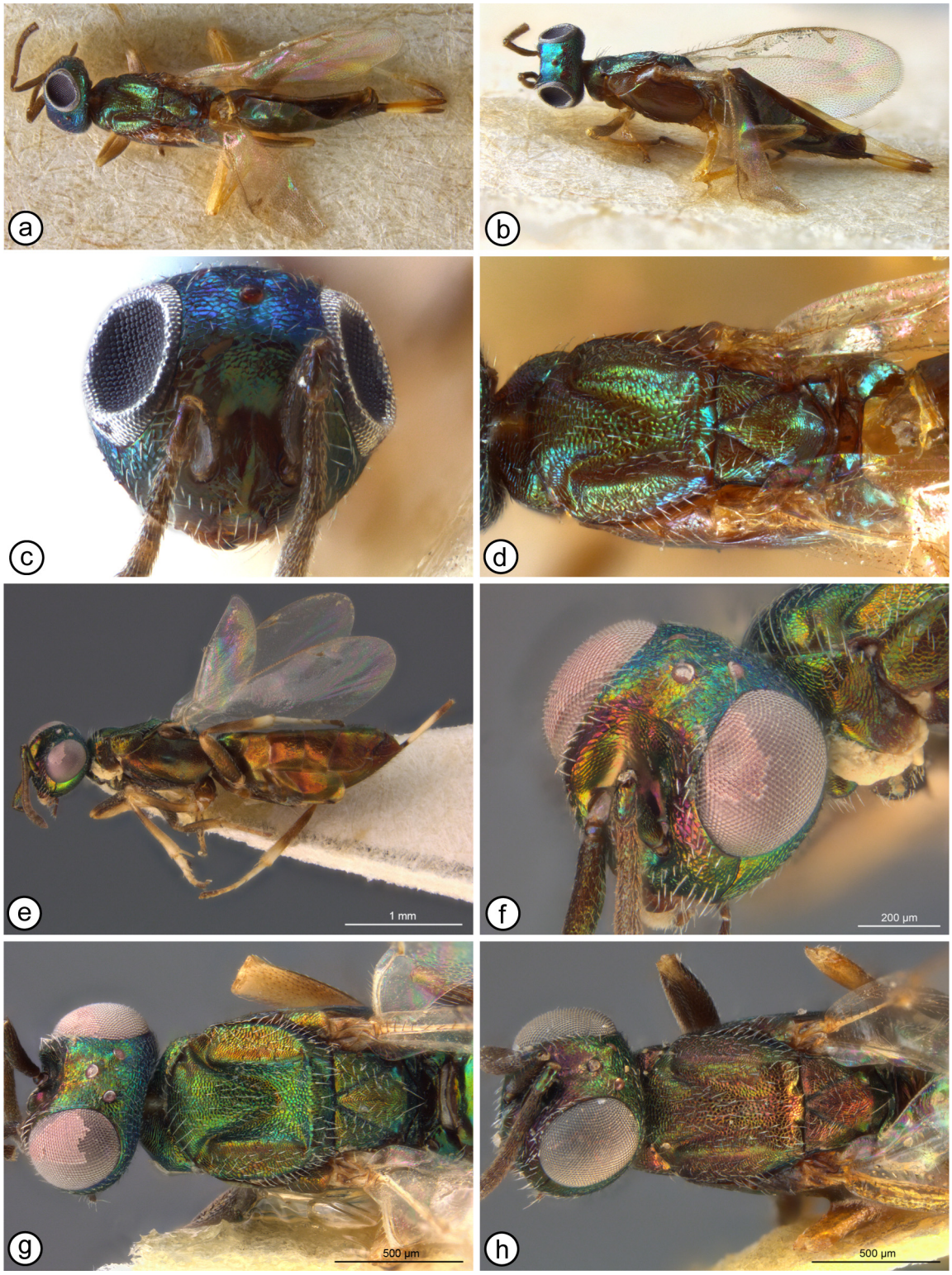

FIGURE 61. *Eupelmus martellii*, ♀. *a–d* (MNHN syntype): **a**, dorsal habitus; **b**, lateral habitus; **c**, head, frontal; **d**, mesosoma, dorsal. *e–h* (2013-167): **e**, lateral habitus; **f**, head, frontolateral; **g**, head and mesosoma, dorsal. **h**, head and mesosoma, dorsal (2013-168).

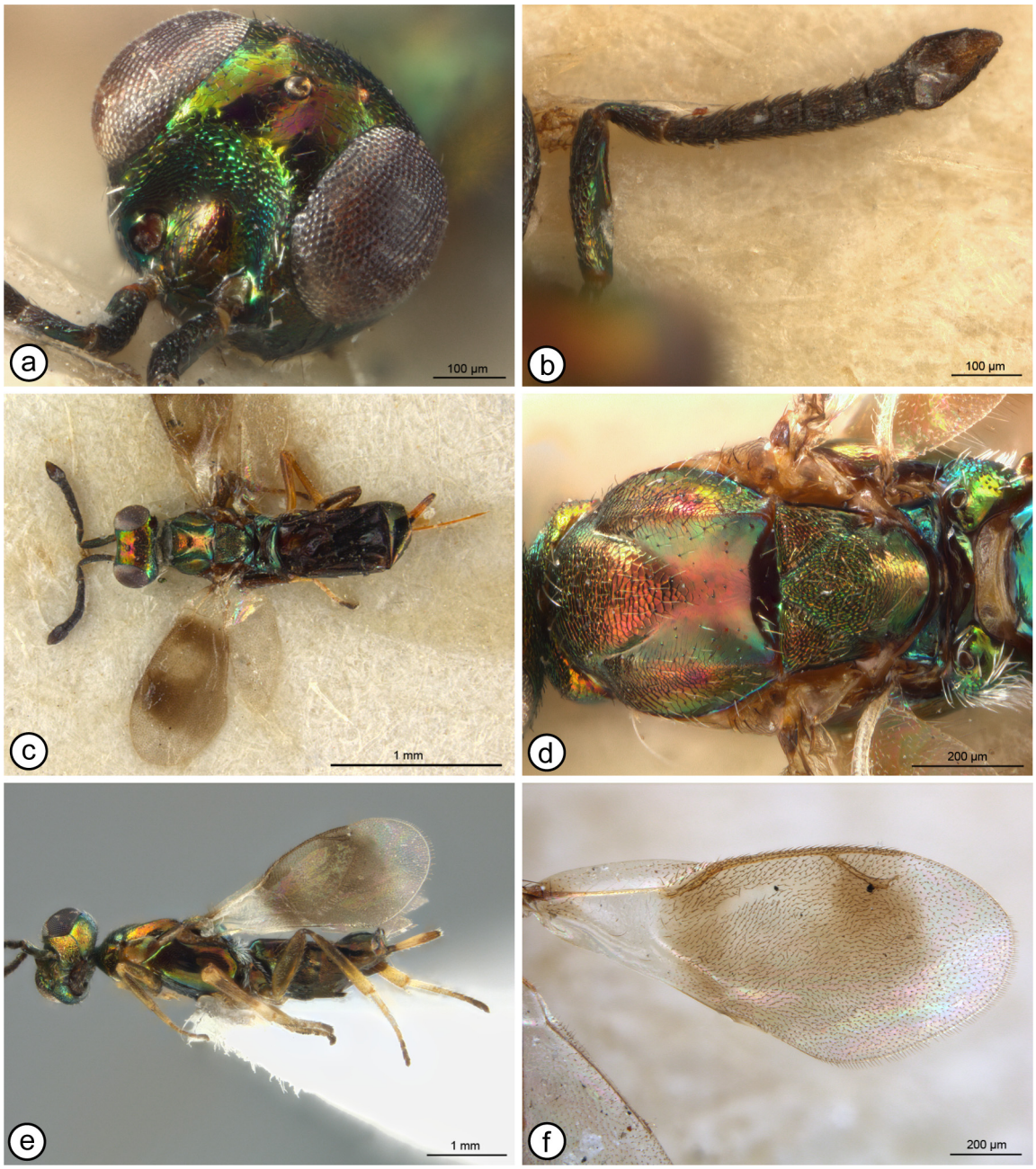

FIGURE 62. *Eupelmus matranus*, ♀. *a–c* (holotype): **a**, head, frontolateral; **b**, right antenna; **c**, dorsal habitus. **d**, mesosoma, dorsal (2012-41). **e**, lateral habitus (2013-10). **f**, fore wing (2012-42).

E. (*Eupelmus*) *matranus* Erdős

Figs 62a–f (♀), 63a–e (♂)

Eupelmus splendens Bolívar y Pieltain, 1934: 201–203. Holotype ♀, MNCN, examined by LF. Type data: Spain, Madrid Prov., Loeches, 5.V.1924, R.G. Mercet. Homonym of *Eupelmus splendens* Giraud (1872: 416–418), discovered by Bouček, 1977: 64.

Eupelmus matranus Erdős, 1947: 68−70. Holotype ♀, HNHM, examined. Type data: Hungary, Mt. Mátra, 26.VI.1947, Erdős. Synonymy with *E. spelendens* Bolívar y Pieltain by Bouček, 1977: 64; confirmed by Askew & Nieves-Aldrey, 2000: 53.

Description. FEMALE (habitus: Fig. 62c, e). Length = 1.5–2.8 mm. Head bright green, though often with some coppery to reddish lusters under some angles of light (Fig. 62a, c); with slightly lanceolate white setae on lower face and parascrobal region almost to level of dorsal margin of scrobal depression compared to less conspicuous hairlike setae on frontovertex. Maxillary and labial palps brown. Antenna (Fig. 62b) dark with scape and pedicel

usually with some metallic luster or sometimes scape with up to about basal half yellow. Mesosoma with pronotum variably dark brown to green, including lateral panel; mesonotum (Fig. 62d) bright green to bluish-green under some angles of light except usually with some coppery to reddish lusters, particularly mesally or within posteromedial depressed region of mesoscutum; prepectus usually and tegula often yellow, distinctly contrasting with mesonotum, though sometimes dark brown with reddish to coppery lusters (Fig. 62e); acropleuron dark green with coppery luster under some angles of light; metanotum and propodeum dark with variably distinct green luster at least laterally; prepectus bare; pronotum with admarginal setae white; mesonotum, including axillae, with white to brownish hairlike setae most similar to frontovertex; callus laterally with quite dense white setae, though usually not completely obscuring cuticle (Fig. 62d). Macropterous; fore wing (Fig. 62f) with costal and basal cells mostly hyaline with white setae, but basally with brownish infuscation and dark setae; disc with all setae dark and with variably dark and extensive brownish infuscation, often more strongly behind parastigma and base of mv and behind stv and pmv, but sometimes almost uniformly between parastigma and apex of pmv except for more hyaline region anteriorly behind mv; costal cell dorsally near leading margin with row of setae over at most about apical half, the more apical setae white and inconspicuous, and ventrally with 2 or 3 rows along length; basal cell and disc entirely setose except for linea calva. Legs varying from mostly pale except for dark coxae, mesotarsal pegs and apical tarsomeres, to entirely dark except for tibiae apically and basal tarsomeres. Gaster (Fig. 62c, e) with hairlike setae; brown with coppery or sometimes slight greenish luster except basal tergite anteriorly distinctly green to bluish-green; ovipositor sheaths with second valvifer and extreme base of third valvula dark, the third valvula also at least light brownish apically so as to be noticeably banded.

Head in dorsal view with interocular distance about 0.35–0.4× head width; in lateral view lenticular, the face almost evenly convex and parascrobal region smoothly merged with frontovertex; vertex meshlike coriaceous to coriaceous-alutaceous; frons usually shiny and at least partly smooth or with subeffaced meshlike sculpture (Fig. 62a), more rarely uniformly though very finely coriaceous; scrobal depression smoothly merged with parascrobal region, strongly reticulate to reticulate-rugose (Fig. 62a). Mesoscutum with at least noticeably finer meshlike to subeffaced coriaceous sculpture within posteromedial depressed region compared to outer surface of lateral lobe and convex part of medial lobe, and usually partly to mostly smooth and shiny (Fig. 62d). Scutellum and axillae low convex in same plane; similarly punctate-reticulate to reticulate-rugose except frenal area finely meshlike coriaceous. Acropleuron meshlike coriaceous to coriaceous-reticulate anteriorly and posteriorly and much more minutely sculptured to almost smooth mesally. Fore wing (Fig. 62f) with cc: mv: pmv: stv = 2.8–3.2: 2.0–2.1: 1.0–1.2: 1.0. Middle leg without mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus; basitarsus with pegs variably distinctly differentiated into two rows apically, second tarsomere with 4 or 5 pegs, third tarsomere with 2 or 3 pegs, and fourth tarsomere usually with 1 peg apically on either side. Propodeum with broadly V- to slightly U-shaped plical depression extending to posterior margin (Fig. 62d). Gaster (Fig. 62c, e) about as long as mesosoma; not atypically modified; usually extending to base or rarely beyond base of third valvula depending on preservation of gaster, with third valvula about 0.5–0.7× length of metatibia or about 0.7–1.0× length of mv; hypopygium extending about three-quarters length of gaster.

MALE (habitus: Fig. 63a). Length = 1.1–1.5 mm. Head mostly green to bluish-green (Fig. 63a) or more bluish under some angles of light (Fig. 63b), though frons sometimes with slight coppery luster mesally below anterior ocellus; frons meshlike coriaceous to at most slightly coriaceous-reticulate; vertex uniformly curved into occiput, meshlike coriaceous-reticulate to reticulate-imbricate posteriorly; scrobal depression meshlike reticulate (Fig. 63b); setae white, hairlike to slender-lanceolate, particularly on parascrobal region (Fig. 63b); lower face lateral to clypeus with comparatively numerous apically curved setae forming obvious patch of usually quite dense appearing setae (Fig. 63b); gena posterior to malar sulcus with 1 seta conspicuously thicker and longer than others, as long or longer than length of malar space (Fig. 63b), and ventral to this near oral margin with tuft of several much shorter, apically hooked setae, and posterior to eye with apices of setae directed toward orbit. Antenna (Fig. 63c) with scape dark except sometimes extreme base and outer, ventral, longitudinally sensory region in part to entirely pale; pedicel (Fig. 63c) at least about 2× as long as wide and about as long as combined length of fl1–fl4, and ventrally with 4 or 5 long white setae, of which basal 3 hook-like curved (Fig. 63e); length of flagellum + pedicel slightly shorter than or at most as long as head width; flagellum distinctly clavate (Fig. 63c) with funiculars increasing in width to clava, the clava with ventrally flat or collapsed micropilose sensory region; anellus strongly transverse, discoidal; funicle with all funiculars transverse, at least the basal and apical ones distinctly so, and fu1–fu4 or at least fu2–fu4 ventrally with modified sensory region so in ventral view appearing asetose and flat. Maxillary and labial palps brown. Mesosoma mostly green to bluish-green (Fig. 63a) but sometimes with some

coppery luster; setae hairlike, pale brownish to white; tegula yellowish-brown. Front leg with femur dark at least posteroventrally and usually more extensively, but anterior surface mediolongitudinally to entirely pale; tibia mostly pale except dorso- and ventrolongitudinally to more extensively dark except at least anterior surface longitudinally; tarsus pale to brown. Middle and hind legs dark except trochantelli, knees or at least tibiae basally, tibiae apically, tibial spurs and basal tarsomeres pale. Fore wing (Fig. 63d) with mv about 1.7–1.9× length of stv; costal cell dorsally near leading margin with row of dark setae over about apical two-thirds to three-quarters, and ventrally with dark setae in 2 rows basal to parastigma; basal cell uniformly setose with dark setae; disc dorsally behind base of mv and parastigma delineating slender speculum closed posterobasally by setae. Propodeum with complete median carina, and panels finely meshlike coriaceous.

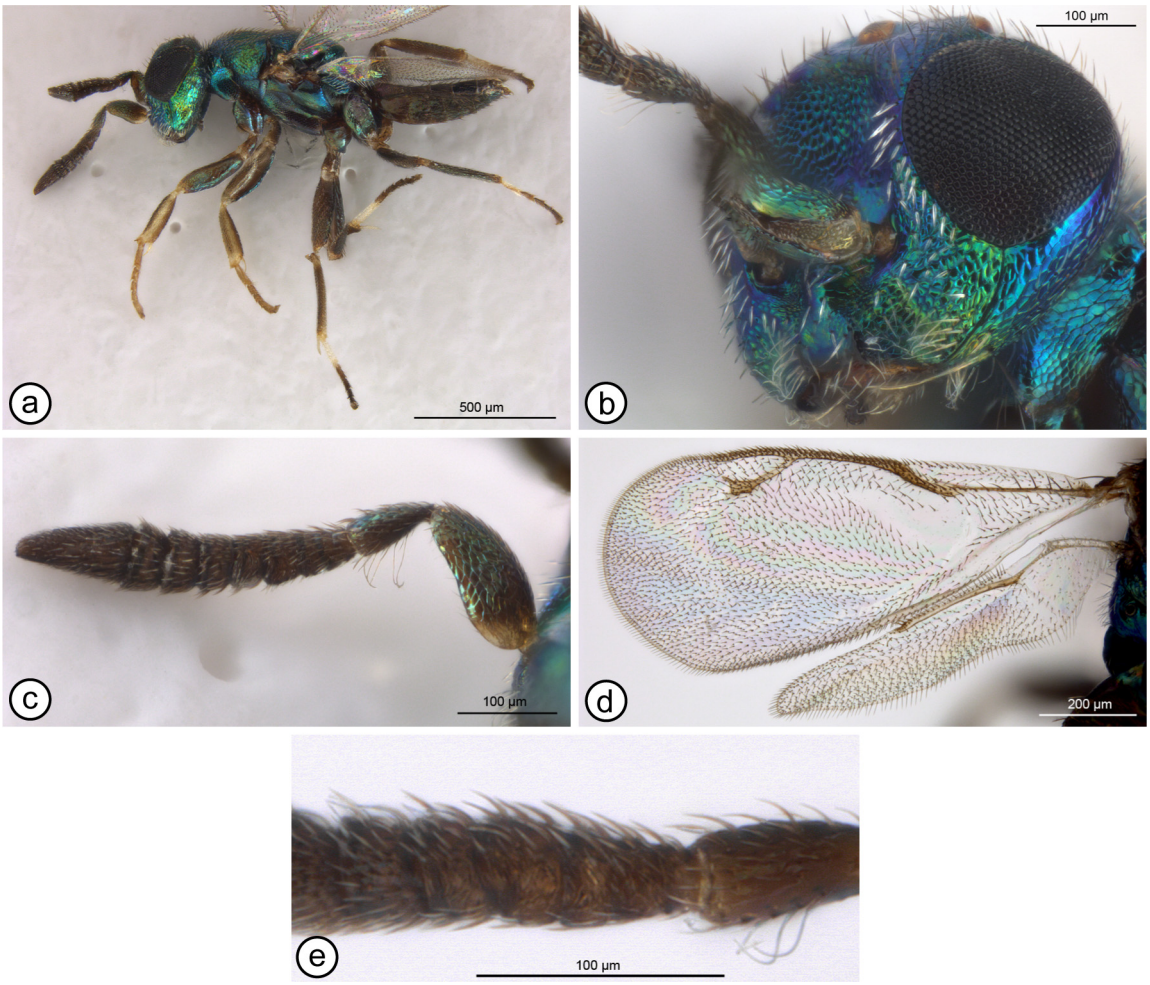

FIGURE 63. *Eupelmus matranus*, ♂. *a, c* (2013-117): **a**, lateral habitus; **c**, antenna, outer view. *b, d* (2013-116): **b**, head, frontolateral; **d**, wings. **e**, pedicel to base of fl7, ventral view (2013-146).

Distribution. France, Hungary, Italy, **Jordan*** [O. Jordan, J. Klapperich, Wadi Sir b. Amm., 600m, 20.IV.1956 (HNHM: 1♀)], Spain, Romania (Andriescu 1974).

Biology. A primary parasitoid in galls of Cynipidae (Hymenoptera) on oaks (Fagaceae: *Quercus* L.). Martelli & Arru (1958) reported it from *Andricus grossulariae* Giraud and *Neuroterus lanuginosus* Giraud on *Q. suber* L., whereas Andriescu (1974) reported it from *Andricus multiplicatus* Giraud (incorrectly stated as *E. splendens* in Melika *et al.* 2002a) and Askew *et al.* (2013) from *Pseudoneuroterus saliens* (Kollar) on *Q. cerris*. We saw females and males reared from *P. macropterus* (Hartig) and *P. saliens* on *Q. cerris* (CTPC), and collected by sweeping *Q. faginea* Lam. and *Q. ilex* L. (ARPC).

Remarks. Erdős (1947, fig. 1a–d) illustrated the antenna, head in lateral view, scutellar-axillar complex, and fore wing of the female when he described *E. matranus.* He noted that females of his new species were similar to those of *E. splendens* Giraud. Differentiation of *E. matranus* and *E. splendens* within the *splendens*-group is discussed under the latter species (see also under *E. bicolor* and *E. bulgaricus*).

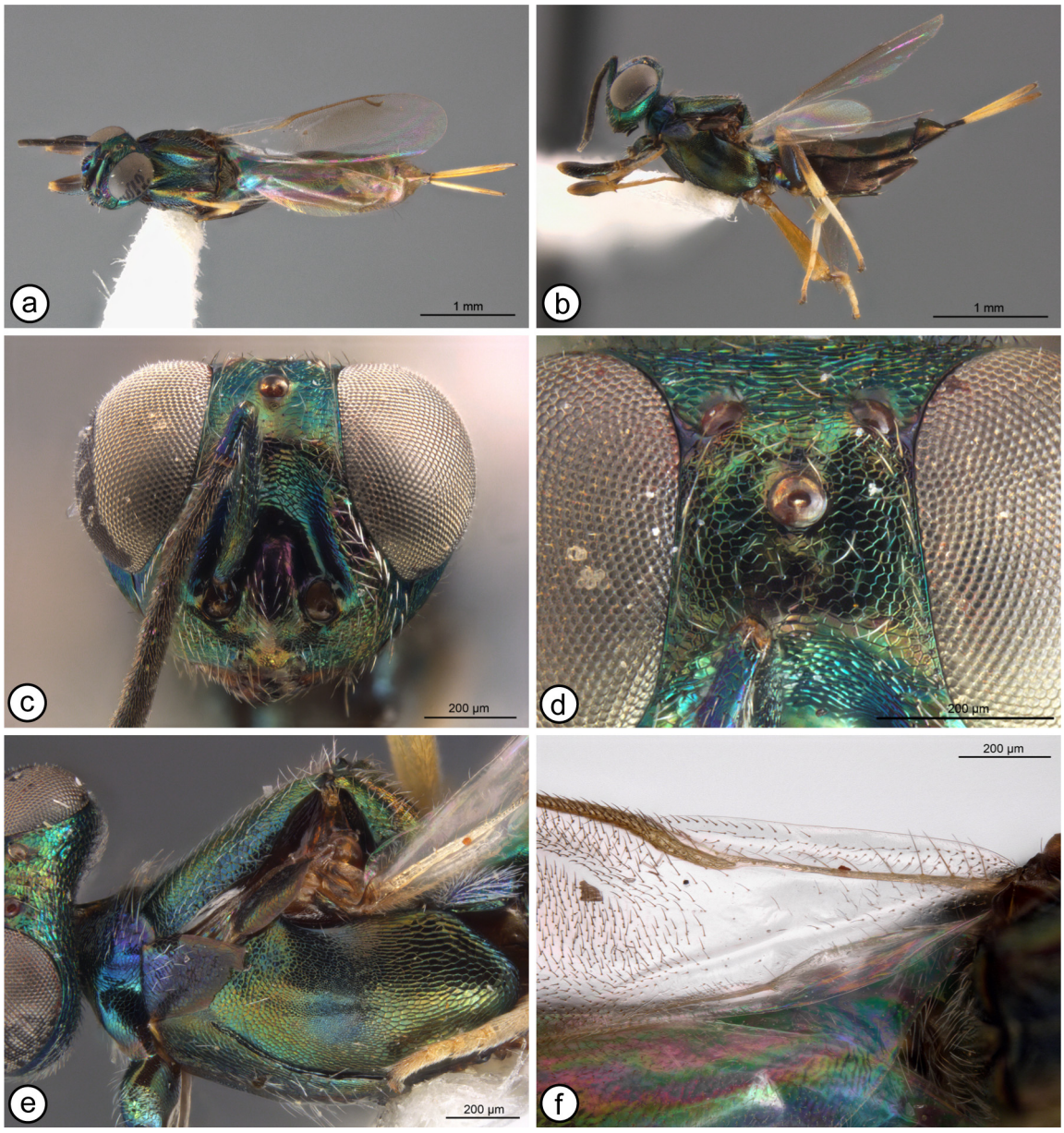

FIGURE 64. *Eupelmus mehrnejadi*, ♀. *a, e, f* (holotype): **a**, dorsal habitus; **e**, vertex/occiput (dorsal) and mesosoma (lateral); **f**, fore wing base. *b–d* (2013-79): **b**, lateral habitus; **c**, head, frontal; **d**, upper part of scrobal depression and frontovertex.

E. (*Eupelmus*) *mehrnejadi* Gibson & Fusu n. sp.

Figs 64a–f (♀), 65a–i (♂)

Type material. Holotype ♀ (CNC). IRAN: Ravar, 3.iv.2006, ex. *Kermania pistaciella* on *Pistacia vera*, M.R. Mehrnejad / HOLOTYPE ♀ *Eupelmus* (*Eupelmus*) *mehrnejadi* Gibson & Fusu, det. G. Gibson 2015. Condition: point-mounted; contorted; entire except right antenna beyond anellus and left antenna beyond fl6 missing.

Paratypes (4♀ & 7♂, all CNC). **Iran**: same data as holotype (1♀) except collected 3.IV.2007 (7♂, four with CNC Photo 2013-80, 2013-81, 2013-145 and 2014-130) or without host plant given (3♀, one with CNC Photo 2013-79).

Excluded from type series. **Iran**: Gahvareh, ex. *Aphelonyx persica* gall on *Quercus brantii*, mid-summer, G. Melika, Eann039 (CNC: 1♂).

Etymology. Named after Dr. Reza Mehrnejad, Iranian Pistacio Research Institute, who reared the type series and kindly donated the specimens to the CNC from his private collection.

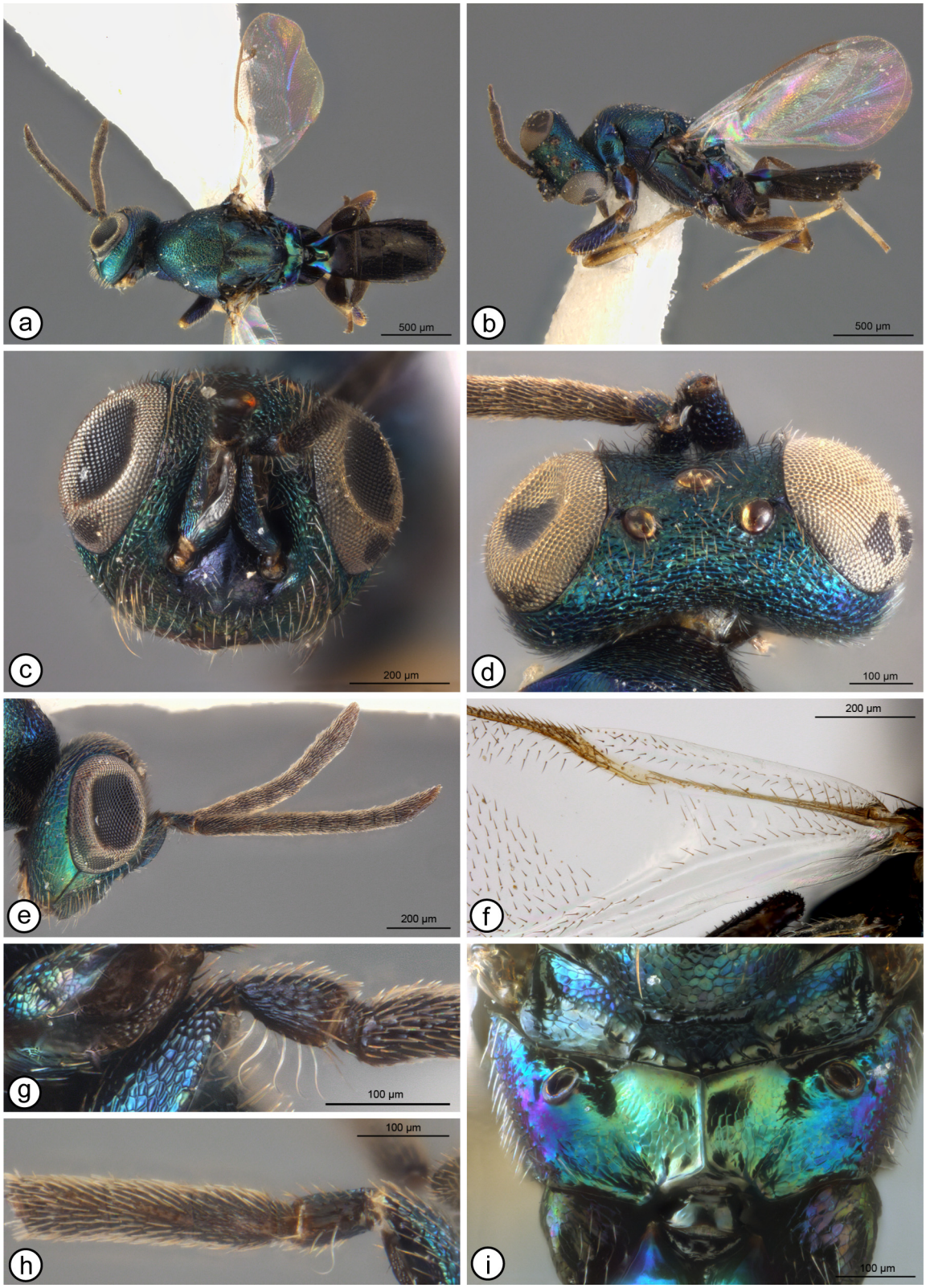

FIGURE 65. *Eupelmus mehrnejadi*, ♂. *a, c, e, g, i* (2014-130): **a**, dorsal habitus; **c**, head, frontal; **e**, head, lateral; **g**, pedicel to base of fl3, inner view; **i**, apex of scutellum to propodeum. **b**, lateral habitus (2013-80). *d, f* (2013-81): **d**, head, dorsal; **f**, fore wing base. **h**, pedicel to base of fl5, ventral view (2013-145).

Description. FEMALE (habitus: Fig. 64a, b). Length = 2.9–3.5 mm. Head (Fig. 64c) mostly green to bluish-green but frons usually dark or with slight coppery luster mesally below anterior ocellus (Fig. 64d), interantennal prominence mesally and parascrobal region variably extensively dark with purple to violaceous lusters (Fig. 64c),

and vertex or occiput often with some coppery luster; with white, slightly lanceolate setae on lower face and parascrobal region compared to thinner, more hairlike setae on frontovertex. Maxillary and labial palps brown. Antenna dark except scape and usually pedicel with green to bluish-green luster similar to head. Mesosoma with pronotum blue to purple at least dorsolaterally (Fig. 64e), mesoscutum extensively green to bluish-green but convex part of medial lobe with at least some coppery luster and lateral lobe dorsolongitudinally with distinct coppery luster except reddish-violaceous posteriorly (Fig. 64a), scutellar-axillar complex greenish laterally but with distinct coppery luster mesally, prepectus and tegula dark but prepectus with some blue to purple luster similar to pronotum dorsolaterally (Fig. 64e) and tegula usually with slight metallic lusters under some angles of light, acropleuron (Fig. 64e) green to bluish-green with extensive coppery luster, and propodeum mostly bright green to bluish-green with at most slight coppery luster but more blue to purple lateral of spiracle; mesonotum with white, hairlike to slightly lanceolate setae, prepectus extensively setose but setal apices not extending over prepectal margins, and callus with white setae obviously denser than on mesoscutum but not concealing cuticle (Fig. 64e). Macropterous; fore wing hyaline (Fig. 64b) or at most with very slight brownish infuscation behind discal venation not extending to posterior margin; costal cell (Fig. 64f) dorsally near leading margin with row of light to dark brown setae over at most apical half, and ventrally with 2 or 3 rows of often comparatively light coloured setae along length; smv with white to light yellowish setae obviously lighter in colour than brown setae of discal venation; basal cell (Fig. 64f) with white setae basally but with conspicuous, broad bare region behind apex of smv and base of parastigma; disc entirely setose except for linea calva. Front leg with femur dark except narrowly apically and tibia dark dorsally and ventrally, but base narrowly, apex more widely, and entire anterior and posterior surfaces pale similar to tarsus. Middle leg pale beyond coxa except for dark mesotibial apical and mesotarsal pegs, but knee, tibia apically and tarsus more whitish-yellow compared to remainder of femur and tibia and tibia subbasally with at least slightly darker, brownish dorsal spot or annulus subbasally. Hind leg with at least about basal three-quarters of femur dark but pale apically; tibia with base narrowly, apex more widely, and entire or most of ventral surface pale; tarsus pale. Gaster (Fig. 64a, b) with hairlike setae; brown except basal tergite anteriorly green to bluish-green; ovipositor sheaths uniformly pale beyond dark base or at most gradually darkened to light brownish-yellow apically with at most only the extreme tip similarly as dark as base.

Head in dorsal view with interocular distance about 0.3× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; vertex alutaceous-imbricate, frons meshlike coriaceous and scrobal depression reticulate to transversely reticulate-rugulose (Fig. 64d); OOL: POL: LOL: MPOD = 0.4–0.5: 1.9–2.0: 1.2–1.3: 1.0. Mesoscutum meshlike reticulate with medial lobe shallower reticulate to somewhat reticulate-imbricate anteriorly and lateral lobe with mediolongitudinal band of minute coriaceous sculpture. Scutellum and axillae low convex in same plane; axilla mostly meshlike reticulate anteriorly to obliquely reticulate imbricate posteriorly; scutellum longitudinally reticulate-imbricate lateral midline (frenal area not visible). Acropleuron (Fig. 64e) shallowly reticulate anteriorly and posteriorly of much more minutely sculptured mesal region, the reticulations meshlike anteriorly but somewhat elongated and longitudinally aligned posteriorly. Fore wing with cc: mv: pmv: stv = 4.7–5.5: 3.8–4.5: 1.0–1.1: 1.0. Middle leg with row of 5–8 mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus and pegs clearly differentiated into two rows apically, second tarsomere with 6 or 7 pegs, third tarsomere with 3 or 4 pegs, and fourth tarsomere with 1 or 2 pegs apically on one or both sides. Propodeum with broadly U-shaped plical depression extending to posterior margin. Gaster (Fig. 64a, b) similar in length to combined length of head and mesosoma; not atypically modified; not quite extending to apex of second valvifer, the latter extending slightly beyond gastral apex, with length of third valvula 1.0–1.05× length of metatibia and 1.25–1.31× length of mv; hypopygium extending about two-thirds length of gaster.

MALE (habitus: Fig. 65a, b). Length = 2.3–2.6 mm. Head (Fig. 65c, d) dark greenish-blue to bluish-green except scrobal depression and interantennal prominence dark; frons meshlike coriaceous or at least more finely sculptured than vertex; vertex uniformly curved into occiput, reticulate with raised edges of sculpture not aligned into transverse ridge or carina (Fig. 65d); scrobal depression extensively meshlike reticulate to reticulate-rugulose excluding shiny scrobes; setae hairlike, pale brownish to brown; lower face in region between torulus and malar sulcus with region of long setae, of which at least some are sinuately to abruptly curved apically (Fig. 65c); gena posterior to malar sulcus with 1 obviously longer seta differentiated from other variably long setae, and posterior to eye with apices directed toward orbit. Antenna (Fig. 65e) with scape entirely dark; pedicel (Fig. 65g) about twice as long as wide, ventrally usually with row of 6 long white setae (6 on left and 4 on right pedicel of one male), with all

but usually apical seta hook-like curved; length of pedicel + flagellum about 1.2× head width; flagellum clavate with funiculars increasing in width and decreasing in length apically to broader, differentiated clava having ventrally flat or collapsed micropilose sensory region; anellus quite strongly transverse, but dull and setose similar to subsequent flagellomeres (Fig. 65g, h); funicle with fu1 subequal in length to pedicel and about 1.7× as long as wide, and apical funiculars subquadrate; in ventral view fu1 and at most fu2 in part with region of short lanceolate setae, visible under lower magnifications as elongate, smoother, shinier regions surrounded by decumbent setae (Fig. 65h). Maxillary and labial palps with at least apical palpomeres pale, whitish (type series). Mesosoma (Fig. 65a, b) similarly greenish-blue to bluish-green as head except propodeum often brighter blue and pronotum laterally and/or propodeum laterally often partly purple to violaceous; setae hairlike, entirely dark on pronotum, brownish to dark on mesonotum, and whitish on propodeal callus; tegula dark brown. Front leg with femur dark; tibia with at least anterior and usually posterior surface longitudinally pale; tarsus pale except for light brownish apical tarsomere. Middle leg with femur dark; tibia with anterior and posterior surfaces longitudinally pale; tibial spur white; tarsus with basal 3 tarsomeres uniformly pale, whitish, with fourth tarsomere usually at least partly and apical tarsomere entirely brownish. Hind leg with both femur and tibia dark; tarsus with similar colour pattern as middle leg. Fore wing (Fig. 65a, b) with mv about 3.1–3.4× length of stv; costal cell (Fig. 65f) dorsally near leading margin with dark setae over about apical half to two-thirds, and ventrally with dark setae at least indistinctly aligned into 2 rows basally; basal cell (Fig. 65f) uniformly setose with dark setae; speculum closed posterobasally by setae (Fig. 65f). Propodeum (Fig. 65i) with complete median carina, panels mostly smooth to variably extensively meshlike coriaceous or sometimes very shallowly reticulate posteriorly.

Distribution. Iran.

Biology. A solitary, pupal, primary parasitoid of *Kermania pistaciella* Amsel (Lepidoptera: Tineidae) or a facultative hyperparasitoid of this through *Chelonus kermakiae* (Tobias) (Braconidae) (Mehrnejad & Basirat 2009), and possibly a parasitoid in *Aphelonyx persica* Melika *et al*. galls on *Quercus brantii* Lindl. (Fagaceae) (see 'Remarks').

Remarks. This species was identified as *E. annulatus* in Mehrnejad & Basirat (2009). Based on field notes, Dr. Mehrnejad confirmed that all females were obtained from the Tale kelaghi site and those labelled as collected the same day in 2006 and 2007 were reared during the two successive years, though the 2007 data were not included in the publication (pers. comm., see Mehrnejad & Basirat 2009, table 1). All five females are contorted, which makes accurate measurement of length difficult. We consider *E. mehrnejadi* as a distinct species from *E. annulatus* based on the unusually long third valvulae (at least as long as metatibia and 1.25× as long as the marginal vein, Fig. 64a, b) in combination with the fore wing having quite a broad and distinct bare region behind the apex of the smv and base of the parastigma as well as obviously lighter coloured setae basally within the basal cell and on the submarginal vein as compared to on the discal veins and disc (Fig. 64f). However, additional rearings are necessary to confirm that these features are not simply host-induced variation within a single variable species, *E. annulatus*. We also saw seven females and one male from Israel (USNM) reared from *Chrysopa* Leach (Neuroptera: Chrysopidae) and two females collected in Greece (AICF, ZMAN) that at least have the basal cell more sparsely setose than the disc and sometimes have a distinct bare region behind the parastigma (Fig. 8b) similar to *E. mehrnejadi*. Other females we include in *E. annulatus* often have a smaller, more circular bare region closed anteriorly and posteriorly by setae, suggesting either intraspecific variation in setal pattern or a transformation series between a uniformly setose fore wing and one with a broad bare region as in *E. mehrnejadi* females. The above females from Israel and Greece differ from those we include in *E. mehrnejadi* in usually also having stronger brownish infuscation behind the discal venation, brownish basal cell and submarginal vein setae similar to those of the disc and discal veins (Fig. 8b), and the third valvulae shorter than the metatibia and at most about 1.15× the length of the marginal vein. Because of this we include these females in *E. annulatus*, though additional rearings from *Chrysopa* are required and without molecular analysis their true species relationships remain questionable. Accurate measurement of the length of the third valvula is very important for correct identification of *E. mehrnejadi* because some females we include in *E. martellii* are very similar to those of *E. mehrnejadi* except for having uniformly setose fore wings and the third valvulae somewhat shorter than the marginal vein. If keyed erroneously through couplet 39 they would key between *E. annulatus* and *E. mehrnejadi* because of their uniformly setose fore wings that have a similar setal colour pattern as *E. mehrnejadi*.

Additional males of *E. mehrnejadi* are required to determine whether the given key features are reliable to differentiate them from males of *E. annulatus*. The only features that appear to differ are the lack of a differentiated

setal region ventrally on fu3 for *E. mehrnejadi* males and perhaps the tarsi and palps being somewhat more extensively pale. The male from Iran that is excluded from the type series was sequenced by G. Stone and G. Melika as part of a study of *Eupelmus* associated with oak galls. In their unpublished results it is basal to a clade formed by several sequences of males of an unidentified species that we discuss under *E. cerris*, but in newer unpublished results it is basal to individuals that cluster as *E. annulatus*. Because of the condition of the remaining specimen it is difficult to be certain whether it is a *E. mehrnejadi* male and it is therefore excluded from the type series. Only one partial antenna remains, which has a distinctly differentiated sensory region on only fu1 (possibly present also on extreme base of fu2), which supports it as a *E. mehrnejadi* male. The male is missing all of its legs beyond the coxae except for the left mesofemur and right middle leg excluding the apical three tarsomeres. The basal two tarsomeres are white, but it is only the third and subsequent mesotarsomeres that may be important for differentiating males of *E. mehrnejadi* and *E. annulatus*. Of the one set of palps that remain, the apical palpomere is brownish with only the extreme tip pale, and thus this is more similar to typical *E. annulatus* males than those of the type series. Furthermore, the host is quite different than the type series of *E. mehrnejadi*. However, we provisionally include it *E. mehrnejadi* because the funicular sensory region is restricted to fu1 (*cf* Fig. 65) rather than being expressed along the length of at least both fu1 and fu2 (Fig. 9f insert).

***E.* (*Eupelmus*) *melanostylus* Gibson & Fusu n. sp.**
Figs 66a–h (♀), 67a–i (♂)

Type material. Holotype ♀ (CNC). YEMEN: Ar Rujum, 16.X.2000-15.I.2001, A. van Harten, A.M. Hager, MT / HOLOTYPE ♀ *Eupelmus* (*Eupelmus*) *melanostylus* Gibson & Fusu, det. G. Gibson 2015. Condition: point-mounted; uncontorted; entire.

Paratypes (13♀ & 6♂, all CNC). **Yemen**: 1♀ (CNC Photo 2014-81), 1♂ (CNC Photo 2014-82), same data as holotype; 1♀ (CNC Photo 2014-79), 3♂ (one with CNC Photo 2014-83), same data as holotype except collected 9.IV-6.VI.2001. 12 km NW of Manakhah, 3.VII-21.VIII.2001, A. van Harten, MT (1♂). San'a, ii.1992, A. van Harten (1♂); 21.X.1997, A. van Harten, from mealybugs on *Lantana camara*, #2771 (1♀). Ta'izz, 10.2001, light trap, A. van Harten, A.R. Al Yarimi (10♀, two with CNC Photo 2014-78 and 2014-80).

Etymology. From the Greek words *melanos* (black) and *stylos* (pillar), in reference to the entirely dark ovipositor sheaths, one of the primary features that differentiates female from those of *E. stenozonus*.

Description. FEMALE (habitus: Fig. 66a, b). Length = 2.0–2.6 mm. Head (Fig. 66c, d) bluish to purple except scrobal depression dark (Fig. 66c), without any coppery luster; with slightly lanceolate white setae on lower face and parascrobal region to or slightly above dorsal level of scrobal depression compared less conspicuous hairlike setae on frontovertex. Maxillary and labial palps brown. Antenna dark with slight bluish luster on scape and pedicel under some angles of light. Mesosoma (Fig. 66a, b, e) similar in colour to head, blue to partly purple or if somewhat greenish under some angles of light then without coppery luster. Pronotum with admarginal setae dark at least mesally, though sometimes white laterally (Fig. 66f); mesonotum, prepectus and callus laterally with similar, slightly lanceolate white setae, the prepectus with 3–9 setae mediolongitudinally (Fig. 66f). Macropterous; fore wing hyaline (Fig. 66b) with white to yellowish setae; costal cell dorsally near leading margin with row of setae over about apical half to two-thirds, and ventrally with 2–3 rows along length; basal cell and disc entirely setose except for linea calva. Front leg with femur dark except narrowly pale apically, tibia narrowly pale basally, more extensively apically and longitudinally along posterior and anterior surfaces, and tarsus yellowish-brown to brown. Middle leg with femur dark except pale apically; mesotibia pale basally and more widely apically but with variably dark region subbasally; mesotibial apical pegs, mesotarsal pegs and apical one or two tarsomeres dark. Hind leg with femur dark except narrowly pale apically; tibia pale basally and somewhat more widely apically, with much longer dark region than mesotarsus; tarsus with at least basal tarsomere white, the subsequent tarsomeres yellowish to dark apically. Gaster (Fig. 66a, b) with hairlike setae; brown with variably extensive and distinct bluish luster under some angles of light, often most distinctly basally; ovipositor sheaths dark except for extreme tip, with third valvulae usually slightly lighter than second valvifers, sometimes most distinctly subbasally, but without distinct medial pale region (Fig. 66h).

Head in dorsal view with interocular distance 0.43–0.46× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; vertex meshlike reticulate to somewhat reticulate-imbricate posteriorly; frons shallowly meshlike reticulate (Fig. 66d); scrobal depression entirely smooth

and shiny (Fig. 66c, d) or at most finely meshlike coriaceous dorsally; OOL: POL: LOL: MPOD = 0.9–1.0: 2.9–3.5: 1.5–2.1: 1.0. Mesoscutum (Fig. 66e) meshlike reticulate except medial lobe with shallower or more transversely imbricate sculpture anteriorly and lateral lobe with mediolongitudinal band of minute coriaceous sculpture. Scutellum and axillae low convex in same plane; axilla usually mostly obliquely and scutellum longitudinally reticulate-imbricate laterad coriaceous midline and frenal area variably distinctly meshlike coriaceous. Acropleuron (Fig. 66h) more-or-less isodiametric meshlike anteriorly and posteriorly and much more minutely sculptured mesally, the larger meshlike sculpture coriaceous-reticulate, at most delineated by only slightly raised lines. Fore wing with cc: mv: pmv: stv = 3.9–6.3: 3.3–5.2: 1.0–1.1: 1.0. Middle leg with row of 4 or 5 mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus and pegs clearly differentiated into two rows apically, second tarsomere with 3–5 pegs, third tarsomere with 2 or 3 pegs, and fourth tarsomere without or with 1 peg apically on either side. Propodeum with very broadly, transversely U-shaped plical depression extending to posterior margin. Gaster (Fig. 66a, b) similar in length to combined length of head and mesosoma; not atypically modified; not nearly extending to apex of second valvifer, the latter extending conspicuously beyond gastral apex (Fig. 66h), with apparent sheath length about 1.3–2.4× length of metatibia and 1.5–2.6× length of mv, and third valvula about 1.3–1.9× length of metatibia and 1.5–2.1× length of mv; hypopygium extending almost three-quarters length of gaster.

MALE (habitus: Fig. 67a, b). Length = 1.5–1.8 mm. Head (Fig. 67a–d, f) blue to bluish-green; frons (Fig. 67c) and vertex (Fig. 67f) reticulate, and vertex uniformly curved into occiput; scrobal depression meshlike reticulate, at least along margins, but scrobes broadly smooth and shiny (Fig. 67c); setae hairlike, white; lower face with evenly distributed setae, the setae longer but straight to evenly curved toward malar sulcus (Fig. 67d); gena posterior to malar sulcus with 1 longer seta differentiated from others, and posterior to eye with apices of setae directed toward orbit. Antenna (Fig. 67g) with scape entirely dark; pedicel (Fig. 67g) at most about 1.5× as long as wide (number of ventral hook-like setae unknown); length of pedicel + flagellum 1.2× head width; flagellum subclavate, apical funiculars only slightly shorter than basal funiculars, but increasing in width apically so basal funicular oblong and apical funiculars quadrate to slightly transverse; anellus very strongly transverse, discoidal, shiny, with inconspicuous row of setae; funicle with appressed setae only slightly removed from surface of funicle, basal funiculars without evident region of differentiated setae ventrally but apical two to three funiculars ventrally (Fig. 67h, i) with short setae similar to micropilose sensory region of clava; clava slightly shorter than apical three funiculars, with comparatively broad-oval micropilose sensory region extending to base (Fig. 67h, i). Maxillary and labial palps dark brown. Mesosoma (Fig. 67a, b, f) with pronotum usually bluish laterally, similar to head, but mesonotum and propodeum more distinctly green; setae hairlike, brown to pale brownish on pronotum and mesonotum and more distinctly white on propodeal callus; tegula dark. Front leg with femur and tibia dark except for knee and tibia apically and longitudinally along anterior and posterior surfaces; tarsus pale basally and increasing dark apically to uniformly brown. Middle leg with femur and tibia dark except knee, apex of tibia narrowly, and tibial spur; tarsus with at least basitarsomere white, the second tarsomere usually somewhat darker yellowish to similarly brown as apical tarsomeres. Hind leg with similar colour pattern as middle leg. Fore wing (Fig. 67e) with mv about 3.0–4.4× length of stv; costal cell dorsally near leading margin with row of 3–10 setae over about apical third to half, and ventrally with setae in single row mesally; basal cell uniformly setose with dark setae; speculum variably completely closed by setae posteriorly, but at least with more than one seta on cubital fold beyond basal fold. Propodeum (Fig. 67f) with complete median carina, quite shiny, only very finely meshlike coriaceous.

Distribution. Yemen.

Biology. Apparently, some mealybug (Coccoidea: Pseudoccidae) on *Lantana camara* L. (Verbenaceae).

Remarks. Females of *E. melanostylus* are differentiated from those of all other regional species except *E. memnonius* by their atypically long, dark ovipositor sheaths (Fig. 66a, b, h). The third valvulae are at most only inconspicuously paler subbasally (Fig. 66h) and usually at least about 1.6× as long as the marginal vein, though one Ta'izz female has the third valvulae only about 1.5× the length of the marginal vein. Females of *E. stenozonus* also rarely have the sheaths only inconspicuously paler subbasally or entirely dark, but they have even shorter ovipositor sheaths and are more distinctly green with at least some coppery to reddish-violaceous luster (Fig. 104a–f). Female *E. melanostylus* are typically mostly bluish to purple (Fig. 66a–f), more similar to *E. acinellus* (Fig. 2a–f). If somewhat greenish under some angles of light then they at least lack coppery luster. The known hosts of *E. melanostylus* and *E. stenozonus* also differ significantly, Pseudococcidae and Tephritidae, respectively.

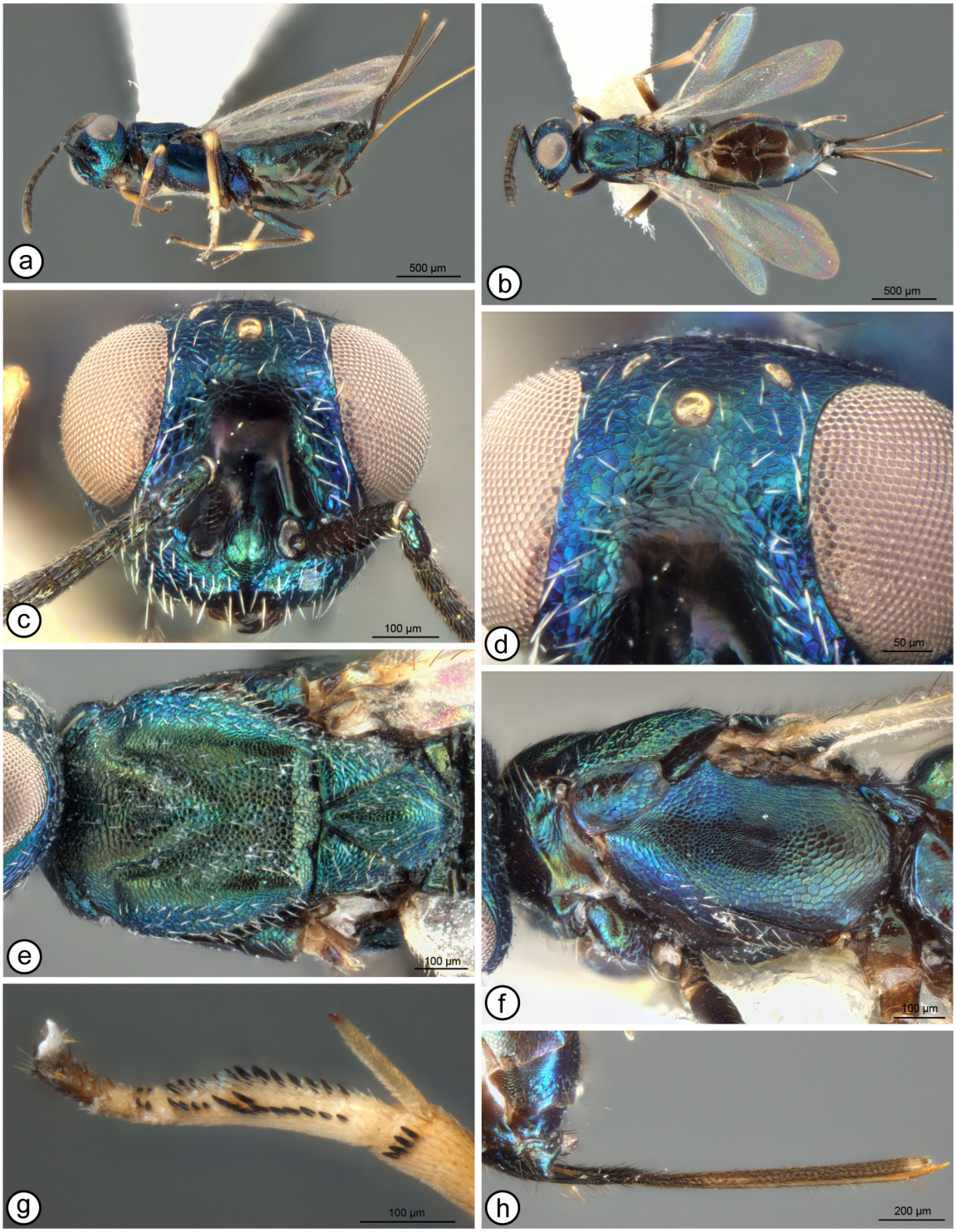

FIGURE 66. *Eupelmus melanostylus*, ♀. **a**, lateral habitus (holotype). **b**, dorsal habitus (2014-80). *c, d, h* (2014-78): **c**, head, frontal, **d**, upper part of scrobal depression and frontovertex; **h**, ovipositor sheaths. **e**, mesosoma, dorsal (2014-79). *f, g* (2014-81): **f**, mesosoma, lateral; **g**, apex of mesotibia and mesotarsus.

We associate males of *E. melanostylus* with females based on some having the same collection data. Although females are similar to and likely closely related to *E. stenozonus* and *E. tanystylus*, males differ conspicuously in antennal structure from those of the latter two species. Males of all three species have an obviously discoidal, smooth and shiny anellus, but those we recognize as *E. melanostylus* have a somewhat clavate flagellum with the funiculars quite distinctly widened apically so that the basal funiculars are oblong and the apical funiculars are quadrate to slightly transverse (Fig. 67g). Further, the funicular setae are subappressed to the surface of the

funiculars and the apical two to three funiculars ventrally have very short setae similar to the broadly oval micropilose sensory region of the clava (Fig. 67h, i). Males of *E. stenozonus* and *E. tanystylus* have a robust-filiform flagellum with more outstanding, curved, and uniformly distributed setae on all funiculars (Figs 3a, c, 105f, g).

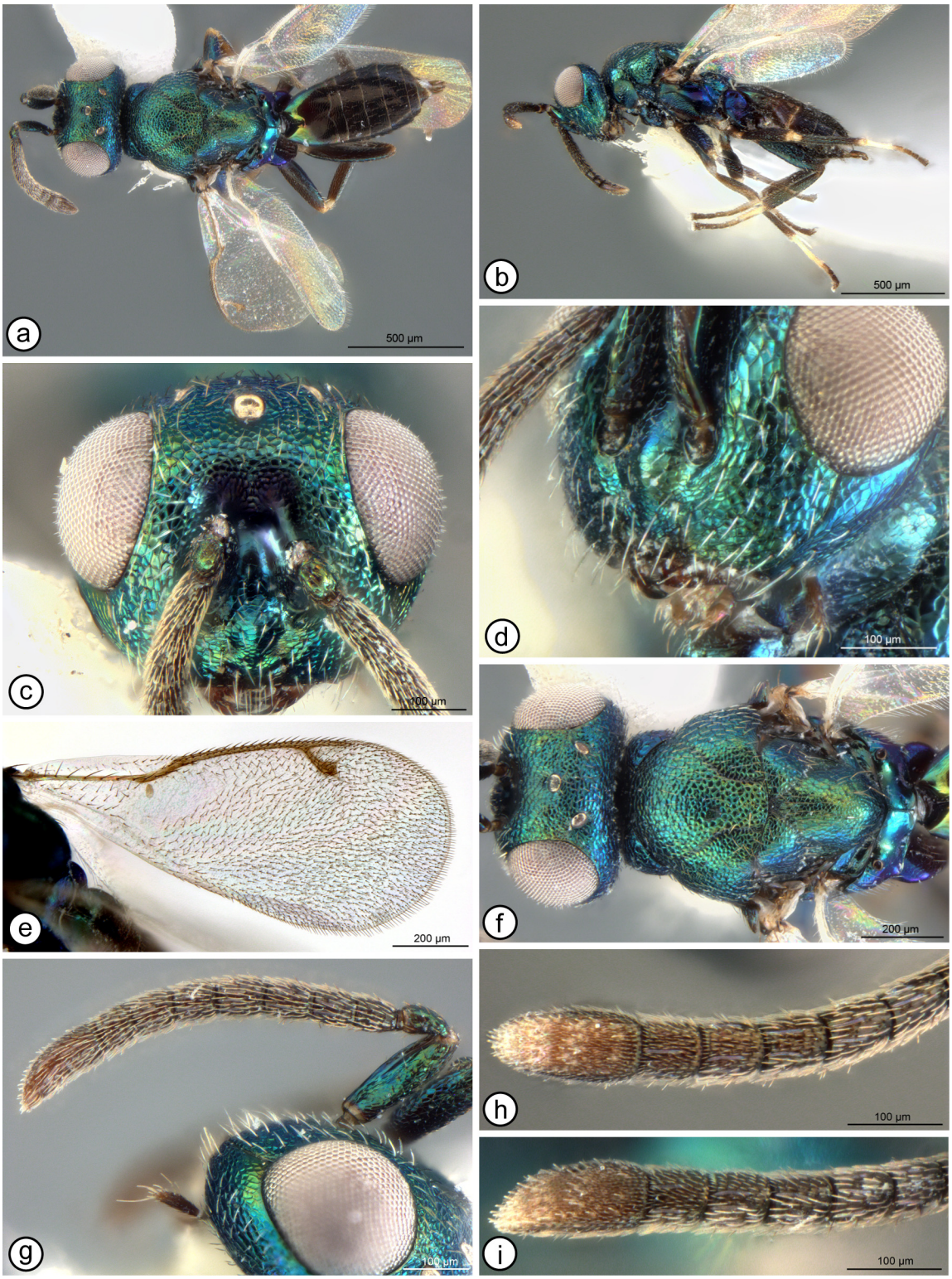

FIGURE 67. *Eupelmus melanostylus*, ♂. *a, c, e–g* (2014-82): **a**, dorsal habitus; **c**, head, frontal; **e**, fore wing; **f**, head and mesosoma, dorsal; **g**, head, lateral. *b, d* (2014-83): **b**, lateral habitus; **d**, lower face, frontolateral; *h, i* (apical five flagellomeres, 2014-82): **h**, ventral; **i**, ventrolateral.

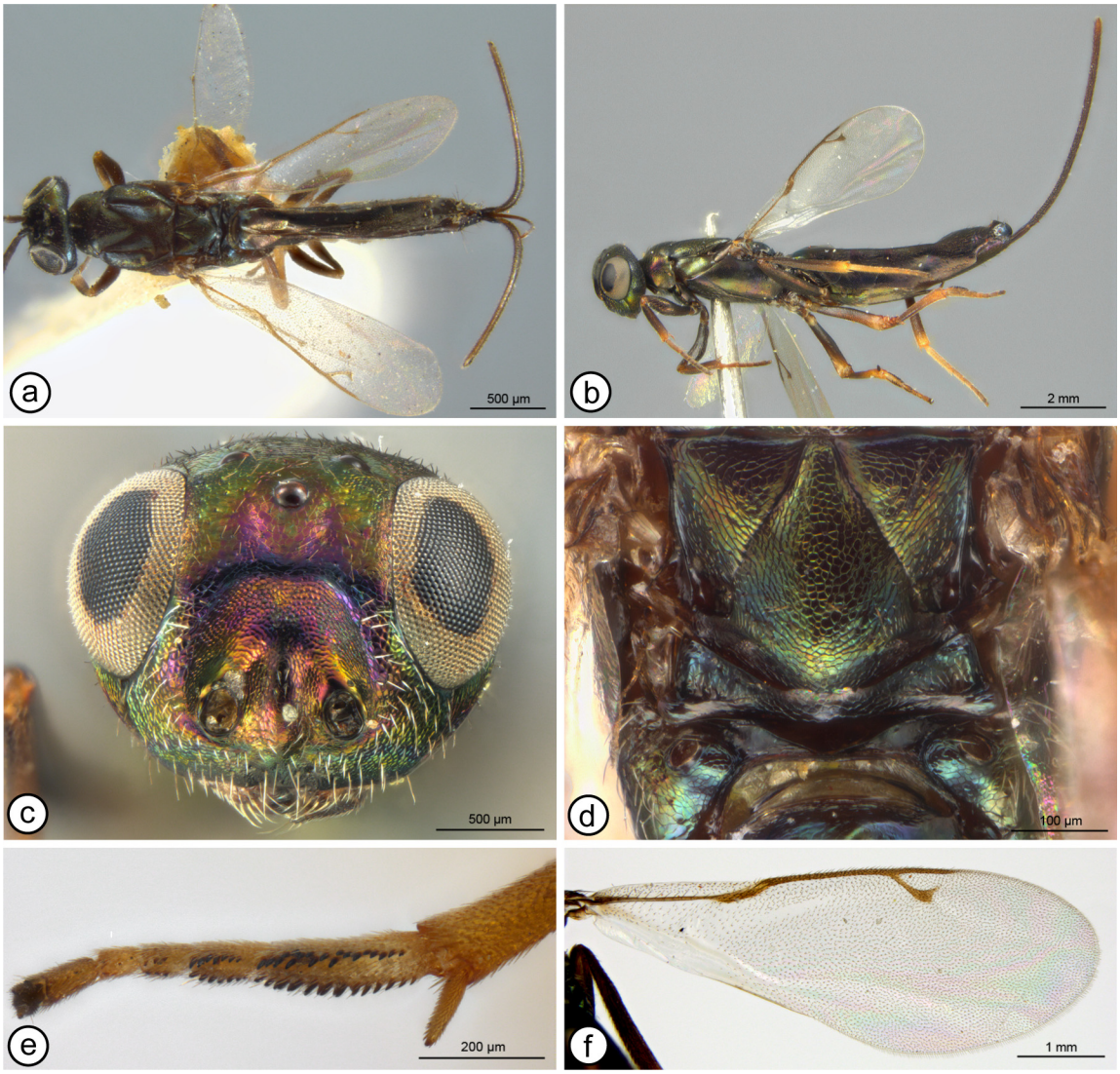

FIGURE 68. *Eupelmus memnonius*, ♀. *a, d* (2012-40): **a**, dorsal habitus; **d**, scutellar-axillar complex to propodeum. *b, c, f* (2013-32): **b**, lateral habitus; **c**, head, frontal; **f**, fore wing. **e**, mesotibial and tarsal peg pattern (2012-39).

E. (*Eupelmus*) *memnonius* Dalman

Fig. 68a–f (♀)

Eupelmus memnonius Dalman, 1820: 377−378. Lectotype ♀, NHRS, designated by Gibson, 1995: 203, examined. Type data: [Sweden] Vestrogothia.

Description. FEMALE (Fig. 68a, b). Length = 3.0–7.0 mm. Head (Fig. 68a–c) mostly dark though with variable metallic lusters, often with slight green or coppery-green lusters under some angles of light or scrobal depression and frontovertex sometimes partly reddish-coppery to violaceous (Fig. 68c) and sometimes with bluish-green to purple lusters along inner orbit; with hairlike to slightly lanceolate white setae on lower face and parascrobal region to about dorsal limit of scrobal depression compared to less conspicuous hairlike setae on frontovertex. Maxillary and labial palps brown. Antenna dark with at most slight green luster on scape and pedicel. Mesosoma (Fig. 68a, b) similar in colour to head, usually dark with slight greenish luster under some angles of light but pronotum and/or mesonotum sometimes also with some reddish-coppery or violaceous lusters; mesonotum with comparatively inconspicuous hairlike setae similar to frontovertex, prepectus bare, and callus with similarly sparse but obviously more elongate white setae than on mesoscutum. Macropterous; fore wing (Fig. 68f) hyaline with dark setae; costal cell dorsally near leading margin with row of setae over most of length, and ventrally with 2 or 3 rows along length; basal cell and disc entirely setose except for linea calva. Front leg mostly dark with basal four tarsomeres and at

least extreme base, apex and anterior surface of tibia pale, though tibia sometimes almost completely pale except for dorsal surface in part. Middle leg varying from mostly orangey beyond coxa except for dark mesotarsal pegs to variably extensively light to dark brown, but femur apically, tibia basally and more extensively apically, and at least basitarsus pale. Hind leg often dark except tibia apically, at least basitarsus, and usually knee pale, though often tarsus and sometimes tibia extensively orangey to yellowish-brown. Gaster (Fig. 68a, b) with hairlike setae; dark except basal tergite anteriorly usually with green luster; ovipositor sheaths not banded, dark or increasingly lighter to pale.

Head in dorsal view with interocular distance almost 0.5× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with face; vertex coriaceous-alutaceous to alutaceous-imbricate posteriorly; frons meshlike coriaceous (Fig. 68c); scrobal depression finely meshlike reticulate (Fig. 68c); OOL: POL: LOL: MPOD = 1.0–1.3: 2.5–3.2: 1.5–1.8. Mesoscutum variably distinctly meshlike sculptured, medial lobe often more coriaceous to alutaceous and depressed posterior region only very shallowly reticulate but sometimes medial lobe shallowly and depressed region more deeply and distinctly reticulate, but lateral lobe with mediolongitudinal band of minute coriaceous sculpture. Scutellum and axillae low convex in same plane to almost flat; varying from entirely meshlike coriaceous in smaller individuals to partly but very shallowly reticulate in larger individuals with axilla obliquely reticulate-imbricate and scutellum longitudinally reticulate-imbricate laterally and frenal area very shallowly meshlike reticulate. Acropleuron more-or-less isodiametric meshlike anteriorly and posteriorly and much more minutely sculptured mesally, the larger meshlike sculpture coriaceous-reticulate, at most delineated by only slightly raised lines. Fore wing (Fig. 68f) with cc: mv: pmv: stv = 3.8–4.3: 2.8–3.4: 1.4–1.6: 1.0. Middle leg (Fig. 68e) without mesotibial apical pegs; mesotarsus with symmetrical peg pattern of basitarsus but pegs comparatively inconspicuously differentiated into two rows, second tarsomere with 5–7 pegs, third tarsomere with 3 or 4 pegs and fourth tarsomere with 0–2 pegs on either side. Propodeum with broadly V- to U-shaped plical depression extending to posterior margin, the depression obviously separated from but overlain basally by slightly protuberant dorsellum (Fig. 68d). Gaster (Fig. 68a, b) at least about 1.75× length of mesosoma or 1.25× combined length of head and mesosoma; not atypically modified but posterior margin of Gt5 usually distinctly separated from base of syntergum so comparatively extensive, medially divided Gt6 visible; not nearly extending to apex of second valvifer, the latter extending quite obviously beyond gastral apex, and third valvulae very long and often curved so difficult to measure accurately, but apparent sheath length about 2.7–3.4× length of metatibia and about 3.3–5.2× length of mv; hypopygium extending at least half to almost two-thirds length of gaster.

MALE. Unknown.

Distribution. Belgium* (ISNB), **France*** (CNC, MHNG), **Hungary*** (CNC), Poland, **Romania*** (AICF), **Spain*** (RMNH), Sweden, United Kingdom.

Biology. Host uncertain, but the Belgium females are labelled "parasite of *Anthaxia manca* ?" (L.) (Coleoptera: Buprestidae), the female from Hungary is labelled "on dead standing *Ulmus*" (Ulmaceae), and the one from Romania labelled "on dead standing oak".

Remarks. Because of the absence of mesotibial apical pegs and conspicuously long ovipositor sheaths, females of *E. memnonius* are most similar to those of *E. curvator*, but the latter have relatively much shorter ovipositor sheaths that are abruptly pale near the base (*cf* Figs 27d, 68b). Females of *E. memnonius* also have an unusually long gaster associated with their long ovipositor sheaths, at least 1.2× the combined length of the head and mesosoma (Fig. 68a), whereas in *E. curvator* the gaster is slightly shorter than the combined length of the head and mesosoma (Fig. 27c).

We classify *E. memnonius*, the type species of *Eupelmus*, in *E.* (*Eupelmus*) because females have dark mesotarsal pegs that are at least obscurely differentiated into two rows apically (Fig. 68e) rather in a single uniform row. However, females have an unusually long postmarginal vein relative to the stigmal vein (Fig. 68f) and a broadly V- to somewhat U-shaped plical depression that is overlain basally by a somewhat protuberant dorsellum (Fig. 68d). In these two respects, as well as the absence of mesotibial apical pegs (Fig. 68e) and a bare prepectus, females resemble most species assigned to *E.* (*Episolindelia*). A sequence of 415bp was obtained for one female from France (CNCHYM 15182) and another 603bp sequence from one female from Romania (DNA voucher mem.RO 01; AICF). In our preliminary analyses both sequences are grouped together and are placed basal on the phylogeny, immediately after *E.* (*E.*) *stramineipes*, which is the most basal species unequivocally placed by morphological characters in *E.* (*Eupelmus*). Hence molecular data also place *E. memnonius* within *Eupelmus s. str.*

However, males have never been associated with females and it is possible that these morphologically more closely resemble *E.* (*Episolindelia*) males.

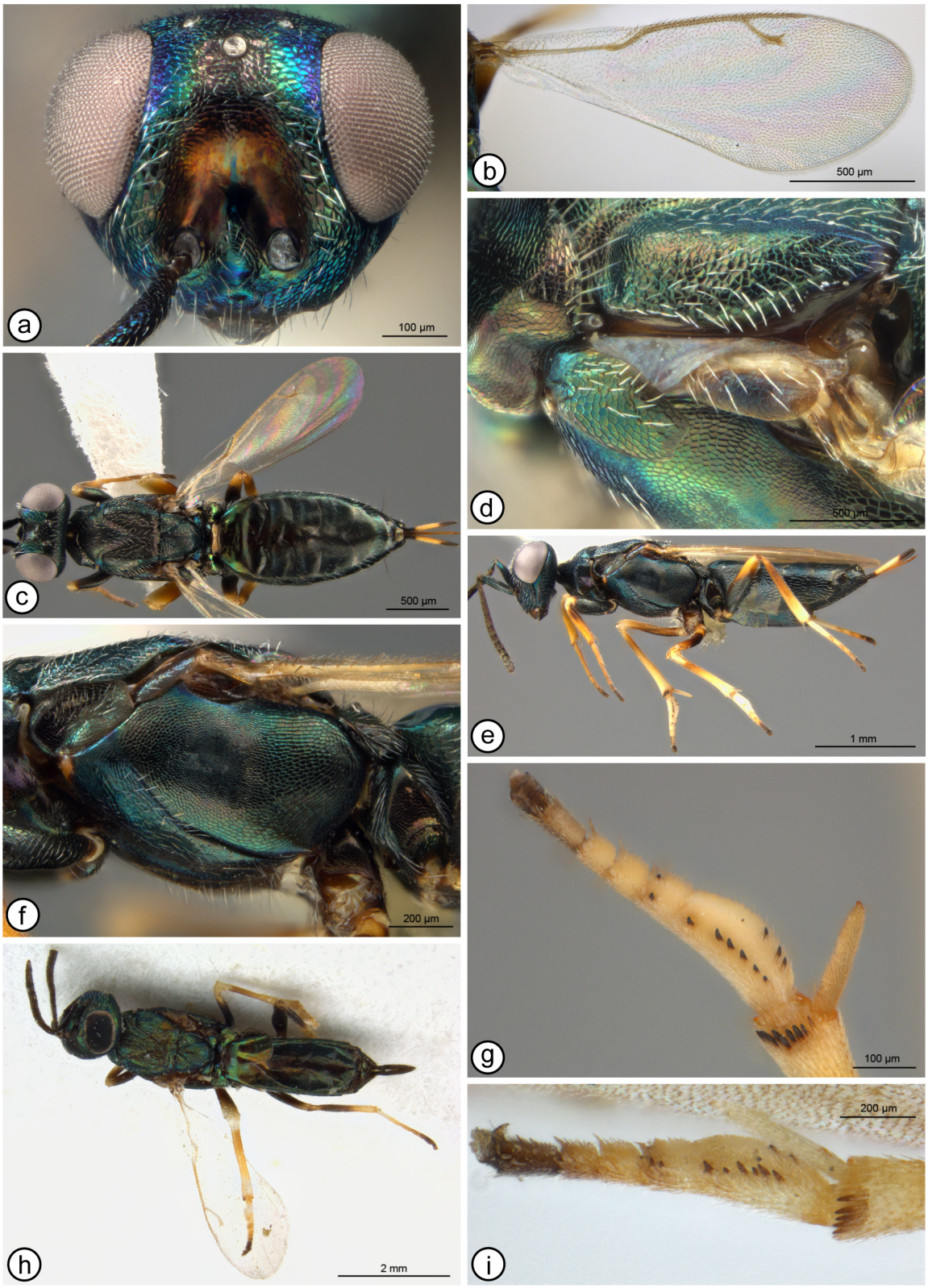

FIGURE 69. *Eupelmus microzonus*, ♀. *a, b* (2012-61): **a**, head, frontal; **b**, fore wing. **c**, dorsal habitus (2012-60). **d**, tegula (2013-18). *e–g* (2012-59): **e**, lateral habitus; **f**, mesosoma, lateral; **g**, mesotibial and tarsal peg pattern. *h, i* (*E. nigricauda* holotype): **h**, dorsal habitus; **i**, mesotibial and tarsal peg pattern.

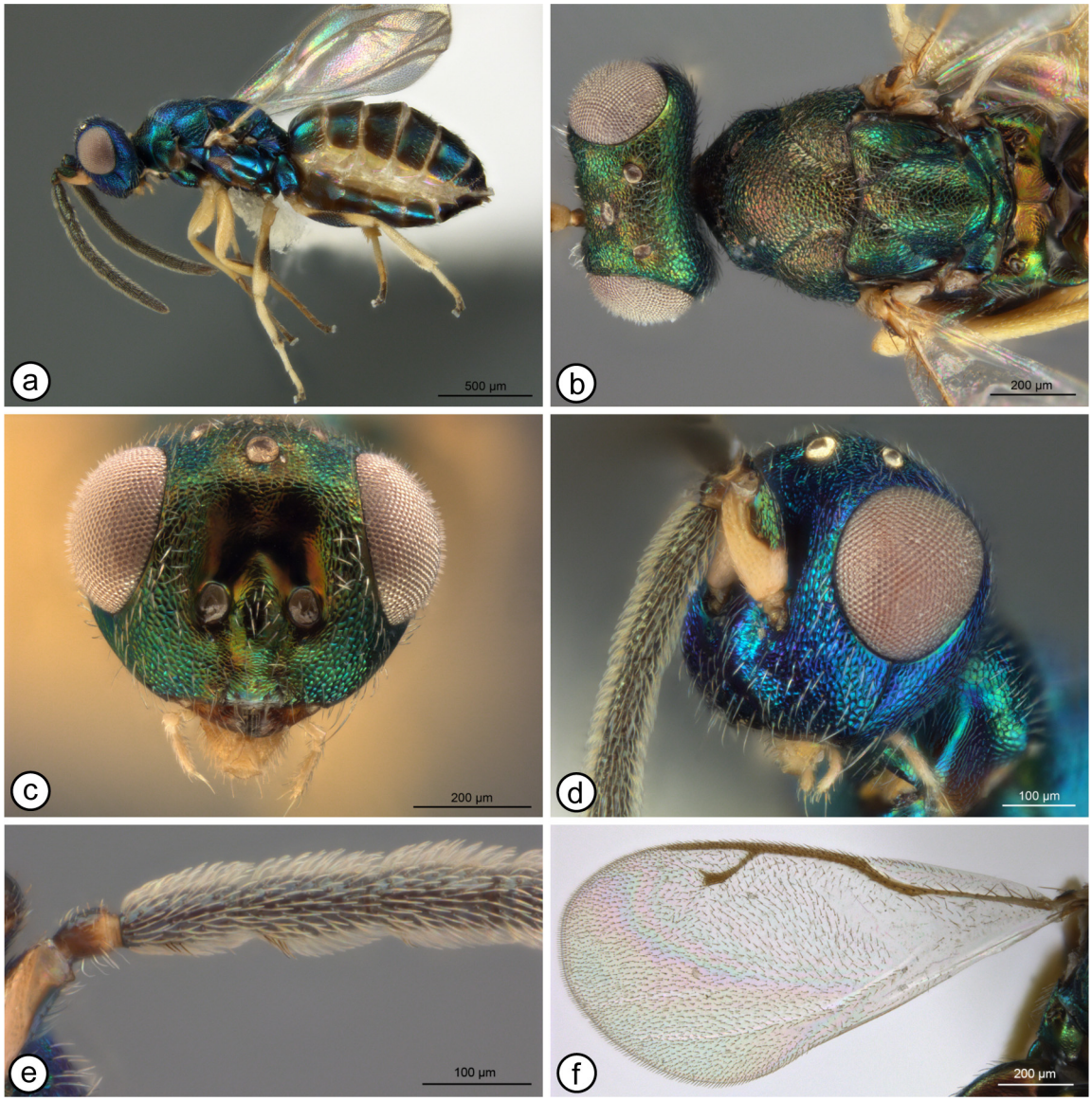

FIGURE 70. *Eupelmus microzonus*, ♂. **a**, lateral habitus (2012-116). *b, c* (2012-117): **b**, head and mesosoma, dorsal; **c**, head, frontal. **d**, head, frontolateral (2012-116). **e**, pedicel to base of fl5, inner view (2013-108). **f**, fore wing (2012-117).

E. (*Eupelmus*) *microzonus* Förster

Figs 69a–i (♀), 70a–f (♂)

Eupelmus microzonus Förster, 1860: 125−126. Syntypes, ♀, NHMW, examined. Type data: Germany, region of Aachen.
Eupelmus nigricauda Nikol'skaya, 1952: 500 (Russian), 1963: 514 (English). Holotype ♀, ZIN, examined. Type data: Crimea. Holotype label: 25.VII.36, Симферополь, Моск. Кар. [Simferopol, Mosk. Kar.], *Malva crispa* / Микр. преп. [Microscope slide] No 1388 / *Eupelmus nigricauda* sp. n. M. Nikolskaja det. / Holotypus ♀. **n. syn.**
Eupelmus insulae Masi, 1919: 302−305. Holotype ♀, MCSN, examined by GG. Type data: Italy: Tuscany, Giglio Is. Synonymy by Gibson, 2011: 64.
Eupelmus pomorum Andriescu, 1974: 162, 185 (*nomen nudum*).
Eupelmus (*Eupelmus*) *nigricauda*; Gibson, 2011: 3, 64–65.

Description. FEMALE (habitus: Fig. 69c, e, h). Length about 1.5–3.8 mm. Head (Fig. 69a) usually mostly green or bluish-green to more distinctly blue along inner orbit, but scrobal depression and usually frons mesally to level of anterior or posterior ocelli black or with coppery or somewhat reddish to violaceous or purple lusters under some angles of light, and sometimes parascrobal region, lower face, and vertex also variably dark or with metallic lusters under some angles of light; with slightly lanceolate white setae on lower face and parascrobal region at least to

dorsal limit of scrobal depression and usually variably widely along inner orbit to about level of anterior ocellus compared to less conspicuous hairlike setae on vertex and mesally on frons below anterior ocellus. Maxillary and labial palps brown. Antenna dark except scape and pedicel usually green to bluish-green under some angles of light. Mesosoma with tegula usually noticeably bicoloured, opaque yellowish to creamy-white along at least about basal two-thirds of inner margin and variably broadly translucent light brownish to dark brown apically and/or laterally (Fig. 69d), though rarely entirely light coloured or sometimes appearing completely brown if light-coloured band very narrow and concealed under mesoscutal margin; mesosoma otherwise similar in colour to head (Fig. 69c, f, h), mostly green to bluish-green though often with some coppery or more reddish to violaceous lusters under some angles of light; pronotum with white admarginal setae (Fig. 69d), mesonotum with slightly lanceolate white setae similar to lower face, prepectus extensively setose at least in dorsal half (Fig. 69d), and callus with comparatively sparse white setae (Fig. 69f). Macropterous; fore wing (Fig. 69b) hyaline with white setae at least within basal cell, the discal setae often more yellowish to brown and therefore more conspicuous, at least apically (see 'Remarks'); costal cell dorsally near leading margin with 1–3 rows of setae over about apical half to three-quarters, of which all but the most distal ones usually inconspicuous, and ventrally with at least 3 rows along length; basal cell and disc entirely setose except for linea calva. Front leg with coxa and trochanter dark, femur dark except apex and usually trochantellus pale, tibia sometimes entirely pale but usually with variably extensive light to dark brown region subbasally on ventral and/or posterior surfaces, and tarsus with at least basitarsus pale though tarsomeres often increasingly darker apically. Middle leg sometimes mostly pale beyond coxa except for mesotibial apical pegs, mesotarsal pegs and apical tarsomere, but usually femur at least somewhat orangey-brown and often darker brown beyond trochantellus except variably broadly apically, and tibia sometimes with variably dark brownish region subbasally. Hind leg with similar colour pattern as front leg except femur more extensively pale apically and tibia varying from entirely pale to extensively dark brown subbasally to mesally. Gaster (Fig. 69c, e, h) with hairlike setae; similarly green to bluish-green as mesosoma to variably extensively brown with coppery or slight violaceous lusters; ovipositor sheaths usually distinctly banded, with broad pale region separating dark basal and apical regions (Fig. 69c, e), though pale band variably strongly reduced to small spot or entirely absent from some small individuals (Fig. 69h).

Head in dorsal view with interocular distance about 0.4–0.45× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; vertex usually alutaceous to alutaceous-imbricate; frons variably meshlike coriaceous to meshlike imbricate or shallowly reticulate (Fig. 69a); scrobal depression sometimes quite extensively shiny with subeffaced sculpture toward scrobes (Fig. 69a), particularly smaller specimens, but usually variably distinctly meshlike coriaceous to reticulate or partly strigose dorsally and dorsolaterally; OOL: POL: LOL: MPOD = 1.0–1.6: 2.8–3.6: 1.7–2.4: 1.0. Mesoscutum (Fig. 69c) mostly meshlike reticulate except larger specimens with medial lobe more alutaceous-imbricate anteriorly and lateral lobe with mediolongitudinal band of minute coriaceous sculpture. Scutellum and axillae low convex in same plane; shallowly meshlike coriaceous-reticulate in smaller specimens though axilla often obliquely and mesoscutal longitudinally reticulate-imbricate laterad midline and frenal area meshlike coriaceous to very shallowly reticulate. Acropleuron (Fig. 69f) more-or-less isodiametric meshlike anteriorly and posteriorly and much more minutely sculptured mesally, the larger meshlike sculpture coriaceous-reticulate, at most delineated by only slightly raised lines. Fore wing (Fig. 69b) with cc: mv: pmv: stv = 2.7–3.5: 1.9–2.4: 1.3–1.5: 1.0. Middle leg (Fig. 69g, i) with row of 3–7 mesotibial apical pegs; mesotarsus with asymmetrical peg pattern on basitarsus, anterior margin with 4–9 pegs and posterior margin with 1–4 pegs, the latter usually within basal half though rarely with 1 peg apically, second tarsomere usually with 1 apical peg on one or both sides, more rarely without pegs or with 2 pegs on one side, and third tarsomere only extremely rarely with 1 apical peg on one side. Propodeum with broadly U-shaped plical depression extending to posterior margin. Gaster (Fig. 69c, e, h) similar in length to combined length of head and mesosoma; not atypically modified; extending to or slightly over base of third valvula, the latter about 0.6–0.7× length of metatibia and 0.9–1.1× length of mv; hypopygium extending between about two-thirds and three-quarters length of gaster.

MALE (habitus: Fig. 70a). Length = 1.2–2.5 mm. Head varying from green (Fig. 70b, c), and then sometimes with variably distinct, diffuse coppery luster under some angles of light, particularly within scrobal depression and on frontovertex (Fig. 70c) or frontovertex with more abruptly defined dark or coppery region mesally from level of posterior or anterior ocelli to scrobal depression, to more bluish-green to distinctly blue to purple (Fig. 70a, d), particularly occiput and sometimes lower face and parascrobal region, but then with mesal region on frontovertex

more greenish; frontovertex reticulate to reticulate-imbricate (Fig. 70c, d), with vertex uniformly curved into occiput; scrobal depression similarly sculptured as frontovertex, though sometimes smoother and shiny within scrobes (Fig. 70c); setae hairlike to slightly lanceolate on lower face, the lower face often with somewhat longer setae toward malar sulcus, but comparatively sparse and evenly spaced, and straight to uniformly curved (Fig. 70c, d); gena posterior to malar sulcus with 1 conspicuously longer seta and posterior to eye with apices directed toward orbit. Antenna (Fig. 70a) with scape bicoloured, pale along ventral length and with up to about basal half pale (Fig. 70d); pedicel similarly dark as flagellum or sometimes pale ventrally; pedicel subglobular, at most only about 2.4× as long as wide, and ventrally with row of 4 or 5 long setae (Fig. 70e), of which all except often apical-most seta curved apically; length of pedicel + flagellum about 1.4–1.7× head width; flagellum elongate-filiform (Fig. 70a) with clava about 0.8–0.9× length of apical two funiculars and about 2.6–2.7× as long as wide; anellus very strongly transverse, discoidal, bare (Fig. 70e); funicle with fu1 about 1.3–1.7× length of pedicel and about 1.9–2.3× as long as wide, with funiculars gradually decreased in length apically so that apical funicular only about 1.6–1.8× as long as wide, but with conspicuous decumbent setae at least about as long as half width of funicular (Fig. 70e); basal funiculars in ventral view without obvious, superficially barer regions of modified setae, though in lateral view sometimes with a few shorter, straight, darker setae basally to subbasally (Fig. 70e). Maxillary and labial palps pale. Mesosoma similar in colour to head (Fig. 70a, b), from green or with slight coppery luster to variably extensively and distinctly blue to purple; setae hairlike, white; tegula pale yellowish (Fig. 70a), usually more narrowly opaque yellow along inner margin adjacent to mesoscutum and more extensively hyaline apicolaterally. Front leg sometimes entirely pale, though usually protibia variably extensively light brownish to dark ventroapically and apical tarsomere dark, and commonly also with up to about basal half of profemur dark, protibia sometimes more extensively dark over ventral or posterior surface, and tarsus often entirely dark. Middle leg sometimes entirely pale, though usually mesotibia narrowly dark or at least with small dark spot apically and apical tarsomere dark, mesofemur also variably extensively dark mesally or at least ventromesally, and up to apical two tarsomeres dark. Hind leg sometimes entirely pale or otherwise with similar colour pattern as middle leg, though metafemur more commonly partly dark and metatibia more commonly entirely pale or at least less distinctly dark apically, and metatarsus sometimes increasingly darker apically beyond pale basitarsomere. Fore wing (Fig. 70f) with mv about 1.6–2.0× length of stv and pmv about 1.3–1.5× length of stv; costal cell dorsally near leading margin with white to dark setae over up to about apical two-thirds, but at least for distance greater than length of parastigma, and ventrally often with whitish and therefore variably conspicuous setae usually arranged in 2 rows along length, though sometimes in only 1 row mesally; basal cell uniformly setose with white to dark setae; speculum at least partly closed posterobasally by setae. Propodeum (Fig. 70b) with complete median carina and uniformly meshlike coriaceous to alutaceous.

Distribution. NEARCTIC. Canada (Gibson 2011, map 11). **PALAEARCTIC**. Noyes (2014) listed over 25 countries across the Palaearctic, including North Africa (Morocco) and the Middle East (Iran). We confirm the latter two records and have also seen numerous specimens from the previously unreported countries of **Afghanistan*** (USNM), Greece (**Crete***: HNHM), **Israel*** (TAUI), **Malta*** (BMNH, ZMUC), Spain (**Mallorca***: ZMAN), **Tajikistan*** (SIZK), **United Arab Emirates*** (CNC).

The anomalous report of *E. microzonus* in the Nearctic region is based on five specimens labelled as collected in a single event from southern Alberta (Gibson 2011).

Biology. Noyes (2014) listed over 20 species of Cynipidae as well as five species of Eurytomidae (Hymenoptera), plus one or more species in Apionidae, Bruchidae and Curculionidae (Coleoptera), Cecidomyiidae, Chloropidae and Tephritidae (Diptera) and Lasiocampidae, Psychidae and Pyralidae (Lepidoptera). Kolomiets (1958) reported it as a hyperparasitoid of *Dendrolimus sibiricus* Chetverikov (Lasiocampidae) through *Aleiodes esenbeckii* (Hartig) (= *Rhogas dendrolimi* (Matsumura)) (Hymenoptera: Braconidae), which shows *E. microzonus* is at least sometimes a hyperparasitoid. We also saw females labelled as reared from *Neodiprion sertifer* (Geoffroy) (Hymenoptera: Diprionidae) (BMNH), *Anthonomus pomorum* (L.)* (Curculionidae) (ANCO, see 'Remarks'), and single females from France and Spain (CNC) reared from canola pods infested with the cabbage seedpod weevil, *Ceutorhynchus obstrictus* (Marsham) (Curculionidae) and the brassica pod midge, *Dasineura brassicae* (Winnertz) (Cecidomyiidae), though the exact host is unknown (Tim Haye, CABI, Délemont, Switzerland, pers. comm.). Plant associates include Asteraceae, Fabaceae, Fagaceae, Lamiaceae, Papaveraceae, Rosaceae and Zygophyllaceae.

Remarks. One of the most common European species of *E.* (*Eupelmus*), *E. microzonus* females are readily

identified by their asymmetrical mesotarsal peg pattern (Fig. 69g, i). If the mesotarsal peg pattern is not visible, females are most likely to be misidentified as *E. gemellus*, but most should be distinguished by colour pattern of the tegula. The tegula is usually quite distinctly bicoloured with the inner margin variably extensively pale over at least about its basal two-thirds (Fig. 69d), though a similar colour pattern is also possessed by females of some other species. Males of *E. microzonus* are very similar to males of some species of *E.* (*Macroneura*) because of similarly extensively pale meso- and metatibiae (Fig. 70a), comparatively gracile-filiform flagellum (Fig. 70a), and ventrally pale scape (Fig. 70d). However, except for males of *E. falcatus*, *E.* (*Macroneura*) males have the tegula and palps brown. Because of a very similar colour pattern, including pale tegulae and palps, males of *E. falcatus* resemble those of *E. microzonus* except for being slightly more elongate-slender. This is most noticeable in structure of the pronotum. In dorsal view, males of *E. falcatus* appear to have a longer pronotum because the neck is at a less strongly oblique angle and the length of the lateral panel is about one-half the width of the pronotum. Males of *E. microzonus* have the neck more abruptly angled relative to the very strongly transverse collar and the length of the lateral panel is obviously less than half, usually only about one-third the width of the pronotum (Fig. 70a). The relative length of the flagellum is also slightly greater for *E. falcatus* males. However, perhaps the most conspicuous difference is that males of *E. falcatus* have the dorsal costal cell setae extending along the leading margin for at most the length of the parastigma.

There seems to be clinal variation in the colour of the fore wing setae, with females from Western and Central Europe having white setae mostly only within the basal cell, the discal setae being brownish, whereas those from the Balkans and Israel have more extensively white setae, with only the apical discal setae more conspicuous, brownish. Females from United Arab Emirates have all the fore wing setae white and inconspicuous. Similar variation in colour of the dorsal setae on the costal cell near the leading margin of the wing is also apparent, with only the most distal setae brown and visible in specimens from southern areas.

Kalina (1988) apparently saw type material of *E. nigricauda* and keyed it together with *E. microzonus*. He differentiated the two only by *E. nigricauda* having entirely black ovipositor sheaths (Fig. 69h) in contrast to banded sheaths (Fig. 69c, e) for *E. microzonus*. A single female labelled as the holotype of *E. nigricauda* (Fig. 69h) was obtained on loan as part of our study. Nikol'skaya (1952) stated that the female length was 2 mm. Because a range in length was not given this suggests the description was based on only one female and the examined female is truly the holotype. It has the same distinctive mesotarsal peg pattern (Fig. 69i) as *E. microzonus* as well as the typical bicoloured tegular colour pattern. Gibson (2011) suggested that *E. nigricauda* was likely a synonym of *E. microzonus* based on females he examined in the USNM that were reared in Ukraine (Poltava) from alfalfa seeds. Based on label data, the specimens were collected by M.N. Nikol'skaya in 1924 and received from Nikol'skaya 17 May 1935, well before the description of *E. nigricauda*. The females are all at the lower end of the size range of typical *E. microzonus* females, only about 2 mm in length, the same length as given by Nikol'skaya (1952) for *E. nigricauda*, and with ovipositor sheaths varying from being distinctly banded to having only a small pale spot submedially or being entirely dark. Several small specimens from Romania (AICF) also show a similar gradation of ovipositor sheath colour. Based on the character combination possessed by the holotype of *E. nigricauda* we interpret the entirely dark ovipositor sheaths as intraspecific variation and consider *E. nigricauda* to be a synonym of *E. microzonus*.

Andriescu (1974) listed "*Eupelmus pomorum* sp. nov. in litt." as reared from *Anthonomus pomorum* (L.), but the name was never validated. Two females (ex. *Anthonomus pommorum*, Iasi, VI.1963, Leg. I. Andriescu), one labelled as holotype and the other as paratype of *E. pomorum* were examined by LF in ANCO and determined to be *E. microzonus*.

Of five specimens from Canada and the Palaearctic analyzed for COI, only one 415bp sequence was obtained from a female from Croatia (CNCHYM 015187).

E. (*Eupelmus*) *minozonus* Delvare

Fig. 71a–g (♀)

Eupelmus (*Eupelmus*) *minozonus* Delvare *in* Al khatib *et al.*, 2015: 143. Holotype ♀, MHNG, examined. Type data: Hungary, Veszprém [district.], Hegyesd, 175 m a.s.l., 46.93333°N 17.5227[7]°E, 27.vi.2010, G[érard] Delvare, sweeping [on] *Quercus cerris* (GDEL4030/10010).

Eupelmus (*Eupelmus*) *minozonus* Delvare *in* Al khatib *et al.*, 2014: 843–846 (unavailable name; original description, keyed, illustrated).

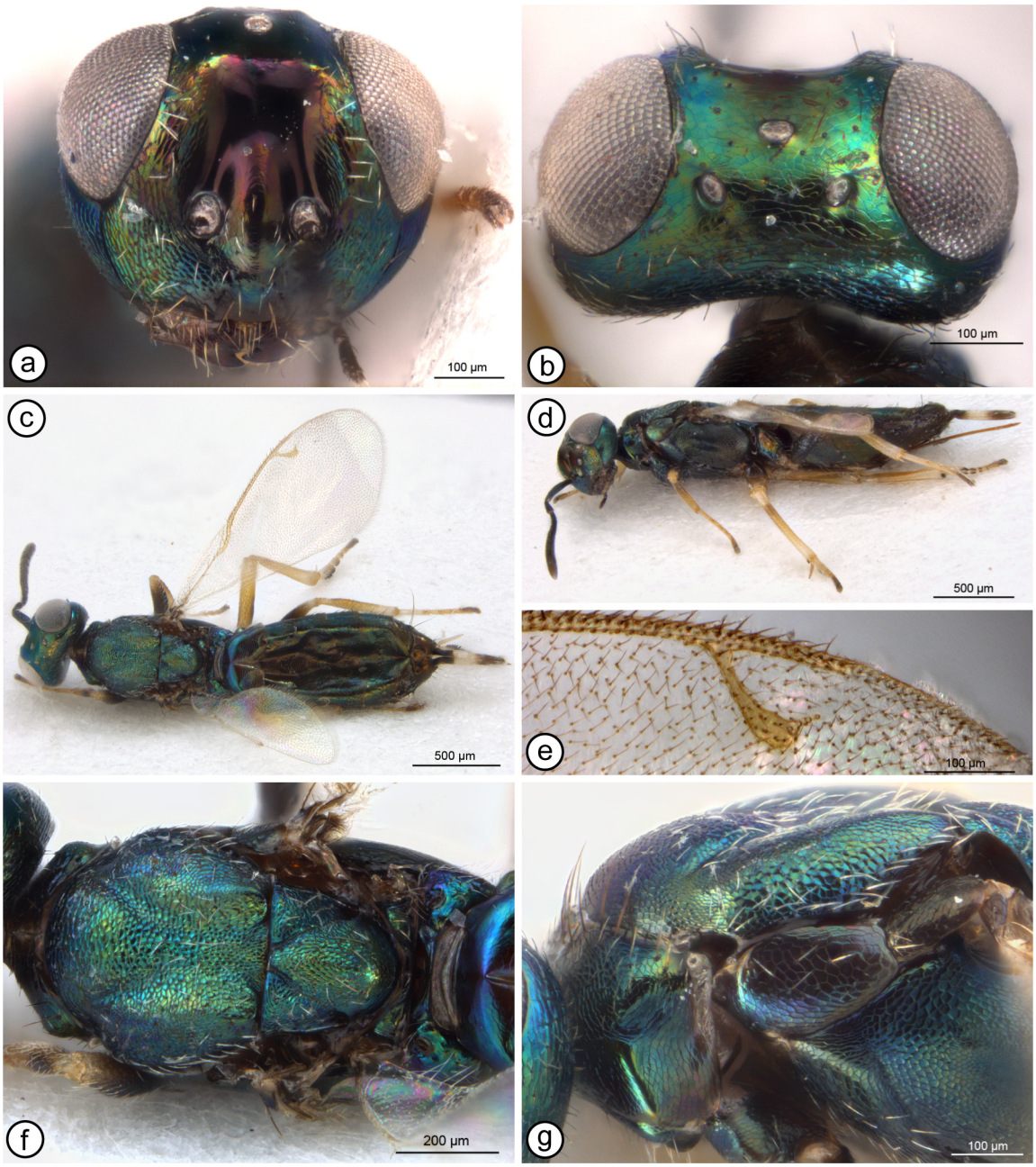

FIGURE 71. *Eupelmus minozonus*, ♀. *a–f* (holotype): **a**, head, frontal; **b**, head, dorsal; **c**, dorsal habitus, **d**, lateral habitus; **e**, stigmal and postmarginal veins; **f**, mesosoma, dorsal. **g**, pronotum and prepectus, lateral (paratype, 2014-43).

Description. FEMALE (habitus: Fig. 71c, d). Length = 2.4–2.7 mm. Head (Fig. 71a, b) mostly green, though lower face and gena laterad malar sulcus sometimes in part more bluish-green to bluish under some angles of light, and scrobal depression and interantennal prominence from about level of toruli, usually parascrobal region in part, and frons variably extensively mesally under some angles of light, dark with slight coppery to reddish-violaceous lusters (Fig. 71a); with hairlike to slightly lanceolate white setae on lower face and parascrobal region to level of dorsal margin of scrobal depression compared to less conspicuous hairlike setae on vertex. Maxillary and labial palps brown. Antenna brown except pedicel and/or scape with slight green to bluish lusters under some angles of light. Pronotum with collar dorsolaterally and lateral panel mostly greenish, usually with slight coppery luster posterolaterally and lateral panel sometimes with small, more bluish region anterodorsally but not contrasting with mesonotum (Fig. 71f, g); admarginal setae dark (Fig. 71g). Mesonotum (Fig. 71f) green dorsally with at most inconspicuous coppery luster, with distinct blue to purple luster usually only anteriorly on mesoscutal medial lobe and sometimes partly within posteromedial depressed region under some angles of light; with white, hairlike to

slightly lanceolate setae. Prepectus (Fig. 71g) brown with slight bluish-green to purple lusters under some angles of light; with 2–5 setae mediolongitudinally. Tegula dark. Acropleuron variably bluish-green to green or sometimes with some purple luster within anterior half, but with slight coppery luster posteriorly. Propodeal callus mostly green to bluish-green except extreme anterolateral corner laterad spiracle sometimes more reddish-violaceous; with similar white setae as mesonotum except somewhat denser (Fig. 71f). Macropterous; fore wing (Fig. 71c) hyaline with pale to yellowish setae; costal cell dorsally near leading margin with row of setae extending about half to two-thirds length, and sometimes apically with additional setae forming partial second row, and ventrally extensively setose with variably dark setae along length, though reduced to 2 rows for short distance mesally; basal cell and disc entirely setose except for elongate linea calva extending to level near middle of parastigma. Front leg sometimes pale except femur mostly dark, but usually trochanter and trochantellus also dark, and protibia often with subbasal dorsal and ventral dark regions. Middle leg mostly pale beyond coxae except for dark mesotibial apical and mesotarsal pegs, but femur variably distinctly brown ventrally to posteroventrally, tibia sometimes with short, subbasal, brownish annulus, and apical tarsomere brownish. Hind leg with about basal two-thirds to three-quarters of femur dark and apical tarsomere brown, but otherwise pale with tibia and tarsus basally, and tibia more broadly apically, usually lighter whitish-yellow compared to somewhat more orangey-yellow region within about basal two-thirds. Gaster (Fig. 71c, d) with hairlike setae; at least partly brown dorsally but with basal tergite green to bluish-green dorsally and with quite distinct green luster laterally on tergites and dorsoapically except for syntergum; ovipositor sheaths distinctly banded, with dark basal band and pale medial band at least slightly longer than apical brown band.

Head in dorsal view (Fig. 71b) with interocular distance 0.42–0.43× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons, and eye height about 1.5–1.6× malar space; in frontal view (Fig. 71a) width 1.18–1.23× height, with lower ocular line intersecting toruli near dorsal margins, malar space 1.38–1.45× distance from oral margin to inner ventral margin of torulus, and latter distance 1.15–1.2× distance between inner mesal margins of toruli; vertex (Fig. 71b) evenly rounded into occiput, transversely alutaceous; frons meshlike coriaceous (Fig. 71b); scrobal depression shiny and smooth except lateral walls coriaceous to alutaceous, and interantennal prominence at most finely coriaceous above level of toruli (Fig. 71a); OOL: POL: LOL: MPOD = 0.8–0.9: 2.3–2.7: 1.4–1.7: 1.0. Mesoscutum (Fig. 71f) with posteromedial depressed region similarly meshlike reticulated as anteromedial lobe; axilla obliquely and scutellum longitudinally reticulate-imbricate laterad midline. Acropleuron more-or-less isodiametric meshlike anteriorly (Fig. 71g) and with somewhat larger meshes posteriorly, but much more minutely sculptured mesally and larger meshlike sculpture at most only delineated by slightly raised ridges. Fore wing (Fig. 71c) with cc: mv: pmv: stv = 4.4–4.5: 4.1–4.4: 1.1–1.2: 1.0; stigmal vein straight. Middle leg with row of 4 mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus and pegs differentiated into two rows apically; second tarsomere with 4 pegs or sometimes 5 pegs along posterior margin, third tarsomere with 2 pegs or sometimes only 1 peg on anterior margin, and fourth tarsomere with 1 peg apically on either side. Propodeum with broadly U-shaped plical depression extending to posterior margin (Fig. 71f). Gaster (Fig. 71c, d) similar in length to combined length of head and mesosoma; not atypically modified; extending to base of third valvula, the latter about 0.7–0.76× length of metatibia and 0.71–0.77× length of mv; hypopygium extending about two-thirds length of gaster.

MALE. Unknown.

Distribution. Hungary.

Biology. Unknown, but type series collected sweeping *Quercus cerris* L. and thus possibly a parasitoid of some cynipid gall maker.

Remarks. The right antenna of the holotype is dissected from the head and glued to the card, and the left fore wing is missing, but otherwise the holotype is entire. Although the internal tissues were digested for DNA extraction, colour of the body does not appear to be adversely affected except for observation of mesofemoral colour pattern (see below).

Eupelmus minozonus is one of six species included in the *urozonus*-group (see under *E. urozonus*). Features given by Al khatib *et al.* (2014) to differentiate females from other *urozonus*-group females included colour pattern of the pronotum, size of the eye compared to the malar space, relative position of the toruli, mesoscutal sculptural features, and leg colour pattern (the latter four features to differentiate it from *E. urozonus*). In addition to the holotype, the species was described from four sequenced paratypes, all from the same collecting event, of which we re-examined three. The supplemental files in Al khatib *et al.* (2014) only included measurements of the

holotype, though the key included ranges for two features. The eye was stated to be 1.45–1.5× the length of the malar space, whereas our measurements of four females determined these ratios as about 1.5–1.6×. Al khatib *et al.* (2014) also stated that the same range for *E. urozonus* was 1.6–1.95×, whereas our measurements revealed a range of 1.67–1.82× for four examined sequenced females (vouchers 10012, 10327, 10355, 10488) and the lectotype (1.78×). Additional females of the two species definitively identified through molecular methods, particularly those of *E. minozonus*, are necessary to determine more confidently whether relative eye size is a valid differential feature for *E. minozonus* relative to *E. urozonus*. Al khatib *et al.* (2014) also stated that the distance between the oral fossa and ventral margin of the torulus is 1.15–1.20× the intertorular distance for *E. minozonus* and 0.65–1.00× for *E. urozonus*. Our measurements are similar to those of Al khatib *et al.* (2014) except for a slightly greater ratio (1.1×) for the lectotype of *E. urozonus*. Consequently, even if there is a slight difference between the two species in the ratio, the difference is so small that it may well overlap with more known specimens of *E. minozonus*. The key further stated the mesofemur was straw yellow in *E. minozonus*, whereas the description stated "straw yellow dorsally, slightly infuscate ventrally", and all tibiae were described as straw yellow except for a dorsobasal spot on the protibia. The true colour pattern is less obvious because of DNA digestion and this might have influenced the original description. Our observations indicate leg colour is variable in the type series. The mesofemur is uniformly pale in one of the paratypes but is dark brown ventrally or posteroventrally over about the basal half to two-thirds in the holotype and the other two examined paratypes. However, because the internal contents of the legs are missing, the mesofemur can appear to be more uniformly and extensively brown depending on the angle and depth of view (*cf* Fig. 71c, d), as discussed also for *E. purpuricollis*. Further, the holotype and one paratype have a short but quite distinct brownish annulus subbasally on the mesotibiae and the protibiae have dark markings both dorsally and ventrally, although these are comparatively small. Regardless, pale mesofemora are quite common for *E. urozonus* females and thus this is not a good key character except for removing from consideration those *E. urozonus* females with an extensively dark mesofemur. Al khatib *et al.* (2014) also stated that *E. minozonus* females have a straight stigmal vein (Fig. 71e) compared to distinctly curved for most *E. urozonus* (Fig. 119f), but this is a comparatively subtle difference that is variable for at least *E. urozonus*. The most difficult differential feature to appreciate, particularly for differently sized and preserved females, is the slight difference in mesoscutal sculpture described by Al khatib *et al.* (2014). In addition, they stated that for *E. minozonus* the ovipositor sheaths were 0.79× the length of the marginal vein (our measurements indicate 0.71–0.77×). The only two measured females of *E. urozonus* were stated as 0.68–0.7×, but our measurements indicate 0.75–0.89× (lectotype: 0.76×), and thus there is overlap also in this feature.

Of more than 650 non-type *urozonus*-group females we examined for this study, we did not find any that we could confidently identify as *E. minozonus* based on morphology. Additional COI sequencing is required to test the validity of the features proposed in Al khatib *et al.* (2014) and more confidently determine the limits of intraspecific variation.

E. (*Eupelmus*) *mirabilis* Kalina n. stat.

Fig. 72a–h (♀)

Eupelmus mirabilis Kalina, 1988: 7–10. Holotype ♀, IAEE, examined by GG. Type data: Israel, Karmel, 13.5.1975, lgt. A. Former.

Description. FEMALE (habitus: Fig. 72a, b). Length = 2.3–3.3 mm. Head (Fig. 72a–d) extensively reddish-coppery to reddish-violaceous except following green to coppery-green: scrobal depression (Fig. 72c, d) and vertex at least partly, sometimes frontovertex mesally and/or frons linearly along inner orbits, and under some angles of light lower face and gena variably extensively and distinctly; with slightly lanceolate white setae on lower face and about ventral half of parascrobal region compared to less conspicuous hairlike setae on frontovertex and parascrobal region dorsally (Fig. 72c). Maxillary and labial palps brown. Antenna dark with variably distinct greenish-coppery luster on scape and pedicel. Mesosoma (Fig. 72e, f) extensively reddish-coppery to reddish-violaceous similar to head, though convex part of medial mesoscutal lobe, lateral lobes mediolongitudinally, scutellar-axillar complex, prepectus anteriorly, and acropleuron sometimes partly greenish, and metanotum laterally and callus brighter green to bluish-green or blue; mesonotum with comparatively conspicuous, white, elongate-slender lanceolate setae on mesoscutum and less conspicuous hairlike setae on scutellar-axillar complex (Fig. 72e), prepectus entirely setose with somewhat denser white setae than on mesoscutum and callus with very

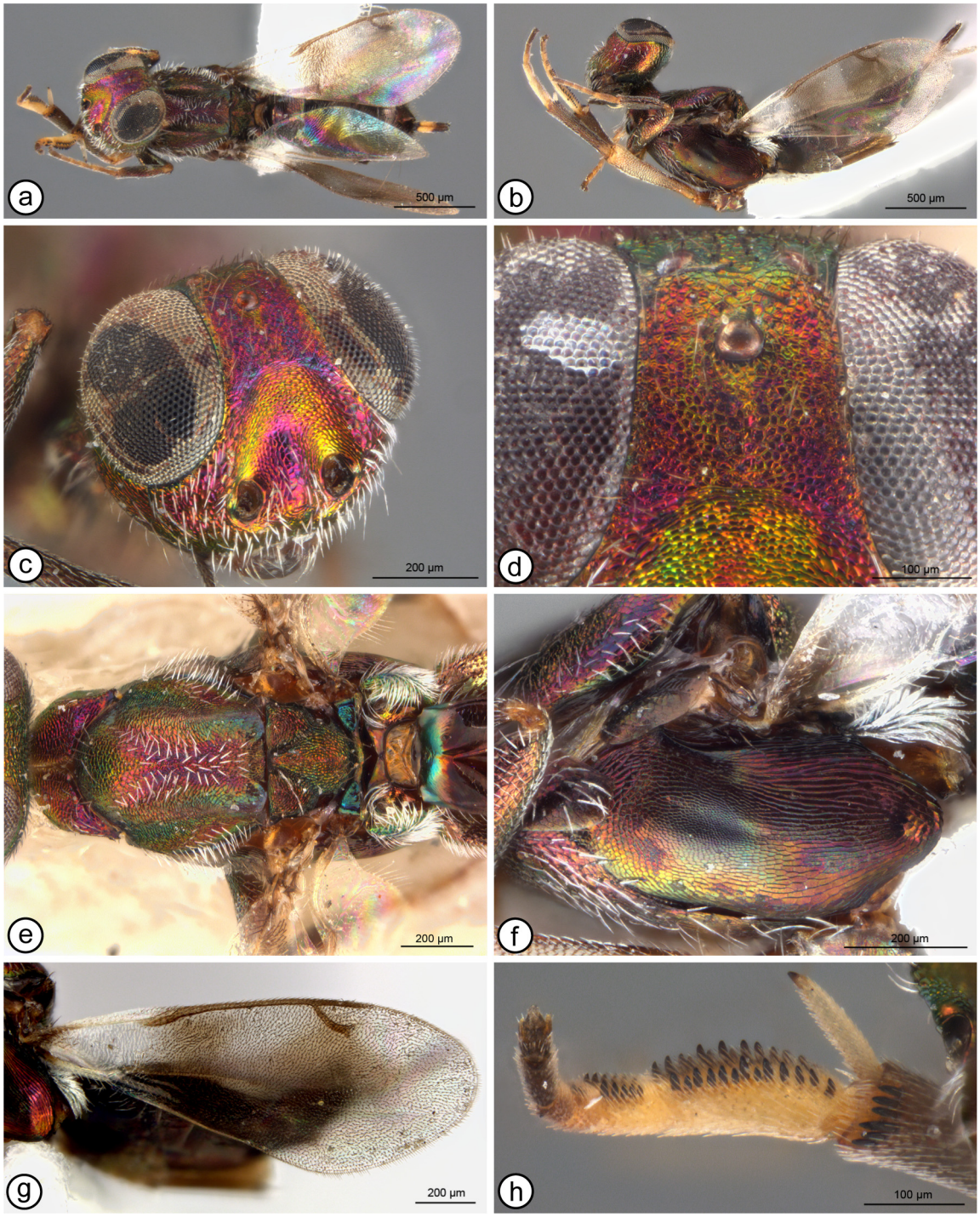

FIGURE 72. *Eupelmus mirabilis*, ♀. *a–c*, *f–h* (2013-54): **a**, dorsal habitus; **b**, lateral habitus; **c**, head, frontolateral; **f**, mesosoma, lateral; **g**, fore wing; **h**, apex of mesotibia and mesotarsus. *d, e* (holotype): **d**, upper part of scrobal depression and frontovertex; **e**, mesosoma, dorsal.

dense white setae (Fig. 72e). Macropterous; fore wing (Fig. 72g) disc without linea calva, more-or-less distinctly bifasciate with darker brownish regions behind parastigma and base of mv and behind stv, to more extensively infuscate between parastigma and apex of pmv except for more hyaline region behind mv, but even more hyaline regions of disc with dark setae; costal cell infuscate basally but mostly hyaline with 1 to 2 rows of dark setae dorsally near leading margin over about apical two-thirds, and ventrally with dark setae within infuscate region but less conspicuous white setae along most of length; basal cell infuscate and with dark setae basally, but mostly hyaline with white setae. Front leg dark with slight reddish luster except base of tibia narrowly and basal four

tarsomeres lighter, yellowish to yellowish-brown. Middle leg variably dark brown except trochantellus, knee and basal three or four tarsomeres paler, yellowish to yellowish-white. Hind leg, including trochanter, dark brown except at least basal tarsomere pale. Gaster with hairlike setae; dark brown with reddish-coppery luster under some angles of light except basal tergite basally variably extensively and distinctly bright green to blue (Fig. 72e); ovipositor sheaths banded, with medial pale band at least as long as apical dark band, but sheaths linearly dark along ventral margin so basal and apical dark regions continuous ventrally.

Head in dorsal view with interocular distance about 0.3× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; vertex mostly meshlike reticulate-imbricate; frons meshlike coriaceous with distinct impressed lines between cells and surface of most cells slightly depressed mesally or slightly sculptured, granular, under some angles of light (Fig. 72c, d); scrobal depression quite strongly reticulate-imbricate to somewhat transversely reticulate-strigose dorsally (Fig. 72c); OOL: POL: LOL: MPOD = 0.4–0.6: 1.5–2.4: 1.5–2.0: 1.0. Mesoscutum distinctly reticulate except inner surface of lateral lobe more finely sculptured, meshlike coriaceous-reticulate, posterolaterally (Fig. 72e), and outer surface of lateral lobe more finely reticulate-imbricate. Scutellum and axillae low convex in similar plane; mostly reticulate similar to mesoscutum posteromedially, though scutellum more longitudinally reticulate-imbricate laterad midline anterior to meshlike coriaceous frenal area. Acropleuron meshlike coriaceous to very shallowly reticulate anterior to much more minutely sculptured mesal region, and posterior to this with sculpture mostly longitudinally aligned so as to appear strigose to very shallowly strigose-reticulate (Fig. 72f). Fore wing (Fig. 72g) with cc: mv: pmv: stv = 3.6–4.1: 3.0–3.3: 1.2–1.4: 1.0. Middle leg (Fig. 72h) with row of 5–7 mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus, the pegs alternating in length over about apical half but forming only single row on either side; second tarsomere with 5–7 pegs, third tarsomere with 3 pegs, and fourth tarsomere with 1 peg apically on either side. Propodeum with V-shaped plical depression extending almost to posterior margin (Fig. 72e). Gaster similar in length to combined length of head and mesosoma; not atypically modified; extending to or almost to base of third valvula, the latter about 0.6× length of metatibia and 0.7–0.8× length of mv; hypopygium extending about 0.7× length of gaster.

MALE. Unknown.

Distribution. Israel [Nahal Oren (N-5), 28.X.1996, L. Friedman, on *Quercus calliprinos*, CNC Photo 2013-54 (TAUI: 1♀)].

Biology. Unknown, but single female collected from *Quercus calliprinos* Webb.

Remarks. Kalina (1988) described *E. mirabilis* from two females, of which we examined both. The holotype is card-mounted by its venter and is complete, the illustrations of the antenna, fore wing and middle leg provided by Kalina (1988, figs 5–8, plate I, figs 1, 2, 6, 8) being of parts dissected from the paratype. *Eupelmus mirabilis* and *E. pini* are the only regional species whose females have mesotibial apical and mesotarsal pegs (Figs 72h, 86h) and the mesoscutum posteriorly similarly strongly sculptured as the anteromedial lobe (Figs 72e, 86j), but which lack a fore wing linea calva (Figs 72g, 86e). They are therefore keyed together, but differ in many features, only some of which are included in the key. Females of *E. mirabilis* also have a distinctive frons sculpture (Fig. 72d). Although coriaceous by definition, the individual cells are exceptionally well delineated by impressed lines and the cell surfaces are slightly depressed and/or microsculptured under some angles of light.

E. (*Eupelmus*) *nitidus* Nikol'skaya n. stat.

Fig. 73a–i (♀), 74a–g (♂)

Eupelmus nitidus Nikol'skaya, 1952: 502 (Russian), 1963: 516 (English). Holotype ♀, ZIN, examined. Type data: USSR, Soviet Central Asia. Holotype label: ст. Фараб, з. Бухара, Гольбек [st. Farab, z. Bukhara, Gol'bek], 19.IV.913 / *Eupelmus nitidus* sp. n. M. Nikolskaja det. / Holotypus ♀ [recent red printed label] [type locality is in Turkmenistan at the border with Uzbekistan].

Description. FEMALE (habitus: Fig. 73a, b). Length = 2.2–3.0 mm. Head (Fig. 73c–e) green with variably extensively reddish-violaceous to reddish-coppery lusters under different angles of light, particularly on parascrobal region (Fig. 73c, d) and frontovertex at least in dorsal view (*cf* Fig. 73e), but also sometimes more extensively; with hairlike to slightly lanceolate white setae on lower face and parascrobal region to level of dorsal margin of scrobal depression compared to less conspicuous hairlike setae on vertex. Maxillary and labial palps brown. Antenna with scape and pedicel brown with variably distinct metallic lusters, green and coppery, under

some angles of light, but flagellum brown. Pronotum dorsolaterally reddish-violaceous to reddish-coppery except usually extreme posterolateral margin greenish to greenish-coppery under some angles of light, and pronotal panel dorsally variably extensively and distinctly reddish-violaceous to reddish-coppery (Fig. 73g); admarginal setae pale. Mesonotum (Fig. 73f) often extensively and conspicuously bright reddish-violaceous to reddish-coppery except for some green luster, mostly along margins of sclerites, but if mostly green to bluish-green then at least with slight reddish-violaceous lusters under some angles of light on mesoscutum and axillae similar to that of pronotum and head; with white, hairlike to slightly lanceolate setae. Prepectus (Fig. 73g) brown with slight greenish luster under some angles of light to similarly reddish-violaceous as mesonotum and pronotum laterally; with 2–6 setae within dorsal half. Tegula dark. Acropleuron (Fig. 73g) brownish but with variable coppery and green to bluish-green lusters under some angles of light, to more extensively reddish-violaceous to reddish-coppery with some green luster. Propodeal callus variably brown to green or reddish-coppery; with longer and denser white setae than on mesoscutum but not obscuring cuticle (Fig. 73f). Macropterous; fore wing (Fig. 73h) hyaline with somewhat paler, more whitish, setae in basal cell compared to yellowish to brown discal setae; costal cell dorsally near leading margin with row of yellowish setae over about apical third to half or distal setae darker, and ventrally with mostly whitish setae in at least 2 rows along length; basal cell and disc entirely setose except for elongate linea calva extending to level about equal with middle of parastigma. Front leg with femur and tibia dark except knee narrowly and tibia apically pale, the tibia not pale longitudinally and thus without separate dorsal and ventral dark regions; tarsus pale basally and increasingly dark apically. Middle leg, including mesotibial apical and mesotarsal pegs, dark except trochanter sometimes, trochantellus, knee, tibia apically somewhat more broadly, and basal four tarsomeres pale, the tibia in dorsal view with medial dark region at least twice length of basal or apical pale regions. Hind leg similar to middle leg except trochantellus sometimes fuscous. Gaster (Fig. 73a, b) with hairlike setae; mostly brown to reddish-violaceous except for variably distinct greenish luster on basal tergite, laterally on tergites and dorsoapically under some angles of light; ovipositor sheaths distinctly banded, with dark basal band and medial pale band at least about twice as long as apical brownish band.

Head in dorsal view with interocular distance 0.40–0.45[0.42]× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons, and eye height about 1.5–1.8[1.75]× length of malar space; in frontal view width about 1.2–[1.3×] height, with lower ocular line intersecting torulus at about mid height, malar space 1.54–1.66[1.58]× distance from oral margin to inner ventral margin of torulus, and latter distance equal to or only very slightly shorter than distance between inner mesal margins of toruli; vertex evenly rounded into occiput, transversely alutaceous- to reticulate-imbricate; frons in part often with sculpture defined by very slightly raised ridges, usually at least obscurely reticulate in ocellar triangle and sometimes also very shallowly reticulate to imbricate in region between anterior ocellus and inner orbit (Fig. 73e); scrobal depression and interantennal prominence shiny and virtually smooth (Fig. 73c, d) but scrobal depression, excluding scrobes, with obscure, effaced, meshlike sculpture under some angles of light (Fig. 73d); OOL: POL: LOL: MPOD = 1.0–[1.1]: 2.8–[3.1]: 1.9–[2.2]: 1.0. Mesoscutum (Fig. 73f) with posteromedial depressed region similarly meshlike reticulate as anteromedial lobe; axilla mostly obliquely and scutellum longitudinally reticulate-imbricate laterad midline. Acropleuron more-or-less isodiametric meshlike anteriorly and with larger meshes more-or-less longitudinally aligned posteriorly, but much more minutely sculptured mesally and larger meshlike sculpture at most delineated by only slightly raised ridges. Fore wing (Fig. 73h) with cc: mv: pmv: stv = 4.2–5.1[4.4]: [3.5]–4.7: 1.0–1.2[1.1]: 1.0; stigmal vein with proximal margin straight basal to recurved stigma (Fig. 73h). Middle leg (Fig. 73i) with row of 4 or [5] mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus and pegs differentiated into two rows apically; second tarsomere usually with 5 pegs along anterior margin and 6 pegs along posterior margin [4 or 5 pegs along anterior margin and 5 or 6 pegs along posterior margin depending on leg], third tarsomere with 2 pegs along anterior margin and 3 pegs along posterior margin, and fourth tarsomere usually without peg on anterior and with 1 peg apically on posterior margin. Propodeum with broadly U-shaped plical depression extending to posterior margin (Fig. 73f). Gaster (Fig. 73a, b) similar in length to combined length of head and mesosoma; not atypically modified; extending to base of third valvula, the latter about [0.68]–0.76× length of metatibia and 0.76–0.85 [0.83]× length of mv; hypopygium extending about two-thirds length of gaster.

MALE (habitus: Fig. 74a). Length = 1.6–2.0 mm. Head with face dark at least mesally from about level of anterior or posterior or ocelli through interantennal prominence, but lower face (Fig. 74c), vertex (Fig. 74b, d), and usually variably extensively along inner orbits above level of scrobal depression (Fig. 74d) dark green with some reddish-violaceous luster; frons finely but distinctly meshlike reticulate so as to be obviously roughened (Fig. 74d); vertex uniformly curved into occiput, reticulate (Fig. 74b); scrobal depression meshlike reticulate dorsomedially

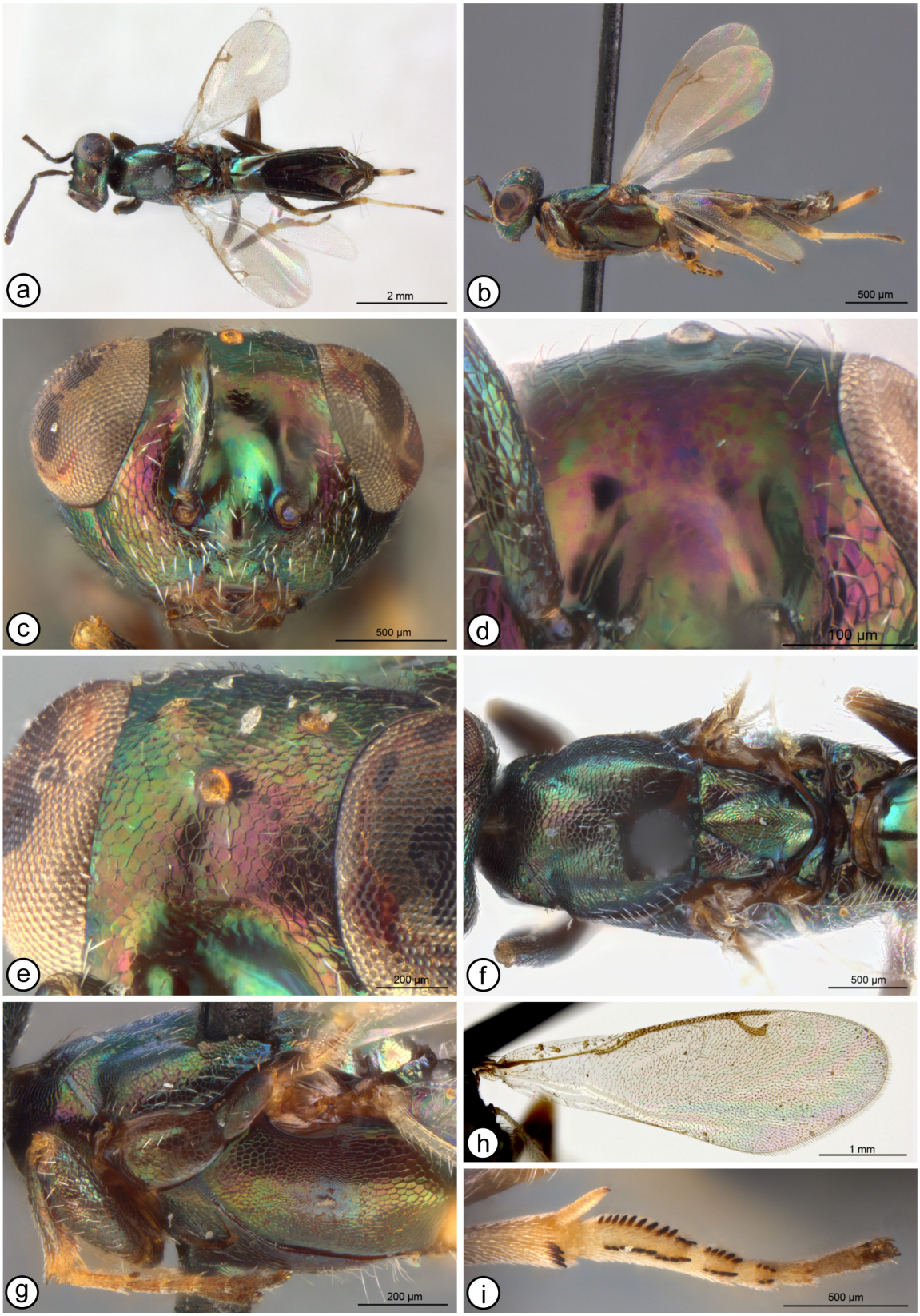

FIGURE 73. *Eupelmus nitidus*, ♀. *a–c, e–i* (holotype): **a**, dorsal habitus; **b**, lateral habitus; **c**, head, frontal (scapes blurred); **e**, upper part of scrobal depression and frontovertex, frontolateral; **f**, mesosoma, dorsal; **g**, mesosoma, lateral; **h**, fore wing; **i**, apex of mesotibia and mesotarsus. **d**, scrobal depression (2015-27).

FIGURE 74. *Eupelmus nitidus*, ♂. *a, b, d–g* (2015-26): **a**, lateral habitus; **b**, head and mesosoma, dorsal; **d**, scrobal depression and frontovertex; **e**, left antenna, outer view; **f**, right antenna, inner view; **g**, fore wing base. **c**, lower face (2015-25).

and laterally, but extensively smooth and shiny through scrobes and interantennal prominence (Fig. 74c, d); setae hairlike, pale brownish to brown; lower face with setae somewhat longer toward malar sulcus, but evenly distributed and longer setae straight to uniformly curved (Fig. 74c); gena posterior to malar sulcus with 1 obviously longer seta differentiated from other variably long setae, and posterior to eye with apices of setae directed toward orbit. Antenna (Fig. 74e, f) with scape entirely dark; pedicel about twice as long as wide, ventrally with row of 5 long white setae, of which all but possibly apical seta apically hook-like curved; length of pedicel + flagellum about as long or slightly longer than width of head; flagellum distinctly clavate with funiculars obviously increasing in width to broadly oval clava (Fig. 74e, f) having ventrally flat or collapsed micropilose sensory region (Fig. 74f); anellus transverse, but a distinct, dull, setose segment similar to subsequent flagellomeres; funicle with fu1 about 0.7–0.8× as long as pedicel, but distinctly longer than wide, and apical funiculars variably distinctly transverse; basal funiculars without evident differentiated region of setae ventrally. Palps brown. Mesosoma dorsally (Fig. 74 b) with similar metallic lusters as head, mostly dark green to somewhat bluish-green or somewhat

more distinctly bluish to purple laterally except propodeum brighter green to bluish-green, the callus more definitely blue; setae hairlike, entirely dark on pronotum, brownish to dark on mesonotum, and whitish on propodeal callus; tegula dark brown. Front leg extensively dark but knee, tibia apically and longitudinally on anterior and posterior surfaces pale (Fig. 74a, b); tarsus pale basally to brownish apically. Middle leg with femur and tibia dark except femur very narrowly and tibia somewhat more widely apically, and tibial spur and basal 3 tarsomeres white. Hind leg with similar colour pattern as middle leg. Fore wing with mv about 2.9–3.2× length of stv; costal cell dorsally setose apically for a distance only slightly greater than length of parastigma, and ventrally with only a single row of setae over most of its length, except setae indistinctly arranged on two rows in front of parastigma; basal cell uniformly setose with dark setae; speculum open posterobasally (Fig. 74g). Propodeum (Fig. 74b) with complete median carina, indistinctly longitudinally rugulose posteriorly near foramen, with panels mostly variably extensively meshlike coriaceous to very shallowly and inconspicuously reticulate.

Distribution. Israel* [Mashabe Sade, 26.XI.1984, A Freidberg (TAUI: 5♀)], **Spain* [**Lleida, Torres de Segre, 31T BG80, ex *Amblypalpis* on *Tamarix can*., coll. 13.II.2010, em. 2010, A. Ribes (1♀); same data except col. 25.I.2012, em. 2012 (1♀, DNA ug.SP 07 and CNC Photo 2015-27; 1 ♂, DNA ug.SP 03 and CNC Photo 2015-26); same data except em. 13.VI.2012 (1 ♂, DNA ug.SP 04 and CNC Photo 2015-25) (all ARPC)], Turkmenistan (Noyes 2014).

Biology. The specimens from Spain were reared from *Amblypalpis* sp. (Lepidoptera: Gelechiidae) galls on *Tamarix canariensis* Willdenow (Tamaricaceae).

Remarks. Nikol'skaya (1952) did not state the number of females on which *E. nitidus* was based, but stated that the female length was 2.7 mm. Although not found by Kalina (1988), we obtained on loan as part of our study a single female labelled as holotype. The absence of a range in length given in the original description suggests the species was based on only a single female and the one we examined is indeed the holotype. It is mounted on a rectangular card by a slender pin through the posteromedial depressed region of the mesoscutum (Fig. 73b, f) and is entire except the right antenna is missing beyond fl4 and the apex of the left clava is missing, apparently eaten by psocids.

In addition to the holotype we saw five complete or partial females from Israel and two females and two males from Spain that we identify as *E. nitidus*. Two of the males and one of the females from Spain were successfully sequenced for COI. Similar to the Turkmenistan holotype, the Israel and Spanish females have extensively dark legs (Fig. 73a, b, g) and except for the unsequenced female from Spain quite distinct and extensive reddish-coppery to reddish-violaceous lusters on the head and mesosoma (Fig. 73c–g). They also share a feature that is included in the key, but not detailed in the description because of the difficulty in making accurate, comparable measurements among specimens. The mesotarsus of any female can have the tarsomeres aligned in a straight or variably curved line, which affects accurate measurement of the total length of the mesotarsus. However, females of *E. nitidus* appear to have an atypically short mesotibia relative to the mesotarsus, the mesotarsus being at least 0.8× as long as the mesotibia. The head of the unsequenced female from Spain is strongly collapsed so that colour and sculpture of the frons and scrobal depression are not visible. Further, unlike the other females, it is mostly dark green with only obscure reddish luster laterally on the pronotum. However, its leg colour pattern is similar to the other females and the mesotarsus is slightly over 0.8× the length of the mesotibia. A fourth female has the same label data as the sequenced female and male collected 25.I.2012 that we include in *E. nitidus*. Sequencing for this female (ARPC: DNA extracted 10.III.2015, Fusu, ug.SP 02) failed. It has similarly dark legs as for the other females, but it lacks any reddish-violaceous luster on its head and mesosoma, has the scrobal depression excluding the scrobes finely reticulate, and the mesotarsus only about 0.7× as long as the mesotibia. We identify this female as *E. confusus* and consider it yet another example of more than one *Eupelmus* species sometimes being reared from the same host species in a single locality at the same time.

Because of their clavate flagellum (Fig. 74e, f) and setal pattern of the lower face (Fig. 74c), males of *E. nitidus* are most similar to those of *E. azureus*, differing most conspicuously in fore wing setal pattern. The two known males have the costal cell dorsally setose apically for a distance only a little greater than the length of the parastigma and ventrally have only a single row of setae over most of its length, as well as the speculum being open posterobasally (Fig. 74g). The two males also have the frons finely, but quite distinctly reticulate-roughened (Fig. 74d) as compared to coriaceous for *E. azureus* males (Fig. 14c). There may also be a difference in body colour, that of *E. nitidus* being mostly dark-green to bluish-green (Fig. 74a–d), whereas *E. azureus* males usually are more extensively blue and purple (Fig. 121a–d), but more specimens are required to assess this difference reliably.

Females of *E. nitidus* are very similar to those we include in the *urozonus* group based on their comparatively short ovipositor sheaths and the scrobal depression being shiny and essentially smooth, with only a slight indication of effaced meshlike sculpture (Fig. 73c, d), which differs little from that of other *urozonus*-group females. We do not include it in the *urozonus* group in part because our preliminary molecular analyses based on COI from the two specimens from Spain indicate *E. nitidus* belongs to a clade that contains, among other species, *E. annulatus*, *E. gemellus* and *E. longicalvus*. The species groups we recognize are not intended to define monophyletic lineages (see *Species groups* under 'Methods'), and thus *E. nitidus* might be included in the *urozonus*-group for the sake of species comparisons based on its shiny scrobal depression. However, males of *E. nitidus* have a clavate flagellum (Fig. 74e, f) as well as short and evenly spaced and curved setae on the lower face (Fig. 74c), whereas males we assign to the *urozonus*-group have a compact-filiform flagellum (Figs 76d, 121e, g) and longer, apically curved to sinuate setae forming a denser tuft of setae on the lower face between each torulus and malar sulcus (Figs 76b, 121c). It is also because of these morphological differences between *E. nitidus* and *urozonus*-group males that we do not include *E. nitidus* within the *urozonus* group (see further under 'Remarks' for *E. urozonus*).

E. (*Eupelmus*) *opacus* Delvare

Figs 75a–h (♀), 76a–e (♂)

Eupelmus (*Eupelmus*) *opacus* Delvare *in* Al khatib *et al.*, 2015: 143. Holotype ♀, NHRS, examined. Type data: DNA: LF.ur.SW 02, 10460 / SWEDEN, Östergötland, Ög., Ödeshögs kommun, Omberg, Stocklycke äng, lime meadow, 58°18.452'N 14°37.859'E, 23.viii/16.ix.2005, Trap ID 13, Coll. event 1648, SMTP / Holotype / *Eupelmus opacus* Delvare sp. n., Holotype ♀, G. Delvare det. 2013.

Eupelmus (*Eupelmus*) *opacus* Delvare *in* Al khatib *et al.*, 2014: 846–847 (unavailable name; original description, keyed, illustrated).

Description. FEMALE (habitus: Fig. 75f, g). Length = [2.25]–2.7 mm. Head extensively green (Fig. 75a, b, d) but interantennal prominence and scrobal depression from level of toruli, at least upper parascrobal region, frons variably widely mesally between scrobal depression and anterior ocellus, and sometimes lower face in part under some angles of light dark or with variably distinct violaceous luster (Fig. 75a); with hairlike to slightly lanceolate white setae on lower face and parascrobal region to level of dorsal margin of scrobal depression compared to less conspicuous hairlike setae on vertex. Maxillary and labial palps brown. Antenna brown or scape and pedicel with slight greenish luster. Pronotum dorsolaterally blue to purple or sometimes with posterior margin reddish-violaceous, and lateral panel extensively blue to purple over about dorsal half, contrasting with mostly green mesonotum (Fig. 75h); admarginal setae brown. Mesonotum (Fig. 75c, e) mostly green, sometimes with some coppery luster on the mesoscutum, posteriorly on convex part of medial lobe, within posteromedial depressed region, and less distinctly mediolongitudinally on lateral lobes under some angles of light (Fig. 75c), but lateral margin of lateral lobe at most with very limited bluish to purple luster under some angles of light, sometimes more distinctly posteriorly near axilla (Fig. 75h); with white, hairlike to slightly lanceolate setae. Prepectus brown or with slight metallic lusters under some angles of light; with [3] or 4 setae (Fig. 75h). Tegula dark. Acropleuron brownish to variably extensively and conspicuously greenish to bluish-green and sometimes with some coppery luster posteriorly. Propodeal callus green to bluish-green similarly to mesonotum; with similar white setae as mesonotum except somewhat denser. Macropterous; fore wing (Fig. 75g) hyaline with whitish-yellow to yellowish-brown setae; costal cell dorsally near leading margin with row of setae over about apical third to half, and ventrally extensively setose with dark setae along length, though reduced to 2 rows for varying length mesally; basal cell and disc entirely setose except for elongate linea calva extending to level of about middle of parastigma. Front leg with femur dark except very narrowly pale apically; tibia dark except narrowly pale basally and more extensively apically, with pale region extending more extensively basally on anterior and posterior surfaces, but not completely separating dorsal and ventral dark regions; tarsus pale. Middle leg with knee, tibia variably extensively apically, basal four tarsomeres and sometimes trochanter and trochantellus pale, the femur and tibia otherwise dark including mesotibial apical pegs and mesotarsal pegs. Hind leg similar to middle leg or more extensively dark but at least knee, tibia apically and basal four tarsomeres pale. Gaster (Fig. 75f, g) with hairlike setae; mostly brown except for variably distinct green to bluish-green luster basally on basal tergite and variably extensively and distinctly laterally on tergites and dorsoapically; ovipositor sheaths distinctly banded, with dark basal band and medial pale band of similar length or only slightly longer than apical brown band.

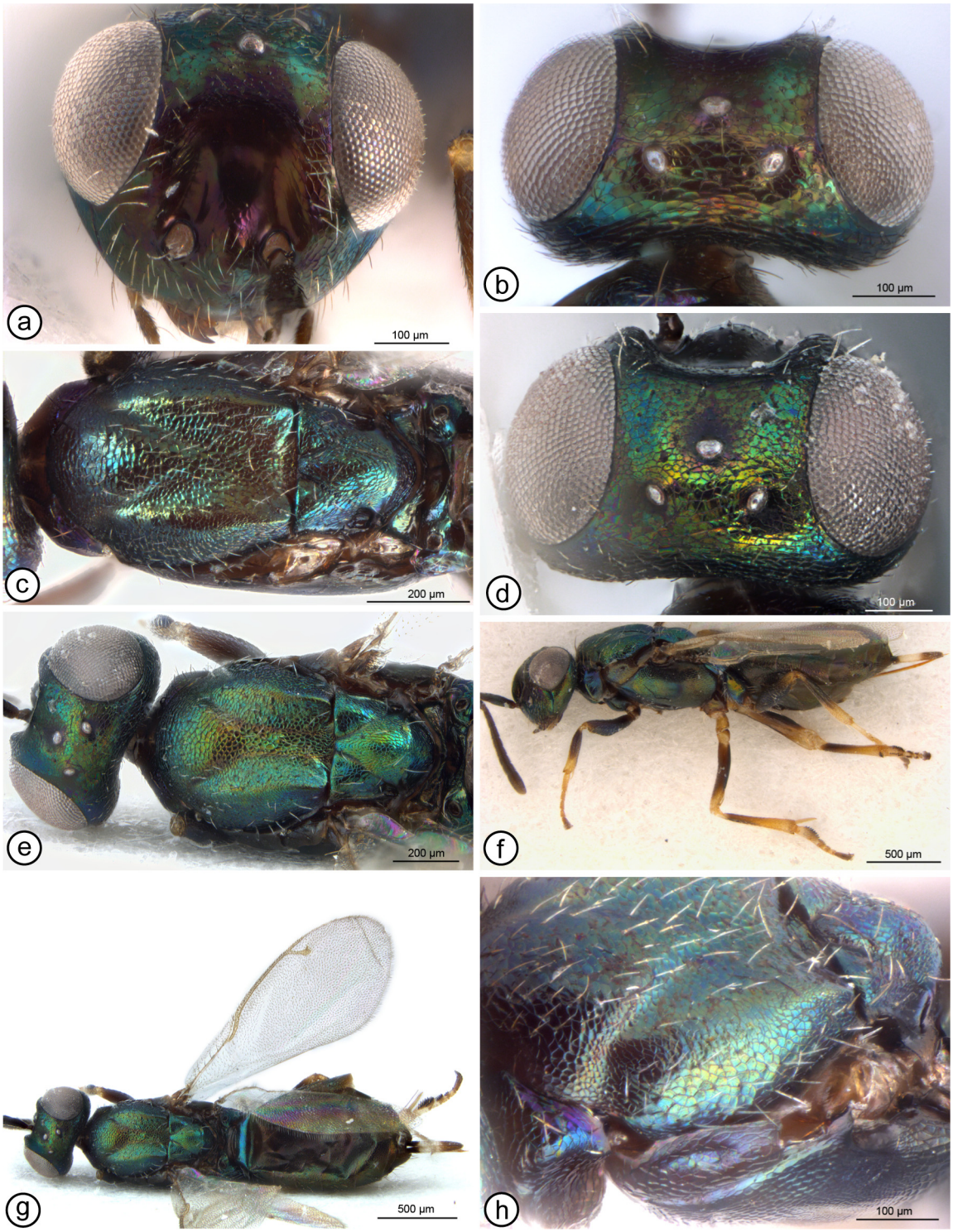

FIGURE 75. *Eupelmus opacus*, ♀. *a–c, h* (holotype): **a**, head, frontal; **b**, head, dorsal; **c**, head and mesosoma, dorsal; **h**, pronotum and mesoscutum, anterolateral. *d–g* (paratype): **d**, head, dorsal; **e**, head and mesosoma, dorsal; **f**, lateral habitus; **g**, dorsal habitus and fore wing.

Head in dorsal view (Fig. 75b, d) with interocular distance [0.44]–0.46× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons, and eye height [1.6]–1.72× length of malar space; in frontal view (Fig. 75a) width 1.18–[1.24]× height, with lower ocular line intersecting torulus near dorsal margin of torulus, malar space [1.5]–1.52× distance from oral margin to inner ventral margin of torulus, and latter distance 1.04–[1.22]× distance between inner mesal margins of toruli; vertex evenly rounded into occiput, transversely alutaceous to alutaceous-imbricate; frons meshlike coriaceous (Fig. 75a, b, d); scrobal

depression shiny and smooth except finely sculptured dorsolaterally and interantennal prominence finely meshlike or smooth and shiny over about dorsal half (Fig. 75a); OOL: POL: LOL: MPOD = [1.06]–1.5: [2.5]–2.75: [1.6]–1.75: 1.0. Mesoscutum (Fig. 75c, e) with posteromedial depressed region similarly meshlike reticulate as anteromedial lobe; axilla mostly obliquely and scutellum longitudinally reticulate-imbricate laterad midline. Acropleuron more-or-less isodiametric meshlike anteriorly and with slightly larger meshes posteriorly, but much more minutely sculptured mesally and larger meshlike sculpture at most only delineated by slightly raised ridges. Fore wing (Fig. 75g) with cc: mv: pmv: stv = [3.9]–4.4: 3.9–[4.0]: 1.0–[1.3]: 1.0; stigmal vein straight. Middle leg with row of 3 or 4 mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus and pegs differentiated into two rows apically; second tarsomere with 4 pegs, third tarsomere with 2 or 3 pegs along anterior margin and 2 pegs along posterior margin, and fourth tarsomere with 1 peg apically on either side. Propodeum with broadly U-shaped plical depression extending to posterior margin (Fig. 75c, e). Gaster (Fig. 75f, g) similar in length to combined length of head and mesosoma; not atypically modified; extending to base of third valvula, the latter about 0.64–[0.91]× length of metatibia and 0.69–[0.95]× length of mv; hypopygium extending about two-thirds length of gaster.

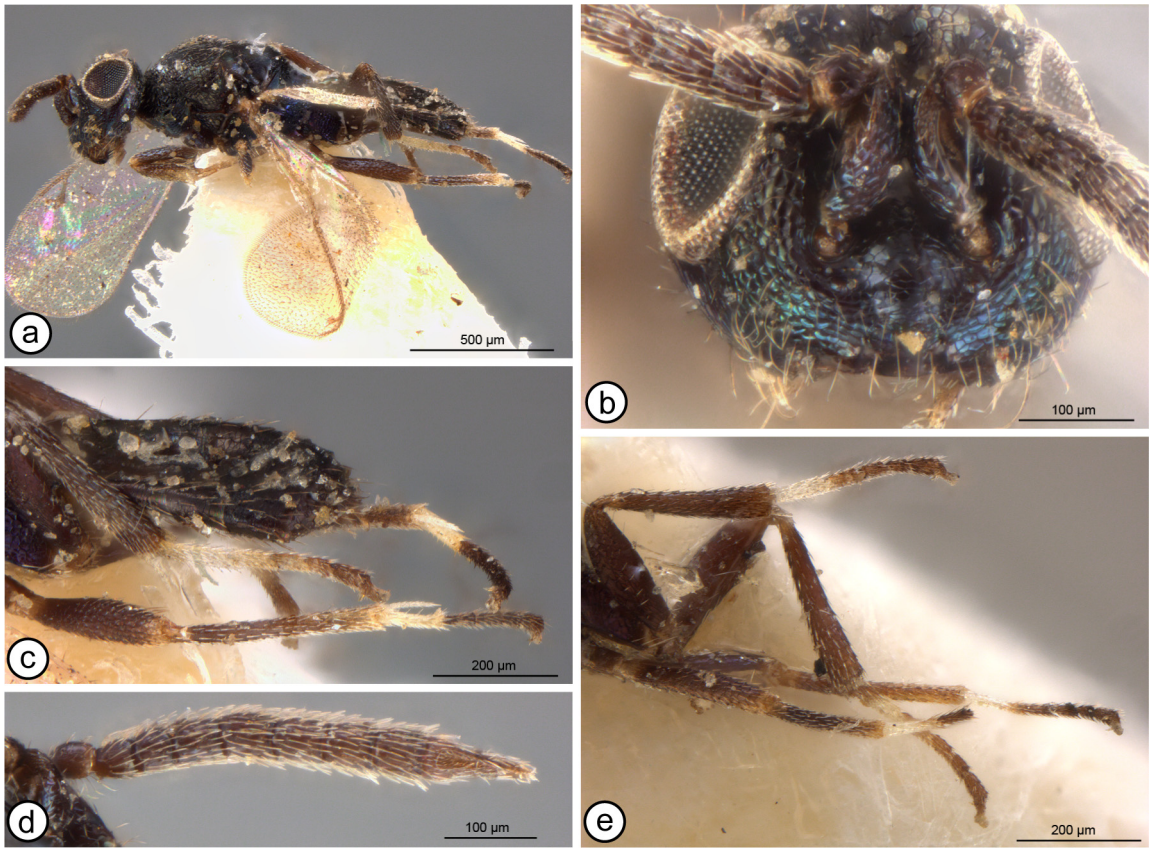

FIGURE 76. *Eupelmus opacus*, ♂. *a–d* (2014-98): **a**, lateral habitus; **b**, head, frontal; **c**, gaster and legs; **d**, antenna. **e**, legs (2014-99).

MALE (habitus: Fig. 76a). Same as described for *E. urozonus* except possibly for mesobasitarsus always entirely white and basal two to three tarsomeres of hind leg white or at least distinctly paler than apical two tarsomeres (see 'Remarks').

Distribution. England* [Cambs, Woodwalton Fen, NNR, 19-28.VII.1978 (NMPC:1♀)], **Germany*** [Bamberg, Gartenstadt, (10.VIII.1963), 14.VIII.1963, aus *Betula* seed (ZSMC: 2♀)], Greece, **Netherlands*** [N.B., Udenhout, "De Brand", 25.VIII–1.IX.1990, Ins. WG (RMNH: 1♀)], **Norway*** [Nedre-Eiker, Mjøndalen, Ryggkollen, 3.VIII–28.IX.2008, Lars Ove Hansen (2♀ CNC)], **Spain*** [Les, Lleida, 3TT CH14, A. Ribes, ex. *Betula pendula* fruits col. 19.VIII.2008, em. 29.X.2008 (1♀), 10.V.2009 (RICO: 2♂)], Sweden, **Ukraine*** [Chernomorskiy Nature Reserve [Black Sea Biosphere Reserve], galls on twigs of *Salix borysphenica*, col. 25.VI.1970, em. IV.71, Zerova (SIZK: 1♀ without head); Kiev, Rybnoe lake, goat willow in a dry marsh, M. Zerova, ex. *Rhabdophaga salicis*, coll. 15.IV.1973, em. 8.V.1973 (SIZK: 2♀, 2♂ on two pins, one with CNC Photo 2014-98 and other with CNC Photo 2014-99)].

Biology. We saw two females and two males reared from *Rhabdophaga salicis* (Schrank)* galls (Diptera: Cecidomyiidae) on *Salix caprea* L.* and a headless female that we questionably identify as *E. opacus* reared from an unknown gall on twigs of *Salix borysphenica* [sic] [*Betula borysthenica* Klokov ?]* (SIZK); two females reared from seeds of *Betula* (ZSMC), and one female and two males reared from seeds of *Betula pendula* Roth* (RICO). The last two records almost certainly are associated with *Semudobia betulae* Winnertz (Diptera: Cecidomyiidae). It is therefore possible that *E. opacus* is associated exclusively with Cecidomyiidae.

Remarks. Although the internal tissues of the holotype of *E. opacus* were digested for DNA extraction, colour of the body does not appear to be adversely affected except possibly for the mesonotum. In the key by Al khatib *et al*. (2014), the mesonotum is stated as being predominantly bluish with greenish reflections on the lateral bosses of the mesoscutum. The description stated that the mesoscutum is bluish on the anterior half of the convex medial lobe and outer slopes of the lateral lobes, but greenish elsewhere. When viewed from a direct dorsal view, the mesonotum of the holotype is quite extensively brown with less distinct green luster (Fig. 75c) than when viewed from an oblique angle. From an oblique angle, the mesonotum is more distinctly green (Fig. 75h), similar to the paratype (Fig. 75e). However, the holotype is also the smaller individual and the colour difference might be correlated with size. Neither female had the mesonotum predominantly bluish. The holotype is entire but the right antenna is detached and glued to the card, as are the left fore and hind wings.

Eupelmus opacus is one of six species included in the *urozonus*-group (see under *E. urozonus*), based originally on the holotype from Sweden and one female from Greece, of which we examined both. Al khatib *et al.* (2014) used relative size of the posterior ocellus in their couplet 20 as the primary feature to distinguish females of *E. opacus* from those of *E. priotoni*, *E. purpuricollis* and *E. urozonus*. The OOL is conspicuously longer than the posterior ocellus in the paratype (Fig. 75d), but is only slightly longer than the posterior ocellus in the smaller-bodied holotype (Fig. 75b) and thus similar to our measurements of the holotype of *E. priotoni* (see further below). Both females do have the interocular distance about 0.45× the head width as compared to about 0.4× in the holotype of *E. priotoni*, and have three (holotype) or four (paratype) prepectal setae compared to at least 7 prepectal setae for *E. priotoni*. Both of these may be valid differential features (see further below and under *E. priotoni*). The two type females and the unique holotype of *E. priotoni* all have the mesofemora extensively dark similar to the pro- and metafemora, though the holotype of *E. purpuricollis* also has the mesofemur partly dark ventroposteriorly, indicating variability in mesofemoral colour at least for the latter species.

Because of uncertainty over the morphological limits of *E. opacus*, the female description above is based only on the two original type specimens. However, we did see 10 additional females listed under distribution that we identify as *E. opacus*. These females, if correctly identified, support a low number of prepectal setae (2–4) in combination with leg colour pattern as valid differentiating features for *E. opacus* females. The largest females examined (2.4 mm) have at most four prepectal setae and all have both the meso- and metatibiae obviously darkened in part. Females of *E. simizonus* also commonly have only four prepectal setae, and frequently pale meso- and metatibiae as well as pale pronotal admarginal setae. The additionally observed females of *E. opacus* usually also have the mesosoma dorsally mostly greenish, but can have variably distinct purple to reddish-violaceous lusters on some of the following parts: frontovertex, mesoscutum including sometimes laterally along margin, scutellum and axillae, propodeal callus, basal gastral tergite, lateral pronotal panel, tegula and acropleuron. The purple to reddish-violaceous lusters are always much less extensive and conspicuous than on the pronotum, and unlike *E. purpuricollis* females the vertex is green to bluish-green, not broadly purple to bright reddish-violaceous. Additional measurements from the newly identified females are as follows: interocular distance 0.44–0.46× head width; eye height 1.59–1.83× length of malar space; in frontal view width 1.19–1.22× height; malar space 1.36–1.5× distance from oral margin to inner ventral margin of torulus, and latter distance 1.05–1.17× distance between inner mesal margins of toruli; OOL: POL: LOL: MPOD = 1.0–1.14: 2.4–2.9: 1.4–1.7: 1.0; fore wing with cc: mv: pmv: stv = 4.3–4.9: 4.0–5.3: 1.1–1.38: 1.0; third valvula 0.79–0.95× length of metatibia and 0.82–0.98× length of mv. The additional females show that the comparatively short ovipositor sheaths (0.73× length of mv) and long OOL (1.5× MPOD) of the paratype may be exceptional within the species. They also show that relative interorbital distance in addition to the number of prepectal setae might be useful features to differentiate *E. opacus* and *E. priotoni* females. However, unequivocal features to differentiate females of these two species remain to be demonstrated. Also, as noted by Al khatib *et al.* (2014), *E. opacus* females could be mistaken easily for those of *E. minozonus* if pronotal colour pattern is not observed, but the four known females of *E. minozonus* all have both the meso- and metatibiae pale without distinct dark regions subbasally and the mesofemur is either similarly pale or only partly darkened basoventrally to posteroventrally.

We saw at least one rearing with males associated with females that we identify as *E. opacus*. One male and female from Ukraine mounted on the same pin are labelled as reared from *Rhabdophaga salicis*. Another male and female that are similarly mounted together lack labels, but because of the same mounting evidently are from the same collecting event. Based on these two males, the male of *E. opacus* (Fig. 76a–e) is very similar to typical *E. urozonus* males except the meso- and metatarsi are somewhat more extensively pale. One of the males has the mesobasitarsomere entirely white in distinct contrast to the following four similarly dark tarsomeres as well as the first two tarsomeres of the metatarsus white and the third tarsomere yellowish-brown (Fig. 76c). The other male also has the mesobasitarsomere essentially entirely white (extreme apex slightly brownish), but only the basitarsus of the metatarsus is completely white and the following two tarsomeres are only very slightly lighter than the other tarsomeres (Fig. 76e). Another two males from Spain are associated through rearing with one small, badly collapsed female that we provisionally identify as *E. opacus* based on a combination of pronotal colour pattern, dark mesofemur and the presence of just two prepectal setae. These two males have the mesotarsus dark except for the extreme base of the basitarsus being whitish, and the metatarsus having the basitarsus white except for being slightly darkened dorsoapically. The latter two males are thus very similar to typical *E. urozonus* males and would key out with them through the first half of couplet 35. Almost all observed European males we identify as *E. urozonus* have both the meso- and metatarsi entirely infuscate or at most the metabasitarsomere white and the mesobasitarsomere white only within about its basal half (Fig. 121a). However, *E. urozonus* males seen from Iran (Fig. 121b) and other rare males from Europe and Tajikistan have more extensively pale meso- and metatarsi similar to the Ukrainian males we interpret as *E. opacus* (see further under 'Remarks' for *E. urozonus*).

E. (*Eupelmus*) *orientalis* (Crawford) n. stat.

Figs 77a–e, g (♀), 78a, d, f (♀), 79a–d, f, h (♂)

Bruchocida orientalis Crawford, 1913: 247. Syntypes, 3♀, USNM, 2♀ examined by GG. Type data: India, Bangalore, L.C. Goleman, reared from *Bruchus chinensis*.

Eupelmus orientalis; Monge & Huignard, 1991: 187. Change of combination.

Description. FEMALE (Fig. 77a). Length = 2.1–4.0 mm. Head (Fig. 77a–c) usually at least partly bright green, though face and frontovertex often variably extensively to rarely almost entirely reddish-coppery; with conspicuously lanceolate white setae except for bare scrobal channel (Fig. 77c), those behind outer orbit dense and directed anteriorly so at least closest row parallel with orbit (*cf* Fig. 53b). Maxillary and labial palps brown. Antenna dark except scape yellowish-orange (orangey-brown to dark brown in some South African females, Fig. 77a, c), and flagellum with reflective white setae on at least basal three and often part or all of fourth and rarely fifth funicular (Fig. 77c). Mesosoma (Fig. 77a, b) similar in colour to head, varying from largely green with limited reddish-coppery lusters to almost entirely reddish-coppery with only some greenish luster medially on acropleuron, though following sometimes comparatively dark with less distinct metallic lusters under most angles of light: prepectus, tegula, and mesopectus ventral to acropleural sulcus; with conspicuous though variably broadly flattened white lanceolate setae, including conspicuously dense setae on callus (Fig. 77d), except following bare: vertical surface of lateral panel of pronotum, acropleuron, metanotum and propodeal plical region; pronotum posterodorsally with elongate, entirely or at least apically white setae (Fig. 77b). Macropterous; fore wing with linea calva; sometimes hyaline (Fig. 77f) but usually variably distinctly and extensively infuscate behind discal venation and often basally within costal and/or basal cells (Fig. 77e); basal cell, costal cell and smv usually with white setae (contrasting with brown setae of disc from level about equal to middle of parastigma or base of mv), though all often with at least a few darker, yellowish-brown to dark brown setae basally (Figs 77g, 78a) and rarely with basal dark setae extending more extensively apically (Fig. 78d), but at least dark setae of basal cell and disc separated by some lighter coloured setae apically in basal cell and on disc basally behind parastigma (Fig. 78d). Legs with conspicuous, variably broadly flattened white lanceolate setae on coxae, femora, and at least dorsobasally on mesotibia; front leg rarely entirely dark brown with slight greenish luster except for knee, but most commonly extensively yellowish-orange beyond coxa except for brown tarsus and femur and tibia with posterior surfaces or tibia apically at least slightly darkened to brown; middle leg usually mostly yellowish-orange to orangey-brown except mesotibial apical pegs, mesotarsal pegs, apical 1–3 tarsomeres and often coxa laterally dark, and extreme apex of femur and at least basal one or two tarsomeres lighter whitish-yellow; hind leg with coxa variably dark with green luster similar to acropleuron to more reddish-coppery luster similar to gaster, but

otherwise usually mostly yellowish-orange to orangey-brown or more rarely dark brown but with knee, extreme apex of tibia variably distinctly, and basal one or two tarsomeres white. Gaster (Fig. 77a) with conspicuous, variably broadly flattened white lanceolate setae laterally and dorsally on apical three tergites; reddish-coppery or with variably extensive green luster laterally except basal tergite anteriorly green to bluish-green; ovipositor sheaths with extreme base of third valvula dark and often a lighter brown region apically, but medial pale region much longer than either basal or apical regions.

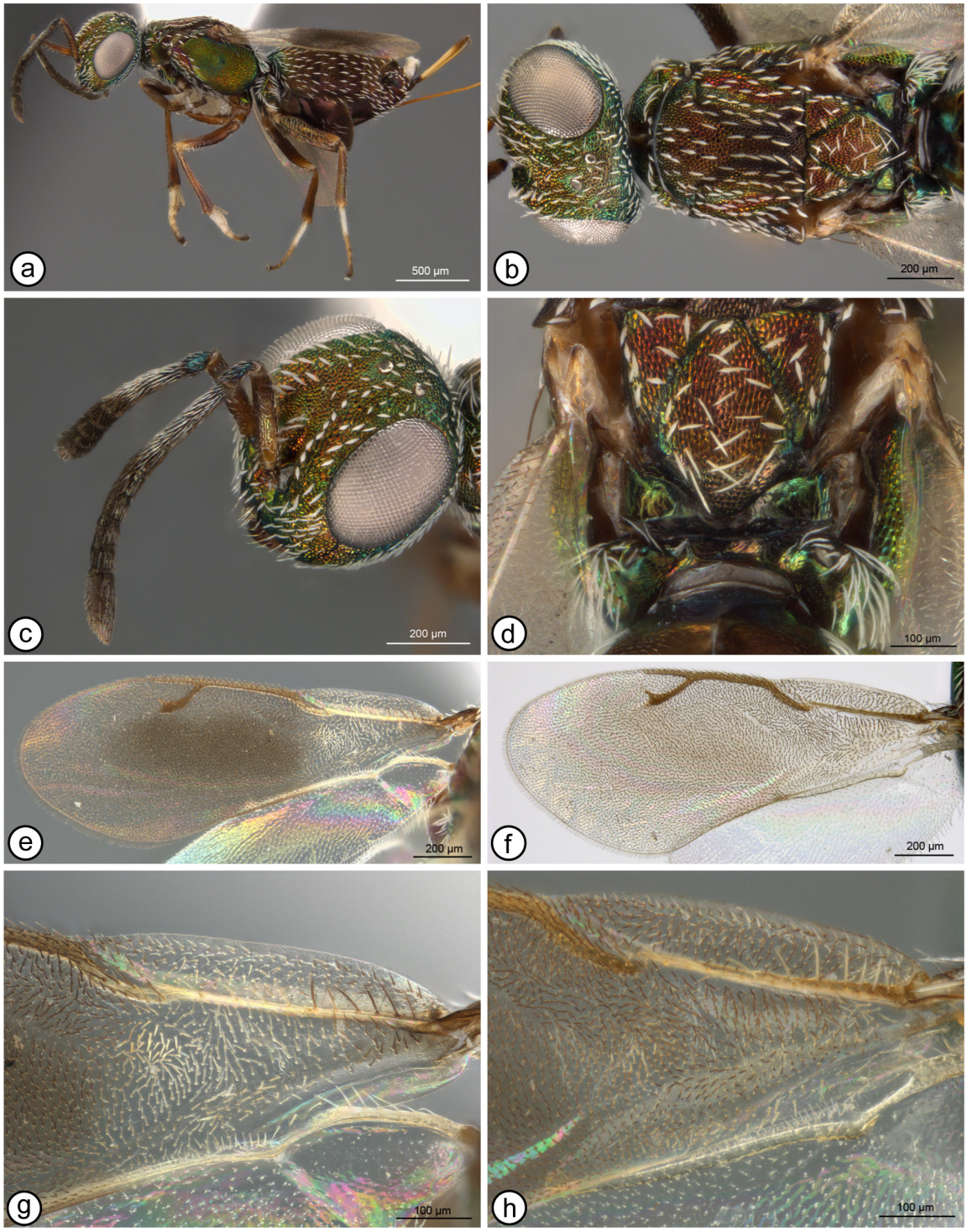

FIGURE 77. *Eupelmus* spp. ♀. *a–d* (*E. orientalis*, 2012-48): **a**, lateral habitus; **b**, head and mesosoma, dorsal; **c**, antennae and head, frontolateral; **d**, scutellar-axillar complex to propodeum. *e, g* (*E. orientalis*, 2012-50): **e**, fore wing; **g**, fore wing base. *f, h* (*E. vuilleti*, 2013-151): **f**, fore wing; **h**, fore wing base.

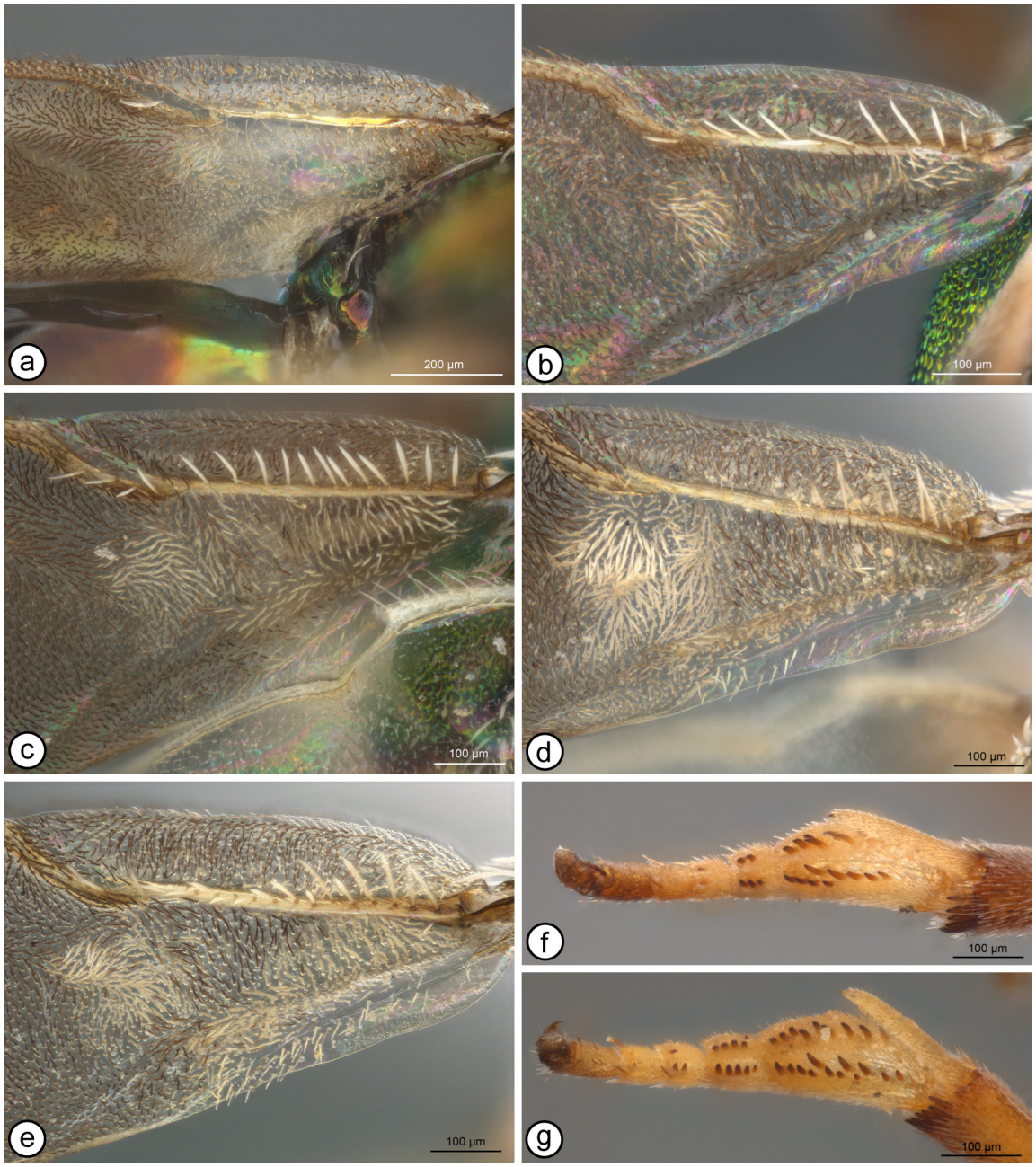

FIGURE 78. *Eupelmus* spp. ♀. *a, d, f* (*E. orientalis*): **a**, fore wing base (paratype, 2013-149); **d**, fore wing base (2013-112); **f**, apex of mesotibial and mesotarsus (paratype 2013-149). *b, c, e, g* (*E. vuilleti*): **b**, fore wing base (2012-101); **c**, fore wing base (2013-114); **e**, fore wing base (2013-113); **g**, apex of mesotibial and mesotarsus (paratype, 2013-152).

Head in dorsal view with interocular distance about 0.4× head width; in lateral view comparatively flat-lenticular, but face almost evenly convex with broad parascrobal region smoothly merged with frons; frontovertex and scrobal depression similarly punctate-reticulate to somewhat reticulate-rugose (Fig. 77c), with reticulations usually obviously smaller than on parascrobal region; OOL: POL: LOL: MPOD = 1.1–2.0: 3.2–5.0: 1.7–2.4: 1.0. Mesoscutum (Fig. 77b) meshlike punctate-reticulate similar to frons and scrobal depression except lateral lobe with comparatively inconspicuous mediolongitudinal band of minute coriaceous sculpture. Scutellum and axillae low convex in same plane; axilla punctate-reticulate to more longitudinally or obliquely reticulate-strigose; scutellum longitudinally reticulate-punctate to reticulate-strigose or reticulate-imbricate except frenal area more uniformly meshlike reticulate. Acropleuron distinctly meshlike reticulate anteriorly and posteriorly of minutely punctate mesal region, posterodorsally with larger and variably distinctly longitudinally aligned reticulations. Fore wing (Fig. 77e, f) with cc: mv: pmv: stv = 3.4–4.0: 1.9–2.3: 0.9–1.0: 1.0. Middle leg (Fig. 78f) with row of 6–8

mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus and pegs at least obscurely differentiated into two rows apically, second tarsomere usually with at most 3 pegs on one side and 2 pegs on other side (very rarely with up to 4 pegs on one side and 3 pegs on other of one leg), third tarsomere with at most 1 peg on either side and fourth tarsomere without pegs (very rarely with 2 pegs on one side and one on other of one leg). Propodeum (Fig. 77d) with comparatively large, rectangular plical depression extending to posterior margin, the lateral margins subparallel. Gaster (Fig. 77a) similar in length to combined length of head and mesosoma; not atypically modified; extending almost to or slightly over base of third valvula, the latter about 0.8–1.0× times length of metatibia and about 1.6–2.0× length of mv; hypopygium extending about three-quarters length of gaster.

MALE (habitus: Fig. 79a). Length = 1.4–3.1 mm. Head (Fig. 79a–d) usually comparatively bright green to bluish-green, though often with limited blue to purple lusters along inner orbits, lower face and gena, and sometimes mesally with variably conspicuous reddish-coppery to violaceous on part or all of vertex through interantennal prominence; frons distinctly meshlike reticulate to punctate-reticulate; vertex uniformly curved into occiput, similarly or more minutely reticulate as frons to transversely imbricate; scrobal depression and scrobes similarly sculptured as frons; setae white, hairlike on frontovertex (Fig. 79b, c) from about dorsal level of scrobal depression but usually quite distinctly lanceolate (Fig. 79c, d) along most of parascrobal region, lower face, and gena; lower face with uniformly distributed, comparatively short setae at most increasing only slightly in length toward malar sulcus (Fig. 79c); gena posterior to malar sulcus with 1 conspicuously longer seta than others, and posterior to eye with apices of setae at least directed anteriorly at about a 45° angle to orbit and sometimes subparallel with orbit (Fig. 79d). Antenna with scape at least pale basally and along outer, ventral, longitudinal sensory region, and usually more extensively to entirely yellowish or yellowish-orange (Fig. 79c); pedicel subglobular, only about as long as wide (Fig. 79c), and ventrally with row of 3 or 4 long setae, though usually only 3 curved; length of pedicel + flagellum about 2.1–2.2× head width; flagellum elongate-filiform (Fig. 79a) with clava about 0.7–0.8× length of apical two funiculars; anellus very strongly transverse, discoidal, smooth and shiny; funicle with fu1 about 2.2–3.0× as long as pedicel and 2.9–3.5× as long as wide, with all subsequent funiculars conspicuously longer than wide, the apical funicular about 2.4–3.0× long as wide, and with recumbent, curved white setae about as long as width of funiculars (Fig. 79c, d); basal funiculars without regions of modified setae ventrally. Maxillary and labial palps brown. Mesosoma (Fig. 79a, b) usually similarly green as head, but sometimes with variably distinct and extensive reddish-coppery to violaceous luster, usually only mesally, but if more extensively then at least with some green to bluish-green luster laterally on mesonotum; setae white, elongate-lanceolate along posterior margin and laterally on pronotum and laterally on mesoscutum (Fig. 79d), but mostly hairlike dorsally on mesonotum (Fig. 79b); tegula usually entirely yellowish (Fig. 79a) but sometimes darker brownish apically. Legs with femora dark except pale apically, tibiae usually mostly yellowish but mesotibia and usually metatibia with subapical darker brown region and metatibia rarely extensively dark; protarsus often uniformly yellowish to gradually darkened apically, but at least meso- and metatarsi with basal three tarsomeres pale in contrast to apical two brown tarsomeres. Fore wing (Fig. 79f) with mv about 1.75–2.5× length of stv; costal cell (Fig. 79h) dorsally near leading margin with whitish to brown setae, but with distinct dark setae usually only over about apical third to half (very rarely most of length), and ventrally with comparatively inconspicuous whitish setae along length; basal cell uniformly setose, usually with comparatively inconspicuous white (Fig. 79h), though sometimes with distinct brown setae; disc hyaline, usually with whitish setae (Fig. 79f) at least basally, and speculum open or variably extensively closed posterobasally by row of setae. Propodeum with complete median carina, with panels meshlike-coriaceous to alutaceous (Fig. 79b).

Distribution. AFROTROPICAL. **Botswana*** (CNC), **Kenya*** (CNC, RMNH), **Madagascar*** (BMNH), **Malawi*** (BMNH), **Mozambique*** (CNC), Niger, **Nigeria*** (BMNH), **Senegal*** (MNHN), **Somalia*** (CNC, RMNH), South Africa, West Africa, **Zaire*** (CNC). **ORIENTAL**. India, **Thailand*** (CNC). **PALAEARCTIC**. **Israel*?** (CNC), **United Arab Emirates*** (CNC), **Yemen*** (CNC). Noyes (2014) also listed Iraq based on by Abdul-Rassoul (1990).

Biology. A primary, solitary parasitoid of *Piezotrachelus varium* (Wagner)* (Coleoptera: Apionidae) (BMNH, misidentified as *E. vuilleti* in Prevett 1961; MNHN, misidentified as *E. vuilleti* in Risbec 1950, 1951), *Bruchus ornatus* Boheman* (Coleoptera: Bruchidae) (MNHN, misidentified as *E. vuilleti* in Risbec 1950, 1951), *Phenacoccus manihoti* Matile-Ferrero* (Hemiptera: Pseudococcidae) (BMNH), *Palaeococcus bicolor* Newstead* (Hemiptera: Margarodidae) (MNHN, misidentified as *E. vuilleti* in Risbec 1950, 1951), plus species of Bruchidae and Curculionidae (Coleoptera). See Noyes (2014) for extensive citations on biology, primarily related to the

cowpea weevil, *Callosobruchus maculatus* (Fabricius) (Bruchidae), including as a facultative hyperparasitoid of *Dinarmus basalis* (Rondani) (Hymenoptera: Pteromalidae), *E. vuilleti* and itself (see also biology for *E. vuilleti*). Kalyanam (1960) also listed *Dactylethra candida* Stainton (Lepidoptera: Gelechiidae) as a host. Numerous studies have investigated the biological characteristics of *E. orientalis*, *E. vuilleti* or both (see Noyes 2014).

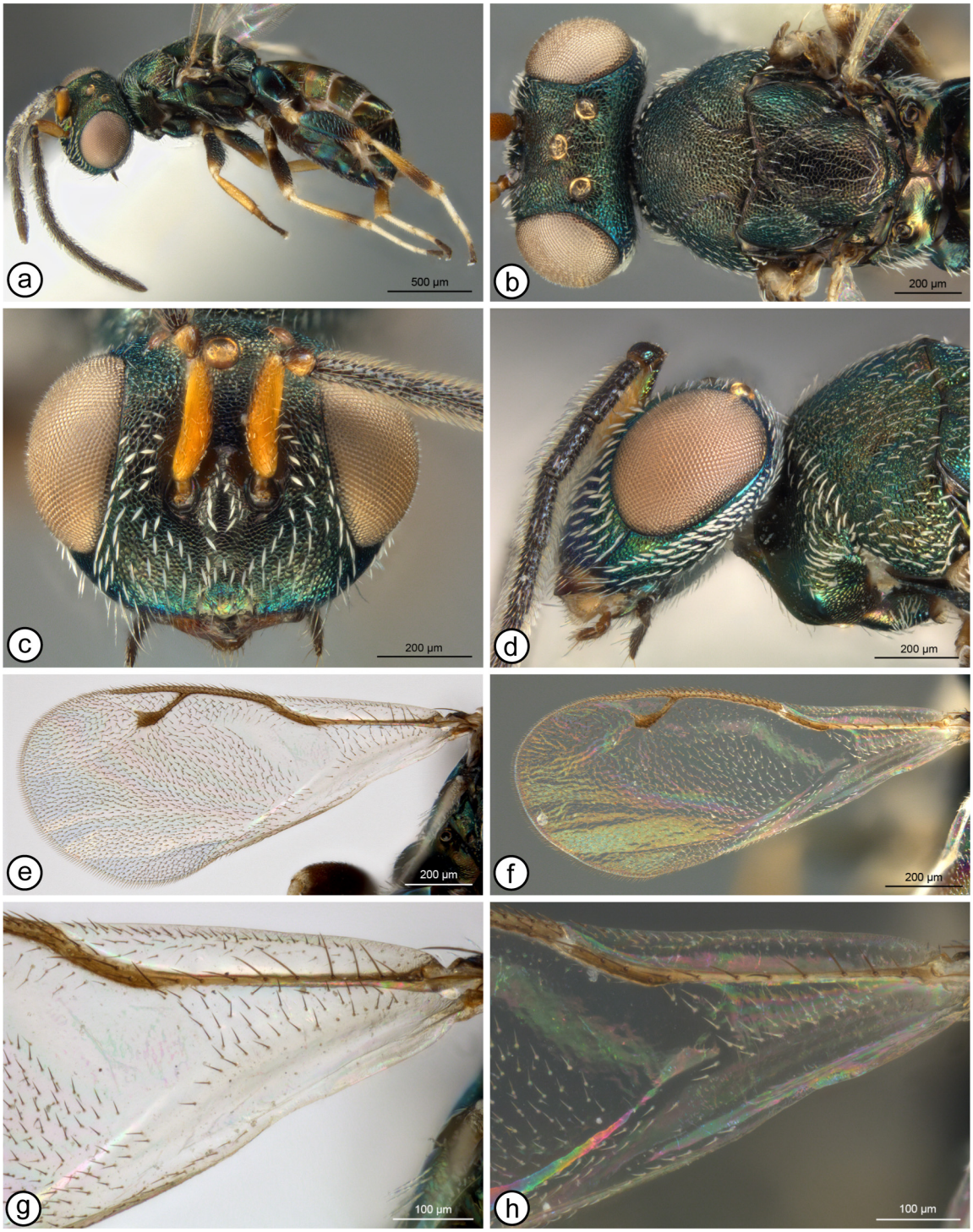

FIGURE 79. *Eupelmus* spp. ♂. *a–d* (*E. orientalis*): **a**, lateral habitus (2012-102); **b,** head and mesosoma, dorsal (2012-104); **c**, head, frontal (2013-103); **d**, head, pronotum and mesoscutum, lateral (2013-109). *e, f* (fore wing): **e**, *E. vuilleti* (2012-105); **f**, *E. orientalis* (2013-148). *g, h* (fore wing base): **g**, *E. vuilleti* (2012-105); **h**, *E. orientalis* (2013-148). [Figs e and g with white background and Figs f and h with dark background for colour of setae.]

Remarks. We include *E. orientalis*, *E. lanceolatus* and *E. vuilleti* in the *orientalis* species-group based on females sharing conspicuous white lanceolate setae on the head, mesosoma and metasoma (Figs 53b, e, 77a–d) as well as a comparatively large, rectangular plical depression (Figs 53f, 77d), though this latter feature is shared also with *iranicus*-group females. Females of *E. orientalis* and *E. vuilleti* have broadly lanceolate setae over the entire face and mesonotum (Fig. 77a–d), whereas those of *E. lanceolatus* have more hairlike setae on the frontovertex (Fig. 53a), convex part of the anterior mesoscutal lobe, and scutellar-axillar complex (Fig. 53e). Further, the lanceolate setae of *E. lanceolatus* are somewhat more slender with less distinctly outcurved sides than for females of the other two species, particularly on the head. Some of the smallest males of *E. orientalis* lack conspicuously lanceolate setae; however, like males and females of the other two species they at least have the setae along the outer orbit directed anteriorly at an acute angle or even subparallel with the outer orbit (Figs 54d, 79d) rather than the apices being directed toward the orbit as in other *Eupelmus* species (e.g. Figs 123a, 126c). Unlike females, males of *E. orientalis* and *E. vuilleti* also have the setae on the frons and at least median mesoscutal lobe hairlike (Fig. 79b, c) rather than distinctly lanceolate and thus males of the three species are even more similar to each other than are females. However, the head and mesosoma of *E. orientalis/E. vuilleti* males has more extensive greenish luster (Fig. 79a–d) than do *E. lanceolatus* males (Fig. 54a, d) and the meso- and metatibiae sometimes are darker.

Doury & Rojas-Rousse (1994) stated that the "presence of a specific ring of white bristles between the thorax and the abdomen of females of *E. orientalis* is the main phenotypic character which distinguishes *E. orientalis* from *E. vuilleti*". We do not know what the ring of white bristles refers to because females of both species have the gaster laterally (Fig. 77a) and the propodeal callus (Fig. 77d) with conspicuous, though variably dense and broadly lanceolate white setae. Crawford (1913) differentiated females of *E. orientalis* from those of *E. vuilleti* primarily by "color and the white hairs on the base of the wings". He described *E. orientalis* females as having "white hairs as far as the apex of the submarginal vein, beyond this the hairs dark", whereas *E. vuilleti* females were described as "hairs on wings all dark". However, females of the type-series of *E. orientalis* have a few brown setae basally and the extreme base of the basal cell variably distinctly brown (*cf* Fig. 77g), with the setae otherwise white behind the submarginal vein to the base of the parastigma, including a region of white setae basally on the disc behind the parastigma. In contrast, females of the type-series of *E. vuilleti* have mostly dark fore wing setae, though there are a few inconspicuously lighter, whitish setae basally within the basal cell as well as a small region of variably conspicuously lighter coloured setae just beyond the basal fold behind the parastigma (*cf* Fig. 77h). Crawford (1913) also stated for *E. orientalis* that the wings were "somewhat infuscated" compared to "slightly dusky" for *E. vuilleti* and the setae beyond the submarginal vein were "longer and more numerous than in *vuilleti*". Most females we saw are quite readily identified either as *E. orientalis* or *E. vuilleti* by the difference in colour of the setae basally and the presence or absence of evident discal infuscation. However, three female (BMNH) voucher specimens identified as *E. vuilleti* from Prevett (1961) have a fore wing setal colour pattern like that described for *E. orientalis* but have hyaline wings and comparatively short discal setae characteristic of *E. vuilleti*. Further, some females seen from Israel, UAE and Yemen have different mixtures of white and brown setae within the basal cell that are intermediate between the two extremes described for *E. orientalis* and *E. vuilleti*. Of these, we identify as *E. orientalis* those that have at least a few brown setae basally in the basal cell (Figs 77g, 78a, d) and that have lighter-coloured, whitish setae apically in the basal cell and basally on the disc behind at least the base of the parastigma (Fig. 78d) so that the brownish setae of basal cell and disc are separated. We identify as *E. vuilleti* those that have the basal-most setae of the basal cell whitish (Figs 77h, 78b, c, e) rather than brown and that apically have brown setae extending from the basal cell through the basal fold and onto the disc except often for a more-or-less circular region of whitish setae that is separated from the parastigma by brown setae (Fig. 78b, c, e). Interestingly, females of *E. orientalis* have entirely white setae on the submarginal vein when the basal cell setae are entirely white, but when there are some brown setae basally within the basal cell there are usually also a few brown setae present basally on the submarginal vein (Fig. 77g). Even though the basal cell setae are mostly brown for typical *E. vuilleti* females, the setae on the submarginal vein are always white (Figs 77h, 78b, c, e).

Although variable, mesotarsal peg pattern also appears to be helpful in distinguishing *E. orientalis* and *E. vuilleti* females. Type females of *E. vuilleti* (Fig. 78g) have on either side of the tarsomeres a 5/5 or 5/4 peg pattern on the second tarsomere and a 2/1 or 1/1 peg pattern on the third tarsomere. Females we identify as *E. vuilleti* based on fore wing features have any combination of 5/5 or 5/4 to 3/3 or rarely 3/2 peg patterns, though they at least have a 1/1 to 2/2 peg pattern on the third tarsomere. Type females of *E. orientalis* (Fig. 78f) have a 3/2 peg pattern on the second tarsomere and minute pegs apically on either side of the third tarsomere (1/1), whereas other females we

identify as *E. orientalis* often have only a 2/2 or 2/1 peg pattern on the second tarsomere and/or the third tarsomere lacks pegs. However, females from Yemen that we identify as *E. orientalis* have up to a 3/3 or 4/3 peg pattern on the second tarsomere of one leg and up to a 2/1 peg pattern on the third tarsomere on both legs. All 11 females we identify as *E. orientalis* from UAE have 3/2 and 1/1 peg patterns respectively on the two tarsomeres, whereas of 25 females we identify as *E. vuilleti* from UAE only 2 have this pattern, the others having at least a 3/3 peg pattern on the second tarsomere. The females identified as *E. vuilleti* in Prevett (1961) have anywhere from a 2/1 to a 3/2 peg pattern on the second tarsomere and lack pegs from the third tarsomere except for one that has a minutes peg apically on either side. Thus, these females are more similar to typical *E. orientalis* both in tarsal peg pattern and basally white fore wing setae.

Two females (CNC) collected in Israel, likely in a Malaise trap, from exactly the same locality but at slightly different times (15-18.IV.1996 *versus* 26-27.IV.1996), illustrate problems in confidently differentiating some *E. orientalis* and *E. vuilleti* females. The one collected 26-27.IV has a fore wing setal colour pattern (Fig. 78b) typical of *E. vuilleti* (disc at most very slightly and inconspicuously infuscate and basal cell with mostly brown setae except for a few white setae basally and in a small circular region behind the parastigma), but an atypical 3/2 and 1/1 peg pattern on the second and third tarsomeres. The fore wing of the female collected 15-18.IV (Fig. 78c) also lacks distinct discal infuscation but otherwise resembles typical *E. orientalis* (basal cell with mostly white setae except for a relatively few scattered brown setae and with brown setae immediately behind the parastigma so as to indistinctly separate the parastigma from white setae basally on the disc). However, unlike most *E. orientalis* with extensively white setae, the basal-most setae are white rather than dark and both mesotarsi have a 4/3 and 1/1 peg pattern on the second and third tarsomeres, respectively. Another female from UAE has brown setae extensively through the basal cell in combination with entirely white submarginal vein setae (Fig. 78d), and thus might be identified as *E. vuilleti*, but the basal-most setae are pale and the mesotarsal peg pattern is typical of *E. orientalis* (*cf* Fig. 78f), and we therefore include it in the latter species.

Males of *E. orientalis* and *E. vuilleti* have not been distinguished previously. Based on males confidently associated with identified females, males of *E. orientalis* typically have white fore wing setae (Fig. 79f) at least through the basal cell and disc basally (Fig. 79h) in combination with a comparatively long marginal vein relative to the stigmal vein (at least about 1.75×). Males of *E. vuilleti* always have entirely dark fore wing setae (Fig. 79e, g) in combination with a usually shorter marginal vein (Fig. 79e) (about 1.6× as long as stigmal vein in the two *E. vuilleti* syntypes). However, as for females, there appears to be variation in fore wing setal colour and/or overlap in relative lengths of the marginal vein. Some males that should be *E. orientalis* based on association with females have a long marginal vein that is at least twice as long as the stigmal vein, but have dark setae similar to *E. vuilleti* males. Further, some males with entirely dark setae have marginal veins that are intermediate in length between those typical of *E. vuilleti* and *E. orientalis*. The presence of light coloured fore wing setae also tends to be associated with relatively fewer setae dorsoapically in the costal cell (Fig. 79h), and dark setae associated with a dorsally extensively setose costal cell (Fig. 79g), but again this appears to be highly variable.

Molecular analyses are required to confirm or refine our interpretation of females and males of *E. orientalis* and *E. vuilleti* so as to further investigate whether there might be only a single, highly variable species or two species that sometimes hybridize and result in what appears to be intermediate states of the fore wing setal colour patterns in both sexes as well as mesotarsal peg pattern of females. Unfortunately, COI sequencing was unsuccessful for five individuals of *E. orientalis* attempted and only partial sequences were obtained from two females of *E. vuilleti* and three individuals of *E. lanceolatus*, respectively. Interestingly, Ndoutoume *et al.* (2000) noted that *E. orientalis* and *E. vuilleti* are sympatric in the same cowpea fields in Niger and that both species were present in stored crops at the beginning of storage in November, but that only *E. vuilleti* remained by the end of January.

E. (*Eupelmus*) *orthopterae* (Risbec)

Figs 80a–i (♀), 81a–h (♂)

Holceupelmus bifasciatus Cameron, 1905: 317. Lectotype ♀, BMNH, designated by Bouček, 1976: 352, examined. Type data: South Africa: Cape Colony, Dunbrody. Secondary homonym of *Eupelmus bifasciatus* Giraud, 1871.

Brasema orthopterae Risbec, 1951: 214–217. Lectotype ♀, MNHN, designated by Fusu *et al*., 2015: 467, examined by LF. Type data: Senegal: M'Bambey, reared from oothecae of *Miomantis pellucida*. Synonym of *Holceupelmus bifasciatus* Cameron (1905), discovered by Bouček, 1976: 352.

Brasema orthopterae; Risbec, 1956: 129 (♀ keyed).
Eupelmus orthopterae; Bouček, 1976: 352.
Eupelmus (*Eupelmus*) *orthopterae*; Fusu *et al.,* 2015: 467.

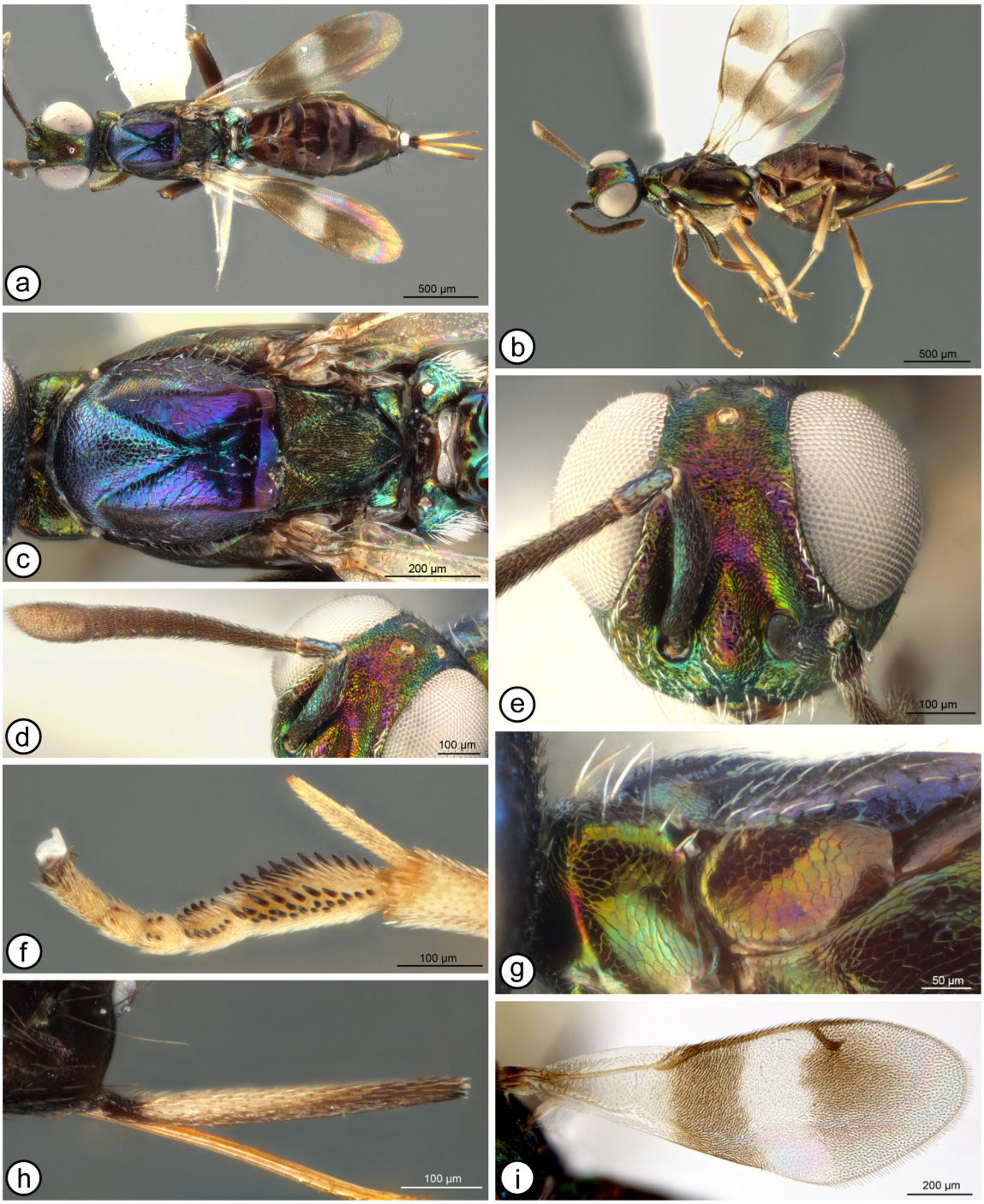

FIGURE 80. *Eupelmus orthopterae*, ♀. *a, c, h* (2014-67): **a**, dorsal habitus; **c**, mesosoma, dorsal; **h**, ovipositor sheaths. *b, d–g* (2014-66): **b**, lateral habitus; **d**, antenna; **e**, head, frontal; **f**, apex of mesotibia and mesotarsus; **g**, pronotum and prepectus, lateral. **i**, fore wing (2014-68).

Description (based on Palaearctic and Afrotropical individuals). FEMALE (habitus: Fig. 80a, b). Length = 2.0–2.8 mm. Head with face (Fig. 80e) mostly bright green or under some angles of light partly bluish, but at least with coppery to reddish-violaceous U-like or oval region extending from scrobal depression to either side or completely surrounding anterior ocellus, or sometimes with entire frontovertex between scrobal depression and posterior ocelli coppery to reddish-violaceous except narrowly green along inner orbits, and with scrobal depression and interantennal prominence usually also variably extensively coppery-green to reddish-violaceous, but vertex,

occiput and temples dark purple to violaceous or blue; with slightly lanceolate white setae on lower face and parascrobal region compared to less conspicuous hairlike setae on frontovertex. Maxillary and labial palps brown. Antenna dark with distinct purple to blue or greenish lusters on scape, pedicel and basal funiculars. Pronotum green (Fig. 80c, g) to variably extensively dark purple or violaceous laterally; admarginal setae pale (Fig. 80g). Mesoscutum (Fig. 80c) variably extensively purple or violaceous to reddish-violaceous, at least anteriorly and laterally on lateral lobes, but usually more blue to bluish-green within posterior depressed region, and usually contrasting conspicuously with mostly dark green scutellar-axillar complex, the scutellum and axillae often with variably distinct coppery luster under some angles of light; mesonotum with hairlike to slightly lanceolate white setae. Prepectus (Fig. 80g) brown or dark with variably distinct green or coppery lusters; bare. Tegula dark. Acropleuron often mostly brown or with slight reddish-violaceous lusters, but usually with some green or coppery-green luster, at least anteriorly. Propodeal callus purple or blue to greenish but much more densely and conspicuously setose with slightly lanceolate white setae than mesoscutum. Macropterous; fore wing (Fig. 80i) basal cell hyaline with white to yellowish setae except basally narrowly infuscate with dark setae; disc without linea calva, bifasciate, with broad, slightly curved hyaline band behind about apical half of marginal vein having white setae abruptly separating infuscate regions with dark setae behind parastigma and about basal half of marginal vein and behind stigmal and postmarginal veins, the apical infuscate region gradually lightened to hyaline apically but with dark setae; costal cell dorsally bare near leading margin or at most with a few setae apically associated with setae in front of parastigma, and ventrally with mostly 2 rows along length, though sometimes only 1 row mesally. Front leg dark brown except trochantellus and tibia very narrowly pale basally, and protibia variably distinctly lighter to pale longitudinally along anterior and posterior surfaces. Middle leg with femur dark or sometimes also pale apically, tibia pale basally and variably extensively apically to mostly pale except subbasally, and basal four tarsomeres pale to white except for mesotarsal pegs. Hind leg colour similar to middle leg except coxa sometimes pale apically and tibia sometimes variably extensively pale along ventral margin or mostly pale except dorsolongitudinally mesally. Gaster (Fig. 80a, b) with hairlike setae; mostly brown or with slight coppery luster except basal tergite usually with at least slight bluish to purple luster dorsobasally; ovipositor sheaths (Fig. 80h) at least extensively, abruptly pale beyond short basal dark region, though often variably darker brownish along ventral margin and gradually darker, yellow to brown apically.

Head in dorsal view with interocular distance about 0.33–0.39× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; vertex smoothly rounded into occiput, finely meshlike alutaceous to coriaceous-imbricate; frons quite strongly and conspicuously imbricate to reticulate-imbricate (Fig. 80e); scrobal depression punctate-reticulate to reticulate-rugulose (Fig. 80e); OOL: POL: LOL: MPOD = 1.0–1.2: 1.25–1.5: 1.25–1.33: 1.0, and ocellar triangle equilateral to slightly elongate rather than obviously transverse. Mesoscutum (Fig. 80c) with posterior depressed region obviously less strongly sculpture than reticulate anteromedial lobe, though usually completely smooth and shiny only posteromedially near transscutal articulation but increasingly more distinctly coriaceous to coriaceous-imbricate anteriorly and laterally. Scutellum and axillae low convex; axilla obliquely strigose to strigose-imbricate; scutellum longitudinally strigose anterior to much smoother, shiner frenal area. Acropleuron meshlike coriaceous anteriorly, much more minutely sculptured to virtually smooth mesally, and posteriorly with larger, longitudinally aligned meshlike coriaceous sculpture. Fore wing (Fig. 80i) with cc: mv: pmv: stv = 3.4–5.4: 3.4–4.0: 1.1–1.3: 1.0. Middle leg (Fig. 80f) without dark mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus and peg clearly differentiated into two rows along much of length, second tarsomere with 4–6 pegs, third tarsomere with 2 or 3 pegs, and fourth tarsomere without or with 1 peg apically on either side. Propodeum with V- to U-shaped plical depression extending to posterior margin (Fig. 80c). Gaster (Fig. 80a, b) similar in length to combined length of head and mesosoma; not atypically modified; extending to base of third valvula, the latter about 0.71–0.77× length of metatibia and about 1.1–1.2× length of mv; hypopygium extending about half or slightly more length of gaster.

MALE (habitus: Fig. 81a). Length = 1.8–2.1 mm. Head (Fig. 81a–c) extensively bright green but often with bluish luster on lower face (Fig. 81b), gena, temples and vertex (Fig. 81c), and sometimes with limited coppery luster on frons, within scrobal depression, and dorsally on interantennal prominence (Fig. 81c); frons distinctly imbricate to reticulate-imbricate and vertex much more finely alutaceous-imbricate (Fig. 81c); scrobal depression reticulate to reticulate-rugulose (Fig. 81c); setae white, lanceolate, and similarly short and evenly distributed on lower face and parascrobal region to dorsal limit of scrobal depression (Fig. 81b), but hairlike and much less conspicuous on frontovertex (Fig. 81c); gena posterior to malar sulcus without differentiated long seta (Fig. 81b),

and posterior to eye with apices of setae directed toward orbit. Antenna (Fig. 81d) with scape yellow, pedicel and flagellum brown or sometimes pedicel and basal funiculars somewhat lighter yellowish-brown; pedicel (Fig. 81d, f) about 2.3–2.7× as long as wide, ventrally without long setae (Fig. 81f); length of pedicel + flagellum about 1.2–1.3× head width; flagellum distinctly clavate (Fig. 81d) with funiculars increasing conspicuously in width to clava, the clava broadly rounded apically and ventrally with flat micropilose sensory region; anellus quadrate to slightly longer than wide, a dull, setose segment similar to subsequent funiculars (Fig. 81f); funicle with basal funiculars longer than wide but apical funiculars quadrate to slightly transverse; basal funiculars without evident regions of differentiated setae ventrally. Maxillary and labial palps yellow to white. Mesosoma comparatively bright green to bluish-green and often with slight coppery luster under some angles of light; setae hairlike, white to brownish, and comparatively inconspicuous on mesonotum, but callus with longer, much denser and more conspicuous white setae; tegula yellow, translucent. Legs with femora, tibiae and basal tarsomeres comparatively robust, the tarsomeres also distinctively elongate with metabasitarsomere longer than combined length of subsequent tarsomeres (Fig. 81g); entirely yellow except metacoxa dorsobasally, procoxa sometimes basolaterally, and metafemur apically rarely dark. Fore wing (Fig. 81e) uniformly setose, without speculum; basal cell (Fig. 81h) hyaline with white to yellowish setae; disc bifasciate (Fig. 81e), with hyaline band having white setae behind about apical half of marginal vein separating infuscate regions with dark setae behind stigmal vein and behind parastigma and about basal half of marginal vein, the region posterior to stigmal vein variably distinct and extensive but not extending to posterior or apical margins, where more hyaline but with dark setae; mv about 2.8–2.9× length of stv and subequal in length to pmv; costal cell (Fig. 81h) with at least a couple of setae apically near leading margin and usually more extensively setose for distance about equal to length of parastigma. Propodeum with complete median carina, and uniformly meshlike coriaceous to very shallowly reticulate.

Distribution. AFROTROPICAL. Noyes (2014) reported *E. orthopterae* from Senegal and South Africa. We confirm these records and saw specimens also from **Burkina Faso*** (AICF, GDPC), **Zimbabwe*** (BMNH, CNC) and (all CNC) **Congo***, **Ethiopia***, **Ivory Coast***, **Kenya***, **Mozambique***, **Nigeria***, **Tanzania***. **PALAEARCTIC**. **Israel*** (CNC, TAUI).

Biology. Solitary egg parasitoid in the oothecae of *Blepharodes soudanensis* Werner and *Calidomantis* (=*Miomantis*) *pellucida* (Saussure) (Mantoidea: Mantidae) (Cameron 1905; Risbec 1951; Hawkes 1989).

Hawkes (1989) noted that the female:male sex ratio averaged 9:1 and described aggression among conspecific males, including injuries that he deduced was from biting and correlated with greater mandibular development in males than females. Although not mentioned, males also have comparatively robust legs (Fig. 81a), the most conspicuous feature being the unusually long and robust basal tarsomere of each leg (Fig. 81g). Based on the observation of male aggression by Hawkes (1989), the leg modifications might be adaptations for male to male fighting on the oothecae of their hosts in competition for females. Male fighting is documented for species of *Podagrion* Spinola (Torymidae) (Grissell & Goodpasture 1981) that are also parasitoids in mantid egg cases. Most males (called heteromorph males) in addition to having enlarged metafemora also have enlarged basitarsi on all legs (Delvare 2005). Smith (1969) provided a lateral habitus drawing of the female of *E. orthopterae* for comparison with similar fore wing colour patterns of *Tachydromia* (Diptera: Empidae) species. He suggested that the banded wings (Fig. 81e), when folded over the body (Fig. 81a), would "break up" the insects outline and thus help protect them from predators while searching for hosts.

Remarks. *Eupelmus orthopterae* is primarily Afrotropical in distribution, known only from Israel in the Palaearctic. We did not try to borrow Afrotropical material from other institutions, resulting in our description of the male being based on only five individuals. The description therefore undoubtedly does not encompass total variation, but is sufficient to easily recognize males. Both sexes of *E. orthopterae* are readily differentiated from other *E.* (*Eupelmus*) species except likely *E. fasciatus* by their entirely setose, bifasciate fore wings (see under latter species). Except for the different described ovipositor sheath colour pattern and prepectal setal pattern, the slightly more variable colour and structure described for females of *E. orthopterae* compared to *E. fasciatus* most likely simply reflects a greater number of individuals seen.

As discussed under generic and subgeneric classification, males are atypical for the genus in lacking a fore wing speculum (Fig. 81e) and for the subgenus in lacking the row of long, apically curved pedicular setae (Fig. 81f) as well as lacking a differentiated, longer genal seta (Fig. 81b).

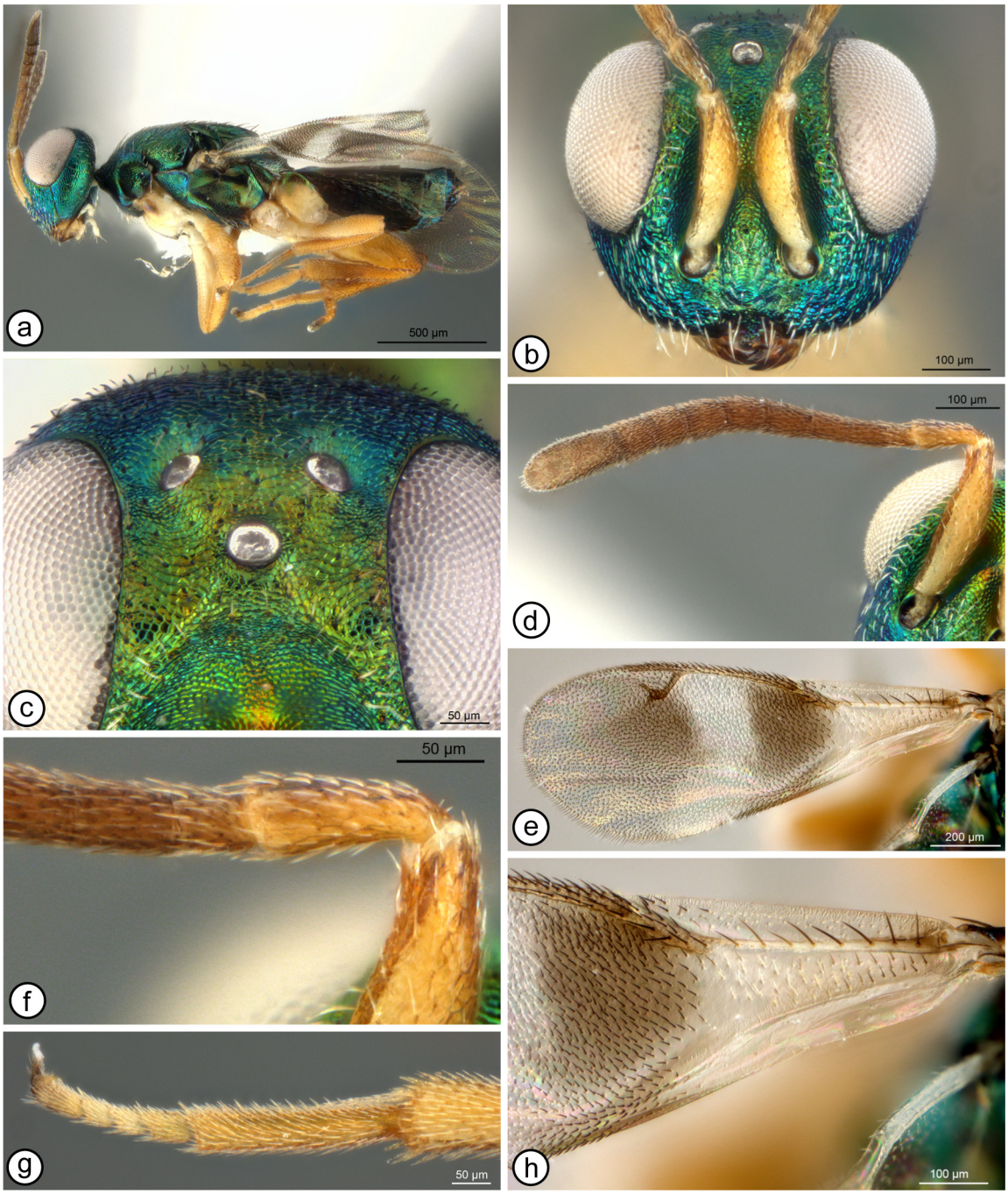

FIGURE 81. *Eupelmus orthopterae*, ♂. *a, b, e, h* (2014-69): **a**, lateral habitus; **b**, head, frontal; **e**, fore wing; **h**, fore wing base. *c–f* (2014-71): **c**, upper part of scrobal depression and frontovertex; **d**, antenna; **f**, pedicel to base of fl3. **g**, metatarsus (2014-70).

E. (*Eupelmus*) *peculiaris* Narendran n. stat.

Figs 82a–j (♀), 83a–g (♂)

Eupelmus peculiaris Narendran *in* Narendran *et al.*, 2011: 4–6. Holotype ♀, DZCU, not examined. Type data: India, Karnataka, Makutta, 26.vi.2003, Srinivas.

Description. FEMALE (habitus: Fig. 82b, d). Length = 2.0–4.9 mm. Head (Fig. 82a) dark or with only slight greenish to blue or reddish-violaceous lusters; with brown hairlike setae not contrasting with cuticle except lower parascrobal region sometimes with slightly lanceolate white setae near torulus and upper parascrobal region and/or frons usually with some white hairlike setae. Maxillary and labial palps brown. Antenna (Fig. 82c) dark except

scape yellow to yellowish-white or sometimes darker brown basally and more rarely dorsoapically, pedicel sometimes yellow apically, and flagellum with at least fl6–fl8 and fl5 partly white, but usually fl5 entirely and fl4 partly, and rarely fl3 partly white apically (extralimital specimens, see Remarks). Mesosoma (Fig. 82b, d, f) dorsally usually with more distinct metallic lusters than head, most commonly with variably extensive green to bluish lusters on mesoscutum, metanotum and propodeum (Fig. 82g) and variably extensive coppery luster on scutellum or entire scutellar-axillar complex, with pronotum dorsally, prepectus and acropleuron more commonly dark brown with less distinct coppery to violaceous lusters, and tegula dark brown or only rarely yellow (extralimital specimens, see 'Remarks'); mesoscutum (Fig. 82f) with comparatively long white hairlike setae and scutellar-axillar complex with similar brownish setae, tegula entirely covered with comparatively long white setae as on mesoscutum, and callus with similar though often somewhat sparser white setae (Fig. 82g). Macropterous; fore wing hyaline with dark setae or sometimes with slight yellowish tinge or at most with quite obscure, light brownish infuscation behind discal venation (Fig. 82e); costal cell dorsally near leading margin with setae mostly aligned in 2 rows along length, and ventrally almost completely setose; basal cell and disc entirely setose except for linea calva, though this sometimes quite narrow with apices of setae on either side overlapping. Legs, including coxae (Fig. 82b), sometimes entirely pale except for mesotarsal pegs, though procoxa, profemur and less commonly protibia variably extensively darker orange to similarly dark as mesosoma, mesofemur sometimes variably extensive darker orange to brownish subapically and rarely with posterior surface variably extensively brownish, and mesocoxa and metacoxa often more distinctly white though metacoxa sometimes dark brown basally (extralimital material, see 'Remarks'). Gaster (Fig. 82b, d) with hairlike setae; varying from mostly dark brown to bright green or bluish-green laterally and variably extensively dorsoapically; hypopygium brown, but one or more basal sternites yellowish-white to hyaline; ovipositor sheaths usually dark basally and variably extensively pale apically, not distinctly banded though extreme tip usually brown (Fig. 82i) and sheaths rarely entirely dark (see 'Remarks').

Head in dorsal view with interocular distance almost 0.4× head width; in lateral view head lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; frontovertex (Fig. 82a) distinctly meshlike reticulate to variably extensively transverse reticulate-imbricate on vertex; scrobal depression similarly sculptured as frons except for smooth scrobes (Fig. 82a), comparatively deep and abruptly angled though not carinately margined laterally; OOL: POL: LOL: MPOD = 0.6–0.7: 1.6–1.8: 1.0–1.2. Mesoscutum (Fig. 82f) distinctly meshlike reticulate except medial lobe usually more alutaceous-imbricate anteriorly and lateral lobe with mediolongitudinal band of minute coriaceous sculpture. Scutellum and axillae low convex in same plane; meshlike reticulate or axilla more diagonally reticulate-rugose posteriorly and scutellum more longitudinally reticulate to somewhat reticulate-imbricate laterad midline and frenal area meshlike reticulate. Acropleuron comparatively deeply and conspicuously meshlike reticulate anterior and posterior of minutely meshlike coriaceous or irregular sculptured mesally region, the larger reticulations delineated by distinct ridges. Fore wing (Fig. 82e) with cc: mv: pmv: stv = 3.0–3.5: 3.7–4.4: 1.3–1.5: 1.0. Middle leg (Fig. 82h) without mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus, including a complete outer row and a shorter inner row mesally, second tarsomere with 5–7 pegs, third tarsomere with 2–4 pegs, and fourth tarsomere with 1 or 2 pegs on either side, with number of pegs often one greater along posterior than anterior margin of third, fourth and sometimes second tarsomere. Propodeum (Fig. 82g) with comparatively long plical region and V-shaped plical depression having curved lateral margins so as to be more narrowly V-shaped within posterior half, sometimes with almost contiguous margins. Gaster (Fig. 82b, d) at least slightly longer than combined length of head and mesosoma; syntergum with posterolateral angles abruptly inflexed anteromesally toward base of sheaths, in dorsal view V-like protruding on either side of anal sclerite (Fig. 82j), and in lateral view with cercus almost directly below spiracle and conspicuously advanced, at about posterior third of gaster (Fig. 82i); extending over and usually concealing base of third valvula but apparent length measured in ventral view from point where third valvula concealed about 0.5–0.7× times length of metatibia or mv; hypopygium extending only to about middle of gaster.

MALE (habitus: Fig. 83a). Length = 1.0–2.5 mm. Head (Fig. 83b, c, f) dark or with bluish luster on face; frons meshlike coriaceous to variably distinctly reticulate (Fig. 83b, c); vertex uniformly curved into occiput (Fig. 83b), reticulate to reticulate-imbricate; scrobal depression usually mostly reticulate, including scrobes immediately above toruli, but variably distinctly depending on size of individual either upper portion of scrobal depression smooth and shiny or depression with divergent smooth bands extending from either side of apex of interantennal prominence toward dorsal margin of depression (Fig. 83c, f) so as to rarely differentiate small depression or pit

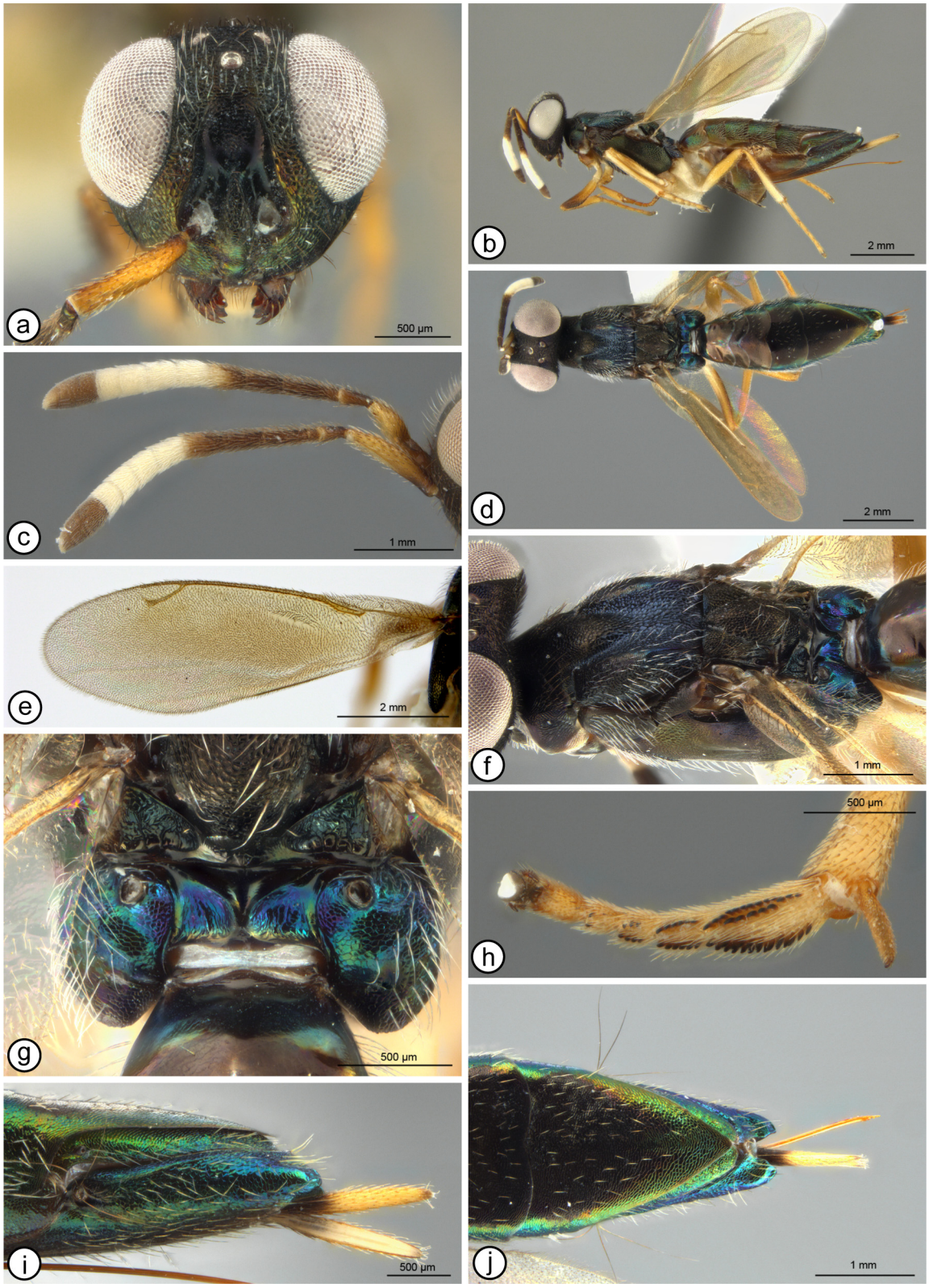

FIGURE 82. *Eupelmus peculiaris*, ♀. **a**, head, frontal (2013-24). **b**, lateral habitus (2013-20). **c**, antennae (2013-25). *d, f, g* (2013-23) **d**, dorsal habitus; **f**, mesosoma, dorsolateral; **g**, apex of scutellum to propodeum. **e**, fore wing (2013-21). **h**, apex of mesotibia and mesotarsus (2013-22). *i, j* (apex of gaster and ovipositor sheaths, 2013-22): **i**, lateral; **j**, dorsal.

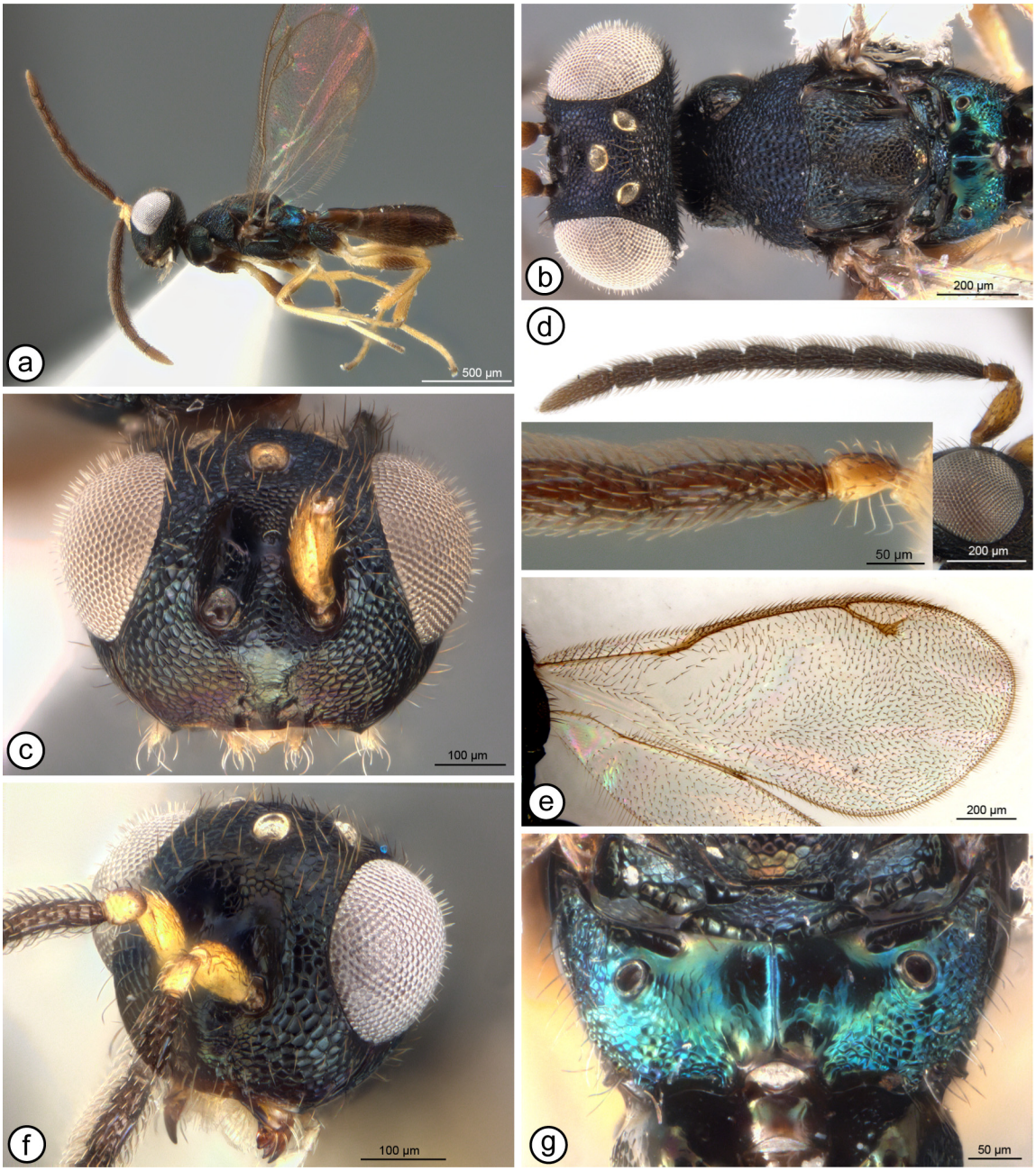

FIGURE 83. *Eupelmus peculiaris*, ♂. **a**, lateral habitus (2014-58). *b, g* (2014-62): **b**, head and mesosoma, dorsal; **g**, propodeum. **c**, head, frontal (2014-61). *d, e* (2014-60): **d**, antenna [insert: pedicel to fl3, 2014-58)]; **e**, fore wing. **f**, head, frontolateral (2014-59).

dorsad interantennal prominence; setae hairlike, dark, on lower face and gena similarly short and uniformly distributed (Fig. 83c, f). Antenna with scape usually and pedicel often yellow to orange (Fig. 83f), but pedicel sometimes and scape more rarely partly (Fig. 83d) to entirely similarly brownish as flagellum but at least not dark; pedicel (Fig. 83d insert) about 1.3–1.5× as long as wide, ventrally with 4 long, hooked setae; length of flagellum + pedicel about 2× head width; flagellum elongate-filiform (Fig. 83d) with clava subequal in length to apical two funiculars and tapered to apex; anellus very strongly transverse, discoidal, shiny, bare (Fig. 83d insert); funicle with fu1 about 3× as long as wide (Fig. 83d insert), the funiculars decreased in length apically but all distinctly longer than wide and uniformly covered with conspicuous decumbent setae, the basal funiculars lacking differentiated setae ventrally, and larger individuals often with basal funiculars in lateral view slightly curved or funiculars appearing somewhat asymmetrical with pedicel insertion and particularly more basal funiculars, slightly offset vertically, being inserted into apex of preceding funicular somewhat ventrally (Fig. 83d). Maxillary and labial palps

brown or up to apical two palpomeres pale to white. Mesosoma (Fig. 83a, b) mostly dark or with variably distinct bluish luster and sometimes with some coppery luster, particularly scutellum apically, and propodeum brighter green to bluish-green or blue (Fig. 83g); setae hairlike and dark similar to head; tegula usually dark brown, though often paler in smaller individuals. Legs sometimes entirely yellow beyond coxae but usually pro- and metafemora partly dark (Fig. 83a) and rarely metatibia darkened apically. Fore wing (Fig. 83e) with mv about 2.3–2.6× stv; costal cell dorsally near leading margin with setae over at least about apical three-quarters, and ventrally with 2 to 3 rows of setae along length; basal cell uniformly setose with brown setae; speculum closed posterobasally by setae, and usually with at least 1 or 2 setae mesally within bare area and sometimes interrupted diagonally by 1–3 rows of setae (Fig. 83e). Propodeum with complete median carina, meshlike coriaceous in smallest individuals but usually at least finely reticulate-imbricate to reticulate (Fig. 83g).

Distribution. ORIENTAL. India, **Indonesia*** (CNC), **Malaysia*** (Pahang: CNC, Sabah: CNC, MHNG, RMNH), **Taiwan*** (CNC), **Thailand*** (CNC). **PALAEARCTIC**. **Japan*** [Honshu, Aichi Prefecture, Narai, Toyota, 31.VII–7.VIII.1990, K. Yamagishi, PT, CNC Photo 2013-20 (CNC: 1♀); Honshu, Mt. Sanage-Yama, 18-24.VI.1993, T. Kanabe, Intercep., decid. for. (CNC: 1♂); Honshu, Yamaguichi Pref., Yamaguichi, Mt. Kounomine, 20.VI.2004, Y. Higashiura (ELKU: 1♀); Kyushu, Fukuoka Pref., Fukuoka, Mt. Tachibana, 5–11.VIII.1979, YPT second[ary] evergr.[een] for.[est] (CNC: 2♀, one with CNC Photo 2013-25), 29.VII–4.VIII.1979, YPT, cutover land (CNC: 1♀, 1♂), 17.VIII.1992, PT (CNC: 1♀ CNC Photo 2013-21), K. Yamagishi, 12.VI.1979, Y. Higashiura, YPT (ELKU: 1♀); Kyushu, Fukuoka Pref., Hisayama, Inunaki pass, 27.VI.1996, Y. Higashiura (ELKU: 1♀); Kyushu, Fukuoka Pref., Kasuya, Ino, 6.VII.1996, Y. Higashiura (ELKU: 1♀)], **South Korea*** [Chungnam, Daejeon-si, Wadong, 36º24.02'N 127º25.98'E, 18.V–19.VI.2006, 16.VII–8.VIII.2006, P. Tripotin, MT, for. edge, wild rose patch (CNC: 1♀ 2♂); Daejeon, Changdong, 20.V–19.VI.2007, 3MT on small forested hills, P. Tripotin, DNA extracted 25.I.2014, L. Fusu, pe.KO.1 (AICF: 1♀); Daejeon, Changdong-2-gu, 19.VI–24.VII.2007, 2MT on small forested hill, P. Tripotin (AICF: 1♂), same data except 24.IV–20.V (AICF: 4♂) and 20.V–19.VI (AICF: 4♂); Daejeon, Wadong, 20.V–19.VI.2007, tombs & gardens on small forested hills, P. Tripotin (AICF: 2♀, 18♂ of which 1♂ with DNA extracted 25.I.2014, L. Fusu, pe.KO.3m and 1♂ with DNA extracted 25.I.2014, L. Fusu, pe.KO.2m and CNC Photo 2014-60), same data except 24.IV–20.V (AICF: 13♂), 19.VI–24.VII (AICF: 8♂), and 24.VII-21.VIII (AICF: 1♂); Jeollabukdo, Buan-gun, Sannae-myeon, Yuyu, 21.IV–27.V.2007, 2MT low hill at forest edge, P. Tripotin (AICF: 1♂)].

Biology. Host unknown, but holotype collected from *Vateria indica* L. (Dipterocarpaceae) (Narendran *et. al* 2011).

Remarks. The above descriptions are based on both Palaearctic and Oriental material. We did not examine type material of *E. peculiaris*, but the females we include in the species closely match the description and illustrations given by Narendran *et al.* (2011, figs 1–3, photos I–III) except for some features that we currently interpret as intraspecific variation. Three females from Thailand differ by having entirely dark ovipositor sheaths that in lateral view project only slightly (about 0.1× length of the metatibia) beyond the apex of the syntergum. These also have a less extensively white flagellum with fl5 partly dark, and the metacoxae variably extensively dark brown in about their basal half. However, another 11 Thailand females have sheaths that project beyond the apex of the syntergum by about 0.3× the length of the metatibia and have an orangey subapical region, but with about the basal third to two-thirds and the tip being dark, and the basal dark region extending past the gastral apex. One of the females has fl5 partly dark but the other 10 have fl5 entirely white and frequently the extreme inner apical surface to about the apical half of fl4 lighter in colour. The latter ovipositor sheath and flagellar colour patterns appear to be very similar to what Narendran *et al.* (2011, photos I–III) illustrated for the holotype and similar females are encountered in Malaysia. Females from the Palaearctic region always have the sheaths completely pale beyond the gastral apex, though typically with a darkened tip, and somewhat more elongate, usually about or slightly more than 0.5× the length of the metatibia (Fig. 82i), though rarely only about 0.36×. Another two females from Taiwan differ from other Oriental and Palaearctic females by having yellowish-brown or orangey rather than brown tegulae and one of them has both fl3 and fl4 partly white apically. Additional material or molecular analyses are necessary to determine whether more than one species is represented by what we interpret as *E. peculiaris*.

In addition to their uniquely bicoloured flagellum (Fig. 82c), females of *E. peculiaris* also differ from all other Palaearctic *E.* (*Eupelmus*) in having dark hairlike setae on the lower face (Fig. 82a) rather than white and at least very slightly flattened setae. They also have an unusual propodeal structure in which the margins of the plical

depression are distinctly curved so that they are broadly convergent over about the basal half and narrowly convergent to subparallel over about the apical half (Fig. 82g) rather than uniformly, broadly V- to U-shaped. Another unusual feature is that one or more of the basal sternites are whitish to hyaline (Fig. 82b), though females of *E. bicolor* also appear to have the gaster whitish ventrobasally. Finally, Narendran *et al.* (2011) noted the derived syntergal structure (Fig. 82i, j) and suggested that, based on this, the species might deserve a higher rank, at least a subgenus level. The derived structure includes the posterolateral angles of the syntergum being conspicuously protuberant on either side of the anal sclerite (Fig. 82j) and an unusually advanced cercus positioned under the spiracle (Fig. 82i) in combination with a very large, triangular Gt5 (Fig. 82j) that occupies at least one-third the length of the gaster (Fig. 82d). Although the name selected for the species is certainly apt, we consider different modifications of the gaster and syntergum in *Eupelmus* to at most delineate species groups, as discussed by Gibson (1995: 204) for an unnamed species group that includes *E. peculiaris*.

Males are similar to females in having dark, hairlike setae on the head (Fig. 83c, f), including subequally short setae on the gena (Fig. 83f). In addition, the speculum usually is quite obviously interrupted by setae mesally (Fig. 83e), with at least one or two setae and sometimes up to three diagonal rows of setae through the region. Males also have an unusual scrobal depression sculptural pattern, though this is not always obvious in small individuals. The scrobal depression is mostly reticulate, including the scrobes immediately above the toruli, but usually the scrobes are dorsally shiner or there are two divergent shiny regions extending from either side of the interantennal prominence toward the dorsal margin of the depression. Although we do not describe relative size of the posterior ocelli for males, most males we include in *E. peculiaris* also have conspicuously large ocelli, the posterior ocelli usually quite obviously larger than, though rarely only subequal to, the OOL. The more numerous males examined from the Oriental region are more variable in colour and sculpture patterns than the Palaearctic males, the frons sometimes being coriaceous rather than reticulate and the legs sometimes being entirely yellow beyond the coxae or not only with the pro- and metafemora extensively dark (Fig. 83a) but also the metatibiae apically.

E. (*Eupelmus*) *phragmitis* Erdős

Figs 84a–j (♀), 85a–f (♂)

Eupelmus phragmitis Erdős, 1955a: 36, 45. Lectotype ♀, HNHM, designated by Thuróczy, 1992: 140, examined. Type data: Hungary, Gárdony, Velencei tó, 10.VII.1953, 'de *Phragmitibus*', Erdős.
Eupelmus (*Eupelmus*) *phragmitis*; Fusu, 2009: 316.

Description. FEMALE (habitus: Fig. 84b, c). Length 2.5−3.9 mm excluding ovipositor sheaths. Head (Fig. 84a) metallic green under most angles of light except frons medially from about level of posterior ocelli and sometimes scrobal depression in part and gena behind eye partly with coppery luster; with comparatively inconspicuous hairlike to slightly lanceolate white setae on lower face and parascrobal region to about dorsal margin of parascrobal region and even less conspicuous hairlike setae on frontovertex. Maxillary and labial palps white to brown. Antenna (Fig. 84g, h) with scape and pedicel brown with variably distinct metallic green luster; flagellum with funicle brown but clava often white (Fig. 84g) or at least somewhat lighter in colour apically (colour difference usually not obvious if clava strongly collapsed). Mesosoma (Fig. 84b, c) mostly metallic green similar to head except tegula uniformly translucent yellowish to brown; mesonotum with comparatively inconspicuous white, hairlike setae, prepectus bare, and callus with longer and more conspicuous white setae than on mesonotum, but comparatively sparse. Macropterous; fore wing (Fig. 84d) hyaline or disc with comparatively faint brownish infuscation beyond basal fold, sometimes somewhat more distinctly in broad longitudinal band from basal fold to stv (Fig. 84e) behind level of linea calva (Fig. 84d); costal cell dorsally near leading margin with row of brown setae over at least basal half and often over length, and ventrally with at least 3 rows of similar setae along length; basal cell and disc entirely setose with similar brownish setae except for linea calva. Legs rarely with all femora yellow, usually with at least posterior surface of profemur ventromesally partly dark and often one or more of metafemur, mesofemur and tibiae partly dark. Gaster (Fig. 84b, c) with hairlike setae; partly brown to reddish-coppery dorsally, but metallic green laterally and variably extensively posterodorsally; ovipositor sheaths mostly pale, the extreme base and apex darker.

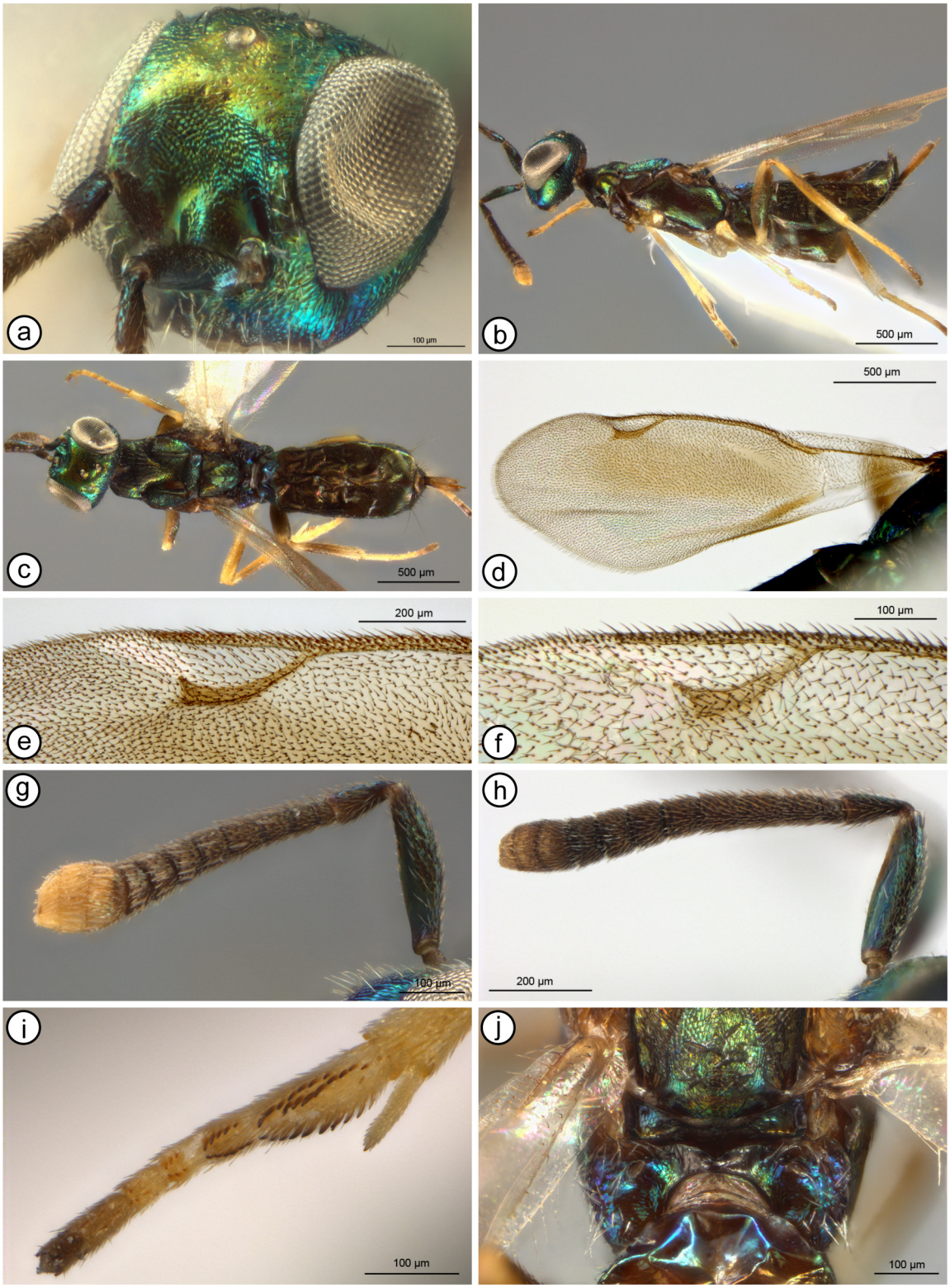

FIGURE 84. *Eupelmus phragmitis*, ♀. *a–c, f, g, i, j* (2010-36): **a**, head, frontolateral; **b**, lateral habitus; **c**, dorsal habitus; **f**, postmarginal and stigmal veins; **g**, antenna; **i**, apex of mesotibia and mesotarsus; **j**, apex of scutellum to propodeum. *d, e, h* (2013-49): **d**, fore wing; **e**, postmarginal and stigmal veins; **h**, antenna.

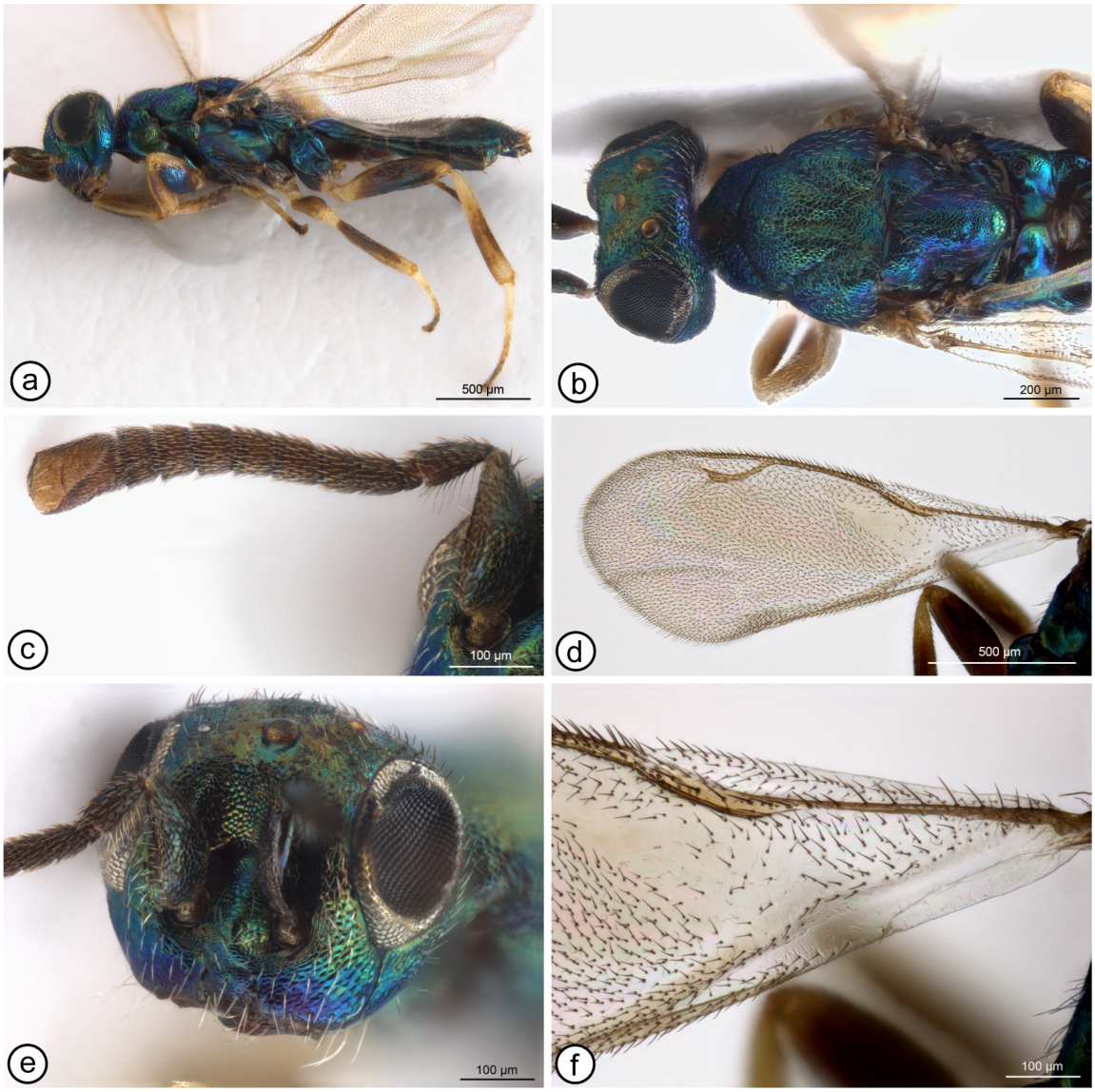

FIGURE 85. *Eupelmus phragmitis*, ♂. *a, b* (2013-122): **a**, lateral habitus; **b**, head and mesosoma, dorsal. *c–f* (2013-121): **c**, antenna, inner view; **d**, fore wing; **e**, head, frontolateral; **f**, fore wing base.

Head in dorsal view with interocular distance about 0.43–0.48× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; frontovertex coriaceous or cells only slightly depressed so as to appear slightly roughened, but scrobal depression distinctly reticulate (Fig. 84a); OOL: POL: LOL: MPOD = 1.0–1.1: 2.2–2.4: 1.4–1.5: 1.0. Antenna (Fig. 84g, h) with scape about 3.0–3.6× as long as maximum breadth; fu1 very slightly wider than long to slightly but distinctly longer than wide, fu2−fu4 longer than wide, fu5−fu8 shorter and slightly widened apically such that at least fu7 and fu8 slightly transverse, and clava comparatively broadly subcircular, obliquely truncate apically and at most about 1.75× as long as wide. Mesoscutum meshlike reticulate except lateral lobe with mediolongitudinal band of smaller, meshlike coriaceous sculpture. Scutellum and axillae low convex in same plane; axillae meshlike reticulate to reticulate-imbricate laterally and scutellum reticulate-imbricate laterad more meshlike coriaceous-reticulate midline anterior to much larger and more uniformly meshlike sculpture of frenal area. Acropleuron more-or-less isodiametric meshlike anteriorly and posteriorly and much more minutely sculptured to almost smooth mesally, the cells anteriorly and posteriorly defined by only very slightly raised ridges. Fore wing (Fig. 84d) with cc: mv: pmv: stv = 3.0–4.3: 2.4–2.8: 1.2–1.5: 1.0; stv usually curved into stigma from about basal third to half (Fig. 84e), but if appearing quite straight over basal two-thirds then only at about an angle of 30° relative to pmv (Fig. 84f). Middle leg (Fig. 84i) without mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus, the pegs distinctly

differentiated into two rows; second tarsomere with 5 or 6 pegs, third tarsomere with 3 or 4 pegs, and fourth tarsomere without pegs. Propodeum with broadly V-shaped plical depression extending at most half-length of plical region (Fig. 84j). Gaster (Fig. 84b, c) similar in length to combined length of head and mesosoma; syntergum with posteroventral angles abruptly angled inward between anal sclerite and ovipositor sheaths so in lateral view syntergum posteriorly usually obliquely Ω-like over sheaths and sometimes almost flat over sheaths; gaster extending over base of third valvula with constriction between second valvifer and third valvula not evident, but visible sheath length 0.35–0.5× length of metatibia and 0.52–0.66× length of mv (typically much less if measured from posterior margin of syntergum); hypopygium extending somewhat over half length of gaster.

MALE (habitus: Fig. 85a). Length = 2.1–3.0 mm. Head (Fig. 85a, b, e) mostly bluish-green to bronze-green except sometimes vertex and occiput more distinctly blue (Fig. 85b), face (Fig. 85e) usually with at least slight coppery or reddish-coppery luster mesally from about level of posterior ocelli ventrally, in part or entirely to ventral level of toruli, and lower face narrowly to broadly blue to violet along oral margin; frons meshlike coriaceous to finely coriaceous-reticulate (Fig. 85e); vertex uniformly curved into occiput, similarly sculptured as frons; scrobal depression meshlike reticulate (Fig. 85e) except scrobe smooth and shiny immediately above torulus; with setae hairlike to very slightly lanceolate, whitish; lower face toward malar sulcus sometimes with longer, but evenly distributed, straight to only slightly, evenly curved setae (Fig. 85e); gena posterior to malar sulcus with 1 longer seta differentiated from other variably long setae, and posterior to eye with apices of setae directed toward orbit. Antenna (Fig. 85c) with scape entirely brown with slight metallic green luster on inner surface or at most with only extreme base pale and outer, ventral, longitudinal sensory region lighter brown to yellowish, and clava pale yellowish-brown or at least slightly paler than funicle (difference not obvious if clava collapsed); pedicel about 2.2× as long as wide, ventrally with 6–9 long, straight to slightly sinuate or hooked setae; length of pedicel + flagellum subequal in length to head width; flagellum distinctly clavate with funiculars increasing conspicuously in width to clava, the clava broadly rounded or truncate apically and ventrally with flat or collapsed micropilose sensory region; anellus transverse, about half as long as fu1 but a distinct, dull, setose segment similar to subsequent funiculars; funicle with basal funiculars transverse to slightly longer than wide but apical funiculars distinctly transverse; basal funiculars without evident regions of differentiated setae ventrally. Maxillary and labial palps yellowish-brown. Mesosoma (Fig. 85a, b) usually mostly bluish-green to blue with at least medial lobe of mesoscutum more greenish-blue with slight coppery luster, and sometimes with limited purple luster on scutellar-complex and posteriorly on mesoscutal lateral lobe; setae hairlike, mostly pale brown to brown except more whitish on mesoscutum and propodeal callus; tegula pale, uniformly brownish-yellow to translucent yellow and then more opaque yellow narrowly along inner margin. Front leg pale except posterior surface of femur extensively dark, dorsal and ventral or posterodorsal and anteroventral surfaces of tibia variably extensively dark, and tarsomeres increasingly darker apically or apical two tarsomeres more obviously dark than basal tarsomeres. Middle leg dark except trochanter, trochantellus, anterior and dorsal surface of femur longitudinally, anterior surface of tibia longitudinally at least in part apically, tibial spur, and basal three tarsomeres pale. Hind leg with trochanter, trochantellus, femur apically, tibia at least basally and apically and sometimes more extensively, tibial spurs, and basal three tarsomeres pale. Fore wing (Fig. 85d) with mv about 2.0–2.2× length of stv; stv projecting at about 30° angle relative to pmv, with length about 1.9–2.2× distance between posterior margin of stigma and posterior margin of pmv; costal cell (Fig. 85f) dorsally near leading margin with single row of dark setae over at least apical third to two-thirds or at most with a couple offset setae, and ventrally with dark setae aligned into 2 or 3 rows; basal cell (Fig. 85f) uniformly setose with brownish setae; disc sometimes hyaline but usually with slight yellowish to brownish tinge at least behind venation and comparatively narrow and short speculum sometimes appearing almost like a linea calva closed posterobasally by at least a few setae in row on cubital fold and in larger specimens separated from cubital fold by about 3 rows of setae. Propodeum (Fig. 85b) with complete median carina, and panels uniformly, finely, meshlike coriaceous.

Distribution. *Western Palaearctic*: Czech Republic, **Greece*** [Kerkini Lake N. Park nr Kerkini, Pumping station site, MT, G. Ramel, 9-15 (2♀), 16-22 (1♂), 23-29 (1♀, 1♂).V.2007 (all AICF)], Hungary, **Israel*** [En Pelugot, 16.IV.1973, D. Furth (1♀); Neot Hakikar, 20.V.1974, A. Freidberg (1♀) (both TAUI)], Romania, **Ukraine*** (all SIZK) [Chernomorsky nature reserve, Rybal'che, from stems of *Phragmites communis* with *Tetramesa phragmitis*, 16.V.1971, Zerova (2♀); Chernomorsky nature reserve, Soleno oz. [ero], *Schoenoplectus mucronatus*, collected 19.V.1971, reared 10.VI.1971, Zerova (3♀); Donetsk Oblast, Homutovskaya steppe, reed, collected 23.IV, reared 19.V.1975, Zerova (7♀); Donetsk Oblast, Homutovskaya steppe, from stems of *Phragmites*

communis, 29.V.66 (4♀); Kherson Oblast, Chernomorsky nature reserve, Ivano-rybal'ch. plot, reed, from *Tetramesa phragmitis*, 16.V.71, M. Zerova (1♀). *Far eastern Palaearctic*: **South Korea*** [Jeollabukdo, Buan-gun, Dongjin-myeon, Dongjeon-li, Dongjing estuary, 2MT on mud flat, 21.IV–27.V.2007, P. Tripotin (AICF: 2♀, 1♂)].

Although the specimens from South Korea are markedly disjunct from the European records, they were collected in an estuary on a mud flat, and *Phragmitis australis* (Cav.) occurs in South Korea (Holm *et al*. 1991). Because *P. australis* has an extensive world distribution it is quite possible that *E. phragmitis* is also more widely distributed than presently known.

Biology. A parasitoid of *Tetramesa phragmitis* (Erdős) (Hymenoptera: Eurytomidae) associated with *Phragmites australis* (Poaceae) (Erdős 1960, Tudor & Roman 1973, Fusu 2009). Three females from Ukraine card-mounted on a single pin are labelled as reared from the plant *Schoenoplectus mucronatus* (L.) (Cyperaceae), which is anomalous.

Remarks. *Eupelmus phragmitis* is one of three species assigned to the *stramineipes* species group, as discussed under *E. stramineipes*. Within the group, females of *E. levis* have a unique fore wing setal pattern, whereas females of *E. stramineipes* have a unique, bicoloured tegular colour pattern. Some *E. phragmitis* females are easily identified because the clava is white (Fig. 84g) or at least distinctly lighter in colour than the flagellum, but some have the clava almost the same colour as the flagellum, particularly specimens with the clava strongly collapsed (Fig. 84h). Many females are also distinguished by a distinctively long stigmal vein that curves to the stigma from about mid-length of the vein or before (Fig. 84e). However, even if the stigmal vein is quite straight with the stigma reflexed at an angle within about its apical third (Fig. 84f) similar to that of *E. levis* (Fig. 55f) and *E. stramineipes* (Fig. 106d), the vein is at a more acute angle, only about 30° (Fig. 84e, f) compared to the greater angle, about 40–45° (Figs 55f, 106d), for *E. levis* and *E. stramineipes*. As remarked under *E. levis*, there also appears to be some difference in relative length of the marginal vein *versus* the stigmal vein in females of the three species, though the ratio is continuous between *E. phragmitis* and *E. stramineipes*, being about 2.8–3.3× in *E. phragmitis* and 3.3–3.4× in *E. stramineipes*. Similarly, colour, shape, and relative measurements of the clava appear to essentially form a continuum in the two species though relative lengths of the funiculars are slightly longer for *E. stramineipes* (Fig. 106i) than for *E. phragmitis* (Fig. 84g, h) females.

Males of *E. levis* are unknown. Although we have seen only a few *E. phragmitis* and *E. stramineipes* males they appear to differ at least in the features listed in the key. Additionally, *E. stramineipes* males also have the lower face more-or-less uniformly greenish to bluish-green or somewhat more distinctly blue laterally under some angles of light (Fig. 107c), whereas *E. phragmitis* sometimes has the lower face quite obviously bicoloured, narrowly to broadly blue to violet along the oral margin (Fig. 85e). Males of *E. stramineipes* also have hyaline fore wings with the speculum not atypically narrowed (Fig. 107d) and the dorsal setae of the costal cell in two rows (Fig. 107d insert), whereas the fore wings of *E. phragmitis* males frequently have a slight yellowish to brownish tinge, at least behind the venation, in addition to a narrow speculum (Fig. 85d, f) and the dorsal setae of the costal cell in only one distinct row with at most a couple of setae offset (Fig. 85f). Finally, *E. stramineipes* males have about the basal three funiculars slightly longer than wide (Fig. 107f), whereas males of *E. phragmitis* have the basal funiculars somewhat more transverse, though sometimes fu1 and fu2 are longer than wide (Fig. 85c). Additional males of the two species are needed to more confidently determine limits of variation in these features for the two species.

E. (*Eupelmus*) *pini* Taylor

Figs 86a–j (♀), 87a–g (♂)

Eupelmus pini Taylor, 1927: 205−207. Lectotype ♀, USNM, designated by Gibson 2011: 71, examined by GG. Type data: Roslindale, Boston, Mass, R.L. Taylor, ex. *Pissodes strobi* [in terminal shoots of white pine taken October, 1926].

Eupelmus Aloysii Russo, 1938: 229−230. Syntypes, 5♀, depository unknown. Type data: Italy, Salerno Prov., Pisciotta, reared from *Phloeotribus scarabaeoides* (Bern.). Synonymy by Gibson, 2011: 72.

Eupelmus sculpturatus Nikol'skaya, 1952: 501–502 (Russian), 1963: 515 (English). Syntypes, ♀, ZIN, 1♀ examined. Type data: Southern part of European part of USSR, Western Europe. Syntype examined label: Кам. Степь [Kamennaya Steppe], на on *Scolytus*, 24.VII.49, [illegible signature] / *Eupelmus sculpturatus* sp. n. M. Nikolskaja det. / Holotypus ♀ [recent red label]. Synonymy with *E. aloysii* by Kalina, 1988: 3. Synonymy with *E. pini* by Gibson, 2011: 72.

Eupelmus suecicus Hedqvist, 1963: 137−138. Holotype ♀, BMNH, examined by GG. Type data: Sweden, Uppland, Lovön, reared from *Hylesinus toranio* (Coleoptera: Scolytidae). Synonymy with *E. aloysii* by Bouček, 1968: 237. Synonymy with *E. pini* by Gibson, 2011: 72.

Eupelmus carinifrons Yang, 1996: 215−216, 326. Holotype ♀, NWCF, not examined (1♀ paratype examined by GG). Type data: China, Beijing, Yunnan, Henan; *ex. Cryphalus* sp. on *Pinus bungeana*, *Tomicus piniperda* on *Pinus yunnanensis* and *Phloeosinus aubei* on *Platycladus orientalis*. Synonymy with *E. pini* by Gibson (2011: 72).

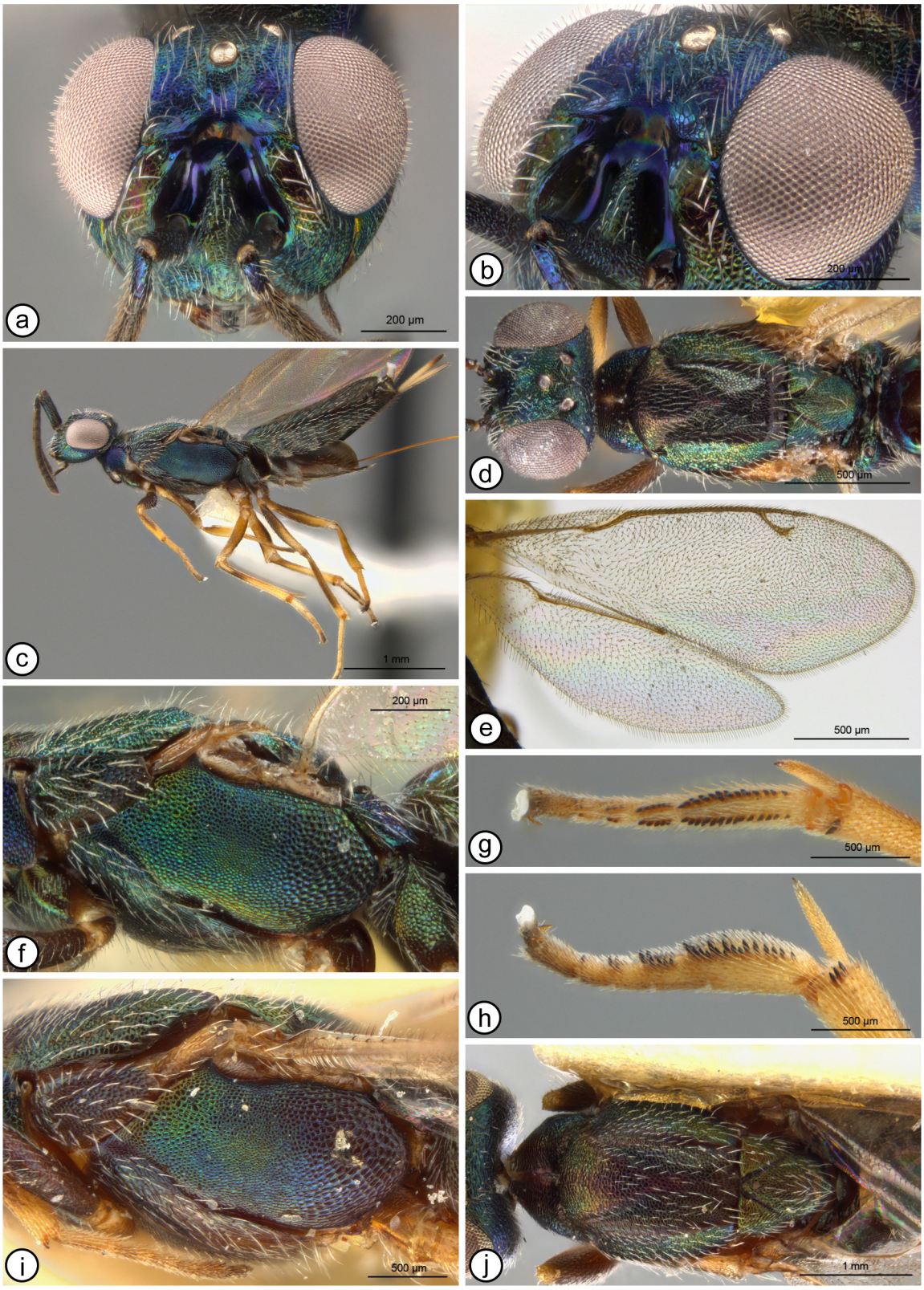

FIGURE 86. *Eupelmus pini*, ♀. *a–c* (2012-57): **a**, head, frontal; **b**, scrobal depression and frontovertex, frontolateral; **c**, lateral habitus. *d–f* (*E. carinifrons* paratype): **d**, head and mesosoma, dorsal; **e**, wings; **f**, mesosoma, lateral. *g, h* (apex of mesotibia and mesotarsus, 2013-19): **g**, ventral; **h**, lateral. *i, j* (*E. sculpturatus* syntype): **i**, mesothorax, lateral; **j**, mesosoma, dorsal.

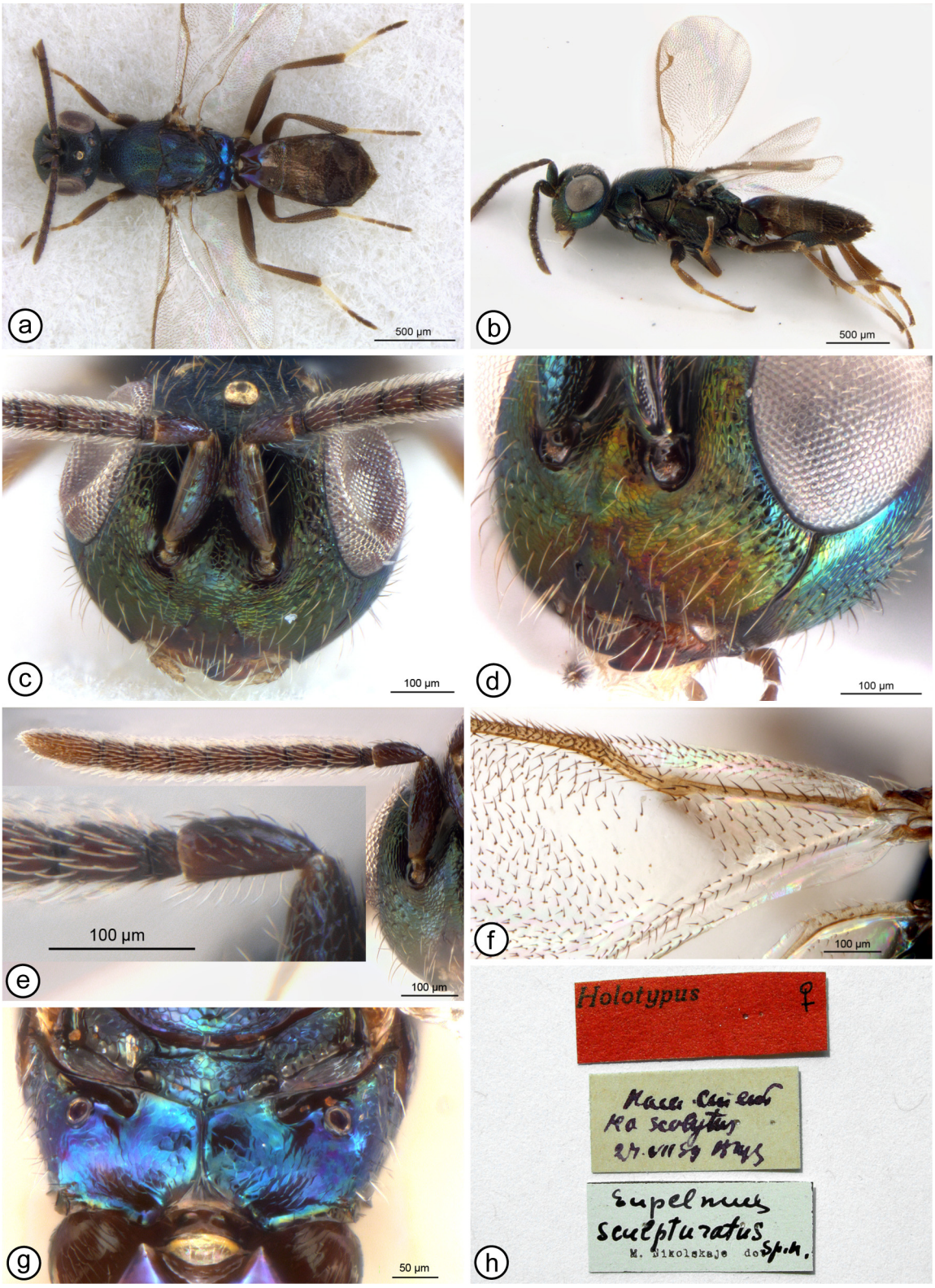

FIGURE 87. *Eupelmus pini*, ♂. *a, c, e, g* (2013-144): **a** dorsal habitus; **c**, head, frontal; **e**, antenna, inner view [insert: pedicel to base of fl3]; **g**, propodeum. *b*, *d*, *f* (2014-57): **b**, lateral habitus; **d**, lower face; **f**, fore wing base. **h**, labels of syntype of *E. sculpturatus* examined.

Description. FEMALE (habitus: Fig. 86c). Length = 1.6–4.3 mm. Head of smaller specimens brown with limited greenish luster mostly within scrobal depression, but larger specimens (Fig. 86a, b, d) variably extensively metallic green to greenish-blue or sometimes with some blue or purplish lusters, with interantennal and/or parascrobal

regions sometimes with coppery or somewhat reddish lusters under some angles of light, and frontovertex usually partly dark mesally (often with dark band extending from posterior ocelli on either side of anterior ocellus toward scrobal depression and sometimes with narrow dark band between posterior ocellus and inner orbit); with slightly lanceolate white setae on lower face and parascrobal region dorsally to undulation near dorsal limit of scrobal depression compared to less conspicuous white to dark hairlike setae on frontovertex. Maxillary and labial palps brown. Antenna dark except scape and pedicel sometimes with variably distinct metallic lusters. Mesosoma (Fig. 86c, d, f, i, j) with tegula usually noticeably bicoloured, yellowish along inner margin and with apical and/or lateral margins variably extensively brown (Fig. 86d), though sometimes entirely brown in smaller specimens, otherwise similar in colour to head, mostly brown (smaller specimens) or with variably distinct green to blue or purple lusters, the mesoscutum medially usually variably extensively reddish-brown to purple or violaceous and scutellar-axillar complex green or variably extensively coppery to violaceous under some angles of light, and acropleuron usually quite distinctly green at least anteriorly or green with coppery luster under some angles of light, though sometimes non-metallic brown or more blue to purple posteriorly; mesonotum with hairlike to slightly lanceolate white setae, prepectus entirely covered with slightly lanceolate white setae, and callus with comparatively sparse white setae similar to prepectus (Fig. 86f). Macropterous; fore wing (Fig. 86e) hyaline with dark setae; costal cell dorsally near leading margin with 1 to several rows of setae along length depending on size of specimen, and ventrally with at least 2 rows of setae; basal cell and disc entirely setose, without linea calva. Front leg with femur brown except trochantellus and extreme apex pale, tibia varying from mostly brown except basally and apically to mostly pale except dorsal, ventral or posterior surfaces variably extensively brown, and tarsus with at least apical tarsomere brown, otherwise pale to brownish-yellow apically. Middle leg beyond coxa varying from mostly pale except anterior and posterior margins of femur and short subbasal region on tibia brown and mesotibial apical pegs and mesotarsal pegs dark, to mostly brown except knee, tibia apically and basal three or four tarsomeres pale. Hind leg sometimes almost entirely brown except for tarsus, but at least larger specimens with trochantellus, up to about dorsoapical half of femur, tibia basally, apically and ventrally, and tarsus pale except for apical one or two tarsomeres. Gaster (Fig. 86c) with hairlike setae; mostly brown with slight coppery luster or greenish luster laterally under some angles of light except basal tergite anteriorly more commonly with more distinct green to blue lusters; ovipositor sheaths distinctly banded with medial pale region at least as long as apical dark region and usually much longer than either basal or apical dark regions.

Head in dorsal view with interocular distance about 0.4–0.45× head width; in lateral view lenticular, the face almost evenly convex, but in all except smallest specimens with quite distinct, rounded to abruptly margined undulation (Fig. 86a, b) across comparatively broad upper parascrobal region near dorsal level of scrobal depression; frontovertex variably sculptured, almost entirely meshlike coriaceous in smaller specimens to extensively reticulate or reticulate-imbricate except coriaceous medially below anterior ocellus and above transverse undulation (Fig. 86a, b), and vertex usually more coriaceous-alutaceous to transversely imbricate-strigose in larger specimens; scrobal depression smooth and shiny, comparatively deep and abruptly angled though not carinately margined laterally (Fig. 86a, b); OOL: POL: LOL: MPOD = 0.6−1.1: 2.1−3.2: 1.3−1.7: 1.0. Mesoscutum (Fig. 86d, j) meshlike reticulate except medial lobe usually more alutaceous-reticulate to alutaceous anteriorly and lateral lobe with mediolongitudinal band of minute coriaceous sculpture. Scutellum and axillae low convex in same plane; meshlike reticulate or axilla obliquely reticulate-imbricate posteriorly and scutellum reticulate-imbricate laterad midline and frenal area meshlike coriaceous-reticulate. Acropleuron (Fig. 86f, i) comparatively coarsely reticulate even in smaller specimens and more-or-less distinctly reticulate-alveolate anterior and posterior of mesal microsculptured region in larger individuals. Fore wing (Fig. 86e) with cc: mv: pmv: stv = 4.0−4.7: 3.6−4.4: 1.4−1.5: 1.0. Middle leg (Fig. 86g, h) with row of 2–5 mesotibial pegs; mesotarsus with symmetrical peg pattern on basitarsus, the pegs differing in length so as to form irregular or serrate row (Fig. 86h) but not distinctly differentiated into two rows along either side (Fig. 86g), second tarsomere 4−7 pegs, third tarsomere with 2–4 pegs, and fourth tarsomere with 0–2 pegs apically on either side. Propodeum with broadly U-shaped plical depression extending to posterior margin (Fig. 86d). Gaster (Fig. 86c) similar in length to combined length of head and mesosoma; not atypically modified; extending to or slightly over base of third valvula, the latter about 0.7−0.8× length of metatibia and 0.7−0.9× length of mv; hypopygium extending about three-quarters length of gaster.

MALE (habitus: Fig. 87a, b). Length = 2.2–2.5 mm. Head dark brown (Fig. 87a, b) with variably distinct metallic bluish-green or coppery luster under some angles of light (Fig. 87c, d); frons coriaceous; vertex uniformly curved into occiput, transversely imbricate; scrobal depression mostly smooth and shiny except along extreme

margins; setae hairlike, very pale brownish; lower face with longer setae toward malar sulcus, but evenly distributed and straight to only slightly, evenly curved (Fig. 87c, d); gena posterior to malar sulcus with several long, curved setae of similar length, lacking one conspicuously differentiated seta, and posterior to eye with apices of setae directed toward orbit. Antenna (Fig. 87e) with scape entirely dark; pedicel about 2.5× as long as wide, ventrally with row of 7–10 long white setae of which only most basal are somewhat curved apically (Fig. 87e insert); length of pedicel + flagellum about 1.3× head width; flagellum comparatively gracile-subfiliform to inconspicuously clavate (Fig. 87e), the flagellomeres increasing very slightly in width apically to similarly wide fusiform clava about 2.7–2.8× longer than wide and very slightly longer than apical two funiculars; anellus transverse, but a distinct segment about 0.25–0.3× length of fu1 and obviously setose with more than one row of setae (Fig. 87e insert); funicle with fu1 about 0.7–0.9× length of pedicel and about 1.6–1.8× as long as wide, but apical funicular, though only slightly shorter than fu1, at most only about 1.1–1.2× as long as wide, and funiculars with conspicuous, curved setae projecting out at about 45° angle for distance equal to at least about one-third funicular width; basal funiculars ventrally without evident region of differentiated setae. Maxillary and labial palps brown. Mesosoma (Fig. 87a, b) similar in colour to head except mesonotum with more distinctly bluish-green luster, the axillae somewhat more distinctly blue and propodeum much brighter blue to purple; setae hairlike, pale brownish on pronotum and mesonotum and white on propodeal callus; tegula dark. Front leg brown except knee and apex and anterior and posterior surfaces of tibia longitudinally pale; tarsomeres similarly pale or somewhat more brownish-yellow. Middle leg brown with knee slightly lighter in colour and tibial spur and basal two tarsomeres white. Hind leg brown with only tibial spurs and basitarsus white or second tarsomere brownish-white. Fore wing (Fig. 87b) with mv about 2.9× length of stv; costal cell (Fig. 87f) dorsally near leading margin with numerous dark setae in row over entire length plus second row over at least mesal two-thirds, and ventrally with dark setae in 2 or 3 rows; basal cell (Fig. 87f) uniformly setose with dark setae; speculum comparatively reduced, separated from parastigma by about 4 rows of setae and closed posterobasally by 2 or 3 rows setae on cubital fold (Fig. 87f). Propodeum with complete median carina, quite shiny, very shallowly meshlike reticulate to posteriorly reticulate and more finely meshlike coriaceous anteriorly.

Distribution. NEARCTIC. Canada, USA Gibson (2011, map 13). **PALAEARCTIC.** Noyes (2014) listed 17 countries throughout the Palaearctic, including China and South Korea in the far eastern Palaearctic. Additionally, we saw females from **Germany*** (BMNH, ZSMC), **Japan*** (AICF, ELKU), **Turkey*** (MKUI) and Russia (**Primorskii Kray***: BMNH).

The presence of *E. pini* in China, Japan and South Korea in the far eastern Palaearctic as well as Western Europe and North America makes *E. pini* the most widespread species of *E*. (*Eupelmus*) known. Although possibly a naturally occurring Holarctic species, presence in North America more likely results from an accidental introduction because the earliest collection record listed is 1926 (type specimens).

Biology. Fusu (2009) and Gibson (2011) summarized known hosts, which Noyes (2014) listed as *Anoplophora chinensis* (Förster) (Coleoptera: Cerambycidae), *Pissodes strobi* (Peck) (Coleoptera: Curculionidae) and several species of Scolytidae (Coleoptera) associated with Cupressaceae, Oleaceae, Pinaceae and Rosaceae. We also saw a female (BMNH) labelled with "Anobiidae". The female syntype of *E. sculpturatus* we examined was reared from a species of *Scolytus* Geoffroy, although this is not mentioned in the original description. All previous records indicate *E. pini* as a primary parasitoid, but we saw a single female (CNC) labelled as ex. *Coeloides sordidator* (Ratzeburg)* (Braconidae) cocoons from *Pissodes castaneus* (De Geer)* on *Pinus sylvestris* L.*. One male is labelled as reared from "*P. maritima*", which probably refers to *Pinus pinaster* Aiton, the maritime pine. Another two new plant associates inidcated are *Alnus glutinosa* (L.)* (BMNH) and "ex. *Corylus* twigs"* (NHRS) (Betulaceae).

Remarks. We obtained on loan as part of our study a single female labelled as the holotype of *E. sculpturatus*. The specimen is likely from Kamennaya Steppe (Preserve in Voronezh Oblast, Russia) (Fig. 87h). Nikol'skaya (1952) gave the length of the female as 3.7–4.0 mm and distribution as the southern part of European part of USSR and Western Europe. Consequently, the original description was based on at least two females and because a holotype was not selected the specimen examined must be treated as a syntype. The syntype examined confirmed Kalina's (1988) synonymy of *E. sculpturatus* under *E. aloysii* and Gibson's (2011) subsequent synonymy under *E. pini*. Although described from widely different localities, the mesosoma is virtually identical in the type specimens of *E. carinifrons* (Fig. 86f), *E. sculpturatus* (Fig. 86i) and *E. pini* (Gibson 2011, fig. 20) in both dorsal and lateral views. The types also have the characteristic undulation on the upper parascrobal region (Fig. 86a, b) as well as other characteristic features of the species such as absence of a linea calva (Fig. 86e).

The female description above is based on Palaearctic specimens only, but even so specimens vary considerably in size, which likely is a consequence of parasitizing different sized hosts. Differences in colour and sculpture also appear to be at least partly correlated with body size. Smaller females are typically more extensively brown, including the legs and sometimes the ovipositor sheaths, with the head and mesosoma lacking distinct metallic luster and with finer sculpture. Regardless, females are readily differentiated from other Palaearctic species by the presence of hyaline fore wings without a speculum. Except for one of the smallest observed females, they also have quite an obvious rounded to abruptly margined undulation across the upper parascrobal region (Fig. 86a, b), and even small females have the acropleuron more coarsely sculptured compared to most other species (Fig. 86f, i). As noted by Fusu (2009), specimens are only quite rarely collected though the species is widely distributed. Females usually share a bicoloured tegula with the much more commonly collected *E. microzonus*.

Fusu (2009) described a single male from Romania that was associated with females through rearing as *E. aloysii*, and this was subsequently redescribed as the male of *E. pini* by Gibson (2011). However, material from Turkey (MKUI) obtained during this study, with sexes associated through collecting data, showed that the male was missassociated and it is a male of *E. vindex*. This was further confirmed (Al khatib, pers. comm.) through COI sequence of a similar male from Romania (DNA voucher 10543-LF.pi.RO 01; AICF). Our description of the male of *E. pini* is based on two males, one (ZSMC) from France (Corsica, "Forêt de Zonza (3.X.67), 14.V.68, *P.* [*Pinus*] *maritima*, Aste U. Zweige") and one (AICF) from South Korea ("Chungnam, Daejeon, Wadong, tombs & gardens on small forested hills, 3MT, 24.IV-20.V.2007, P. Tripotin rec."). As discussed in 'Methods', the described males uniquely have a flagellum that combines a setose anellus (Fig. 87e insert), which is otherwise characteristic of a clavate flagellum, with the flagellar structure that more resembles a filiform flagellum (Fig. 87e). The two males are not associated with females by rearing, but we initially concluded they were males of *E. pini* based on their unusually extensively setose costal cell and cubital fold (Fig. 87f), the presumed host tree the Corsican male was reared from, and because *E. pini* is the only species that occurs in both the western and far eastern Palaearctic with otherwise unassociated males. This was confirmed subsequently because the male from South Korea was associated through its COI sequence (voucher ug.KO 47) with a female from South Korea (CNCHYM 015211) and one from USA (CNCHYM 015206) (unpublished data). Males likely are more variable than indicated by the two described above and it remains to be determined whether all the features used in the key are truly differential.

E. (*Eupelmus*) *pistaciae* Al khatib

Figs 88a–h (♀), 89a–f (♂)

Eupelmus (*Eupelmus*) *pistaciae* Al khatib *in* Al khatib *et al.*, 2015: 144. Holotype ♀, MHNG, examined. Type data: France, Hérault**,** Cazevieille, 230 m a.s.l., 43.75222°N 03.77000°E, 28.x.2011, G[érard] Delvare, ex. *Megastigmus pistaciae* on *Pistacia terebinthus*, emerged [15].v.2012 (GDEL4027/10507).

Eupelmus (*Eupelmus*) *pistaciae* Al khatib *in* Al khatib *et al.*, 2014: 847–850 (unavailable name; original description, keyed, illustrated).

Description. FEMALE (habitus: Fig. 88a, b). Length = 2.9–4.5 mm. Head (Fig. 88c–e) green with at least some coppery to reddish-coppery lusters within scrobal depression and on parascrobal region and under different angles of light often much more extensively coppery on interantennal prominence, lower face at least laterally, and frontovertex (Fig. 88d, e), particularly on frons below level of anterior ocellus (Fig. 88d); with slightly lanceolate white setae on lower face and parascrobal region to level of dorsal margin of scrobal depression compared to more hairlike setae on frontovertex. Maxillary and labial palps brown or at most apical maxillary palpomere yellowish-brown. Antenna with scape entirely orange to mostly dark with metallic luster except usually at least extreme base of at least inner surface lighter orange to orangey-brown (Fig. 88a); flagellum dark. Mesosoma (Fig. 88b, f) varying from mostly coppery to reddish-coppery with only limited greenish lusters along margins of sclerites to much more extensively green, but at least pronotum laterally with at least slight coppery luster (Fig. 88e, f) and callus partly to entirely coppery to reddish-coppery (Fig. 88f), and often prepectus at least mesally, tegula, and mesonotum and acropleuron variably extensively and distinctly coppery to reddish-coppery. Pronotum with admarginal setae pale (Fig. 88f); mesonotum and prepectus with similar hairlike to slightly lanceolate white setae, the prepectus extensively setose (Fig. 88f); callus with somewhat longer setae but not obscuring cuticle (Fig. 88f). Macropterous; fore wing (Fig. 88g) hyaline with yellowish to brown setae; costal cell dorsally near leading margin with row of setae over about apical one-third to three-quarters, and ventrally with at least 3 rows along length;

basal cell and disc entirely setose except for elongate linea calva. Legs except for dark mesotibial apical and mesotarsal pegs often entirely yellow to yellowish-orange beyond coxae with knees, tibiae apically, and tarsi lighter yellow to yellowish-white, though sometimes dorsal surface of protibia subbasally brown to dark and one or more of following variably obviously brown (then sometimes with very slight metallic green luster): posterior surface of profemur, small spot subbasally on mesotibia dorsally, up to about basal two-thirds of posterior surface of metafemur, and longitudinal band on posterior or dorsal surface of metatibia subbasally to more extensively. Gaster (Fig. 88a, b) with hairlike setae; brown with coppery to reddish-coppery lusters except basal tergite often greenish anteriorly under some angles of light and other tergites sometimes with limited, obscure greenish luster; ovipositor sheaths dark basally and usually lighter orangey-brown to yellow apically, but even if quite dark apically then without distinct basal margin delineating pale medial band.

Head in dorsal view (Fig. 88e) with interocular distance about 0.4–0.45× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; vertex evenly curved into occiput and uniformly, transversely alutaceous-imbricate to imbricate-strigose, the sculpture transversely aligned but not differentiated into ridge or carina (Fig. 88e); frons variably distinctly roughened, imbricate to shallowly reticulate-imbricate (Fig. 88d); scrobal depression distinctly reticulate to transversely reticulate-strigose (Fig. 88c, d); OOL: POL: LOL: MPOD = 0.8–0.9: 2.1–2.4: 1.3–1.5: 1.0. Mesoscutum mostly meshlike reticulate except medial lobe more reticulate-imbricate to transversely imbricate anteriorly and lateral lobe with mediolongitudinal band of minute coriaceous sculpture. Scutellum and axillae low convex in same plane; axilla mostly obliquely and scutellum longitudinally reticulate-imbricate laterad midline anterior to meshlike coriaceous frenal area. Acropleuron (Fig. 88f) more-or-less isodiametric meshlike anteriorly and posteriorly and much more minutely sculptured mesally, the larger meshlike sculpture coriaceous-reticulate, the cells at most delineated by only slightly raised ridges. Fore wing (Fig. 88g) with cc: mv: pmv: stv = 5.0–5.8: 4.4–5.6: 0.8–1.3: 1.0. Middle leg (Fig. 88h) with row of 5–7 mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus and pegs clearly differentiated into two rows apically; second tarsomere with 5 or 6 pegs, third tarsomere with 2 or 3 pegs, and fourth tarsomere with 1 peg apically on either side. Propodeum with broadly U-shaped plical depression extending to posterior margin. Gaster (Fig. 88a, b) similar in length to combined length of head and mesosoma; not atypically modified; extending to or slightly over base of third valvula, the latter about 0.65−0.7× length of metatibia and 0.7−0.8× length of mv; hypopygium extending about two-thirds length of gaster.

MALE (habitus: Fig. 89a, b). Length = 2.1–3.0 mm. Head sometimes more brownish with limited metallic lusters in smallest individuals, but usually green to bluish-green with frontovertex often more distinctly blue to purple (Fig. 89a–d) or sometimes with slight coppery to reddish-violaceous luster on frons and parascrobal region; frontovertex distinctly reticulate; vertex evenly rounded into occiput; scrobal depression mostly meshlike reticulate to reticulate-imbricate except scrobes smooth or with only subeffaced meshlike sculpture at least ventrally, and often continuously above interantennal prominence (Fig. 89c); setae hairlike, mostly white except more brownish and thus less conspicuous on frontovertex; lower face lateral to torulus with region of progressively longer setae toward malar space, but all setae straight to only slightly curved apically (Fig. 89c, d); gena posterior to malar sulcus with 1 conspicuously longer curved seta and about 4 shorter setae between it and oral margin, and posterior to eye with apices of setae directed toward orbit. Antenna (Fig. 89f) with scape entirely dark, about 2.0–2.3× as long as wide; pedicel at most 1.5× as long as wide with 7 or 8 long, apically hooked setae (Fig. 89f, left insert) and exterior to these 5–8 much shorter and less conspicuous, straight, dark setae in row along most of length (Fig. 89f, right insert); length of pedicel + flagellum about 1.3–1.5× head width; flagellum robust-filiform (Fig. 89f) with clava subequal in length to apical two funiculars; anellus very strongly transverse, discoidal, shiny, with at most inconspicuous, sparse setae at extreme apical margin (Fig. 89f inserts); funicle with fu1 about 1.15–1.2× as long as pedicel and about 1.25–1.5× as long as wide, with subsequent funiculars all longer than wide and of similar length or only slightly shorter apically, and uniformly covered with decumbent, curved setae except in ventral view fu1 and fu2 usually with what appears as less setose longitudinal region of differentiated, shorter, more lanceolate setae. Maxillary and labial palps brownish except apical maxillary palpomere pale (Fig. 89b), at least over apical half. Mesosoma (Fig. 89a, b) similarly coloured as head, more brownish with limited metallic lusters in smallest individuals, but usually green, sometimes with slight coppery luster, to bluish-green or more distinctly blue with some purple, particularly axillae; setae hairlike, white to pale brownish; tegula dark. Front leg with trochantellus pale; femur dark except narrowly apically; tibia pale at least basally and apically, but with brown to dark band at least dorsolongitudinally and sometimes ventrolongitudinally; tarsus pale except usually apical tarsomere brown.

Middle and hind legs similar in colour pattern to front leg except mesotibia varying from almost entirely pale to extensively brown to dark except basally and apically, and metatibia always mostly brown to dark except narrowly basally and apically or at most more extensively pale ventrobasally. Fore wing with mv about 3.1–3.5× length of stv and pmv subequal in length or only slightly longer than stv; costal cell (Fig. 89e) dorsally near leading margin with dark setae apically for at most distance about equal to length of parastigma, and ventrally almost always with 2 complete rows along length; speculum closed by setae posterobasally to variably extensively open. Propodeum with complete median carina, the panels meshlike coriaceous to coriaceous-reticulate.

Distribution. Crimea* (ZISK), Cyprus, France, Greece, Iran, **Italy*** [Ceriale nr Albenga, 3.IX.1972, Z. Bouček (BMNH: 1♀)], **Saudi Arabia*?** [Village Qaraah, Khamis M., 2000m, 16.IV.1976, Wittmer, Büttiker (BMNH: 1♀)], Tunisia, Turkey.

Biology. Associated with species of *Pistacia* L. (Anacardiaceae). Specimens from France were reared from *Megastigmus pistaciae* Walker (Torymidae) in seeds of *Pistacia terebinthus* L. Specimens from Turkey were also reared from *P. terebinthus*, whereas other specimens were reared from seeds of *P. vera* L. (Iran, Tunisia) and *P. atlantica* Desfontaines (as *P. mutica* Fischer & C. A. Meyer) (Iran and Ukraine). Al khatib *et al.* (2014) also indicated it is associated with *P. lentiscus* L. and suggested the species might be a hyperparasitoid through *Eurytoma pistaciae* Rondani and *Sycophila pistacina* (Rondani) (Eurytomidae).

Remarks. The holotype of *E. pistaciae* is entire and not noticeably affected by DNA extraction. Most *E. pistaciae* females should key through the second half of couplet 67 because they have the scape quite obviously orangey, at least basally, rather than uniformly dark. Such females could be mistaken for some *fulvipes*-group females that also have the scape at least partly pale as well as the frons variably distinctly imbricate-roughened and the legs mostly yellowish-orange beyond the coxae. However, such *fulvipes*-group females have the pronotum blue to bluish-green laterally (e.g. Figs 29g, 31c, d, 34b) whereas this is coppery (Fig. 88f) or at least green with a slight coppery luster laterally for *E. pistaciae* females. Typical *E. pistaciae* females also have quite distinct coppery luster in the scrobal depression (Fig. 88c) as compared to greenish to bluish lusters (e.g. Figs 29h, 34c, d, 50c) for most *fulvipes*-group females, though the coppery luster is sometimes quite limited for some *E. pistaciae* females (Fig. 88d) so as to resemble some E. *fulvipes* females that also have a bit of coppery luster within the depression. Most *fulvipes*-group females also differ in having a vertexal carina, though this is variably developed and not always evident. We tentatively include in *E. pistaciae* a single female collected in Saudi Arabia. In addition to its entirely orange scapes it has entirely orange legs except that the metafemora are brown within about their basal third and the metatibiae have a very slight brownish tinge mesally; the frons is almost entirely reticulate-imbricate, the vertex is evenly rounded into the occiput, and the scrobal depression is extensively coppery to coppery-violaceous. It is primarily because of this latter feature we include this female in *E. pistaciae*; however, the mesosoma lacks conspicuous coppery lusters, including the pronotum laterally, which has only very slight coppery or bluish lusters under some angles of light, the admarginal setae brown and the ovipositor sheaths 0.9× the length of the marginal vein, conspicuously longer than other females. This female might represent a separate but morphologically very similar species to *E. pistaciae* and for this reason we do not include this variation in the description.

Very few *E. pistaciae* females seen have the scape only inconspicuously lighter basally and thus could be keyed through the first half of couplet 67. Difficulty could also be encountered taking females with a more-or-less uniformly dark scape through couplet 69 because of variation in leg colour pattern, though those with a dark scape always have the metatibia partly dark whether or not the profemora and/or the metafemora are noticeably darkened.

Because of a similar number of long, curved pedicular setae (Fig. 89f, left insert), males are very similar to those of *E. confusus* except for the apical maxillary palpomere being partly pale (Fig. 89b). They also have a larger number (5–8) of shorter, dark, secondary setae that form a more definite row along the length of the pedicel (Fig. 89f, right insert) exterior to the long curved setae (Fig. 89f, left insert) than do males of *E. confusus*. Both the difference in colour of the maxillary palps and presence of a secondary row of pedicular setae may not always be obvious, but *E. pistaciae* males almost always have two complete rows of setae ventrally on the costal cell and the dorsal setae extending only about the length of the parastigma (Fig. 89e). Males of *E. confusus* usually have the ventral setae arranged in only a single row, at least for a short distance mesally and/or the dorsal setae extending along the leading margin for a distance obviously greater than the length of the parastigma (Fig. 26h). Of numerous females and males reared from different sites in Crimea (ZISK) from seeds of *P. atlantica*, we saw from Nikita (26.VIII.1986) a single *E. confusus* female reared together with three males and two males of *E. pistaciae*.

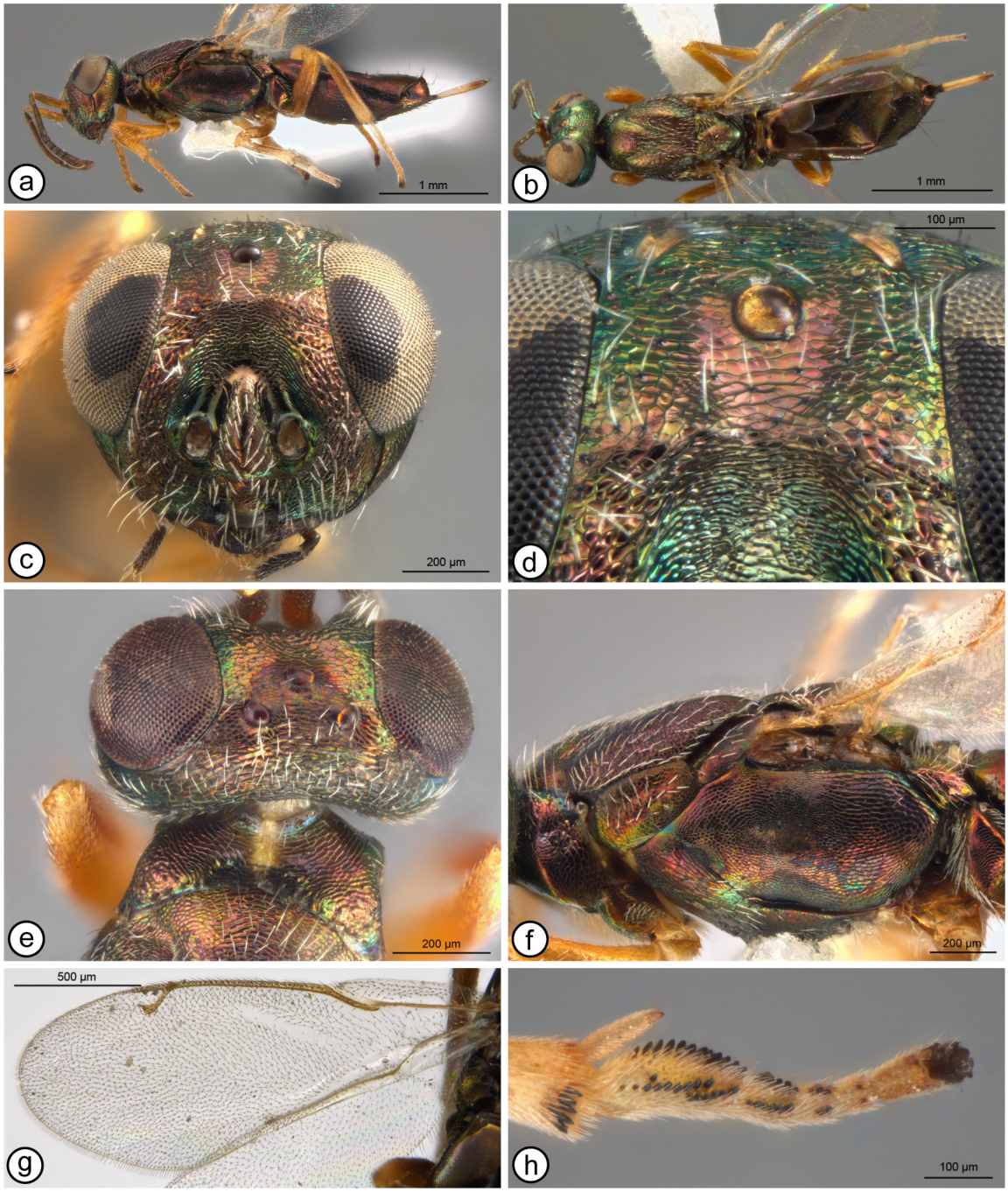

FIGURE 88. *Eupelmus pistaciae*, ♀. *a, f* (2013-124): **a**, lateral habitus; **f**, mesosoma. *b, g* (2012-82): **b**, dorsal habitus; **g**, fore wing. **c**, head, frontal (2012-81). *d, h* (2012-83): **d**, upper part of scrobal depression and frontovertex; **h**, apex of mesotibia and mesotarsus. **e**, head and pronotum, dorsal (2013-123).

Besides the specimens sequenced in Al khatib *et al*. (2014), we sequenced two more specimens for COI, one from Iran resulting in a 525bp sequence (CNCHYM 015247) and one from Greece resulting in a 626bp sequence (CNCHYM 015249). The new sequences cluster with the previously known ones from France, but the pairwise distance between the sequences from the three countries is large, though not much above the maximum estimated intraspecific variability of 4.8% in *E. annulatus* (Al khatib *et al.* 2014). For *E. pistaciae*, it is over 2% between France and Greece and over 5% between France and Iran. We interpret this as geographical variability within one species, with the large genetic differentiation related to the fact that the species is probably stenotopic, being strictly associated with *Pistacia* tree stands.

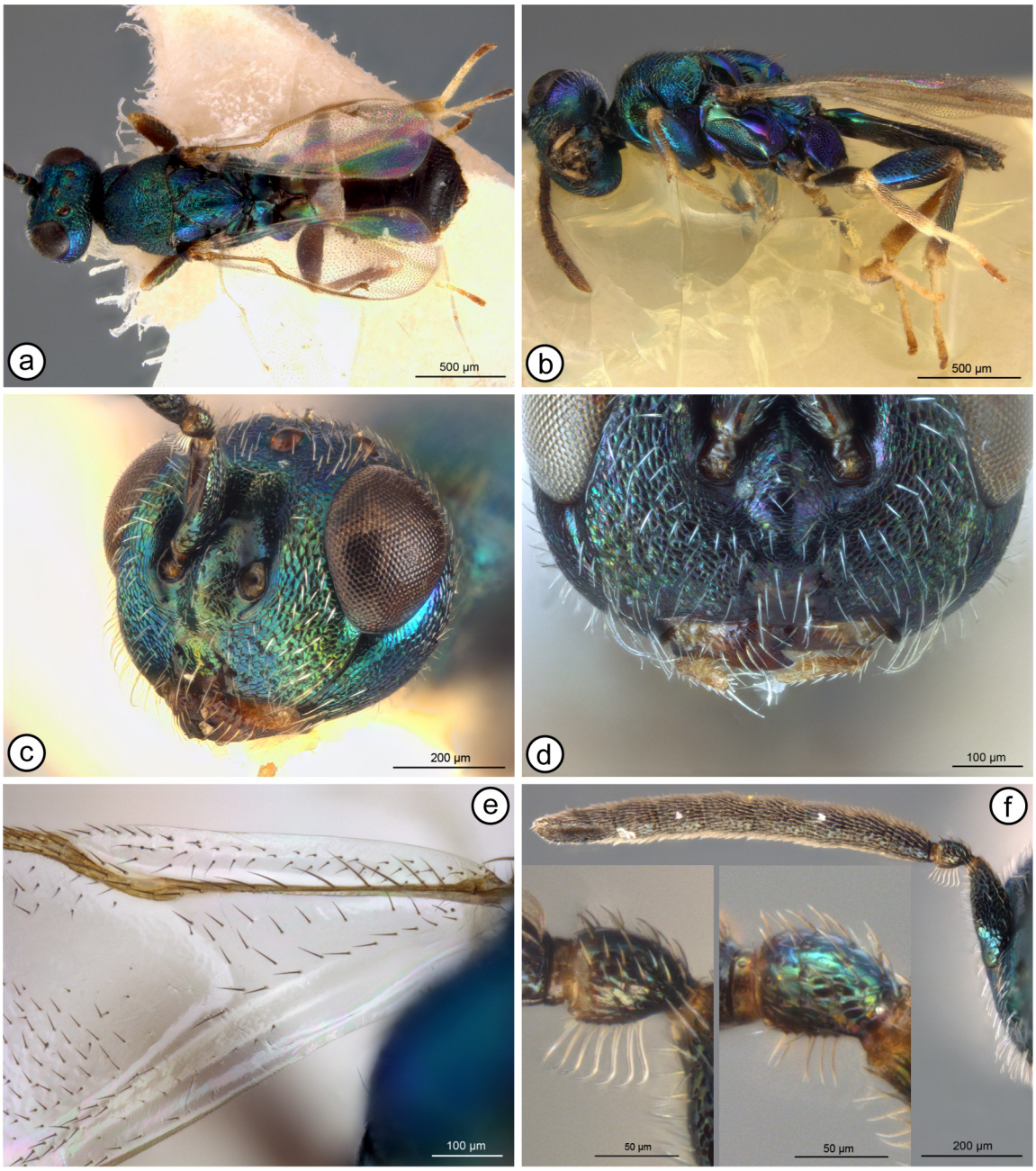

FIGURE 89. *Eupelmus pistaciae*, ♂. *a, c, e, f* (2013-125): **a**, dorsal habitus; **c**, head, frontolateral; **e**, fore wing base; **f**, antenna, inner view [left insert: pedicel to base of fl3, inner view; right insert: pedicel to base of fl3, outer view]. **b**, lateral habitus (2013-127). **d**, lower face, frontal (2013-126).

E. (*Eupelmus*) *priotoni* Delvare

Figs 90a–h (♀), 91a–f (♀)

Eupelmus (*Eupelmus*) *priotoni* Delvare *in* Al khatib *et al.*, 2015: 144. Holotype ♀, MHNG, examined. Type data: France, Aveyron, Sauclières, 700 m a.s.l., Lit de la Virenque, 43.96389°N 3.35583°E, 15.vi.2011, G[érard] Delvare (GDEL4051/10038).

Eupelmus (*Eupelmus*) *priotoni* Delvare *in* Al khatib *et al.*, 2014: 850–852 (unavailable name; original description, keyed, illustrated).

Description (based on holotype, see 'Remarks'). FEMALE (habitus: *cf* Fig. 90h). Length = 3.7 mm. Head (Fig. 90a, b) under most angles of light with lower face and frontovertex mostly green but frons mesally below anterior ocellus and narrowly along inner orbits dark with slight violaceous luster similar to scrobal depression and most of

parascrobal region above level of toruli (Fig. 90a), with vertex somewhat more bluish to purple under some angles of light, but not reddish-violaceous (Fig. 90b); with hairlike to slightly lanceolate white setae on lower face and parascrobal region to level of dorsal margin of scrobal depression compared to less conspicuous hairlike setae on vertex. Maxillary and labial palps brown. Antenna brown except scape and pedicel with distinct blue to bluish-green luster. Pronotum reddish-violaceous to purple laterally, mostly reddish-violaceous dorsolaterally and lateral panel mostly purple, but distinctly contrasting with mostly green mesonotum (Fig. 90d); admarginal setae dark. Mesonotum (Fig. 90e) with convex part of mesoscutal medial lobe blue to partly purple under most angles of light and with some bluish luster on inner, inclined surfaces of mesoscutal lateral lobes, but mostly green with slight coppery luster, particularly lateral lobes mediolongitudinally and scutellum along scutoscutellar sutures; with white, hairlike to slightly lanceolate setae. Prepectus (Fig. 90d) variably distinctly brownish to bluish or purple except along margins depending on angle of light; with 8 setae [7 setae remaining on visible right prepectus but additional setal pore visible dorsal to penultimate setae of lower row of setae] in two rows mediolongitudinally. Tegula dark. Acropleuron mostly green to bluish-green with slight coppery luster posteriorly. Propodeal callus mostly blue or setose region more greenish depending on angle of light, and purple or reddish-violaceous laterally under some angles of light. Macropterous; fore wing hyaline (Fig. 90g) with yellowish to brown setae; costal cell dorsally near leading margin with row of setae over about apical two-thirds, and with shorter second row from about level of base of parastigma, and ventrally extensively setose with at least 3 rows along length; basal cell and disc entirely setose except for elongate linea calva extending to level of about middle of parastigma. Front leg with femur dark except apex very narrowly pale; tibia narrowly pale basally and more widely apically and along anterior and posterior surfaces to differentiate dorsal and ventral dark bands; tarsus pale basally but increasingly darker brown apically. Middle leg with trochanter, trochantellus, femur apically, tibia basally and more widely apically, and basal four tarsomeres pale, but most of femur, subbasal region on tibia, mesotibial apical and tarsal pegs, and apical tarsomere dark. Hind leg similar to middle leg except trochanter and trochantellus similarly dark as most of femur. Gaster (Fig. 90f) with hairlike setae; mostly brown except bright green to bluish green basally on basal tergite and much less distinctly laterally on tergites and dorsoapically; ovipositor sheaths (Fig. 90f) distinctly banded, with dark basal band and pale mesal band about twice as long as apical dark brown band.

Head in dorsal view with interocular distance about 0.4× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons, and eye height 1.69× length of malar space; in frontal view (Fig. 90a) width 1.26× height, with lower ocular line intersecting torulus near dorsal margin of torulus, malar space 1.5× distance from oral margin to inner ventral margin of torulus, and latter distance 1.07× distance between inner mesal margins of toruli; vertex evenly rounded into occiput, transversely alutaceous-imbricate (Fig. 90b); frons meshlike coriaceous (Fig. 90a, b); scrobal depression shiny except inner walls finely sculptured similar to interantennal prominence (Fig. 90a); OOL: POL: LOL: MPOD = 1.0: 2.4: 1.7: 1.0. Mesoscutum (Fig. 90e) with posteromedial depressed region similarly meshlike reticulate as anteromedial lobe; axilla mostly obliquely and scutellum longitudinally reticulate-imbricate laterad midline. Acropleuron more-or-less isodiametric meshlike anteriorly and with slightly larger meshes posteriorly, but much more minutely sculptured mesally and larger meshlike sculpture at most delineated by slightly raised ridges. Fore wing (Fig. 90g) with cc: mv: pmv: stv = 4.8: 4.6: 1.0: 1.0; stigmal vein straight. Middle leg with row of 6 mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus and pegs differentiated into two rows apically; second tarsomere with 5 pegs, third tarsomere with 3 pegs and fourth tarsomere with 1 peg apically on either side. Propodeum with broadly U-shaped plical depression extending to posterior margin (Fig. 90e). Gaster (Fig. 90f) similar in length to combined length of head and mesosoma; not atypically modified; extending to base of third valvula, the latter 0.83× length of metatibia and about 0.9× length of marginal vein; hypopygium extending about two-thirds length of gaster.

MALE. Unknown (see 'Remarks').

Distribution. Austria* [Merkenstein, N 10, 3.IV.1959, *Salix caprea*, ex. *Gypsonoma incarnana* [?] od. *Gelechia muscosella* (ZSMC: 2♀, one with CNC Photo 2014-113)], France, **Germany*?** [Eiche SW, 1.VII.1962, CNC Photo 2014-117 (ZSMC: 1♀)]; **Portugal*** [Beira alta, Valhelhas, 15.VI.1999, M. J. Gijswijt (ZMAN: 1♀)], **Sweden*** [Sk., Åhus, 19.II.1965, K-J. Hedqvist (BMNH: 1♀); Up., Vallentuna, 22, 28.II.1957, 2.VI.1965, K-J. Hedqvist (BMNH: 3♀, one with CNC Photo 2014-110 and one with CNC Photo 2014-111)], **Switzerland*** [Gypsy Moth Lab, cage 27, from nest U.S.D.A. 7567, CNC Photo 2014-112 (USNM: 1♀)].

Biology. The two females from Austria apparently were reared from some moth, possibly either *Gelechia muscosella* Zeller or a species of *Gypsonoma* (Gelechiidae) on *Salix caprea* L., and the female from Switzerland possibly from *Lymantria dispar* (L.).

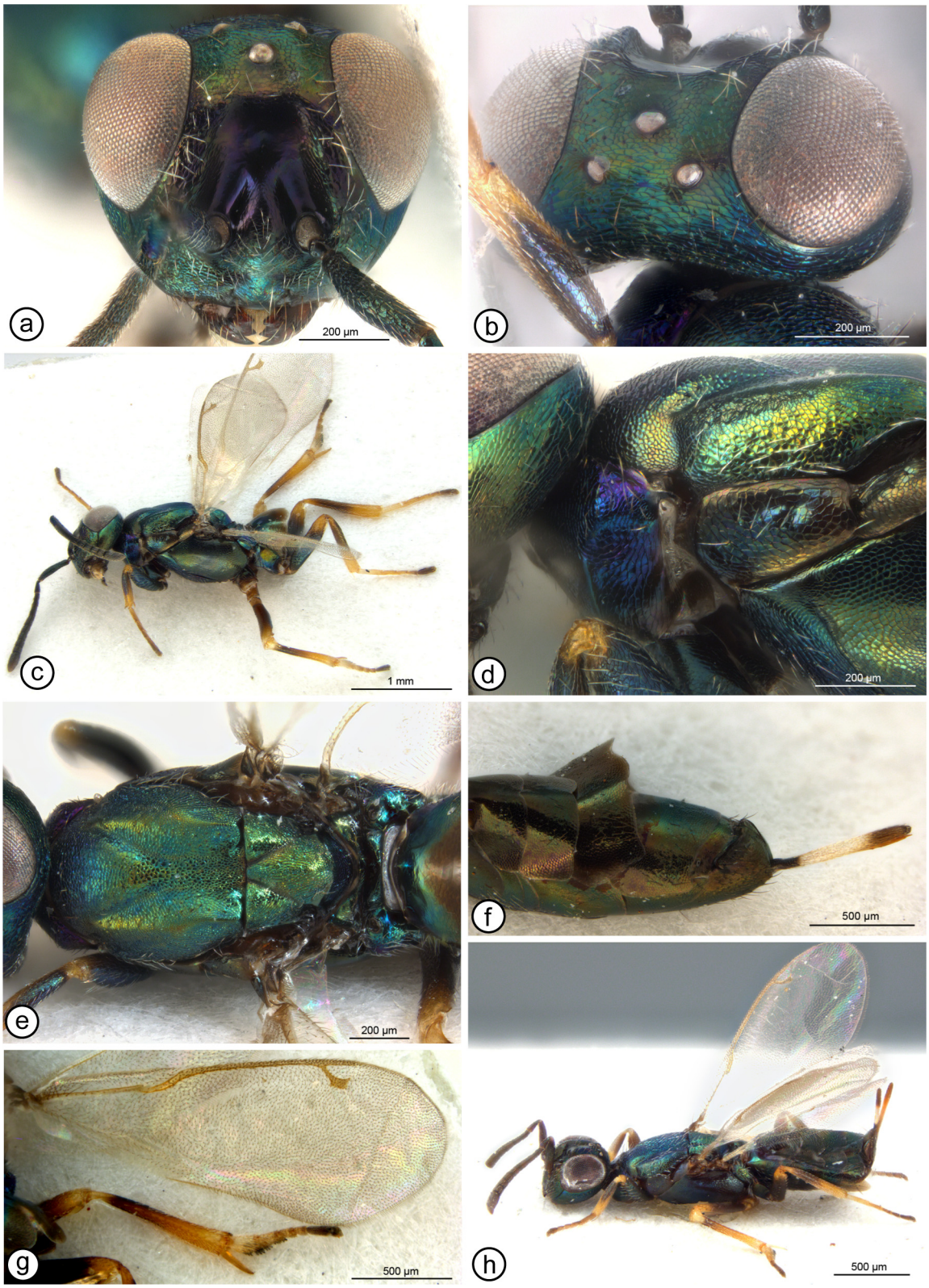

FIGURE 90. *Eupelmus priotoni*, ♀. *a–g* (holotype): **a**, head, frontal; **b**, head, dorsolateral; **c**, head and mesosoma, lateral; **d** pronotum, mesoscutum and prepectus, lateral; **e**, mesosoma, dorsal; **f**, gaster; **g**, fore wing. **h**, dorsolateral habitus (2014-117).

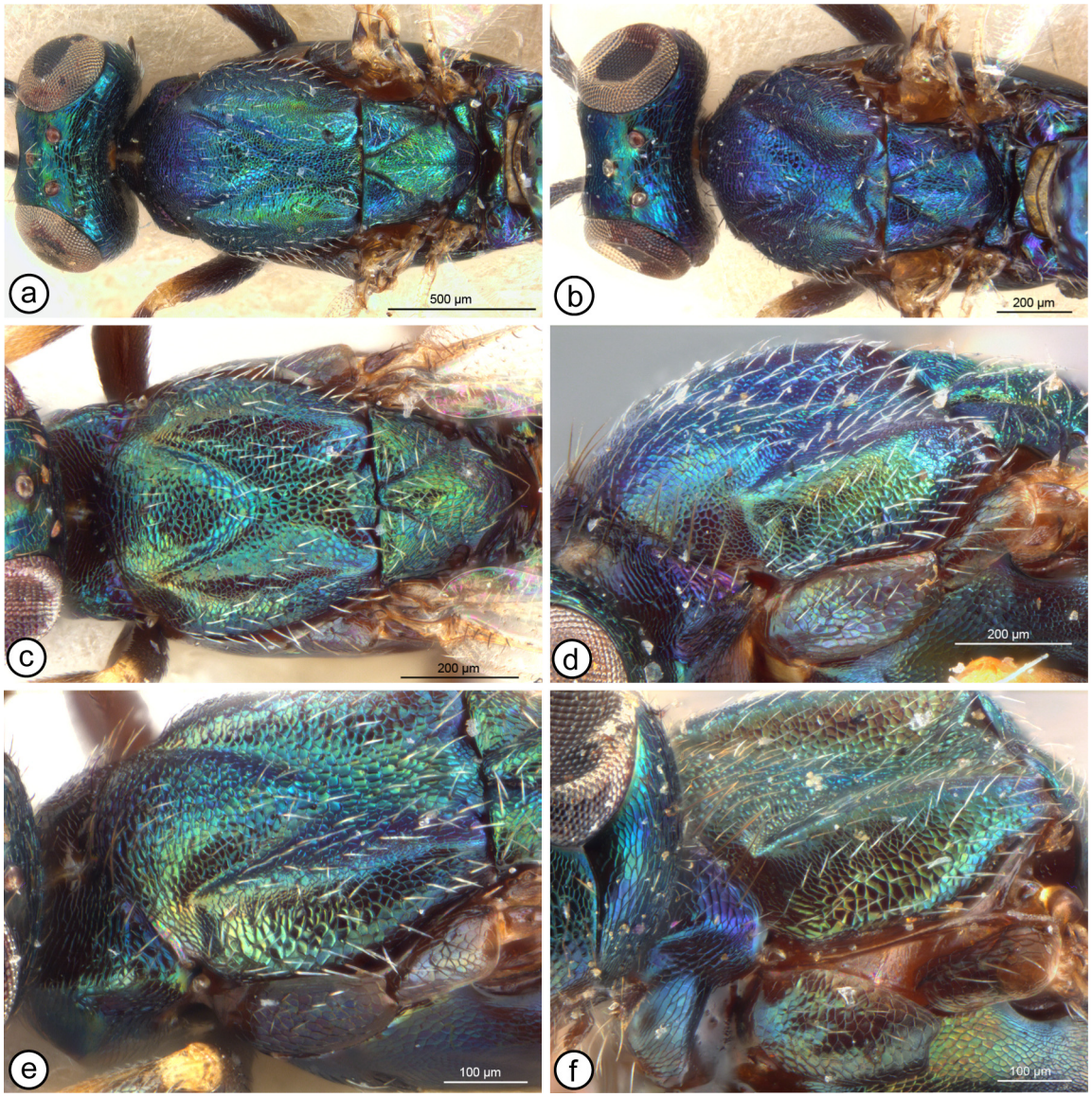

FIGURE 91. *Eupelmus priotoni*, ♀. *a, b* (head and mesosoma, dorsal): **a**, 2014-111; **b**, 2014-110. **c**, mesosoma, dorsal (2014-117). *d–f* (pronotum, mesoscutum and prepectus): **d**, 2014-113; **e**, 2014-117; **f**, 2014-112.

Remarks. The unique holotype of *E. priotoni* is complete, though the gaster beyond the basal gastral tergite is detached (Fig. 90c) and glued to a separate card (Fig. 90f) below that with the head and mesosoma. Length of the gaster given in our redescription is that stated in the original description. Although the internal tissues were digested for DNA extraction, colour of the body does not appear to be adversely affected.

Eupelmus priotoni is one of six species included in the *urozonus*-group (see *E. urozonus*). Originally described from a single female, Al khatib *et al.* (2014) differentiated it from other *urozonus*-group species using a combination of features, including from *E. purpuricollis* by length of the ovipositor sheaths, relative height of the toruli, and ratio of the distance between the toruli to that between a torulus and the oral margin (their couplet 21). Al khatib *et al.* (2014) described the LOL as 0.83× the diameter of the ocellus, but our measurements indicate the LOL and MPOD are virtually equal for at least the right side (left side cannot be measured accurately because of head position). Our measurements also indicate the distance between the oral margin and inner ventral margin of a torulus is slightly, but definitely greater than the distance between the inner mesal margins of the torulus rather than the described 0.9×. This ratio is thus closer to that of *E. purpuricollis* than suggested in the key of Al khatib *et al.* (2014). Because of the only slight differences in ratios used, and the likelihood that these will prove to be more variable with additional specimens, we key females of those *urozonus*-group species with a contrasting pronotal-mesoscutal colour pattern based on leg colour pattern. As such, we key *E. priotoni* along with *E. opacus*, the two

species being separated primarily by the number of prepectal setae (more than 7 for *E. priotoni versus* 2–4 for *E. opacus*). Most females we identify as *E. priotoni* also have a slightly narrower interocular distance than those of *E. opacus*, usually about 0.4× for *E. priotoni* compared to about 0.45× for *E. opacus*, though the female identified as *E. priotoni* from Åhus has an interocular distance equal to 0.44× the head width.

Because of uncertainty over the morphological limits of *E. priotoni*, the female description given above is based only on the holotype. However, we did see nine additional females that we identify as *E. priotoni*, including one female (Fig. 90h) labelled simply as "Eiche SW". The latter female has only the extreme posterolateral margin of the pronotum variably distinctly purplish under different angles of light in contrast to the mostly greenish mesoscutum (Fig. 91c, e), and thus resembles those *E. urozonus* females with dark admarginal setae (e.g. Fig. 120e), similar leg colour pattern, and a more bluish to purple pronotum and mesoscutum than is typical for the species (see further under *E. urozonus*). All nine females identified as *E. priotoni* have partly dark meso- and metatibiae (Fig. 90c, h), usually both with at least the dorsal and outer surfaces dark over about the basal half excluding their extreme bases, though shorter than this in the Eiche and two Austrian females (Fig. 90h). The mesofemora are also comparatively dark brown except apically and basally, similar to the pro- and metafemora (Fig. 90c, h). The least extensively dark leg colour pattern resembles the most extensively dark leg colour pattern of females we include in *E. simizonus,* but females we include in the latter species are characterized by pale (Fig. 101f, h) rather than dark (Fig. 91d–f) pronotal admarginal setae. Most of the females we identify as *E. priotoni* also have the head and mesonotum mostly greenish, though the vertex and mesonotum are extensively purplish to somewhat reddish-violaceous under some angles of light in one of three females from Vallentuna, Sweden (Fig. 91b), and thus also similar to some females we include in *E. urozonus* (Fig. 120f, g) or *E. purpuricollis* (Fig. 95b, c, e). Females we include in *E. purpuricollis* do not have as extensively dark middle and hind legs (Fig. 95c, d) as for *E. priotoni* females, with only one known *E. purpuricollis* female having the metatibia partly dark (Fig. 95d). The other two Vallentuna females have a variably more greenish vertex and mesonotum except that the convex part of the anteromedial lobe and sometimes the depressed posteromedial region of the mesoscutum and the axillae are partly bluish to purple (Fig. 91a), as for the other five females we identify as *E. priotoni*. Consequently, vertex and mesonotal colour pattern are quite variable if the eight females are correctly identified (Figs 90e, 91a–f), and sometimes similar to some *E. urozonus* and *E. purpuricollis* females. The two Austrian females have 11 or 12 prepectal setae (Fig. 91d), more similar to typical *E. purpuricollis* females (Fig. 95e), whereas the others have only 6–8 prepectal setae (Fig. 91e, f), more similar to the holotype of *E. priotoni* (Fig. 90d). The lesser number of setae in at least some instances might result from loss through abrasion. For example, the Eiche female has seven setae on the right prepectus but only three visible setae on the left prepectus (Fig. 91e), though pores indicate both sides originally had seven setae. Unlike the holotype of *E. priotoni*, all but two of the females have only a single distinct row of dorsal setae within the costal cell. Other measurements of the females are as follows: interocular distance 0.39–0.44× head width; eye height 1.59–1.8× length of malar space; in frontal view head width 1.17–1.3× height; malar space 1.36–1.56× distance from oral margin to inner ventral margin of torulus, and latter distance 1.0–1.27× distance between inner mesal margins of toruli; OOL: POL: LOL: MPOD = 0.75–1.0: 1.9–3.25: 1.3–1.9: 1.0; fore wing with cc: mv: pmv: stv = 4.4–4.7: 3.8–4.5: 1.06–1.19: 1.0; third valvulae 0.77–0.85× length of metatibia and 0.78–0.98× length of marginal vein.

It should be noted that the female from Switzerland we include in *E. priotoni* (Fig. 91f) apparently was reared from the same Gypsy moth cage (#7567) as the female from Germany (Bavaria) that we tentatively identify as *E. simizonus*. The latter female has pale pronotal admarginal setae (Fig. 101h) but differs from the holotype of *E. simizonus* in having both the meso- and metatibiae noticeably darkened subbasally (Fig. 101g), somewhat similar to females we include in *E. priotoni*. A second female from Hungary we include in *E. simizonus* based on molecular evidence has even darker legs. Further, the USNM has one male labelled "Switzerland, thro Rhul, Gypsy Moth Lab., 5.VI.07". This male is indistinguishable from males we identify as *E. urozonus*, having the meso- and metatarsus entirely infuscate.

It is possible that our couplet keying of *E. priotoni* with *E. opacus* reflects evolutionary relationships because on the COI ML tree (Al khatib *et al.* 2014, fig. 1) *E. priotoni* clusters with *E. opacus*. On the other hand in the ML tree based on the nuclear gene *Wingless* (Al khatib *et al*. 2014, fig. 2) *E. priotoni* clusters together with *E. purpuricollis* and *E. janstai* in an unresolved polytomy. If these two gene trees accurately represent phylogenetic relationships of the respective genes, it is possible that *E. priotoni* might be the result of a historical introgression, with the mtDNA more related to that of *E. opacus*. As such, the dark mesotibia indicates it is closer to *E. opacus*

but the larger number of prepectal setae and vertexal and mesonotal colour patterns to *E. purpuricollis*. This would also explain apparent intergradation of features used to distinguish *E. priotoni* from *E. opacus* or *E. priotoni* from *E. purpuricollis*.

***E.* (*Eupelmus*) *punctatifrons* Fusu & Gibson n. sp.**
Figs 92a–f (♀), 93a–h (♀), 94a–g (♂)

Type material. Holotype ♀ (CNC). UNITED ARAB EMIRATES: near Mahafiz, 21–28.viii.2006, LT [light trap], coll. AvH [Anthony van Harten] UAE 7826 / HOLOTYPUS ♀ *Eupelmus* (*Eupelmus*) *punctatifrons* Det. Fusu L. 2013. Condition: point-mounted; uncontorted; entire.

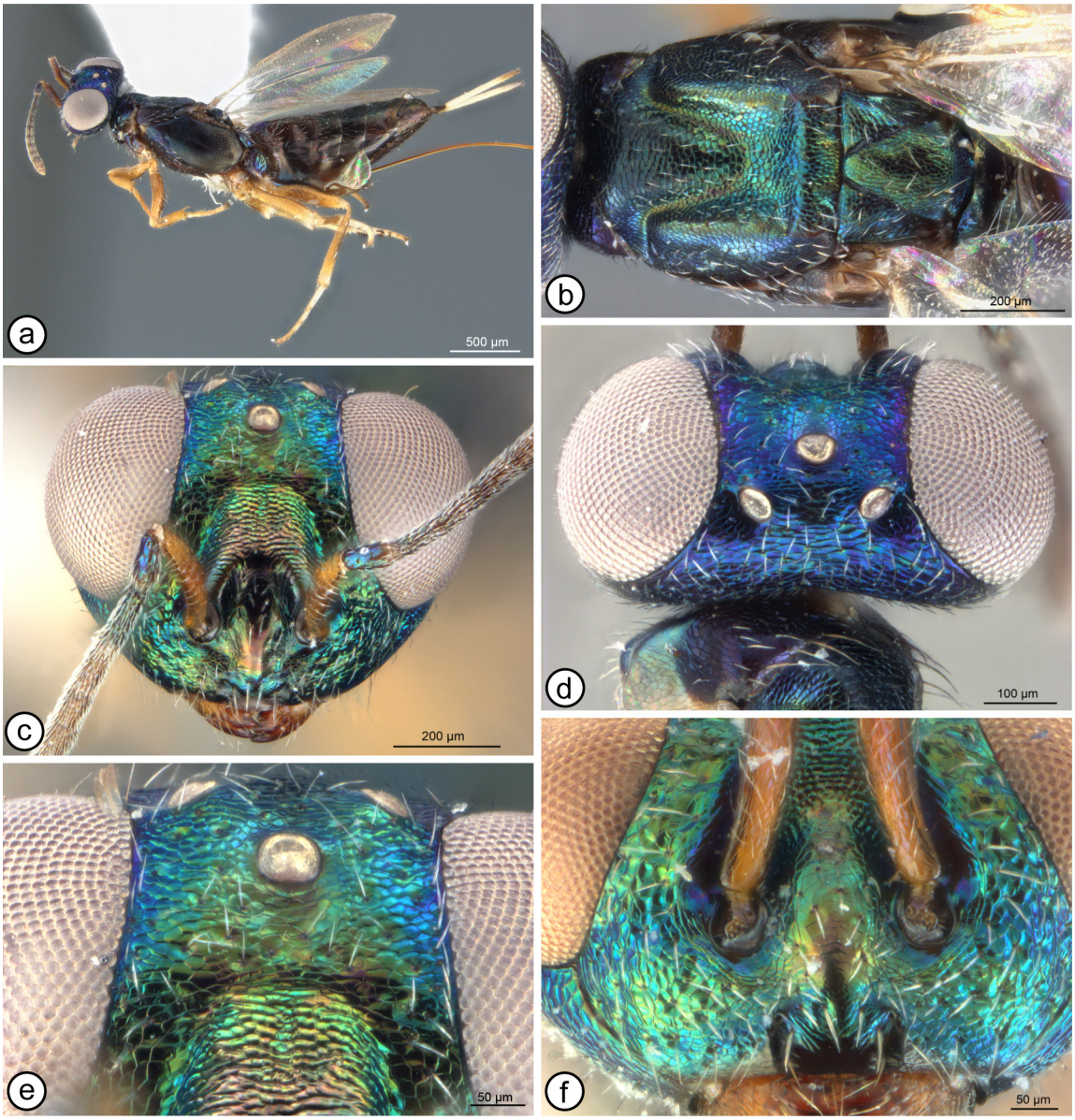

FIGURE 92. *Eupelmus punctatifrons*, ♀. *a, b, d* (2014-53): **a**, lateral habitus; **b**, mesosoma, dorsal; **d**, head, dorsal. *c, e, f* (holotype): **c**, head, frontal; **e**, upper part of scrobal depression and frontovertex; **f**, lower face, frontal.

Paratypes (7♀ & 4♂). **United Arab Emirates**: same data as holotype (CNC: 1♀, CNC Photo 2014-53). Fujairah, 25°08'N 56°21'E, 16-24.II.2005 (CNC: 1♀, CNC Photo 2014-73), 28.II–1.IV.2006, UAE#4160 (CNC: 2♀, one with CNC Photo 2014-72), light trap, A. van Harten. Hatta, 24°49'N 56°07'E, 19–28.III.2006, 10854 (CNC: 1♀), 8–26.IV.2006, UAE#4619 (AICF with permission from CNC: 1♀, CNC Photo 2014-54), light trap, A. van Harten. Wadi Maidaq, 25°18'N 56°07'E, 1–8.VII.2006, A. van Harten, light trap, UAE#5555 (AICF with

permission from CNC: 1♂, CNC Photo 2014-75). **Yemen**: Sayun, 12–14.VIII.2002 (CNC: 1♀, CNC Photo 2014-55), 20–22.VIII.2002 (CNC: 2♂, one with CNC Photo 2014-74), A. van Harten & A. Al Zubayn, light trap. Al Kowd, VI.2002, A. van Harten & S. Al Haruri, light trap (CNC: 1♂).

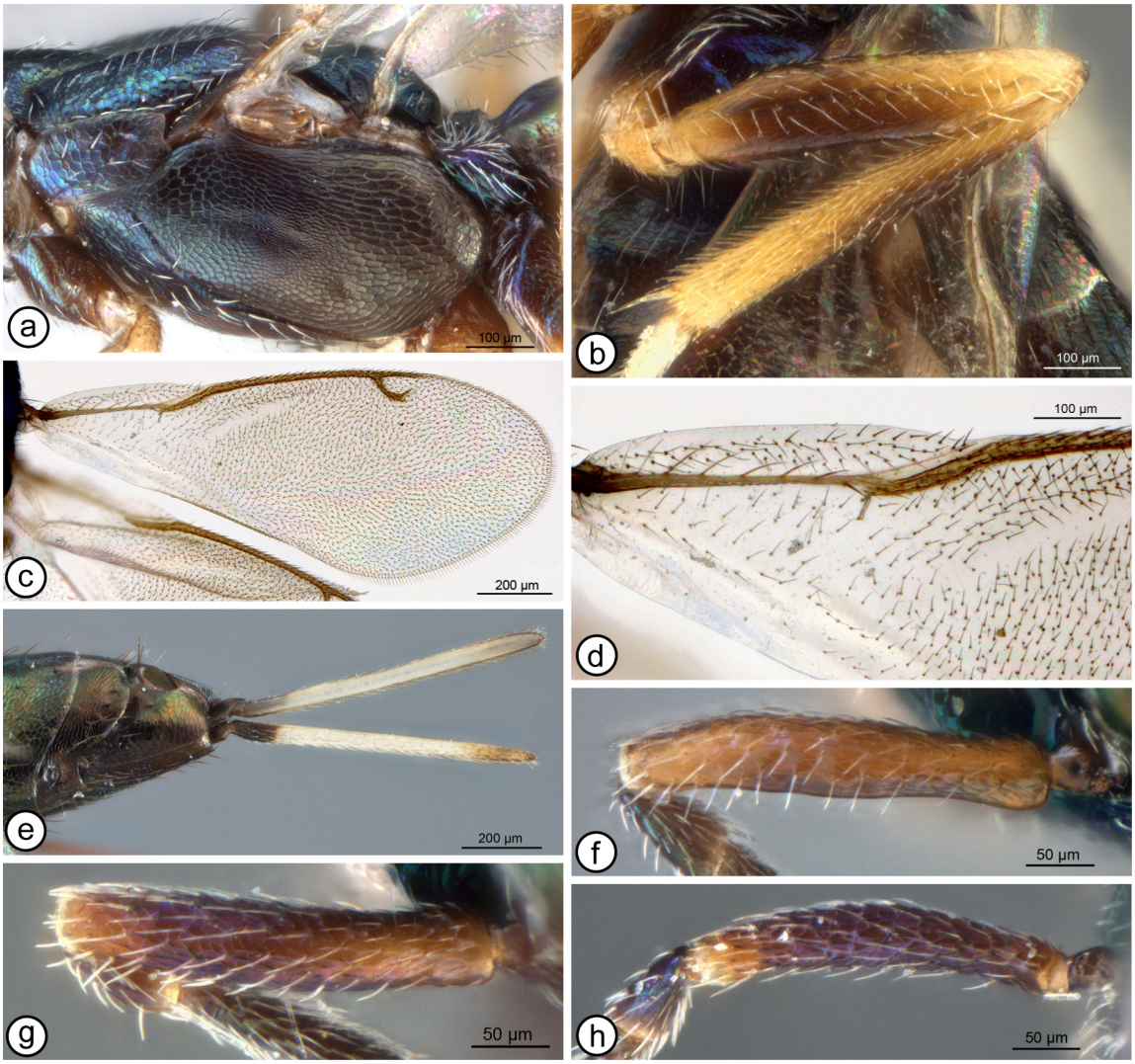

FIGURE 93. *Eupelmus punctatifrons*, ♀. *a, c, d* (2014-55): **a**, mesosoma, lateral; **c**, fore wing; **d**, fore wing base. *b, g, h* (2014-73): **b**, hind leg, outer view; **g**, scape, inner view; **h**, outer view. **e**, apical tergites and ovipositor sheaths, lateral (2014-54). **f**, scape, inner view (holotype).

Etymology. The specific name is based on the frons having setae originating from shallow, circular depressions.

Description. FEMALE (habitus: Fig. 92a). Length = 2.5–3.2 mm. Head (Fig. 92c–f) usually mostly green to somewhat bluish-green with variably extensive coppery to reddish-violaceous lusters, most commonly within scrobal depression (Fig. 92c), and on parascrobal regions, interantennal prominence and frontovertex mesally, and sometimes lower face (Fig. 92f), but under some angles of light at least vertex (Fig. 92d) and usually frontovertex along inner orbits (Fig. 92e) variably broadly to sometimes almost entirely blue, purple or more rarely reddish-violaceous; with slightly lanceolate white setae on lower face and parascrobal region compared to more hairlike setae on frontovertex. Maxillary and labial palps brown. Antenna with scape often at least extensively yellowish to orange, distinctly contrasting with dark flagellum (Fig. 92c, f), but sometimes mostly brown and even with some metallic luster under some angles of light (Fig. 93g, h), but at least inner surface lighter, orangey, either mediolongitudinally (Fig. 93f) or apically and basally (Fig. 93g) so as not to be uniformly dark; pedicel and flagellum brown though pedicel and basal flagellomeres with metallic luster under some angles of light. Pronotum laterally blue to purple or violaceous (Fig. 92d); admarginal setae white (Fig. 92d). Mesonotum (Fig. 92b) mostly

green to bluish-green with variably distinct coppery luster except usually median lobe anteriorly and sometimes outer surface of lateral lobe darker, more blue to violaceous; with hairlike to slightly lanceolate white setae. Prepectus (Fig. 93a) brown or with slight metallic lusters under some angles of light; extensively setose with 7–18 very slightly lanceolate white setae. Tegula dark. Acropleuron (Fig. 93a) with variably distinct metallic lusters, usually more brown with coppery luster to greenish-coppery posterior to level of mesally microsculptured region and more greenish to blue or purple anteriorly. Propodeal callus dark blue to purple at least laterad spiracle, though often variably extensively green more mesally; with similar but denser white setae than on mesoscutum (Fig. 93a). Macropterous; fore wing (Fig. 93c) hyaline with white setae basally to about level of parastigma but discal setae darker, brown; costal cell (Fig. 93d) dorsally near leading margin almost always setose apically for distance at least equal to length of parastigma and sometimes up to about apical half, though rarely almost bare (holotype right wing with single setae and left wing entirely bare), but ventrally with at least 3 rows of setae along length; basal cell and disc entirely setose except for elongate linea calva extending to level about equal with middle of parastigma (Fig. 93d). Front leg often entirely pale beyond coxa, though sometimes femur with posterior surface in part and tibia dorsolongitudinally variably distinctly brownish or, more rarely, femur almost entirely and tibia dorso- and ventrolongitudinally dark, but trochanter, trochantellus, femur apically, tibia except for dorsal and ventral dark bands, and at least basal four tarsomeres pale. Middle leg pale beyond coxa except for dark mesotibial apical and mesotarsal pegs, though usually most of femur and tibia subbasally darker, more orangey compared to lighter yellow to whitish knee, tibia apically, and basal tarsomeres. Hind leg sometimes similarly pale as middle leg beyond coxa, though often femur with outer surface variably extensively mesally and dorsal surface of tibia mesally variably extensively and distinctly brownish though not strongly dark (Fig. 93b). Gaster (Fig. 92a) with hairlike setae; dark brown, at least dorsomesally, though basal tergite basally green to bluish-green and tergites laterally and sometimes apical tergites dorsally less conspicuously greenish under some angles of light; ovipositor sheaths (Fig. 93e) with three distinct bands, a short dark basal region, a much longer medial white region, and an apical yellowish to brown to light brown region, the latter only about one-third length of medial white region.

Head in dorsal view (Fig. 92d) with interocular distance 0.33–0.39× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; vertex evenly rounded into occiput, transversely reticulate-imbricate; frons almost coriaceous in smaller females (Fig. 92e), but usually variably distinctly meshlike-imbricate along inner orbits laterad anterior ocellus so as to be at least slightly roughened, and with setae variably distinctly originating from tiny, shallow, circular depressions (Fig. 92e), and parascrobal region and lower face with setae originating from somewhat larger and more conspicuous depressions so as to be more noticeably roughened or wrinkled (Fig. 92f); scrobal depression distinctly meshlike reticulate (Fig. 92c, e); OOL: POL: LOL: MPOD = 0.5: 1.9–2.1: 1.1–1.3: 1.0. Mesoscutum (Fig. 92b) mostly meshlike reticulate except anteromedial lobe anteriorly more transversely alutaceous-reticulate and lateral lobe with mediolongitudinal band of minute coriaceous sculpture. Scutellum and axillae low convex in same plane; axilla mostly obliquely imbricate and scutellum coriaceous to only slightly, longitudinally imbricate laterally. Acropleuron (Fig. 93a) meshlike reticulate anteriorly and posteriorly relative to much more minutely sculptured region mesally, and with larger meshlike sculpture delineated by variably distinct ridges. Fore wing (Fig. 93c) with cc: mv: pmv: stv = 5.1–5.4: 4.6–5.2: 1.3–1.5: 1.0. Middle leg with row of 4 or 5 mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus and pegs clearly differentiated into two rows apically; second tarsomere with 4–6 pegs, third tarsomere with 2 or 3 pegs, and fourth tarsomere often without but sometimes with 1 peg on one side apically. Propodeum with broadly U-shaped plical depression extending to posterior margin. Gaster (Fig. 92a) similar in length to combined length of head and mesosoma; not atypically modified; extending almost to or to base of third valvula, the second valvifers sometimes extending slightly beyond gastral apex; third valvula about 1.1× length of metatibia and about 1.3× length of mv; hypopygium extending almost two-thirds length of gaster.

MALE (habitus: Fig. 94a). Length = 2.2–2.6 mm. Head (Fig. 94a–c, e) variably extensively dark green to bluish-green or vertex sometimes more distinctly blue, but at least interantennal prominence (Fig. 94c) and scrobal depression dark (Fig. 94b, e) or with variably distinct violaceous to brighter reddish-violaceous lusters and frontovertex and lower face (Fig. 94c) sometimes also variably extensively similarly coloured; vertex uniformly curved into occiput, transversely alutaceous-imbricate; frons meshlike coriaceous to imbricate with at most surface of only some cells slightly depressed, but not completely delineated by ridges (Fig. 94e); scrobal depression, including scrobes, at least with obvious meshlike sculpture, and more distinctly reticulate to transversely strigose-reticulate in larger individuals; setae hairlike to very slightly lanceolate, white; lower face toward malar sulcus with

somewhat longer but evenly distributed setae, with the longer setae uniformly curved (Fig. 94b, c); gena posterior to malar sulcus with 1 longer seta differentiated from others, and posterior to eye with apices of setae directed toward orbit. Antenna (Fig. 94f) with scape entirely dark; length of pedicel + flagellum 1.2–1.3× head width; pedicel (Fig. 94g) globular, only about as long as wide, ventrally with row of 4 long white setae, of which at least basal 3 are hook-like curved; anellus very strongly transverse, discoidal, shiny, with at most inconspicuous sparse setae at extreme apical margin (Fig. 94g); flagellum robust-filiform (Fig. 94f), fu1 at least slightly and up to about 1.2× longer than pedicel, with all funiculars longer than wide but at most about 1.4× as long as wide, and clava subequal in length to apical two funiculars; funicle and clava densely covered with appressed white setae, the basal funiculars without evident regions of differentiated setae ventrally. Maxillary and labial palps light to dark brown. Mesosoma (Fig. 94a) similar in colour to head, almost entirely green to bluish-green or partly bluish, though sometime partly dark or with slight violaceous luster, most commonly scutellar-axillar complex except frenal area usually more quite green to blue or purple, and mesonotum posteriorly sometimes also partly dark; setae hairlike, white; tegula dark. Front leg with femur mostly dark with reddish-violaceous to blue or purple luster on at least posterior surface and tibia with dorso- and ventrolongitudinal dark bands, but knee narrowly pale and tibia apically and longitudinally on anterior and posterior surfaces pale; protarsus pale except apical tarsomere dark. Middle leg similarly coloured as profemur except tibia entirely brownish to dark except narrowly pale apically and basally. Hind leg similarly coloured as middle leg. Fore wing (Fig. 94d) with mv slightly more than 4× length of stv and pmv only slightly longer than stv; costal cell dorsally near leading margin with 4–8 setae apically anterior to parastigma, and ventrally with only single row of setae over at least about basal half; basal cell with pale to light brownish setae along basal and mediocubital folds, but only quite sparsely setose within cell; speculum sometimes closed posterobasally by only one seta on cubital fold distal to basal fold, though usually cubital fold with more setae. Propodeum with complete median carina, quite shiny though often with variably distinct meshlike sculpture, particularly posteriorly.

Distribution. United Arab Emirates, Yemen.

Biology. Unknown, but all type specimens were collected by light trap.

Remarks. Because of an at least partly pale scape (Figs 92c, 93f, g), comparatively long ovipositor sheaths, and similar distribution, females of *E. punctatifrons* are most likely to be mistaken for *E. vanharteni*. Females are differentiated primarily by the features given in the key. However, because only one female of *E. vanharteni* is known, limits of intraspecific variation are unknown for the species. The *E. vanharteni* female has slightly shorter ovipositor sheaths and the apical dark region is somewhat shorter and darker brown (Fig. 122h) than that of *E. punctatifrons* females (Fig. 93e). The body colour of the *E. vanharteni* female is generally somewhat darker than for *E. punctatifrons* females (*cf* Figs 122f, 92b and 122d, 92d), including having obviously brown to dark rather than white pronotal admarginal setae (difference most conspicuous laterally (*cf* Figs 122g, 92d). However, the white prepectal setae are more conspicuous for the *E. vanharteni* female (Fig. 122g) because these, although slender, are more obviously flattened, lanceolate. The specific name of *E. punctatifrons* is based on the frons (Fig. 92e), in addition to the parascrobal region and lower face (Fig. 92f), having setae originating from shallow, circular depressions (best seen from strongly oblique view). The frons is mostly meshlike coriaceous (small females) to variably distinctly meshlike imbricate (larger females), whereas the lower parascrobal region and lower face are more obviously reticulate. Because of this, the individual depressions are usually more obvious on the frons (Fig. 92e) than on the lower parascrobal region and lower face, which appear more roughened to wrinkled, punctate-reticulate (Fig. 92f), because of the combination of setal depressions and reticulations. The sculpture is more obvious in larger than smaller females. The single *E. vanharteni* female also has setal punctures evident on the lower face, though not as obviously on the frons (Fig. 122e).

The male of *E. punctatifrons* is described based on individuals being collected at light traps in the same locality in Yemen, though at different times. Males are similar to those of several other species that are characterized in part by a robust-filiform flagellum (Fig. 94f), relatively short and evenly curved setae on the lower face (Fig. 94b, c), and the vertex being rounded into the occiput without a vertexal carina. In addition to the features given in couplet 29, the flagellum has denser, more appressed white setae (Fig. 94f, g) than other similar species, which generally have more obvious setae because they are curved out more distinctly from the respective flagellomere (e.g. Fig. 38e, f). Males are very similar to those of *E. cerris*, except in having a less setose costal cell, the protibia longitudinally pale, and more extensively pale tarsi.

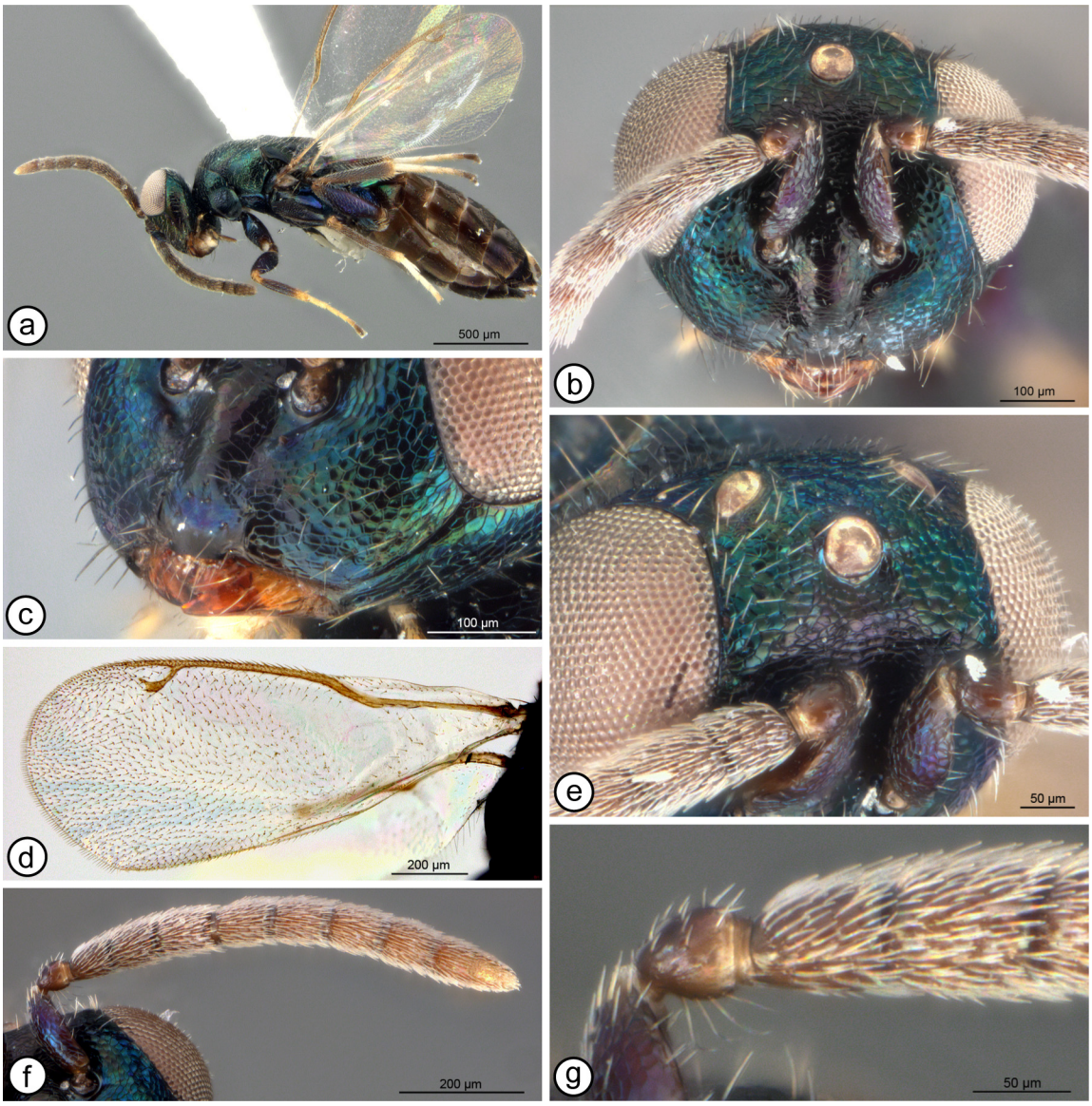

FIGURE 94. *Eupelmus punctatifrons*, ♂. **a**, lateral habitus (2014-74). *b–g* (2014-75): **b**, head, frontal; **c**, lower face, frontolateral; **d**, fore wing; **e**, upper part of scrobal depression and frontovertex; **f**, antenna; **g**, pedicel to base of fl4.

E. (*Eupelmus*) *purpuricollis* Fusu & Al khatib

Figs 95a–f (♀), 96a–h (♀)

Eupelmus (*Eupelmus*) *purpuricollis* Fusu & Al khatib *in* Al khatib *et al.*, 2015: 144. Holotype ♀, AICF, examined. Type data: DNA: LF.u.GR 02, 10650 / GREECE, Kerkini lake nr Neo Petritsi; Malaise trap; Midway Site, 30.VI[original description states "vii"]-06.VII.2008, N41°18'49.8", E23°16'35.6", 750 m asl., Leg. Gordon Ramel / HOLOTYPUS *Eupelmus* (*Eupelmus*) *purpuricollis* Det. Fusu L. 2014.

Eupelmus (*Eupelmus*) *purpuricollis* Fusu & Al khatib *in* Al khatib *et al.*, 2014: 854–856 (unavailable name; original description, keyed, illustrated).

Description. FEMALE (habitus: Figs 95c, d, 96a, e). Length = 2.8–3.2 mm. Head (Figs 95a, b, 96b, f) with lower face mostly green to bluish-green, but scrobal depression, interantennal prominence from about level of toruli, and parascrobal regions extensively, dark with coppery- to slight reddish-violaceous luster (Fig. 95a); frons variable, usually mostly greenish but often with slight coppery luster variably extensively mesally and/or with bluish to purple luster laterally along inner orbits (Figs 95b, 96b, f), and sometimes very narrowly dark with coppery luster along inner orbits similar to parascrobal region (Fig. 95a); vertex and/or temples (Figs 95b, 96b, f) purple to bright reddish-violaceous at least laterally and sometimes within ocellar triangle; with hairlike to slightly lanceolate white

setae on lower face and parascrobal region to level of dorsal margin of scrobal depression compared to less conspicuous hairlike setae on vertex. Maxillary and labial palps brown. Antenna brown except pedicel and/or scape usually with slight green or purple lusters depending on angle of light. Pronotum dorsolaterally and lateral panel over at least dorsal half violaceous to purple, contrasting distinctly with mostly dorsally green mesoscutum (Figs 95e, 96c, g, h); admarginal setae dark (Figs 95e, 96c, h). Mesonotum mostly green dorsally, but variably extensively and broadly purple to reddish-violaceous laterally along mesoscutal margin similar to pronotum laterally (Figs 95e, 96c, g, h), and sometimes with similar luster on axillae under some angles of light; with white, hairlike to slightly lanceolate setae. Prepectus (Figs 95e, 96c, h) brown with slight reddish-violaceous luster similar to pronotum and mesoscutum laterally; with 9–12 setae in two or three rows mediolongitudinally. Tegula dark. Acropleuron variably bluish-green to purple or violaceous anteriorly, more dull greenish with slight coppery luster posteriorly. Propodeal callus purple to reddish-violaceous at least lateral to level of spiracle, sometimes more bluish-green posterior to spiracle; with similar white setae as mesonotum except somewhat denser. Macropterous; fore wing (Fig. 95f) hyaline with yellowish to brown setae; costal cell dorsally near leading margin with one distinct row of setae over about apical third to two-thirds, at most with a couple of setae offset from straight row but not arranged in two distinct rows, and ventrally extensively setose with at least 3 rows of dark setae along length; basal cell and disc entirely setose except for elongate linea calva extending almost to level of base of parastigma. Front leg with femur dark except very narrowly pale apically; tibia pale basally, apically and along anterior and posterior surfaces so as to separate dorsal and ventral dark bands; tarsus pale. Middle leg pale beyond coxa except for dark mesotibial apical and mesotarsal pegs and apical tarsomere, or at most femur brown only on posterior to posteroventral surfaces but with dorsal surface lighter, yellowish-orange compared to lighter yellowish knee, tibia apically and basal tarsomeres. Hind leg with trochantellus and trochanter usually, femur mostly, and up to basal half of tibia sometimes dark, but femur and tibia at least broadly apically, and at least basal four tarsomeres pale. Gaster (Figs 95c, d, 96a) with hairlike setae; mostly brown but with distinct green to bluish-green luster basally on basal tergite and less distinctly laterally and dorsoapically under some angles of light; ovipositor sheaths distinctly banded, with dark basal band and pale medial band at least slightly and usually about one-third longer than variably dark brown apical band.

Head in dorsal view (Figs 95b, 96b, f) with interocular distance about 0.40× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons, and eye height 1.85–1.95× malar space; in frontal view (Fig. 95a) width 1.19–1.24× height, with lower ocular line intersecting toruli near dorsal margins, malar space about 1.29–1.33× distance from oral margin to inner ventral margin of torulus, and latter distance about 1.12–1.25× distance between inner mesal margins of toruli; vertex evenly rounded into occiput, transversely alutaceous-imbricate; frons meshlike coriaceous (Figs 95a, 96b); scrobal depression shiny and smooth (Fig. 95a) except lateral walls coriaceous to alutaceous, and interantennal prominence at most finely coriaceous above level of toruli; OOL: POL: LOL: MPOD = 0.7–0.8: 2.1–2.4: 1.3–1.5: 1.0. Mesoscutum (Fig. 96c, h) with posteromedial depressed region similarly meshlike reticulate as anteromedial lobe; axilla mostly obliquely and scutellum longitudinally reticulate-imbricate laterad midline. Acropleuron more-or-less isodiametric meshlike anteriorly and with somewhat larger meshes posteriorly, but much more minutely sculptured mesally and larger meshlike sculpture at most only delineated by slightly raised ridges. Fore wing (Fig. 95f) with cc: mv: pmv: stv = 5.0–5.1: 4.5–4.6: 1.1–1.3: 1.0; stigmal vein straight (Fig. 95f). Middle leg with row of 5 mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus and pegs differentiated into two rows apically; second tarsomere with 5 pegs, third tarsomere with 2 pegs or sometimes 3 pegs along posterior margin, and fourth tarsomere either with 1 peg apically on either side or sometimes 2 pegs posteroapically. Propodeum with broadly U-shaped plical depression extending to posterior margin. Gaster (Figs 95c, d, 96a) similar in length to combined length of head and mesosoma; not atypically modified; extending to base of third valvula, the latter about 0.72–0.75× length of metatibia and 0.75–0.79× length of mv; hypopygium extending about two-thirds length of gaster.

MALE. Unknown.

Distribution. **Bulgaria*** [Rhodope Mts, Besapari hills, 3 km SW Novo selo fill., 350 m., 1.VIII.2000, A. Stojanova, CNC Photo 2014-109 (PUPB/IBER: 1♀)], Greece.

Biology. Unknown.

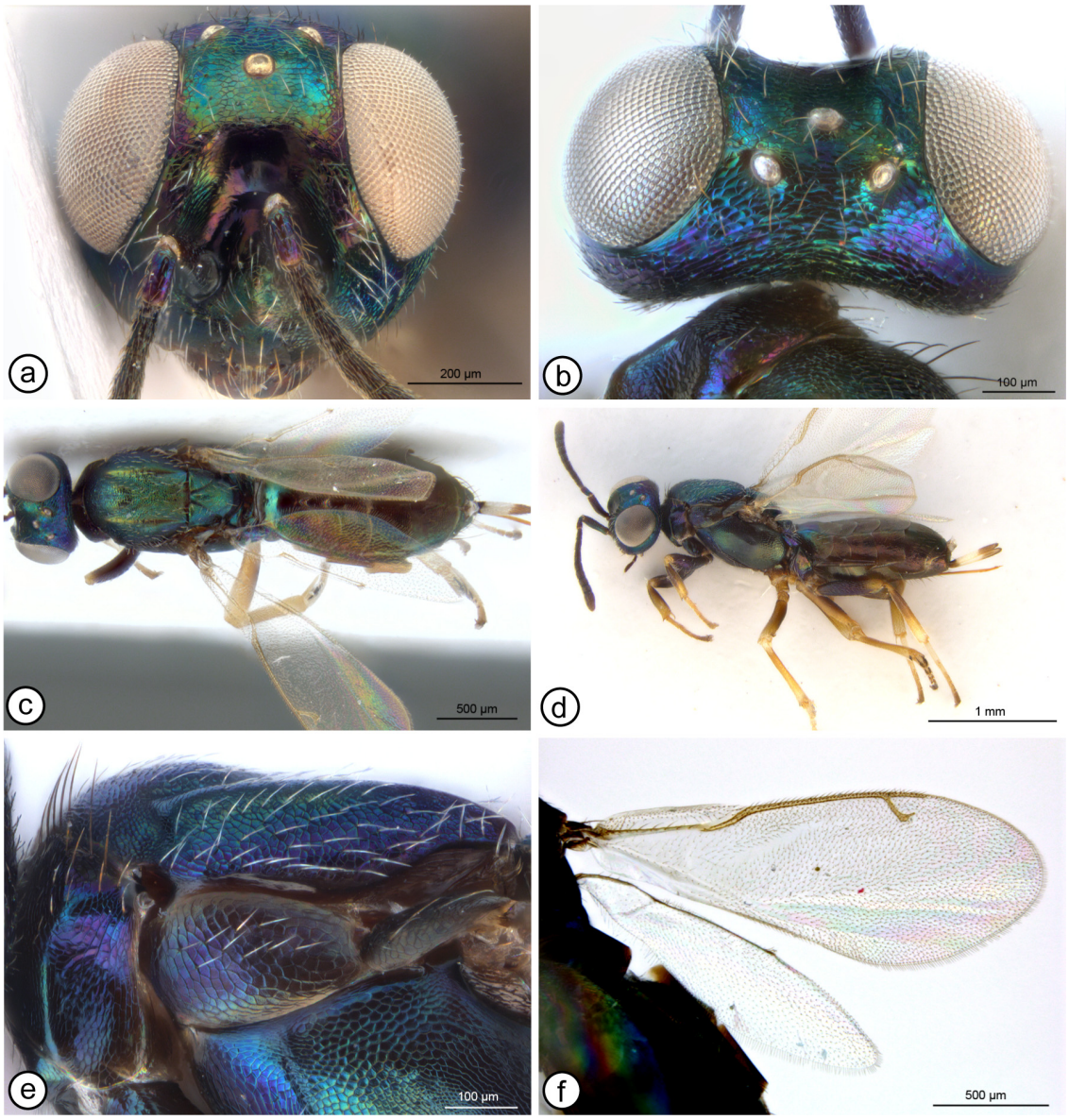

FIGURE 95. *Eupelmus purpuricollis*, ♀: **a**, head, frontal (paratype, 2014-35). *b–d* (holotype): **b**, head, dorsal; **c**, dorsal habitus; **d**, lateral habitus. *e, f* (paratype, 2014-36): **e**, pronotum and prepectus, lateral; **f**, wings.

Remarks. *Eupelmus purpuricollis* is one of six species included in the *urozonus*-group (see under *E. urozonus*), and was described from four females from Greece. Although the internal tissues of the holotype were digested for DNA extraction, colour of the body does not appear to be adversely affected except for the mesofemur, which is mostly pale except for the posterior to posteroventral surfaces being brown. Because the internal leg contents are missing the mesofemur appears brown if focused at a strongly oblique angle (Fig. 95d). However, only the posterior and posteroventral surfaces are brown and thus the mesofemur appears mostly pale if viewed from a somewhat posterodorsal angle (Fig. 96c) but more distinctly brown from a direct dorsal view because the ventrally brown region shows through. Two studied paratypes have the mesofemur uniformly yellow to yellowish-orange except paler basally and apically (Fig. 96a, left insert). The holotype also has the metatibia extensively darkened within its basal half (Fig. 95d), whereas the two paratypes have the metatibiae mostly yellowish-orange except paler apically (Fig. 96a, right insert). If some individuals have an even more extensively dark mesofemur they could be mistaken for *E. priotoni* (see further under latter species), but are differentiated most conspicuously by the vertex being variably extensively reddish-violaceous to blue or purple (Figs 95b, 96b, f) and the mesoscutal lateral lobe having a similar colour pattern laterally along the margin (Figs 95e, 96c, g, h). The ovipositor sheaths of the type series females of *E. purpuricollis* are also relatively shorter than the holotype of *E. priotoni*, at most about 0.8× compared to about 0.9× the length of the marginal vein.

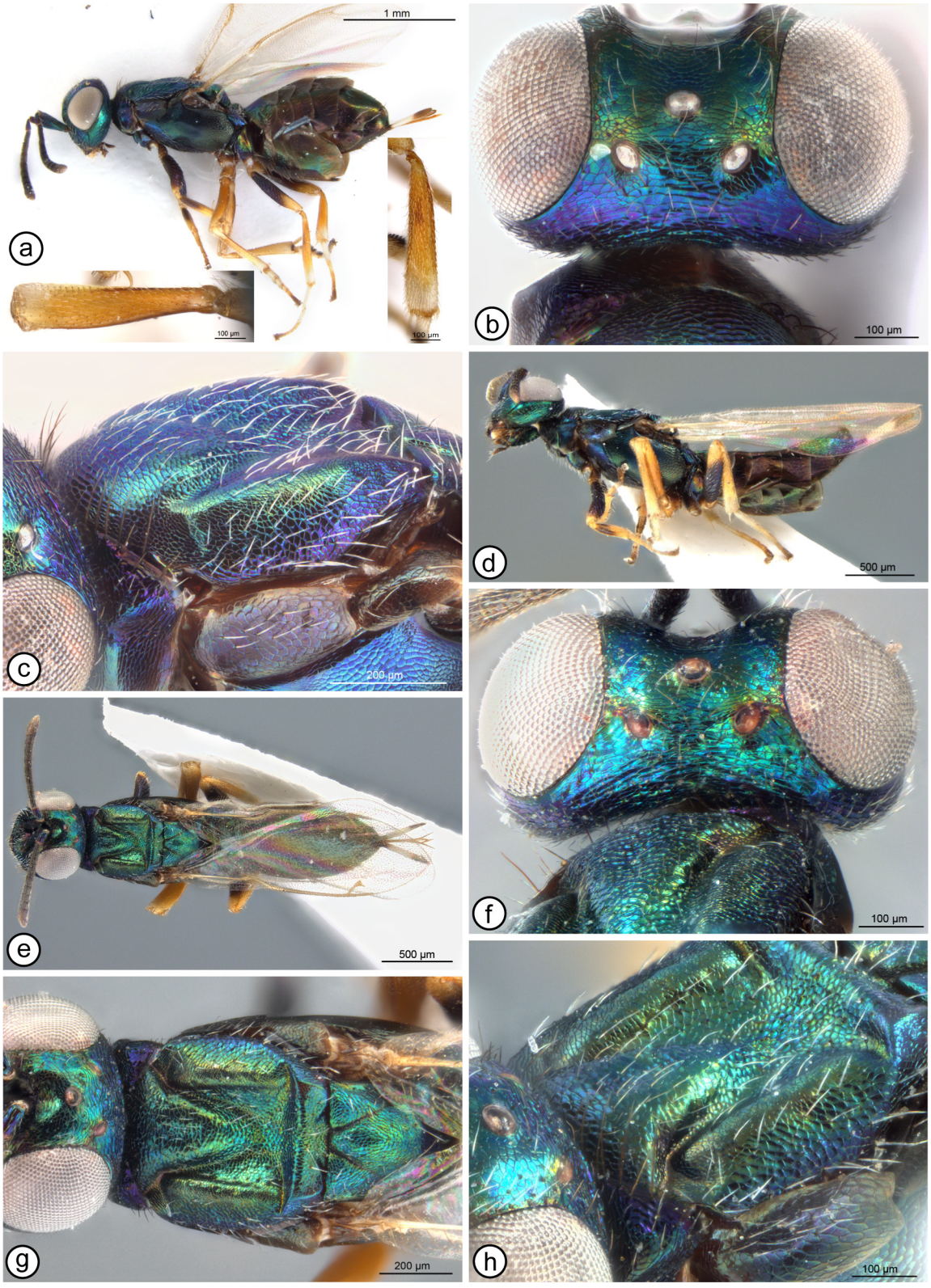

FIGURE 96. *Eupelmus purpuricollis*, ♀: **a**, lateral habitus [left insert: mesofemur (dorsal view); right insert: metatibia (outer view)] (paratype, 2014-35). *b, c* (paratype, 2014-36): **b**, head, dorsal; **c**, pronotum, mesoscutum and tegula. *d–h* (2014-109): **d**, lateral habitus; **e**, dorsal habitus; **f**, head, dorsal; **g**, frontovertex and mesonotum, dorsal; **h**, pronotum, mesoscutum and tegula.

Because of uncertainty over the morphological limits of *E. purpuricollis*, the female description is based only on the holotype and two examined paratypes. However, we did see one other female from Bulgaria (Fig. 96d–h) that we are quite confident is conspecific. The middle legs and metatibiae are pale (Fig. 96d) similar to the

paratypes (Fig. 96a), the pronotum has dark admarginal setae (Fig. 96h) and is purple laterally so as to contrast conspicuously with the mostly green mesonotum (Fig. 96g, h), the vertex is variably distinctly blue to purple, though with only very limited reddish-violaceous lusters under some angles of light (Fig. 96f), the mesoscutum laterally is variably distinctly blue to purple along its length under some angles of light (Fig. 96g, h), and the right prepectus has 13 setae (Fig. 96h) (left prepectus with fewer because of abrasion). Additional measurements are as follows: interocular distance 0.41× head width; eye height 1.78× length of malar space; in frontal view width 1.2× height; malar space 1.37× distance from oral margin to inner ventral margin of torulus, and latter distance 1.17× distance between inner mesal margins of toruli; OOL: POL: LOL: MPOD = 0.89: 2.7: 1.6: 1.0; fore wing with cc: mv: pmv: stv = 4.7: 4.2: 1.2: 1.0; third valvula 0.73× length of metatibia and 0.81× length of marginal vein.

Some females we currently attribute to *E. priotoni* have vertexal and mesoscutal colour patterns variably closely similar to some *E. purpuricollis* females. However, similar to the holotype of *E. priotoni* (Fig. 90c), such females always have both the meso- and metatibiae partly dark within about their basal half and somewhat darker mesofemora, though it remains to be shown more conclusively whether leg colour pattern is a stable differentiating feature (see further under *E. priotoni*).

E. (*Eupelmus*) *saharensis* Kalina n. stat.

Figs 97a–i (♀), 98a–f (♂)

Eupelmus saharensis Kalina, 1988: 13–15. Holotype ♀, IAEE, examined by GG. Type data: Afr. sept.: Algiria [sic], Tassili-N-Ajjer, Djanet, 28.10.1975, A. Hoffer.

Description. FEMALE. (habitus: Fig. 97a, b). Length = [1.2–1.6 mm]. Head (Fig. 97c) bright green with variably distinct coppery to reddish-coppery luster on frons near or dorsally within scrobal depression, and on parascrobal region mesally and interantennal prominence; with conspicuous white lanceolate setae on lower face, parascrobal region to dorsal limit of scrobal depression (Fig. 97c), and vertex compared to somewhat thinner, more hairlike, sparser setae on frons (Fig. 97c, d). Maxillary and labial palps pale except apical maxillary palpomere dark brown. Antenna with scape yellow except dorsoapically brownish for distance less than length of pedicel (Fig. 97c, d), pedicel and flagellum brown with slight metallic green luster on pedicel under some angles of light or sometimes pedicel ventrally or apically and anellus lighter, yellowish. Mesosoma bicoloured (Fig. 97a, b, e); prothorax, including prosternum, yellowish-orange except pronotum with dark spot posterolaterally adjacent to spiracle; mesoscutum extensively green or green with slight coppery luster dorsally, but yellowish-orange posterolaterally (Fig. 97e) and laterally along mesoscutal margin (Fig. 97b); scutellar-axillar complex with axillae yellowish-orange in distinct contrast to green scutellum (Fig. 97e); prepectus and tegula yellowish- to brownish-orange; acropleuron yellowish- to brownish-orange, but ventrally mesopectus mostly dark except yellowish- to brownish-orange anteriorly toward procoxa, prepectus and acropleuron; metanotum yellowish-orange; propodeum brown except callus with variably distinct green to bluish luster; prepectus bare; pronotum with admarginal setae white; mesonotum, including axillae, with slightly lanceolate white setae, those on axillae similarly as sparse as on mesoscutum (Fig. 97e); callus laterally with dense white setae forming reflective surface (Fig. 97e). Macropterous; fore wing (Fig. 97f) with costal and basal cells hyaline with white setae, though both cells basally often with some setae somewhat darker; disc more-or-less distinctly bifasciate, comparatively light brownish basally behind parastigma and base of mv and behind stv and pmv to level about midway between apex of pmv and wing apex, though paler or hyaline also longitudinally along mediocubital fold, with setae in hyaline region behind about apical half of mv at least anterior to mediocubital fold and near wing apex white or paler than dark setae within infuscate regions; costal cell dorsally near leading margin without or with at most 1 seta apically in region anterior to parastigma (often also dark setae adjacent to parastigma), but ventrally with whitish setae along length, the setae numerous apically but in only 1 or 2 rows mesally and basally; basal cell and disc entirely setose except for short, often comparatively obscure linea calva (Fig. 97f insert). Front leg, including coxa, similarly yellowish-orange as acropleuron except at least apical two tarsomeres brown. Middle leg, including coxa, yellowish-orange except knee and basal four tarsomeres paler, more whitish, and mesotibial apical pegs and mesotarsal pegs with tip variably conspicuously and extensively darkened and apical tarsomere brown. Hind leg with coxa brownish except apically, otherwise yellowish-orange except for dark apical tarsomere. Gaster (Fig. 97a) with hairlike setae; mostly yellowish-orange to orangey-brown except basal tergite basally brownish with variably distinct greenish to bluish lusters; ovipositor sheaths pale except for extreme tip.

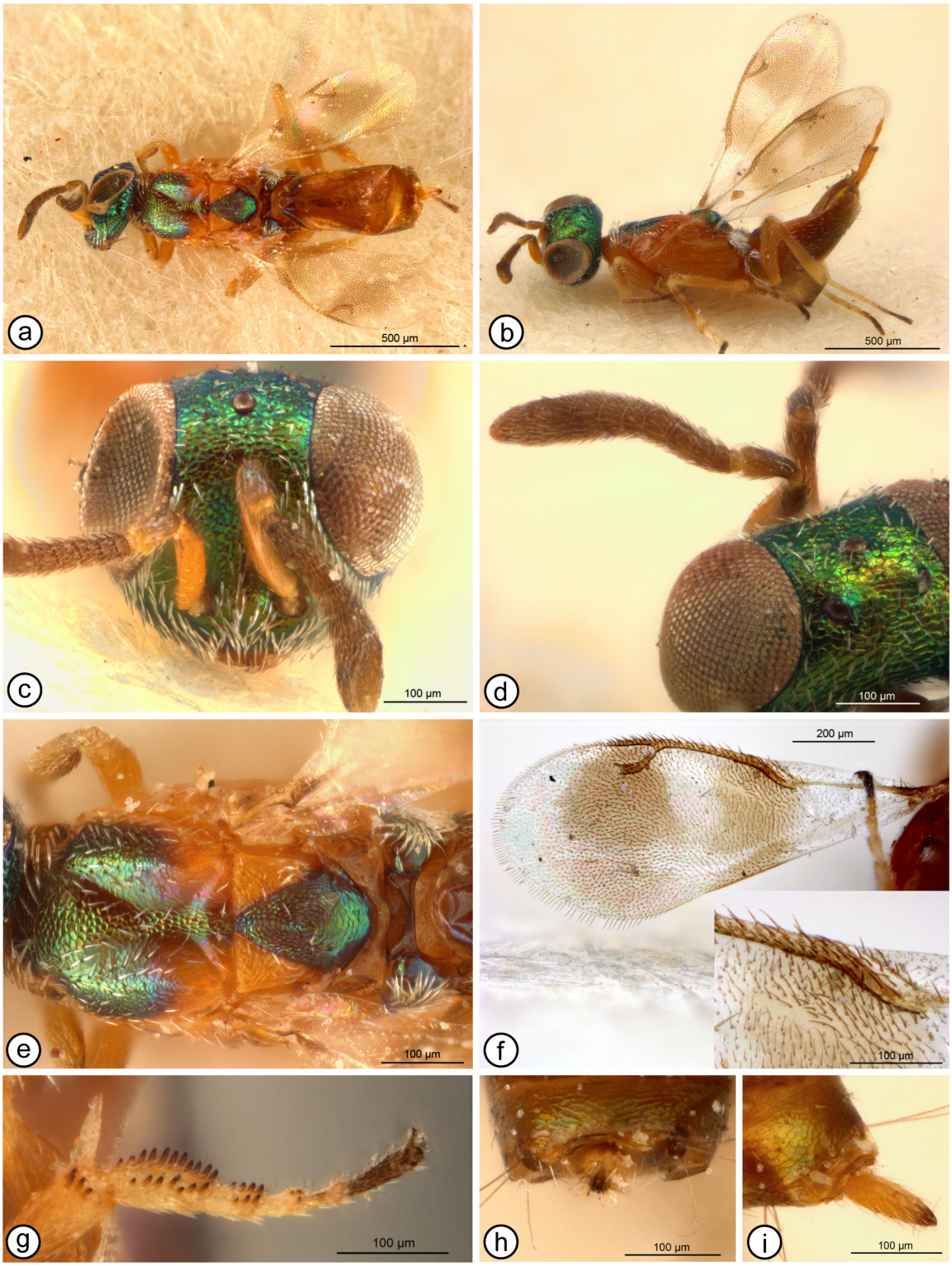

FIGURE 97. *Eupelmus saharensis*, ♀. *a, e* (paratype 2015-12): **a**, dorsal habitus; **e**, mesosoma, dorsal. *b, c* (paratype 2015-13): **b**, lateral habitus; **c**, head, frontal. *d, f* (holotype): **d**, antenna and frontovertex; **f**, fore wing [insert: linea calva enlarged]. **g**, apex of mesotibia and mesotarsus (paratype 2015-14). *h, i,* ovipositor sheaths and apex of syntergum (paratype 2015-12): **h**: posterior; **i**, posterolateral.

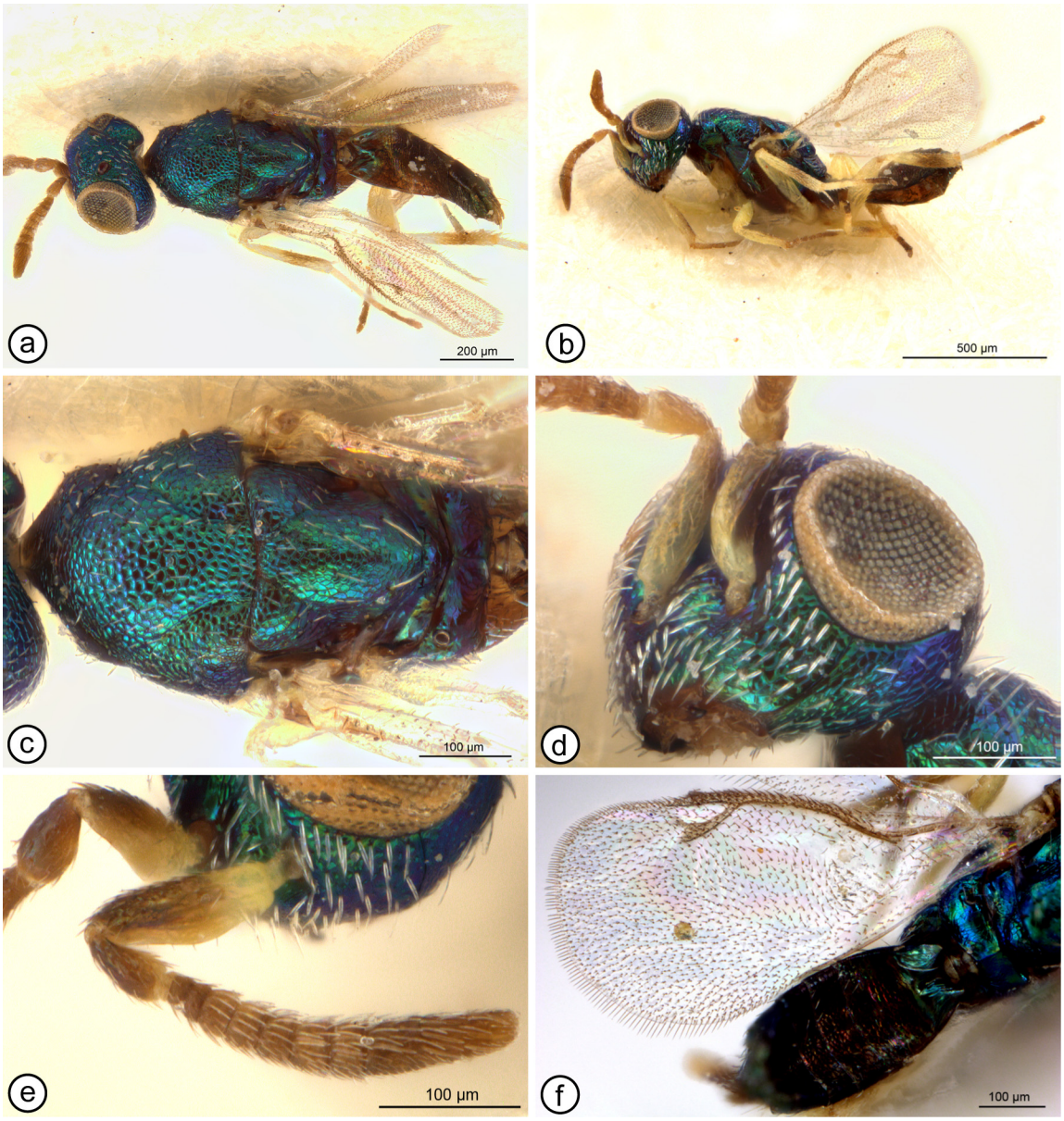

FIGURE 98. *Eupelmus saharensis*, ♂. *a–d* (2015-15): **a**, dorsal habitus; **b**, ventrolateral habitus; **c**, mesosoma, dorsal; **d**, head, frontolateral, and basal part of antennae. *e, f*: (2015-16): **e**, antenna; **f**, fore wing, propodeum and gaster.

Head in dorsal view with interocular distance slightly less than 0.4× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; vertex reticulate-imbricate to transversely alutaceous-imbricate; frons meshlike reticulate to more finely coriaceous-reticulate in smaller individuals; OOL: POL: LOL: MPOD = 0.6–0.8: 2.3–2.8: 1.8–2.0: 1.0. Mesoscutum with anteromedial lobe mostly meshlike reticulate, the sculpture continued mediolongitudinally throughout posterior depressed region of mesoscutum (Fig. 97e), but inclined surfaces of lateral lobes with much finer, less conspicuous sculpture to almost entirely smooth and shiny. Scutellum and axillae low convex in same plane; axilla reticulate to reticulate-imbricate laterally; scutellum reticulate to reticulate-imbricate laterally anterior to much smoother and shinier, meshlike sculptured frenal area. Acropleuron more-or-less distinctly meshlike anteriorly, much more minutely sculptured to shiny and virtually smooth mesally, and posteriorly with larger, longitudinally aligned meshlike coriaceous sculpture. Fore wing (Fig. 97f) with cc: mv: pmv: stv = 4.0–4.2: 2.5–2.8: 1.0–1.3: 1.0. Middle leg (Fig. 97g) with 4 or 5 mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus, the pegs relatively inconspicuously differentiated in length to form single serrate line or only obscurely differentiated into two rows apically, second tarsomere with 3–5 pegs, third tarsomere with 1 or 2 pegs, and fourth tarsomere without pegs on

either side. Propodeum with broadly U-shaped plical depression extending to posterior margin (Fig. 97e). Gaster (Fig. 97a, b) similar in length to combined length of head and mesosoma; not atypically modified, but at least air-dried specimens with syntergum flattened over or variably distinctly apically reflexed above sheaths (Fig. 97h, i); extending over base of third valvula so as to conceal division between second valvifers and third valvulae, but the latter about 0.5× length of metatibia and subequal in length to mv, and apparent sheath length less (Fig. 97b); hypopygium extending about or slightly more than half length of gaster.

MALE (habitus: Fig. 98a, b). Length about 1.2 mm. Head (Fig. 98a, b, d) green to slightly bluish-green or frontovertex sometimes more distinctly blue under some angles of light; frontovertex meshlike reticulate and uniformly curved into occiput; scrobal depression similarly meshlike reticulate as frons; setae white, with those on lower face and gena conspicuous, lanceolate, subequally short and evenly distributed, without a differentiated longer seta on gena (Fig. 98d), and those behind eye directed toward outer orbit. Antenna (Fig. 98e) with scape pale basally and ventrally, but variably extensively darkened dorsoapically, at least on outer surface (Fig. 98d, e); pedicel almost twice as long as wide, pale ventrally (Fig. 98d) but at least partly dark dorsally (Fig. 98e), and ventrally without apically curved setae, the setae short, straight and projecting at acute angle relative to ventral margin; length of flagellum + pedicel subequal to width of head; flagellum distinctly clavate with funiculars increasing in width to clava, the clava with ventrally flat or collapsed micropilose sensory region; anellus discoidal, bare, yellowish; funicle with basal two funiculars transverse, anelliform, the subsequent funiculars subquadrate to transverse apically (Fig. 98e), and basal funiculars without regions of differentiated setae ventrally. Maxillary and labial palps pale, whitish-yellow. Mesosoma (Fig. 98c) green to bluish-green except tegula yellow and usually with more brown to yellowish-brown band ventrally along transepisternal line and obliquely though mesopleuron; setae slender-lanceolate to hairlike. Front leg yellow except coxa variably extensively dark basally, tibia sometimes brownish ventroapically, and tarsus with at least apical tarsomeres brownish. Middle leg, including sometimes coxa, mostly yellow but tibia at least indistinctly brownish subapically, femur sometimes variably extensively and distinctly dark ventrally, and apical two or three tarsomeres brown. Hind leg mostly yellow beyond coxa but tibia brownish within about apical half except variably distinctly apically, femur sometimes with outer surface partly brownish mesally, and apical two or three tarsomeres brown. Fore wing (Fig. 98f) with mv about 1.7× as long as stv; costal cell dorsally near leading margin with row of dark setae over at least apical half, and ventrally with single row of dark setae basal to parastigma; basal cell uniformly setose with dark setae; disc dorsally with at least one row of setae behind base of mv and parastigma so speculum sometimes comparatively narrow apically, but broadened toward and closed posterobasally by setae. Propodeum with complete median carina, and panels at most finely coriaceous-alutaceous.

Distribution. Algeria.

Biology. Host unknown, but type series swept from *Tamarix* (Tamaricaceae) (Kalina 1988).

Remarks. Kalina (1988) described *E. saharensis* based on 59 females, of which we examined the holotype and five paratypes. Kalina (1988) stated that specimens were fairly common sweeping *Tamarix*, though his are the only specimens we saw. He also stated the male was unknown, but we received with the type material three males from the same collecting events as some of the paratypes, one collected 1.X.1975 (CNC Photo 2015-15) and two collected 23.X.1975 (one with CNC Photo 2015-16). These undoubtedly are males of *E. saharensis*, and they were labelled as such by Kalina.

The card-mounted holotype is entire but contorted. Images provided in the original description by Kalina (1988, figs 23–27 and plate III, figs 3–5, 7) were taken from a paratype. As discussed under *E. fulgens*, *E. saharensis* possesses several features characteristic of most *fulgens*-group species, but has a more similar fore wing colour pattern to most *splendens*-group species (*cf* Figs 19g, 97f) and based on similar mesosomal colour patterns may be most closely related to *E. bulgaricus* of that group (*cf* Figs 19e, 97e). The mesosomal colour pattern differs most conspicuously only in the prosternum and metanotum (Fig. 97e) being entirely yellowish in *E. saharensis* females. Those females we examined have a relatively short and inconspicuous linea calva (Fig. 97f), which might easily be overlooked in some specimens, and because of this we key females before it is necessary to observe presence or absence of a linea calva.

Males of *E. saharensis* are atypical for the subgenus in having uniformly short, slightly lanceolate genal setae (Fig. 98d) and lacking apically curved pedicular setae (Fig. 98e). As such, males (Fig. 98a, b) closely resemble some *E.* (*Episolindelia*) males, including having a short, clavate flagellum with a discoidal, pale anellus (Fig. 98e), and the scape being pale at least ventrolongitudinally (Fig. 98d). The legs are also at least extensively pale, though

variation in the only three examined males suggests that the description likely does not adequately encompass intraspecific variation.

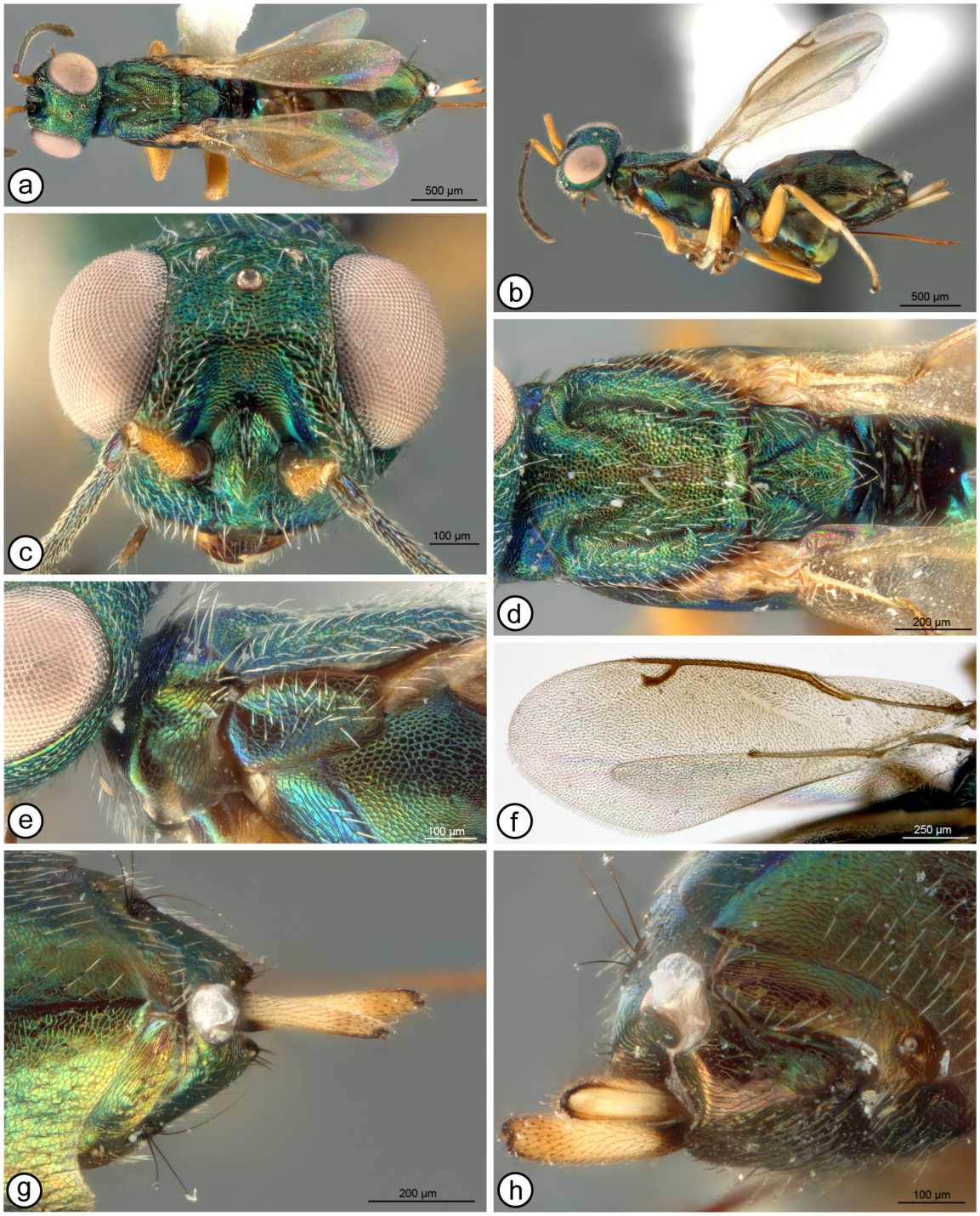

FIGURE 99. *Eupelmus setosus*, holotype ♀: **a**, dorsal habitus; **b**, lateral habitus; **c**, head, frontal; **d**, mesosoma, dorsal; **e**, pronotum, mesonotum and prepectus, lateral; **f**, fore wing; **g**, apical tergites and ovipositor sheaths, dorsal; **h**, apical tergites and ovipositor sheaths, posterolateral.

***E.* (*Eupelmus*) *setosus* Fusu & Gibson n. sp.**
Fig. 99a–h (♀)

Type material. Holotype ♀ (CNC). UNITED ARAB EMIRATES: al-Ajban, 24.36N 55.01E, 09.xi-07.xii.2005, light traps & MT, Anthony van Harten / HOLOTYPUS ♀ *Eupelmus* (*Eupelmus*) *setosus* sp. n. Det. Fusu L. 2013. Condition: point-mounted; uncontorted; entire.

Etymology. The specific name is based on the prepectus and pronotum being extensively and conspicuously setose.

Description. FEMALE (habitus: Fig. 99a, b). Length = 3.1 mm. Head (Fig. 99c) uniformly bright green to bluish-green except for slight coppery luster within scrobal depression and on parascrobal region under some angles of light; with comparatively conspicuous, slightly lanceolate white setae, particularly on parascrobal regions and lower face. Maxillary and labial palps brown. Antenna with scape yellow (Fig. 99b, c), pedicel and flagellum brown, the pedicel and basal flagellomeres with at most very slight metallic luster under some angles of light. Pronotum blue dorsolaterally (Fig. 99d, e) though panel green (Fig. 99e); admarginal setae white (Fig. 99e). Mesonotum (Fig. 99d) similarly green to bluish-green as head except axillae more distinctly blue under most angles of light and mesoscutum and scutellum mesally with slight coppery luster; with comparatively conspicuous, slightly lanceolate white setae. Prepectus (Fig. 99e) green to bluish-green or variously extensively brown depending on angle of light; almost completely setose with numerous, slightly lanceolate white setae. Tegula yellow (Fig. 99d, e). Acropleuron mostly green with coppery luster under some angles of light except more bluish to purple anterodorsally. Propodeal callus purple to reddish-violaceous in contrast to mesonotum; with similar, slightly lanceolate though denser white setae than mesonotum. Macropterous; fore wing (Fig. 99f) almost hyaline but with very slight, inconspicuous yellowish tinge behind discal venation, with basal cell setae white or at least paler than somewhat darker yellow to brownish discal setae; costal cell dorsally near leading margin with row of comparatively inconspicuous whitish setae along apical two-thirds to three-quarters, and ventrally with at least 2 rows along length; basal cell and disc entirely setose except for elongate linea calva extending to level about equal with middle of parastigma. Legs entirely yellow, including apices of pro- and mesocoxae, except for dark mesotibial apical pegs and mesotarsal pegs. Gaster (Fig. 99a, b) mostly green to bluish-green except in dorsal view apical half of basal tergite and subsequent three tergites mostly brown; laterally with comparatively conspicuous, slightly lanceolate white setae; ovipositor sheaths pale beyond short, dark basal region, not distinctly banded though somewhat darker, yellowish apically and extreme apical margin dark (Fig. 99g, h).

Head in in dorsal view with interocular distance about 0.41× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; vertex evenly rounded into occiput, transversely reticulate-imbricate; frons and scrobal depression distinctly meshlike reticulate (Fig. 99c); OOL: POL: LOL: MPOD = 1.0: 2.5: 1.5: 1.0. Mesoscutum (Fig. 99d) mostly meshlike reticulate except anteromedial lobe anteriorly more transversely alutaceous-reticulate and lateral lobe with mediolongitudinal band of minute coriaceous sculpture. Scutellum and axillae low convex in same plane; axilla mostly obliquely and scutellum longitudinally reticulate-imbricate laterad midline anterior to meshlike coriaceous frenal area. Acropleuron meshlike reticulate anteriorly and posteriorly relative to much more minutely sculptured region mesally, and with larger meshlike sculpture delineated by distinct ridges. Fore wing (Fig. 99f) with cc: mv: pmv: stv = 4.8: 4.0: 1.2: 1.0. Middle leg with row of 7 mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus and pegs clearly differentiated into two rows apically; second tarsomere with 7 pegs, third tarsomere with 3 or 4 pegs, and fourth tarsomere with 1 or 2 pegs apically on either side. Propodeum with broadly U-shaped plical depression extending to posterior margin (Fig. 99d). Gaster (Fig. 99d) similar in length to combined length of head and mesosoma; not atypically modified; extending slightly beyond base of third valvula, the latter about 0.72× length of metatibia and 0.89× length of mv, but apparent sheath length only about 0.57× length of metatibia and about 0.70× length of mv; hypopygium extending about two-thirds length of gaster.

MALE. Unknown.

Distribution. United Arab Emirates.

Biology. Unknown.

Remarks. The unique holotype of *E. setosus* is differentiated from females of other species possessing both mesotibial apical and mesotarsal pegs by the tegula, legs beyond the coxae, and scape all being yellow. The gaster extends quite distinctly over the base of the third valvulae and the posterolateral margins of the syntergum are abruptly angled inwards between the anal sclerite and ovipositor sheaths (Fig. 99h) so in dorsal view the posterolateral angles appear slightly protuberant on either side of the anal sclerite (Fig. 99g). Although difficult to quantify, the holotype also has the head (Fig. 99c), dorsal surface of the pronotum and mesoscutum (Fig. 99d, e), and prepectus more conspicuously setose than females of most other species. This results, in part, because the setae are white in distinct contrast to the green body colour, but also because they are slightly though quite obviously elongate-lanceolate, even on the mesoscutum. Females of a few other species are similarly densely and extensively

setose, but the setae usually are less conspicuous because they do not contrast so conspicuously in colour with the body and/or are hairlike (e.g. *cf* Fig. 99e with Figs 7e, 22g and Fig. 99d with Figs 7d, 22e).

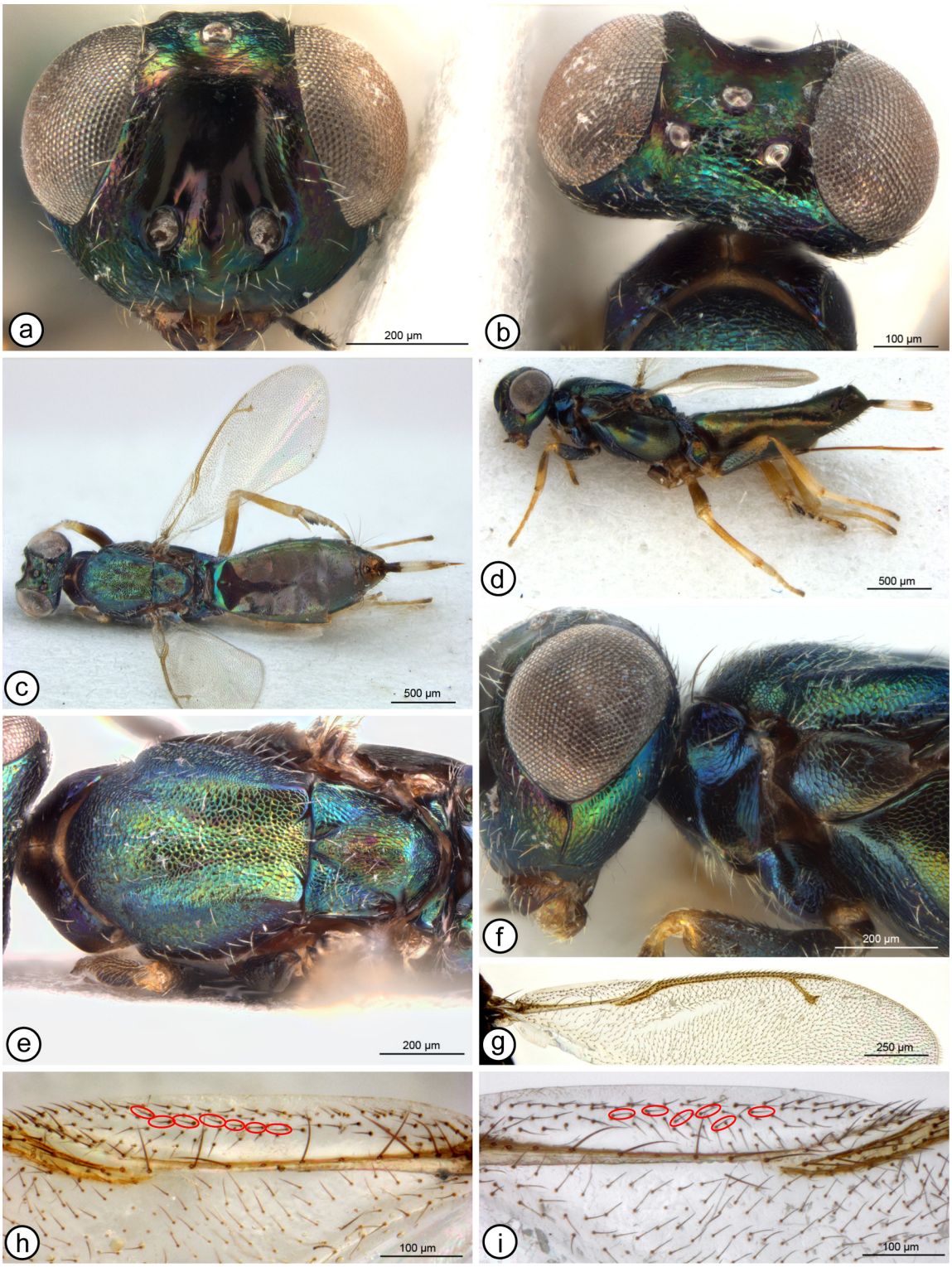

FIGURE 100. *Eupelmus simizonus*, holotype ♀: **a**, head, frontal; **b**, head and pronotum, dorsal; **c**, dorsal habitus; **d**, lateral habitus; **e**, mesosoma, dorsal; **f**, head, pronotum and prepectus, lateral; **g**, anterior half of fore wing; **h**, left fore wing costal cell; **i**, right wing costal cell (dorsal setae forming second row of setae circled).

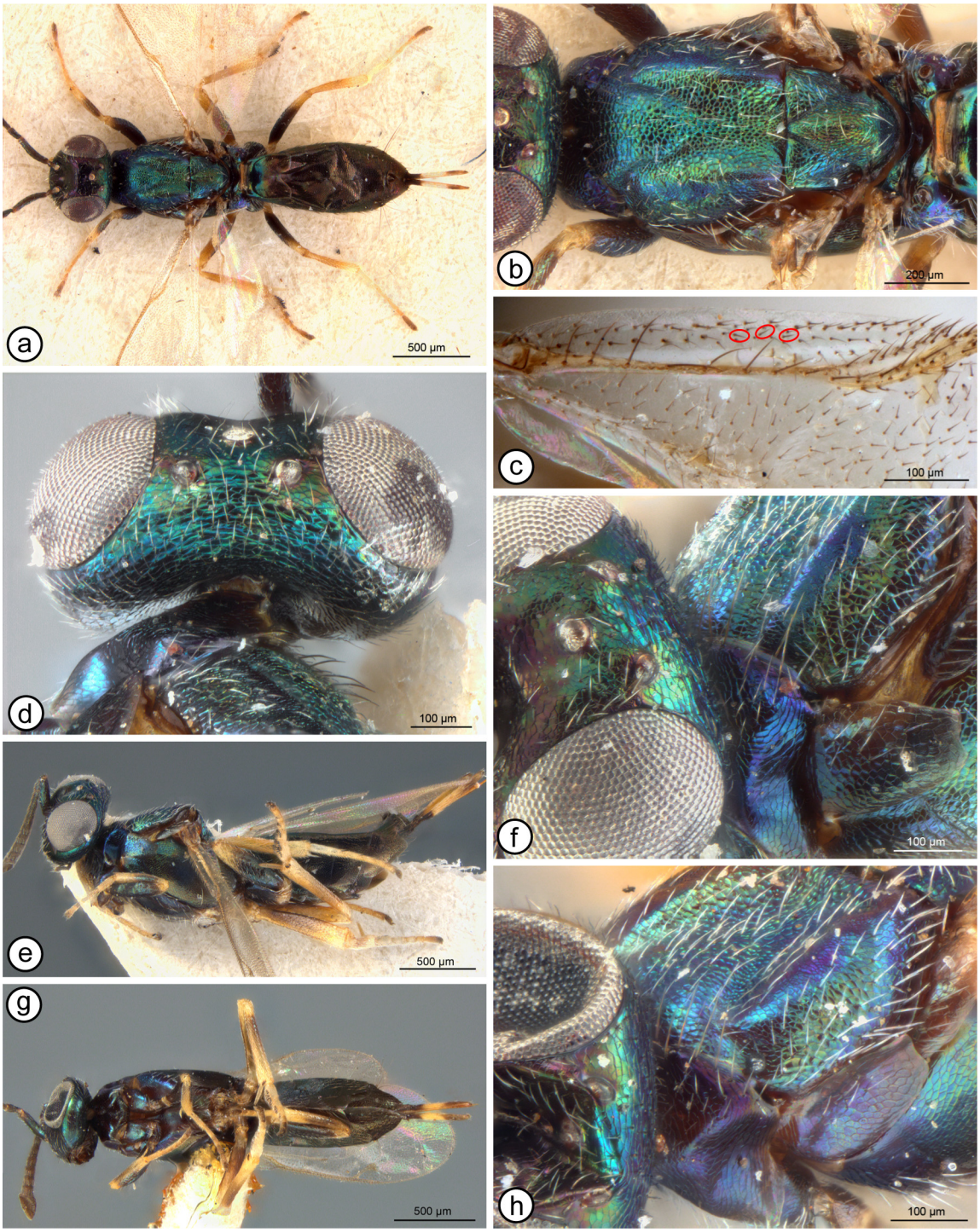

FIGURE 101. *Eupelmus simizonus*, ♀. *a–c* (2014-105): **a**, dorsal habitus; **b**, vertex and mesosoma, dorsal; **c**, right fore wing costal cell (3 dorsal setae forming second row of setae circled). *d–f* (2014-106): **d**, head (dorsal) and pronotum (lateral); **e**, lateral habitus; **f**, vertex, pronotum, mesoscutum and tegula. *g, h* (2014-107): **g**, body, ventral view; **h**, vertex, pronotum, mesoscutum and tegula.

E. (*Eupelmus*) *simizonus* Al khatib

Figs 100a–i (♀), 101a–h (♀)

Eupelmus (*Eupelmus*) *simizonus* Al khatib *in* Al khatib *et al.*, 2015: 145. Holotype ♀, MHNG, examined. Type data: France, Ardèche, Les Vans, 175 m a.s.l., Lit du Granzon, 44.38722°N 4.15444°E, 15.vii.2012, G[érard] Delvare, sweeping on *Quercus pubescens* (GDEL4142/10297).

Eupelmus (*Eupelmus*) *simizonus* Al khatib *in* Al khatib *et al.*, 2014: 855–856 (unavailable name; original description, keyed, illustrated).

Eupelmus urozonus, cryptic species A; Kaartinen *et al.*, 2010.

Description. FEMALE (based on holotype and a sequenced non-type female from Hungary, with values for latter between square brackets) (habitus: Fig. 100c, d). Length = [2.4]–2.93 mm. Head (Fig. 100a, b) with lower face and most of frontovertex in dorsal view green, but most of frons below anterior ocellus and in frontal view head from about level of toruli through scrobal depression and parascrobal regions mostly dark with slight reddish-violaceous luster (Fig. 100a); with hairlike to slightly lanceolate white setae on lower face and parascrobal region to level of dorsal margin of scrobal depression compared to less conspicuous hairlike setae on vertex. Maxillary and labial palps brown. Antenna brown except scape and pedicel with slight bluish-green luster under some angles of light. Pronotum (collar indented laterally) dorsolaterally and lateral panel over at least dorsal half purple to violaceous (Fig. 100f), contrasting with mostly green mesonotum (Fig. 100e); admarginal setae pale at least laterally (mostly missing) [setae whitish laterally and brown mesally, though with lighter apices]. Mesonotum (Fig. 100e) mostly green with some coppery luster, particularly within posteromedial depressed region of mesoscutum and on scutellum, but mesoscutal lateral lobes mediolongitudinally and posterolaterally and axillae with distinct blue to purple luster under some angles of light; with white, hairlike to slightly lanceolate setae. Prepectus (Fig. 100f) brown with slight metallic luster under some angles of light; with 4 setae anterodorsally (3 remaining on right prepectus, but additional setal pore visible) [3 on left prepectus]. Tegula dark. Acropleuron mostly greenish with slight coppery luster except more minutely sculptured mesal region blue to purple. Propodeal callus greenish behind but blue to purple lateral to spiracle; with similar white setae as mesonotum except somewhat denser. Macropterous; fore wing (Fig. 100g) hyaline with yellowish to brown setae; costal cell dorsally near leading margin with two distinct rows of setae, one over most of length and a second, shorter row of 6 (right wing) or 7 (left wing) off-set setae mesally (Fig. 100h, i) [6 setae on right wing and those of left wing abraded], and ventrally extensively setose with dark setae along length, though reduced to two rows for very short length subbasally; basal cell and disc entirely setose except for elongate linea calva extending almost to level of base of parastigma. Front leg with femur dark except very narrowly pale apically; tibia pale basally, apically and along anterior and posterior surfaces so as to separate dorsal and ventral dark bands; tarsus pale. Middle leg pale beyond coxa, mostly yellowish to brownish-yellow, with knee, tibia apically and basal tarsomeres more whitish and tibia subbasally and femur, particularly from oblique view, more distinctly brownish-yellow [mesofemur strongly darkened along most of length posteroventrally except apically, almost as dark as pro- or metafemora, but paler along anterodorsal margin; tibia brownish in about basal third except basally (*cf* Fig. 101g)]; mesotibial apical and tarsal pegs dark. Hind leg with femur mostly dark, but trochanter and trochantellus, femur apically, and tibia and tarsus paler [tibia darker, brownish in about basal half but paler basally and more whitish apically, and basal tarsomere white]. Gaster (Fig. 100c, d) with hairlike setae; mostly brown but with distinct green to bluish-green luster basally on basal tergite and less distinctly laterally and dorsoapically under some angles of light; ovipositor sheaths distinctly banded, with dark basal band and pale medial band longer than basal or lighter brown apical band.

Head in dorsal view (Fig. 100b) with interocular distance 0.39 [0.44]× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons, and eye height 1.94 [1.78]× malar space; in frontal view (Fig. 100a) width about 1.26 [1.27]× height, with lower ocular line intersecting toruli near dorsal margins, malar space 1.36 [1.35]× distance from oral margin to inner ventral margin of torulus, and latter distance about 1.09 [1.25]× distance between inner mesal margins of toruli; vertex evenly rounded into occiput, transversely alutaceous-imbricate; frons meshlike coriaceous; scrobal depression shiny and smooth except lateral walls finely coriaceous to alutaceous, and interantennal prominence shiny with only very obscure sculpture above level of toruli (Fig. 100a) [scrobal depression also finely coriaceous over about dorsal third and interantennal prominence quite distinctly imbricate-coriaceous]; OOL: POL: LOL: MPOD = 0.55: 2.3: 1.4: 1.0 [0.86: 2.7: 1.6: 1.0]. Mesoscutum (Fig. 100e) with posteromedial depressed region similarly meshlike reticulate as anteromedial lobe; axilla mostly obliquely and scutellum longitudinally reticulate-imbricated laterad midline. Acropleuron more-or-less isodiametric meshlike anteriorly and with slightly larger meshes posteriorly, but much more minutely sculptured mesally and larger meshlike sculpture at most only delineated by slightly raised ridges. Fore wing (Fig. 100g) with cc: mv: pmv: stv = 4.7: 4.5: 1.2: 1.0 [4.5: 4.2: 1.2: 1.0]; stigmal vein straight [slightly curved]. Middle leg with row of 4 [3] mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus and pegs differentiated into two rows apically; second tarsomere with 5 [4] pegs, third tarsomere with 3 [2] pegs and fourth

tarsomere with 1 peg on anterior and 2 pegs on posterior margin apically [both sides with 1 peg]. Propodeum with broadly U-shaped plical depression extending to posterior margin. Gaster (Fig. 100c, d) similar in length to combined length of head and mesosoma; not atypically modified; extending to base of third valvula, the latter 0.79× length of metatibia and 0.81 [0.85]× length of mv; hypopygium extending about two-thirds length of gaster.

MALE. Unknown.

Distribution. France, **Germany*?** [Bavaria thro Ruhl, Gypsy Moth Lab, cage 31, from nest U.S.D.A. 7567, MF Franconia, CNC Photo 2014-107 (USNM: 1♀)], **Hungary*** [Veszprém distr. 4.5 km NNE Nagavászony, 27.VI.2010, H. Baur, G. Delvare, G. Gibson, P. Jansta (CNC: 1♀; DNA voucher ug.HU 01)], **Russia*?** [Voronezh, Kaverinskiy nature reserve, plot 266, 8.VIII.1981, Fursov, CNC Photo 2014-106 (SIZK: 1♀)], **Sweden*** [Got. [Gotland], Hall, 10/8-50, T. Nyholm, CNC Photo 2014-105 (BMNH: 1♀)].

Biology. Kaartinen *et al.* (2010, supplementary Table S1) reported *Eupelmus urozonus*, "cryptic species A", from *Heliozela sericiella* (Haworth) (Lepidoptera: Heliozelidae)* on *Quercus robur* L.* (vouchers Euro 33, 34, and 37), a species that produces gall-like swellings on the petiole of several *Quercus* species, and from *Andricus callidoma* (Hartig) (Cynipidae)* also on *Q. robur* (voucher Euro 38). Though we did not locate these vouchers, the associated COI sequences cluster with the sequence of *E. simizonus* provided by Al khatib *et al.* (2014) and a newly obtained sequence for a female from Hungary. Consequently, the clade shown in dark green in fig. 3a of Kaartinen *et al.* (2010), "cryptic species A", and its associated host records represent *E. simizonus*. The female from Bavaria cited above was reared from the nest of the gypsy moth and thus possibly from *Lymantria dispar* (L.) or from an unnoticed host such as leaf-mining Lepidoptera larvae. The holotype of *E. simizonus* was collected sweeping *Quercus pubescens* Willdenow.

Remarks. Although the internal tissues of the holotype of *E. simizonus* were digested for DNA extraction, colour does not appear to be adversely affected except the mesofemur appears more distinctly brown if viewed from a strongly oblique angle (Fig. 100d) compared to yellowish if viewed dorsally (Fig. 100c). Both the mesofemur and mesotibia are stated as reddish-testaceous in the original description. The holotype is entire other than only one antenna remains, which is glued separately to the card; the right pronotal panel is indented, affecting its shape, and the pronotal admarginal setae are mostly missing, though they do appear to be pale, at least laterally, and are stated as white in the original description.

Eupelmus simizonus is one of six species we include in the *urozonus*-group based on females sharing an entirely or extensively smooth and shiny scrobal depression (Fig. 100a) and comparatively short ovipositor sheaths. However, the molecular results of Al Khatib *et al*. (2014) indicate *E. simizonus* is more closely related to other species within *E*. (*Eupelmus*) (Al Khatib *et al*. 2014, figs 1, 2) and thus the shiny scrobal depression in females of this species was derived independently of that of the other species we include in the *urozonus*-group (see further under 'Remarks' for *E. urozonus*). Of the species we include in the *urozonus* group, one differential feature given by Al khatib *et al.* (2014) for *E. simizonus* is that the ventral margins of the toruli are hardly below the lower ocular line (Al khatib *et al.* 2014). However, this is a relative feature that is partly influenced by the angle of viewing. The photograph of the front of the head of the holotype in Al khatib *et al.* (2014, figs 9G, 26A, C) is taken from a somewhat more ventral angle than normal, the posterior ocelli not being visible and the dorsal margin of the anterior ocellus being slightly above the dorsal curvature of the head. The heads of the other *urozonus*-group species illustrated are photographed from a slightly different angle such that the posterior ocelli are visible and the anterior ocellus is completely below the dorsal curvature of the head (e.g. figs 3C, 10B, D, G, 11F). Viewing the head of *E. simizonus* so that the posterior ocelli are visible at the top of the head results in the lower ocular line intersecting the toruli within about their dorsal third (Fig. 100a). A more objective measurement is length of the malar space compared to the distance between the oral margin and the inner ventral margin of a torulus. Our measurements of type material of the six *urozonus*-group species determine this as follows (measurements from Al khatib *et al.* (2014) within brackets): 1.36× [1.37×] holotype and 1.35× for the female from Hungary, respectively, for *E. simizonus* compared to 1.6–1.72× [1.74–1.80×] for *E. opacus*, 1.73× [2.02] for *E. priotoni*, 1.28–1.33× [1.51–1.65] for *E. purpuricollis*, 1.38–1.5× [1.58] for *E. minozonus*, and 1.48× and 1.58× for the primary types of *E. urozonus* and *E. nitidus*, respectively. It is even more difficult to obtain comparable measurements for another ratio given to differentiate *E. simizonus*, head width compared to height, because of curvature of the head and positioning the head exactly for the same view in all instances. Although the measurements are comparatively minute and require high magnification for accuracy, perhaps the easiest differential ratio to obtain is the OOL relative to the maximum diameter of the posterior ocellus, which for the holotype of *E. simizonus* is about 0.55.

Unlike Al khatib *et al.* (2014), we use leg colour pattern as a primary differential feature for those *urozonus*-group females with a laterally purple to blue pronotum that contrasts with a more greenish mesoscutum, and therefore key *E. simizonus* with *E. purpuricollis* rather than prior to *E. opacus*, *E. priotoni* and *E. purpuricollis*.

Because of uncertainty over the morphological limits of *E. simizonus*, the female description above is based only on the holotype and a second female from Hungary that is definitely conspecific because of an associated DNA sequence. Additionally, we saw one female from Sweden (Fig. 101a–c) that we are quite confident is also conspecific with the above-mentioned females. The mesofemur is more distinctly brown under most angles of light than for the holotype, but it is obviously lighter than the dark pro- and mesofemora (thus intermediate between the holotype and the female from Hungary), and both the meso- and metatibiae are entirely yellow (Fig. 101a), as for the holotype of *E. simizonus* but unlike the female from Hungary or *E. opacus* and *E. priotoni* females. Also similar to the holotype is the presence of only four prepectal setae, a costal cell with a few (three) dorsal setae offset mesally as a comparatively indistinct double row (Fig. 101c), and the presence of primarily pale pronotal admarginal setae. Mesally, the admarginal setae appear more brownish basally (Fig. 101b) similar to the female from Hungary, possibly because of head position relative to the pronotum, but the setae are at least not dark. Consequently, although not given as a differential feature in Al khatib *et al.* (2014), the presence of comparatively pale admarginal setae may differentiate females of *E. simizonus* from those of *E. minozonus*, *E. opacus*, *E. priotoni* and *E. purpuricollis*, though not *E. urozonus* (see further under last species). The interorbital distance of the Swedish female (0.42× head width) is intermediate between the holotype of *E. simizonus* and recognized *E. opacus* females, while the same ratio for the Hungarian female (0.44× head width) is even closer to *E. opacus* (0.44–0.46× head width). Because of how the female from Sweden is glued to its card rectangle it is not possible to accurately measure eye height to length of the malar space, length of the malar space to the distance between the torulus and oral margin, or the latter distance to the distance between the inner mesal margins of toruli. However, measurable ratios include head width:head height = 1.25×; OOL: POL: LOL: MPOD = 0.88: 2.5: 1.5: 1.0; fore wing with cc: mv: pmv: stv = 4.5: 4.2: 1.13: 1.0; third valvula 0.82× length of metatibia and 0.85× length of mv.

We also saw single females from European Russia (Fig. 101d–f) and Germany (Fig. 101g, h) that we questionably identify as *E. simizonus*. The Russian female has both the meso- and metatibiae pale and the mesofemur more-or-less pale, appearing somewhat darker under some angles of light, but definitely not dark (Fig. 101e). Further, the admarginal setae are a mixture of whitish setae laterally and basally dark and apically pale setae mesally (Fig. 101f) as for the Hungarian female, eye height is comparatively long relative to the malar space (1.9×), the third valvulae are also comparatively long (0.83× length of metatibia and 0.89× length of marginal vein), length of the malar space is 1.4× the distance between the oral margin and the inner ventral margin of a torulus, and the latter distance is 1.09× the intertorular distance. All of these features are similar to the holotype of *E. simizonus*. However, the Russian female has more prepectal setae (8 on left prepectus, Fig. 101f) and it also has a longer OOL (0.67× MPOD; POL = 2.6, LOL = 1.3), though the Hungarian female and Swedish female we identify as *E. simizonus* have an even longer OOL (0.86 and 0.88× MPOD, respectively). Only one wing (left) is clearly visible, which has the dorsal setae of the costal cell extending about 0.7× its length and with only two clearly offset setae within its apical half rather than a distinct second row of setae. It has only a slight purplish luster on the vertex under some angles of light and distinct purplish luster on the mesoscutum only on the smoother dorsolongitudinal sculptured bands of the lateral lobes and posterolaterally near the axillae (Fig. 101f), and thus likely is not *E. purpuricollis*. It might be a *E. priotoni* female with atypically light coloured middle legs, but what we identify as *E. priotoni* has dark admarginal setae and a different mesoscutal colour pattern. Though the convex part of the medial lobe usually is quite distinctly bluish to purple in *E. priotoni* females, posteriorly the mesoscutum is uniformly green to slightly bluish-green without contrasting regions posterolaterally. If our identification is correct, a low prepectal setal count is not characteristic for all *E. simizonus* females.

The female questionably identified as *E. simizonus* from Bavaria has atypically dark middle and hind legs. The mesofemur is definitely brownish except yellow apically and basally, and both the meso- and metatibiae have their dorsal surface quite obviously brownish subbasally (Fig. 101g), thus approaching the leg colour pattern of the Hungarian female, but also *E. opacus* and *E. priotoni*. The admarginal setae of the Bavarian female are quite obviously whitish (Fig. 101h). The costal cell dorsally also has a second row of at least four setae subapically, though some *E. priotoni* females have a similar setal pattern. The head is strongly collapsed so that accurate measurement of most features is difficult, but eye height is about 1.9× the length of the malar space, and the latter is at least 1.35× the distance between the oral margin and the inner ventral margin of a torulus. The third valvulae

are about 0.75× the length of the metatibia and about 0.83× the length of the marginal vein. It also has only four prepectal setae (Fig. 101h) similar to the females more confidently identified as *E. simizonus*, though so does *E. opacus* in combination with comparatively dark middle and hind legs (see further under latter species). It is strange that the Bavarian female is labelled as being reared in the same Gypsy moth cage (#7567) as the female we identify as *E. priotoni*, which apparently came from Switzerland (see further under *E. priotoni*).

If the three females above are correctly identified as *E. simizonus* then the key characters used by Al khatib *et al.* (2014), excluding torular position, vary at least as follows (measured value of holotype in square brackets): head width:head height from [1.25]–1.35×, OOL from [0.55]–0.88×, and number of prepectal setae from [3]–8. Further, the third valvulae vary from 0.75–0.83[0.79]× the length of the metatibia and 0.83–0.89[0.81]× the length of the marginal vein (see further under *E. urozonus*).

E. (*Eupelmus*) *splendens* Giraud

Figs 102b–i (♀), 103a–g (♂)

Eupelmus splendens Giraud, 1872: 416−418. Lectotype ♀, MNHN, here designated, examined. Type data: France, Montpellier, reared from galls of *Bathyaspis aceris* Förster on *Acer monspessulanum* L.

Eupelmus splendens Bolívar y Pieltain, 1934; Bouček, 1977: 64 (incorrect synonymy; discovered by Askew & Nieves-Aldrey, 2000: 53).

Eupelmus matranus Erdős, 1947; Bouček, 1977: 64 (incorrect synonymy; discovered by Askew & Nieves-Aldrey, 2000: 53).

Eupelmus (*Eupelmus*) *splendens*; Askew & Nieves-Aldrey, 2000: 54.

Description. FEMALE (habitus: Fig. 102b, g). Length = 1.6–2.8 mm. Head (Fig. 102f) bright green, though often with some coppery to reddish lusters under some angles of light; with slightly lanceolate but quite distinct white setae on lower face and parascrobal region almost to level of dorsal margin of scrobal depression compared to less conspicuous hairlike setae on frontovertex. Maxillary and labial palps brown or labial palps sometimes pale. Antenna (Fig. 102e) uniformly dark except scape variably extensively yellow basally or ventrobasally (Fig. 102f) and pedicel and dark part of scape often with some metallic luster. Mesosoma bicoloured (Fig. 102b, g); pronotum green at least dorsally (Fig. 102h), the lateral panel often yellow to orangey-brown (Fig. 102b) or sometimes brown with reddish-coppery luster; mesonotum usually bright green except mesoscutum sometimes with coppery to reddish lusters under some angles of light (Fig. 102h), particularly mesally and outer surface of lateral lobe (smaller individuals sometimes with mesoscutum more extensively brown than scutellar-axillar complex, but still with distinct greenish luster); tegula and prepectus varying from yellow to orangey-brown to brown with slight greenish luster (Fig. 102b, g, h); acropleuron and mesopectus variable, similarly dark as mesonotum with slight metallic green luster to orangey-brown with coppery luster to orange and then in strong contrast to mostly green mesonotum (Fig. 102b); metanotum and propodeum with variably distinct green to bluish luster at least laterally, the dorsellum and propodeal plical region more commonly dark brown; prepectus bare; pronotum with admarginal setae white; mesonotum with white to brownish hairlike setae most similar to those on frontovertex; callus laterally with quite dense white setae, though usually not completely obscuring cuticle. Macropterous; fore wing (Fig. 102d) with costal and basal cells (Fig. 102i) mostly hyaline with white setae, but basally with brownish infuscation and dark setae; disc with all setae dark and at least obscurely bifasciate with variably dark brownish infuscation behind parastigma and base of mv, and behind stv and pmv, or at least with lighter infuscate to hyaline region behind most of mv if more uniformly infuscate behind venation posteriorly (Fig. 102d); costal cell (Fig. 102i) dorsally near leading margin with row of setae over at most about apical half, the more apical setae white and inconspicuous, and ventrally with 2 or 3 rows along length; basal cell (Fig. 102i) and disc entirely setose except for linea calva. Legs with at least meso- and metacoxae extensively dark basally and with mesotarsal pegs and apical tarsomeres dark, but otherwise mostly pale except following sometimes variably distinctly brown: posterior surface of profemur, posterior surface of protibia except basally and more widely apically, small subbasal ring on mesotibia, outer and inner surfaces of metafemur within apical half, and obscure subbasal region on metatibia similar to mesotibia. Gaster (Fig. 102b, g) with hairlike setae; brown with coppery or sometimes slight greenish luster except basal tergite anteriorly distinctly green to bluish-green; ovipositor sheaths with second valvifer and extreme base of third valvula dark, the third valvula otherwise pale to variably dark brownish apically so as to be distinctly banded or not.

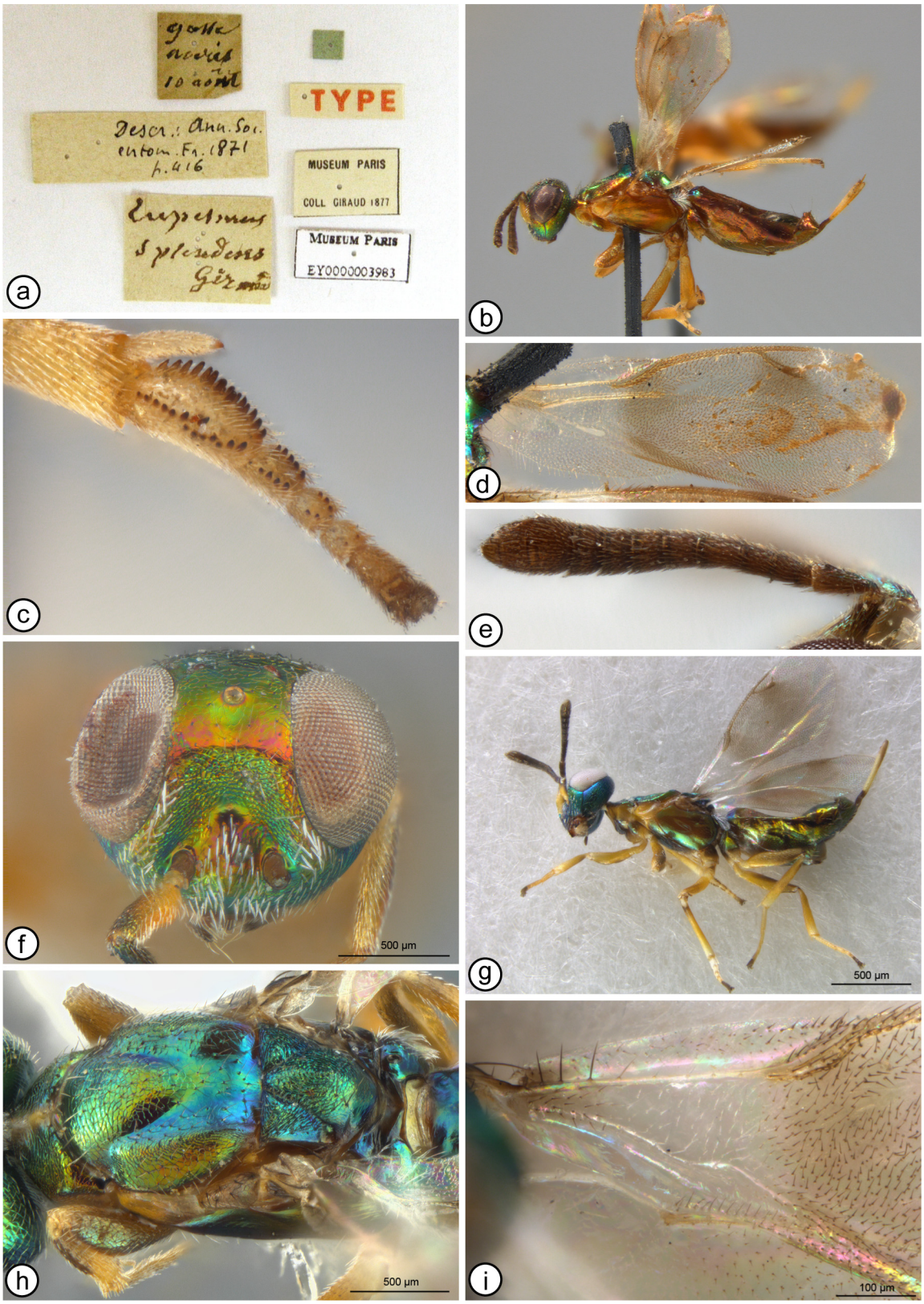

FIGURE 102. *Eupelmus splendens*, ♀. **a**, labels for lectotype and MNHN paralectotype #1. *b–d* (lectotype): **b**, lateral habitus; **c**, apex of mesotibia and mesotarsus; **d**, right fore wing (and hind wing beneath). **e**, MNHN paralectotype #2, antenna. **f**, head, frontal (2013-9). *g, i* (2012-43): **g**, lateral habitus; **i**, fore wing base. **h**, mesosoma, dorsal (2013-8).

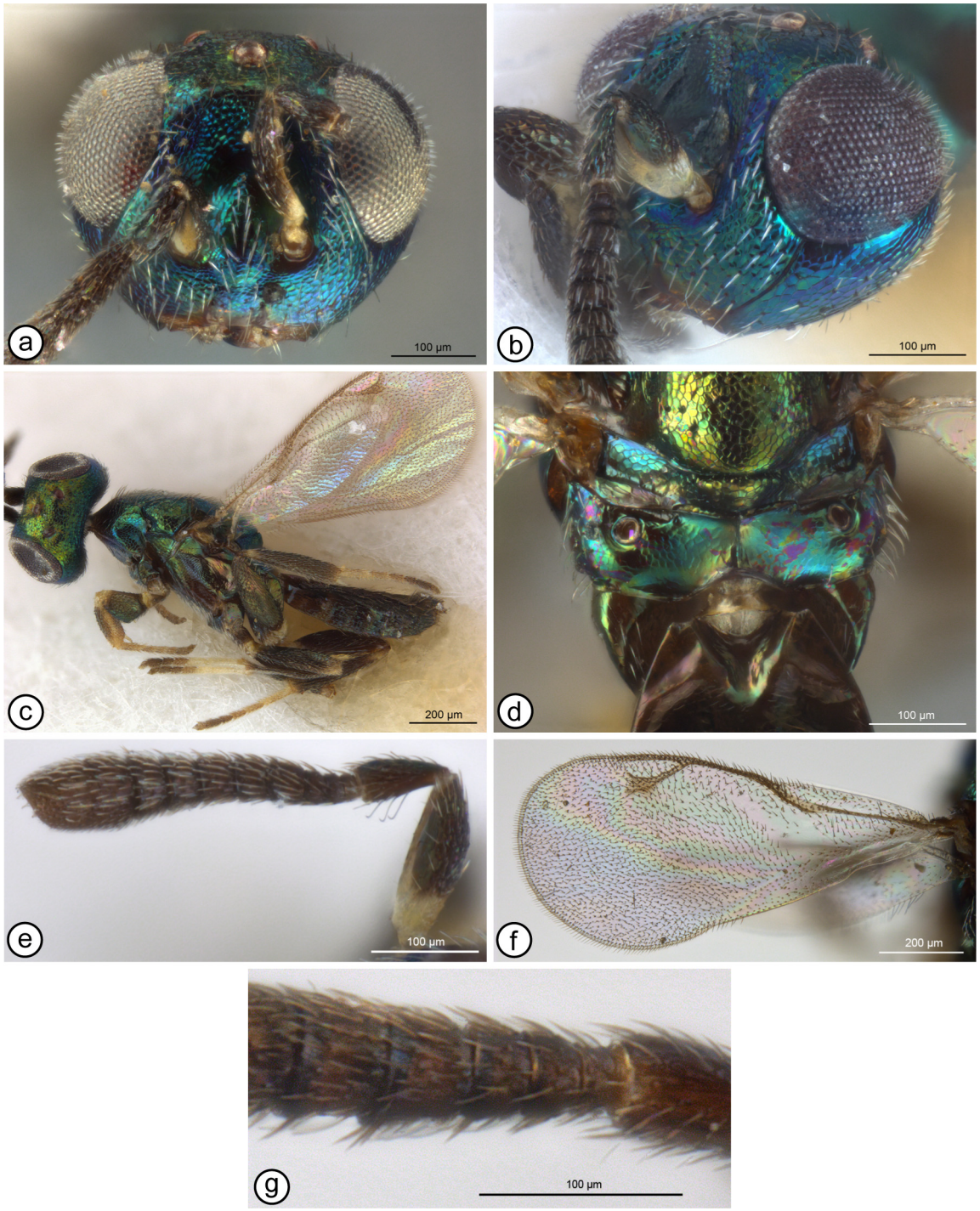

FIGURE 103. *Eupelmus splendens*, ♂. **a**, head, frontal (2012-93). *b, e* (2013-118): **b**, head, frontolateral; **e**, antenna, outer view. **c**, lateral habitus (2013-119). *d, f* (2012-92): **d**, apex of scutellum to propodeum; **f**, fore wing. **g**, pedicel to base of fl7, ventral view (2013-147).

Head in dorsal view with interocular distance about 0.35–0.4× head width; in lateral view lenticular, the face almost evenly convex and scrobal depression smoothly merged with frons; vertex meshlike coriaceous-alutaceous posteriorly to finely coriaceous or partly smooth and shiny; frons usually at least partly smooth and shiny or with subeffaced sculpture, though sometimes very finely meshlike coriaceous (Fig. 102f); scrobal depression reticulate to reticulate-rugose (Fig. 102f). Mesoscutum (Fig. 102h) with posteromedial depressed region shinier and variably distinctly more finely meshlike coriaceous to smooth compared to outer surface of lateral lobe and convex part of medial lobe. Scutellum and axillae low convex in same plane; punctate-reticulate except frenal area finely meshlike coriaceous. Acropleuron at least with very fine sculpture and difficult to see if light coloured, but meshlike

coriaceous to coriaceous-reticulate anteriorly and posteriorly and much more minutely sculptured to smooth mesally. Fore wing (Fig. 102d) with cc: mv: pmv: stv = 2.0–3.8: 1.7–2.5: 1.0–1.2: 1.0. Middle leg (Fig. 102c) without mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus; basitarsus apically with at least a couple of pegs overlapping, but often not clearly differentiated into two rows; second tarsomere with 3–5 pegs, third tarsomere with 2 or 3 pegs on at least one side, and fourth tarsomere often with 1 peg apically on at least one side. Propodeum with broadly V-shaped plical depression extending to posterior margin (Fig. 102h). Gaster (Fig. 102b, g) about as long as mesosoma; not atypically modified; not quite extending to apex of second valvifer, the latter extending slightly but distinctly beyond gastral apex, with third valvula about 0.75–0.9× length of metatibia and about 1.2–1.4× length of mv (sheaths superficially longer if apically extended part of second valvifer included).

MALE (habitus: Fig. 103c). Length = 1.0–1.6 mm. Head (Fig. 103a, b) mostly green to bluish, though frons sometimes with slight coppery luster mesally below anterior ocellus and parascrobal region, lower face and gena sometimes more distinctly blue to purple under some angles of light; frons meshlike coriaceous to at most very slightly coriaceous-reticulate; vertex uniformly curved into occiput, meshlike coriaceous to sometimes reticulate-imbricate posteriorly; scrobal depression meshlike reticulate (Fig. 103a, b); setae white, hairlike to slender-lanceolate, particularly on parascrobal region; lower face toward malar sulcus often with uniformly spaced, short setae (Fig. 103a, b), but if with longer, apically curved setae ventrally near oral margin then these not numerous or appearing dense; gena posterior to malar sulcus with 1 longer seta differentiated from others, at most as long and usually obviously shorter than length of malar space, and ventral to this with at most 3 much shorter, uniformly curved setae along oral margin, and posterior to eye with apices of setae directed toward orbit. Antenna (Fig. 103e) with scape dark except sometimes extreme base and outer, ventral, longitudinally sensory region in part to entirely pale (Fig. 103e); pedicel (Fig. 103e) at least about 2× as long as wide and about as long as combined length of fl1–fl4, and ventrally with 3 or 4 long white setae, of which basal 3 hook-like curved; length of flagellum + pedicel slightly shorter than or at most as long as head width; flagellum distinctly clavate (Fig. 103e) with funiculars increasing in width to clava, the clava with ventrally flat or collapsed micropilose sensory region; anellus strongly transverse, but dull, setose and of similar length to fl2; funicle with all funiculars transverse, at least the basal (Fig. 103g) and apical ones strongly so; basal funiculars without evident regions of differentiated setae ventrally. Maxillary and labial palps whitish. Mesosoma (Fig. 103c) mostly green to bluish-green, but propodeum sometimes more bluish (Fig. 103d); setae hairlike, pale brownish to white; tegula often dark but sometimes variably distinctly yellow. Front leg with femur dark at least posteroventrally and usually more extensively, but anterior surface mediolongitudinally to entirely pale; tibia mostly pale except dorso- and ventrolongitudinally to more extensively dark except at least anterior surface longitudinally; tarsus pale to infuscate. Middle and hind legs dark except trochantelli, knees or at least tibiae basally, tibiae apically, tibial spurs and basal two tarsomeres of at least middle leg white. Fore wing (Fig. 103f) with mv about 1.6–1.9× length of stv; costal cell dorsally near leading margin with row of dark setae over about apical two-thirds to three-quarters, and ventrally with dark setae in two rows basal to parastigma; basal cell uniformly setose with dark setae; disc dorsally bare behind base of mv and parastigma, delineating slender speculum closed posterobasally by setae. Propodeum (Fig. 103d) with complete median carina, and panels finely meshlike coriaceous.

Type material examined. Lectotype ♀ (MNHN, Fig. 102b–d), one of two females mounted separately by minutien pins into a pith block, with seven labels as in Fig. 102a. The lectotype, here designated, is the female on the left side of the pith block with the minutien pin through its right mesoscutal lateral lobe immediately anterior to the axilla (Fig. 102b).

Paralectotypes (3♀): 1♀ (MNHN), second female pinned with lectotype that is pinned medially through the mesoscutum immediately anterior of the scutellum; 1♀ (MNHN), individually minutien-mounted into a pith block, with two labels (small, green, square piece of card, and black-bordered white card with "MUSEUM PARIS COLL GIRAUD 1877"; 1♀ (NMPC), individual minutien-mounted into a historically recent rectangular card, with one red label in Bouček's handwriting "Cotypus ♀, *Eupelmus splendens*, Giraud, 1871, VIII. Montpellier, *B. aceris*".

Distribution. Croatia, Czech Republic, France, Germany, **Greece*** [Crete (CNC)], Italy, Romania?, Slovakia, Spain. The record for Romania is based on Melika *et al.* (2002a) (see 'Biology' under *E. matranus*), but we have not seen specimens of *E. splendens* from Romania.

Biology. A primary parasitoid in galls of Cynipidae (Hymenoptera). We saw specimens reared from *Pediaspis aceris* (Gmelin) on *Acer monspessulanum* L. (Sapindaceae) (ARPC, CNC, SMFG, ZMAN), confirming the record

of Pujade i Villar (1989), and *P. aceris* on *Acer opalus* Miller* (MNCN). Quacchia *et al.* (2013) also reported it from *Dryocosmus kuriphilus* on *Castanea sativa* Miller (Fagaceae), but the record in Melika *et al.* (2002a) for *Andricus multiplicatus* was based on Andriescu (1974), which listed *E. matranus*.

Remarks. *Eupelmus splendens*, *E. bicolor*, *E. bulgaricus* and *E. matranus* comprise the *splendens* species-group based on females lacking mesotibial pegs in combination with the posteromedial depressed region of the mesoscutum being at least partly much smoother and shinier than the convex part of the medial lobe. The putatively derived mesoscutal sculpture pattern is also shared with *E. saharensis* and most *fulgens*-group females, as is discussed under *E. fulgens*.

When Askew & Nieves-Aldrey (2000) resurrected *E. splendens* from synonymy under *E. matranus* they stated that, based on specimens they had seen, females were smaller and more slender than those of *E. matranus* (1.7–2.0 mm *versus* 2.2–2.8 mm in length), the ovipositor sheaths were longer relative to the metatibia (0.9× to almost as long as metatibia *versus* 0.6–07×) or gaster (0.42–0.50× *versus* 0.31–0.36×), the gaster was longer relative to the mesosoma (at least 1.2× *versus* not more than 1.1×), the head in dorsal view was less transverse (about 1.6× as wide as long *versus* 1.75–1.9×), and the combined length of the pedicel and flagellum was shorter (scarcely longer than head width *versus* 1.1×). Females of the two species we observed overlap in length. Furthermore, measurements of the flagellum, head width and gaster length can be imprecise because the flagellum is often curved or the eyes or gaster collapsed in air-dried specimens. Of the differential features listed, length of the third valvula compared to either length of the metatibia or marginal vein is the easiest to measure accurately as well as to appreciate visually without the need of measuring (*cf* Fig. 102b, g with Fig. 62e). Females of *E. splendens* typically also have the second valvifers extending slightly but quite obviously beyond the apex of the gaster, which is likely correlated with their longer third valvulae, whereas the second valvifers normally extend only to the apex of the gaster in *E. matranus* females, though this feature can be affected by whether the gaster is collapsed or inflated apically. Females of *E. splendens* are more variable in colour pattern than those of *E. matranus*, often having the acropleuron and lateral panel of the pronotum as well as the tegula and prepectus variably distinctly lighter and contrasting with the mostly or entirely dark green mesonotum (Fig. 102b). Females of *E. matranus* never have the mesosoma contrasting distinctly in colour, the mesonotum, acropleuron and lateral panel of the pronotum being similarly dark (Fig. 62e), though the tegula and/or prepectus sometimes are lighter in colour.

Askew and Nieves-Aldrey (2000) saw a single associated male of *E. matranus*, which they stated differed from males of *E. splendens* in having the long seta lateral of the malar sulcus equal in length to the malar sulcus compared to only about half the length of the sulcus, and in having the entire anterior surface of the scape yellow rather than just the extreme base and sometimes its anterior margin (*cf* Askew & Nieves-Aldrey 2000, figs 3, 4). However, our measurements indicate the genal seta can sometimes be almost as long as the malar sulcus in *E. splendens* males, though typically shorter and less conspicuous than for *E. matranus*. Further, the comparatively broad, depressed sensory band along the outer ventral half of the scape can be light-coloured in *E. splendens* as well. Our description of *E. matranus* males is based on only seven individuals, apparently from a single rearing, and thus likely does not adequately encompass intraspecific variation. However, known *E. matranus* males differ in colour from those of *E. splendens* by having only the basitarsomere of the mesotarsus white (Fig. 63a) rather than at least the basal two tarsomeres white (Fig. 103c), and in having a slightly lighter, yellowish-brown rather than brown tegula. Further, at least fu2–fu4 and sometimes fu1 appear to be flat and asetose ventrally because of modified sensilla (Fig. 63e), whereas the basal funiculars appear uniformly cylindrical and setose (Fig. 103g) for *E. splendens* males. Furthermore, even though *E. splendens* males can have a couple or a few longer, apically curved setae on the lower face and gena on either side of the malar sulcus near the oral margin, these are not conspicuous (Fig. 103b). Males of *E. matranus* have more numerous setae, typically with the curved apices overlapping, so as usually to appear as quite conspicuous tufts of setae (Fig. 63b).

E. (*Eupelmus*) *stenozonus* Askew

Figs 104a–h (♀), 105a–g (♂)

Eupelmus (*Eupelmus*) *stenozonus* Askew *in* Askew & Nieves-Aldrey, 2000: 54−56. Holotype ♀, MNCN, not examined (3♀ paratypes examined by GG). Type data: Canary Islands, La Gomera, above Santiago, 28.III.1999, R.R. Askew.

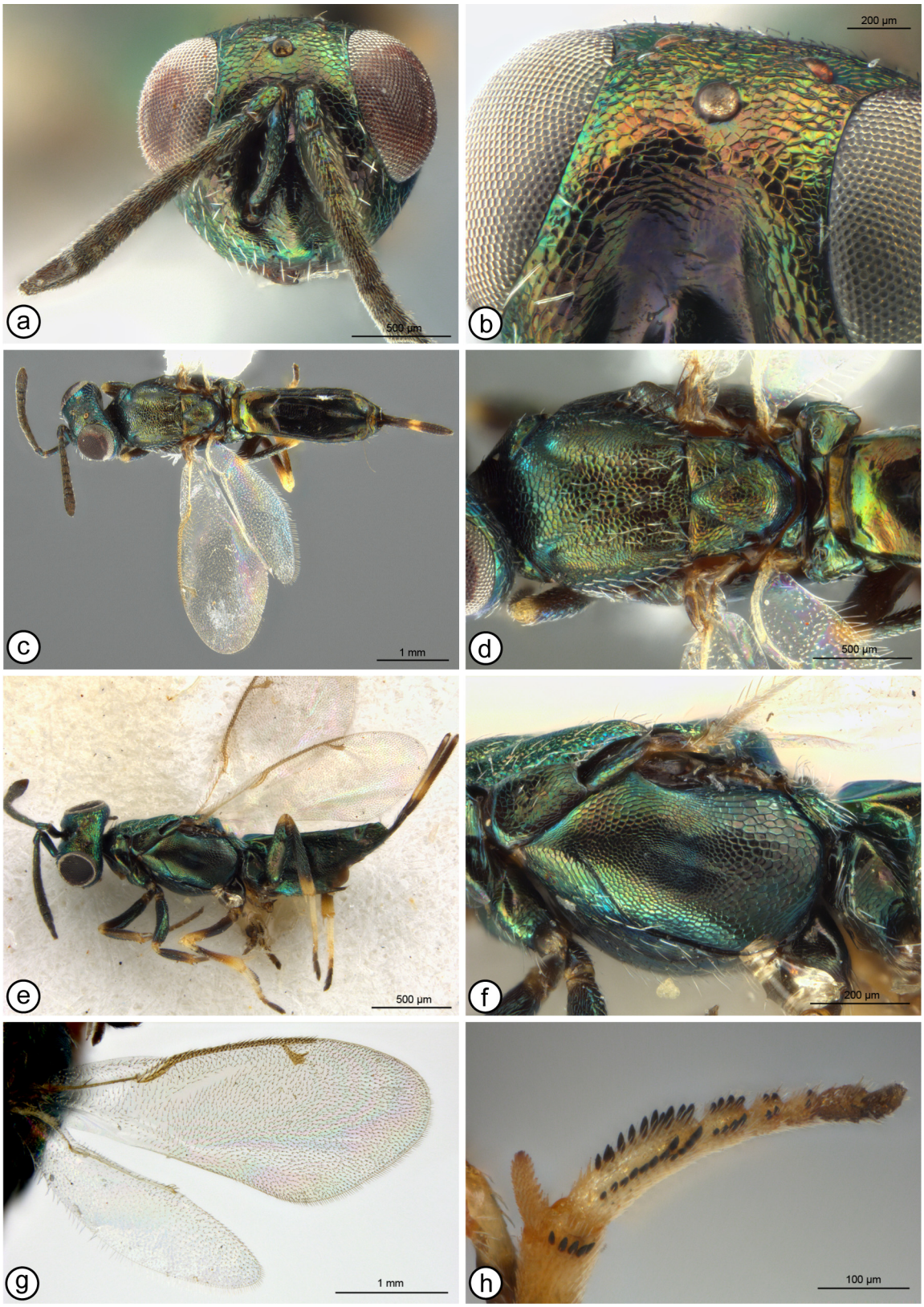

FIGURE 104. *Eupelmus stenozonus*, ♀. **a**, head and antennae, frontal (2013-3). **b**, scrobal depression and frontovertex (2013-4). *c, d* (2013-2): **c**, dorsal habitus; **d**, mesosoma, dorsal. *e, f* (paratype, 2010-44): **e**, lateral habitus; **f**, mesosoma, lateral. **g**, wings (2013-5). **h**, apex of mesotibia and mesotarsus (2012-62).

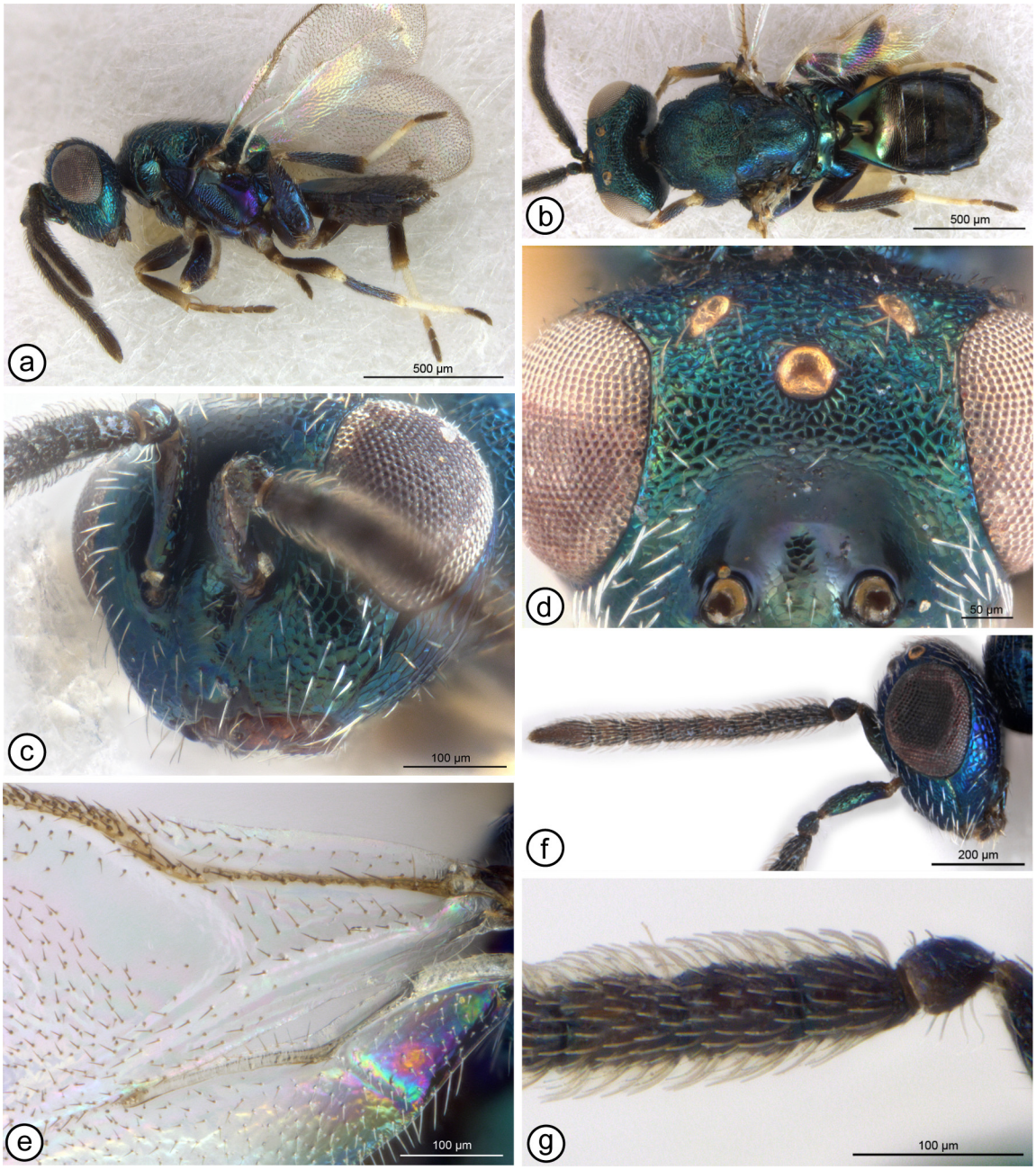

FIGURE 105. *Eupelmus stenozonus*, ♂. **a**, lateral habitus (2013-135). **b**, dorsal habitus (2013-136). **c**, head, frontolateral (2013-139). **d**, upper part of scrobal depression and frontovertex (2014-120). **e**, fore wing base (2013-138). *f, g* (2013-137): **f**, antenna and head, lateral; **g**, pedicel to base of fl5, inner view.

Description. FEMALE (habitus: Fig. 104c, e). Length = 1.5–2.8 mm. Head (Fig. 104a, b) with at least vertex and occiput green or with slight coppery luster (Fig. 104b), the face usually also similarly green or partly green to bluish-green under some angles of light (Fig. 104a); with slightly lanceolate white setae on lower face and parascrobal region to or slightly above dorsal level of scrobal depression compared to less conspicuous hairlike setae on frontovertex. Maxillary and labial palps brown. Antenna (Fig. 104a) dark with metallic lusters similar to head on scape and pedicel. Mesosoma (Fig. 104c–f) similar in colour to head, variably distinctly green with at least some coppery to reddish-coppery luster under some angles of light. Pronotum with at least some brownish to dark admarginal setae mesally, though often variably extensively pale laterally; mesonotum, prepectus and callus laterally with similar, slightly lanceolate white setae (Fig. 104f), the prepectus with a variable number of setae in two or three longitudinal rows mesally or within dorsal half. Macropterous; fore wing (Fig. 104c, g) hyaline with white setae at least basally, though discal setae often more yellowish to brown; costal cell dorsally near leading

margin with 1 or 2 partial rows of setae over about apical half to two-thirds, and ventrally with at least 3 rows along length; basal cell and disc entirely setose except for linea calva. Front leg with femur dark except narrowly pale apically, tibia at least narrowly pale basally and more extensively apically and usually variably extensively pale along posterior and/or anterior surfaces, and tarsus yellowish-brown to brown. Middle leg with femur at least orangey to brown except paler apically, and often similarly dark as front and hind leg; mesotibia with variably long and distinctly brown region subbasally; mesotibial apical pegs, mesotarsal pegs and apical one or two tarsomeres dark. Hind leg with femur dark except narrowly pale apically; tibia at least pale basally and more widely apically, often more-or-less conspicuously along ventral length; tarsus with at least basal two tarsomeres pale. Gaster (Fig. 104c, e) with hairlike setae; brown with variably extensive and distinct greenish luster under some angles of light, often most distinctly basally; ovipositor sheaths extremely rarely uniformly dark except for pale tip, but usually more-or-less distinctly banded with pale band typically conspicuously shorter than, but at most only about as long as, basal and apical dark bands.

Head in dorsal view with interocular distance 0.4–0.43× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; vertex meshlike reticulate to somewhat reticulate-imbricate posteriorly; frons shallowly meshlike reticulate (Fig. 104b); scrobal depression smooth and shiny or at most coriaceous-reticulate within about dorsal half (Fig. 104b); OOL: POL: LOL: MPOD = 0.9–1.0: 2.5–3.2: 1.5–2.0: 1.0. Mesoscutum (Fig. 104d) meshlike reticulate except medial lobe often with shallower or more transversely imbricate sculpture anteriorly and lateral lobe with mediolongitudinal band of minute coriaceous sculpture. Scutellum and axillae low convex in same plane; axilla usually mostly obliquely and scutellum longitudinally reticulate-imbricate laterad midline though axilla sometimes and scutellum mesally more coriaceous and frenal area variably distinctly meshlike coriaceous. Acropleuron (Fig. 104f) more-or-less isodiametric meshlike anteriorly and posteriorly and much more minutely sculptured mesally, the larger meshlike sculpture coriaceous-reticulate, at most delineated by only slightly raised lines. Fore wing (Fig. 104g) with cc: mv: pmv: stv = 4.8–5.2: 4.1–4.9: 0.9–1.1: 1.0. Middle leg (Fig. 104h) with row of 3–7 mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus and pegs clearly differentiated into two rows apically, second tarsomere with 3–5 pegs, third tarsomere with 2 pegs, and fourth tarsomere with 1 peg apically on either side. Propodeum with very broadly, transversely U-shaped plical depression extending to posterior margin (Fig. 104d). Gaster (Fig. 104c, e) similar in length to combined length of head and mesosoma; not atypically modified; not nearly extending to apex of second valvifer, the latter extending quite obviously beyond gastral apex, with apparent sheath length about 1.1–1.4× length of metatibia and 1.5–1.8× length of mv, and third valvula about 0.9–1.1× length of metatibia and 1.2–1.4× length of mv (see 'Remarks'); hypopygium extending almost three-quarters length of gaster.

MALE (habitus: Fig. 105a, b). Length = 1.0–2.0 mm. Head (Fig. 105a–d) usually bluish-green to green, though darker with less distinct metallic luster in smallest individuals; frons and vertex meshlike reticulate (Fig. 105d), and vertex uniformly curved into occiput; scrobal depression meshlike reticulate at least narrowly along margins but at least scrobes and often more extensively smooth and shiny (Fig. 105d); setae hairlike to very slightly lanceolate, white; lower face with evenly distributed and comparatively short setae or larger individuals with somewhat longer but straight to evenly curved setae toward malar sulcus (Fig. 105c); gena posterior to malar sulcus with 1 longer seta differentiated from others, and posterior to eye with apices of setae directed toward orbit. Antenna (Fig. 105f) with scape entirely dark (Fig. 105c); length of pedicel + flagellum 1.3–1.4× head width; pedicel (Fig. 105g) subglobular, at most about 1.3× as long as wide, ventrally with row of 4 long white setae, of which basal 3 are distinctly to hook-like curved; anellus very strongly transverse, discoidal, shiny, with at most inconspicuous sparse setae at extreme apical margin (Fig. 105g); flagellum robust-filiform (Fig. 105f), fu1 at least as long as and up to 1.5× as long as pedicel, with all funiculars longer than wide but at most about 1.4× as long as wide, and clava subequal in length to apical two funiculars; funicle and clava uniformly covered with decumbent, curved setae, the basal funiculars without evident region of differentiated setae ventrally. Maxillary and labial palps light to dark brown. Mesosoma (Fig. 105a, b) similar in colour to head, bluish-green to green, including propodeum, though mesonotum sometimes with purple luster laterally; setae hairlike, brown to pale brownish on pronotum and mesonotum and more distinctly white on propodeal callus; tegula dark. Front leg with at least knee and apex of tibia pale, often anterior and sometimes posterior surface of tibia longitudinally pale, and sometimes one or more basal tarsomeres pale or at least light brownish. Middle leg dark except knee, apex of tibia, tibial spur and basal 2 or 3 tarsomeres pale, the third tarsomere often yellowish-brown, intermediate in colour between basal and apical tarsomeres. Hind leg with similar colour pattern as middle leg except third tarsomere more commonly

dark and second tarsomere very rarely also brown. Fore wing with mv about 3.0–3.6× length of stv, and pmv at most only slightly longer than stv; costal cell (Fig. 105e) dorsally near leading margin with row of 14 or fewer setae over about apical third to half, and ventrally with single row of setae for at least short distance mesally and usually more extensively basally, the setae sometimes paler and less conspicuous basally than apically; basal cell (Fig. 105e) uniformly setose with dark setae; speculum usually almost or completely closed by setae posteriorly, but at least with more than one seta on cubital fold beyond basal fold (Fig. 105e). Propodeum with complete median carina, quite shiny, only very finely meshlike coriaceous.

Distribution. Canary Islands, **Libya*** [Bani Walid, 12.II.2010, Patrick Weill (AICF: 1♀)].

Biology. Specimen label data indicate *Capitites ramulosa* (Loew)* (Diptera: Tephritidae) on *Phagnalon rupestre* (L.) (Asteraceae), *Myopites nigrescens* Becker*, and *Myopites nigripes* [?]* (Tephritidae) on *Schizogyne sericea* (L. f.) (Asteraceae) (ZMAN).

Remarks. *Eupelmus stenozonus* was described based on nine females and two males, of which three females were listed as additional material rather than paratypes. Line drawings illustrated the mesotibial apical and mesotarsal peg patterns and lateral habitus of the female (Askew & Nieves-Aldrey 2000, figs 8, 9). Females with uniformly dark sheaths resemble *E. melanostylus* in this feature (see under latter species), whereas those with typical sheath and body colour patterns more closely resemble *E. tanystylus* (see under latter species and also *E. acinellus*).

Based on numerous specimens in ARPC, BMNH, CNC, MNCN, RMNH and ZMAN, *E. stenozonus* is common in the Canary Islands. Although previously thought to be endemic to these islands, we saw a single female from Libya that differs from other *E. stenozonus* females only in having mostly translucent and inconspicuous fore wing setae, with dark setae only dorsally in the costal cell anterior to the parastigma, a few setae dorsally immediately behind the marginal and postmarginal veins, and along the leading margin of the wing distal to the postmarginal vein. Canary Islands females have dark or at least yellowish fore wing setae except for pale setae in the basal cell and ventrally in the costal cell. Further, the ovipositor sheaths of the Libyan female are shorter, the apparent sheath length about 1.25× the length of the marginal vein and the third valvula about 1.1× length of the marginal vein. Other examined *E. stenozonus* females have the apparent sheath length at least about 1.4× length of the marginal vein and the third valvula about 1.2× length of the marginal vein. Differences are less evident when comparing length of the sheaths with that of the metatibia, the ratios for the Libyan female being at the lower end of variation for the species (apparent sheath length 1.05× length of metatibia and third valvula 0.9× length of metatibia). We interpret these differences as intraspecific variability, but more specimens from North Africa are needed in order to see if variation of the Libyan female is correlated with distribution. The female was collected in the Tripolitanian pre-desert and its pale fore wing setae could be an adaptation to local ecological conditions. In at least one other species, *E. microzonus*, females from desert areas have pale setae on the wing disc (see 'Remarks' under latter species). Based on its known host, *Capitites ramulosa*, which is recorded also from North Africa, Syria and Israel, *E. stenozonus* may be even more widely distributed than currently known.

Ribes Escolà & Askew (2009) distinguished males of *E. stenozonus* from those of *E. acinellus* by flagellar features that are subtle and apparently variable. Although we saw very few males of *E. acinellus*, these have at most the basitarsus of the middle and hind legs pale and the costal cell has numerous setae along the leading margin compared to 14 or fewer setae for *E. stenozonus* males. Most *E. stenozonus* males also have the speculum more extensively closed by setae posteriorly than observed *E. acinellus* males.

E. (*Eupelmus*) *stramineipes* Nikol'skaya

Figs 106a–j (♀), 107a–f (♂)

Eupelmus stramineipes Nikol'skaya, 1952: 498 (Russian), 1963: 512 (English). Syntypes, ♀ & ♂, ZIN, 1♀ examined. Type data: USSR, Soviet Central Asia. ♀ syntype examined label: Туркмения, Баирам Али, люцерна [Turkmenistan, Bayramaly, alfalfa], 21 VII 33 / *Eupelmus stramineipes* sp. n. ♀ M. Nikolskaja det. [same text on the underside of the first label] / Holotypus ♀ [recent red label].

Eupelmus velenceensis Erdős, 1955a: 36, 45. Lectotype ♀, HNHM, designated by Thuróczy, 1992: 140, examined by GG. Type data: Hungary, Gárdony, Velencei tó, 10.VII.1954, 'de *Phragmitibus*', Erdős. Synonymy by Bouček, 1965a: 546.

Eupelmus (*Eupelmus*) *stramineipes*; Gibson, 2011: 75.

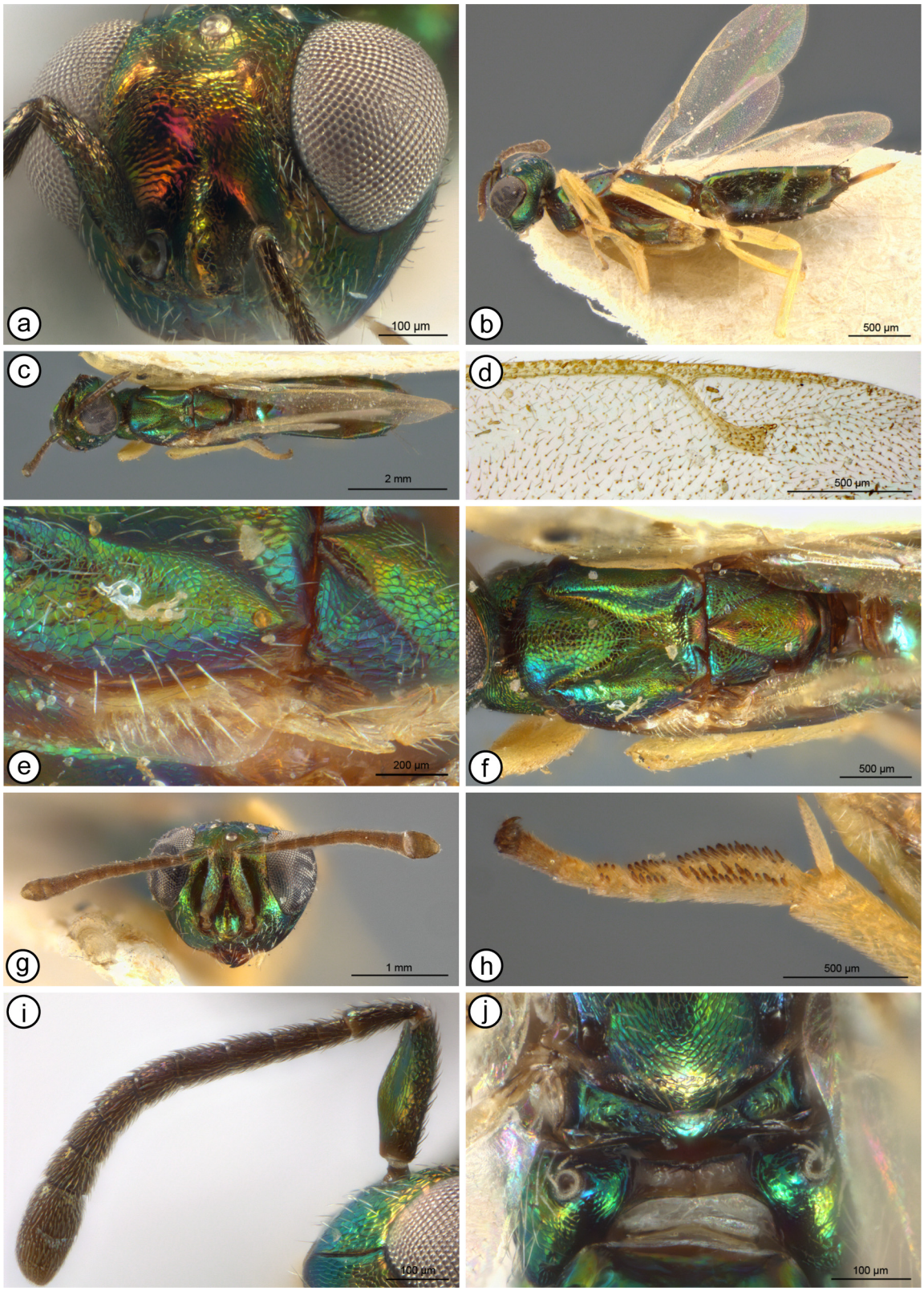

FIGURE 106. *Eupelmus stramineipes*, ♀. *a, i, j* (2012-45): **a**, head, frontolateral; **i**, antenna; **j**, apex of scutellum to propodeum. *b–h* (syntype): **b**, lateral habitus; **c**, dorsal habitus; **d**, stigmal and postmarginal veins; **e**, tegula; **f**, mesosoma, dorsal; **g**, head and antennae, frontal; **h**, apex of mesotibia and mesotarsus.

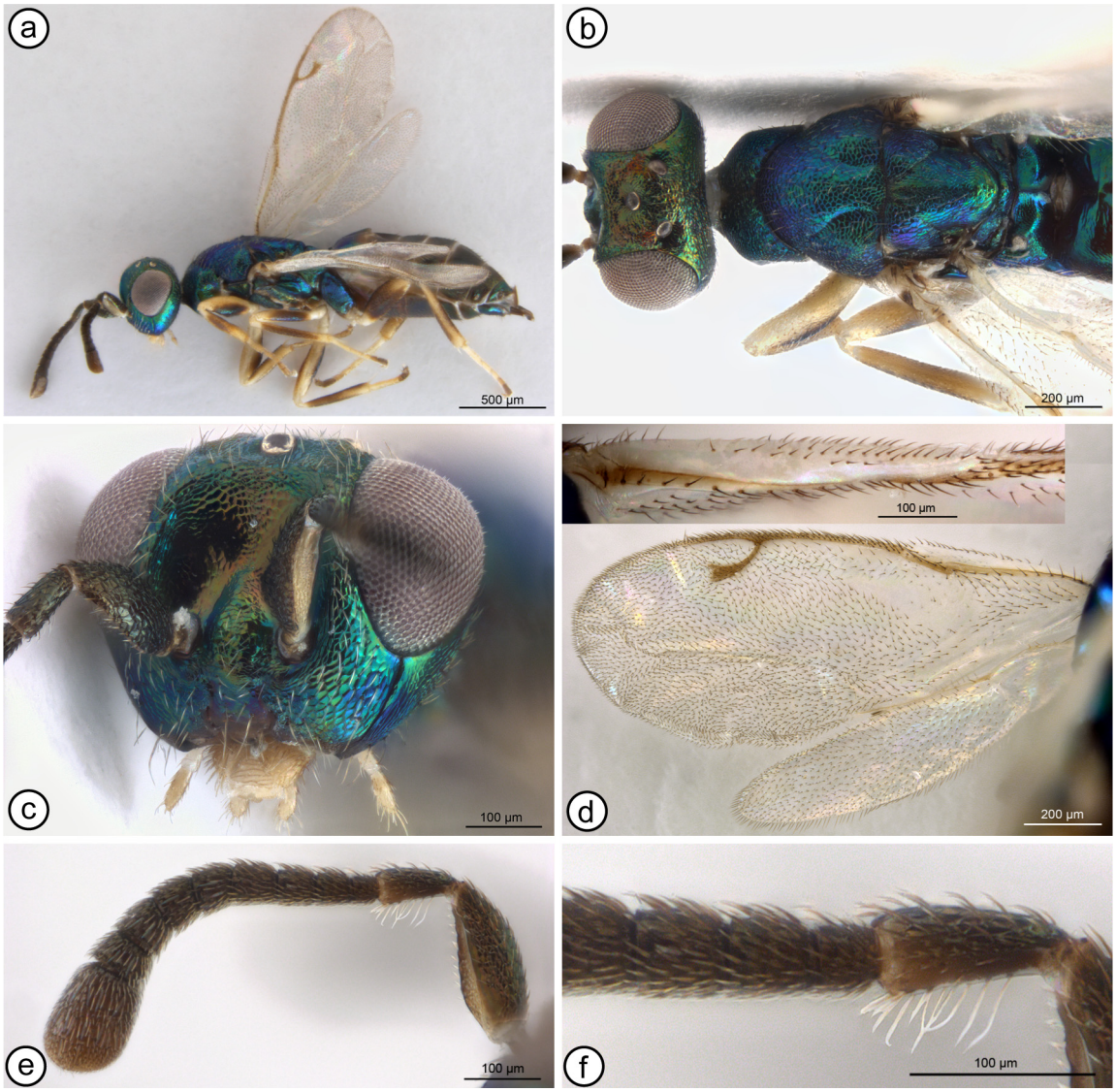

FIGURE 107. *Eupelmus stramineipes*, ♂ (2013-120): **a**, lateral habitus; **b**, head and mesosoma, dorsal; **c**, head, frontal; **d**, wings (insert: costal cell); **e**, antenna, outer view; **f**, pedicel to base of fl4, outer view.

Description. FEMALE (habitus: Fig. 106b, c). Length = 2.7–3.5 mm. Head (Fig. 106a, g) bright green to bluish-green with at least some reddish-coppery luster within scrobal depression and usually on frontovertex under some angles of light; with comparatively inconspicuous hairlike to slightly lanceolate setae white setae on lower face and parascrobal region to about dorsal margin of parascrobal region and even less conspicuous hairlike setae on frontovertex. Maxillary and labial palps white to brownish-yellow. Antenna (Fig. 106g, i) dark with greenish luster on scape and pedicel under at least some angles of light. Mesosoma with tegula lighter in colour than mesosoma and variably distinctly bicoloured, more opaque yellow along about basal two-thirds of inner margin and more translucent yellowish to slightly brownish-yellow apically and laterally (Fig. 106e); mesosoma (Fig. 106b, f) otherwise similar in colour to head, usually primarily bright green to bluish-green with some coppery luster usually under some angles of light though acropleuron and sometimes prepectus brownish with more limited metallic luster; mesonotum with comparatively inconspicuous hairlike to slightly lanceolate white setae, prepectus bare, and callus with comparatively sparse but longer white setae (Fig. 106j). Macropterous; fore wing (Fig. 106b) hyaline with yellowish to dark setae; costal cell dorsally near leading margin with setae along most of length, including in 2 or 3 partial rows over about apical half, and ventrally with at least 3 rows along length; basal cell and disc entirely setose except for linea calva. Legs mostly pale beyond coxae except for dark mesotarsal pegs, tibiae usually with at least inconspicuous subbasal brownish spot, and dorsal or posterior surfaces of protibia often more extensively and distinctly brown mesally. Gaster (Fig. 106b) with hairlike setae; often mostly green to bluish-green

though variably extensively brownish to coppery, at least dorsally in part; ovipositor sheaths with third valvula variably extensively dark basally and pale apically except usually for darker tip.

Head in dorsal view with interocular distance about 0.4× head width; in lateral view lenticular, the face almost evenly convex and parascrobal region smoothly merged with frons; frontovertex meshlike coriaceous to slightly meshlike-imbricate, but scrobal depression distinctly reticulate to transversely reticulate-rugulose (Fig. 106a); OOL: POL: LOL: MPOD = 0.8–1.1: 2.1–2.5: 1.3–1.5: 1.0. Antenna (Fig. 106g, i) with scape about 3.3× as long as maximum breadth; flagellum with at least fl1–fl6 longer than wide and fl7 and fl8 quadrate to slightly wider than long; clava oblong, about 1.75–1.85× as long as maximum width, and asymmetrically though uniformly tapered. Mesoscutum (Fig. 106f) shallowly meshlike reticulate except lateral lobe with mediolongitudinal band of minute coriaceous sculpture. Scutellum and axillae low convex in same plane; axilla shallowly reticulate anteriorly to obliquely reticulate-imbricate posteriorly; scutellum extensively meshlike coriaceous though somewhat reticulate-imbricate laterally and frenal area more uniformly meshlike coriaceous to shallowly reticulate. Acropleuron more-or-less isodiametric meshlike anteriorly and posteriorly and much more minutely sculptured mesally, coriaceous-reticulate with cells defined by at most very slightly raised ridges. Fore wing with cc: mv: pmv: stv = 3.9–4.3: 3.2–3.6: 1.4–1.7: 1.0; stv at angle of at least 40° relative to pmv with stigma recurved longitudinally from vein in about apical half to third (Fig. 106d). Middle leg (Fig. 106h) without mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus and pegs differentiated into two rows over much of length, second tarsomere with 6–8 pegs, third tarsomere with 3–5 pegs, and fourth tarsomere without pegs on either side. Propodeum (Fig. 106j) with very broadly V-shaped, sometimes anteriorly almost transverse plical depression extending at most about half length, the posterior half convex and smooth or nearly so except for fine median carina. Gaster (Fig. 106b) similar in length to combined length of head and mesosoma; syntergum with posteroventral angles abruptly angled inward between anal sclerite and ovipositor sheaths, in lateral view syntergum posteriorly usually obliquely Ω-like over sheaths or even almost flat over sheaths; extending over base of third valvula and concealing constriction between second valvifer and third valvula, with visible length of third valvula only slightly greater than 0.5× length of metatibia and about 0.7× length of mv (typically much less if measured from posterior margin of syntergum); hypopygium extending somewhat beyond middle of gaster.

MALE (habitus: Fig. 107a). Length 2.2–2.3 mm. Head (Fig. 107b, c) mostly bluish-green except with coppery luster within scrobal depression (Fig. 107c) and on frontovertex (Fig. 107b), most distinctly on frons between each posterior ocellus and scrobal depression; frons meshlike coriaceous to finely coriaceous-reticulate; vertex uniformly curved into occiput (Fig. 107b), similarly sculptured as frons; scrobal depression and scrobes with similar meshlike sculpture, but depression reticulate and scrobes shallower and shinier (Fig. 107c); with setae hairlike to very slightly lanceolate, white; lower face toward malar sulcus with somewhat longer, but evenly distributed, straight to only slightly, evenly curved setae (Fig. 107c); gena posterior to malar sulcus with 1 longer seta differentiated from other setae, and posterior to eye with apices of setae directed toward orbit. Antenna (Fig. 107e) with scape mostly brown with slight metallic green luster on inner surface but extreme base pale and broad longitudinal sensory region along outer surface ventrally light brownish to almost pale; pedicel (Fig. 107f) about 2× as long as wide, ventrally with about 6 long, straight to slightly sinuate setae; length of pedicel + flagellum almost 1.2× head width; flagellum distinctly clavate (Fig. 107e) with funiculars increasing conspicuously in width to clava, the clava broadly rounded apically and ventrally with flat micropilose sensory region; anellus quadrate (Fig. 107f), as long as or virtually as long as wide and at least 0.75× length of fu1, a distinct, dull, setose segment similar to subsequent funiculars; funicle with basal funiculars slightly longer than wide but apical funiculars distinctly transverse; basal funiculars without evident regions of differentiated setae ventrally. Maxillary and labial palps pale. Mesosoma dorsally (Fig. 107b) more distinctly bluish than head with purple luster anteriorly on median mesoscutal lobe, axillae laterally, and indistinctly to strongly on scutellum anterior to frenal area; setae hairlike, mostly whitish except pale on scutellum; tegula yellow, mostly translucent except very narrowly opaque yellow along inner margin adjacent to mesoscutum. Front leg pale except posterior surface of femur extensively and dorsal and ventral surfaces of tibia partly dark mesally. Middle leg dark except trochanter, trochantellus, anterior surface of femur longitudinally or also dorsally, anterior surface of tibia longitudinally at least in part apically, tibial spur, and basal three tarsomeres pale. Hind leg with trochanter and trochantellus pale, femur partly dark brown but lighter yellowish-brown apically, tibia mostly similarly yellowish-brown except darker brown dorso- and ventrolongitudinally, and tibial spurs and basal three tarsomeres pale. Fore wing (Fig. 107d) with mv about 2.4× length of stv; stv projecting at about 40° angle relative to pmv, with length only about 1.2–1.4× distance between

posterior margin of stigma and posterior margin of pmv; costal cell dorsally near leading margin with mostly 2 rows of dark setae over about apical two-thirds (Fig. 107d insert), and ventrally with dark setae aligned into 2 or 3 rows; basal cell uniformly setose with brownish setae; disc hyaline and speculum closed posterobasally by row of setae on cubital fold. Propodeum with complete median carina, and panels uniformly, finely, meshlike coriaceous (Fig. 107b).

Distribution. NEARCTIC. USA (Gibson 2011, map 12). **PALAEARCTIC**. Noyes (2014) recorded *E. stramineipes* from eight countries in Western Europe and as far east as Mongolia in central Asia, and here we newly record it from **Greece*** (AICF).

Two Nearctic records from Delaware and New York (USA) are undoubtedly the result of accidental introduction (Gibson 2011).

Biology. Host unknown, but reared from *Phragmites* Adanson (Poaceae), including the common reed *Phragmites australis* (Cavanilles) [= *P. communis* (Trinius)] and suggested as likely some Cecidomyiidae (Diptera) by (Bouček 1977).

Remarks. Noyes (2014) stated that two female "paratypes" of *E. stramineipes* are from Turkmenistan and Uzbekistan, citing personal communication of V.A. Trjapitzin. However, the original description also states that the length of the male is 1.5 mm, showing that Nikol'skaya (1952) had both sexes even though only the female was described. The female syntype (Fig. 106b–h) we examined is labelled as holotype. Erdős (1955a) described *E. velenceensis* based on 30 females and 6 males reared from *Phragmites,* 10.VII.1954, Gárdony, Lake Velencei. Thuróczy (1991) found and designated one female as lectotype and another 22 females and 4 males as paralectotypes in HNHM. We discovered an additional two Erdős females in ZSMC labelled as "Gárdony, 10.VII.1953" from "Phragmite vulgari Lam.", plus another Erdős female labelled "Tompa, 15.VI.1949, Templom-tèr fűveln". In MNHN there is a third female labelled "Gárdony 1953.VII.10, dr. Erdos, De Phragmite vulgari Lam., ♀ Cotypus, *Eupelmus velenceensis* Erd. det Erdos".

Eupelmus stramineipes, *E. phragmitis* and *E. levis* comprise the *stramineipes* species-group, which is defined primarily by females sharing the following features: mesotibial apical pegs lacking (Figs 84i, 106h), prepectus bare, ovipositor sheaths less than length of marginal vein, mesoscutum entirely sculptured, propodeal plical depression V-shaped and extending only about half way to posterior margin (Figs 84j, 106j), and posterolateral margins of syntergum abruptly angled inwards above ovipositor sheaths such that posteriorly the syntergum is obliquely angled to flattened over the sheaths (Fig. 55h) rather than forming a vertically truncate surface. *Eupelmus claviger* might also be assigned to this species group, though the V-shaped plical depression extends to the posterior margin of the propodeum (Fig. 24h), the mesotarsal pegs are not arranged into two distinct rows on the basitarsus (Fig. 24e), and the single known female has the posterolateral margins of the syntergum reflexed inward at a right angle so they form a vertical, truncate surface. The scape apparently is also yellowish, unlike for females of the other three species. Of the three *stramineipes*-group species, females of *E. stramineipes* uniquely have a bicoloured tegular colour pattern (Fig. 106e), though this difference is not always conspicuous. Additional features to help differentiate females and males of *E. stramineipes* and *E. phragmitis* are given under 'Remarks' for the latter species. A single female of *E. stramineipes* was sequenced for COI and a 415 base pair fragment was obtained (CNCHYM 015241).

E. (*Eupelmus*) *tachardiae* (Howard) n. stat.

Figs 108a–i (♀), 109a–h (♂)

Pteromalus sp. Gernet, 1863: 170–173. Synonymy by Mahdihassan, 1923: 76.

Anastatus tachardiae Howard *in* Howard & Ashmead, 1896: 641. Holotype ♂, USNM, examined. Type data: Ceylon [Sri Lanka], Punduloya, E. E. [Ernest] Green, reared from *Tachardia albizziae* ["Par: on *Carteria lacca*" according to label data].

Brasema annulicaudis Cameron, 1913: 98–99. 2♀ syntypes, BMNH, examined. Type data: [India: Dehra Dun], December, reared from *Tachardia albiziae* [sic]. Synonymy by Ferrière, 1935: 394–395.

Eupelmus tachardiae; Ferrière, 1935: 394–395 (redescription: fig. 2a-c; Mani, 1989: 676–677 (redescription; fig. 158 (♀ *nec* ♂ habitus)).

Eupelmus tachardiae; Narendran & Anil, 1995: 2 (misidentification).

Description. FEMALE (habitus: Fig. 108d–g). Length = 2.0–4.2 mm. Head (Fig. 108a) sometimes extensively dark coppery- or reddish-violaceous to dark violaceous, but with at least lower face green or coppery-green in part,

frons usually with at least some greenish luster laterally along inner orbits and/or below anterior ocellus, vertex often with some blue to purple lusters (Fig. 108h), and scrobal depression often at least slightly greenish (Fig. 108i) except laterally near toruli more distinctly blue to purple or sometimes reddish-violaceous under some angles of light (Fig. 108a); with slightly lanceolate white setae at least on lower face and parascrobal region to level of dorsal margin of scrobal depression compared to more hairlike setae on frontovertex. Maxillary and labial palps brown. Antenna with scape usually variably distinctly paler than flagellum, often mostly yellow to orange (Fig. 108a, h) at least apically, but sometimes only somewhat lighter, orangey-brown, mediolongitudinally on inner surface compared to darker dorsal and ventral margins (Fig. 108b) where sometimes with conspicuous metallic luster or rarely uniformly brown (Fig. 108c) though not dark with metallic luster; pedicel and flagellum dark except pedicel dorsally and often flagellum basally with some metallic lusters. Pronotum variably distinctly purple to dark violaceous laterally (Fig. 108h) or sometimes brighter reddish-violaceous along posterolateral margin; admarginal setae dark. Mesonotum (Fig. 108h) with hairlike to slightly lanceolate setae, the setae white except sometimes anteriorly; mesoscutum varying from comparatively dark to sometimes almost entirely greenish, often partly green within posteromedial depressed region and sometimes green to coppery-green dorsolongitudinally along convex part of lateral lobes or with variably distinct blue to purple lusters similar to pronotum, at least anteriorly and along lateral margin of lateral lobe above prepectus and tegula; scutellar-axillar complex or at least scutellum green except often variably extensively coppery to somewhat reddish-violaceous mesally. Prepectus brown or with variably extensive blue to purple lusters similar to pronotum laterally; with comparatively inconspicuous, white, hairlike setae. Tegula dark. Acropleuron variably extensively brown to more bluish or green anteriorly and coppery-brown posteriorly. Metanotum and propodeum variably extensively brown to green except callus usually with some blue to purple lusters, most commonly posterior to spiracles; callus with similar or more conspicuous, longer white setae than on mesonotum. Macropterous; fore wing hyaline with uniformly yellowish to brownish setae except sometimes basal cell setae white; costal cell dorsally near leading margin with 1 or 2 partial rows of setae over at least about apical half, and ventrally with at least 3 rows along length; basal cell and disc entirely setose except for elongate linea calva. Front leg with trochanter and femur except narrowly apically dark, and tibia pale longitudinally along anterior and posterior surfaces but with variably differentiated darker region ventro- and/or dorsolongitudinally subbasally. Middle leg usually almost uniformly pale beyond coxa except for dark mesotibial apical and mesotarsal pegs, but femur and tibia except basally and apically rarely variably distinctly darker orange to brownish. Hind leg usually with at least about basal half of femur brown to dark, tibia entirely pale or variably extensively and distinctly brownish subbasally to mesally, at least dorsally. Gaster (Fig. 108d–g) with hairlike setae; mostly brown to coppery-brown except basal tergum basally bright green to blue or purple and apical terga with less distinct greenish luster; ovipositor sheaths usually with three distinct bands, the apical band sometimes either much lighter brownish than basal band, gradually lightened apically or lighter subapically than dark apex, but quite abruptly delineated and of similar length or somewhat shorter than medial pale band.

Head in dorsal view with interocular distance usually 0.37–0.45× head width (see 'Remarks'); in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; vertex transversely reticulate-imbricate (Fig. 108i) with occiput often differentiated from vertex by variably distinct transverse ridge, though sometimes smoothly rounded with transversely aligned sculpture having sharp margins but not coalesced into differentiated ridge or carina (Fig. 108h); frons imbricate to very finely reticulate (Fig. 108i), the meshlike sculpture defined by slightly, inconspicuously raised ridges, though inconspicuously so in smaller individuals; scrobal depression distinctly reticulate to transversely reticulate-rugulose, including at least about dorsal half of scrobes; OOL: POL: LOL: MPOD = 0.6–1.5: 2.1–3.1: 1.3–1.8: 1.0. Mesoscutum meshlike reticulate except medial lobe extensively reticulate-imbricate and lateral lobe with mediolongitudinal band of minute coriaceous sculpture. Scutellum and axillae low convex in same plane; axilla variably extensively meshlike coriaceous to reticulate anteriorly but more reticulate-imbricate posteriorly; scutellum coriaceous medially and longitudinally reticulate-imbricate laterally anterior to meshlike coriaceous frenal area. Acropleuron meshlike anteriorly and posteriorly of much more minutely sculptured mesal region, the sculpture often larger and more distinctly reticulate posteriorly than anteriorly. Fore wing with cc: mv: pmv: stv = 4.3–6.0: 4.2–5.8: 1.0–1.3: 1.0. Middle leg with row of 4–6 mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus and pegs clearly differentiated into two rows apically, second tarsomere with 4–7 pegs, third tarsomere with 1–3 pegs, and fourth tarsomere with 1 or 2 pegs apically on either side. Propodeum with broadly U-shaped plical depression extending to posterior margin. Gaster (Fig. 108d–g) similar in length to combined length of head and mesosoma; not atypically modified;

extending to or almost to apex of second valvifer, the latter sometimes extending slightly beyond gastral apex, with third valvula about 0.65–0.8× length of metatibia and 0.72–0.85× length of mv; hypopygium extending about two-thirds length of gaster.

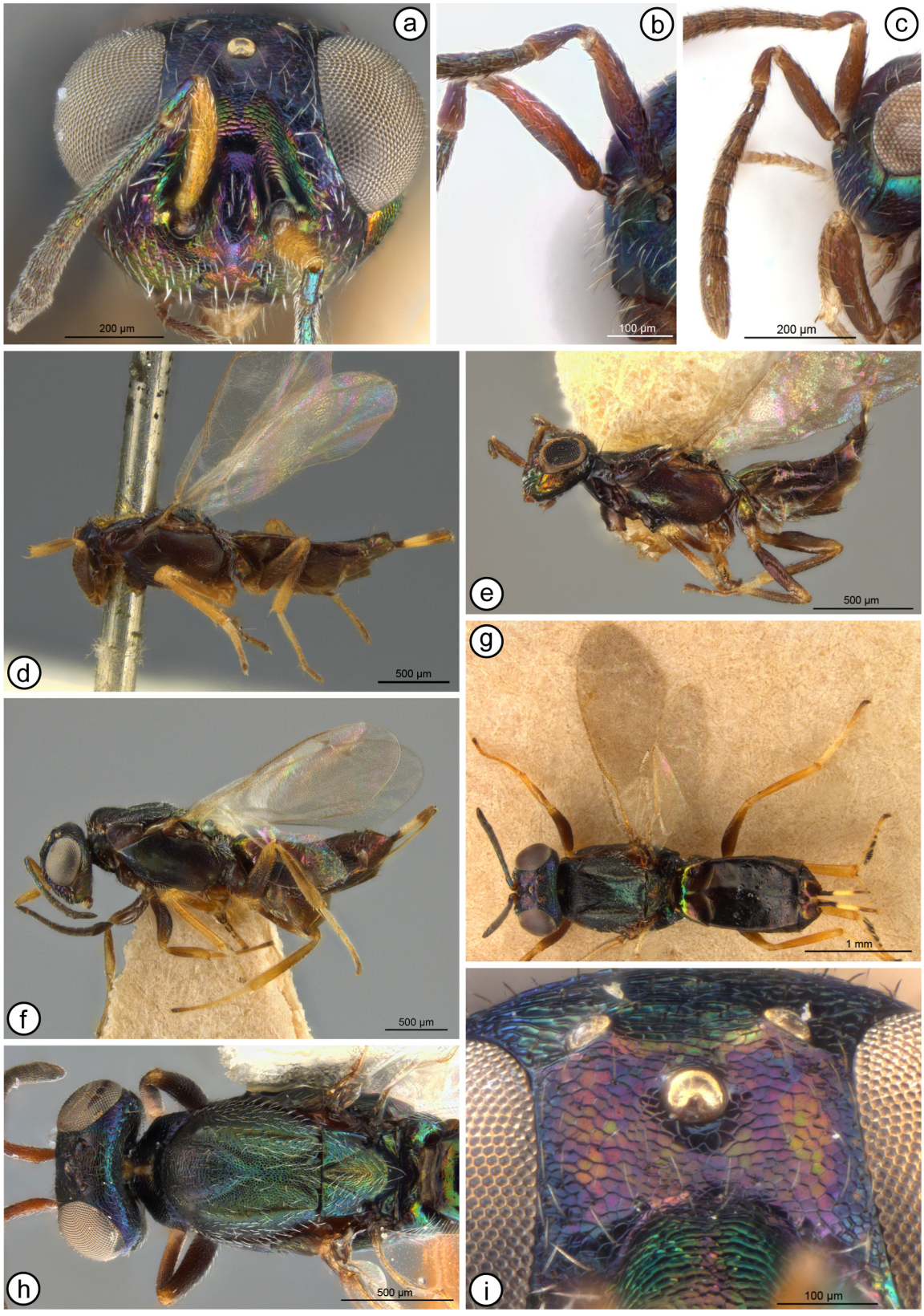

FIGURE 108. ***a–g****, Eupelmus tachardiae*, ♀. *a, f* (2012-128): **a**, head, frontal; **f**, lateral habitus. **b**, scapes (2014-95). **c**, scapes and antenna (2014-96). *d, e* (*E. annulicaudis* syntypes): **d**, lateral habitus (2012-134); **e**, lateral habitus (2012-133). **g**, dorsal habitus (2012-129). **h,** head and mesosoma, dorsal (2014-133). **i**, frontovertex (2012-130).

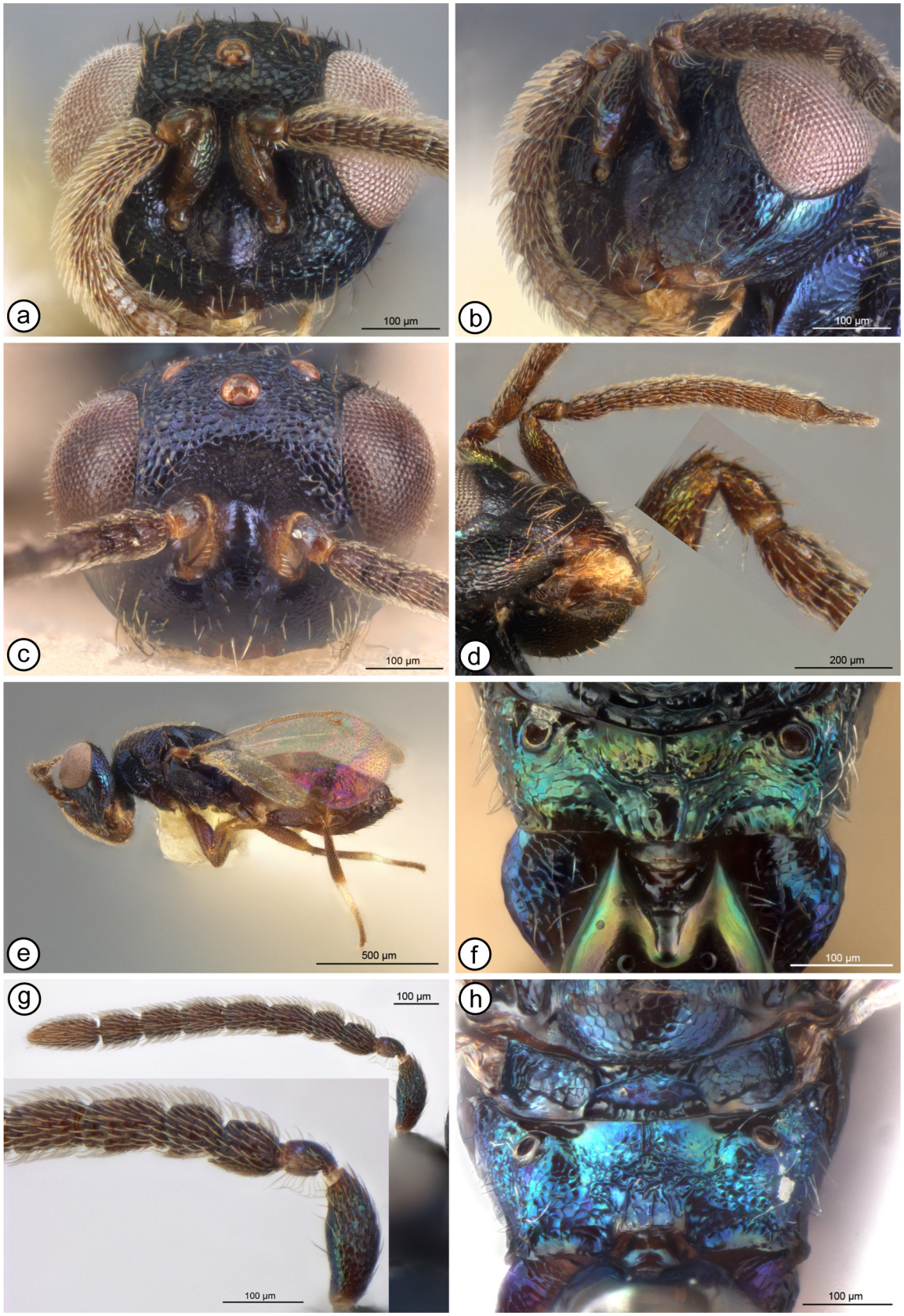

FIGURE 109. *Eupelmus tachardiae*, ♂. *a, b, e* (holotype): **a**, head, frontal; **b**, lower face, frontolateral; **e**, lateral habitus. *c, f* (2012-132): **c**, head, frontal; **f**, apex of scutellum to base of gaster (2012-132). **d**, gena and antenna, lateral [insert: pedicel to base of fl3] (2012-131). *g, h* (2014-93): **g**, antenna [insert: scape to base of fl5]; **h**, propodeum.

MALE (habitus: Fig. 109e). Length = 1.4–2.25 mm. Head (Fig. 109a–c) dark brown to black or face with slight bluish luster and sometimes frontovertex or vertex in part with slight coppery luster; frons and vertex similarly, distinctly meshlike reticulate; vertex differentiated from occiput by distinct to almost laminar transverse carina; scrobal depression distinctly reticulate-punctate to interantennal prominence, through scrobes sometimes shinier with subeffaced sculpture toward torulus (Fig. 109c); setae hairlike, white to brown; lower face in region between torulus and malar space with longer setae of which some abruptly curved, hook-like, or sinuate apically, and usually differentiated as denser tuft (Fig. 109c, d) though rarely more-or-less evenly distributed and therefore comparatively sparse (holotype, Fig. 109a, b); gena posterior to malar sulcus with 1 conspicuously long seta and ventral to this usually 3 shorter setae closer to oral margin, and posterior to eye with apices of setae directed toward orbit. Antenna (Fig. 109d, g) with scape entirely dark, ovoid (Fig. 109a, g), and about 2× as long as wide; pedicel (Fig. 109d, g) about 1.25–1.6× as long as wide, ventrally with 5–8 apically hook-like setae (inserts, Fig. 109d, g); length of pedicel + flagellum about 1.2–1.25× head width; flagellum robust-filiform (Fig. 109d, g) with clava subequal in length to apical two funiculars; anellus very strongly transverse, discoidal, shiny, with at most inconspicuous, sparse setae at extreme apical margin (inserts, Fig. 109d, g); funicle with fu1 oblong, about 1.2× as long as pedicel and definitely longer than wide with subparallel sides, and all subsequent funiculars at least slightly but at most 1.6× longer than wide and uniformly covered with decumbent, curved setae (holotype, Fig. 109a, b) or fu1–fu3 in ventral view appearing less setose with region of much shorter, differentiated setae (Fig. 109g insert). Maxillary and labial palps brown except usually apical palpomeres pale apically. Mesosoma dark similar to head (Fig. 109e) or at least propodeum with more distinct blue to greenish to bluish lusters (Fig. 109f, h), and scutellum sometimes distinctly coppery mesally; setae hairlike, brownish; tegula dark. Legs with metacoxa dark to variably distinctly blue to purple or violaceous, and in lateral view often distinctly reticulate but dorsal margin evenly curved and narrowed to apex; femora usually similarly dark except knees often paler; protibia entirely pale or with variably extensive and distinct ventro- and/or dorsolongitudinal dark bands, mesotibia sometimes entirely pale similar to protibia but usually variably distinctly brownish to dark, and metatibia yellowish-brown to entirely dark similar to femur; mesotibial spur pale; protarsus more-or-less uniformly pale to yellowish-infuscate; mesotarsus sometimes almost completely dark or with basitarsus variably extensively pale and apical four tarsomeres uniformly brown or increasingly dark yellowish to brown apically; metatarsus with at least basitarsus pale, the subsequent tarsomere also pale or increasingly darker apically. Fore wing with mv about 3.7–4.4× length of stv and pmv subequal in length or only slightly longer than stv; costal cell dorsally near leading margin with dark setae only apically anterior to parastigma, and ventrally with row of dark setae only within about apical half (holotype) or continuous to base. Propodeum usually coarsely sculptured, more-or-less distinctly rugose with irregular transverse carina(e) intersecting median carina medially, and with paralateral carina on either side of median carina extending anteriorly from foramen to join transverse carinae (Fig. 109f, h), but at least with incomplete or medially interrupted median carina, and rarely (holotype) with fine Y-shaped carina extending anteriorly from posterior margin, the divergent arms on either side of fine median carina extending posteriorly from anterior margin for about half distance, and panels otherwise finely coriaceous except for a couple of irregular paralateral carinae extending anteriorly from propodeal foramen, but usually more.

Distribution. **ORIENTAL**. China, India, Pakistan, Sri Lanka (Noyes 2014) and possibly **Taiwan*** (FSCA) based on males unassociated with females. **PALAEARCTIC**. **China*** (CNC, IZCAS), **Japan*** (CASC, CNC, ELKU, USNM), **South Korea*** (AICF, CNC).

Of the females identified as *E. urozonus* in Yang (1996, p. 214), we examined one (Inner Mongolia, Neimenggu, Huhehot Peoples's Park, 3.VIII.1994, almond tree trunk), and it is *E. tachardiae*.

Biology. Type material was reared as an endoparasitoid of *Kerria albizziae* (Green) and *K. lacca* (Kerr) (Hemiptera: Kerridae). Glover (1930, 1934) and Glover *et al.* (1935) also reported it as a hyperparasitoid of the larvae of lac insect predators, including *Eublemma amabilis* Moore (Lepidoptera: Noctuidae) through the ectoparasitoid *Bracon greeni* Ashmead (= *Microbracon tachardiae* Cameron) and *Holcocera pulverea* Meyr (Lepidoptera: Blastobasidae) through the endoparasitoid *Apanteles tachardiae* Cameron (Braconidae). Thompson (1955) listed it also as a hyperparasitoid through the lac insect primary parasitoids *Erencyrtus dewitzi* Mahdihassan and *Tachardiaephagus tachardiae* (Howard) (Encyrtidae), as did Islam & Hayat (1986). The latter host was also listed by Narendran & Anil (1995: 2), but this appears to be based on a misidentification because females were keyed, in part, by the fore wing lacking a linea calva. Glover (1930) also stated that *Machaerota planitiae* Distant (Hemiptera: Cercopidae) is an alternative host on *Ziziphus jujuba* Mill. (Rhamnaceae), a host tree used in the cultivation of *K. lacca*.

We have also seen individuals reared from the following. **Coleoptera**: SCOLYTIDAE* (Yang 1996, as *E. urozonus*). **Hymenoptera**: CYNIPIDAE—*Aphelonyx glanduliferae* Mukaigawa on *Quercus serrata* Murray (Fagaceae) (ELKU); *Dryocosmus kuriphilus* Yasumatsu* (EIHU) on *Castanea* spp. (CNC) and *Castanea crenata* Siebold & Zuccarini (ELKU) (Fagaceae). DIPRIONIDAE—*Diprion nipponicum* Rohwer* (Diprionidae) (USNM). **Diptera**: CECIDOMYIIDAE—*Hexomyza schineri* (Giraud) on *Populus tremula* var. *sieboldii* (Miq.) H.Ohashi (ELKU).

We also saw females labelled as from seeds of *Astragalus* (Fabaceae), *Lithocarpus* (Fagaceae), and *Styrax calvescens* Perkins (Styracaceae) (all China: USNM).

Remarks. As discussed under *E. fulvipes*, *E. tachardiae* is included as one of ten species within the *fulvipes* species group because of the presence of a vertexal carina in at least males. The species was described from a single male from Sri Lanka that was "supposed" to have been reared from *Kerria* (= *Tachardia*) *albizziae*, though the type label states *Kerria* (= *Carteria*) *lacca*. Ferrière (1935) subsequently associated males reared from *K. lacca* in India with the holotype of *E. tachardiae* and co-reared females with those that Cameron (1913) had described as *Brasema annulicaudis*, which were also reared from lac insects in India. The latter form the basis of our concept of *E. tachardiae* females. Although both *E. tachardiae* and *E. annulicaudis* were described from the Oriental region, Noyes (2014) included it in the Palaearctic from China based on Liu *et al.* (1963). However, the latter study was conducted in Yunnan Province, which is Oriental. We saw four females from Yunnan labelled as reared from *K. lacca* (IZCAS). We also include females from Japan and South Korea in what we interpret as *E. tachardiae*, though none reared from lac insects.

The holotype male of *E. tachardiae* differs from five other Ferrière (1935) voucher males (BMNH, ETHZ) reared from lac insects in several respects as noted in the description. Most conspicuously the lower face is quite sparsely and uniformly setose (Fig. 109a, b) without a differentiated tuft of setae, though a couple of the setae are longer than the others and hooked apically. Further, the propodeum is not rugulose, unlike all other males included in *E. tachardiae* (e.g. Fig. 109f, h), but is comparatively finely sculptured with a posteriorly incomplete median carina flanked by the arms of a Y-shaped carina that extends anteriorly from the foramen. This sculpture pattern approaches that of some *E. kiefferi* males, but the dorsal margin of the metacoxa is uniformly curved like other males we include in *E. tachardiae* (Fig. 109f). The holotype also has the costal cell less extensively setose than for other males and fu1–fu3 appear to lack differentiated setae ventrally, though this might be size related.

Ferrière (1935) stated that the type series of *B. annulicaudis* then consisted of four females, "the type and cotypes". We examined two females labelled as "type". One lacks its head (Fig. 108d) and the other (Fig. 108e) has the frontovertex partly broken. Under most angles of light the scapes of the latter female are quite obviously pale, orangey with some bluish luster (Fig. 108e). The interantennal prominence and most of the scrobal depression are dark reddish-violaceous to coppery-violaceous except for the sides of the scrobes, which are quite bright green. It is atypical in that the interorbital distance is half the head width (though this might be an artefact because the eyes are collapsed) and the OOL is obviously greater the maximum posterior ocellar diameter. Other females identified as *E. tachardiae* have the interorbital distance at most only about 0.43× times the head width and the OOL is at most equal to the diameter. Although the frontovertex is partly broken the frons appears to be very finely reticulate (cells delineated by slightly raised, fine ridges) laterally along the inner orbits below the posterior ocelli and more finely coriaceous below the anterior ocellus and near the scrobal depression. The female with its head lacks both front legs, but has the metatibiae more extensively darkened and the mesofemora and the mesotibiae subbasally are a darker brown (Fig. 108e) than for the female that lacks its head. The latter female also lacks its left front leg and right tarsus. The pro- and metafemora and metatibiae are darkened as per the original description, though the mesofemora are mostly orange rather than "infuscate" as originally described (Fig. 108d), and the right protibia has only relatively obscurely differentiated, light brownish regions dorso- and ventrolongitudinally, subbasally, but possibly partly as a result of some fading. The original description states "fore legs dark blue, the tibiae below and their apex and base above and the tarsi testaceous" (Cameron 1913, p. 98).

Our concept of *E. tachardiae* females includes those far eastern Palaearctic *fulvipes*-group females that have pale middle legs but the profemur almost entirely dark, the protibia darkened ventro- and/or dorsolongitudinally subbasally, and the metafemur distinctly darkened within at least the basal third (metatibia sometimes also variably extensively darkened mesally as for type material of *E. annulicaudis*) in combination with usually a more-or-less distinctly and extensively pale scape. Although often entirely yellowish to orange (Fig. 108a), the scape sometimes is paler only apically or only relatively inconspicuously lighter in colour, a dark orangey-brown,

mediolongitudinally (Fig. 108b) or even rarely essentially uniformly brown (Fig. 108c). Males of *E. tachardiae* and *E. kiefferi* are readily differentiated by the features given in the key, but differentiation of females is sometimes questionable because of variation in scape colour and similar leg colour patterns in both species. We are also uncertain as to the correct species identity of two females from Crimea that we provisionally identify as *E. xenium*, but which might represent western Palaearctic specimens of *E. tachardiae* (see under *E. xenium*).

Several *E. tachardiae* females were sequenced for COI either by G. Stone and G. Melika or by us, including several with entirely pale scapes and some with the scape comparatively dark though noticeably paler on the inner surface mediolongitudinally, but also three (ug.KO 08, 45, 46) with the scape either uniformly brown or only very slightly paler mediolongitudinally. Of the latter three females, one lacks its metatibiae as well as an evident vertexal carina, but the other two have extensively darkened metatibiae and at least a slightly developed vertexal carina. We key these two females through the first half of couplet 67, though unsatisfactorily differentiating them from far eastern Palaearctic *E. kiefferi*. Two Japanese females reared along with one male from *D. kuriphilus* (EIHU) have dark scapes and although the frons is very finely reticulate would likely have been identified as *E. kiefferi* except for the associated male, which has a rugulose propodeum and dorsally smoothly arched metacoxa. Both of these females also have the metatibiae partly dark, but there could be some females with entirely pale metatibiae. Such females would incorrectly key to *E. kiefferi* at couplet 83. Because of scape and leg colour pattern, typical females of *E. tachardiae* are also very similar to those of *E. iris*, but the latter have shorter ovipositor sheaths and known females lack a vertexal carina.

Ferrière (1935: 395) stated that "like several European species it [*E. tachardiae*] has probably several hosts and may not be specially related to the lac insects". Our concept of *E. tachardiae* includes individuals reared from other hosts, but this requires testing through molecular studies. As noted above, several individuals from Japan and South Korea that we include in *E. tachardiae* under our morphological concepts were sequenced for COI. Initial results indicate they constitute a single species that molecularly is clearly different from *E. fulvipes* and most similar to several sequenced individuals of *E. luteipes* and one *E. flavicrurus* female (see further under latter species); however, none of the sequenced specimens were reared from lac insects or is Oriental in origin. Individuals reared from lac insects from the Oriental region, preferably from India and Sri Lanka, need to be sequenced and compared with those we identify as *E. tachardiae* to ensure our application of nomenclature is correct.

E. (*Eupelmus*) *tanystylus* Gibson & Fusu n. sp.

Figs 110a–f (♀), 111a–g (♂)

Type material. Holotype ♀ (EIHU). Kanemi, Tokunoshima, Ryukyu, Japan / 24.IV.1996, M. Sueyoshi / Host *Rhabdochaeta naevia* Ito / HOLOTYPE ♀ *Eupelmus* (*Eupelmus*) *tanystylus* Gibson & Fusu, det. G. Gibson 2015. Condition: glued by right side on triangular point; uncontorted; entire.

Paratypes (4♀ & 4♂, all EIHU and reared by M. Sueyoshi). **ORIENTAL**. **Japan** (hosts all *Rhabdochaeta naevia* Ito): same data as holotype (1♀, CNC Photo 2014-31); Ryukyus, 10-28.IV.1996 (2♂, one with CNC Photo 2014-131); Ryukyu, Iriomote Is., Ha[i]mita, 17.III.1997 (1♀, CNC Photo 2014-32; 1♂, CNC Photo 2014-34), Shirahama, 12.IV.1996 (1♂, CNC Photo 2014-33); Ryukyu, Okierabu Is., Kasaishi, 22.IV.1996 (1♀). **Taiwan?**: Taipei, Yieliu, 27.XI.1977, host *Rhabdochaeta asteria* Hendel (1♀, CNC Photo 2014-30) [likely mislabelled, see under 'Distribution'].

Etymology. Formed from the Greek words *tany* (long) and *stylos* (pillar), in reference to the long ovipositor sheaths, the principal feature distinguishing females from those of *E. stenozonus*.

Description. FEMALE (habitus: Fig. 110c). Length = 2.3–2.5. Head usually mostly dark with slight violaceous luster under some angles of light (Fig. 110a, b, d), to more extensively greenish, particularly vertex and lower face, but also sometimes variably extensively along inner orbits. Head with slightly lanceolate white setae on lower face and parascrobal region to or slightly above dorsal level of scrobal depression compared less conspicuous hairlike setae on frontovertex. Maxillary and labial palps brown. Antenna dark with metallic lusters similar to head on scape and pedicel. Mesosoma (Fig. 110c–f) similar in colour to head, usually quite extensively dark with slight violaceous to more distinct coppery lusters, including most of pronotum, anterior mesoscutal lobe variably extensively anteriorly and lateral lobes mediolongitudinally, prepectus and acropleuron, though pronotum sometimes with more distinct greenish luster laterally, mesonotum at least partly green, and scutellar-axillar complex with at least some coppery to violaceous luster (Fig. 110d, e). Pronotum with admarginal setae brownish

to dark mesal to level of spiracles, though often paler apically; mesonotum, prepectus and callus laterally with similar, slightly lanceolate white setae, the prepectus with about 5–7 setae mediolongitudinally (Fig. 110f). Macropterous; fore wing hyaline (Fig. 110c) with white setae basally, though discal setae more yellowish to brown; costal cell dorsally near leading margin with 1 or 2 partial rows of setae over about apical half to two-thirds, and ventrally with at least 3 rows along length; basal cell and disc entirely setose except for linea calva. Front leg with femur dark except narrowly pale apically, tibia at least narrowly pale basally and more extensively apically and variably extensively pale along posterior and/or anterior surfaces, and tarsus pale to yellowish-brown. Middle leg pale beyond coxae except for dark mesotibial apical and mesotarsal pegs, the femur and tibia similar in colour except for paler knee. Hind leg with femur dark except narrowly apically; tibia extensively dark dorsally, but pale basally, more widely apically and more-or-less obviously along ventral length; tarsus with at least basal two tarsomeres pale. Gaster (Fig. 110c) with hairlike setae; extensively brown but green to bluish-green basally and usually with less distinct greenish luster apically and sometimes laterally; ovipositor sheaths distinctly banded with medial pale band shorter than either basal or apical dark bands, though extreme apex also pale.

Head in dorsal view with interocular distance about 0.4× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; vertex meshlike reticulate to somewhat reticulate-imbricate posteriorly; frons very shallowly meshlike reticulate (Fig. 110b); scrobal depression smooth and shiny or with only subeffaced sculpture to very shallowly coriaceous-reticulate dorsally (Fig. 110b); OOL: POL: LOL: MPOD = 0.8–0.9: 1.9–2.1: 1.1–1.3: 1.0. Mesoscutum (Fig. 110d, e) meshlike reticulate except medial lobe anteriorly more shallowly reticulate to transversely reticulate-imbricate and lateral lobe with mediolongitudinal band of minute coriaceous sculpture. Scutellum and axillae low convex in same plane; axilla mostly obliquely and scutellum longitudinally reticulate-imbricate laterad midline anterior to meshlike coriaceous frenal area. Acropleuron (Fig. 110f) more-or-less isodiametric meshlike anteriorly and posteriorly and much more minutely sculptured mesally, the larger meshlike sculpture coriaceous-reticulate, at most delineated by only slightly raised lines. Fore wing with cc: mv: pmv: stv = 5.0–5.5: 4.1–4.7: 1.0–1.2: 1.0. Middle leg with row of 4 or 5 mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus and pegs clearly differentiated into two rows apically, second tarsomere with 3 or 4 pegs, third tarsomere with 1 or 2 pegs, and fourth tarsomere with 1 peg apically on either side. Propodeum with very broadly, transversely U-shaped plical depression extending to posterior margin (Fig. 110e). Gaster (Fig. 110c) similar in length to combined length of head and mesosoma; not atypically modified; not nearly extending to apex of second valvifer, the latter extending conspicuously beyond gastral apex, with apparent sheath length about 1.75–1.9× length of metatibia and 1.95–2.4× length of mv, and third valvula about 1.35–1.5× length of metatibia and 1.5–1.8× length of mv; hypopygium extending almost three-quarters length of gaster.

MALE (habitus: Fig. 111a). Length = 1.8–1.9 mm. Head (Fig. 111a–d, f) mostly dark bluish-green but frontovertex, except at least along inner orbits, variably extensively dark with slight violaceous luster (Fig. 111c); frons and vertex reticulate, and vertex uniformly curved into occiput (Fig. 111d); scrobal depression meshlike reticulate laterally and dorsally though continuously smooth and shiny above interantennal prominence through scrobes (Fig. 111c); setae hairlike, white; lower face with evenly distributed and evenly curved setae (Fig. 111c, f); gena posterior to malar sulcus with 1 longer seta differentiated from others, and posterior to eye with apices of setae directed toward orbit. Antenna (Fig. 111e) with scape entirely dark; pedicel (Fig. 111e insert) about 1.0–1.3× as long as wide, ventrally with row of 5 long white setae, of which at least basal 4 distinctly to hook-like curved; length of pedicel + flagellum 1.3–1.4× head width; flagellum robust-filiform (Fig. 111e) with clava subequal in length to apical two funiculars; anellus very strongly transverse, discoidal, shiny, with at most inconspicuous sparse setae at extreme apical margin (Fig. 111e insert); funicle with fu1 1.3–1.4× as long as pedicel and about 1.3–1.6× as long as wide, with all funiculars oblong but at most about 1.8× as long as wide and uniformly covered with decumbent, curved setae (Fig. 111e, g); basal funiculars without evident region of differentiated setae ventrally. Maxillary and labial palps dark brown. Mesosoma (Fig. 111a, b) similar in colour to head, dark bluish-green to green except propodeum brighter and mesonotum sometimes more-or-less extensively dark or with slight reddish-violaceous to coppery lusters mediolongitudinally under some angles of light (Fig. 111b); setae hairlike, brown to pale brownish on pronotum and mesonotum and more distinctly white on propodeal callus; tegula dark. Front leg with most of femur and tibia dorso- and ventrolongitudinally dark, but knee, apex and anterior and posterior surface of tibia, and tarsus pale or apical tarsomeres variably dark brown. Middle leg dark except knee, apex of tibia, tibial spur and basal 2 or 3 tarsomeres pale, the third tarsomere usually more yellowish-brown, intermediate

in colour between basal and apical two tarsomeres. Hind leg with similar colour pattern as middle leg. Fore wing with mv about 2.8–3.3× length of stv; costal cell dorsally near leading margin with row of 7–10 setae over about apical third to half, and ventrally with 2 rows along length or reduced to single row mesally, but uniformly dark; basal cell uniformly setose with dark setae; speculum completely closed by setae posteriorly. Propodeum with complete median carina, quite shiny, only very finely meshlike coriaceous (Fig. 111b).

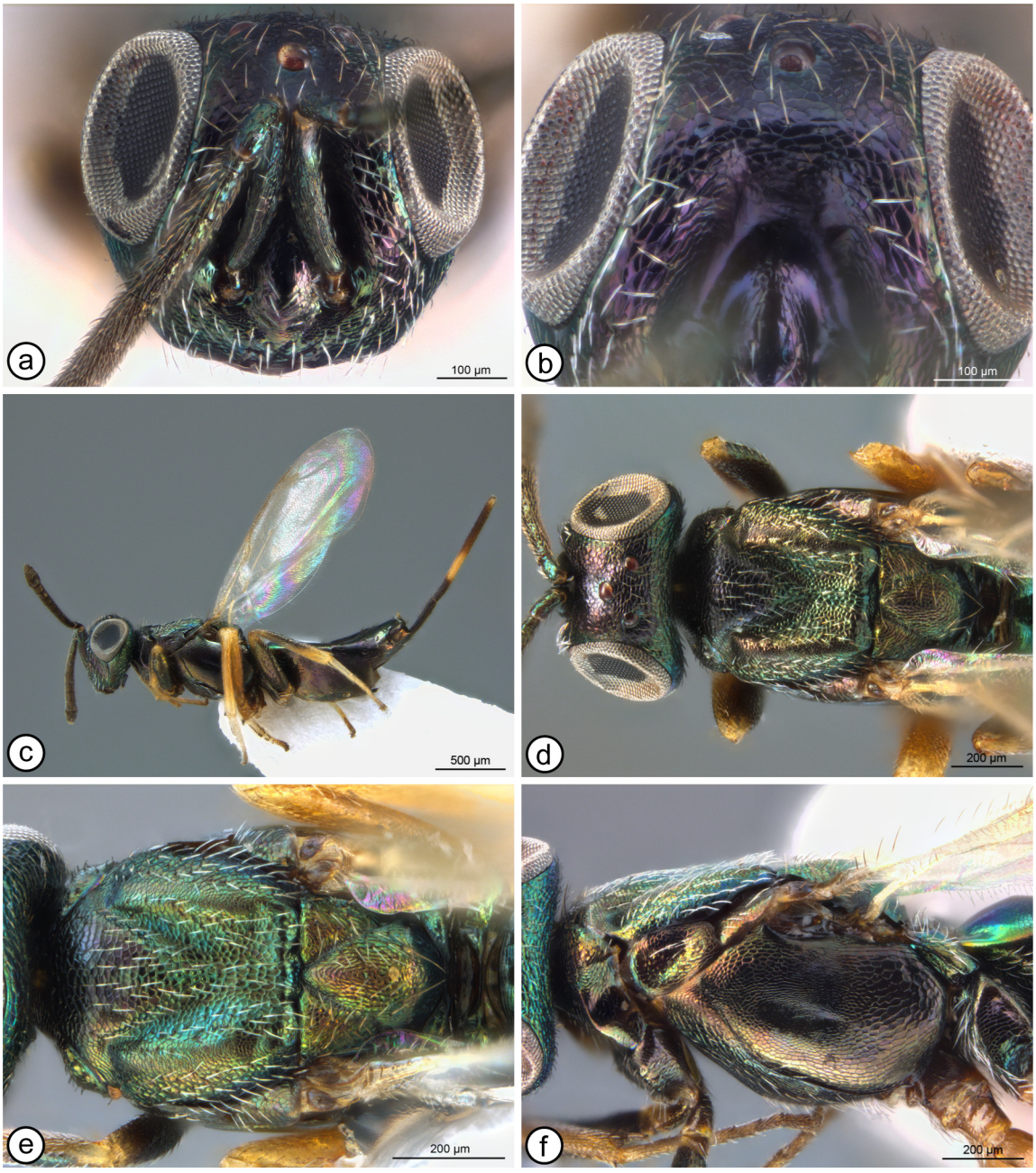

FIGURE 110. *Eupelmus tanystylus*, ♀. *a, c, d* (holotype): **a**, head, frontal; **c**, lateral habitus; **d**, head and mesosoma, dorsal. **b**, scrobal depression and frontovertex, frontal (2014-31). **e**, mesosoma, dorsal (2014-32). **f**, mesosoma, lateral (2014-30).

Distribution. Oriental part of Japan and possibly Taiwan. Although one female is labelled as reared from *C. asteria* in Taiwan, this specimen may actually be from "Ryukyu, Okierabu Is., Ootsukan". Sueyoshi (1999: 222) states this as the locality for a single female *Eupelmus* reared from *R. asteria*, whereas the Taiwan locality is listed for a single female *Pteromalus*. Consequently, either the published records or locality labels were inadvertently switched for the single *Eupelmus* and *Pteromalus* specimens. Switching of the locality labels is probably more likely.

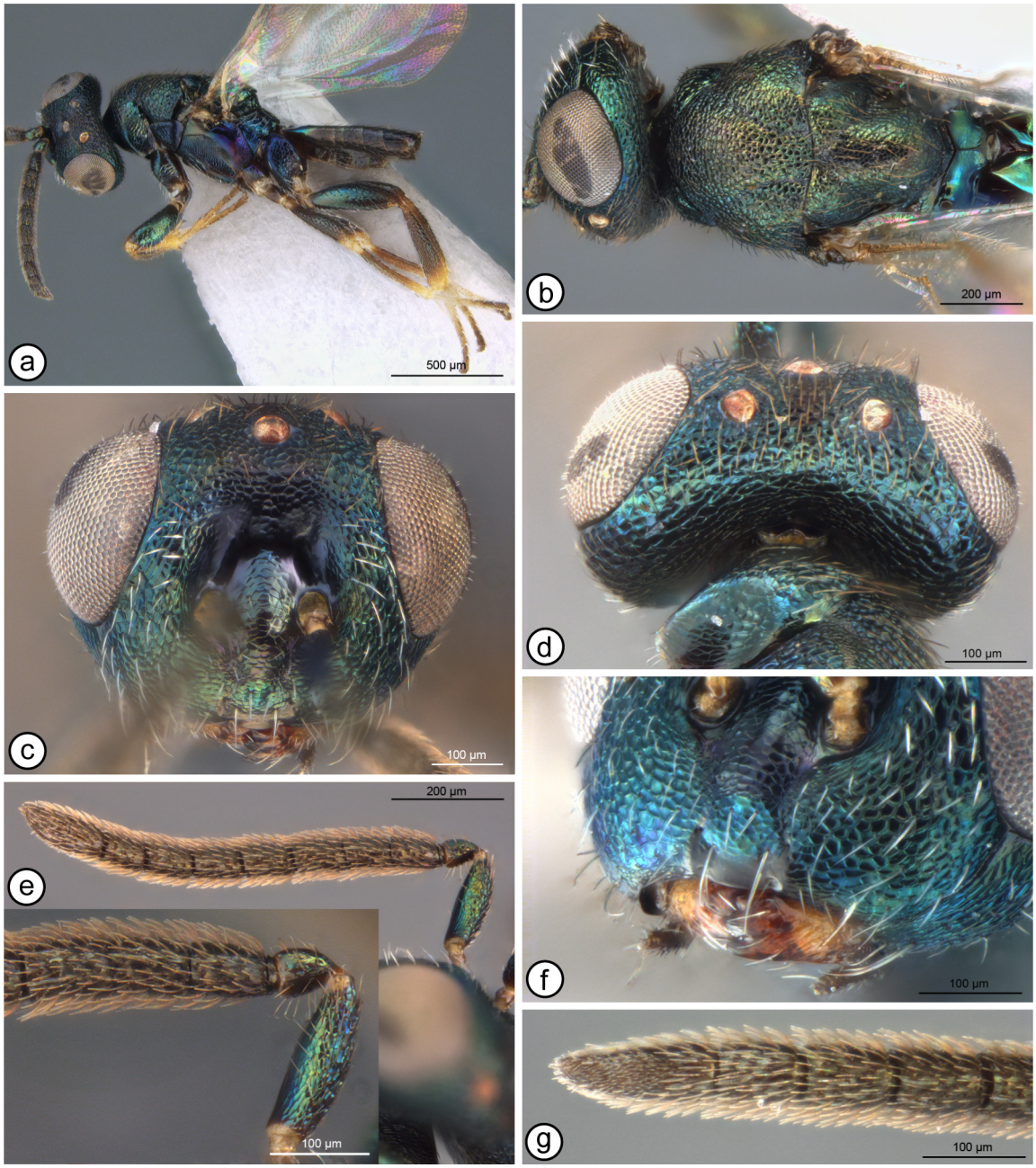

FIGURE 111. *Eupelmus tanystylus*, ♂. *a, b, f* (2014-131): **a**, lateral habitus; **b**, head (lateral) and mesosoma (dorsal); **f**, lower face, ventrolateral. *c–e, g* (2014-34): **c**, head, frontal; **d**, head, dorsal; **e**, antenna [insert: scape and pedicel through fl4; **g**, apical four flagellomeres, ventral view.

Biology. A pupal parasitoid of *Calliptera asteria* (Hendel) and *Calliptera naevia* (Ito) (Diptera: Tephritidae), as reported under the name *Eupelmus* sp. by Sueyoshi (1999).

Remarks. Although the Ryukyu Islands are part of Japan, which is mainly Palaearctic, the islands themselves lie south of 30ºN, and thus are more properly treated as Oriental. However, we decided to describe *E. tanystylus* in this revision for two reasons. First, our revision includes other examples of species known from South Korea and/or Japan as well as from the Oriental region in China or Taiwan. It is therefore quite possible that *E. tanystylus* will eventually be discovered from the Palaearctic part of Japan. We also describe it to bring attention the similarity of both sexes to those of *E. stenozonus*. The latter species is also a parasitoid of Tephritidae, but is known only from the Canary Islands and from Libya. It is surprising that such similar species with similar hosts occur in such widely separated regions as the Canary and Ryukyu Islands. We differentiate *E. tanystylus* females primarily by the ovipositor sheaths of the five known females being somewhat longer than those of the numerous *E. stenozonus*

observed (*cf* Figs 110c, 104e). Females of *E. stenozonus* are also typically more extensively green (Fig. 104a–f) than known *E. tanystylus* females (Fig. 110a–f) and have a darker middle leg colour pattern, though some individuals of the two species have quite similar colour patterns. The four known males of *E. tanystylus* are differentiated from those of *E. stenozonus* primarily by having five (Fig. 111e insert) rather than four (Fig. 105g) long pedicular setae ventrally. Similarly to females, they are also somewhat darker than typical *E. stenozonus* males. However, molecular analyses are needed to verify the species distinctness. It is possible that *E. stenozonus* was introduced accidentally by man from the Canary into the Ryukyu Islands in the recent past along with some adventive tephritid fruit fly. The differences observed might only reflect differences resulting from the introduction of a very small founder population.

***E.* (*Eupelmus*) *tetrazostus* Gibson & Fusu n. sp.**
Fig. 112a–i (♀)

Type material. Holotype ♀ (CNC). JAPAN: Aichi Pref., Narai, Toyota, 13-19.IX.1990, K. Yamagishi, PT. [pan trap]/ HOLOTYPE ♀ *Eupelmus* (*Eupelmus*) *tetrazostus* Gibson & Fusu, det. G. Gibson 2015. Condition: point-mounted; uncontorted; entire.

Etymology. From the Greek words *tetra* (four) and *zoster* (belt or girdle), in reference to the colour pattern of the ovipositor sheaths of the holotype.

Description. FEMALE (habitus: Fig. 112a, b). Length = 2.7 mm. Head (Fig. 112c–e) with occiput and vertex purple to blue to dark purplish-brown under different angles of light, remainder dark purplish-brown with variably distinct green to bluish-green lusters under different angles of light, including frons and scrobal depression; with mostly brownish, hairlike setae except white and somewhat longer, therefore more obvious setae on parascrobal region. Maxillary and labial palps brown. Antenna with scape yellow (Fig. 112c, h), pedicel mostly brown but lighter brownish-yellow ventroapically, and flagellum dark brown with slight metallic lusters under some angles of light. Mesosoma (Fig. 112e, f) with tegula and prepectus brown, otherwise brown with variably distinct purple to bluish-green lusters, most distinctly on pronotum laterally, within posteromedial depressed region of mesoscutum, scutellar-axillar complex, metanotum laterally and callus. Pronotum with admarginal setae dark; mesonotum, prepectus and callus with similar white to brownish hairlike setae, the prepectus with two rows of a total of eight setae (Fig. 112f). Macropterous; fore wing hyaline with yellowish to brown setae; costal cell dorsally near leading margin with row of setae over about apical two-thirds, and ventrally with at least 2 rows along length; basal cell and disc entirely setose except for linea calva extending basally to about base of mv. Excluding dark mesotibial apical and mesotarsal pegs, legs mostly pale beyond coxae but profemur, particularly posterior surface, dark brown except narrowly apically, protibia with less distinct dorsal and ventral subbasal brownish regions, and metafemur with anterior and posterior surfaces brown subbasally, more extensively ventrally than dorsally. Gaster (Fig. 112a, b) with hairlike setae; mostly brown but basal tergite anteriorly purple to blue and with variably distinct greenish lusters laterally under some angles of light, the terminal three tergites more distinctly and extensively so dorsally under most angles of light; ovipositor sheaths (Fig. 112i) with four distinct bands, dark basally and subapically and pale subbasally and apically, and with the pale bands very short, shorter than the dark bands.

Head in dorsal view (Fig. 112e) with interocular distance 0.42× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; vertex rounded into occiput, the alutaceous-imbricate sculpture raised into narrow, sharp ridges but not coalesced into discernable transverse ridge (Fig. 112e); frons slightly roughened, alutaceous-imbricate to reticulate-imbricate (Fig. 112f); scrobal depression more distinctly reticulate to transversely reticulate-strigose dorsally (Fig. 112c); OOL: POL: LOL: MPOD = 1.0: 2.6: 1.75: 1.0. Mesoscutum (Fig. 112e) mostly meshlike reticulate except medial lobe more transversely alutaceous-imbricate anteriorly and lateral lobe with mediolongitudinal band of minute coriaceous sculpture. Scutellum and axillae low convex in same plane; axilla meshlike reticulate mesally to obliquely reticulate-imbricate laterally and scutellum longitudinally reticulate-imbricate laterad midline anterior to meshlike coriaceous frenal area. Acropleuron (Fig. 112e) more-or-less isodiametric meshlike anteriorly and posteriorly and much more minutely sculptured mesally, the larger meshlike sculpture coriaceous-reticulate, the cells at most delineated by only slightly raised ridges. Fore wing with cc: mv: pmv: stv = 4.8: 5.9: 1.0: 1.0. Middle leg (Fig. 112g) with row of 4 mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus and pegs clearly differentiated into two rows apically; second tarsomere with 5 pegs, third tarsomere with 2 pegs on anterior margin and 3 pegs on

posterior margin, and fourth tarsomere with 1 peg apically on either side. Propodeum with broadly U-shaped plical depression extending to posterior margin (Fig. 112e). Gaster (Fig. 112a, b) similar in length to combined length of head and mesosoma; not atypically modified; extending slightly over base of third valvula, the latter (measured in ventral view) 0.57× length of metatibia and 0.55× length of mv; hypopygium extending about two-thirds length of gaster.

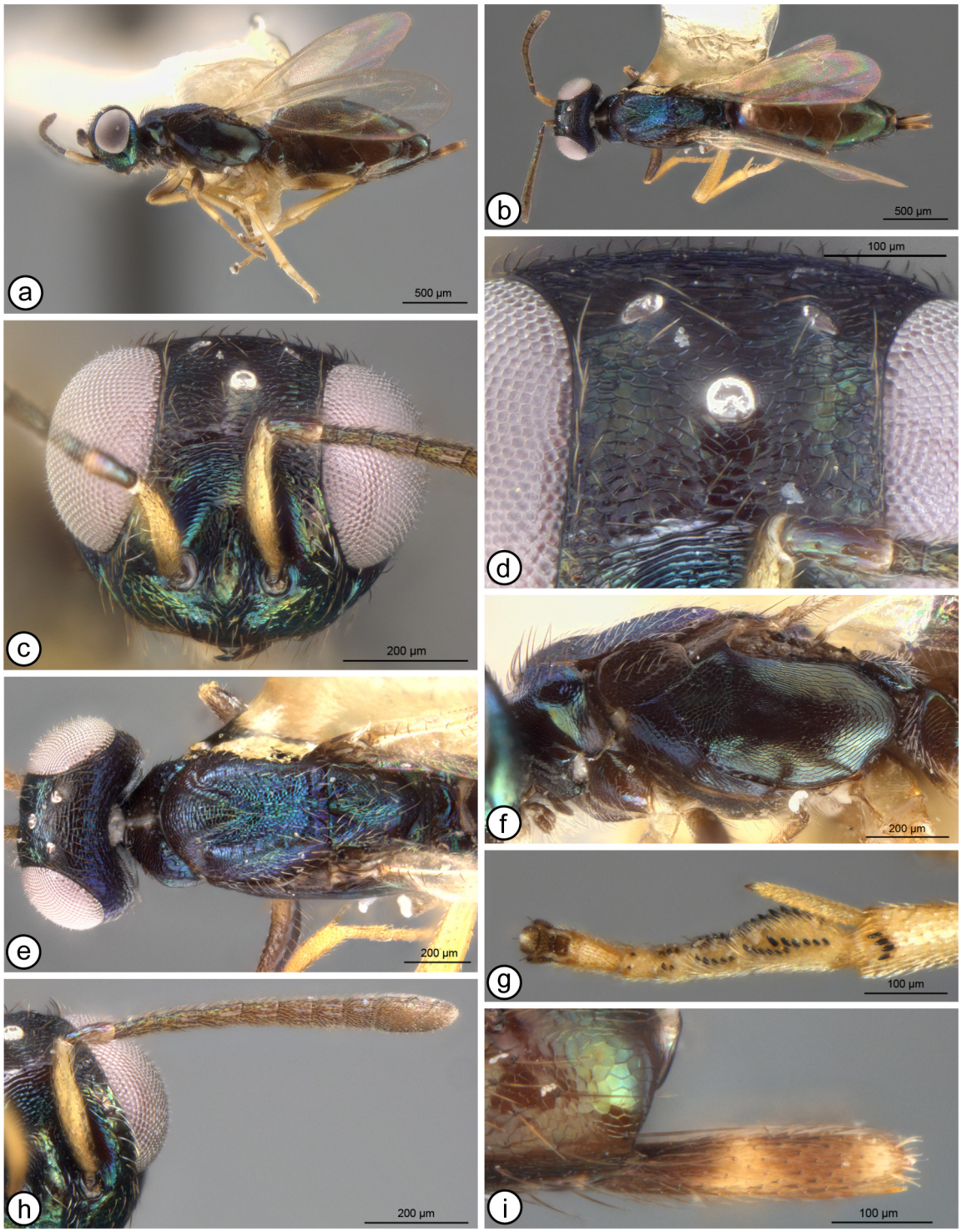

FIGURE 112. *Eupelmus tetrazostus*, ♀. *a–h* (holotype): **a**, lateral habitus; **b**, dorsal habitus; **c**, head, frontal; **d**, frontovertex; **e**, head and mesosoma, dorsal; **f**, mesosoma, lateral; **g**, apex of mesotibia and mesotarsus; **h**, antenna. **i**, ovipositor sheaths.

MALE. Unknown.

Distribution. Japan.

Biology. Unknown.

Remarks. See under *E. brachystylus* for features to differentiate females of these two species and those of *E. brachyurus*. Comparatively very short, quadri-banded ovipositor sheaths is the primary differential feature for *E. tetrazostus* (Fig. 112i), but only a single female is known. Without additional females it is not possible to confidently predict whether some females may have longer ovipositor sheaths and, if so, whether the subbasal pale band could be longer and more distinct than for the holotype.

E. (*Eupelmus*) *tibicinis* Bouček

Figs 113a–d (♀), 114a–g (♂)

Eupelmus tibicinis Bouček, 1963: 277−279. Holotype ♀, NMPC, not examined. Type data: USSR, Moldavian SSR, Bendery, 5.VII.1961, V.I. Talitzki, reared from eggs of *Tibicen* [*Tibicina*] *haematodes*.

Eupelmus (*Eupelmus*) *tibicinis*; Al khatib *et al.*, 2014: 814 (♀ keyed), 822 (♂ keyed).

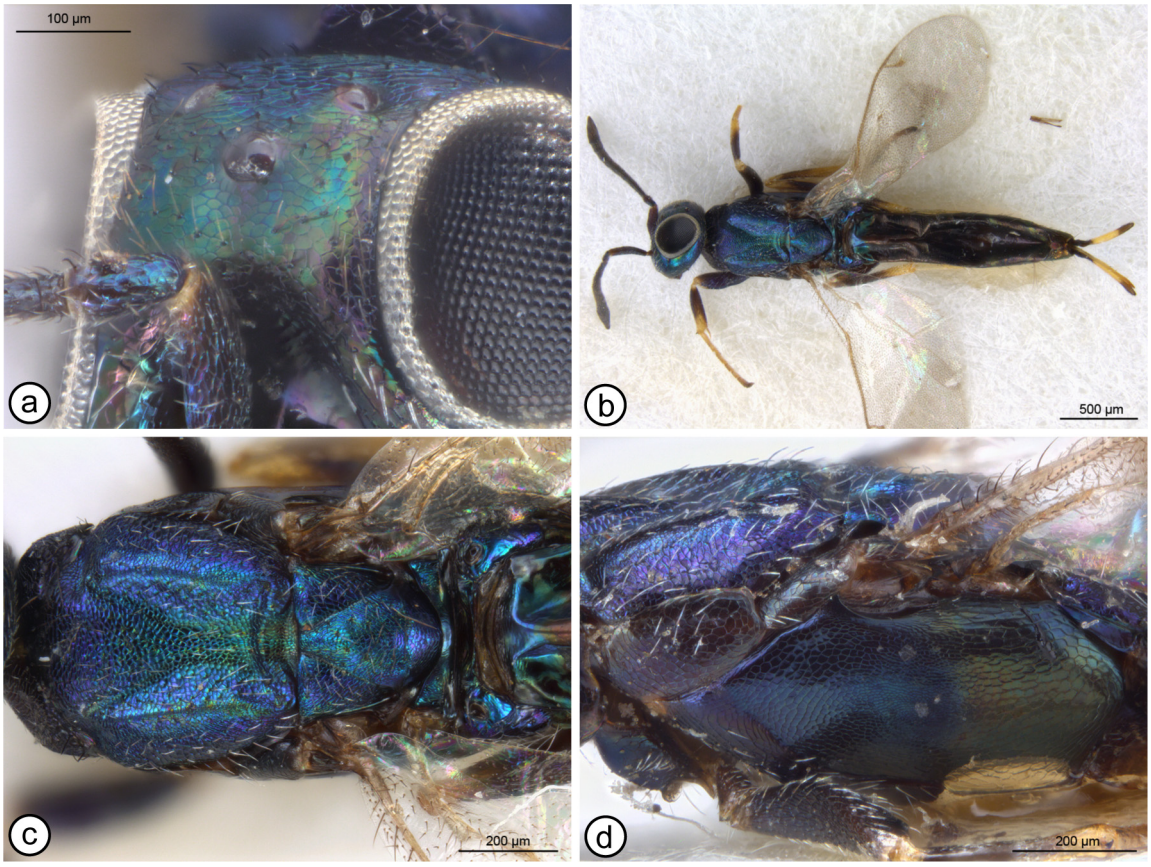

FIGURE 113. *Eupelmus tibicinis*, ♀. *a–c* (2012-65): **a**, upper part of scrobal depression and frontovertex; **b**, dorsal habitus; **c**, mesosoma, dorsal. **d**, mesosoma, lateral (2012-66).

Description. FEMALE (habitus: Fig. 113b). Length about 3 mm. Head (Fig. 113a, b) mostly dark with variably distinct green to bluish-green lusters under different angles of light (Fig. 113a) except vertex and occiput more distinctly blue to purple; with slightly lanceolate white setae on lower face and about ventral two-thirds of parascrobal region compared to less conspicuous hairlike setae on frontovertex and dorsal third of parascrobal region. Maxillary and labial palps brown. Antenna dark with metallic lusters similar to head on scape and pedicel. Mesosoma (Fig. 113b–d) similar in colour to head, primarily blue to purple though mesonotum sometimes with slight greenish luster under some angles of light, acropleuron sometimes with more obscure metallic lusters than mesonotum and with slight greenish or coppery lusters mesally to posteriorly (Fig. 113d), and tegula and prepectus often more brown with variably distinct metallic lusters. Pronotum with admarginal setae dark; mesonotum with

hairlike to slightly lanceolate, mostly white setae; prepectus sparsely setose with up to 7 (?) setae mostly within dorsal half (Fig. 113d); callus with comparatively sparse white setae similar to mesoscutum. Macropterous; fore wing (Fig. 113b) hyaline with dark setae; costal cell dorsally near leading margin with 1 or 2 partial rows of setae over about apical half to two-thirds, and ventrally with about 3 rows along length; basal cell an disc entirely setose except for linea calva. Front leg dark with metallic luster except knee pale, tibia variably extensively pale apically and along anterior surface, and tarsus variably pale to brownish-yellow but at least apical tarsomere dark. Middle leg dark except knee, tibia much more extensively apically than basally, and tarsus pale except usually apical tarsomere. Hind leg dark with knee, tibia apically, and tarsus pale except for apical tarsomere. Gaster (Fig. 113b) with hairlike setae; brown with at most very slight and limited metallic lusters except basal tergite anteriorly more distinctly greenish-blue; ovipositor sheaths distinctly banded, with elongate medial pale band obviously longer than either basal or apical dark regions.

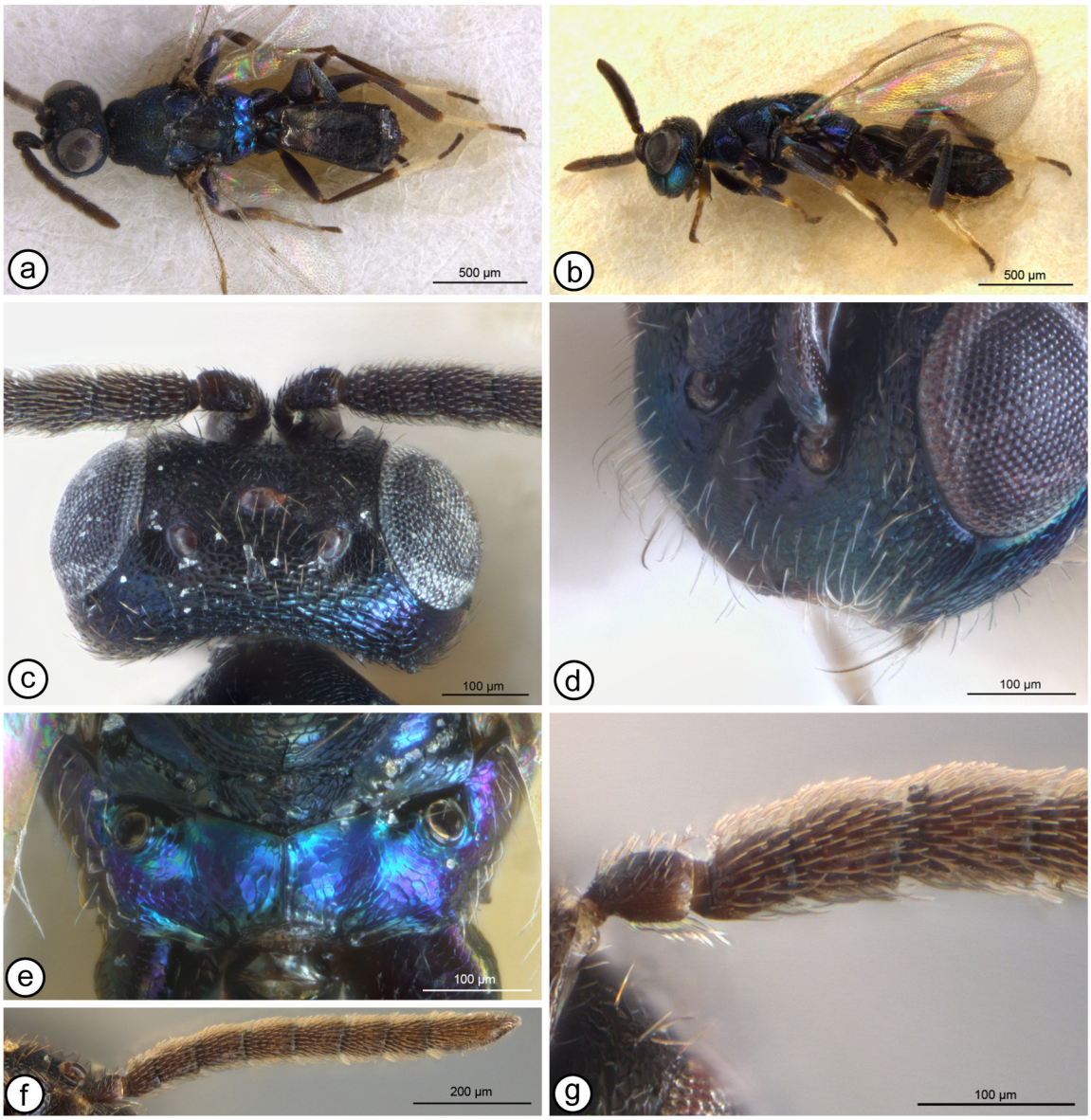

FIGURE 114. *Eupelmus tibicinis*, ♂. *a, e* (2013-134): **a**, dorsal habitus; **e**, metanotum and propodeum. *b–d, f, g* (2012-94): **b**, lateral habitus; **c**, head, dorsal; **d**, lower face, frontolateral; **f**, flagellum; **g**, pedicel to base of fl5, inner view.

Head in dorsal view with interocular distance about 0.4× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; vertex transversely coriaceous-alutaceous to alutaceous-imbricate posteriorly; frons meshlike coriaceous (Fig. 113a); scrobal depression with scrobes smooth and shiny, but at least about dorsal half of depression finely coriaceous (Fig. 113a); OOL: POL: LOL: MPOD about

1.0: 2.4: 1.5: 1.0. Mesoscutum (Fig. 113c) meshlike reticulate except medial lobe with sculpture somewhat more transverse anteriorly and lateral lobe with mediolongitudinal band of minute coriaceous sculpture. Scutellum and axillae low convex in same plane; axilla mostly obliquely and scutellum longitudinally reticulate-imbricate laterad more coriaceous midline and frenal area meshlike coriaceous-reticulate. Acropleuron (Fig. 113d) more-or-less isodiametric meshlike anteriorly and posteriorly and much more minutely sculptured mesally, the larger meshlike sculpture coriaceous-reticulate, at most delineated by only slightly raised ridges. Fore wing with cc: mv: pmv: stv = 4.5–5.0: 4.3–4.5: 1.0–1.1. Middle leg with row of at least 3 mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus and pegs clearly differentiated into two rows apically, second tarsomere with about 6 pegs, third tarsomere with 3 or 4 pegs, and fourth tarsomere with 1 or 2 pegs apically on either side. Propodeum with very broadly, transversely U-shaped plical depression extending to posterior margin (Fig. 113c). Gaster (Fig. 113b) about 1.15–1.25× as long as combined length of head and mesosoma; not atypically modified; not extending to apex of second valvifer, the latter usually extending quite obviously beyond apex, with apparent sheath length about 1.1× length of metatibia and 1.1–1.2× length of mv, and third valvula about 1.0× length of metatibia and 1.0–1.1× length of mv.

MALE (habitus: Fig. 114a, b). Length = about 2 mm. Head (Fig. 114c, d) dark or with slight bluish luster, particularly on lower face (Fig. 114d); frons and vertex reticulate, and vertex uniformly curved into occiput, the raised edges of sculpture sometimes partly aligned transversely but not into differentiated ridge or carina (Fig. 114c); scrobal depression with at least fine meshlike sculpture excluding smooth and shiny scrobes; setae hairlike, pale brownish to brown; lower face in region between torulus and malar sulcus with region of obviously longer setae that apically are sinuately to abruptly curved (Fig. 114d); gena posterior to malar sulcus with 1 obviously longer seta differentiated from other variably long setae, and posterior to eye with apices of setae directed toward orbit. Antenna (Fig. 114f) with scape entirely dark; pedicel (Fig. 114g) at most about 1.5× as long as wide, ventrally with 7 long, abruptly hook-like setae; length of pedicel + flagellum about 1.3–1.4× head width; flagellum robust-filiform (Fig. 114f) with clava subequal in length to apical two funiculars; anellus very strongly transverse, discoidal, bare (Fig. 114g); funicle with fu1slightly shorter than pedicel and only about two-thirds as long as fu3, the funiculars at most about 1.4× as long as wide with decumbent, curved setae; fu1–fu3 in ventral view each with region of short lanceolate setae visible under lower magnifications as elongate, smoother, shinier regions surrounded by decumbent setae. Maxillary and labial palps brown. Mesosoma (Fig. 114a, b) similar in colour to head except propodeum more distinctly blue to purple (Fig. 114e); setae hairlike, brown on pronotum and mesonotum and more distinctly white on propodeal callus; tegula dark. Front leg with knee and anterior and posterior surfaces of tibia longitudinally pale for at least part of length; tarsus variably dark yellowish-brown, with basitarsus often paler. Middle leg with knee and sometimes tibia longitudinally lighter in colour, but only tibial spur and basal two tarsomeres white. Hind leg dark except spurs and basal two tarsomeres pale. Fore wing with mv about 3.4–4.0× length of stv; costal cell dorsally near leading margin with dark setae over about apical half, and ventrally with dark setae at least indistinctly aligned into 2 rows within basal half; basal cell uniformly setose with dark setae; speculum closed posterobasally by setae. Propodeum (Fig. 114e) with complete median carina, plical region sometimes more distinctly meshlike reticulate posteriorly but mostly meshlike coriaceous and quite shiny.

Distribution. Azerbaijan, Croatia?, France (Al khatib *et al*. 2014), Moldova. The record for Croatia by Bouček (1977) is likely erroneous. Of three specimens cited by him from Croatia, we saw one of two listed from Biograd and it is a female *E. acinellus* (see 'Distribution' for latter species).

Biology. An egg parasitoid of *Tibicina haematodes* (Scopoli) (Hemiptera: Cicadidae) (Bouček 1963).

Remarks. Bouček (1963, figs 1, 2) provided line drawings of the dorsal habitus and anterior part of the female fore wing when he described *E. tibicinis* based on 18 females and 11 males reared from *T. haematodes*. The allotype and some paratypes of both sexes were stated as deposited in ZIN. Our description of *E. tibicinis* is based on only four card-mounted females and five males, most of which were identified by Bouček but are not part of the type series. The description of the female likely does not encompass intraspecific variation adequately because some structures are missing or the method of mounting obscures some features in some of the females. The species may be most closely related to *E. janstai*, as discussed under the latter species. Because of their comparatively long ovipositor sheaths (Fig. 113b), coriaceous frons and quite shiny though very finely sculptured scrobal depression (Fig. 113a), females also resemble those of the more common species *E. azureus*, but they are obviously more elongate-slender with a longer, more slender gaster (Fig. 113b).

Only one of the examined, card-mounted males had a flagellum in a position that the ventral surface could be

observed. This had elongate regions of short, dark, lanceolate setae differentiated from the other decumbent setae on fu1–fu3, though only obscurely so on fu3. Except for having the basal two tarsomeres of the mesotarsus white, males are very similar to males of *E. urozonus*.

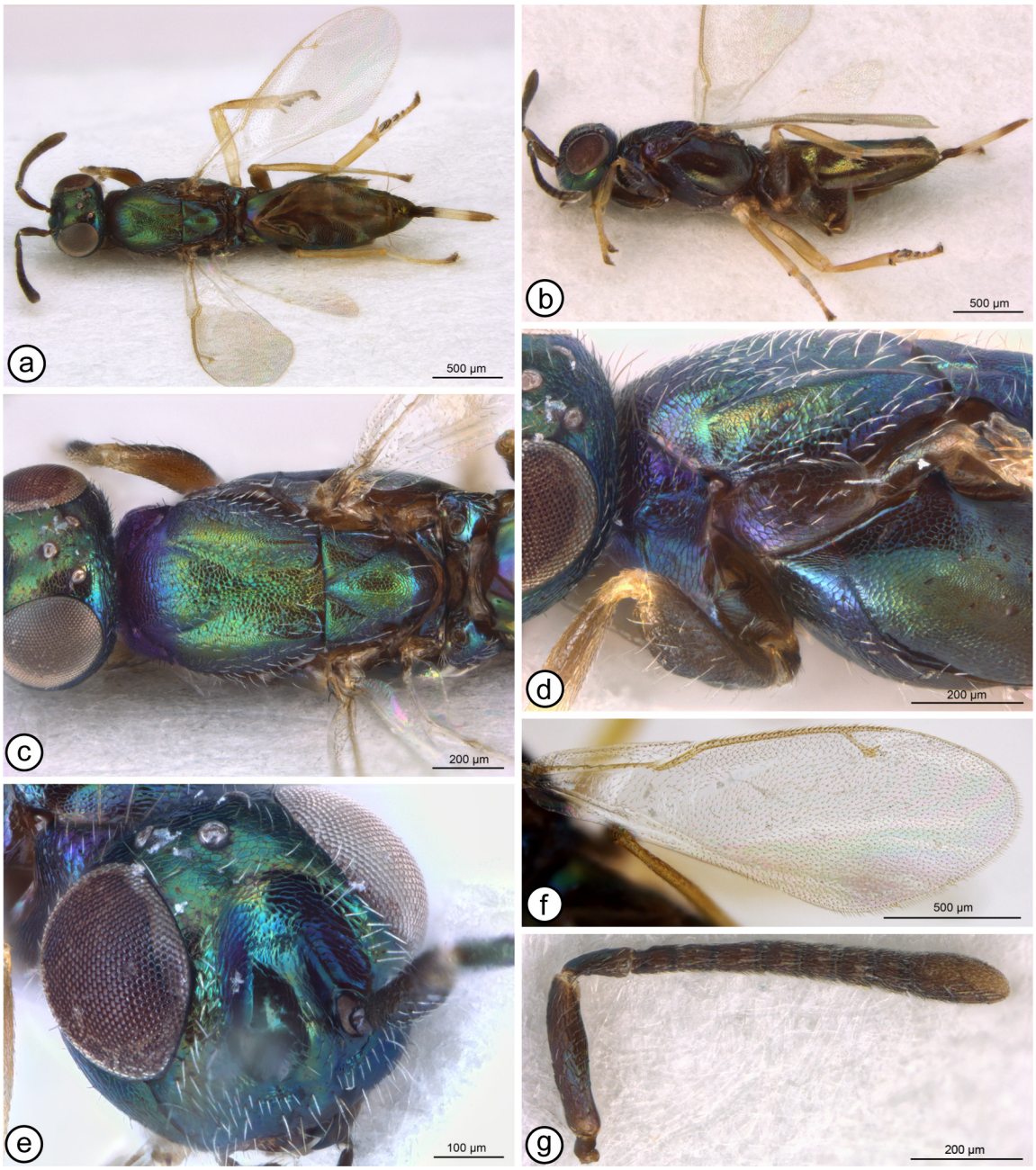

FIGURE 115. *Eupelmus tremulae*, ♀. *a–f* (holotype): **a**, dorsal habitus; **b**, lateral habitus; **c**, head and mesosoma, dorsal; **d**, pronotum, mesoscutum and prepectus, lateral; **e**, head, frontolateral (antennae blurred); **f**, fore wing. **g**, antenna (paratype).

E. (*Eupelmus*) *tremulae* Delvare

Figs 115a–g (♀), 116a–j (♂)

Eupelmus (*Eupelmus*) *tremulae* Delvare *in* Al khatib *et al.*, 2015: 145. Holotype ♀, MHNG, examined. Type data: Czech Republic, Jindóichùv [sic] Hradec, Veselí nad Lužnicí, 1 km E. of Charles University field station (Ruda), 49.15296°N 14.70646°E, 422 m a.s.l., 05.vi.2007, P[etr] Jansta, ex. *Harmandia* sp. (Cecidomyiidae) on *Populus tremula*, adult emergence 13.vi.2007 (PJ07003_1_1 / 10570).

Eupelmus (*Eupelmus*) *tremulae* Delvare *in* Al khatib *et al.*, 2014: 856–857 (unavailable name; original description, keyed, illustrated).

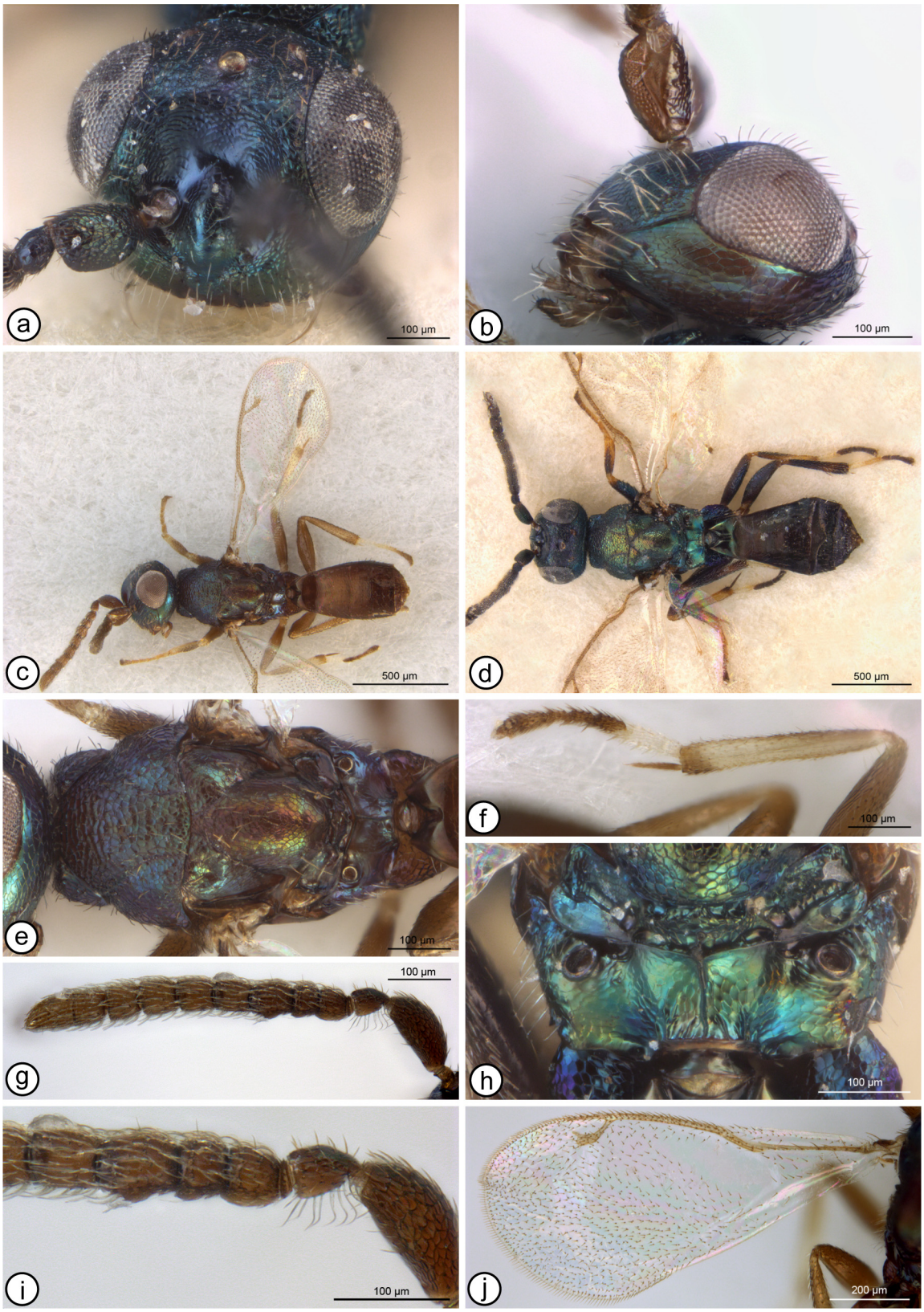

FIGURE 116. *Eupelmus tremulae*, ♂. *a, d, h* (2014-7): **a**, head, frontal (left antenna blurred); **d**, dorsal habitus; **h**, apex of scutellum to propodeum. *b, c, e–g, i, j* (paratype): **b**, head (lateral) and scape (outer view); **c**, dorsal habitus; **e**, mesosoma, dorsal; **f**, mesofemur and tibia; **g**, antenna, inner view; **i**, pedicel to base of fl6, inner view; **j**, fore wing.

Description. FEMALE (habitus: Fig. 115a, b). Length = 2.8–2.9 [2.65] mm. Head (Fig. 115c, e) mostly green, though occiput and frontovertex more brown with less distinct green luster under some angles of light, and lateral

surface of scrobal depression and scrobes with variably distinct blue or purple to violaceous lusters under different angles of light (Fig. 115e); with white setae, the setae slightly lanceolate on lower face and parascrobal region to level of dorsal margin of scrobal depression compared to somewhat less conspicuous, more hairlike white setae on frons. Maxillary and labial palps brown. Antenna (Fig. 115g) with scape similarly dark as flagellum, and only dorsal surface of pedicel with greenish luster under some angles of light. Pronotum reddish-violaceous to purple laterally (Fig. 115c–e), with lateral panel variably brownish to extensively blue or with some violaceous luster (Fig. 115d); admarginal setae pale, but somewhat brownish rather than white. Mesonotum (Fig. 115c) mostly green or brownish with less distinct green luster depending on angle of light but with outer surface of lateral lobe more bluish to violaceous near mesoscutal margin; with hairlike to slightly lanceolate white setae. Prepectus (Fig. 115d) primarily brown but with slight bluish to purple lusters under some angles of light, with 9 [8–12] comparatively inconspicuous, pale setae mediolongitudinally. Tegula dark. Acropleuron variably brown to more distinctly green to bluish or with some purple luster anteriorly under some angles of light. Propodeal callus with hairlike to slightly lanceolate white setae similar to mesonotum. Macropterous; fore wing (Fig. 115f) hyaline, the discal setae pale, white to yellowish; costal cell dorsally near leading margin with somewhat darker setae in row over about apical half to two-thirds, and ventrally with 3 or more rows over most of length except mesally to varied extent; basal cell and disc entirely setose except for elongate linea calva extending to level about equal with middle of parastigma. Front leg with femur dark except narrowly pale apically; tibia dark dorso- and ventrolongitudinally and pale basally, more widely apically, and along entire anterior and posterior surfaces. Middle leg pale except mesotibial apical and mesotarsal pegs dark. Hind leg with trochanter and about basal three-quarters of femur dark, but trochantellus, femur apically, tibia entirely, and at least basal four tarsomeres pale, the apical tarsomere more brownish. Gaster (Fig. 115a, b) with hairlike setae; with variably extensively green luster, but at least brown to coppery-brown dorsally over about apical half of first and subsequent three gastral tergites, with first gastral tergite basally green to coppery-green laterally and blue to purple mesally; ovipositor sheaths distinctly banded with dark basal band, much longer pale band, and light brown apical band quite abruptly delineated from medial band.

Head in dorsal view with interocular distance about 0.41× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; in frontal view distance from oral margin to inner ventral margin of torulus about 1.27–1.3× distance between inner mesal margins of toruli; vertex evenly rounded into occiput, at most sculpture aligned to form a very fine, obscure transverse carina at about level of outer orbits; frons entirely meshlike coriaceous (Fig. 115c, e); scrobal depression shallowly meshlike reticulate, the scrobes with even more effaced meshlike sculpture to smooth toward toruli (Fig. 115e); OOL: POL: LOL: MPOD = 0.6–0.7: 2.3–2.4: 1.3: 1.0. Mesoscutum (Fig. 115c) mostly meshlike reticulate except medial lobe more reticulate-imbricate to transversely imbricate anteriorly and lateral lobe with mediolongitudinal band of minute coriaceous sculpture. Scutellum and axillae low convex in same plane; axilla mostly meshlike coriaceous to obscurely coriaceous-reticulate dorsally and obliquely coriaceous-imbricate laterally, and scutellum meshlike coriaceous to coriaceous-imbricate laterally anterior to somewhat larger, more isodiametric meshlike sculpture on frenal area. Acropleuron more-or-less isodiametric meshlike anteriorly and posteriorly and much more minutely sculptured mesally, with larger meshlike sculpture somewhat larger posteriorly than anteriorly but delineated by only slightly raised ridges. Fore wing with cc: mv: pmv: stv = 5.3–5.6: 4.4–4.5: 1.2: 1.0. Middle leg with row of 5 or 6 mesotibial apical pegs; mesotarsus with symmetrical pattern on basitarsus and pegs clearly differentiated into two rows apically; second tarsomere with 4 or 5 pegs, third tarsomere with 2, and fourth tarsomere with 1 peg apically on either side. Propodeum with broadly U-shaped plical depression extending to posterior margin (Fig. 115c). Gaster (Fig. 115a, b) similar in length to combined length of head and mesosoma; not atypically modified; not quite extending to apex of second valvifer, the latter extending slightly beyond gastral apex, with length of third valvula 0.92–1.0× length of metatibia and 1.07–1.1× length of mv; hypopygium extending somewhat beyond half length of gaster (when appressed to sheaths).

MALE (habitus: Fig. 116c, d). Length = 1.5–2.1 mm. Head (Fig. 116a–d) dark brown with slight green to bluish lusters under different angles of light to mostly dark blue to bluish-green with obscure, limited violaceous lusters under some angles of light (Fig. 116 a, b) except lower face and gena more distinctly greenish; frons comparatively finely sculptured, but at least slightly roughened, meshlike coriaceous-reticulate to reticulate-imbricate (Fig. 116a), and vertex more distinctly reticulate-imbricate to reticulate; vertex differentiated from occiput by distinct transverse carina; scrobal depression variably distinctly reticulate to transversely strigose-reticulate, though scrobes shiny, including continuously across interantennal prominence, with at most obscure,

subeffaced meshlike sculpture (Fig. 116a); setae hairlike, white ventrally to brown dorsally; lower face in region between torulus and malar space with tuft-like region of longer setae, of which at least some abruptly curved, hook-like, or sinuate apically (Fig. 116a, b); gena posterior to malar sulcus with 1 long seta and between this and oral margin with 5 progressively shorter setae (paratype), and posterior to eye with apices of setae directed toward orbit. Antenna (Fig. 116i) with scape entirely dark, ovoid, about 1.25–1.53× as long as wide (Fig. 116b); pedicel (Fig. 116i) at most about 1.4× as long as wide, ventrally with 7 long setae, of which all but apical-most hooked; length of pedicel + flagellum about 1.3–1.4× head width; flagellum robust-filiform (Fig. 116g) with clava subequal in length to apical two funiculars; anellus very strongly transverse, discoidal, shiny, with at most inconspicuous, sparse setae at extreme apical margin (Fig. 116i); funicle with fu1 slightly shorter than pedicel and slightly wider than long but quadrangular, fu2 similar to fu1 in length and shape, fu3 quadrate to oblong, and fu4–fu6 oblong but at most only about 1.5× as long as wide, and uniformly covered with decumbent, curved setae except fu1–fu3 in ventral view with less setose longitudinal region of differentiated, shorter, straighter setae. Maxillary and labial palps dark brown. Mesosoma from mostly brown with slight bluish luster (paratype, Fig. 116c, e) or more distinctly green with limited coppery lusters (Fig. 116d) except pronotum more obviously blue; setae hairlike, brownish; tegula dark. Front leg with femur dark except narrowly pale apically; tibia pale basally, more widely apically and along anterior and posterior surfaces, but partly dark at least ventrolongitudinally; tarsus pale or increasingly darker brown apically. Middle leg with femur dark except narrowly apically; tibia sometimes extensively pale, but at least light brownish dorsobasally and apically adjacent to dark mesotibial spur (paratype, Fig. 116f), and sometimes tibia with dark dorso- and ventrolongitudinal bands similar to protibia (Fig. 116d); tarsus with basitarsus pale and apical four tarsomeres dark. Hind leg with metacoxa brown with slight violaceous luster dorsally (paratype) or bluish laterally and brighter purple to violaceous dorsally, and in lateral view dorsal margin uniformly tapered to apex or with dorsoapical margin obscurely denticulate or raised into irregular, slender flange; femur and tibia brown to dark brown or knee and tibia subapically slightly paler; tarsus with basal 3 (paratype) or 2 tarsomeres pale and subsequent 2 or 3 tarsomeres brown to dark. Fore wing (Fig. 116j) with mv about 3.0–3.4× length of stv and pmv about 1.1–1.3× as long as stv; costal cell dorsally near leading margin with dark setae apically for distance little more than length of parastigma, and ventrally with multiple rows apically but reduced to single row within at least basal half. Propodeum (Fig. 116h) with complete median carina, variably distinctly meshlike coriaceous to reticulate posteriorly and with 1 or 2 short paralateral carinae extending anteriorly from propodeal foramen on either side.

Distribution. Czech Republic, **Hungary*** [Miske, 13.VI.1944, dr Erdős, CNC Photo 2014-7 (HNHM: 1♂)].

Biology. Reared from *Harmandia* sp. (Diptera: Cecidomyiidae) on *Populus tremula* L. (Salicaceae).

Remarks. The holotype of *E. tremulae* is entire, but because of treatment for DNA extraction the legs are empty and thus can be seen through. To some extent this is also obvious for the meso- and metasoma depending on the angle of light, and likely is the reason why the mesonotum of the holotype is less distinctly green when observed from a direct dorsal view than from an oblique view. The male paratype is even more obviously an "empty shell", and this likely explains why observed metallic colouration of the mounted specimen is less intense than that described originally (Fig. 116c, e).

As discussed under *E. fulvipes*, *E. tremulae* is included as one of ten species within the *fulvipes* species group because of the presence of a vertexal carina in at least males. The two available females lack a distinct vertexal carina, having at most "an almost imperceptible transverse ridge", as originally stated by Al khatib *et al*. (2014). Because of the possibility of a more distinct vertexal carina for some females we key the species twice based on presence or absence of this feature. If the ovipositor sheaths are not measured accurately, females would key to *E. kiefferi*, which also lack or have a variably developed vertexal carina, but whose ovipositor sheaths are at most 0.85× the length of the marginal vein. Although unstated, the female images for *E. tremulae* provided by Al khatib *et al.* (2014, fig. 7C–G) are of the paratype, which has the more distinct, darker metallic colouration of the two females.

In addition to the paratype male, we saw a second male from Hungary that also has a dark mesotibial spur (Fig. 116d). This feature (Fig. 116f) readily distinguishes *E. tremulae* males from other *fulvipes*-group males. The two males also have the scape at most only about 1.5× as long as wide and ovoid (Fig. 116b). The non-paratype male is the larger individual and is generally darker with more distinct metallic luster on the head and mesosoma (*cf* Fig. 116 d, c), and has coarser sculpture. This is to be expected from a larger male, but the colour differences likely are also at least partly due to effects of whole specimen DNA extraction from the paratype male as discussed above.

Neither male is mounted so that a direct lateral view of the metacoxa is visible. The smaller male has the dorsal surface of the metacoxa uniformly curved apically though with the dorsoapical margin denticulate. The larger male from an inner view of one coxa appears to have the sculpture more distinctly raised dorsoapically into a slender, irregular flange. Additional males are required to determine the exact structure from an outer lateral view.

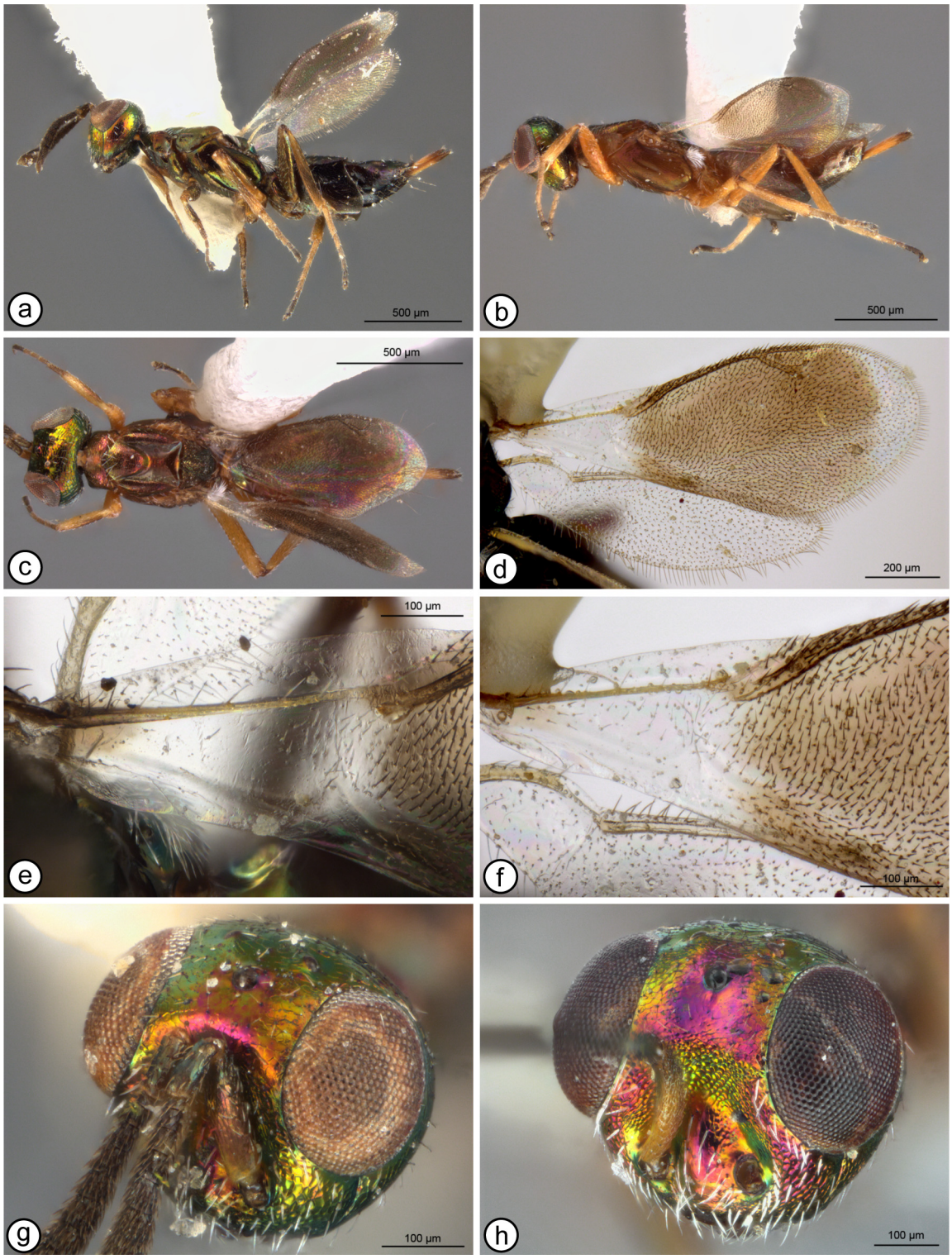

FIGURE 117. *Eupelmus tryapitzini*, ♀. *a, d, f, g* (2013-52): **a**, lateral habitus; **d**, wings; **f**, fore wing base; **g**; head, frontolateral. *b, c* (2013-53): **b**, lateral habitus; **c**, dorsal habitus. *e, h* (2013-51): **e**, fore wing base; **h**, head, frontolateral.

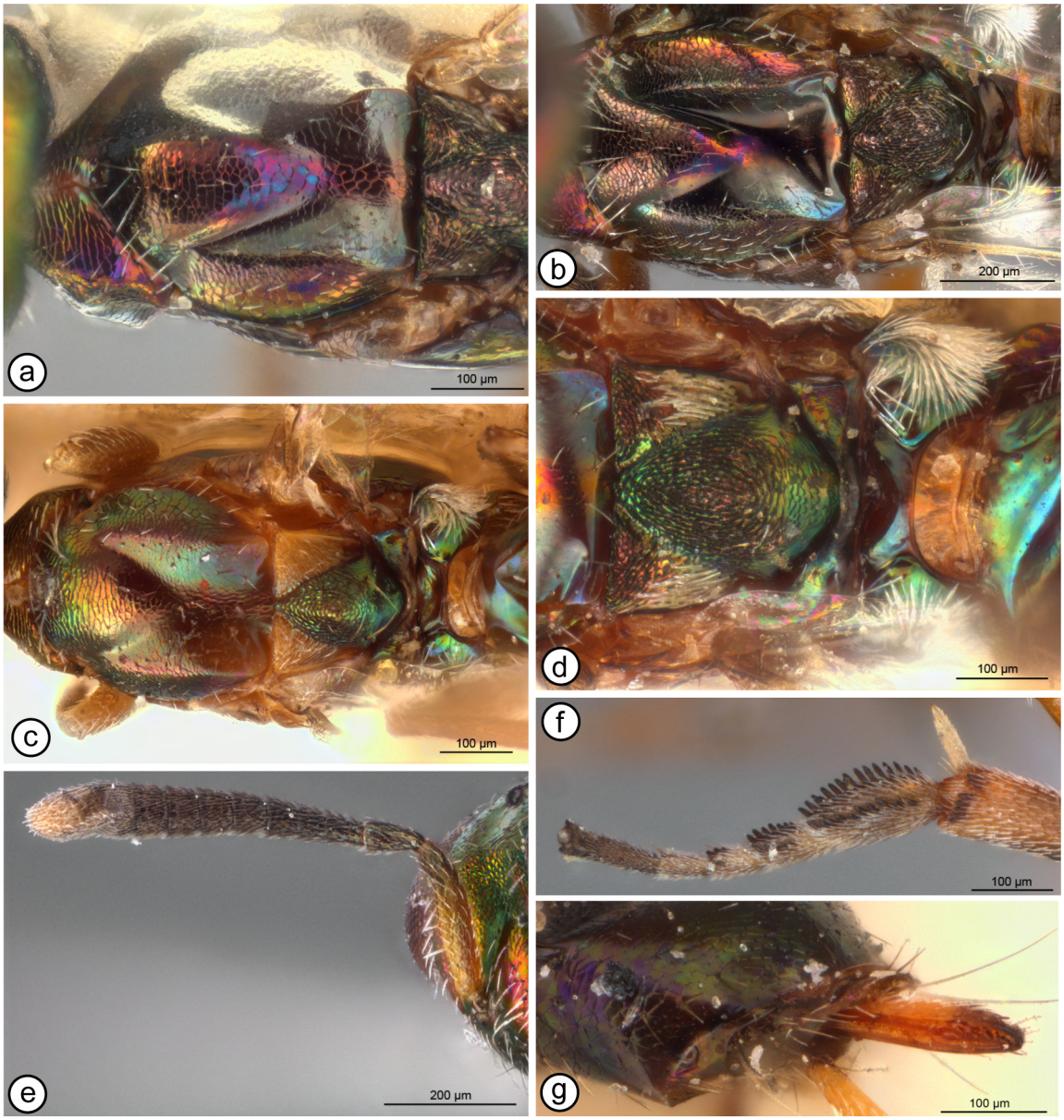

FIGURE 118. *Eupelmus tryapitzini*, ♀. **a**, mesosoma, dorsal (2013-52). *b, e, f* (2013-51): **b**, mesosoma, dorsal; **e**, antenna; **f**, apex of mesotibia and mesotarsus. **c**, mesosoma, dorsal (2015-22). *d, g* (2015-24): **d**, scutellar-axillar complex to base of gaster; **g**, gastral apex, posterodorsal.

E. (*Eupelmus*) *tryapitzini* Kalina n. stat.

Figs 117a–h (♀), 118a–g (♀)

Eupelmus tryapitzini Kalina, 1988: 13. Holotype ♀, IAEE, examined by GG. Type data: Africa sept.: Algeria, Aures: Ain Zaatout, 26-27.V.1971, A. Hoffer et J. Horák.
Eupelmus claviger; Kalina, 1988: 11–12 (misidentification).

Description. FEMALE (habitus: Fig. 117a–c). Length = 1.7–3.7 mm. Head almost entirely green or with some coppery-green luster in some smaller individuals, but usually with variably extensive reddish-coppery luster (Fig. 117g, h), most commonly on frontovertex and interantennal prominence, though gena and temple often also with variably distinct and extensive coppery to reddish-violaceous lusters; with slightly lanceolate white setae on lower face and parascrobal region to level of dorsal margin of scrobal depression compared to less conspicuous hairlike setae on vertex or frontovertex (Fig. 117h). Maxillary and labial palps brown. Antenna (Fig. 118e) with scape sometimes entirely bright orangey-yellow, more commonly variably extensively darkened dorsoapically to

apically, but rarely yellow only at extreme base near radicle and remainder brownish with slight reddish-coppery luster, with pedicel and flagellum usually dark brown, but fu1 and/or pedicel sometimes paler when scape most extensively pale. Mesosoma (Figs 117c, 118a, b) variably dark orangey-brown (Fig. 117b) to coppery- or dark brown (Fig. 117a) with reddish-violaceous lusters dorsally (Fig. 118a, b), the prepectus, tegula and acropleuron usually lighter than mesonotum, and scutellar-axillar complex usually and mesoscutum often at least partly green, though axillae sometimes variably distinctly and extensively paler, yellowish-orange (Fig. 118c), in contrast to scutellum; prepectus bare; pronotum with admarginal setae white; mesonotum with comparatively inconspicuous hairlike to slightly lanceolate white setae except axilla over about posterior half to two-thirds with denser, more distinctly lanceolate, anteriorly pointing white setae that in larger individuals form a reflective surface (Fig. 118d); callus with conspicuously long and dense white setae forming reflective surface (Figs 117b, 118b, d). Macropterous; fore wing (Fig. 117d) usually with faint brownish infuscation basally within basal cell, but at least with distinct, variably dark brownish infuscation from base of parastigma to somewhat beyond midway between apex of pmv and wing apex, the infuscation sometimes paler toward posterior margin of wing or even almost hyaline behind mediocubital fold but with all discal setae dark; costal cell (Fig. 117e, f) dorsally bare near leading margin (sometimes with dark setae adjacent to parastigma), but ventrally with 1 (basally) to 2 (apically) lines of white setae; basal cell (Fig. 117e, f) with white setae except usually for a few darker setae basally when membrane slightly infuscate, and at least less densely setose than disc, usually partly to extensively bare though typically more-or-less extensively setose apically and anteriorly near smv; disc with comparatively very short linea calva at most as long as parastigma. Legs yellowish-orange to dark brown with some metallic luster on femora, but knees, tibiae apically, and sometimes tarsi basally paler, with mesotibial apical pegs dark and mesotarsal pegs dark reddish at least apically. Gaster (Fig. 117a, b) with hairlike setae; orangey-brown basally to entirely dark brown except often with metallic green luster dorsobasally and sometimes apically, and/or partly with slight violaceous luster; ovipositor sheaths sometimes entirely pale except possibly for extreme tip, but usually about apical one-quarter to one-third darker, yellowish-brown to brown.

Head in dorsal view with interocular distance about 0.4–0.45× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; vertex transversely alutaceous-coriaceous to alutaceous-imbricate; frons comparatively shiny (Fig. 117g, h) but entirely meshlike coriaceous-alutaceous to very slightly imbricate in part except sometimes smoother below anterior ocellus; scrobal depression strongly reticulate to reticulate-rugulose, though sometimes smoother and shinier ventrally toward torulus; OOL: POL: LOL: MPOD = 1.3–1.5: 2.4–2.7: 1.8–2.2: 1.0. Mesoscutum (Fig. 118a–c) with anteromedial lobe mostly meshlike coriaceous to alutaceous-imbricate or very finely reticulate, the sculpture often continued mediolongitudinally throughout posterior depressed region of mesoscutum (Fig. 118a, c), but at least inclined surfaces of lateral lobes with less conspicuous, very fine to subeffaced sculpture and sometimes depressed region extensively to almost entirely smooth and shiny (Fig. 118b). Scutellum and axillae low convex in same plane; axilla reticulate to reticulate-imbricate or strigose laterally; scutellum reticulate-punctate mesally to reticulate-imbricate laterally anterior to much smoother and shinier, meshlike sculptured frenal area. Acropleuron more-or-less distinctly meshlike anteriorly, much more minutely sculptured to shiny and virtually smooth mesally, and posteriorly with larger, longitudinally aligned meshlike coriaceous sculpture. Fore wing (Fig. 117d) with cc: mv: pmv: stv = 3.4–3.7: 2.3–2.4: 1.1–1.2: 1.0. Middle leg (Fig. 118f) with 5–7 mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus, the pegs of uniform length or only relatively inconspicuously differentiated in length to form single serrate line or only obscurely differentiated into two rows apically, second tarsomere with 4–7 pegs, third tarsomere with 1–3 pegs, and fourth tarsomere without pegs on either side. Propodeum with broadly V- to U-shaped plical depression extending to posterior margin (Fig. 118c, d). Gaster (Fig. 117a, b) similar in length to combined length of head and mesosoma; not atypically modified, but at least air-dried specimens with syntergum apically flattened over or variably distinctly reflexed above sheaths (Fig. 118g); extending to or somewhat over base of third valvula, the latter about 0.6× length of metatibia and subequal in length to mv, but apparent sheath length usually much less; hypopygium extending about half or slightly more length of gaster.

MALE. Unknown.

Distribution. Algeria, **Azerbaijan*** [USSR: Azerb. SSR, Mingečaur, 4.VIII.1967, Bčk. (IAEE: 2♀, CNC Photo 2015-22 and 2015-23)], **Israel*** [Enot Samar, 3.III.1998, N. Meltzer & V. Kravchenko, on *Tamarix*, CNC Photo 2013-51 (TAUI: 1♀); Nahal, Neqarot, N Sappir, 6.IV.1998, 2.V.1998, I. Yarom & V. Kravchenko, on *Tamarix* (TAUI: 2♀, one with CNC Photo 2013-52 and other with CNC Photo 2013-53)], **Tunisia*** [10 km S. from Alchichine, 10.IV.1977, S. Mahunka (HNHM: 2♀)].

Biology. Unknown, but Israel specimens labelled as "on *Tamarix*".

Remarks. Kalina (1988) described *E. tryapitzini* based on five females varying from about 1.2–1.9 mm in length according to the original description. We examined all five (one paratype with CNC Photo 2015-24), which were labelled by Kalina as "*Eupelmus triapitzini*" even though the validly published name is *E. tryapitzini*. The holotype is card-mounted and is entire; it is in a contorted state but is one of the largest specimens. The original description is very brief and the species was not illustrated, being instead compared to what Kalina (1988) described and illustrated as *E. claviger* (Kalina 1988, figs 19, 22 and plate III, figs 1, 2, 6, 8). However, Kalina's (1988) identification of *E. claviger* is incorrect (see under latter species). We saw two females from Azerbaijan identified as *E. claviger* by Kalina and consider them to be conspecific with *E. tryapitzini*. They differ most conspicuously from other examined specimens of *E. tryapitzini* by having the axillae slightly paler laterally to entirely yellowish-orange (Fig. 118c) similar to females of *E. bulgaricus* (Fig. 19e) and *E. saharensis* (Fig. 97e). This agrees with his description of the axillae being "fulvous" for his *E. claviger* and "concolourous with scutellum, dull green" for *E. tryapitzini*. Kalina (1988) provided a few other more subtle colour and structural features to differentiate the two, but based on material on hand colour appears to be quite variable and the smaller paratypes of *E. tryapitzini* have a more uniformly green head without distinct reddish-violaceous luster and the basal tarsomeres of at least the hind leg somewhat paler than the more apical tarsomeres. Two smaller females from Israel have the palest legs, with one having the legs almost entirely orangey (Fig. 117b). Although additional material is required for greater confidence, we believe the variability we describe above for *E. tryapitzini* represents intraspecific variation and the species extends through North Africa through the Middle East to Azerbaijan.

Eupelmus tryapitzini is assigned to the *fulgens*-group along with *E. longicaudus* and *E. fulgens*, as discussed under the latter species. Within the group, females of *E. tryapitzini* are very similar to those of *E. fulgens* except for the presence of a linea calva, which sometimes is very small (Fig. 117f). Sculpture of the posteromedial depressed region of the mesoscutum is apparently quite variable for females of both species, though in all instances the inclined lateral surfaces of the depressed region are at least partly more finely sculptured than the anteromedial convex region and mediolongitudinally (Figs 33b, 118a–c). Females also show considerable variation in colour and the extent of setation of the basal cell, with one female of *E. tryapitzini* having this entirely, though less densely setose, than the disc (Fig. 117f). Those females with pale axillae that contrast distinctly with the scutellum (Fig. 118c) are also very similar to *E. saharensis* females (Fig. 97e), particularly because the latter also have a very short linea calva (Fig. 97f), and some females of *E. tryapitzini* have the lateral sclerites of the mesosoma comparatively pale, orangey, approaching that of *E. saharensis* females (Fig. 97a, b, e). However, females differ in described fore wing colour pattern (*cf* Figs 97f, 117d) (see further under *E. saharensis* and *E. fulgens*).

E. (*Eupelmus*) *urozonus* Dalman

Figs 119a–h (♀), 120a–h (♀), 121a–h (♂)

Eupelmus urozonus Dalman, 1820: 378−379. Lectotype ♀, NHRS, designated by Graham, 1969a: 92, examined. Type data: [Sweden] Vestrogothia.

Eupelmus zonurus; Dalman, 1820: T.8, fig. 34−37.

Pteromalus Orthia Walker, 1839: 223. Lectotype ♂, BMNH, designated by Graham, 1969b: 852, examined. Type data: England, near London. Synonymy by Graham, 1969a: 92; Graham, 1969b: 852.

Pteromalus Audouinii Ratzeburg, 1844: 205. Neotype ♂, BMNH, here designated, examined by LF (♂ syntypes in DEIC lost *vide* Bouček 1967: 279). Original type data: [Germany?], reared from "*Microgaster disparis*" cocoons [on *Lymantria dispar* (L.)]. Synonymy by Giraud, 1863: 1270.

? *Pteromalus Dufourii* Ratzeburg, 1848: 192. Syntypes, ♂, DEIC, lost *vide* Bouček 1967: 279. Type data: [Germany]. Synonymy by Dalla Torre, 1898: 278. Ruschka (1921) listed *P. dufourii*, in part, both as a synonym of *E. urozonus* Dalman (p. 286) and of *E. spongipartus* Ratzeburg (p. 283).

Eupelmus Bedeguaris Ratzeburg, 1852: 199. Neotype ♀, NHMW, here designated, examined (♀ syntypes in DEIC lost *vide* Bouček 1967: 279). Original type data: [Germany?], reared from galls of *Diplolepis rosae*. Synonymy by Ruschka, 1921: 286.

Eupelmus hostilis Förster, 1860: 126−127. Lectotype ♀, NHMW, here designated, examined by LF. Type data: [Germany], reared from galls of *Cynips interruptrix* [*Neuroterus quercusbaccarum*]. Synonymy by Ruschka, 1921: 286.

Eupelmus urozonius; Giraud, 1863: 1270.

Pteromalus Andouinii; Ruschka, 1921: 286.

Eupelmus (*Eupelmus*) *urozonus*; Gibson, 1995: 202; Al khatib *et al.* 2014: 819 (♀ keyed), 822 (♂ keyed).

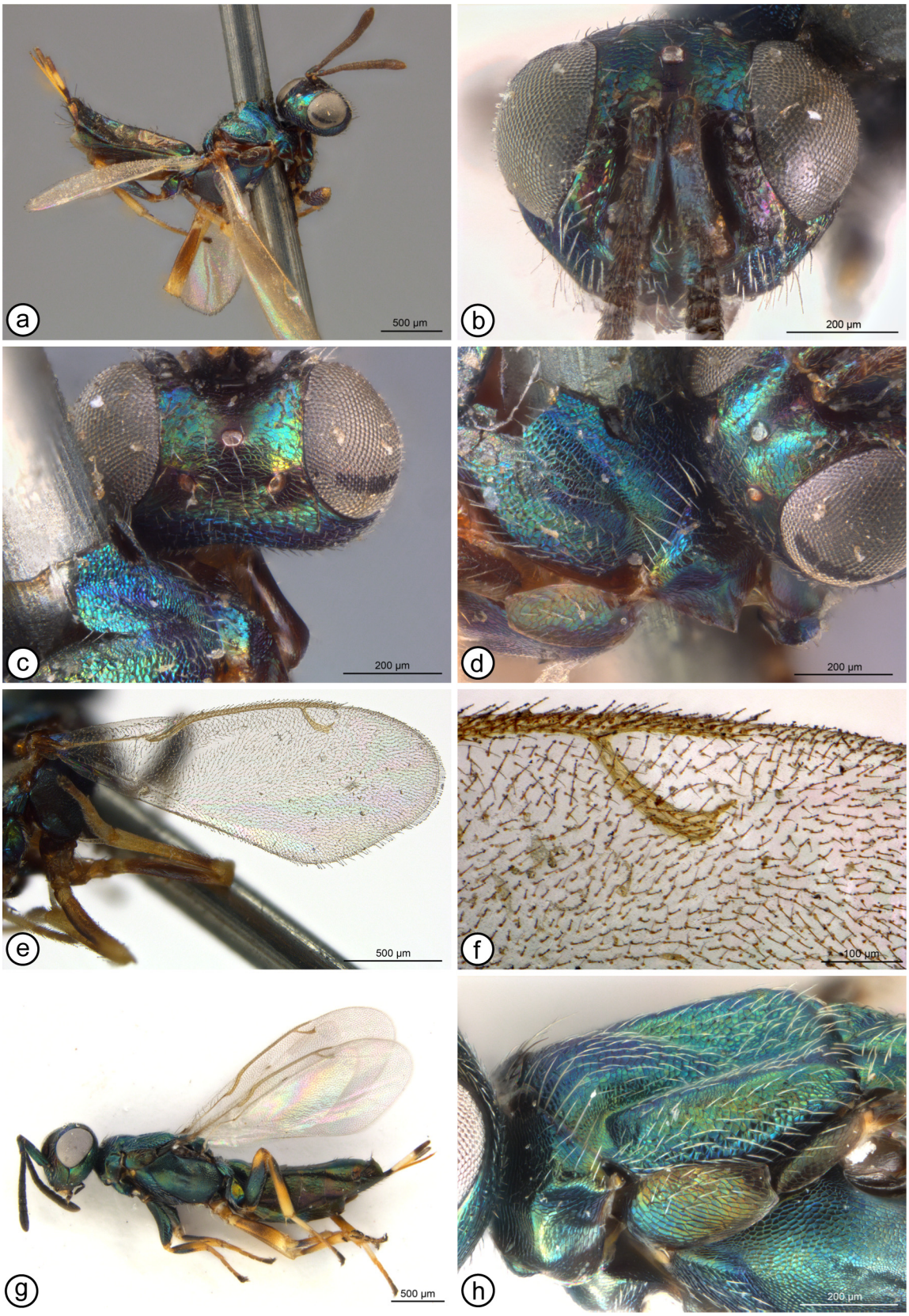

FIGURE 119. *Eupelmus urozonus*, ♀. *a–f* (lectotype): **a**, lateral habitus; **b**, head, frontal; **c**, head (dorsal) and pronotum (dorsolateral); **d**, frontovertex and pronotum (dorsolateral), prepectus and right half of mesoscutum; **e**, fore wing; **f**, stigmal and postmarginal veins. *g, h* (*E. bedeguaris* neotype): **g**, lateral habitus; **h**, pronotum, mesoscutum and prepectus, lateral.

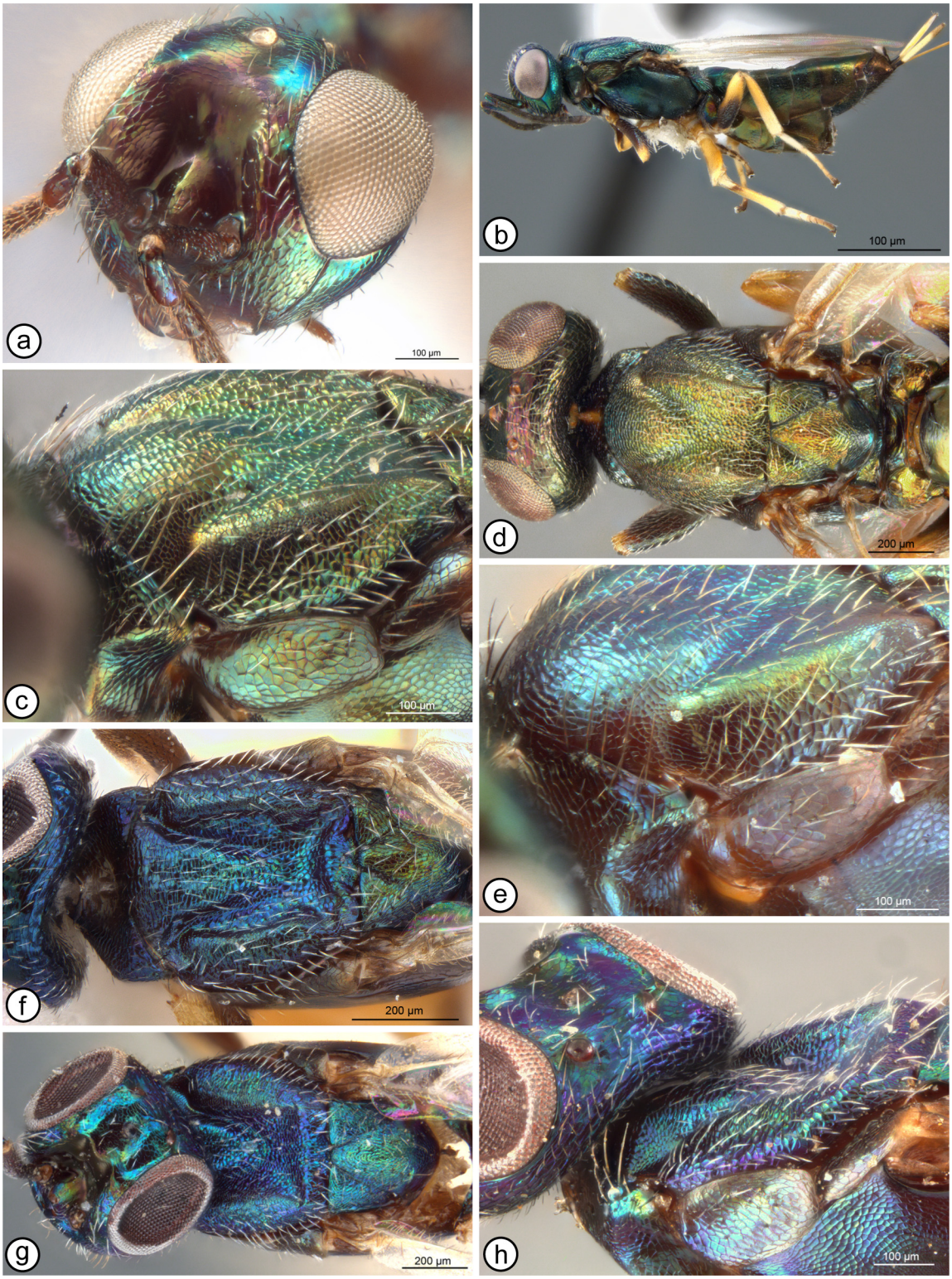

FIGURE 120. *Eupelmus urozonus*, ♀. **a**, head, frontolateral (2010-30). **b**, lateral habitus (2014-114). **d**, head and mesosoma, dorsal (2012-76). **c, e** (pronotum, mesoscutum and prepectus): **c**, 2012-76; **e**, 2014-116. **f**, mesosoma, dorsal. *g, h* (2014-108): **g**, head (frontal) and mesosoma (dorsal); **h**, frontovertex (dorsolateral), pronotum, mesoscutum and prepectus (lateral).

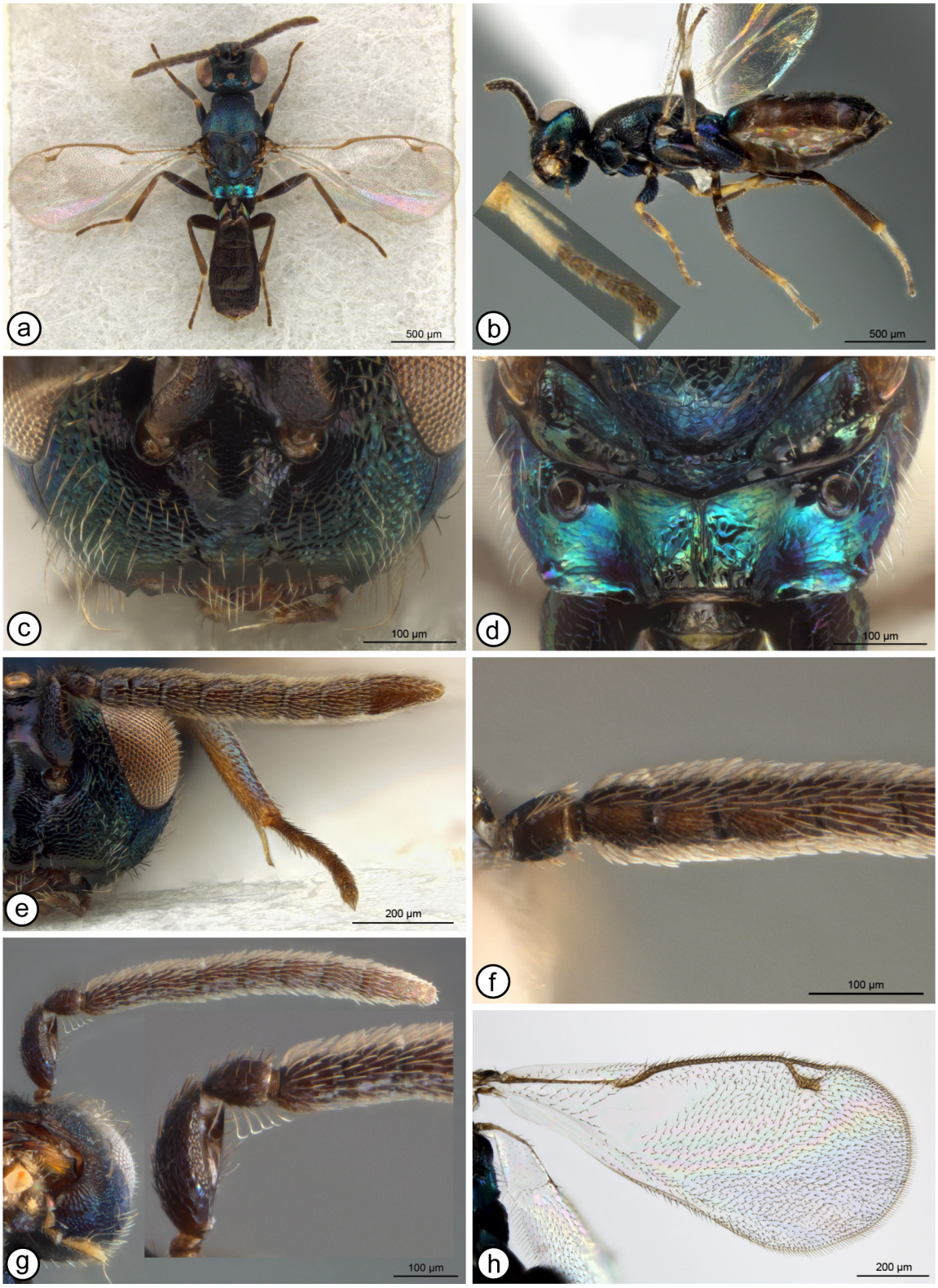

FIGURE 121. *Eupelmus urozonus*, ♂. **a**, dorsal habitus (2010-31). **b**, lateral habitus [insert: enlargement of mesotarsal colour pattern] (2012-119, Iran). *c–e* (2010-31): **c**, lower face, frontal; **d**, apex of scutellum to propodeum; **e**, head (partial), antenna (inner view) and protibia and tarsus. **f**, pedicel to base of fl6, ventral view (2013-133); **g**, flagellum [insert: scape, ventral view, to base of fl4], inner view (2013-132). **h**, fore wing (2012-120).

Description. LECTOTYPE (habitus: Fig. 119a). Length about 2.75 mm (contorted). Head (Fig. 119a–d) mostly bluish-green, though scrobal depression (mostly concealed by scapes) and interantennal prominence from about level of toruli, parascrobal regions almost entirely, and frons mediolongitudinally below anterior ocellus dark with slight coppery to reddish-violaceous lusters (Fig. 119b), and under some angles of light vertex with coppery luster transversely in region of ocellar triangle (Fig. 119c) and occiput more distinctly blue to purple; with hairlike to slightly lanceolate white setae on lower face and parascrobal region to level of dorsal margin of scrobal depression compared to less conspicuous hairlike setae on vertex. Maxillary and labial palps brown. Antenna brown except scape and pedicel with slight bluish luster under some angles of light. Pronotum with collar green to bluish-green or bluish dorsolaterally except under some angles of light extreme posterior margin purple to violaceous and extreme posterolateral angle with slight coppery luster (Fig. 119c, d), lateral panel mostly green to bluish-green except for small, more purplish region anterodorsally under some angles of light (Fig. 119d), but not contrasting distinctly with mesonotum (Fig. 119a, d); admarginal setae likely all pale though mesal setae concealed by head (Fig. 119d). Mesosoma with mesoscutum mostly destroyed by pin, but lateral lobe and apparently medial lobe posteriorly mostly greenish, (furrow separating medial and lateral lobes and under some angles of light mesoscutal lobe anteriorly and lateral lobe laterally along margin more distinctly bluish to purple in part, Fig. 119d); scutellar-axillar complex with scutellum bluish-green to posteriorly purple under some angles of light; mesonotum with hairlike to slightly lanceolate white setae. Prepectus (Fig. 119d) brown with slight metallic luster under some angles of light; with 7 setae (right prepectus) in two lines within dorsal half. Tegula dark. Acropleuron dark with bluish or purple to violaceous lusters under most angles of light. Propodeal callus more distinctly green than rest of mesosoma; with similar white setae as mesonotum except somewhat denser. Macropterous; fore wing (Fig. 119e) hyaline with yellowish setae; costal cell dorsally near leading margin with row of setae over about apical three-quarters, and mesally with additional offset setae forming less distinct second row, and ventrally extensively setose with at least 3 rows along length; basal cell and disc entirely setose except for elongate linea calva extending to level about equal with middle of parastigma. Front leg with femur dark except narrowly pale apically; tibia extensively dark but narrowly pale basally, somewhat more broadly apically, and narrowly longitudinally along anterior and posterior surfaces; tarsus pale except apical tarsomeres more brownish. Middle leg with trochanter pale; femur brown (darker brown along most of length posteroventrally, and lighter brownish dorsally) except trochantellus and apex pale; tibia pale except for dark mesotibial apical pegs and short, subbasal brown annulus; tarsus pale except mesotarsal pegs dark and apical tarsomere brownish. Hind leg with trochanter pale; femur dark except trochantellus and extreme apex pale; tibia pale basally and apically but with subbasal brown region extending half-length except ventral surface lighter, more yellowish; tarsus pale except apical tarsomere brownish. Gaster (Fig. 119a) with hairlike setae; mostly brown but with greenish luster basally on basal tergite and under some angles of light more bluish to bluish-green luster laterally on tergites and dorsally on penultimate tergum except mediolongitudinally; ovipositor sheaths distinctly banded with dark basal band and pale medial band slightly longer than light brown apical band.

Head in dorsal view with interocular distance 0.42× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons, and eye height 1.78× length of malar space; in frontal view (Fig. 119b) width about 1.3× height, with lower ocular line intersecting torulus within dorsal third, malar space about 1.5× distance from oral margin to inner ventral inner margin of torulus, and latter distance about 1.1× distance between inner mesal margins of toruli; vertex evenly rounded into occiput, transversely alutaceous to alutaceous-imbricate; frons meshlike coriaceous (Fig. 119b–d); scrobal depression smooth and shiny except inner walls apparently finely sculptured; OOL: POL: LOL: MPOD = 0.9: 2.9: 1.8: 1.0. Mesoscutum apparently mostly meshlike reticulate except medial lobe more transversely reticulate-imbricate anteriorly (Fig. 119d); axilla mostly obliquely and scutellum longitudinally reticulate-imbricate laterad midline. Acropleuron more-or-less isodiametric meshlike anteriorly and with slightly larger meshes posteriorly, but much more minutely sculptured mesally and larger meshlike sculpture at most delineated by only slightly raised ridges. Fore wing (Fig. 119e) with cc: mv: pmv: stv = 4.1: 3.4: 1.1: 1.0 (left wing); stigmal vein with proximal margin shallowly curved along length (Fig. 119f). Middle leg with row of 5 mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus and pegs clearly differentiated into two rows apically; second tarsomere with 5 pegs, third tarsomere with 2 pegs on anterior and 3 pegs along posterior margin, and fourth tarsomere with 1 peg apically on either side (right leg). Propodeum with broadly U-shaped plical depression extending to posterior margin. Gaster (Fig. 119a) similar in length to combined length of head and mesosoma; not atypically modified, but flattened apically such that anal sclerite and

surrounding syntergum faced dorsally as a result of drying; not extending to apex of second valvifer, the latter extending slightly but distinctly beyond apex of gaster, with third valvula about 0.71× length of metatibia and 0.76× length of mv; hypopygium extending about two-thirds length of gaster.

MALE. (habitus: Fig. 121a, b). Length = 1.0–2.4 mm. Head with at least scrobal depression and frons mesally to anterior ocellus dark, sometimes entirely dark but usually with variably distinct bluish-green luster on frons along inner orbits below posterior ocelli and lower face, and often vertex and parascrobal region at least in part; frons meshlike coriaceous in smaller individuals but usually shallowly reticulate-imbricate to reticulate at least in part; vertex smoothly rounded into occiput, but transversely reticulate to reticulate-imbricate with carinate margins of sculpture sometimes aligned and then variably distinctly transversely strigose in larger individuals; scrobal depression with at least scrobes smooth and shiny, but with lateral surfaces of depression and dorsally variably distinctly meshlike coriaceous to reticulate; setae variably distinctly brownish, those on lower face sometimes pale apically; lower face in region between torulus and malar space with tuft-like region of longer, apically hook-like or sinuately curves setae (Fig. 121c, e, g); gena posterior to malar sulcus with at least 1, sometimes up to 3 conspicuously longer setae and ventral to these with variable number of shorter setae, and posterior to eye with setae directed toward orbit. Antenna (Fig. 121e, g) with scape entirely dark; pedicel at most about 1.5× as long as wide, ventrally with 6 long, apically curved setae (Fig. 121g insert); length of pedicel + flagellum about 1.1–1.3× head width; flagellum robust-filiform (Fig. 121e, g) and uniformly covered with short, recumbent setae except fu1–fu3 in ventral view with elongate regions of differentiated, shorter, straighter setae (Fig. 121f); anellus very strongly transverse, discoidal, shiny, bare (Fig. 121g insert); funicle with fu1 subquadrate, slightly transverse to slightly longer than wide and about as long as to slightly longer than fl2, but both slightly shorter than fl3, the subsequent funiculars subequal in length or also slightly shorter than fl3; clava slightly longer than apical two funiculars. Maxillary and labial palps brown. Mesosoma dorsally (Fig. 121a) similar in colour to head, dark or variably distinctly bluish-green to blue or purple, particularly brighter propodeum (Fig. 121d), and scutellum sometimes with some coppery to reddish-violaceous luster; setae hairlike, brownish; tegula dark. Front leg dark except knee and longitudinal band anteriorly and posteriorly on tibia pale. Middle leg entirely dark except for tibial spur and often basal half or less of basitarsomere, though sometimes basitarsomere mostly pale except for some brownish colour dorsally or apically and rarely entirely white (Fig. 121b insert), the tibia also sometimes partly to entirely pale, most often variably extensively and distinctly longitudinally similar to protibia (see 'Remarks'). Hind leg similar in colour to middle leg except metatibia dark or at most pale basally or variably extensively ventrobasally, and basitarsus more commonly and subsequent one or two tarsomeres sometimes also pale to rarely entirely white (see 'Remarks'). Fore wing (Fig. 121a, h) with mv about 3.1–4.0× length of stv and pmv at most about 1.2× length of stv; costal cell dorsally near leading margin with row of dark setae apically for up to about half length, and ventrally with 1 to 2 rows of setae basal to parastigma; speculum closed or mostly closed posterobasally by row of setae. Propodeum with complete, straight median carina and with variably distinct meshlike sculpture, almost smooth and shiny to quite distinctly and irregularly reticulate posteriorly, but at least without transverse rugae intercepting median carina.

Type material examined. ***Eupelmus urozonus*.** Lectotype ♀ (NHRS, Fig. 119a–f), pinned through mesoscutum, with following labels: IO. [small, off white label] / *Eupelmus urozonus* Dalman LECTOTYPE: M. de V. Graham det. 1968 [rectangular label having shortest sides lined with orange] / orange rectangular label with "8" [printed] and below "58" [hand written].

Paralectotypes (NHRS). 6♀ according to Graham (1969a), of which one seen by GG for our study. 1♀ similarly mounted as lectotype with following labels: [small red triangle] / [?]08. [small, off white label] / *Eupelmus urozonus* Dalm PARALECTOTYPE M. de V. Graham ♀ det. 1968 / orange rectangular label with "10" [printed] and below "58" [hand written].

The lectotype is entire, but strongly contorted and with most of the mesonotum except for the lateral inclined surfaces of the lateral lobes pierced by the pin, though part of the left side of the mesoscutum is raised upwards beside the pin. Graham (1969a) interpreted the first label as the number 10. Although not noted by Graham (1969a), the type series of *E. urozonus* consists of at least two species. Only one of six paralectotypes was examined, but this female, which is similar in size (about 2.6 mm in length) and colour pattern to the lectotype of *E. urozonus*, has the third valvulae about 0.96× the length of the metatibia and about 1.2× the length of the marginal vein, as well as the admarginal setae brown rather than white. We identify this paralectotype as *E. azureus*.

Eupelmus hostilis. Lectotype ♀ (NHMW), mounted through left part of mesoscutum on same minutien pin as

one ♂, with following labels: Aach. Först [printed] / Collect. G. Mayr [printed in black ink] / *E. hostilis* [hand written] Förster [printed] Type [hand written] / *E. urozon.* Dlm. [printed in blue ink] det. Ruschka [printed in black ink] / Lectotype ♀ [red label] / Lectotype ♀ *Eupelmus hostilis* Först. Det. Fusu L. 2011.

Paralectotypes (1♀ & 4♂, NHMW): 1♂ on same minutien pin as lectotype, 1♀ & 1♂ on second minutien pin, and 2♂ on third minutien pin, all attached to same block of black elder pith.

The lectotype female of *E. hostilis*, here designated, is entire and uncontorted, but the tip of the right antenna is gnawed by booklice; both eyes are shrunken, but the head is not collapsed so that a shiny scrobal depression is clearly visible. The lectotype is marked with a small red LT label on the pith block. The male on the same pin is also entire, though the tips of both antennae damaged by booklice. The female on the second pin has the left front and hind legs and both antennae broken beyond fu1, and the head is badly collapsed so that the scrobal depression is concealed. The male on the pin is badly damaged with the head, gaster, all appendages of the right side, left middle leg and hind tibia missing. The two males on the third minutien are badly damaged and discoloured.

Eupelmus bedeguaris. Neotype ♀ (AICF, will be deposited in NHMW, Fig. 119g, h), here designated: GERMANY: Rottenburg-Wurmlingen, galls of *Diplolepis rosae* on *Rosa canina* 4-7.x.2012, Leg. Martin Albers / NEOTYPUS ♀ *Eupelmus bedeguaris* Ratz. Det. Fusu L. 2013.

Pteromalus Audouinii. Neotype ♂ (BMNH), here designated: AUSTRIA: Trausdorf. ex *Apant.* [*eles*] *melanosc.* [*elus*] in *Lym*. [*antria*] *dispar* viii.79. Eichhorn / ♂ *Eupelmus urozonus* Dalm. det. Z. Bouček, 1979 / NEOTYPUS ♂ *Pteromalus Audouinii* Ratz. Det. Fusu L. 2013.

Species synonymy. When Ratzeburg described *P. cordairii*, it was compared with *P. audouinii* and he stated that the two species are very similar. Hence it is reasonable to conclude that *P. audouinii* is a male *Eupelmus*. *Pteromalus audouinii* was described as having the hind tarsus with the first tarsomere whitish, the rest being gradually darkened, which corresponds to many *E. urozonus* males. However, the original description mentions that the radial (stigmal) vein is half the length of the marginal vein, which does not agree with males of any species close to *E. urozonus*. Because the type material of *P. audouinii* is lost, along with most of Ratzeburg's collection (Bouček 1967), we follow the opinions of Giraud (1863) and Ruschka (1921), who consider *P. audouinii* as a synonym of *E. urozonus*. For stability of nomenclature we here designate a male neotype for *Pteromalus audouinii*. The species most likely was described from Germany based on specimens reared from cocoons of a species of *Microgaster* (Hymenoptera: Braconidae) parasitizing *Lymantria dispar* (L.) (Ratzeburg 1844). The specimen selected as the neotype is part of a small series of two females and one male reared from *Cotesia melanoscela* (Ratzeburg) (= *Microgaster melanoscelus*) (Hymenoptera: Braconidae) parasitizing *L. dispar*. Because we did not find a suitable specimen originating in Germany we select a specimen from Austria that matches the original host data.

Pteromalus dufourii was considered as a synonym of *E. urozonus* by Dalla Torre (1898). The original description mentions that the tibiae and tarsi are darker than in *P. audouinii*, the hind tarsus with no white tarsomeres. This fits quite well with the males of *E. urozonus*, but the description also mentions that the punctation of the thorax and gaster is very fine, with almost no sculpture and the antennae are "unusually thick", these latter characters disagreeing with *E. urozonus*. Ruschka (1921) considered *P. dufourii* as a synonym, in part, of both *E. urozonus* and *E. spongipartus* because of the description of the antennae. Males of the latter species have a shorter and thicker antenna than *E. urozonus* males.

The type material of *E. bedeguaris* is lost, but it was described as having a greenish colour, the ovipositor not quite half as long as the gaster and with a yellowish-white ring, and all legs dark except for apices of the femora and tibiae plus the tarsi. The specimens were obtained from Rose bedeguar galls and the species was compared with *E. urozonus*. *Eupelmus urozonus* and *E. fulvipes* both frequently inhabit *Diplolepis rosae* galls, but the description better fits that of *E. urozonus*. Further, Ruschka (1921) treated *E. bedeguaris* as a synonym of *E. urozonus*, although this name was treated as valid by Noyes (2014). In order to preserve stability of nomenclature a female neotype is here designated. The specimen was reared from *D. rosae* galls kindly collected in Germany by Martin Alberts at our request and fits well the original description. Ratzeburg described *E. bedeguaris* based on specimens he received from Brischke (Ratzeburg, 1852) who lived and worked in Gdańsk. Consequently, the original type locality might be now in northern Poland, but there is no clear evidence of this.

Distribution. In addition to the Palaearctic, Noyes (2014) listed *E. urozonus* from the Afrotropical (South Africa), Australasian (Australia), Nearctic (USA) and Oriental (India) regions. However, at least the Nearctic records result from misidentifications (Gibson 2011). Further, females from Australia and India seen in the BMNH

that were questionably identified as *E. urozonus* are not this species because they all have reticulate scrobal depressions. Within the Palaearctic, the species was listed from Europe, North Africa, the Middle East and far eastern Palaearctic region. However, we saw no individual of *E. urozonus* from the far eastern Palaearctic and our study indicates records from China and South Korea result from misidentifications. Examined voucher specimens reported as *E. urozonus* in Yasumatsu & Kamijo (1979) are *E. kamijoi* (see under latter species) and a single examined female (CNC: Fig. 108h) identified as *E. urozonus* in Yang (1996) is *E. tachardiae* (see 'Distribution' for latter species). Although not examined, specimens reported in Yang (1996) from *Dryocosmus kuriphilus* could be *E. kamijoi*, whereas those reported from the same host in Pak (1963) more likely are *E. kiefferi* (see further under 'Distribution' for *E. kamijoi*).

We saw specimens we confirm as *E. urozonus* from the following: Austria, Belgium, Bulgaria, Czech Republic, **Denmark*** (ZMUC), Finland, France including Corsica, Germany, Greece (**Corfu***: BMNH, **Crete***: CNC, MHNG), Hungary, Iran, Italy including Sardinia, Lebanon, Montenegro, Morocco, Netherlands, Portugal, Romania, Russia, **Saudi Arabia*** (CNC), Slovakia, Spain, Sweden, Switzerland, Syria, Turkey, United Kingdom (England, Wales).

Biology. Noyes (2014) listed about 170 species in 32 families of 5 insect orders as hosts of *E. urozonus*. However, the list is unreliable because the concept of *E. urozonus* has changed over the years and until relatively recently (Gibson 2011) even included some species with a sculptured scrobal depression that are now interpreted as *E. kiefferi* and *E. gemellus* and related species. Cynipidae has the greatest number of host species listed for any single family, but this family likely also contains hosts for at least some of the species recently differentiated from *E. urozonus* through molecular methods. We saw individuals of *E. urozonus* labelled as reared from the following insect hosts. **Lepidoptera.** Lepidoptera pupa (HNHM). GELECHIIDAE: *Amblypalpis olivierella* Ragonot* on *Tamarix aphylla* (L.)* (Tamaricaceae) (CNC). OECOPHORIDAE: *Cacochroa permixtella* (H. S.)* (MHNG). TORTRICIDAE: *Epinotia* [= *Pelatea*] *festivana* (Hübner)* (MHNG); *Rhyacionia buoliana* (Denis & Schiffemüller). **Coleoptera.** BRUCHIDAE: *Bruchidius* sp. on *Lens culinaris* Medik. (Fabaceae). CURCULIONIDAE: *Ceutorhynchus constrictus* (Marsham)* larvae on *Alliaria petiolata* (M. Bieb)* (Brassicaceae) (CNC). SCOLYTIDAE: *Ips acuminatus* (Gyllenhal). **Diptera.** AGROMYZIDAE: *Hexomyza schineri* (Giraud)* (CTPC). CECIDOMYIIDAE: *Dasineura auritae* Rübsaamen* on *Salix cinerea* L. (Salicaceae) (SMFG), *D. oleae* (Löw); *Asphondylia gennadii* (Marchal); *Mikiola fagi* (Hartig) on *Fagus sylvatica* L. (Fagaceae); *Rabdophaga salicis* (Schrank)* on *Salix cinerea* L. (SMFG). TEPHRITIDAE: *Bactrocera oleae* (Rossi) on *Olea europaea* L. (Oleaceae); *Myopites olivieri* Kieffer on *Dittrichia viscosa* (L.) (Asteraceae); *Rhagoletis meigenii* Löw* (CTPC). **Neuroptera.** CHRYSOPIDAE: *Chrysopa** cocoon (HNHM). **Hymenoptera.** CYNIPIDAE: *Andricus burgundus* Giraud on *Quercus suber* L., *A. coriarius* (Hartig) (CTPC), *A. corruptrix* (Schlechtendal), *A. grossulariae* Giraud gall on *Quercus cerris* L. (Fagaceae), *A. kollari* (Hartig) gall on *Quercus robur* L., *A. lignicolus* Hartig, *A. quercuscalicis* (Burgsdorff) galls on *Quercus* sp., *A. quercusradicis* (Fabricius) [= *radicis* Hartig], *A. quercustozae* (Bosc); *Aphelonyx cerricola* Giraud on *Quercus cerris*; *Biorhiza pallida* (Olivier); *Chilaspis nitida* (Giraud) gall on *Quercus cerris* L.; *Cynips disticha* Hartig gall on *Quercus petraea* (Mattuschka), *C. longiventris* Hartig; *Diplolepis fructuum* (Rübsaamen), *D. mayri* (Schlechtendal), *D. rosae* (L.) gall on *Rosa canina* L. and *R. corymbifera* Borkh. (Rosaceae); *Neuroterus anthracinus* (Curtis) [=*ostreus* Giraud]; *Pediaspis aceris* (Gmelin) on *Acer monspessulanum* L. (SMFG); *Plagiotrochus australis* Mayr, *P. quercusilicis* (Fab.) (ZMAN). BRACONIDAE: *Apanteles anarsiae* (Faure & Alabouvette)* (HNHM); *Cotesia melanoscela* (Ratzeburg) [= *Apanteles melanoscelus*] in *Lymantria dispar* (L.). TENTHREDINIDAE: *Nematus salicis* (L.) [= *Pontania capreae* (L.)]* (HNHM). ICHNEUMONIDAE: *Phobocampe disparis* (Viereck)* (USNM).

Remarks. *Eupelmus urozonus* is one of six species we assign to the *urozonus*-group along with *E. minozonus*, *E. opacus*, *E. priotoni*, *E. purpuricollis* and *E. simizonus*. The group is defined by females having ovipositor sheaths that are shorter than the length of the marginal vein and a shiny scrobal depression (e.g. Fig. 120a). It is also defined by conspecific males having a robust-filiform flagellum (Figs 76d, 121e, g) in combination with the lower face having longer, apically curved or sinuate setae forming a tuft of denser setae between the torulus and malar sulcus (Figs 76b, 121c), and the mesotarsus having at most the basal tarsomere pale (Figs 76c, e, 121a, b). The morphological delineation of the *urozonus* group is quite arbitrary because females of some other species, such as *E. azureus*, *E. gelichiphagus* and *E. janstai*, also have a completely or extensively smooth and shiny scrobal depression (Figs 13g, h, 35a, 45a), but differ by having longer ovipositor sheaths. Further, females of *E. nitidus* not only have an essentially smooth and shiny scrobal depression (Fig. 73c, d), but also have comparatively short

ovipositor sheaths. Males are unknown for *E. janstai*, but at least those of *E. azureus*, *E. gelichiphagus* and *E. nitidus* have a clavate flagellum (Figs 14d, 36b, 74e, f), short and uniformly spaced setae on the lower face (Figs 14e, 36e, 74c), and more extensively pale mesotarsi (Figs 14b, 36a, 74a).

With the exception of *E. urozonus*, all of the species we include in the *urozonus* group were first differentiated partly based on molecular evidence within what Al khatib *et al.* (2014) treated as the *urozonus* complex, a larger group of 21 species. This complex was defined within *Eupelmus* based on features of both females and males; however, the features given for males not only are characteristic of most *E*. (*Eupelmus*) males but also those of *E*. (*Macroneura*), as we discuss in part under 'Subgeneric classification' for *Eupelmus*. Further, most of the features given to define the complex based on females are undoubtedly symplesiomorphic within *Eupelmus*, such as macroptery, body with hairlike setae, posteromedial region of mesoscutum sculptured, etc. Consequently, the *urozonus* complex, as based on females, was defined primarily through exclusion of species more likely exhibiting derived features. The six species we include in the *urozonus* group are those keyed through couplet 15' of Al khatib *et al.* (2014), i.e. those with the frontovertex coriaceous and the scrobal depression mostly smooth. In their molecular analyses all six species do not form a monophyletic clade. Relationships based on the nuclear gene 'Wingless' indicate *E. minozonus*, *E. priotoni*, *E. purpuricollis* and *E. urozonus* form a monophyletic clade if *E. janstai* is included (Al khatib *et al.* fig. 2), whereas COI indicate *E. minozonus*, *E. opacus*, *E. priotoni*, *E. purpuricollis* and *E. urozonus* form a monophyletic clade if *E. janstai* is included (Al khatib *et al*. fig. 2). Inclusion of *E. simizonus* in the clades was not supported by either gene. As discussed under *E. nitidus*, our preliminary molecular analyses indicate this species, whose females would key through couplet 15' of Al khatib *et al.* (2014), is also not most closely related to other species we include in the *urozonus* group. Consequently, one of the primary features by which the *urozonus*-group is differentiated, a smooth and shiny scrobal depression in females, was almost certainly derived more than once, as likely also were differences in ovipositor sheath length among species, such as evidently in *E. janstai* (see under 'Remarks' for latter species).

The five species newly described in Al khatib *et al.* (2014) that we include in the *urozonus* group were based just on females and a total of 13 individuals. Consequently, reliable estimation of intraspecific variation was difficult. Al khatib *et al.* (2014) identified 92 females as *E. urozonus*, of which 23 were sequenced. Therefore, about 12% of the females of the species we include in the *urozonus* group were identified as new species. We examined more than 650 non-type *urozonus*-group females. Of these, we identified 24 females at least questionably as one of *E. opacus* (10), *E. priotoni* (9), *E. purpuricollis* (1) or *E. simizonus* (4), or only about 4% of examined material as one of the five new species.

Within the *urozonus* group, the majority of *E. urozonus* females appear to be quite readily differentiated from all other group females by the presence of obviously pale, whitish pronotal admarginal setae (Fig. 119h) in combination with the pronotum laterally being similar in colour to the mesoscutum, both usually being more-or-less green or somewhat bluish-green though often also with some coppery luster (Figs 119h, 120c, d). However, colour of the admarginal setae is variable, some females having entirely white admarginal setae (Fig. 119d, h), others with white setae laterally and dark setae mesally (Fig. 120d), and still others with entirely dark setae (Fig. 120e). Leg colour pattern is also highly variable, some females having the middle legs and metatibiae pale (Fig. 120b) and others the mesofemur and the meso- and metatibiae variably extensively dark (Fig. 119g). Paler *versus* dark pronotal admarginal setae does not appear to be correlated with paler *versus* darker leg colour pattern, some females with either leg colour pattern having entirely white admarginal setae.

Females of *E. minozonus* share the same similarly coloured pronotum and mesoscutum (Fig. 71f, g) as most *E. urozonus*, but have dark pronotal admarginal setae (Fig. 71g). We did not find any females we identify as *E. minozonus* among material we examined and use the features given by Al khatib *et al.* (2014) to separate the two species in couplet 62. Females of *E. opacus*, *E. priotoni*, *E. purpuricollis* and *E. simizonus* all have a laterally blue to purple or reddish-violaceous pronotum that typically contrasts conspicuously with a mostly greenish mesoscutum (see images of respective species). Further, except for *E. simizonus*, the latter species all have darkish pronotal admarginal setae. We include couplet 57 to first exclude the easily recognizable *E. urozonus* females characterized by white admarginal setae in combination with a non-contrasting green (Fig. 120c, d) to bluish-green (Fig. 119h) pronotum and mesoscutum. However, females we include in *E. urozonus* sometimes vary conspicuously from this "typical" colour pattern. Even the lectotype of *E. urozonus* has quite a distinct bluish tinge under most angles of light (Fig. 119a), including the posterolateral margin of the pronotum (Fig. 119c, d), though the admarginal setae appear to be white (Fig. 119d), the extreme posterolateral angle of the pronotum is coppery

(Fig. 119c, d), and the prepectus and mesoscutum do not appear to contrast conspicuously because the mesonotum is also variably distinctly bluish to purple under some angles of light (Fig. 119a, c, d). The neotype of *E. bedeguaris* also has quite evident bluish lusters under some angles of light, but the pronotum laterally is the same colour as the mesoscutum and again the admarginal setae are white (Fig. 119h). Because of such variation we are not completely confident of all of our identifications. For example, a female from Romania (USNM) ("1987 [not the year because specimen looks at least as being from early 20th century], Banat 6/22, Herculesbad, [? indecipherable genus name] *pilosus* [?]") has the head quite strongly blue to purple and the vertex with some reddish-violaceous lusters under some angles of light (Fig. 120g, h). Although the mesoscutal lateral lobes are greenish longitudinally under most angles of light, the mesoscutum is otherwise distinctly blue to purplish similar to the head (Fig. 120g, h). Although difficult to observe because of head position, pronotal colour does not appear to contrast conspicuously with the mesoscutum and the admarginal setae are white, at least laterally (Fig. 120h). The middle legs and metatibiae are yellow and the right prepectus has 12 setae. Because of condition of the specimen, accurate measurement of the third valvula relative to the marginal vein is not possible, but other measurable ratios include interocular distance 0.41× head width; eye height 1.82× length of malar space; in frontal view width 1.13× height; malar space 1.58× distance from oral margin to inner ventral margin of torulus, and latter distance 1.14× distance between inner mesal margins of toruli; and OOL: POL: LOL: MPOD = 0.67: 2.6: 1.8: 1.0. Another female from Germany (ZMAN) (Freiburg, Kaiserstuhl, H. Meyer, ex. *Craneiobia corni* on *Cornus sang*., 14.X.19?) is similarly mostly dark blue to purple with white admarginal setae (Fig. 120f). Both females have the scutellum more noticeably greenish (Fig. 120f, g). Even though the mostly dark blue to purple colour pattern at least superficially resembles that of typical *E. purpuricollis* females, we provisionally identify these as atypical *E. urozonus* because both the pronotum and mesoscutum are blue to purple and the pronotum has white admarginal setae.

As noted above, females of *E. simizonus* have pale admarginal setae and thus resemble many *E. urozonus* females except for their different pronotal-mesoscutal colour pattern. Of the five females measured, all have the third valvulae at least 0.8× the length of the marginal vein. Al khatib *et al.* (2014) stated in the supplemental files that females of *E. urozonus* have comparatively short third valvulae, 0.65–0.7× and 0.7× the length of the metatibia and marginal vein, respectively; however, this assertion apparently is based on measurement of just the two females from France listed in "Doc. S1". Measurements of females we include in *E. urozonus* indicate the third valvulae are most often less than 0.8×, but sometimes are up to almost 0.9× the length of the marginal vein. This includes some females from Iran (AICF, CNC) (Fig. 120b) in which the third valvulae are longer than 0.8× the length of the marginal vein and which are associated with males that are keyed separately from other *E. urozonus* males at couplet 35 because they have a somewhat different meso- and metatarsal colour pattern. The Iranian females are uniformly bluish-green with white admarginal setae similar to the neotype of *E. bedeguaris*, but have pale middle legs and metatibiae (Fig. 120b) rather than these being partly dark (Fig. 119g). As part of their study Al khatib *et al*. (2014) also included two females of *E. urozonus* from Iran (LF.ur.IR 02/10457 and LF.ur.IR 17/10458) that are part of the series in AICF discussed above with atypically long ovipositor sheaths (10457 with sheaths 0.9× length of margin vein). The two specimens are not genetically distinct from those from Europe, and hence the observed difference in the leg colour pattern for males and females and for ovipositor sheath length in females is geographical variability within the same species based on molecular evidence.

Females of *E. urozonus* with dark pronotal admarginal setae (Fig. 120e) can also be mistaken for *E. opacus* and *E. priotoni* or *E. purpuricollis* and *E. simizonus* depending on how darkly coloured are the middle legs and metatibiae, as differentiated at couplet 59. Presently, a functional definition of a *E. urozonus* female is "any *urozonus*-group female not identified through morphological features as one of the other six species". Further molecular analyses are desperately needed to test the species concepts and key features presented here and in Al khatib *et al.* (2014), including the validity of using colour of the pronotal admarginal setae as a primary differential feature. Such analyses could show that some of what we currently interpret as intraspecific variation results from additional unrealized cryptic species within what we call *E. urozonus*. For this reason, we do not provide an exhaustive female description for *E. urozonus*, but only describe the lectotype in the hope that this will be helpful in establishing correct nomenclature in the future if additional cryptic species are discovered.

Males we include in *E. urozonus* are distinguished by a combination of features as detailed in the key, but in part are characterized by a robust-filiform flagellum (Fig. 121e, g), non-carinately margined occiput (as opposed to *fulvipes*-group males), and lower face with a denser, tuft-like region of apically curved to sinuate setae (Fig. 121c, e, g). Almost all males from Europe also have all the tarsi or at least the pro- and mesotarsi entirely or almost

entirely infuscate to dark (Fig. 121a), the mesobasitarsomere sometimes being partly white basally and the hind leg somewhat more commonly having the basitarsomere partly to entirely white. However, 16 of 19 males seen from Iran (AICF, CNC), some associated with females (Fig. 120b) through collecting and rearing, have the mesobasitarsomere entirely white or only slightly brownish apically and about half of them also the basal two or three tarsomeres of the metatarsus white or at least distinctly paler than the apical two tarsomeres (Fig. 121b). We also saw a male (CTPC) from Bulgaria (Sofia District, Zheleznitsa, 14.IV.2002, G. Georgiev) with the mesobasitarsomere white, in distinct contrast to the following four similarly dark tarsomeres, and the metatarsus with the basal two tarsomeres white in distinct contrast to the following dark tarsomeres. Another male (SIZK) from Tajikistan (Gissar range, Kondara [gorge], 26.III.1981, Zerova) has the basal tarsomeres of both the middle and hind legs white and the following one or two tarsomeres whitish-brown to light brown but definitely not dark. Another unlabelled SIZK male has a similar tarsal colour pattern to the Tajikistan male and might be from the same collecting event. Because the males from Iran show that *E. urozonus* males can sometimes have both the meso- and metatarsi extensively pale, we are uncertain whether the males from Bulgaria and Tajikistan are *E. opacus* males or males of *E. urozonus* with atypically pale tarsi. Molecular analyses and additional rearings associating males and females within the *urozonus*-group are needed to better quantify intra- and interspecific variation in tarsal colour pattern as a species differentiation feature. Correctly identifying males can be further complicated by more than one species sometimes being reared together. For example, we saw 38 females associated with nine males (SIZK) labelled "Crimean peninsula, Nikita, ex. *Diplolepis mayri*, coll. 17.IX.1967, [various emergence dates]". Of the females, three are *E. kiefferi* and the others are *E. urozonus*. Of the nine males, seven have the mesotarsus infuscate except for the extreme base of the basitarsomere, though most have the metabasitarsomere extensively to entirely pale. These we identify as *E. urozonus* males. The other two males have both the meso- and metatarsi extensively pale and might be incorrectly keyed to *E. opacus* or *E. urozonus* with atypically pale tarsi. However, both have the metacoxa angulate dorsoapically (*cf* Fig. 51f) and an occipital carina, though this is very narrow and obscure in one. We therefore identify these males as *E. kiefferi*.

E. (*Eupelmus*) *vanharteni* Fusu & Gibson n. sp.

Fig. 122a–h (♀)

Type material. Holotype ♀ (CNC). UNITED ARAB EMIRATES: Al-Ajban, 24º36N 55º01'E, 01.iv-02.v.2006, Malaise trap, A. Van Harten, UAE#5653 / HOLOTYPUS ♀ *Eupelmus* (*Eupelmus*) *vanharteni* sp. n. Det Fusu L. 2013. Condition: point-mounted; uncontorted; entire, with gaster slightly inflated because of critical-point drying.

Etymology. Named in honour of Antonius van Harten in recognition of his effort to document the fauna of the United Arab Emirates.

Description. FEMALE (habitus: Fig. 122a, b). Length = 3.3 mm. Head (Fig. 122c–e) with interantennal prominence, scrobal depression and parascrobal region almost entirely dark with slight reddish-violaceous luster under some angles of light (Fig. 122c), the dark region also extending dorsomedially broadly on frons to anterior ocellus where narrowly extending on either side of ocellus mesally within ocellar triangle to vertex (Fig. 122d, e), but lower face, lateral walls of scrobal depression and frons along inner orbits under some angles of light (Fig. 122e), and vertex under most angles of light green to bluish-green; with slightly lanceolate white setae on lower face and parascrobal region compared to more hairlike setae on frontovertex. Maxillary and labial palps brown. Antenna with scape yellow (Fig. 122a–c), pedicel and flagellum brown though pedicel and basal flagellomeres with slight metallic luster. Pronotum dark with variably distinct purple to violaceous lusters laterally under some angles of light (Fig. 122d); admarginal setae dark. Mesonotum (Fig. 122f) mostly dark violaceous though scutellar-axillar complex and posteriorly depressed region of mesoscutum in part greenish to bluish-green and scutellum mediolongitudinally with slight coppery luster under some angles of light; with hairlike to slightly lanceolate white setae. Prepectus (Fig. 122g) similarly as dark as mesoscutum; entirely setose with 16 elongate, slightly but quite distinctly lanceolate white setae, the apices of setae not extending beyond margins. Tegula dark. Acropleuron (Fig. 122g) greenish-coppery posterior to level of mesally microsculptured region, and blue to purple anteriorly or at most with slight coppery luster anteroventrally under some angles of light. Propodeal callus dark blue to purple; with similar but much denser white setae than on mesoscutum (Fig. 122g). Macropterous; fore wing hyaline (Fig. 122b) with white setae basally to level about equal with apex of parastigma, but darker brownish over most of disc;

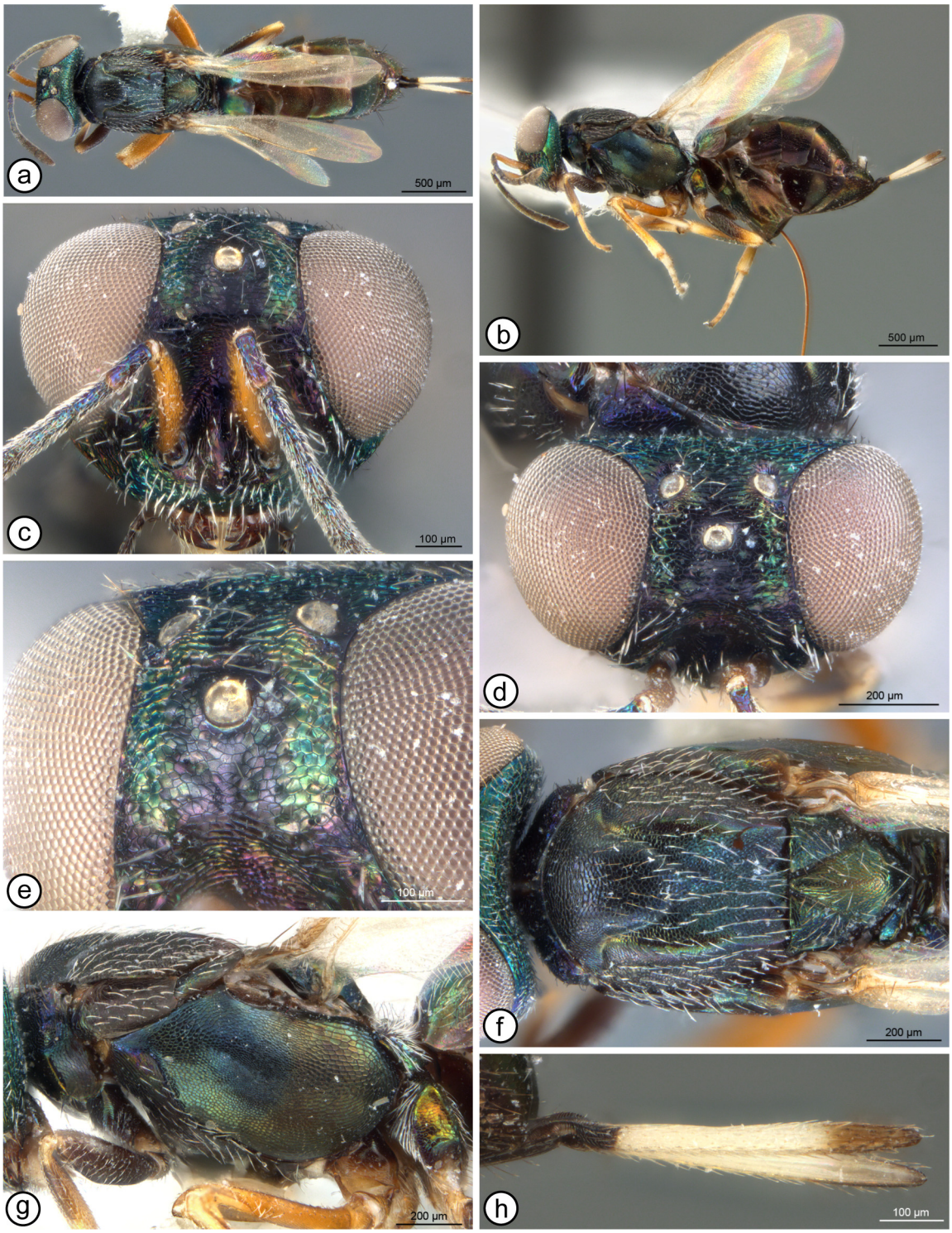

FIGURE 122. *Eupelmus vanharteni*, holotype ♀: **a**, dorsal habitus; **b**, lateral habitus; **c**, head, frontal; **d**, head, dorsal; **e**, upper part of scrobal depression and frontovertex; **f**, mesosoma, dorsal; **g**, mesosoma, lateral; **h**, ovipositor sheaths.

costal cell dorsally near leading margin with row of setae over about apical two-thirds, and behind this a second shorter row, and ventrally with at least 3 rows of setae along length; basal cell and disc entirely setose except for elongate linea calva extending to level about equal with base of mv. Front leg with trochanter, most of femur, tibia dorso- and ventrobasally, and apical tarsomere dark, but knee narrowly, tibia along entire anterior and posterior surfaces and broadly apically, and basal four tarsomeres pale. Middle leg pale beyond coxa except for dark

mesotibial apical and mesotarsal pegs, though most of femur and tibia subbasally darker, more orangey compared to lighter yellow to whitish knee, tibia apically, and basal tarsomeres. Hind leg with about basal two-thirds of femur and outer surface of tibia mesally dark, but trochanter, trochantellus, about apical third of femur, and tibia basally, apically and along entire inner surface pale, with tarsus whitish basally but gradually slightly darker, more yellowish apically. Gaster (Fig. 122a, b) with hairlike setae; dark brown, at least dorsomesally, but with some green to bluish-green luster, mostly distinctly on basal tergite but also less on tergites laterally and apical tergites laterally under some angles of light; ovipositor sheaths (Fig. 122h) with three distinct bands, a short dark basal region, a long medial white region, and an apical brownish region, the latter about half length of medial white region and extending completely to apex and dorsal and ventral margins of sheath.

Head in dorsal view (Fig. 122d) with interocular distance 0.33× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; vertex evenly rounded into occiput, transversely imbricate to reticulate-imbricate with carinate margins of sculpture not coalesced into differentiated carina or ridge; frons imbricate to slightly reticulate-imbricate along inner orbit ventral to posterior ocellus in variably greenish band, though mostly coriaceous mesally in dark region (Fig. 122e); scrobal depression, including scrobes, transversely strigose-reticulate (Fig. 122c, e); lower face with setae originating from comparatively shallow, circular depressions so as to be noticeably roughened to wrinkled; OOL: POL: LOL: MPOD = 0.4: 2.2: 1.5: 1.0. Mesoscutum (Fig. 122f) meshlike reticulate except medial lobe with shallower to more transversely imbricate sculpture anteriorly and lateral lobe with mediolongitudinal band of minute coriaceous sculpture. Scutellum and axillae low convex in same plane; axilla mostly obliquely and scutellum longitudinally reticulate-imbricate on either side of midline. Acropleuron (Fig. 122g) more-or-less isodiametric meshlike anteriorly and posteriorly, and much more minutely sculptured mesally, the meshlike sculpture shallowly reticulate. Fore wing with cc: mv: pmv: stv = 5.7: 5.0: 1.1: 1.0. Middle leg with row of 6 mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus and pegs differentiated into two rows apically; second tarsomere with 5 pegs, third tarsomere with 3 pegs, and fourth tarsomere with 1 or 2 pegs apically on either side. Propodeum with broadly U-shaped plical depression extending to posterior margin (Fig. 122f). Gaster (Fig. 122a, b) similar in length to combined length of head and mesosoma; not atypically modified; not quite extending to apex of second valvifer, the latter extending slightly beyond gastral apex, with third valvulae about 0.9× length of metatibia and 1.06× length of mv; hypopygium extending about two-thirds length of gaster.

MALE. Unknown.

Distribution. United Arab Emirates.

Biology. Unknown.

Remarks. Because of its comparatively long ovipositor sheaths and yellow scape, the only known female of *E. vanharteni* is most similar to females of *E. cerris* and, particularly, *E. punctatifrons* (see further under latter species). The single female is insufficient to estimate intraspecific variation in length of the ovipositor sheaths. If the sheaths can sometimes be somewhat shorter than the marginal vein, the female would key through the second half of couplet 39 to couplet 86, where because of a comparatively dark body colour and longer sheaths would key through the second half of the couplet to *E. fulvipes* based on distribution. However, females we include in *E. fulvipes* have the vertex and occiput differentiated by a transverse ridge, the ovipositor sheaths at most about 0.8× the length of the mv, and a wider interocular distance with a correspondingly longer OOL than the only known *E. vanharteni* female.

E. (*Eupelmus*) *vindex* Erdős

Figs 123a–h (♀), 124a–f (♂)

Eupelmus vindex Erdős, 1955b: 291−292. Holotype ♀, HNHM, examined. Type data: Hungary, Kalocsa, 24.VI.1946, Erdős.
Eupelmus (*Eupelmus*) *vindex*; Fusu, 2008: 824.
Eupelmus (*Eupelmus*) *aloysii*, part (♂); Fusu, 2009: 316, fig. 2c (misidentification).
Eupelmus (*Eupelmus*) *pini*, part (♂); Gibson, 2011: 73 (misidentification).

Description. FEMALE (habitus: Fig. 123c, e). Length = 3.3–4.1 mm. Head (Fig. 123a, b, d) with scrobal depression and frons medially to at least level of anterior ocellus dark (Fig. 123a), otherwise dark to variably extensively green to bluish-green under different angles of light, at least along upper parascrobal region and

variably extensively on frons along inner orbit; with slightly lanceolate white setae on lower face and parascrobal region to at least dorsal limit of scrobal depression compared to less conspicuous hairlike setae on vertex and at least medially on frons. Maxillary and labial palps brown. Antenna dark except scape often partly orangey-brown to bright orange (Fig. 123a, b). Mesosoma (Fig. 123c–e) similar in colour to head, though pronotum quite distinctly blue to purple at least laterally (Fig. 123d); mesonotum (Fig. 123d) primarily green but usually with some coppery luster under some angles of light; prepectus, tegula, acropleuron, metapleuron and propodeum with similar metallic lusters as mesonotum or more extensively brown under some angles of light (Fig. 123e); mesonotum with mostly white hairlike to slightly lanceolate white setae, prepectus comparatively inconspicuously setose mesolongitudinally, and callus with comparatively sparse white setae similar to mesoscutum. Macropterous; fore wing (Fig. 123f) hyaline or disc rarely with very slight yellowish to light brownish tinge, but all setae similarly dark; costal cell dorsally near leading margin with 1 or 2 partial rows of setae over about apical half, and ventrally with at least 3 rows along length; basal cell and disc entirely setose except for linea calva. Front leg usually entirely pale beyond coxa or mostly pale except posterior surface of femur variably extensively dark, though femur sometimes entirely dark except narrowly apically and then tibia extensively brownish except narrowly basally and more widely apically. Middle leg usually entirely pale beyond coxa except for dark mesotibial apical and mesotarsal pegs (knee, tibia apically, and tarsus basally usually lighter yellowish-white compared to other more yellowish-orange or brownish-yellow parts), but sometimes tibia subbasally and femur except basally and apically more distinctly brown. Hind leg with femur entirely pale to entirely brown except apically, and tibia entirely pale to variably extensively brownish except narrowly basally and variably extensively apically, but tarsus pale except for apical tarsomere. Gaster (Fig. 123c, e) with hairlike setae; dark brown with slight coppery or violaceous to purple lusters under some angles of light except basal tergite anteriorly green; ovipositor sheaths rarely with about basal quarter dark and apical three-quarters uniformly yellowish, but usually appearing banded and often variably distinctly tricoloured because basal region dark, medial region pale, and apical region at least slightly darker, brownish-yellow, to more distinctly brown, and with basal and apical regions sometimes connected by slender brownish band along ventral margin (Fig. 123g).

Head in dorsal view with interocular distance about 0.40–0.45× head width; in lateral view comparatively flat-lenticular (Fig. 123b) to somewhat subtriangular with parascrobal region smoothly merged with frons, but frontovertex and most of parascrobal region forming single, slightly convex plane quite abruptly angled relative to short, ventral-most part of parascrobal region and lower face; vertex alutaceous to alutaceous-imbricate; frons and upper parascrobal region meshlike imbricate to very shallowly reticulate (Fig. 123a); scrobal depression punctate-reticulate medially to more transversely reticulate-strigose dorsolaterally (Fig. 123a); OOL: POL: LOL: POD = 1.1–1.6: 3.2–3.7: 1.7–2.0: 1.0. Mesoscutum (Fig. 123d) more-or-less uniformly meshlike reticulate except sculpture more transverse and/or finer anteriorly on convex part of median mesoscutal lobe and lateral lobe with mediolongitudinal band of minute coriaceous sculpture. Scutellum and axillae low convex in same plane; meshlike coriaceous or axilla obliquely and scutellum longitudinally more coriaceous-imbricate laterad midline and frenal area meshlike coriaceous. Acropleuron more-or-less isodiametric meshlike anteriorly and posteriorly and much more minutely sculptured mesally, the cells sometimes somewhat partly larger and more elongate posteriorly but delineated by only slightly raised lines. Fore wing (Fig. 123f) with cc: mv: pmv: stv = 4.6–5.2: 4.5–5.0: 1.1–1.3: 1.0. Middle leg with row of 4–8 mesotibial apical pegs; mesotarsus with symmetrical pattern of pegs on basitarsus and pegs clearly differentiated into two rows over about apical half, second tarsomere with 5 or 6 pegs and usually third tarsomere with 3 pegs and fourth tarsomere with 2 apical pegs on either side, though in smaller specimens second tarsomere with only 4 pegs on one side and third tarsomere with 4 pegs on one side or with 3 pegs on one side and 2 pegs on the other, and fourth tarsomere with only 1 peg on one side. Propodeum with broadly U-shaped plical depression extending to posterior margin (Fig. 123d). Gaster similar in length to combined length of head and mesosoma; syntergum with posterolateral margins abruptly inflexed anteromesally toward base of sheaths, in dorsal view variably distinctly V-like protuberant on either side of anal sclerite (Fig. 123h); extending distinctly over base of third valvula (Fig. 123g), hence length sometimes difficult to measure accurately, but third valvula about 0.6–0.7× length of metatibia and 0.8–0.9× length of mv and in lateral view portion extending beyond apex of gaster only about 0.45–0.55× length of metatibia and 0.55–0.7× length of mv and at most equal in length to ventral length of basal two metatarsomeres, and comparatively thick, about 4.2–5.1× as long as high; hypopygium extending not quite two-thirds length of gaster.

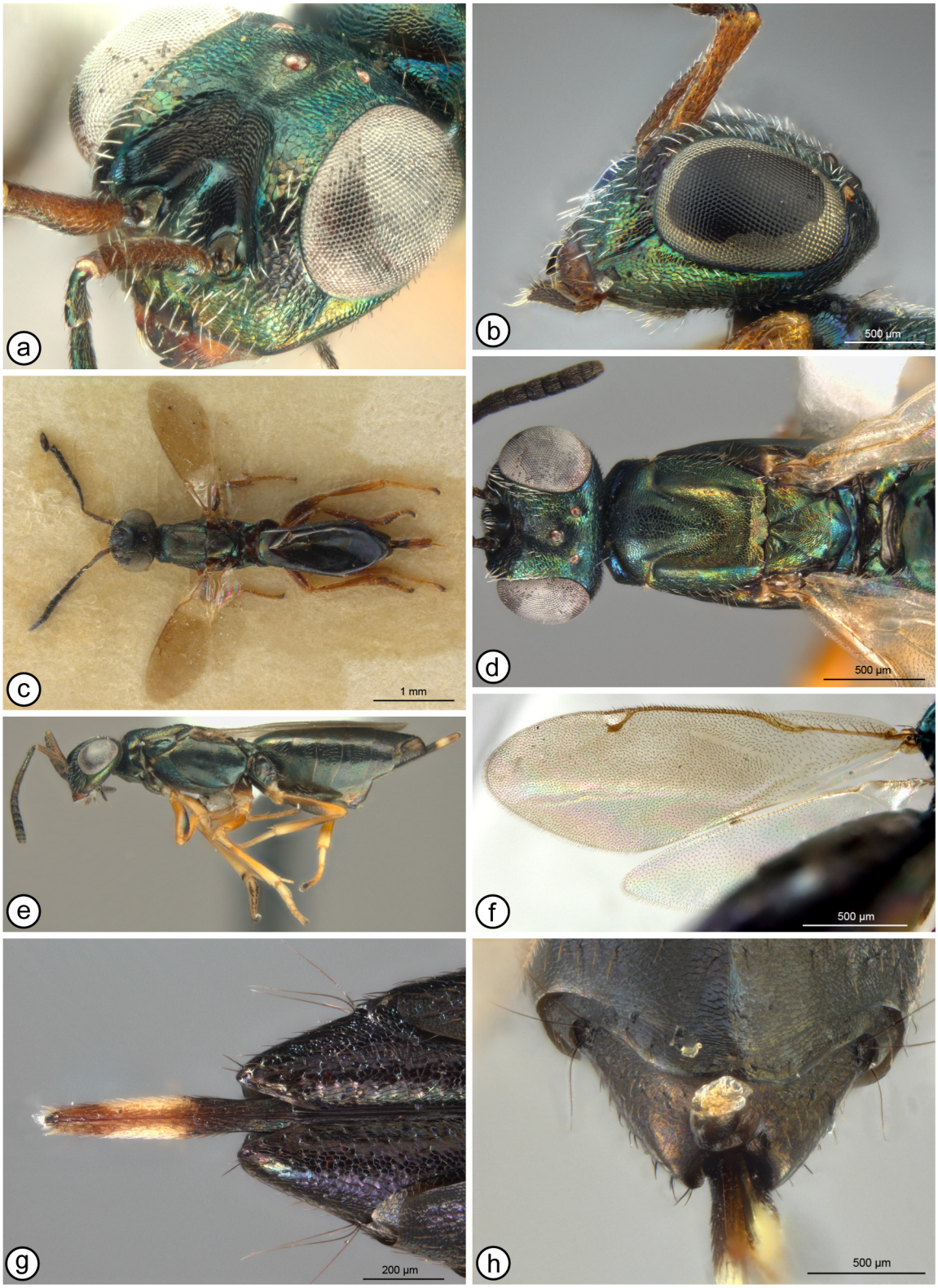

FIGURE 123. *Eupelmus vindex*, ♀. *a, d, e* (2010-34): **a**, head, frontolateral; **d**, head and mesosoma, dorsal; **e**, lateral habitus. *b, g* (2013-6): **b**, head, lateral; **g**, apex of gaster and ovipositor sheaths, ventral. **c**, dorsal habitus (holotype). **f**, fore wing (2012-33); **h**, apex of gaster, dorsal (2013-7).

FIGURE 124. *Eupelmus vindex*, ♂. **a**, lateral habitus (2013-130). *b, c* (2012-113): **b**, head, frontolateral; **c**, head and mesosoma, dorsal. *d, e* (2013-131): **d**, fore wing base; **e**, wings. **f**, pedicel to base of fl4, outer view (2013-129).

MALE (habitus: Fig. 124a). Length = 1.7–2.7 mm. Head (Fig. 124a–c) mostly dark green to more bluish-green except scrobal depression dark or with violaceous luster, and sometimes lower face mesally and frontovertex partly to almost entirely dark with limited coppery luster; frons meshlike reticulate; vertex uniformly curved into occiput (Fig. 124c), reticulate to reticulate-imbricate; scrobal depression meshlike reticulate similar to frons; setae hairlike, white; lower face toward malar sulcus with long, but evenly distributed, straight to only slightly, evenly curved setae (Fig. 124b); gena posterior to malar sulcus with 1 longer seta differentiated from other variably long setae, and posterior to eye with apices of setae directed toward orbit. Antenna with scape orangey at least basally and along outer, ventral, longitudinal sensory region, and often more extensively to entirely orange (Fig. 124b); pedicel (Fig. 124f) about 1.3–1.5× as long as wide, ventrally with 4 long, usually hooked white setae; length of flagellum + pedicel about 1.9–2.1× head width; flagellum elongate-filiform (Fig. 124a) with clava almost as long as apical two funiculars and about 2.8–3.3× as long as wide; anellus very strongly transverse, discoidal, shiny, bare (Fig. 124f); funicle with fu1 about 1.8–2.0× as long as pedicel and about 2.4–3.0× as long as wide (Fig. 124f) with funiculars gradually decreased in length apically so apical funicular only about 1.9–2.0× as long as wide but with conspicuous decumbent setae at least about as long as half width of funicular; basal funiculars without evident regions of modified setae ventrally. Maxillary and labial palps pale. Mesosoma (Fig. 124a, c) sometimes quite distinctly bluish-green to blue, but usually similarly green as head and then sometimes with variably distinct and extensive coppery luster; setae hairlike, white; tegula usually yellow to orangey, though rarely dark brown except apically.

Legs sometimes uniformly yellow except mesofemur ventromesally and apical tarsomeres dark, but often more distinctly orange than yellow and rarely with up to all femora dark ventrally and up to two apical tarsomeres dark. Fore wing (Fig. 124e) with mv about 2.9–3.8× length of stv; costal cell (Fig. 124d) dorsally near leading margin with setae over at most about apical half and usually over little more than length of parastigma, and ventrally with 2 rows basal to parastigma; basal cell (Fig. 124d) uniformly setose with pale, brownish setae; speculum closed posterobasally by setae. Propodeum with complete median carina and uniformly meshlike coriaceous to coriaceous-reticulate (Fig. 124c).

Distribution. ORIENTAL. India (Narendran *et al.* 2001). **PALAEARCTIC**. **Algeria*** (IAEE), **Azerbaijan*** (SIZK), **Bulgaria*** (CTPC, IBER), **France*** (ZMAN), **Greece*** (AICF, CNC, CTPC, ZMUC), Hungary, **Israel*** (TAUI), Italy, Romania, **Tunisia*** (ZMAN), **Turkey*** (MKUI).

Biology. One male that previously was misidentified as *E. pini* (see 'Remarks' for latter species) was reared from *Pinus* branches with xylophagous coleopterans. Buhroo *et al.* (2002, 2006) also reported the species in India as a parasitoid of *Scolytus nitidus* Schedl (Coleoptera: Scolytidae), but the parasitoid species identification requires confirmation (Fusu 2009). The characteristic flattened-subtriangular head of females (Fig. 123b) might be an adaptation for entering narrow spaces such as under the bark of dead branches, which suggests the species parasitizes hosts related to dead wood.

Remarks. Erdős (1955b, fig. 4g–l) illustrated the head in dorsal and lateral views, antenna, scutellar-axillar complex, venation, and ovipositor sheaths when he described *E. vindex* from two females. Based on collections we examined, females are only rarely collected. Because of their reticulate scrobal depression and quite distinctly reticulate-imbricate frons they are most likely to be mistaken for *E. martellii*, but are distinguished by their modified syntergal structure (Fig. 117h, see further under *E. atropurpureus*) and comparatively short and thick ovipositor sheaths (Fig. 123g) as described in the key and above. Head shape usually also is quite distinctive, though difficult to quantify. The scape is also often at least partly orangey and the legs extensively light coloured similar to some *fulvipes*-group females, but the vertex lacks any indication of a transverse carina or ridges. Single females examined from Algeria and Tunisia have darker, more extensively brown legs than other females examined from continental Europe, and the female from Algeria has the apical three-quarters of the ovipositor sheaths uniformly yellow, but they similar in other respects to other *E. vindex* females. A COI sequence of 616bp was obtained from a female from Hungary (CNCHYM 015242) and one of 630bp from a female from Greece (CNCHYM 015243).

E. (*Eupelmus*) *vuilleti* (Crawford)

Figs 77f, h (♀), 78b, c, e, g (♀), 79e, g (♂)

Bruchocida vuilleti Crawford, 1913: 246. Syntypes, USNM, 4♀ & 2♂, examined by GG. Type data: Haut Senegal-Niger [Mali], Koulikoro, J. Vuillet, reared from *Bruchus quadrimaculatus*.
Eupelmus vuilleti; Bigot *et al.*, 1990: 351.
Eupelmus (*Eupelmus*) *vuilleti*; Fusu, 2008: 824.

Description. FEMALE. As described for *E. orientalis* except: fore wing hyaline or disc with slight yellowish to brownish tint but without conspicuous infuscate region behind discal venation (Fig. 77f); basal cell and disc usually with similarly coloured brownish setae except sometimes basal-most setae of basal cell lighter yellowish to white (Figs 77h, 78b) or, if white setae extensive basally, then at least with brown setae apically in basal cell and through basal fold into disc except often for a variably conspicuous, more-or-less circular region of whitish setae isolated behind parastigma (Fig. 78c, e); smv setae always all white (Figs 77h, 78b, c, e); costal cell setae yellowish to brown similar to basal cell and discal setae; basal cell setae usually somewhat longer than on disc, but similarly spine-like and uniformly distributed with setae on basal fold obliquely aligned but not distinctly convergent from either side of fold; mesotarsus at least with 3 pegs on both sides and usually with 4 or 5 pegs along at least one side of second tarsomere and with 1 peg on either side of third tarsomere or sometimes 2 pegs on one side (Fig. 78g).

MALE. As described for *E. orientalis* except: fore wing usually with shorter mv, only about 1.5–1.9× length of stv (most often about 1.6× or less), but at least with conspicuous brownish setae and costal cell dorsally near leading margin with dark setae apically over at last half, and usually most of length; disc sometimes with slight yellowish to light brownish tinge behind venation.

Distribution. AFROTROPICAL. Burkina Faso, Mali, Niger, Nigeria, Senegal, **Sudan*** (BMNH), Togo,

Yemen* (CNC). Noyes (2014) also listed West Africa. **PALAEARCTIC. Israel*** (CNC, MHNG), **Oman*** (CNC), **United Arab Emirates*** (CNC). Noyes (2014) listed France, but this record is based on a laboratory colony (Terrasse and Rojas-Rousse 1986), not establishment.

Biology. A primary parasitoid of species of Bruchidae (Coleoptera) and a facultative hyperparasitoid of *Dinarmus basalis* (Rondani) (Hymenoptera: Pteromalidae) as well as *E. orientalis* and rarely itself on the cowpea weevil, *Callosobruchus maculatus* (Fabricius) (Rojas-Rousse *et al.* 1999) similar to *E. orientalis* (Noyes 2014). Within stored cowpeas, *E. vuilleti* penetrates deeply within the stored seeds whereas *E. orientalis* remains on the surface (Rojas-Rousse *et al.* 1999). Prevett (1961) and Risbec (1950, 1951) also reported *E. vuilleti* from *Piezotrachelus varium* (Wagner) (Coleoptera: Apionidae), but both records are based on a misidentification of *E. orientalis* (see under 'Remarks' for latter species). Risbec (1951) also wrongly recorded *Palaeococcus bicolor* Newstead (Hemiptera: Margarodidae) as a host because the specimens in MNHN in Risbec's collection are a misidentification of *E. orientalis* (Fusu *et al*. 2015). We saw specimens (MHNG) labelled as reared from *Bruchidius albosparsus* (Fåhraeus)* and *Caryedon gonagra* (Fab.)* (Bruchidae) (see also under *E. orientalis*).

Remarks. See under *E. orientalis*. COI sequencing was attempted for five individuals, but only partial sequences (86bp and 161bp) were obtained from two females from UAE (DNA voucher CNCHYM 015224 and CNCHYM 015225, respectively).

E. (*Eupelmus*) *weilli* Fusu & Gibson n. sp.

Figs 125a–f (♀), 126a–f (♀)

Type material. Holotype ♀ (AICF). LIBYA: Bukamash, 20.II.2010, Leg. Patrick Weill / HOLOTYPUS / *Eupelmus* (*Eupelmus*) *weilli* sp. n. Det. Fusu L. 2013. Condition: glued by right side on rectangular card; contorted; entire.

Paratype. **Yemen**: Ar Rujum, 9.IV-5.VI.2001, A. van Harten, Mal. tp (CNC: 1♀, CNC Photo 2014-56).

Etymology. Named in honour of Patrick Weill, who collected the majority of the *Eupelmus* specimens we saw from Libya, including the holotype of *E. weilli*.

Description. FEMALE (habitus: Fig. 125a, b). Length = 1.6–2.0 mm. Head (Figs 125a–f, 126c) dark brown with only slight metallic lusters on frons and lower face and frontovertex under some angles of light (Fig. 125a, b, d) to quite distinctly metallic (Fig. 125c, e), the lower face, frons along inner orbits and for short distance below anterior ocellus, and vertex green under most angles of light, but face between level of ventral margin of torulus and dorsal limit of scrobal depression, frons medially extending to level of anterior ocellus on either side, and gena under some angles of light mostly dark violaceous; with slightly lanceolate white setae on lower face and parascrobal region to dorsal limit of scrobal depression compared to less conspicuous hairlike setae on vertex and frons. Maxillary and labial palps brown. Antenna dark with at most faint green luster on scape and pedicel. Pronotum brown at least mesally (Fig. 126a, b), laterally sometimes blue to reddish-violaceous along extreme posterolateral margin (Fig. 126a, c); admarginal setae brown or sometimes pale laterally. Mesonotum similar in colour to head, mostly brown with slight metallic luster except frenal area bright blue to purple (Fig. 126b), to more extensively metallic (Fig. 126a), mostly dark violaceous or with slight coppery or greenish lusters mesally under some angles of light, but with outer surface of lateral lobe more extensively and scutellar-axillar complex laterally and posteriorly green; with brownish to laterally white, hairlike to slightly lanceolate setae. Prepectus (Fig. 126c) brown to variably extensively and distinctly green to bluish-green under different angles of light; with 1–5 setae. Tegula dark. Acropleuron brown or variably extensively reddish-violaceous or with some green to bluish-green luster anteriorly. Propodeal callus variably distinctly blue, green or violaceous under different angles of light; with comparatively sparse white setae similar to mesoscutum. Macropterous; fore wing (Fig. 126e) hyaline with yellowish to dark setae; costal cell dorsally near leading margin with row of setae apically for distance at least equal to length of parastigma and sometimes for almost complete length, and ventrally with 2 complete rows mesally along length; basal cell and disc entirely setose except for elongate linea calva extending to level about equal with middle of parastigma. Front leg dark brown except at least knee, apex of tibia narrowly and basitarsus pale, though femur and tibia in part sometimes with dark green luster and tibia sometimes with basally tapered pale region along anterior and posterior surfaces extending almost to base. Middle leg with trochantellus, knee more widely than for front leg, tibia variably extensively and basal four tarsomeres pale except for tarsal pegs, the femur sometimes also pale ventrally and tibia with at least short, dark annulus subbasally. Hind leg more extensively dark

than middle leg, but trochantellus and knee variably distinctly pale, with femur sometimes obscurely paler ventrally and tarsus with at least basal two tarsomeres pale, the more apical tarsomeres somewhat darker. Gaster (Fig. 125a, b) with hairlike setae; dark brown with very faint coppery or green lusters under some angles of light; ovipositor sheaths at least mostly brown (Figs 125b, 126d, f), gradually lightened apically (Fig. 126f) or tip and short region subbasally pale (Fig. 126d).

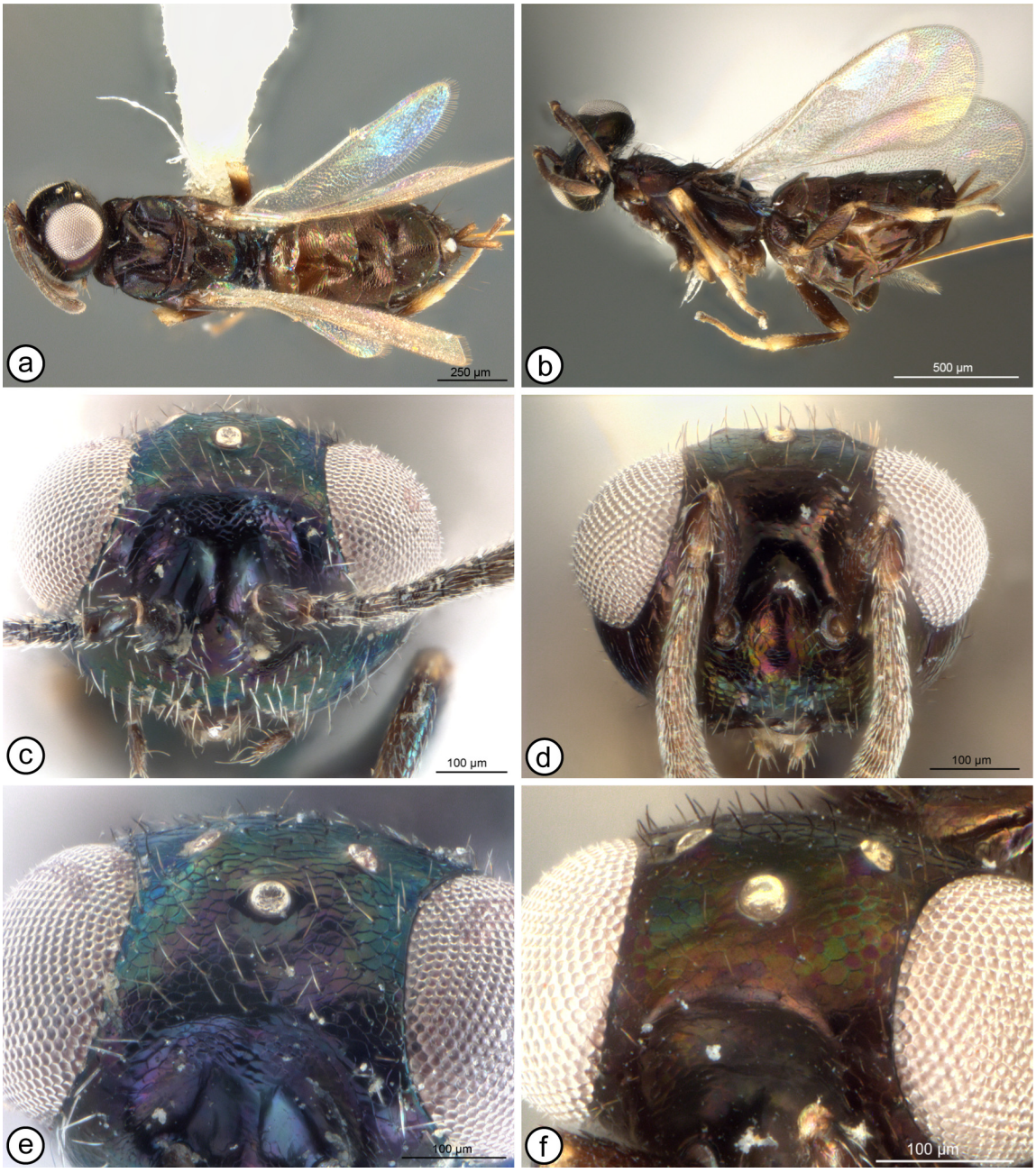

FIGURE 125. *Eupelmus weilli*, ♀. *a, b* (paratype): **a**, dorsal habitus; **b**, lateral habitus. *c, d* (head, frontal): **c**, holotype; **d**, paratype. *e, f* (upper part of scrobal depression and frontovertex): **e**, holotype; **f**, paratype.

Head in dorsal view with interocular distance about 0.4–0.46× head width; in lateral view hemispherical to high-subtriangular (Fig. 126c), the lower face and parascrobal region forming comparatively long surface angled to shorter, low-convex frons and vertex; vertex meshlike coriaceous to more transversely alutaceous or alutaceous-imbricate; frons variably distinctly meshlike coriaceous (Fig. 125f) to inconspicuously imbricate (Fig. 125e); interantennal prominence and at least scrobes smooth and shiny (Fig. 125c–f), the scrobal depression otherwise quite shiny with subeffaced meshlike sculpture or more distinctly coriaceous-imbricate to somewhat reticulate-imbricate dorsally and laterally (Fig. 125c, e); OOL: POL: LOL: POD = 1.2: 2.8–3.2: 1.6–1.7: 1.0. Mesoscutum

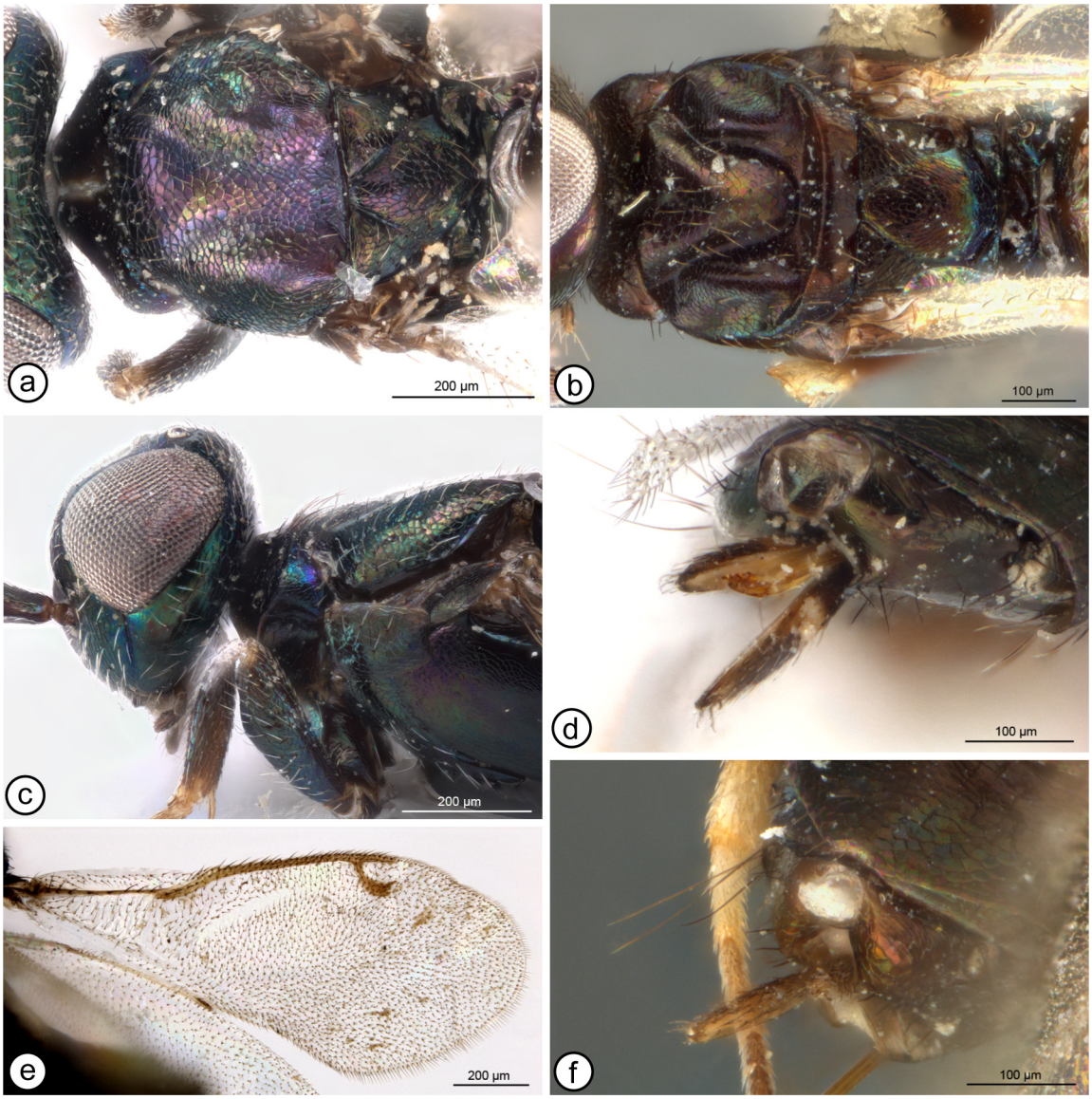

FIGURE 126. *Eupelmus weilli*, ♀. *a, b* (mesosoma, dorsal): **a**, holotype; **b**, paratype. *c–e* (holotype): **c**, head, front leg and anterior part of mesosoma, lateral; **d**, apex of gaster and ovipositor sheaths, posterodorsal; **e**, fore wing. **f**, apex of gaster and ovipositor sheaths, posterodorsal (paratype).

coriaceous (Fig. 126b) to shallowly meshlike reticulate (Fig. 126a) except lateral lobe with mediolongitudinal band of somewhat finer sculpture. Scutellum and axillae low convex in same plane; meshlike coriaceous to slightly coriaceous-imbricate. Acropleuron more-or-less isodiametric meshlike anteriorly and posteriorly and much more minutely sculptured mesally, the cells larger and more elongate posteriorly but delineated by at most only slightly raised ridges. Fore wing (Fig. 126e) with cc: mv: pmv: stv = 4.4–4.5: 3.7–3.8: 0.9–1.0: 1.0. Middle leg with row of 3 or 4 mesotibial apical pegs; mesotarsus with symmetrical pattern of pegs on basitarsus and pegs clearly differentiated into two rows over about apical half, second tarsomere with 3 or 4 pegs, third tarsomere with 1–3 pegs, and fourth tarsomere with 1 peg on either side, or sometimes fourth tarsomere with minute second peg on one side. Propodeum with broadly U-shaped plical depression extending to posterior margin (Fig. 126b). Gaster (Fig. 125a, b) similar in length to combined length of head and mesosoma; syntergum with posterolateral angles inflexed anteromesally above sheaths, almost vertically to strongly obliquely, hence in dorsal view syntergum more-or-less V-like protuberant on either side of anal sclerite to more-or-less flattened, Ω-like, over sheaths (Fig. 126d, f); extending over base of third valvula such that division between second valvifer and third valvula not readily apparent, but apparent length of ovipositor sheaths about 0.4–0.5× length of metatibia and 0.47–0.55× length of mv, and in lateral view not distinctively thick; hypopygium extending about two-thirds length of gaster.

MALE. Unknown.

Distribution. Libya, Yemen.

Biology. Unknown.

Remarks. The two known females of *E. weilli* differ somewhat in structure, sculpture and colour pattern. The smaller female, from Yemen, is mostly dark brown with limited metallic lusters (Figs 125a, b, d, f, 126b), whereas the larger holotype from Libya has the head (Figs 125c, d, 126c) and dorsal surface of the mesosoma (Fig. 126a) much more distinctly green to dark violaceous. The larger female also has a more distinct pale region subbasally on the ovipositor sheaths (Fig. 126d), though the protibia less obviously paler along the anterior and posterior surfaces. The smaller female is also more finely sculptured, generally more coriaceous (Figs 125f, 126b) than the somewhat more distinctly reticulate to imbricate larger female (Figs 125e, 126a). Both have the syntergum inflexed anteromesally similar to such species as *E. atropurpureus* (see further under this species), *E. peculiaris*, *E. setosus* and *E. vindex*, though slightly differently in the two specimens. The larger holotype has the posterolateral angles of the syntergum obliquely inflexed so that the anal sclerite appears more-or-less Ω-like flattened over the sheaths (Fig. 126d). The Yemen female has the posterolateral angles more vertically inflexed (Fig. 126f) and therefore in dorsal view appears somewhat V-like angulate on either side of the anal sclerite. This difference may simply be the result of a difference in preservation because the Yemen female was critical-point dried and the holotype HMDS dried, and has the gaster shrivelled. At least the colour and sculptural differences could be size-correlated. However, the larger holotype has the costal cell setose dorsoapically for a distance only about equal to the length of the parastigma, whereas the Yemen female has a row of setae along almost the entire length of the cell. This is not conspicuous in the Yemen female because the fore wing setae are much paler (mostly white) than the dark setae of the holotype.

Because of syntergal structure and generally quite dark body colour, females are superficially similar to those of *E. vindex* or macropterous females of *E. atropurpureus*. However, among other differentiating features, the head in lateral view is quite highly convex to subtriangular (Fig. 126c) and the basal cell similarly setose as the disc (Fig. 126e). Females of *E. vindex* have a distinctively flat-lenticular to subtriangular head (Fig. 123g), and females of *E. atropurpureus* have the basal cell bare or almost so (Fig. 10h).

E. (*Eupelmus*) *xenium* Fusu & Gibson n. sp.

Fig. 127a, b, d, f, g (holotype ♀), c, e, h, i (Crimea ♀)

Type material. Type material. Holotype ♀ (CNC). SWEDEN: Skane, Svedala Kommun, Lemmestro, 55°30'28"N 13°21'14"E, ex. canola seed pods, coll. 7.VII.2014, Tim Haye / DNA extracted 23.iv.2015, Fusu, ug.SW 01 / HOLOTYPUS ♀ *Eupelmus* (*Eupelmus*) *xenium* sp. n. Det. Fusu L. 2015. Condition: glued by right side on a rectangular card; empty exoskeleton with internal tissue digested during DNA extraction; uncontorted; entire except for the missing right antenna beyond fl4 and last tarsal segment on left mesotarsus.

Excluded from type series. Crimea: Крымский зап. VШ. 1977, из шиповника, Дьякончук [Crimean nature reserve, VIII.1977, from dog rose, D'jakonchuk] (SIZK: 2♀).

Etymology. The Latin word *xenium* (gift), in reference to the gift of molecular data for clarifying the status of the holotype relative to other similar *fulvipes*-group species. Noun in apposition.

Description. FEMALE (based on holotype and two females from Crimea, with features of the latter between square brackets) (holotype habitus: Fig. 127a). Length = 2.3 [3.6] mm. Head extensively dark reddish-violaceous, but under some angles of light the following variably distinctly and extensively green to bluish-green (Fig. 127b, f, g): band on frons between posterior ocellus and scrobal depression, within scrobal depression excluding scrobes, lower face, and vertex obscurely [frons more extensively green to bluish-green (Fig. 127e, h, i), vertex green to bluish-green mesally and blue, purple or violaceous laterally near orbits (Fig. 127e, i)]; with slightly lanceolate white setae on lower face and parascrobal region to level of dorsal margin of scrobal depression compared to more hairlike setae on frontovertex. Maxillary and labial palps brown. Antenna with scape entirely yellow (Fig. 127a, b) [extensively pale (Fig. 127c), but ventral carinate margin brown or even somewhat more extensively brownish ventrally and basally]; pedicel and flagellum dark except pedicel dorsally and flagellum basally with some metallic green to purple lusters. Pronotum dorsolaterally variably distinctly blue or purple with some reddish-violaceous luster depending on viewing angle (Fig. 127d), and with extreme lateral margin and lateral panel more green to coppery-green (Fig. 127a) [pronotum more distinctly purple dorsolaterally and lateral panel more reddish-

violaceous to purple (Fig. 127e, i)]; admarginal setae dark. Mesonotum with hairlike to slightly lanceolate pale setae; variably distinctly and extensively greenish depending on angle of light, but convex part of anteromedial lobe more extensively dark reddish-violaceous to brown without distinct metallic luster, lateral lobe posteriorly with blue to purple lusters, particularly outer surface above tegula, and scutellar-axillar complex with extensive coppery luster under some angles of light except frenal area bluish-green to purple (Fig. 127d) [mesoscutum, including anteromedial lobe, more distinctly green or anteromedial lobe blue to purple, but lateral lobe with coppery luster longitudinally along ridge and outer surface with variably extensive blue to purplish luster (Fig. 127e); scutellar-axillar complex green to bluish-green except scutellum mostly coppery to reddish-coppery (Fig. 127e)]. Prepectus under most angles of light with blue to purple lusters (Fig. 127a, c) similar to pronotum laterally; with comparatively inconspicuous, white, hairlike setae. Tegula dark. Acropleuron green to bluish-green with coppery luster anteriorly and more coppery-brown posteriorly (Fig. 127a, c). Metanotum and propodeum primarily greenish; callus with more conspicuous, longer white setae than on mesonotum. Macropterous; fore wing hyaline with brownish setae beyond parastigma but basal cell setae white; costal cell dorsally near leading margin with row of setae over about apical two-thirds, and ventrally with mostly 3 rows along length; basal cell and disc entirely setose except for elongate linea calva. Front leg with trochanter and tarsus pale, femur dark except narrowly apically, and tibia dark dorso- and ventrolongitudinally but narrowly pale basally, somewhat more extensively apically, and along anterior and posterior surfaces (Fig. 127a, c). Middle leg almost uniformly pale beyond coxa except for dark mesotibial apical and mesotarsal pegs, though femur very slightly brownish posteroventrally (Fig. 127a) [entirely pale except for pegs (Fig. 127c)]. Hind leg with trochanter, tibia, femur apically, and tarsus pale, but at least about basal three-quarters of femur dark brown with slight metallic luster [femur with about apical quarter to half pale]. Gaster with hairlike setae; mostly brown to coppery-brown except basal tergum basally bright green to blue, and terga laterally and apical terga with slight greenish luster; ovipositor sheaths with three distinct bands, the apical band lighter brownish than dark basal band and about 0.6× length of medial pale band (Fig. 127a) [apical band even lighter brownish-yellow and almost 0.5× length of medial pale band (Fig. 127c)].

Head in dorsal view with interocular distance about 0.35× head width (Fig. 127g, one eye partly collapsed) [0.4× head width (Fig. 127i)]; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; vertex transversely reticulate-imbricate, with some sculpture transversely aligned but not coalesced into transverse ridge (Fig. 127g, i) [coalesced into variably wide and distinct transverse ridge]; frons coriaceous, including along orbit below posterior ocelli (Fig. 127f, g) [frons variably extensively and distinctly, though very shallowly reticulate to reticulate-imbricate (Fig. 127h, i)]; scrobal depression distinctly reticulate to transversely reticulate-rugulose except scrobes immediately above toruli (Fig. 127b); OOL: POL: LOL: MPOD = 0.5: 2.1: 1.5: 1.0 [0.8: 2.4–2.7: 1.7–1.8: 1.0]. Mesoscutum meshlike reticulate except medial lobe more reticulate-imbricate anteriorly and lateral lobe with mediolongitudinal band of minute coriaceous sculpture (Fig. 127d, e). Scutellum and axillae low convex in same plane; axilla meshlike coriaceous to reticulate anteriorly but more reticulate-imbricate posteriorly; scutellum coriaceous medially and longitudinally reticulate-imbricate laterally anterior to meshlike coriaceous frenum (Fig. 127d, e). Acropleuron meshlike anteriorly and posteriorly of much more minutely sculptured mesal region, the sculpture larger and more distinctly reticulate posteriorly than anteriorly (Fig. 127a, c). Fore wing with cc: mv: pmv: stv = 4.7: 5.0: 1.0: 1.0 [4.5–5.0: 4.4–4.6: 1.0–1.1: 1.0]. Middle leg with row of 4 [5–7] mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus and pegs clearly differentiated into two rows apically, second tarsomere with 4 [5–7] pegs, third tarsomere with 2 [3] pegs, and fourth tarsomere with 1 peg apically on either side. Propodeum with broadly U-shaped plical depression extending to posterior margin. Gaster slightly shorter than combined length of head and mesosoma; not atypically modified; extending almost to apex of second valvifer, the latter extending slightly beyond gastral apex, with third valvula about 0.8 [0.68]× length of metatibia and 0.80 [0.77]× length of mv; hypopygium extending about two-thirds length of gaster.

MALE. Unknown.

Distribution. Crimea?, Sweden.

Biology. Uncertain, but the holotype was reared from mass collected canola seed pods infested with larvae of the cabbage seedpod weevil, *Ceutorhynchus obstrictus* (Marsham) (Curculionidae), and the Brassica pod midge, *Dasineura brassicae* (Winnertz) (Cecidomyiidae), or possibly other unobserved contaminants on the pods (T. Haye, CABI, Delémont, Switzerland, pers. comm.). The two females from Crimea apparently were reared from dog rose, *Rosa canina* L., likely as a parasitoid within some cynipid gall.

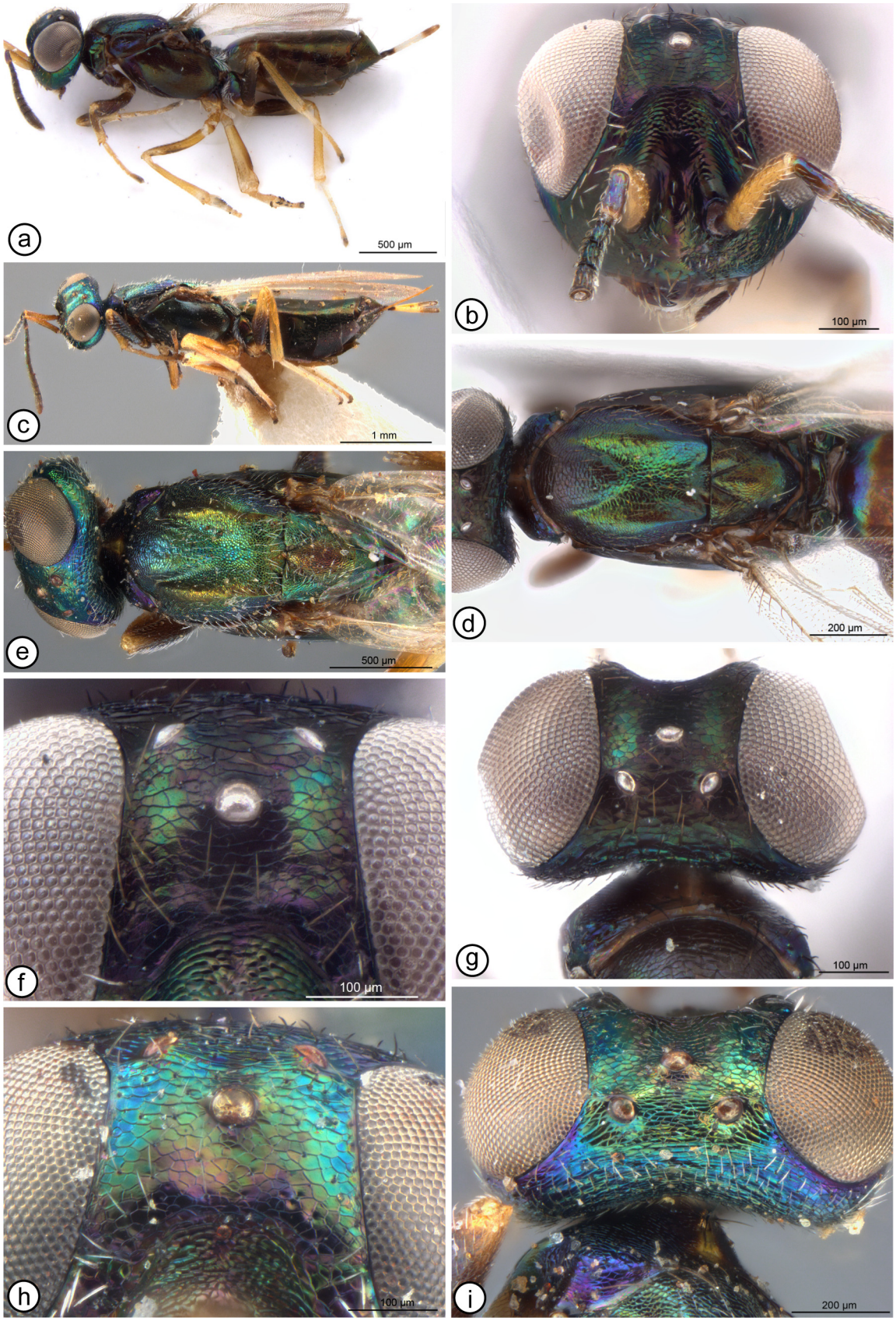

FIGURE 127. *a, b, d, f, g* (*Eupelmus xenium*, holotype ♀): **a**, lateral habitus; **b**, head, frontal; **d**, vertex and mesosoma, dorsal; **f**, frontovertex; **g**, head and pronotum, dorsal. *c, e, h, i* (*E. xenium*?, Crimea ♀): **c**, lateral habitus (2014-126); **e**, head and mesosoma, dorsal (2014-126); **h**. frontovertex (2014-132); **i**, head and pronotum, dorsal (2014-132).

Remarks. Although the above description encompasses both the holotype from Sweden and two females from Crimea, one of which lacks its gaster, we indicate between square brackets observed differences between the Crimean females and the holotype. We do this, and exclude the two Crimean females from the type series, because we are not certain that they and the holotype are conspecific. Among examined Western Palaearctic specimens, the three females uniquely have ovipositor sheaths that are shorter than the marginal vein in combination with pale scapes (Fig. 127a–c) and pale legs except for the pro- and metafemora being entirely dark (Fig. 127a, c). The Crimean females differ most conspicuously in colour from the holotype in having more extensive and distinct metallic luster, particularly on the head (*cf* Fig. 127f, g with Fig. 127h, i). Treatments to extract its DNA may affect colour perception of the holotype somewhat, but the stronger metallic luster of the Crimean females more likely is correlated with their larger body size, particularly the complete one (Fig. 127c). Measured length of the body from the anterior margin of the head to the posterior margin of the acropleuron in lateral view for the holotype compared to the incomplete and complete Crimean female is 1.27, 1.45, and 1.95 mm. The size range may also be correlated with some other observed differences. The holotype has the least number of mesotarsal and mesotibial apical pegs given in the description, whereas the largest female has the most pegs within the range given. Also, the holotype has a coriaceous frons (Fig. 127f, g), whereas the largest female has the frons noticeably roughened, very shallowly reticulate to reticulate-imbricate (Fig. 127h, i) and the most evident, though still comparatively poorly developed, vertexal carina. The frons of the smaller Crimean female is also somewhat reticulate to reticulate-imbricate, but more finely sculptured than the larger female, and it has at most a slightly developed, irregular vertexal ridge medially about as wide as the distance between the posterior ocelli. Structurally, the two Crimean females differ most conspicuously from the holotype in having an obviously wider interorbital distance (*cf* Fig. 127g, i), and the third valvulae shorter relative to the metatibia (less so for the marginal vein).

The only other western Palaearctic species whose female have comparatively short ovipositor sheaths and pale scapes is *E. fulvipes*, but females of this species have all the legs extensively pale beyond the coxae (Fig. 34a, b). Further, the scrobal depression usually has a distinct bluish to purple luster (Fig. 34c, d) and the ovipositor sheaths are shorter, at most 0.75× the length of the metatibia or marginal vein. Because of the variable sculpture pattern of the frons of the three females and their western Palaearctic distribution, we were uncertain based on morphology whether they represented an undescribed species or perhaps were *E. kiefferi* females with entirely pale scapes or western Palaearctic specimens of *E. tachardiae*, females of which are also characterized by pale scapes (Fig. 108a) and a very similar leg colour pattern (Fig. 108d–g). COI sequencing of the female from Sweden resulted in a sequence that is very distinct from those of both *E. kiefferi* and *E. tachardiae*, and we therefore describe it as a new species. The genetic distance between *E. xenium* and *E. tachardiae* or *E. kiefferi* is 12.5% and 14.1% respectively. Though phylogenetic inferences based on COI might not be accurate, our preliminary analyses do not retrieve *E. xenium* as part of the clade that includes *E. tachardiae*, nor is it close to *E. kiefferi*. Rather, it is part of a large clade with mostly unresolved relationships that contains, among other species, *E. fulvipes,* but again genetic distance between *E. xenium* and *E. fulvipes* is very large (12.6%).

The described coriaceous sculpture pattern of the frons of the holotype (Fig. 127f, g) is similar to that of *E. kiefferi* (Fig. 50e), whereas the somewhat roughened sculpture of the two females from Crimea is more similar to *E. tachardiae* (Fig. 108i). Further, the Crimean females have a noticeably wider interorbital distance than the holotype (*cf* Fig. 127g, i). The presumed hosts between the Swedish and Crimean females are also quite different, though six other species of Palaearctic *E*. (*Eupelmus*) are known to include both Coleoptera and Cynipidae as hosts (Table 1). Molecular analyses of similar females from Crimea are necessary to determine confidently whether the females represent yet another new species or are western Palaearctic representatives of *E. tachardiae*.

***E.* (*Eupelmus*) *zebra* Fusu & Gibson n. sp.**
Fig. 128a–i (♀)

Type material. Holotype ♀ (AICF). DNA extracted, 23.iv.2014 Fusu, ug.KO 31 / S. [SOUTH] KOREA: Jeollabukdo, Buan-gun, Sannae-myeon, Yuyu, 2MT, low hill at forest edge, 21.iv–27.v.2007, Tripotin rec. / HOLOTYPUS ♀ *Eupelmus* (*Eupelmus*) *zebra* sp. n. Det. Fusu L. 2015. Condition: glued by right side on rectangular card; empty exoskeleton with internal tissue digested during DNA extraction; uncontorted; entire.

Etymology. From the banded pattern of the ovipositor sheaths that are reminiscent of the striped coat of *Equus zebra*. Noun in apposition.

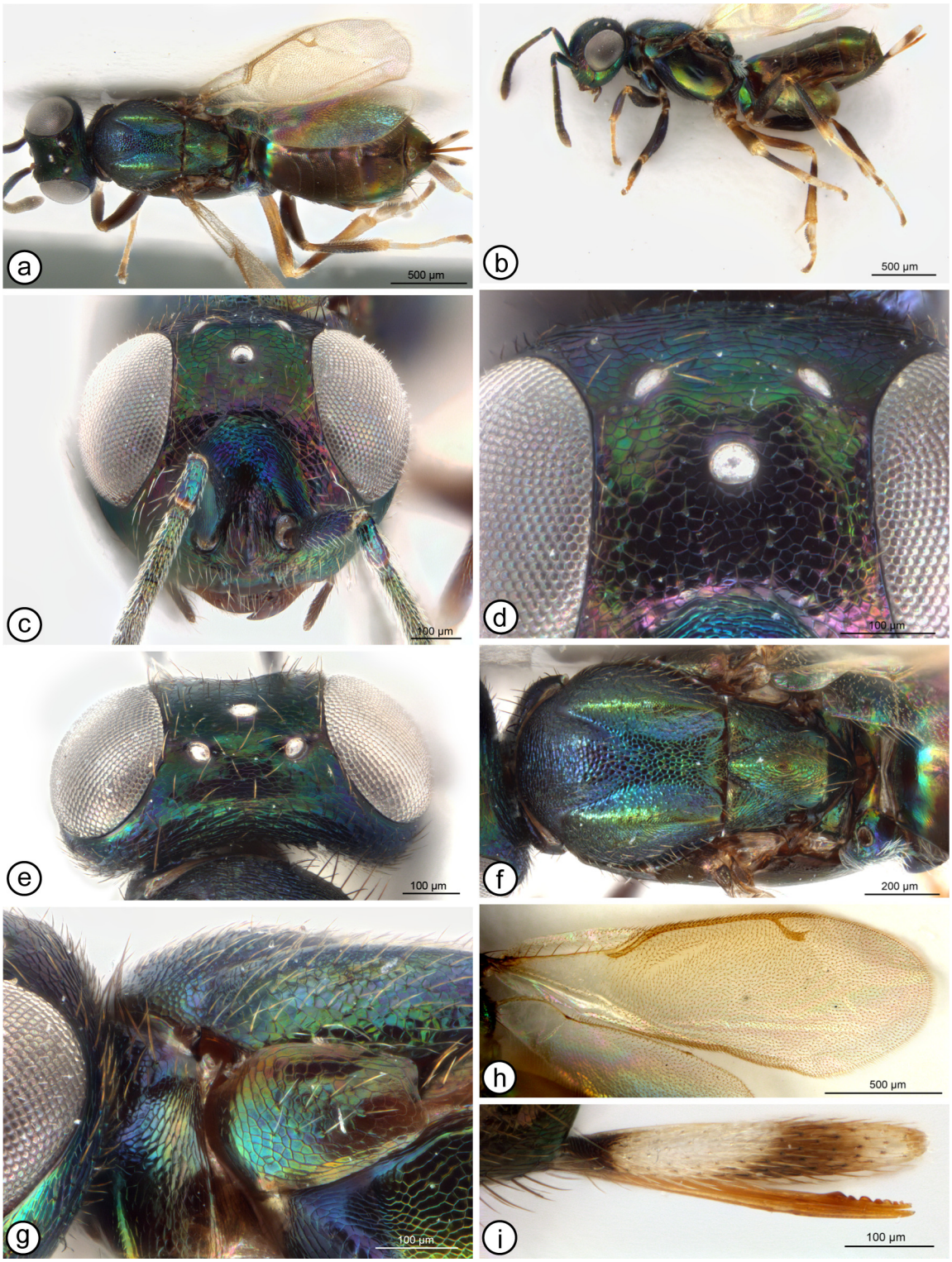

FIGURE 128. *Eupelmus zebra*, holotype ♀: **a**, dorsal habitus; **b**, lateral habitus; **c**, head, frontal; **d**, frontovertex; **e**, head, dorsal; **f**, mesosoma, dorsal; **g**, pronotum, mesoscutum and tegula, lateral; **h**, fore wing; **i**, ovipositor sheath.

Description. FEMALE (habitus: Fig. 128a, b). Length = 2.7 mm. Head (Fig. 128c–e) with frons and vertex variably extensively green to dark reddish-violaceous depending on angle of light, otherwise mostly reddish-violaceous with limited green except scrobal depression extensively bluish to violaceous (Fig. 128c, d); with hairlike to slightly lanceolate white setae on lower face and parascrobal region relative to less conspicuous hairlike setae on frontovertex. Maxillary and labial palps brown. Antenna with scape similarly dark as flagellum, the scape and pedicel with blue luster under some angles of light. Pronotum laterally dark blue to more violaceous along

extreme posterolateral margin (Fig. 128g), contrasting with mostly green mesoscutal lateral lobes; admarginal setae dark (Fig. 128g). Mesonotum (Fig. 128f) with mesoscutum variably green to purple under different angles of light, the anteromedial lobe and inner surface of lateral lobes more purple and outer surface of lateral lobes and depressed region of medial lobe more green under most angles of light, but scutellar-axillar complex mostly green with some coppery luster on scutellum; with hairlike to slightly lanceolate white to slightly brownish setae. Prepectus (Fig. 128g) mostly variably distinctly green or with some blue and purple luster depending on angle of light; with 8 setae in two rows mediolongitudinally. Tegula dark. Acropleuron green to bluish-green with coppery luster anteriorly and more distinct reddish-coppery luster posteriorly depending on angle of light. Propodeal callus variably green to extensively purple posterior to spiracle depending on angle of light; with hairlike to slightly lanceolate, but longer and denser setae than on mesoscutum (Fig. 128f). Macropterous; fore wing (Fig. 128h) hyaline with basal cell setae white but discal setae yellowish to brown; costal cell dorsally near leading margin with setae along most of length, including 2 rows mesally, and ventrally with at least 3 rows along length; basal cell and disc entirely setose except for elongate linea calva extending to level about equal with middle of parastigma. Front leg dark except for knee, tibia apically, and basal fore tarsomeres (under some angles of light anterior and posterior surfaces of tibia appear somewhat paler longitudinally over about apical two-thirds, but possibly affected by contents of leg being digested). Middle leg mostly pale beyond coxa except femur brown posteromesally, tibia with subbasal brown region to about mid-length, apical tarsomere brown and mesotibial apical pegs and mesotarsal pegs dark. Hind leg mostly dark beyond coxa except for knee, tibia apically, and basal four tarsomeres. Gaster (Fig. 128a, b) with hairlike setae; mostly brown except basal tergite basally green to bluish-green and tergites greenish laterally under some angles of light; ovipositor sheaths (Fig. 128i) with four distinct bands, a short dark region basally, a longer white region subbasally, a shorter brown region subapically, and an even shorter pale region apically.

Head in dorsal view (Fig. 128e) with interocular distance about 0.42× head width; in lateral view lenticular with face almost evenly convex and parascrobal region smoothly merged with frons; vertex almost evenly rounded into occiput, but with very fine, obscure U-like emargination (Fig. 128e); frons meshlike coriaceous (Fig. 128d); scrobal depression distinctly meshlike reticulate to transversely strigose-reticulate, with sculpture extending through scrobes almost to toruli (Fig. 128c); OOL: POL: LOL: MPOD = 1.1: 2.6: 1.8: 1.0. Mesoscutum (Fig. 128f) mostly meshlike reticulate except anteromedial lobe anteriorly more transversely alutaceous-reticulate and lateral lobe with mediolongitudinal band of minute coriaceous sculpture. Scutellum and axillae low convex in same plane; axilla mostly obliquely and scutellum longitudinally reticulate-imbricate laterad midline anterior to meshlike coriaceous frenal area. Acropleuron with larger meshlike sculpture anteriorly and posteriorly relative to much more minutely sculptured region mesally, with larger meshlike sculpture at most delineated by only slightly raised ridges. Fore wing (Fig. 128h) with cc: mv: pmv: stv = 4.4: 3.6: 1.0: 1.0. Middle leg with row of 4 mesotibial apical pegs; mesotarsus with symmetrical peg pattern on basitarsus and pegs clearly differentiated into two rows apically; second tarsomere with 5 pegs, third tarsomere with 2 pegs, and fourth tarsomere with 1 peg apically on either side. Propodeum with broadly U-shaped plical depression extending to posterior margin (Fig. 128f). Gaster (Fig. 128a, b) similar in length to combined length of head and mesosoma; not atypically modified; extending to base of third valvula, the latter about 0.64× length of metatibia and 0.73× length of mv; hypopygium extending about two-thirds length of gaster.

MALE. Unknown.

Distribution. South Korea.

Biology. Unknown.

Remarks. Although this newly described species is represented by only a single female, it is described as new in part based on COI evidence, which will be presented in a subsequent publication. The holotype is not noticeably affected by DNA extraction except that because the internal contents are removed, leg colour differs depending on angle of light. This affects most conspicuously apparent colour of the mesofemur. In direct dorsal view the mesofemur is pale except for the posterior surface being darker brown (Fig. 128a), whereas from an oblique view the femur appears more uniformly dark brown similar to the other femora (Fig. 128b). Further, under most angles of light the protibia appears dark except narrowly basally and apically (Fig. 128b), though it is noticeably paler longitudinally over at least about the apical half under some angles of light. Even though there is just a single female, we key *E. zebra* twice because of its head structure, once based on presence and once based on absence of an observable vertexal carina. The holotype has the vertex almost smoothly curved into the vertex, but with a very slight U-like emargination apparent under some angles of light (Fig. 128e). Because there is only a single

individual, we are uncertain as to the limit of variation for this feature, as for other putative differential features such as colour pattern of the ovipositor sheaths.

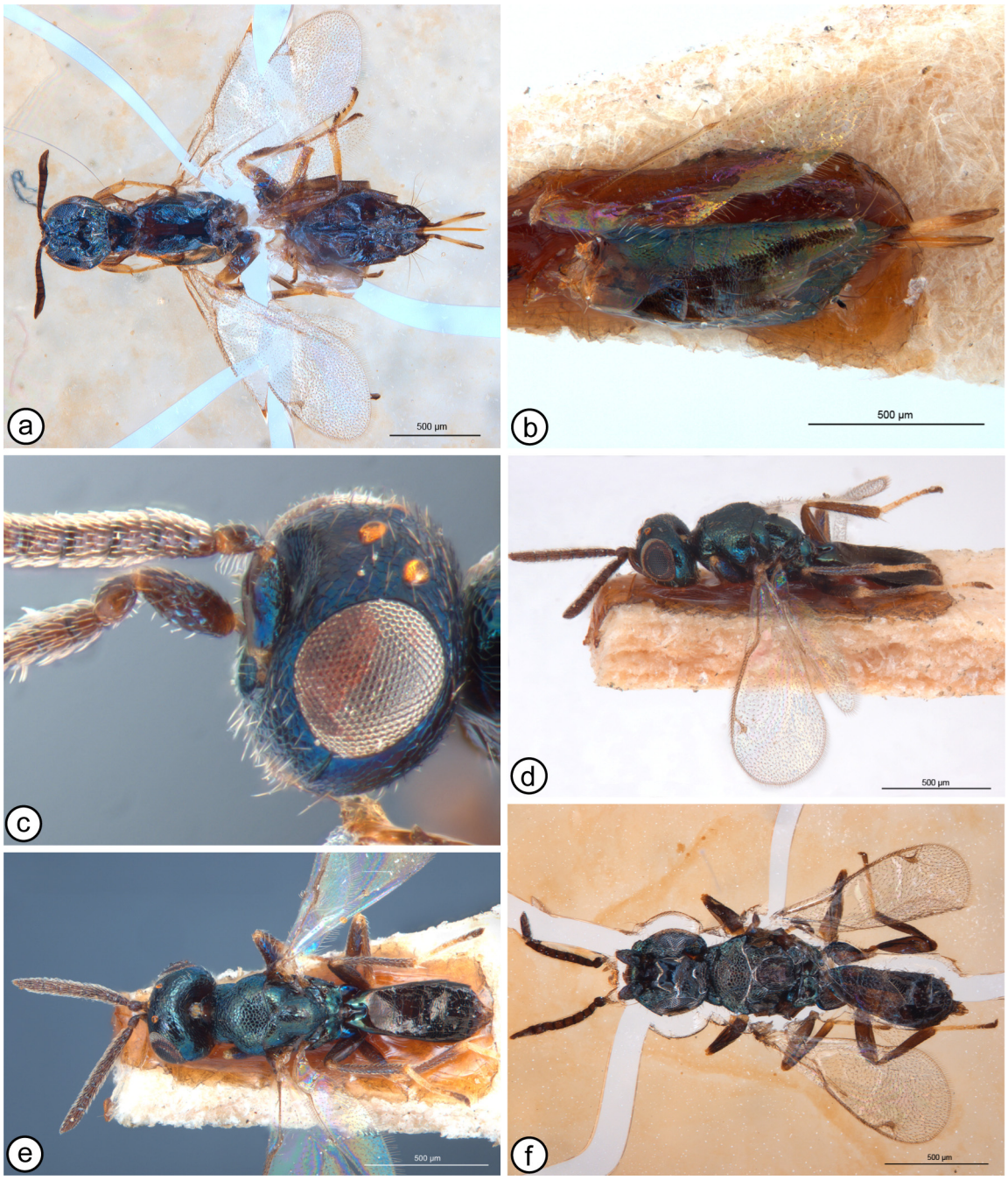

FIGURE 129. *Eupelmus afer* syntypes (L. Fusu images): **a**, ♀ dorsal habitus (slide mounted); **b**, ♀ gaster, lateral (card mounted); **c**, ♂ head and basal half of antennae, lateral (card mounted); **d**, ♂ lateral habitus (card mounted); **e**, ♂ dorsal habitus (card mounted); **f**, ♂ dorsal habitus (slide mounted).

Species excluded from Palaearctic region

E. (*Eupelmus*) *afer* Silvestri

Fig. 129a, b (♀), c–f (♂)

Eupelmus afer Silvestri, 1914: 202–204. Syntypes, 3♀ & 8♂, IFSP, examined by LF. Type data: Eritrea (Nefasit and Dedda), and Cape Colony.

Eupelmus (*Eupelmus*) *afer*; Gibson, 2011: 3, 18–19.

Distribution. AFROTROPICAL. Eritrea (Silvestri 1914), South Africa (Silvestri 1914, Monaco 1978). **PALAEARCTIC?** Introduced into Italy (Silvestri 1914, Viggiani 1975).

Type material examined. Syntypes 3♀, 8♂ (IFSP): *Eupelmus afer* Silv ♂, Nefasit, olive (3♂, slide mounted under one coverslip); *Eupelmus afer* Silv ♀ e ♂, Nefasit, olive (2♀, 2♂, slide mounted under one coverslip, one female dissected); Nefasit, olive, Sett[embre]. 1914 (1♀, 2♂, point mounted); Nefasit, *Dacus*, Ott[obre]. 914 (1♂, card mounted).

Biology. A primary parasitoid of *Bactrocera oleae* (Rossi) (Diptera: Tephritidae) (Silvestri 1914).

Remarks. Silvestri (1914) described *E. afer* from numerous specimens reared as larval ectoparasitoids of *Bactrocera oleae* from Eritrea and South Africa in the Afrotropical region. However, he also stated that 179 individuals were released in two separate events in September 1914, on a farm in "Purgatorio in Fasano", which Viggiani (1975) recorded as "Puglia (Fasano)" in Italy.

Silvestri (1914) provided a dorsal habitus drawing of a female and line drawings of an antenna, the pedicel and basal two flagellomeres, and the setal pattern and venational structure in the area around the stigmal vein and postmarginal vein of a female. The habitus illustration places the female as one of the *urozonus*-complex species with comparatively short ovipositor sheaths relative to length of the marginal vein (0.68× length of marginal vein based on illustration). This conclusion is supported by Silvestri himself comparing his new species to *E. urozonus*. He differentiated it from *E. urozonus*, in part, by males having the basal three tarsomeres of the meso- and metatarsi white rather than infuscate.

Type material of *E. afer* remaining in the Silvestri collection includes a card mounted gaster of a female (Fig. 129b) and three card mounted males (Fig. 129d, e), plus two females (Fig. 129a) and two males (Fig. 129f) mounted together on one microscope slide and three males mounted on another slide. The slide mounted specimens appear to have been mounted in gelatin, which has dried and left a thin layer of air between the specimen and medium that obscures some structures (Fig. 129a, f). However, study of the type material by LF showed that females have rather smooth scrobes and the scrobal depression reticulate laterally and dorsally. The pronotum is more-or-less violaceous and one slide mounted female appears to have four dark admarginal setae. These features and the length of ovipositor sheaths relative to the marginal vein show that females are most similar to those of *E. confusus* though the apical dark band of the ovipositor sheaths is distinctly longer in *E. afer* (Fig. 129b) than *E. confusus* (Fig. 25a, b) females. Further, the male syntypes of *E. afer* have the pronotal neck sloping (Fig. 129d) so as to be visible in dorsal view, whereas the neck is almost vertical in *E. confusus* males so that in dorsal view only the collar is clearly visible. The male syntypes of *E. afer* also have comparatively large, polygonal cells on the mesoscutum except adjacent to the scutellum (Fig. 129e), whereas about the posterior third of the mesoscutum of *E. confusus* males has small, irregular cells (Fig. 26a).

Both *E. afer* and *E. confusus* are parasitoids of the olive fruit fly; however, different *Eupelmus* species often parasitize the same hosts and there appear to be some morphological differences between the remaining type material of *E. afer* and European specimens we identify as *E. confusus*. Prior to any nomenclatural changes we consider collection of topotypic specimens reared from *D. oleae* in Eritrea advisable for further morphological and molecular comparison with *E. confusus*. We therefore consider both *E. confusus* and *E. afer* as valid, but exclude *E. afer* from Palaearctic in distribution. There has never been a subsequent Palaearctic record of *E. afer* in the Palaearctic since its 1914 introduction, and no evidence the species established.

Discussion

The known Palaearctic distribution of the 76 species of *E.* (*Eupelmus*) we recognize from the region is summarized in Table 1. The subdivisions tabulated are somewhat arbitrary and accurate comparisons are hindered by unequal knowledge of the true faunas of the different areas. We saw many more specimens from Europe, particularly Western Europe, than from the other areas. The comparatively large number of individuals examined from Europe resulted in only 3 new species being described of 38 species recorded from the region. Consequently, the number of species recognized from Europe may be quite accurate, though one of the newly described species, *E. hayei*, is based on only a single female collected sweeping a meadow with shepherd's purse, *Capsella bursa-pastoris*, and another, *E. xenium*, was indicated as new primarily by molecular evidence. Knowledge of the eastern Palaearctic fuana is much less comprehensive and is virtually lacking for Russia east of the Ural Mountains and elsewhere in

Eurasia between about 80º–110ºE. *Eupelmus flavicrurus* and *E. curvator* were described from Shaanxi, China, but other species we record from the eastern Palaearctic are all from more eastern China, South Korea and Japan. Of 20 species we record for the far eastern Palaearctic, 11 are described as new, suggesting many additional species wait to be discovered with more comprehensive specimen representation. Ten (8 uniquely) of 32 recognized species are described as new from the Middle East. Only 2 species (1 uniquely) are described as new from North Africa, but the latter undoubtedly is influenced by the relatively few specimens we saw from the area and additional species likely remain to be discovered.

Of the 76 recognized species, only four, *E. atropurpureus*, *E. pini*, *E. phragmitis*, and *E. kiefferi* definitely occur in both the western and far eastern Palaearctic. Of these, *E. pini* has the widest world distribution, being present also in North America (Gibson 2011), though the latter likely is accidental through introduction by man. A female seen from Japan (Honshu) is labelled as reared from a pupa of *Tomicus piniperda* (L.) (Scolytidae), the same host as Gibson (2011) reported for a female from Ontario, Canada. The native range of *T. piniperda* includes Eurasia and North Africa (Haack 2006), but it was repeatedly introduced into North America (Hausner *et al.* 2005) and *E. pini* may have been brought into eastern North America with it or some other host beetle from the Palaearctic. Interestingly, though likely not native, *E. pini* was first described from North America and only afterwards three more times from Europe. *Eupelmus kiefferi* appears to be the only common species in both the western and at least far eastern Palaearctic. Morphologically, it is much more diverse than the other two trans-Palaearctic species and further molecular analyses are required to substantiate our present species concept, as discussed under *E. kiefferi*.

Based on material examined we are quite confident that one species previously thought to be trans-Palaearctic, *E. urozonus*, is restricted to the western Palaearctic. Literature records for *E. urozonus* in the far eastern Palaearctic all appear to be based on misidentifications, mostly of *E. kiefferi* and *E. kamijoi* (e.g. Pak 1963; Yasumatsu & Kamijo 1979; Ôtake *et al.* 1982; Aebi *et al.* 2006), but also *E. tachardiae* (Yang 1996). An important consequence of this is that the newly described *E. kamijoi* appears to be a specialist in *D. kuriphilus* galls, either as a primary parasitoid or sometimes apparently as a hyperparasitoid through *Torymus sinensis*. It is mostly *E. kamijoi*, in addition to three other generalist species (*E. formosae*, *E. kiefferi* and *E. tachardiae*), and not *E. urozonus*, that are associated with *D. kuriphilus* in the eastern Palaearctic. Only *T. sinensis* has so far been used as a biological control agent for *D. kuriphilus.* The misidentification of *E. kamijoi* as other generalist species means that a potentially important species has not been assessed for biocontrol of this pest of chestnut trees.

Based on our results, the entire *urozonus* species-group (*E. minozonus*, *E. opacus*, *E. priotoni*, *E. purpuricollis*, *E. simizonus* and *E. urozonus*) is absent from the far eastern Palaearctic. As discussed under *E. urozonus*, the morphological delineation of this species group is arbitrary, and molecular analyses indicate the group is monophyletic only if *E. simizonus* is excluded and *E. janstai* is included. Females of the *urozonus* group are the most difficult to distinguish morphologically to species in the western Palaearctic and males were previously unrecognized for any species other than *E. urozonus*. We did associate through rearing males of what we provisionally identify as *E. opacus*, but cannot confidently differentiate these morphologically from *E. urozonus* males. This is partly because too few were seen to enable accurate estimation of intraspecific variation.

In the far eastern Palaearctic the *urozonus* group appears to be replaced by *fulvipes*-group species (*E. brachystylus, E. flavicrurus, E. formosae, E. kamijoi, E. kiefferi, E. luteipes, E. tachardiae* and *E. tremulae*), though *E. kiefferi* also occurs in the western Palaearctic along with *E. fulvipes*, *E. xenium*, and possibly *E. tachardiae* (see under *E. xenium*). This species group is similar to the *urozonus* group in being difficult to distinguish morphologically and based on our preliminary molecular results does not constitute a monophyletic clade. Species inclusion in the *fulvipes* group is determined by a single feature, the presence of an evident vertexal carina in at least males. Males typically have quite an obvious vertexal carina, though sometimes this is only quite obscurely developed or not apparent in females. It is therefore possible that one or more of the new *species* we describe from the far eastern Palaearctic based on one or a very few females might be included in the *fulvipes* group once males are associated or further females are collected for more comprehensive knowledge of variation. For example, *E. zebra* is not included in the fulvipes group because the holotype lacks a definite vertexal carina and males are unknown. However, under some angles of light the vertex of the unique female has a very slightly developed U-like emargination. Also, the unique holotype of *E. tetrazostus* and the two known females of *E. adustus*, which also lack a vertexal carina, are characterized partly by pale scapes. This feature is shared with females of several *fulvipes*-group species, though also with some other non-*fulvipes* group species such as *E. cerris, E. punctatifrons,* and *E. vanharteni* from the western Palaearctic.

The possible reason why not every single specimen can always be identified confidently is that some hybridization or introgression may be possible between closely related species. We suspect that this could be the explanation for the existence of what appears to be intermediate individuals in such species pairs as *E. vuilleti* and *E. orientalis* (*orientalis* group), *E. phragmitis* and *E. stramineipes* (*stramineipes* group), *E. iranicus* and *E. kalinai* (*iranicus* group), and some *urozonus*- and *fulvipes*-group species. In one or more of these instances it is possible that only one polymorphic species is present, but we take a conservative approach until genetic data and crossing experiments become available. The possibility of hybridization or introgression and the difficulty of differentiating between intra- and interspecific variation is increased by different species having the same hosts and sometimes even being reared together from the same host gall or individual. For example, females of four species, *E. annulatus*, *E. gelechiphagus*, *E. kiefferi* and *E. urozonus* were reared at the same time and locality from *Amblypalpis olivierella* on *Tamarix aphylla* in Saudi Arabia (see respective species). Within the *fulvipes* group, we also saw instances of *E. kiefferi* and *E. kamijoi* being reared together from *D. kuriphilus* galls, and at least two instances of *E. kiefferi* and *E. formosae* and one instance of *E. kiefferi* and *E. tachardiae* and *E. kiefferi* and *E. fulvipes* being co-reared from the same gall(s) based on co-mounting or identical label data. Additionally, a single female of what appears to be *E. formosae* was reared, though separately, along with numerous individuals of *E. flavicrurus* from *Grapholita molesta* (Tortricidae), either representing another example of similar species having the same host or calling into question the validity of the species. Because of past misidentifications the host records listed in Noyes (2014) are unreliable for several species, particularly *E. urozonus*, *E. annulatus*, *E. azureus*, and *E. fulvipes*. Accuracy of host records is affected also by the equally likely misidentifications of host species, as well as by the determination of whether the parasitoid was a primary or hyperparasitoid. Table 1 summarizes the Ordinal host associations for recognized Palaearctic species of *E.* (*Eupelmus*). Reliable host records are known for only a little over half (43 = 57%) of the recognized species. Species are almost always larval or pupal parasitoids, though *E. tibicinis* is an egg parasitoid of *Tibicina haematodes* (Cicadidae) and *E. orthopterae* an egg parasitoid of Mantidae. Males of the latter species lack the features by which males of the genus and subgenus are distinguished (lack of a speculum, apically curved pedicular setae and an obviously differentiated, longer genal seta). Females of *E. orthopterae*, along with those of *E. fasciatus*, also differ conspicuously in some features from other females in *E.* (*Eupelmus*). A series of females from Israel we questionably identify as *E. annulatus* were reared from a *Chrysopa* (Crysopidae) cocoon, as was *E. urozonus* in one instance. Other known *E.* (*Eupelmus*) species are parasitoids of Homoptera, usually Coccoidea, though *E. kiefferi* is also recorded as a parasitoid of Aphididae or, more commonly, as a primary or hyperparasitoid of Coleoptera, Diptera, Hymenoptera and Lepidoptera. *Eupelmus luteipes* was reared from larvae of the emerald ashborer along with *Tetrastichus planipennisi*, a gregarious endoparasitoid, most likely as a predator of these smaller primary parasitoid larvae rather than as a true hyperparasitoid (see under 'Biology' for the species). Most of the species including Hymenoptera as primary hosts are parasitoids within galls of Cynipidae, but also of other hymenopterous gall makers such as Eurytomidae or their primary parasitoids such as Torymidae, though there are also a few records from Chrysididae and such sawflies as Diprionidae or more rarely Tenthredinidae. Fourteen species are indicated to at least sometimes act as hyperparasitoids, though none as obligate hyperparasitoids, and more species than presently known are very likely facultative hyperparasitoids.

The present revision provides further morphological evidence that at least two of the three recognized subgenera in *Eupelmus*, *E.* (*Episolindelia*) and *E.* (*Eupelmus*), are not monophyletic, though the subgenus concept may still have some value for handling the large number of world *Eupelmus* species. The revision increases the number of valid species of *E.* (*Eupelmus*) in the Palaearctic by about one-third, but even more species undoubtedly remain to be discovered, particularly for the far Eastern Palaearctic and through molecular evidence revealing previously unrecognized cryptic species. Molecular analyses are required to more confidently resolve species limits in the *fulvipes* group, primarily but not exclusively within the far eastern Palaearctic. Additional molecular analyses of specimens identified as various *urozonus*-group species using the morphological features proposed by us or Al khatib *et al.* (2014) are also required to test the reliability of the features for species recognition and to associate conspecific males. Finally, correct application of nomenclature in the far eastern Palaearctic requires testing through a revision of the species of *E.* (*Eupelmus*) from the Indo-Malayan (Oriental) region where the same species may co-occur under some other name and represent the senior synonym or, in such instances as *E. formosae*, *E. peculiaris* and *E. tachardiae*, we may have misapplied the names.

Acknowledgments

We gratefully acknowledge and thank Lisa Bearss and Caroline Boudreault for taking most of the images and preparing the plates of figures that illustrate this work, Dicky Yu for translating labels written in Chinese, and Leah Clarke (summer student) for providing other technical assistance (all AAFC, Ottawa), and Mădălina Viciriuc (Master's student, Al. I. Cuza University of Iasi) for assistance in the molecular work. We are also grateful to many friends and colleagues for the gift of important and sometimes unique specimens that enhanced the scientific value of this revision: Martin Alberts (Germany), Richard Askew (England), Antonius van Harten (Portugal), Tim Haye (Switzerland), Seyed Massoud Madjdzadeh (Iran), Reza Mehrnejad (Iran), Mircea D. Mitroiu and Ovidiu A. Popovici (Romania), Gordon Ramel (China), Ion Şchiopu (Romania), Pierre Tripotin (Australia), and Patrick Weill (France). The curators of the collections listed under 'Material' are also thanked for their patience regarding the return of material from outstanding loans, and P. Janšta (NMPC) for arranging the invaluable loan of Kalina type material. Ionel Andriescu (Al. I. Cuza University) is further acknowledged for permission to use his unpublished manuscript on Romanian Chalcidoidea. Graham Stone (Institute of Evolutionary Biology, The University of Edinburgh, Scotland) and George Melika (Plant Health and Molecular Biology Laboratory, Budapest, Hungary) are acknowledged for their kind permission to use their unpublished molecular data and associated reared material from an unpublished molecular study of *Eupelmus* reared from galls. We are also deeply thankful to the late Antoni Ribes Escolà (Lleida, Spain) for his large collecting and rearing effort, which contributed much to the knowledge of the biology and distribution of chalcid wasps. LF visits to MNCN and HNHM were supported by the SYNTHESYS Project (http://www.synthesys.info/), financed by European Community Research Infrastructure Action under the FP7 "Capacities" Program (ES-TAF-1816 and HU-TAF-2949) and his research is currently sustained by a grant of the Romanian National Authority for Scientific Research, CNCS – UEFISCDI, project number PN-II-RU-TE-2012-3-0057.

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TABLE 1. Palaearctic distribution and Ordinal host associations of *E.* (*Eupelmus*) species based on observed specimens (EU = Europe, NA = North Africa, ME = Middle East, WE = Western Eurasia, FE = Far eastern Palaearctic; CO = Coleoptera, DI = Diptera, HE = Hemiptera, HYp = Hymenoptera, primary parasitoid, HYh = Hymenoptera, hyperparasitoid, LE = Lepidoptera, MA = Mantoidea, NE = Neuroptera). Questionable records are not included in totals of host association counts.

Species[1]	EU[2]	NA	ME[3]	WE[4]	FE[5]	CO	DI	HE	HYp	HYh	LE	MA	NE
E. acinellus	+										+		
E. adustus					+								
E. africanus		+											
E. angustifrons					+								
E. annulatus	+	+	+			+			+	+	+		+?
E. atropurpureus	+	+		+	+	+	+		+	+	+		
E. azureus	+		+						+	+?			
E. bicolor			+						+				
E. brachypterus					+								
E. brachystylus					+								
E. brachyurus					+								
E. bulgaricus	+		+										
E. ceroplastae		+						+					
E. cerris	+	+	+						+				
E. claviger				+									
E. confusus	+	+	+				+		+	+	+		
E. curvator					+	+							
E. fasciatus			+										
E. flavicrurus					+	+	+			+	+		
E. formosae					+	+	+		+	+	+		
E. fulgens	+		+	+									
E. fulvipes	+								+				
E. gelechiphagus			+								+		
E. gemellus	+					+	+		+		+		
E. hayei	+												
E. infimbriatus				+									
E. iranicus	+	+	+										
E. iris					+				+				
E. janstai	+												
E. kalinai	+	+	+				+						
E. kamijoi					+				+	+			
E. kiefferi	+	+	+	+	+	+	+	+	+	+	+		
E. lanceolatus	+		+										
E. levis				+									
E. longicalvus	+												
E. longicaudus			+										
E. luteipes					+	+				+			

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TABLE 1. (Continued)

Species[1]	EU[2]	NA	ME[3]	WE[4]	FE[5]	CO	DI	HE	HYp	HYh	LE	MA	NE
E. magdalenae		+											
E. martellii	+	+					+		+?				
E. matranus	+		+						+				
E. mehrnejadi			+						+?	+	+		
E. melanostylus			+					+					
E. memnonius	+					+							
E. microzonus	+	+	+	+		+	+		+	+	+		
E. minozonus	+												
E. mirabilis			+										
E. nitidus	+		+	+							+		
E. opacus	+						+						
E. orientalis			+			+		+		+			
E. orthopterae			+									+	
E. peculiaris					+								
E. phragmitis	+		+		+				+				
E. pini	+				+	+				+			
E. pistaciae	+	+	+						+	+?			
E. priotoni	+										+		
E. punctatifrons			+										
E. purpuricollis	+												
E. saharensis		+											
E. setosus			+										
E. simizonus	+								+		+		
E. splendens	+								+				
E. stenozonus		+					+						
E. stramineipes	+			+									
E. tachardiae					+		+	+	+	+	+		
E. tanystylus					+		+						
E. tetrazostus					+								
E. tibicinis	+							+					
E. tremulae	+						+						
E. tryapitzini	+	+	+										
E. urozonus	+	+	+				+		+	+	+		+
E. vanharteni			+										
E. vindex	+	+	+			+							
E. vuilleti			+			+				+			
E. weilli		+	+										
E. xenium	+					+?			+?				
E. zebra					+								
TOTAL number	38	19	32	9	20	14	15	6	20	15	16	1	1

[1] Newly described species in bold font.
[2] Europe: east of Ural Mountains north of Syria, Iraq and Iran.
[3] Middle East: Arabian Peninsula and south of Turkey and Azerbaijan, west through Iran.
[4] Western Eurasia: Palaearctic east of Caspian Sea and Iran to Kyrgyzstan and Tajikistan.
[5] Far eastern Palaearctic: Palaearctic east of 80º.

TABLE 2. CNC photo number, depository collection and country of origin and sex of specimens used to illustrate species, excluding primary type specimens and specimens with data cited in the text. Abbreviations in brackets following country indicates type status, if any (PT = paratype, ST = syntype). See 'Material' for collection data associated with museum codons.

Species	CNC Photo no.	Country	Collection	Sex
E. acinellus	2012-63	Spain [PT]	CNC	F
E. acinellus	2013-1	Spain [PT]	ARPC	F
E. acinellus	2013-84	Spain [PT]	ARPC	M
E. acinellus	2013-85	Spain [PT]	ARPC	M
E. acinellus	2014-121	Spain [PT]	ARPC	M
E. annulatus	2010-23	Canada (Ontario)	CNC	M
E. annulatus	2012-70	Germany	CNC	F
E. annulatus	2012-71	France	ZSMC	F
E. annulatus	2013-82	Greece	AICF	F
E. annulatus	2013-83	Hungary	ZSMC	M
E. annulatus	2013-140	Hungary	CPTC	M
E. annulatus	2013-141	Romania	CPTC	M
E. atropurpureus	2010-43	Bulgaria	UCRC	F
E. atropurpureus	2012-34	Italy	CNC	F
E. atropurpureus	2012-35	Hungary	CNC	F
E. atropurpureus	2012-36	Kyrgyzstan	UCRC	F
E. atropurpureus	2013-86	Spain	ARPC	M
E. atropurpureus	2013-88	Spain	ARPC	M
E. atropurpureus	2013-89	Sweden	BMNH	M
E. atropurpureus	2013-90	Japan (Hokkaido)	CNC	M
E. azureus	2010-33	Hungary	NMPC	M
E. azureus	2012-67	Italy	ZSMC	F
E. azureus	2012-69	Lebanon	CNC	F
E. azureus	2012-100	Hungary	NMPC	M
E. azureus	2013-91	Spain	ARPC	M
E. azureus	2013-92	Greece (Crete)	CNC	M
E. cerris	2010-35	Hungary	CNC	F
E. cerris	2012-74	Spain	MNCN	F
E. cerris	2013-13	Bulgaria	PUPB/IBER	F
E. sp. nr *cerris*	2013-97	Iran	CNC	M
E. sp. nr *cerris*	2013-98	Iran	CNC	M
E. confusus	2010-38	Montenegro	CNC	F

.....continued on the next page

TABLE 2. (Continued)

Species	CNC Photo no.	Country	Collection	Sex
E. confusus	2010-39	Italy	CNC	M
E. confusus	2012-77	Italy	CNC	F
E. confusus	2013-99	Italy	CNC	F
E. confusus	2013-100	Italy	CNC	F
E. confusus	2013-101	Italy (Sicily)	CNC	F
E. confusus	2013-102	Spain (Mallorca)	ARPC	M
E. fulvipes	2013-163	Hungary	CTPC	F
E. fulvipes	2013-58	Netherlands? [a]	RMNH	F
E. fulvipes	2013-59	Montenegro	CTPC	F
E. fulvipes	2014-127	France	GDPC	M
E. gemellus	2013-115	Spain	ARPC	M
E. gemellus	2013-169	Spain	ARPC	F
E. gemellus	2013-170	Croatia (Dalmatian Isl.)	NMPC	F
E. gemellus	2013-171	Spain	ARPC	F
E. gemellus	2013-172	Spain	ARPC	F
E. gemellus	2013-173	Spain	ARPC	F
E. gemellus	2013-174	Spain	ARPC	F
E. janstai	2013-30	Czech Republic [PT]	CNC	F
E. janstai	2013-31	Czech Republic [PT]	CNC	F
E. kiefferi	2010-40	Czech Republic	CNC	F
E. kiefferi	2010-41	Romania	AICF	M
E. kiefferi	2010-42	Montenegro	CNC	M
E. kiefferi	2012-79	Hungary	CNC	F
E. kiefferi	2012-80	France	ZSMC	F
E. kiefferi	2012-118	Hungary	CNC	M
E. kiefferi	2012-125	Japan (Honshu)	USNM	M
E. kiefferi	2013-103	Hungary	CNC	F
E. kiefferi	2013-104	Switzerland	CNC	M
E. kiefferi	2013-106	Turkey	CTPC	M
E. kiefferi	2013-107	Japan (Honshu)	USNM	M
E. kiefferi	2013-161	France	ZSMC	M
E. kiefferi	2013-162	France	ZSMC	M
E. kiefferi	2013-164	Austria	BMNH	F
E. kiefferi	2014-29	England	CNC	M
E. longicalvus	2013-153	Sweden	NHRS	F
E. longicalvus	2013-155	Sweden	BMNH	F
E. martellii	2013-167	Libya	MHNG	F
E. martellii	2013-168	Libya	MHNG	F
E. matranus	2012-41	Hungary	HNHM	F

.....continued on the next page

TABLE 2. (Continued)

Species	CNC Photo no.	Country	Collection	Sex
E. matranus	2012-42	Hungary [PT]	HNHM	F
E. matranus	2013-10	Spain	ARPC	F
E. matranus	2013-116	Hungary	CTPC	M
E. matranus	2013-117	Hungary	CTPC	M
E. matranus	2013-146	Hungary	CTPC	M
E. memnonius	2012-39	Hungary	CNC	F
E. memnonius	2012-40	Belgium	ISNB	F
E. memnonius	2013-32	Spain	RMNH	F
E. microzonus	2012-59	Croatia	CNC	F
E. microzonus	2012-60	Croatia	CNC	F
E. microzonus	2012-61	Turkey	CNC	F
E. microzonus	2012-116	Turkey	CNC	M
E. microzonus	2012-117	France	CNC	M
E. microzonus	2013-18	Turkey	CNC	F
E. microzonus	2013-108	Turkey	CNC	M
E. minozonus	2014-43	Hungary	MHNG	F
E. orientalis	2012-48	Thailand	CNC	F
E. orientalis	2012-50	South Africa	CNC	F
E. orientalis	2012-102	United Arab Emirates	CNC	M
E. orientalis	2012-103	United Arab Emirates	CNC	M
E. orientalis	2012-104	United Arab Emirates	CNC	M
E. orientalis	2013-109	United Arab Emirates	CNC	M
E. orientalis	2013-112	United Arab Emirates	CNC	F
E. orientalis	2013-148	South Africa	CNC	M
E. orientalis	2013-149	India [ST]	USNM	F
E. orthopterae	2014-66	South Africa	CNC	F
E. orthopterae	2014-67	South Africa	CNC	F
E. orthopterae	2014-68	South Africa	CNC	F
E. orthopterae	2014-69	Israel	CNC	M
E. orthopterae	2014-70	South Africa	CNC	M
E. orthopterae	2014-71	South Africa	CNC	M
E. peculiaris	2013-22	Taiwan	CNC	F
E. peculiaris	2013-23	Thailand	CNC	F
E. peculiaris	2013-24	Malaysia (Pahang)	CNC	F
E. peculiaris	2014-58	Thailand	CNC	M
E. peculiaris	2014-59	Thailand	CNC	M
E. peculiaris	2014-61	Taiwan	CNC	M
E. peculiaris	2014-62	Malaysia (Pahang)	CNC	M
E. phragmitis	2010-36	Romania	AICF	F

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TABLE 2. (Continued)

Species	CNC Photo no.	Country	Collection	Sex
E. phragmitis	2013-12	Israel	TAUI	M
E. phragmitis	2013-49	Hungary	CTPC	F
E. phragmitis	2013-121	Hungary	CTPC	M
E. phragmitis	2013-122	Hungary	CTPC	M
E. pini	2012-57	South Korea	CNC	F
E. pini	2013-19	France	CNC	F
E. pini	2013-144	France	ZSMC	M
E. pistaciae	2012-81	Greece	CNC	F
E. pistaciae	2012-82	Greece	CNC	F
E. pistaciae	2012-83	Greece	CNC	F
E. pistaciae	2013-123	Greece	CNC	F
E. pistaciae	2013-124	Greece	CNC	F
E. pistaciae	2013-125	Crimea	SIZK	M
E. pistaciae	2013-126	Crimea	SIZK	M
E. pistaciae	2013-127	Crimea	SIZK	M
E. purpuricollis	2014-109	Bulgaria	PUPB/IBER	F
E. splendens	2012-43	Spain	MNCN	F
E. splendens	2012-92	France	CNC	M
E. splendens	2012-93	France	CNC	M
E. splendens	2013-8	Spain	ARPC	F
E. splendens	2013-9	Greece (Crete)	CNC	F
E. splendens	2013-118	France	ZMAN	M
E. splendens	2013-119	France	ZMAN	M
E. splendens	2013-147	France	RMNH	M
E. stenozonus	2010-44	Canary Islands	MNCN	F
E. stenozonus	2012-62	Canary Islands	CNC	F
E. stenozonus	2013-2	Canary Islands	ZMAN	F
E. stenozonus	2013-3	Canary Islands	ZMAN	F
E. stenozonus	2013-4	Canary Islands	RMNH	F
E. stenozonus	2013-5	Canary Islands	ZMAN	F
E. stenozonus	2013-135	Canary Islands	ZMAN	M
E. stenozonus	2013-136	Canary Islands	ZMAN	M
E. stenozonus	2013-137	Canary Islands	ZMAN	M
E. stenozonus	2013-138	Canary Islands	ZMAN	M
E. stenozonus	2013-139	Canary Islands	ZMAN	M
E. stenozonus	2014-120	Canary Islands	ZMAN	M
E. stramineipes	2012-45	Romania	CNC	F
E. stramineipes	2013-120	Romania	CNC	M
E. tachardiae	2012-128	India	BMNH	F

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TABLE 2. (Continued)

Species	CNC Photo no.	Country	Collection	Sex
E. tachardiae	2012-129	India	BMNH	F
E. tachardiae	2012-130	India	BMNH	F
E. tachardiae	2012-131	India	BMNH	M
E. tachardiae	2012-132	India	BMNH	M
E. tachardiae	2014-93	South Korea	AICF	M
E. tachardiae	2014-95	South Korea	AICF	F
E. tachardiae	2014-96	South Korea	AICF	F
E. tachardiae	2014-133	China	CNC	F
E. tibicinis	2012-65	Moldova	BMNH	F
E. tibicinis	2012-66	Moldova	NMPC	F
E. tibicinis	2012-94	Moldova	NMPC	M
E. tibicinis	2013-134	Moldova	NMPC	M
E. urozonus	2010-30	Italy	CNC	F
E. urozonus	2010-31	France	ZSMC	M
E. urozonus	2012-76	Germany? (Eiche)	CNC	F
E. urozonus	2012-119	Iran	CNC	M
E. urozonus	2012-120	Romania	AICF	M
E. urozonus	2013-132	Iran	CNC	M
E. urozonus	2013-133	Iran	CNC	M
E. urozonus	2014-108	Romania	USNM	F
E. urozonus	2014-114	Iran	CNC	F
E. urozonus	2014-116	Austria	ZSMC	F
E. vindex	2010-34	Hungary	CNC	F
E. vindex	2012-33	Romania	AICF	F
E. vindex	2012-113	Romania	CNC	M
E. vindex	2013-6	Greece	CNC	F
E. vindex	2013-7	Hungary	CNC	F
E. vindex	2013-129	Greece	CPTC	M
E. vindex	2013-130	Turkey	MKUI	M
E. vindex	2013-131	Hungary	CTPC	M
E. vuilleti	2012-101	Israel	CNC	F
E. vuilleti	2012-105	United Arab Emirates	CNC	M
E. vuilleti	2013-113	United Arab Emirates	CNC	F
E. vuilleti	2013-114	Israel	CNC	F
E. vuilleti	2013-151	France	CNC	F
E. vuilleti	2013-152	Haut Senegal-Niger [ST]	USNM	F

a. Labelled “exe. St. Pietersberg Encibos”