Zootaxa 2951: 1–97 (2011)
www.mapress.com/zootaxa/

Monograph

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

ZOOTAXA

2951

The species of *Eupelmus* (*Eupelmus*) Dalman and *Eupelmus* (*Episolindelia*) Girault (Hymenoptera: Eupelmidae) in North America north of Mexico

GARY A. P. GIBSON
Agriculture and Agri-Food Canada, Canadian National Collection of Insects, K. W. Neatby Bldg., 960 Carling Avenue, Ottawa, Ontario, Canada, K1A 0C6. E-mail: Gary.Gibson@agr.gc.ca

Magnolia Press
Auckland, New Zealand

Accepted by A. Taeger: 20 Jun. 2011; published: 8 Jul. 2011

GARY A. P. GIBSON
The species of *Eupelmus* (*Eupelmus*) Dalman and *Eupelmus* (*Episolindelia*) Girault (Hymenoptera: Eupelmidae) in North America north of Mexico
(*Zootaxa* 2951)

97 pp.; 30 cm.

8 Jul. 2011

ISBN 978-1-86977-761-6 (paperback)

ISBN 978-1-86977-762-3 (Online edition)

FIRST PUBLISHED IN 2011 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)

Table of contents

Abstract

The species of *Eupelmus* (*Eupelmus*) Dalman and *Eupelmus* (*Episolindelia*) Girault (Chalcidoidea: Eupelmidae) in North America north of Mexico are revised. Illustrated keys are given to differentiate the three subgenera of *Eupelmus* and females and known males of 19 recognized species of *E*. (*Eupelmus*) and *E*. (*Episolindelia*). Five species are classified in *E*. (*Episolindelia*), including the three newly described species *E*. (*Episolindelia*) *fuscipectus* **n. sp.**, *E*. (*Episolindelia*) *grisselli* **n. sp.**, and *E*. (*Episolindelia*) *varicauda* **n. sp.**, which are based only on females. *Eupelmus rubicola* (Ashmead), described originally from a unique male, is tentatively associated with females and is classified as *E*. (*Episolindelia*) *rubicola* **n. stat.** based on this association. Fourteen species are classified in *E*. (*Eupelmus*), including the four newly described species *E*. (*Eupelmus*) *arizonensis* **n. sp.**, *E*. (*Eupelmus*) *curticinctus* **n. sp.**, *E*. (*Eupelmus*) *nitifrons* **n. sp.**, and *E*. (*Eupelmus*) *pervius* **n. sp.** Two Palaearctic species, *E*. (*Eupelmus*) *stramineipes* Nikol'skaya and *E*. (*Eupelmus*) *microzonus* Förster, are newly recorded from North America. Newly placed in synonymy under *E. microzonus* is *E*. (*Eupelmus*) *insulae* Masi **n. syn.** It is further suggested that *E*. (*Eupelmus*) *nigricauda* Nikol'skaya likely is also a junior synonym of *E. microzonus*. Information is also given on the identity of the Palaearctic names *E*. (*Eupelmus*) *afer* Silvestri, *E*. (*Eupelmus*) *martellii* Masi, *E*. (*Eupelmus*) *nubilipennis* Förster, *E*. (*Eupelmus*) *spongipartus* Förster, and *E*. (*Eupelmus*) *urozonus* Dalman. A lectotype is designated for *E*. (*Eupelmus*) *pini* Taylor and under this name are placed in synonymy the Palaearctic names *E. aloysii* Russo **n. syn.**, *E. carinifrons* Yang **n. syn.**, *E. sculpturatus* Nikol'skaya **n. syn.**, and *Eupelmus suecicus* Hedqvist **n. syn.** Four other new synonyms made are *Eupelmus amicus* Girault under *E*. (*Eupelmus*) *cushmani*

(Crawford) **n. syn.**, *Eupelmus ficigerae* (Ashmead) under *E.* (*Eupelmus*) *dryorhizoxeni* Ashmead **n. syn.**, *Eupelmus momphae* Gahan under *E.* (*Eupelmus*) *cyaniceps* Ashmead **n. syn.**, and *Eupelmus quercus* under *E.* (*Eupelmus*) *cynipidis* Ashmead **n. syn.** The subspecies *Eupelmus cyaniceps scolyti* Liao, described originally from China, is treated as *E.* (*Eupelmus*) *scolyti* Liao **n. stat.** and compared to *E.* (*Eupelmus*) *formosae* Ashmead. *Eupelmus floridanus* Howard is treated as a ***nomen dubium*** and the following 20 species are newly transferred from *Eupelmus* to other genera — *Anastatus* (*Anastatus*) *ashmeadi* (Melander & Brues) **n. comb.**, *Brasema aurata* (Ashmead) **n. comb.**, *Brasema barda* (Girault) **n. comb.**, *Brasema brevicauda* (Crawford) **n. comb.**, *Brasema bruchivora* (Crawford) **n. comb.**, *Brasema coccidis* (Girault) **n. comb.**, *Brasema dryophantae* (Ashmead) **n. comb.**, *Brasema flavovariegata* (Ashmead) **n. comb.**, *Brasema fonteia* (Walker) **n. comb.**, *Brasema juglandis* (Ashmead) **n. comb.**, *Brasema lamachus* (Walker) **n. comb.**, *Brasema limneriae* (Howard) **n. comb.**, *Brasema macrocarpae* (Ashmead) **n. comb.**, *Brasema neococcidis* (Peck) **n. comb.**, *Brasema neomexicana* (Girault) **n. comb.**, *Brasema rosae* (Ashmead) **n. comb.**, *Brasema speciosa* (Girault) **n. comb.**, *Brasema sphaericephalus* (Ashmead) **n. comb.**, *Reikosiella* (*Reikosiella*) *biguttata* (Girault) **n. comb.**, and *R.* (*Reikosiella*) *charitopoides* (Girault) **n. comb.**

Key words: Chalcidoidea, Eupelminae, illustrated key

Introduction

Species of *Eupelmus* Dalman (Hymenoptera: Chalcidoidea: Eupelmidae: Eupelminae) have been classified in the three subgenera *E.* (*Eupelmus*), *E.* (*Episolindelia*) Girault, and *E.* (*Macroneura*) Walker since Gibson (1995). The seven North American species of *E.* (*Macroneura*) were revised and keyed under the generic name *Macroneura* by Gibson (1990). However, there are no keys to the North American species of *E.* (*Episolindelia*) or *E.* (*Eupelmus*) excluding two species that Crawford (1908) included in *Cerambycobius* Ashmead, a junior synonym of *Brasema* Cameron, and three species of *E.* (*Eupelmus*) that parasitize the oriental fruit moth (Allen 1962). Furthermore, when Gibson (1995) differentiated *Brasema* from *Eupelmus* he did not include a list of valid species in either of the two genera. Most species of *Brasema* were described originally in *Eupelmus* and although Burks *et al.* (2005) corrected the nomenclature of the South American species, most North American *Brasema* remain incorrectly classified in *Eupelmus*. Because of this, Noyes (2010) listed 44 available valid species names for *Eupelmus* in the Nearctic region, but of these only 24 are true *Eupelmus* and the other names belong in *Brasema* or other genera.

Species of *Eupelmus* are mostly primary or secondary larval/pupal ectoparasitoids of a wide variety of holometabolous insects in concealed situations. Species recognition in the genus, as for other genera of Eupelminae, is based almost entirely on females. This is partly because of the extreme sexual dimorphism that uniquely characterizes Eupelminae within Eupelmidae (Gibson 1986, 1995), but also because males of most species are even more similar to each other than are females. Males of some species have been described if they were reared or otherwise associated with females, but since Ruschka (1921) keys to species of *Eupelmus* invariably differentiated only females. Furthermore, the correct application of names in North America for species of *E.* (*Eupelmus*) depends partly on resolution of species concepts within the "*urozonus*-group" in Europe, as is discussed under *E.* (*Eupelmus*). The present paper is an initial attempt to clarify the taxonomy and host relationships of Nearctic *Eupelmus* by revising the morphospecies of *E.* (*Episolindelia*) and *E.* (*Eupelmus*) within North America north of Mexico. This necessitated reviewing concepts and nomenclature of *urozonus*-group species in Europe and the generic placement of species classified in *Eupelmus* in North America. Although much was accomplished, readers are warned that exact limits of variation for some *urozonus*-group species in North America remain uncertain and not all males or females were confidently distinguished. Ultimately, accurate determination of species limits for *urozonus*-group species in both North America and Europe will require comprehensive molecular and biological analyses in association with refined morphological concepts.

Material and methods

This study was based on about 3,300 examined regional specimens plus additional Palaearctic and Neotropical specimens from 34 institutions listed below. Collections designated with an asterisk (*) indicate institutions that contain, but from which type material was not borrowed for examination. Type specimens of species described from Europe were not examined unless stated otherwise in the text. My species concepts for Palaearctic *Eupelmus* are based primarily on identified specimens borrowed from European collections plus Kalina (1988) and Askew and Nieves-Aldrey (2000).

AEIC American Entomological Institute, Gainesville, FL, USA (D. Wahl).
AICF Lucian Fusu private collection, Alexandru Ioan Cuza University of Iasi, Romania (L. Fusu).
ANSP Academy of Natural Sciences, Department of Entomology, Philadelphia, PA, USA.
BMNH The Natural History Museum, London, England (S. Ryder).
CASC California Academy of Sciences, Department of Entomology, San Francisco, CA, USA (R. Zuparko).
CDFA California State Collection of Arthropods, California Department of Food & Agriculture, Sacramento, CA, USA (S. Gaimari, J. Kishmirian).
CNC Canadian National Collection of Insects, Arachnids and Nematodes, Agriculture & Agri-Food Canada, Ottawa, ON, Canada.
CSUC Department of Bioagricultural Sciences and Pest Management, Colorado State University, Fort Collins, CO, USA (B.C. Kondratieff).
DENH University of New Hampshite Insect Collection, Department of Zoology, Durham, NH, USA (D.S. Chandler).
FSCA Florida State Collection of Arthropods, Division of Plant Industry, Gainesville, FL, USA (J. Wiley).
HNHM Hungarian Natural History Museum, Budapest, Hungary (C. Sándor).
IZCAS Institute of Zoology, The Chinese Academy of Sciences, Beijing, China (H. Xiao).
IRCW Insect Research Collection, Department of Entomology, University of Wisconsin-Madison, Madison, WI (S. Krauth).
KHPC* Karl-J. Hedqvist private collection, Stockholm, Sweden (now in BMNH).
LACM Los Angeles County Museum of Natural History, Insect Collection, Los Angeles, CA, USA (B. Brown).
MCPM Milwaukee City Public Museum, Insect Collection, Milwaukee, WI, USA.
MCSN Museo Civico di Storia Naturale “Giacomo Doria”, Genoa, Italy.
MEMS Mississippi Entomological Museum, Department of Entomology, Mississippi State University, Starkville, MS, USA (T. Schiefer).
MNHN Muséum national d’Histoire naturelle, Ensemble Arthropodes terrestres, Paris, France (A. Touret-Alby).
NCSU North Carolina State University Insect Museum, Department of Entomology, Raleigh, NC, USA (B. Blinn).
NHMW Naturhistorisches Museum, Vienna, Austria (D. Zimmerman).
NHRS Swedish Museum of Natural History, Department of Entomology, Stockholm, Sweden (H. Vardal).
NMPC* National Museum, Natural History, Prague, Czech Republic (P. Janšta).
NWCF Insect Collection of the Insect Natural Enemies Research Laboratory, Northwestern College of Forestry, Yangling, Shaanxi, China (Z.-Q. Yang).
MNCN Museo Nacional de Ciencias Naturales, Madrid, Spain (M. Paris).
QMBA* Queensland Museum, Brisbane, Australia.
OXUM* Hope Entomological Collections, Oxford University Museum, Oxford, England.
TAMU Texas A&M University, College Station, TX, USA (E. Riley).
UAIC University of Arizona Insect Collection, Department of Arizona, Tucson, AZ, USA (C. Olson).
UCDC Bohart Museum of Entomology, University of California, Davis, CA, USA (S. Heydon).
UCFC University of Central Florida Collection of Arthropods, Department of Biology, Orlando, FL, USA (S. Fullerton).
UCRC UCR Entomological Teaching and Research Collection, University of California, Riverside, CA, USA (S. Triapitsyn).
UMRM University of Missouri, W.R. Enns Entomology Museum, Columbia, MO, USA (W.R. Enns).
USNM United States National Entomological Collection, U.S. National Museum of Natural History, Washington, DC, USA (M. Gates).
WFBM W.F. Barr Entomological Collection, University of Idaho, Moscow, ID, USA (F. Merickel).

ZINR* Zoological Institute of Russian Academy of Sciences, St. Petersburg, Russia.
ZMUC Zoological Museum, University of Copenhagen, Copenhagen, Denmark (L. Vilhelmsen).
ZSMC Bavarian State Collection of Zoology, Munich, Germany (S. Schmidt).

Observations were made using a halogen light source and a Nikon SMZ-U microscope fitted with a 10 mm ocular grid having 100 divisions. A piece of translucent Mylar tracing acetate was taped to the objective between the light source and specimen to reduce glare. Specimens were photographed with a Leica DC500 digital camera attached to a Leica Z16 APO macroscope and the serial images obtained combined with AutoMontage. These and the scanning electron microphotographs of male scapes, obtained from uncoated specimens using a Philips XL30 environmental SEM, were digitally retouched using Adobe Photoshop to enhance clarity. Specimens used for photography or microphotography are designated, respectively, with a “CNC Photo 2010” or “CNCI LB-specm” number. This number is cited in the lists of material examined for the respective specimen and in the figure captions for the respective image.

Generic and subgeneric concepts follow Gibson (1995). Gibson (1995, 1997) are followed for terms for structure, with the additional expression **scapular scrobe** (Fig. 73: ss) used for the depression on the outer surface of the male scape into which the pedicel fits when the flagellum is pressed to the scape. Gibson (2009) is followed for terms for sculpture, with the additional term **imbricate** used for sculpture that appears to overlap slightly (i.e. shingle-like) *sensu* Harris (1979). The method of describing the sculpture pattern of the acropleuron and abbreviations used for head measurements follow Gibson (2010). Measurement of scape length does not include the radicle. Width of antennal segments does not include the length of projecting setae; hence, measurement of the width of a flagellomere is influenced by setal density and the extent to which setae are appressed to the flagellomere. Accurate measurement of length of the ovipositor sheaths is very important for identifying females of some *E.* (*Eupelmus*) species. Length of the **ovipositor sheath** (Fig. 9: osh) (= third valvula) is measured in ventral view. It is measured from the transverse suture that differentiates it from the basal **inner plate of the ovipositor** (Fig. 9: ipo) (= second valvifer) and includes the constriction between the two. In most species the inner plate of the ovipositor extends to or only slightly beyond the apex of the gaster (e.g. Figs 38−40). However, females of some species with comparatively long ovipositor sheaths have the inner plate extending conspicuously beyond the apex of the gaster so as to increase the **apparent sheath length** (= length of part of inner plate of the ovipositor projecting beyond apex of gaster + length of ovipositor sheaths) (Fig. 9: asl). Measurement of lengths of the costal cell, marginal, postmarginal and stigmal veins, and other forewing terms used in the descriptions are illustrated in figure 8. Length of the marginal vein is measured between the point of intersection formed between the postmarginal (Fig. 8: pmv) and stigmal (Fig. 8: stv) veins and the point at which the parastigma (Fig. 8: pst) of the submarginal vein (Fig. 8: smv) appears to abut the leading margin of the wing so as to form the base of the marginal vein (Fig. 8: mv). Determining the exact basal point of the marginal vein for measurement can sometimes be difficult because the parastigma curves to form the marginal vein, often resulting in a variably distinct and slender, tapered membranous region above the extreme base of the marginal vein.

Species descriptions are based on regional specimens only, regardless of whether additional specimens considered as conspecific were available from other regions, except for the male of *E.* (*Eupelmus*) *pini* Taylor. The descriptions given for species of *E.* (*Episolindelia*) are much shorter and not rigorously comparable with those given for the species of *E.* (*Eupelmus*) because they are much more readily distinguished. Specimens cited without a collection codon in the lists of material examined are in the CNC. Collection data for holotypes and allotypes are cited as per the type labels, with a “/” distinguishing data on separate labels. For the lists of material examined, obvious errors in data given on labels were corrected and most abbreviations written in full for clarity, but some label data not relevant to locality or hosts were sometimes omitted in order to reduce the length of these sections. Label data other than for primary types were also standardized, including citing the county for specimens collected in the USA. Data given between square brackets are comments by the author, often indicating unreadable writing on labels, the presumed meaning of abbreviations, or additional information taken from other sources. Only the last two digits of the collection year is given for years in the 20th century except where this might cause confusion; the full collection year is always given for specimens collected prior to 1900 and after 1999. For multiple collection events with similar data the data common to all records are given first and separated from record-specific data by a “—”. In order to facilitate comparisons, the family classification of arthropod hosts listed for each species under “Biology” follows Noyes (2010) (e.g. bark beetles are treated as the family Scolytidae rather than a subfamily within Curculionidae). New host records not listed in Noyes (2010) are marked with an asterisk (*). Previously recorded hosts are validated either through reference to Noyes (2010) or, usually, at least one original literature citation. Listed “plant associates” include only those plants that label data indicate specimens were reared from rather than just collected on.

Descriptive taxonomy

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 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.
Propelma Trjapitzin, 1963: 89−91. Type species: †*Propelma rohdendorfii* Trjapitzin, by monotypy and original designation (Baltic amber inclusion). Synonymy by Gibson, 1995: 198.
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.

Remarks. Females and males of *Eupelmus* can be differentiated from those of other genera of Eupelminae using the respective keys in Gibson (1995). Within North America, females are distinguished by the following combination of features: mesotibia apically without groove between tibial spur and base of tarsus (Figs 18, 19, 32, 33; Gibson 1995, figs 332−335); apical tergum (syntergum) of gaster with posterior margin deeply, omega-like (Ω) emarginate, and extremely short dorsally anterior to emargination (Gibson 1995, figs 321−324); penultimate tergum (Gt6) divided dorsolongitudinally by at least a hyaline line and usually partly or completely concealed under posteriorly projecting Gt5 (Gibson 1995, figs 321−324); prepectus with frontal surface *sensu* Gibson (1986) yellow (Figs 42−44). Macropterous females also often have a linea calva (Fig. 8: lc) and obviously exserted ovipositor sheaths that usually are banded, either being dark basally and light apically (e.g. Figs 4, 22) or, more commonly, dark-light-dark (e.g. Figs 5, 24, 34−41).

Regional males of *Eupelmus* are distinguished primarily by having a broad, oblique bare region (speculum) that is contiguous with the basal fold and parastigma to the base of the marginal vein (Gibson 1995, fig. 491). Males of most species also have a longitudinal line of several long, distally curved setae ventrally on the pedicel (Figs 55, 57, 64–66), and one long seta near the base of the mandible below the malar sulcus (Figs 64, 67, 69; Gibson 1995, figs 403, 404). However, the latter two features are not possessed by males of *E*. (*Episolindelia*) *australiensis* (Girault) (Fig. 6), *E*. (*Episolindelia*) *rubicola* (Ashmead) (Figs 7, 56) or *E*. (*Macroneura*) *meteori* (Gahan) in North America.

Gibson (1990: 843) discussed color, sculpture and structural features to help differentiate males of *E*. (*Macroneura*) from those of *E*. (*Eupelmus*), but as is evident from the key below no single feature adequately distinguishes males of the subgenera and the subgenera themselves almost certainly represent a grade of structure rather than monophyletic lineages. *Eupelmus* (*Episolindelia*) comprises what appears to be a comparatively basal group of species whose females retain various symplesiomorphic features of the metanotal-propodeal complex and mesotibial and mesotarsal pegs, whereas *E*. (*Macroneura*) is restricted to species with brachypterous females having an apomorphic metanotal structure. Consequently, *E*. (*Macroneura*) may be monophyletic, but the three subgenera probably represent a nested paraphyletic series.

Key to subgenera of *Eupelmus* Dalman

1 Female 2
- Male. 5

2(1) Brachypterous 3
- Macropterous. 4

3(2) Metanotum large, flattened, and more or less concave posterior to scutellar apex; 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 Gibson 1990 for key to species)
- Metanotum transverse with convex dorsellum covering apex of scutellum (Figs 11, 50); propodeum with a conspicuous V or U-shaped plical depression medially (Figs 11, 50); pronotal collar without transverse ridge (Fig. 11) . . . . ***E.* (*Eupelmus*)**

4(2) Mesotarsal pegs white to reddish, often difficult to distinguish from tarsomeres (Figs 1−5); mesotibial apical pegs, if apparent, more or less spinelike and same color as tibia; propodeum without distinctly exposed plical depression, the posteriorly protuberant dorsellum essentially contiguous with incised anterior margin of propodeum (Gibson 1995, figs 181, 240); lateral surface of prepectus bare . . . . ***E.* (*Episolindelia*)**
- Mesotarsal pegs usually black, but at least brown and contrasting distinctly with whitish tarsomeres (Figs 18, 19, 32, 33); mesotibia sometimes without (Fig. 18), but usually with row of dark pegs along apical margin (Figs 19, 32, 33); propodeum with V to U-shaped plical depression exposed posterior to almost transverse posterior margin of dorsellum (Fig. 50); lateral surface of prepectus often with setae (e.g. Figs 42−44) . . . . ***E.* (*Eupelmus*)**

5(1) Flagellum short-clavate and with apex of pedicel and strongly transverse fl1 yellow (Fig. 6); tegula yellow, contrasting with metallic green mesosoma (Fig. 6); pedicel ventrally without line of long, distally curved setae; head with short, scattered seta above and below malar sulcus. . . . . ***E.* (*Episolindelia*)** [part]
- Flagellum variable, often slender to robust-filiform, but if distinctly clavate then pedicel and flagellum dark; tegula usually dark; pedicel ventrally usually with line of long, distally curved setae (Figs 55, 57, 64−66); head usually with one longer seta below malar sulcus near base of mandible and sometimes additional long, curved setae on lower face above malar sulcus (Figs 64, 67−70) 6

6(5) Head without differentiated long seta below malar sulcus; pedicel ventrally with 2−4 straight setae, but at most only 3 in single line (Fig. 56) 7
- Head with one seta below malar sulcus obviously longer than other setae (Figs 64, 67−70); pedicel ventrally with longitudinal line of 4–10 quite long setae, and the setae quite obviously curved distally if comparatively few in number (Figs 55, 57, 64−66) (not visible if pedicel appressed to scape). 8

7(6) Metacoxa usually extensively yellowish but at least outer surface finely coriaceous, smooth and shiny except for engraved lines; legs often entirely yellowish-orange beyond coxae . . . . ***E.* (*Macroneura*)** [part]
- Metacoxa dark with outer surface quite distinctly reticulate; legs with all femora and at least metatibia partly brown (Fig. 7). . . . . ***E.* (*Episolindelia*)** [part]

8(6) Legs mostly or entirely dark except usually for basal 1−4 tarsomeres and often knees and apices of tibiae very narrowly (Figs 58−61) . . . . ***E.* (*Eupelmus*)** [part]
- Legs, including sometimes coxae, more extensively light-colored to brown with at least about basal half of tibiae light-colored (Figs 52−54) 9

9(8) Maxillary and labial palpi and tegula, except sometimes apically, white (Figs 52, 53); head and body distinctly green to blue; flagellum sometimes clavate . . . . ***E.* (*Eupelmus*)** [part]
- Maxillary and labial palpi and tegula brown; head and body often yellowish to brown; flagellum always filiform 10

10(9) Mesosoma comparatively short and robust, only about 1.5× as long as wide; metacoxa variably distinctly reticulate-roughened; head and body dark but scape and often legs beyond coxae, or at least tibiae, entirely yellowish (Fig. 54) . . . . ***E.* (*Eupelmus*)** [part]
- Mesosoma more elongate-gracile, at least about 1.7× as long as wide; metacoxa very finely coriaceous; color variable, sometimes almost completely yellowish, but if dark then scape at least dorsally and/or tibiae partly brown…***E.* (*Macroneura*)** [part]

Eupelmus (*Episolindelia*) Girault

Episolindelia Girault, 1914.
Eupelmus (*Episolindelia*); Gibson, 1995.

Remarks. Females of *E*. (*Episolindelia*) are differentiated from females of *E*. (*Eupelmus*) by the features given in Gibson (1995) and in the key to subgenera above. Females are always macropterous, have hyaline forewings, and the ovipositor sheaths are obliquely strigose basally. The strigose region constitutes the basal dark region in those females with a bicolored sheath, and usually has noticeably longer setae dorsally and often is slightly thinner than the rest of the sheath. The latter feature is most conspicuous for females of *E. varicauda* in which the sheaths appear somewhat clavate.

Unlike males of *E*. (*Eupelmus*) and most males of *E*. (*Macroneura*), it is likely that males of at least regional species of *E*. (*Episolindelia*) do not have a differentiated long seta below the malar sulcus or a row of distally curved setae along the ventral margin of the pedicel. This conclusion is based on the males of *E. australiensis* and the proposed sex association for *E. rubicola*. It is further likely that regional males *E*. (*Episolindelia*) have a filiform or clavate flagellum depending on whether conspecific females have a similar antennal structure (*cf*. Figs 1, 6 and 3, 7).

Key to species of *E*. (*Episolindelia*) in North America north of Mexico

1 Female 2
\- Male 6
2(1) Flagellum elongate-gracile, fl2−fl5 at least twice as long as wide and length of clava at most only about one-third length of funicle (Figs 3, 5); propodeum with short plical region and median carina behind dorsellum; fl1 and usually pedicel similarly dark as rest of flagellum 3
\- Flagellum short-clavate, fl2−fl5 at most only slightly longer than wide and length of clava at least half length of funicle (Figs 1, 2, 4); propodeum with plical region U-like, linear behind dorsellum; fl1 and pedicel at least apically yellow in contrast to rest of flagellum (Figs 1, 2, 4) 4
3(2) Mesosoma dark except usually for V-like, posteriorly protuberant part of dorsellum (Fig. 5); maxillary and labial palpi and all but extreme apex of profemur dark brown (Fig. 5); scape usually extensively yellowish-orange except along dorsal margin (Fig. 5) . . . . ***E*. (*Episolindelia*) *fuscipectus* n. sp.**
\- Mesosoma with at least prepectus and tegula yellow in addition to protuberant part of dorsellum (Fig. 3); maxillary and labial palpi and profemur entirely or extensively yellow (Fig. 3); scape brownish except sometimes basally (Fig. 3) . . . . ***E*. (*Episolindelia*) *rubicola* (Ashmead)**
4(2) Ovipositor sheath usually about as long as gaster but at least uniformly brown to yellowish-brown; scape dark (Fig. 1); mesosoma brown with slight metallic luster to bright green or bluish-green, but prepectus and tegula yellow (Fig. 1); forewing without linea calva . . . . ***E*. (*Episolindelia*) *australiensis* (Girault)**
\- Ovipositor sheath usually distinctly shorter than gaster but at least partly yellowish-white (Figs 2, 4); scape at least partly yellow (Figs 2, 4); mesosoma either yellow laterally or at least tegula brown (Figs 2, 4); forewing with linea calva 5
5(4) Mesosoma bronzy-brown in strong contrast to yellow gaster (Fig. 2); front and hind legs with femora and tibiae dark except for knees and tibiae apically (Fig. 2); mesonotum finely coriaceous-reticulate . . . . ***E*. (*Episolindelia*) *grisselli* n. sp.**
\- Mesosoma bicolored, yellow laterally but mesonotum all or mostly metallic green to blue (Fig. 4); all legs, including coxae, entirely yellow (Fig. 4); mesonotum distinctly reticulate . . . . ***E*. (*Episolindelia*) *varicauda* n. sp.**
6(1) Flagellum short-clavate with short, inconspicuous setae (Fig. 6); tegula yellow in contrast to usually metallic green mesosoma (Fig. 6); metacoxa very finely coriaceous . . . . ***E*. (*Episolindelia*) *australiensis* (Girault)**
\- Flagellum elongate-filiform with long, outstanding, curved setae (Figs 7, 56); tegula dark, not contrasting with dark mesosoma (Fig. 7); metacoxa strongly reticulate . . . . ***E*. (*Episolindelia*) *rubicola* (Ashmead)**

1. *Eupelmus* (*Episolindelia*) *australiensis* (Girault)
Figs 1, 6; Map 1

Idoleupelmus australiensis Girault, 1913: 94−95. Lectotype, female (QMBA, examined) designated by Bouček, 1988: 560 (see Dahms, 1983: 101). Type data: Australia: Queensland, Nelson [Cairns], sweeping in forest, April 4, 1913.
Eupelmus australiensis; Girault, 1915: 2.
Eupelmus listeri Girault, 1915: 13. Syntypes, female (QMBA, examined). Type data: Australia: New South Wales, Chindera [Tweed River]. Synonymy by Bouček, 1988: 560 (see Dahms, 1984: 758).

Eupelmus australicus Girault, 1915: 8. Lectotype, female (QMBA, examined) designated by Bouček, 1988a: 560. Type data: Australia: Queensland, Brisbane. Synonymy by Bouček, 1988: 560.

Eupelmus popa Girault, 1917c: 4. Syntypes, female (USNM, examined). Type data: Dutch Antilles [Lesser Antilles], Curacao; reared from *Contarinia sorghicola* (Coq.) (Diptera: Cecidomyiidae) in sorghum. Synonymy by Bouček, 1988: 560.

Eupelmus Zangherii Masi, 1946: 27−28. Syntypes, female (MCSN, examined). Type data: Italy, Forli. Synonymy by Bouček, 1965b: 9.

Eupelmus alboannelatus Belanovsky & Dyadechko, 1951: 293. Syntypes, both sexes (ZINR, plus 1♂ and 1♀ syntype NMPC, not examined). Synonymy by Bouček, 1965a: 545, 546 (proposed as synonym of *E. zangherii*).

Eupelmus (*Episolindelia*) *australiensis*; Gibson, 1995: 202.

Description. FEMALE (Fig. 1). Length about 1.3−2.2 mm. Head capsule rarely brown with only slight metallic luster, more commonly bright metallic green or bluish-green; maxillary and labial palpi white to yellowish. Antenna dark brown except fl1 and extreme apex or up to about apical half of pedicel yellow. Mesosoma similar in color to head, but prepectus and tegula yellow. Legs beyond coxae yellow except mesotibia with short, subbasal brown band and anterior surface of mesofemur usually with subapical brown spot at same level of tibial band when femur and tibia appressed, and with apical 1 or sometimes 2 tarsomeres brownish. Gaster yellowish to darker orange or brown dorsally, or yellowish with somewhat darker brown bands dorsolaterally, and often with slight metallic green luster dorsobasally and sometimes laterally, but ovipositor plate ventrally and sheath brown to yellowish-brown.

Head very finely meshlike coriaceous-reticulate except scrobal depression finely, transversely wrinkled above interantennal region; IOD about 0.4−0.5× head width; OOL: POL: LOL: MPOD = 1.3−1.6: 2.6−3.4: 1.4−2.0: 1.0. Antenna with flagellum short-clavate, combined length of pedicel + flagellum only about 1.1−1.3× width of head, fl1 ringlike and subsequent funiculars increasing distinctly in width distally such that pedicel slightly longer than combined length of fl1−fl3, fl4 the most elongate-slender funicular but at most only about 1.4× as long as wide, and clava about half to almost two-thirds length of funicle and 2.1−2.6× as long as wide. Mesoscutum meshlike coriaceous-reticulate medially to more distinctly coriaceous with smaller cells on lateral lobes; scutellar-axillar complex meshlike coriaceous with somewhat smaller cells than mesoscutum medially. Acropleuron with fine meshlike sculpture, the sculpture minute mesally compared to much larger, isodiametric cells posteriorly. Forewing completely setose without linea calva; mv about 2.2−2.9× length of pmv and 3.2−4.1× length of stv; pmv about 1.4−1.5× length of stv. Mesotibia with yellowish, unobvious, spinelike apical pegs (Gibson 1995, fig. 332); mesotarsus ventrally padlike-setose with slender, yellowish to apically reddish but difficult to distinguish mesotarsal pegs on tarsomeres 1−3, the basitarsus with sparse row of pegs along anterior margin and either an incomplete row or at least fewer pegs along posterior margin, second tarsomere with 1 or 2 pegs apically on anterior margin and 1 peg apically on posterior margin, and third tarsomere usually with 1 peg apically on either side. Propodeum with plical region U-like linear behind dorsellum. Ovipositor sheaths sometimes curved but similar in length to gaster and about twice as long as mv.

MALE (Fig. 6). Length about 1.2−1.6 mm. Color similar to female except antenna also with about basal half to two-thirds of scape yellow, mesosoma with only tegula yellow, legs beyond coxae entirely yellow except for apical tarsomeres, and gaster brown.

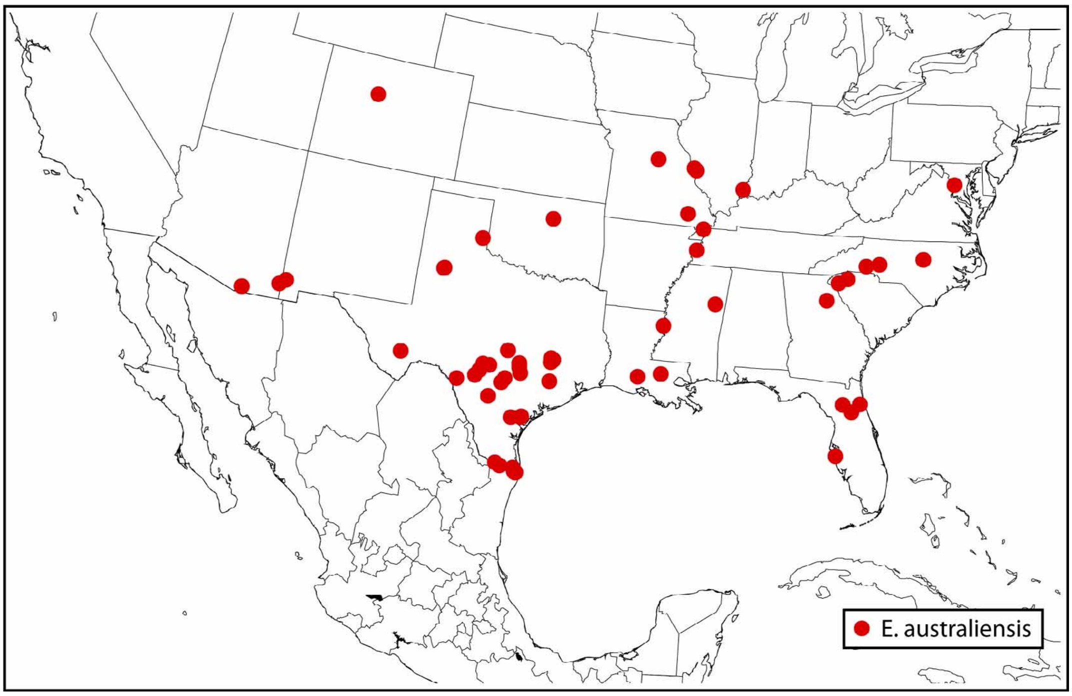
Sculpture similar to female except median mesoscutal lobe more uniformly meshlike coriaceous; mesoscutum with complete, fine, linear notauli; mesopleuron finely, meshlike coriaceous to coriaceous-alutaceous, including lower mesepimeron (apical region posterior to vertical sulcus originating at anterodorsal angle of mesocoxa); metacoxa finely, meshlike coriaceous; propodeum with median carina, but otherwise very finely, meshlike coriaceous. Head with short white setae not differentiated in length or density on lower face or gena below malar sulcus. Antenna short-clavate similar to female, with fl4 sometimes slightly longer than wide and fl5 sometimes quadrate, but other funicular articles transverse and increasing distinctly in width to clava; pedicel ventrally without line of long, distally curved setae. Forewing with speculum closed posteriorly by complete mediocubital setal line; mv about 1.9−2.0× length of pmv and about 2.3−2.6× length of stv; pmv at most about 1.25× length of stv.

Regional material examined (490♀, 56♂). USA. **ARIZONA**: ***Cochise Co.***, Portal, South West Research Station, 14.IX.78, G. Gordh (1♀ UCRC). ***Santa Cruz Co.***, Patagonia — 16.VIII.93, M. Sharkey (1♀); Sonoita Creek Reserve, 31.53ºN 10.77ºW, 4.XI.93, Brown/Wilk (4♀). **ARKANSAS**: ***Mississippi Co.***, Nodena, 22.VI.66, ragweed (1♀ MEMS). **COLORADO**: ***Eagle Co.***, Minturn, 7800', 1.VIII.87, J.D. Pinto (1♀). **FLORIDA**: ***Alachua Co.***, Gainesville — 12.VIII.82, N. Backus, *Cenchrus echinatus* (2♀ FSCA); AEI, 20.VIII-14.IX.87, D.B. Wahl (1♀). ***Manatee Co.***, Bradenton, 11.XII.85, D. Schuster (1♀). ***Marion Co.***, Eureka, 3.IX.76, E.E. Grissell (2♀ FSCA). ***St.***

Johns Co., Hastings, VIII.77, R. Workman, *Sorghum* (9♀, 1♂ FSCA). **GEORGIA**: ***Clarke Co.***, Lake Herrick, Oconee Forest Park, 11-12.VII.87, J. Huber (4♀). **INDIANA**: ***Posey Co.***, New Harmony, 5.X.83, J.T. & D.E. Huber (1♀). **LOUISIANA**: ***East Baton Rouge Parish***, Baton Rouge, 5.VIII.72, L.O. Newsom, [?] *Paspalum* (1♀ USNM). ***Lafayette Parish***, Duson, 1 km N., 11.VIII.96, L.A. Baptiste (27♀, 4♂ UCDC). ***Madison Parish***, Tallulah (85♀, 1♂ MEMS; 1♀ USNM). **MARYLAND**: ***Calvert Co.***, American Chestnut Land Trust, Warrior's Rest Sanctuary, 38º32.006'N 36º35.326'W, 22.VI-8.VII.2007, SEL Hym. Unit (1♀ USNM). **MISSISSIPPI**: ***Oktibbeha Co.***, State College, 22, 30.IX.42, A.L. Hamner, reared from *C. sorghicola* (2♀ MEMS). **MISSOURI**: ***Boone Co.***, Columbia, 10.X.21 (6♀, 2♂ USNM). ***Pemiscot Co.***, Lee Farm, Delta Center, Portageville, 21.VII-12.VIII.77, R.D. Sheeley, *Sorghum* (43♀, 4♂ USNM). ***St. Charles Co.***, St. Charles near Mississippi River, 5.IX.83, J.T. Huber (1♀). ***St. Louis Co.***, St. Louis, Overland, 30.VI.83, E.E. Grissell (4♀ USNM). ***Wayne Co.***, Williamsville, VIII.87 (1♀), 10-26.IX.87 (2♀, 3♂), 8-13.VIII.88 (1♀), 21.X-11.XI.88 (2♀), J. Becker. **NEW MEXICO**: ***Hidalgo Co.***, Cotton City, 4.IX.71, E.E. Grissell & R.F. Denno (1♀ UCDC). **NORTH CAROLINA**: ***Cleveland Co.***, Shelby, 8 mi. N., 26.IX.78, T.J. Bradway (1♀ NCSU). ***Mecklenburg Co.***, Davidson, 14.IX.54, T. Daggy (4♀ NCSU). ***Scotland Co.***, Sandhills, 34.98013ºN 79.55366ºW, 138 m, 17.X.2010, G. Gibson (1♀). ***Wake Co.***, Raleigh, 20.X.40, 12.VIII.40, S.C. Schell (3♀ USNM). Near Raleigh, Centen. campus, 19.IX.94, C.R. Bartlett (3♀ NCSU). Mid Pines Road, 18.X.2010 — 35.741ºN 78.705ºW, G. Gibson (1♂); 35.711ºN 78.705ºW. E. Talamas (1♀). **OKLAHOMA**: ***Payne Co.***, Stillwater, X.58, E.A. Wood, ex *Sorghum* midge (1♂ USNM). **SOUTH CAROLINA**: ***Greenville Co.***, Greenville, 17.IX.55, G. & L. Townes (1♀ AEIC). ***Pickens Co.***, Clemson, Cherrys Crossing, 25-31.VII.87, J. Johnson (1♀). **TEXAS**: ***Bandera Co.***, Lost Maples State Park, 21.VII.86, J.B. Woolley & G. Zolnerowich (5♀ TAMU). ***Bexar Co.***, San Antonio — 15.VII.20, 18.VIII.20, C.H. Gable, ex *C. sorghicola*; 1934, E.V. Walter, ex *Sorghum* midge (1♀ CSCA; 23♀, 11♂ USNM); IX.42, E.S. Ross (1♀, 2♂ CASC); Green Mountain Road, 20.V.95, D.M. Pollock (1♀ MEMS). ***Brazos Co.***, College Station — 16.X.36, R.J. Reinhard (1♀ USNM); 30.VI.81, G.W. Brooks, voucher spec. #16 Texas A&M Univ. (7♀, 11♂ TAMU); Lick Creek Park, 16.X.-17.XI.87, Woolley & Heraty (1♀). Koppe's Bridge, 5 mi. SW Wellborn, 22.VI.72, E.E. Grissell (19♀ TAMU). ***Brewster Co.***, park 5 mi. S. Marathon, 19.VII.63, A.B. Gurney (1♀ USNM). ***Burnet Co.***, Inks Lake State Park, 2.V.87, G. Zolnerowich (1♀). ***Caldwell Co.***, near Lockhart, 1983, C. Cole (1♀). ***Cameron Co.***, Brownsville, upper six, VIII-IX.56 (4♀ USNM). Rancho Viejo Olmito, 3-9.III.66, D.F. Gunz (1♂). Sabal Palm Grove, Brownsville — 6.VII.82, G.A.P. Gibson (3♀); 10.VIII.83, M. Kaulbars (1♀). Southmost Ranch, 7 mi. SE Brownsville, 3-5.XII.78, E. Grissell & A. Menke (1♀ USNM). Southpoint Nursery, 1.0 mi. S. Southmost Ranch, 5-6.VII.82, G.A.P. Gibson (32♀). ***Collingsworth Co.***, 29.IX.61, R. Lynch (6♀, 2♂ TAMU). ***Colorado Co.***, Altwater Prairie Chicken National Wildlife Refuge, 3.VII.91, J.B. Woolley (1♀). ***Frio Co.***, Pearsall, 6 mi. SE, 7.VII.72 — E.E. Grissell & J. Smith (11♀, 3♂ TAMU); E.E. Grissell, sweeping *Sorghum halepense* (21♀, 4♂ FSCA). ***Hidalgo Co.***, Bensten, Rio Grande State Park, 100', 3.VII.82 (1♀). Edinburg, X.51, R.T. Rihard, on *Rhodes* grass (1♀ USNM). Santa Ana National Wildlife refuge, 150', 4.VII.82, G.A.P. Gibson (27♀, 4♂; ♀ CNC Photo 2010-1, ♂ CNC Photo 2010-2). ***Kerr Co.***, Kerrville — 18.VII.56, L.J. Bottimer (2♀); 13.VIII.63, N.L.H. Krauss (1♀ USNM). Stumbergs Patio Ranch, 5.6 mi. W. Hunt, 2000', 1-2.VII.82, G.A.P. Gibson (18♀ CNC; 5♀ AEIC). ***Lubbock Co.***, 4.IX.63, D.R. Rummel (13♀ TAMU). Lubbock, 25.V.64, J. Arding (2♀, 1♂). ***Refugio Co.***, Woodsboro, 8 mi. SW, 14.VI.72, sweeping *Parthenium*, E.E. Grissell (4♀ TAMU). ***San Patricio Co.***, Corpus Christi State Park, 5 mi. W. Mathis, 16.VII.54, J.G. Chillcott (1♀). Welder Wildlife Refuge, Pollito Lake, 29.VI.84, J.C. Schaffner (1♀). ***Travis Co.***, Austin, Zilker Park — 8.X.83, J.B. Woolley (45♀); 27.VI.86, Heraty (4♂ CNC; 5♀, 5♂ TAMU). Heap Farm, 11 mi. S. Austin, 2.VIII.72, E.E. Grissell (1♀ TAMU). ***Ulvalde Co.***, Garner State Park near Rio Frio, 1400', Woolley & Zolnerowich (5♀, 1♂). ***Val Verde Co.***, Del Rio, 20 mi. E., 21.VII.63, A.B. Gurney (1♀ USNM). **VIRGINIA**: ***Fairfax Co.***, near Annandale, 7-13.X.90, D.R. Smith (1♀).

Distribution. Widely throughout southern half of USA to about 40ºN (Map 1). Noyes (2010) listed *E. australiensis* from all biogeographic realms and continents except Antarctica. Callan (1941) stated that the species was apparently accidentally introduced into the Nearctic region from Asia.

Biology. A primary or secondary parasitoid of species of *Contarinia* Rondani (Diptera: Cecidomyiidae) in *Sorghum* L. (Poaceae) and other grasses and herbaceous plants, including the sorghum midge, *Contarinia sorghicola* (Coquillett). When a hyperparasitoid, reported primary hosts are *Aprostocetus diplosidis* Crawford and *Tetrastichus* sp. (Hymenoptera: Eulophidae) (Woodruff 1929). Woodruff (1929) also reported that *E. australiensis* larvae sometimes feed on the sap of the sorghum plant if only a single host larva is available and this is insufficient for complete development. Haseman (1933) reared *E. australiensis* in "breeding jars" along with adults of the sorghum webworm, *Celama sorghiella* (Riley) (Lepidoptera: Noctuidae), and three other parasitic Hymenoptera. This host association has not been confirmed by a subsequent rearing and it is possible there were also unmentioned midges in the mass rearings by Haseman (1933). See Noyes (2010) for complete host list and extensive literature citations.



Map 1. Regional distribution of *E. australiensis*.

2. *Eupelmus* (*Episolindelia*) *fuscipectus* n. sp.
Fig. 5; Map 2

Type material. HOLOTYPE (♀, CNC no. 23945): USA: FL: Seminole Co., Sanford, CFREC, 18.VIII.1987, V. Gupta, MT / Holotype *Eupelmus* (*Episolindelia*) *fuscipectus* Gibson, CNC Type no. 23945. [Condition: point-mounted; entire.]

PARATYPES (20♀). USA. **ARIZONA**: ***Santa Cruz Co.***, Pena Blanca Lake, 1.0 mi. S., 4100', 6.VIII.82, G. Gibson (1♀). **FLORIDA**: ***Alachua Co.***, Gainesville, American Entomological Institute — 24-30.IV.86, J. LaSalle (1♀); 17-24.VII.87, BRC Hym. Team (1♀); 19-30.X.86, D. Wahl (1♀). ***Brevard Co.***, Titusville, State Road 405, Enchanted Forest Sanctuary, White Trail, 21.II-7.III.2000, Z. Prusak, P.J. Russell & S.M. Fullerton, Xeric Oak Hammock (1♀ UCFC). ***Seminole Co.***, Econ Wildlife Area, 1.X.2000, T. Smith, P. Russell & S.M. Fullerton, Scrub Oak/Saw Palmetto (unburned) (1♀ UCFC). Sanford, CFREC, 1.IX.87 (1♀), 28.IX.87 (1♀), 13.X.87 (2♀, CNC Photo 2010-5), V. Gupta. **MISSISSIPPI**: ***Bolivar Co.***, Boyle, 19 km W. on Hwy 446, 33º42'N 99º55'W, 20.VII-3.VIII.97, N.N. Schiff (1♀ UCDC). **NEW MEXICO**: ***Lincoln Co.***, Lincoln, 2 mi. E., 5600', 18.VI.82, G. Gibson (1♀). **TEXAS**: ***Brazos Co.***, Lick Creek Park, College Station, 8-21.IX.81, J.B. Woolley, R. Cecora (1♀). ***Gillespie Co.***, Fredericksburg, 3, 9.V.88, H. & M. Townes (2♀ AEIC). ***Kerr Co.***, Center Point, 21.VI-6.VIII.87, R. Wharton (1♀). ***Nacogdoches Co.***, Steven F. Austin Experimental Forest, Angelina National Forest, 12 km E. Nacogdoches, 30º21'N 94º47'W, 16.V-5.VI.2003, N. Schiff & C. Rudolph (2♀ UCDC). **VIRGINIA**: ***Fairfax Co.***, near Annandale, 28.V-4.VI.88, D. Smith, MT (1♀). **WEST VIRGINIA**: ***Hardy Co.***, Mathias, 3 mi. NE, 38º54.6'N 78º52.8'W, 6.IX-2.X.07, D.R. Smith (1♀, USNM).

Extralimital specimens excluded from type series. BRAZIL. ***Guanabara***: Represa Rio Grande, VII.72, F.H. Oliveira (1♀). ***Pernambuco***: Caruaru, IV-V.72, M. Alvarenga (1♀). MEXICO. ***Chiapas***: L. [Lagunas de] Montebello National Park, 13.VI.69, W.R.Mason (1♀). Munic. Ocozocoautla, El Aguacero, 1800'-2200', 8.VIII.90, J.W. Woolley (1♀). ***Puebla***: Acatepec, 4.4 mi. SW, 9.VII.81, Bogar, Schaffner & Friedlander (1♀ TAMU).

Etymology. A noun in apposition; combination of the Latin words *fusci* (dark) and *pectus* (breast) in reference to its dark mesosoma as opposed to that of *E. rubicola*.

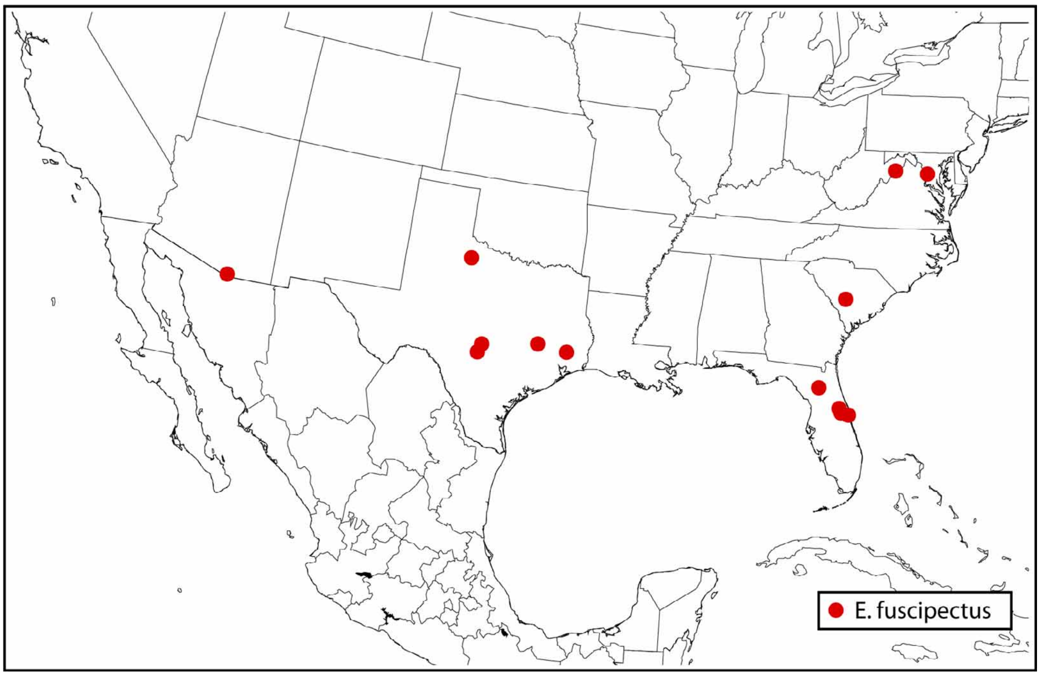
Description. FEMALE (Fig. 5). Length about 2.0−3.9 mm. Head dark brown with slight metallic lusters under some angles of light; maxillary and labial palpi brown. Antenna sometimes entirely dark brown, but usually scape partly to entirely yellow to yellowish orange and sometimes inner surface of pedicel light brown to yellowish. Mesosoma dark brown with V-shaped, posteriorly protuberant part of dorsellum usually yellowish, and mesoscutum medially and propodeum with metallic green or bluish-green lusters under most angles of light, at least in larger specimens. Front leg with trochanter, almost all of femur, and tibia at least subbasally brown, but knee, tibia variably extensively apically, tarsus, and usually trochantellus at least in part yellowish. Middle leg with coxa yellow to yellowish-brown, otherwise yellow except for variably distinct, short, subbasal brown band or spot on tibia and subapical brownish region on femur opposite tibial mark when femur and tibia appressed. Hind leg yellow except for about basal two-thirds of coxa. Gaster dark brown except with metallic green or bluish-green lusters dorsobasally and laterally under some angles of light, at least in larger specimens; ovipositor sheath bicolored with medial yellowish band and similar brown basal and apical bands, the medial band often somewhat longer than apical band but occupying about medial third of sheath.

Head with frons finely coriaceous, but scrobal depression or at least scrobes extensively smooth and shiny; IOD about 0.4−0.5× head width; OOL: POL: LOL: MPOD = 0.8−1.0: 1.8−2.5: 1.1−1.4: 1.0. Antenna with flagellum elongate-gracile, combined length of flagellum + pedicel about 1.6−1.75× width of head, fl1 slightly transverse to quadrate and subsequent funiculars all obviously longer than wide but increasing only slightly in width distally such that pedicel at least slightly and usually distinctly shorter than combined length of fl1 + fl2, fl2 about 2.5−3.6× and fl8 about 1.3−1.7× as long as wide, and clava about one-quarter to one-third as long as funicle and about 2.7−4.0× as long as wide. Mesoscutum finely coriaceous, the cells larger medially than on lateral lobes; scutellar-axillar complex finely coriaceous, the cells smaller than on mesoscutum medially. Acropleuron with very fine meshlike sculpture, the sculpture often almost effaced mesally but at least much smaller than posteriorly, and more or less distinctly aligned longitudinally except toward anterior and posterior margins. Forewing setose except for linea calva; mv about 1.5−1.6× as long as pmv and about 3.7−3.8× as long as stv; pmv about 2.3−2.5× as long as stv. Mesotibia without apical pegs; mesotarsus ventrally with even line of closely spaced, yellowish-orange to reddish pegs on either side of at least basal 3 tarsomeres, the fourth tarsomere usually with 1 inconspicuous apical peg on either side. Propodeum with short plical region and median carina behind dorsellum, the V-like plical depression not extending to foramen. Ovipositor sheaths often curved but about half as long as gaster and about as long as mv.

MALE. Unknown, but presumably very similar to males of *E*. (*Episolindelia*) *rubicola*.

Distribution. Southern and eastern USA to about 40ºN (Map 2), but apparently much more widely distributed through Central America and South America to at least 23ºS in Brazil.

Biology. Unknown.



Map 2. Regional distribution of *E. fuscipectus*.

3. *Eupelmus* (*Episolindelia*) *grisselli* n. sp.
Fig. 2; Map 3

Type material. HOLOTYPE (♀, USNM). USA: ARIZONA: Cochise Co., Carr Canyon (1 mi. W. State Hwy 92) near Nicksville, 31.VIII.1991 / E.E. Grissell, R.F. Denno sweeping *Juniperus* / CNC Photo 2010-6 / Holotype *Eupelmus* (*Episolindelia*) *grisselli* Gibson. [Condition: point-mounted; entire except for left mesotarsus, mesonotum arched, and gaster abnormally inflated as result of critical-point drying.]

PARATYPE. USA. **NEW MEXICO**: ***Grant Co.***, Silver City, 8 mi. E., 22.VIII.71, *Juniperus*, E.E. Grissell & R.F. Denno (1♀ UCDC, CNC Photo 2010-52).

Etymology. Named in honour of Dr. Eric Grissell for his many contributions to the taxonomy and systematics of Chalcidoidea.

Description. FEMALE (Fig. 2). Length about 1.5 mm. Head capsule brown to reddish-bronze, sometimes with limited, slightly greenish lusters under some angles of light; maxillary and labial palpi white. Antenna dark brown except fl1, pedicel, and about basal half of scape yellowish-white. Mesosoma similar in color to head, with protuberant part of dorsellum yellowish-hyaline. Front and middle legs brown except trochanters, trochantelli, knees, apices of tibiae, and basal 4 tarsomeres yellowish. Hind leg entirely yellow beyond coxa except sometimes for apical tarsomere. Gaster yellow; ovipositor sheath mostly yellow but narrowly brownish basally and apically.

Head with very fine meshlike sculpture on frons, the sculpture somewhat more distinctly reticulate within scrobal depression; IOD = 0.55−0.65× head width; OOL: POL: LOL: MPOD = 1.7−1.8: 3.0−3.4: 1.5−1.8: 1.0. Antenna with flagellum short-clavate, combined length of pedicel + flagellum subequal to width of head, fl1 ring-like and other funiculars at least slightly transverse or at most fl4–fl6 quadrate, but funiculars increasing in width to broad clava such that pedicel almost as long as fl1−fl4 and clava about two-thirds to three-quarters length of funicle and about 2.3× as long as wide (when not collapsed and unnaturally compressed). Mesoscutum meshlike reticulate medially, the sculpture becoming more shallowly coriaceous-reticulate dorsolongitudinally on lateral lobes; scutellar-axillar complex meshlike reticulate with somewhat smaller cells than on mesoscutum medially. Acropleuron finely but quite distinctly meshlike reticulate, the sculpture minute mesally compared to much larger isodiametric cells posteriorly and anteriorly. Forewing setose except for short linea calva; mv about 1.5−1.8× length of pmv and 2.4−2.8× length of stv; pmv about 1.4−1.8× length of stv. Mesotibia apparently without apical pegs; mesotarsus ventrally with unobvious yellowish pegs, the pegs possibly in more than one row on basitarsus but in single row on second tarsomere. Propodeum with plical region U-like linear behind dorsellum. Ovipositor sheaths about one-third to one-half as long as gaster and about 1.0−1.3× as long as mv.

MALE. Unknown.

Distribution. Known only from Arizona and New Mexico (Map 3).

Biology. Unknown.

Remarks. Antennal structure of *E. grisselli* is very similar to that of *E. varicauda*. The only two known females likely are insufficient to encompass true variation in the ratios given in the description, including that of ovipositor sheath length.

4. *Eupelmus* (*Episolindelia*) *rubicola* (Ashmead) n. stat.
Figs 3, 7, 56; Map 3

Xenomerus rubicola Ashmead, 1887a: 100. Holotype, male (USNM, examined). Type data: USA, Florida [Jacksonville]; reared from unidentified Diptera larva in stem of *Rubus villosus*. Originally described in Scelionidae (Platygastroidea).
Xeromerus rubicola; Ashmead, 1893: 185. Incorrectly transferred to Pteromalidae.
Eupelmus rubicola; Peck, 1951: 511.

Description. FEMALE (Fig. 3). Length about 1.9−3.8 mm. Head dark brown with variably distinct metallic green, coppery or reddish lusters under some angles of light; maxillary and labial palpi yellowish-white. Antenna brown except up to about basal half of scape lighter, yellowish-brown to yellow. Mesosoma brownish with variably distinct metallic green, coppery or reddish lusters under some angles of light except following yellow: prepectus, tegula, extreme lateral and anterolateral margins of mesoscutum, axilla variably extensively, but at least laterally, V-shaped, posteriorly protuberant part of dorsellum, and mesopectus anteriorly below acropleural sulcus. Front leg with coxa completely yellow to variably extensively brownish with slight metallic luster basally, otherwise yellow except posterior surfaces of tibia and femur sometimes partly brownish. Middle leg with coxa yellow to extensively brownish, otherwise yellow except tibia with variably distinct, short, subbasal, incomplete brown ring or dorsal spot. Hind leg with at least about basal third of coxa brownish with slight metallic green luster, otherwise yellow except sometimes for anterior surface of femur and usually subbasal brown mark on tibia similar to mesotibia. Gaster mostly light to dark brown, including hypopygium, but otherwise variably extensively yellowish ventrally, and dorsally usually with slight metallic lusters under some angles of light, most distinctly on syntergum; ovipositor sheath rarely entirely brown, usually bicolored with medial yellowish and similar brown basal and apical bands, the medial band variable in length but distinctly shorter than basal or apical bands.

Head with frons finely coriaceous, but scrobal depression or at least scrobes smooth and shiny; IOD about 0.3−0.4× width of head; OOL: POL: LOL: MPOD = 0.5−0.75: 1.5−2.0: 1.1−1.3: 1.0. Antenna with flagellum elongate-gracile, combined length of flagellum + pedicel about 1.6−1.75× width of head, fl1 quadrate to slightly longer than wide and subsequent funiculars all obviously longer than wide but increasing only slightly in width distally such that pedicel at least slightly and usually distinctly shorter than combined length of fl1 + fl2, fl2 about 2.7−3.2× and fl8 about 1.3−1.7× as long as wide, and clava about one-quarter to almost one-third as long as funicle and about 2.4−3.6× as long as wide. Mesoscutum finely coriaceous, the cells larger medially than on lateral lobes; scutellar-axillar complex finely coriaceous, the cells smaller than on mesoscutum medially. Acropleuron with variably fine meshlike sculpture, the sculpture sometimes almost effaced mesally but at least much smaller than posteriorly and more or less distinctly aligned longitudinally except toward anterior and posterior margins. Forewing setose except for linea calva; mv about 1.7−2.0× as long as pmv and about 3.5−4.0× as long as stv; pmv about 1.9−2.5× as long as stv. Mesotibia without apical pegs; mesotarsus ventrally with even line of closely spaced, yellowish-orange to reddish pegs on either side of at least basal 3 tarsomeres, the fourth tarsomere usually with 1 inconspicuous apical peg on either side. Propodeum with short plical region and median carina behind dorsellum, the V-like plical depression not extending to foramen. Ovipositor sheaths often upcurved but about two-thirds length of gaster and about 1.5× length of mv.

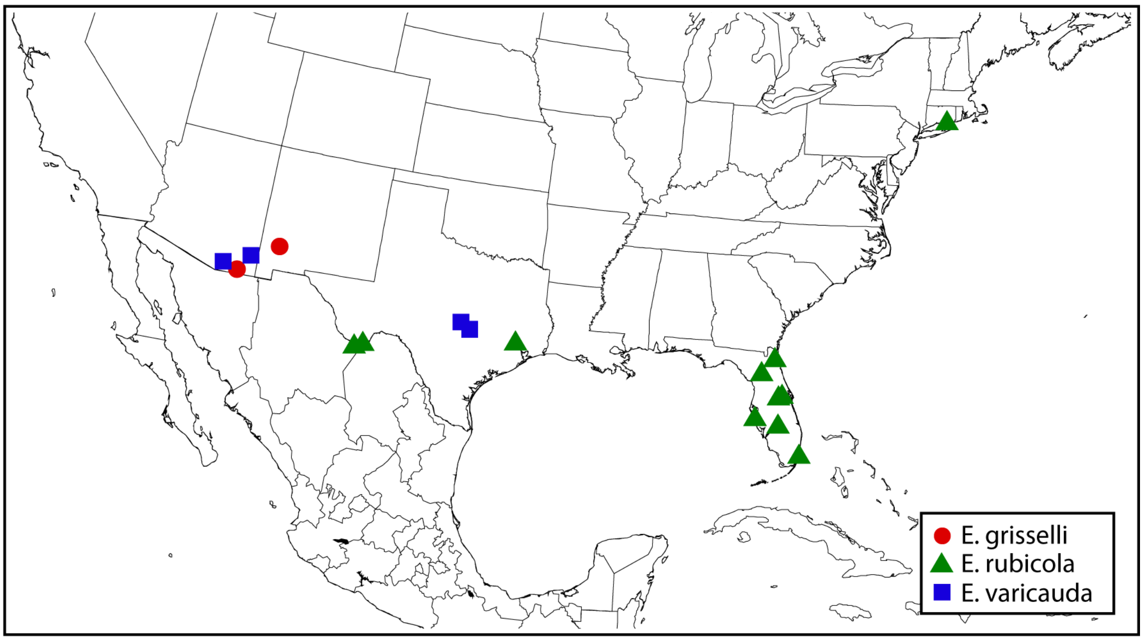
MALE (Fig. 7). Length about 1.7−2.1 mm. Head dark, with at most only very obscure metallic luster; maxillary and labial palpi yellowish-white. Antenna with flagellum brown and pedicel and scape variably extensively yellowish, but pedicel dorsally and scape at least dorsoapically brown. Mesosoma similarly dark as head, but propodeum usually with distinct green to blue luster (less distinct in holotype). Front leg mostly brown but trochanter, trochantellus, usually knee and tibia apically, and basal 3 or 4 tarsomeres white (holotype with tibia entirely yellowish-white). Middle leg similar in color pattern to front leg, with tibia extensively brownish medially. Hind leg brown with trochanter, trochantellus, tibia basally or subbasally, and basal 3 or 4 tarsomeres white (holotype with tibia lighter brown medially than other specimens). Gaster brown except Gt1 bluish-green basally.

Head with frons meshlike coriaceous, but scrobal depression extensively smooth and shiny. Head with IOD about 0.5× width of head; OOL: POL: LOL: MPOD (holotype) = 0.8: 2.0: 1.1: 1.0; lower face with line of longer, curved setae near malar sulcus, but gena without differentiated, longer seta near base of mandible below malar sulcus. Antenna with flagellum elongate-filiform, combined length of flagellum + pedicel about 1.7−2.0× width of head; scape ovoid, about 2.2−2.4× as long wide, outer surface with lanceolate micropunctate sensory region ventrobasal to scapular scrobe; pedicel ventrally with 2 or 3 long, straight setae in single line, excluding additional apical setae not in same line (Fig. 56), subglobose, only about 0.5−0.75× as long as fl2; fl1 very strongly transverse, ringlike; subsequent funiculars and clava all obviously longer than wide with outstanding, curved setae about as long as width of respective segment (Fig. 56), with fl2 about 2.4−2.8× and fl8 about 1.25−1.5× as long as wide, and clava about 3.0−3.5× as long as wide and slightly longer that apical two funiculars. Mesoscutum with complete, deep notauli, and variably deeply meshlike reticulate; scutellum somewhat more finely sculptured, reticulate-coriaceous to coriaceous except for distinctly reticulate-punctate frenum; mesopleuron with acropleuron posteriorly and upper mesepimeron smooth and shiny, but mesepisternum reticulate to reticulate-alutaceous and lower mesepimeron (about posterior quarter of pleuron) reticulate to reticulate-punctate; metacoxa variably distinctly reticulate; propodeum with median carina and more coarsely, though variably, sculptured near median carina than laterally. Forewing with speculum closed posteriorly by complete mediocubital setal line; mv about 1.4× length of pmv and about 3.0−3.3× length of stv; pmv about 2.1−2.3× length of stv.

Regional material examined (22♀, 4♂). USA. **CONNECTICUT**: ***New London Co.***, Lyme, 13.XI.16, A.B. Champlain, reared *Quercus*, Hopk. U.S. 13630t (1♀ USNM). **FLORIDA**: ***Alachua Co.***, Gainesville — 14-21.IV.87, W.R. Mason (2♀); 5-12.XII.86, D. Wahl (1♂); American Entomological Institute, 10-17.IV.86, G. Gibson (1♀), 2-19.IV.86, M. Sharkey (1♀, CNC Photo 2010-3), 3-13.VII.87, BRC Hym. Team (1♂, CNC Photo 2010-4). ***Miami-Dade Co.***, Miami, Dodge Island, 10.V.61, C.E. Stegmaier (1♀ USNM). ***Duval Co.***, Jacksonville (♂ holotype of *E. rubicola*). ***Manatee Co.***, Bradenton, 7.IV.84, D. Schuster (1♀). ***Okeechobee Co.***, Lake Placid, Archibold Biological Station — 19-22.III.87, D. Wahl (1♀); 7-13.VII.87, BRC Hym. Team, FIT (1♀). ***Orange Co.***, Orlando, UCF, 20.V.93 (1♀ UCFC), 25.I.95 (1♀ UCFC), 5.VII.96 (2♀ UCFC), 2, 9.X.97, 27.XI.97 (3♀ UCFC), S.M. Fullerton, LLP-Sand Pine Turkey Oak. ***Seminole Co.***, Econ Wildlife Area, 2.IX.2000, 8.X.2000, T. Smith, P. Russell & S.M. Fullerton, Scrub Oak/Saw Palmetto (burned) (2♀). **TEXAS**: ***Brewster Co.***, Big Bend National Park — Cottonwood Campground, 22.V.83, R. Anderson (1♀); Santa Elena Canyon, 2160', 12.VII.82, G. Gibson (1♀). ***Montgomery Co.***, Jones State Forest, 8 mi. S. Conroe, 1-7.VI.87 (1♀, 1♂ TAMU), 14-20.VII.87 (1♀ TAMU), Wharton, Steck, Caroll.

Extralimital specimens. BAHAMAS: Eleuthera, Rainbow Bay — 16-26.X.85, J.B. Wiley (1♀); 1.VII.87, D.B. & R.W. Wiley (1♀ FSCA).

Distribution. Known from Bahamas in addition to southern and eastern USA (Map 3). The single female from Connecticut indicates a much more extensive Nearctic distribution than is indicated by current specimens.



Map 3. Regional distribution of *E. grisselli* (●), *E. rubicola* (▲) and *E. varicauda* (■).

Biology. The holotype male was reared from an unidentified Diptera larva in a stem of black berry, *Rubus villosus* Aiton (Rosaceae) (Ashmead 1887a). One female apparently was also reared from *Quercus* L. (Fagaceae).

Remarks. My sex association and classification of *E. rubicola* in *E.* (*Episolindelia*) is based partly on a process of elimination of species of *Eupelmus* that are known only from females, and partly because of a single co-collection of a female and a male in Texas. However, the distributions of *E. rubicola* and *E. fuscipectus* overlap in Texas and males of *E. rubicola* have the scape largely yellowish except for being brown dorsally, which is more similar in color pattern to the scape of *E. fuscipectus* females. Males of *E. fuscipectus* and *E. rubicola* should be very similar and it is possible that my sex association is incorrect. Ashmead (1887a) described all tibiae of the holotype of *E. rubicola* as being pale yellowish, and the tibiae certainly are lighter in color than for the three other males I consider as being conspecific, but both the meso- and metatibiae of the holotype appear to be light brownish medially similar to the respective femora.

5. *Eupelmus* (*Episolindelia*) *varicauda* n. sp.

Fig. 4; Map 3

Type material. HOLOTYPE (♀, TAMU): TEXAS, Travis Co., vic. Long Hollow Ck., 30º27'43″[N], 97º52'19″[W], March 26, 1993 (1) / Alexander, Quinn, Riley, Wharten et al., on *Juniperus ashei*, Ja6-LBI / CNC Photo 2010-7 / Holotype *Eupelmus* (*Episolindelia*) *varicauda* Gibson. [Condition: point-mounted.]

PARATYPES (59♀). USA. **ARIZONA**: ***Cochise Co.***, Chiricahua Mountains, T.D. Miller — Camp Rucker, 5600', 4-8.IX.88 (1♀ WFBM); Steward Campground, 5000', 7.IX.88 (1♀ WFBM). Sierra Vista, 12 km S., Ramsey Canyon, 1700m, 1.V.86 (1♀ AEIC), 25.IV-7.V.87 (1♀), B.V. Brown. **TEXAS**: ***Burnet Co.***, Inks Lake State Park, 2.V.87, G. Zolnerowich (1♀). ***Travis Co.*** — 40♀ (TAMU) same data as holotype except with different Ja- numbers, collected: 13.III.93 (4♀), 26.III.93 (7♀), 10.IV.93 (5♀), 23.IV.93 (8♀), 23.VI.93 (2♀), 26.II.94 (5♀), 12.III.94 (1♀), 17.III.94 (2♀), 26.III.94 (2♀), 9.IV.94 (3♀), 23.IV.94 (1♀), these also with different Ja- numbers and numbers in parentheses after date of collection; vic. Cypress Creek, 30º25'58″, 97º52'01″, M. Quinn, E. Riley, R. Wharten, on *Juniperus ashei*, with various Ja- numbers collected 26-27.II.94 (4♀ TAMU), 17.III.94 (5♀ TAMU), 26-27.III.94 (1♀ TAMU), 9-10.IV.94 (3♀ TAMU), 23-24.IV.94 (1♀ TAMU) and with numbers in parenthesis after date of collection.

Etymology. A noun in apposition; combination of the Latin words *varius* (different) and *cauda* (tail) in reference to the highly variable length of the ovipositor sheaths.

Description. FEMALE (Fig. 4). Length about 1.1−1.8 mm. Head capsule metallic green or greenish-blue with frontovertex often more distinctly blue to purple; maxillary and labial palpi yellow. Antenna brown except about basal two-thirds scape, fl1, and pedicel completely or at least apically yellow. Mesosoma with pronotum yellow except for dark incised spiracular margin; mesoscutum mostly greenish-blue to bluish-purple except lateral, vertical surface of lateral lobe yellow and dorsal surface variably extensively brownish to yellow posteriorly; scutellar-axillar complex similar in color to mesoscutum, but axilla with at least lateral surface and sometimes dorsolaterally yellow; mesopectus yellow except brown ventrally between longitudinal transepisternal sulci; metathorax yellow except metanotum often brownish lateral to dorsellum; propodeum yellow at least lateral to spiracle, but often brownish and sometimes with slight metallic luster between spiracles. Legs, including coxae, yellow except for darker pulvilli and claws. Gaster yellow; ovipositor sheaths bicolored with about basal one-third to one-half brown and often only extreme apical margin dark, the apex sometimes more extensively light to dark brown but always obviously shorter than yellowish region.

Head minutely punctate-reticulate; IOD about 0.5 width of head; OOL: POL: LOL: MPOD = 1.8–2.0: 3.4–3.6: 1.8–2.0: 1.0. Antenna with flagellum short-clavate, combined length of pedicel + flagellum about 1.0–1.2× width of head, fl1 ringlike, fl2 and fl8 slightly transverse to quadrate, and other funicular articles slightly transverse to up to about 1.4× as long as wide, but increasing in width to broad clava such that pedicel almost as long as fl1−fl4 and clava about one-half to almost two-thirds length of funicle and about 2.3–2.8× as long as wide (when not collapsed and unnaturally compressed). Mesonotum punctate-reticulate except mesoscutal lateral lobe more finely sculptured posteriorly. Acropleuron finely meshlike reticulate, the sculpture minute mesally compared to much larger isodiametric cells posteriorly and anteriorly. Forewing setose except for short linea calva; mv about 1.4−1.6× length of pmv and 2.4−2.8× length of stv; pmv about 1.7−1.75× length of stv. Mesotibia apparently without apical pegs; mesotarsus ventrally with yellowish or apically slightly reddish pegs, the pegs in uneven double row on basitarsus but in single row on second tarsomere and with only single apical peg on either side of third tarsomere. Propodeum with plical region U-like linear behind dorsellum. Ovipositor sheaths about one-quarter as long to as long as gaster and about 0.6−2.4× as long as mv.

MALE. Unknown.

Distribution. Currently known only from Arizona and Texas (Map 3).

Biology. Host unknown, but associated with *Juniperus* (Cupressaceae).

Remarks. Females of *E. varicauda* are most similar to *E. rubicola* in structure, but differ conspicuously in sculpture and color pattern.

Eupelmus (*Eupelmus*) Dalman

Eupelmus Dalman, 1820.
Holceupelmus Cameron, 1905.

Bruchocida Crawford, 1913.
Lindesonius Brèthes, 1916.
Rafa Brèthes, 1916.
Lepideupelmus Timberlake, 1926.
Neosolindenia Gourlay, 1928.
Propelma Trjapitzin, 1963.
Cocceupelmus Kalina, 1984.
Eupelmus (*Eupelmus*); Gibson, 1995.

Remarks. When Kalina (1988) keyed the females of Palaearctic *Eupelmus* he incompletely differentiated five names as part of the last two couplets, including the classical names *E. annulatus* Nees, *E. nubilipennis* Förster, and *E. urozonus* Dalman. Bouček (1988: 563) recorded *E. urozonus* from Australia and stated that it "belongs to a very difficult species group (*urozonus*-group) and without its revision it is not possible to decide with certainty whether some Australian specimens really belong to *urozonus*". Askew and Nieves-Aldrey (2000: 57) also referred to the *urozonus*-group as "an aggregate of forms which are poorly-differentiated morphologically but distinct biologically". Noyes (2010) recorded *E. urozonus* from more than 60 countries in the Old World, including Europe, northern Africa, Asia and Australia, and from over 100 host species in Coleoptera, Diptera, Hemiptera, Hymenoptera and Lepidoptera. Lotfalizadeh *et al.* (2007: 78) also stated that in Iran they were "able to recognize from fine but distinct morphological characters at least six different forms" that "segregated according to different hosts" but which keyed to *E. urozonus* using available keys. Askew and Blasco-Zumeta's (1997) differentiation of *Eupelmus* sp. from *E. urozonus* is a good example of the subtle features that likely differentiate both sexes of sibling species in the *urozonus*-group, but which equally likely may be affected by specimen size, preservation, and possibly are host-induced.

Although the *urozonus*-group is often alluded to, its morphological limits and membership are not well delimited. Bouček (1988: 559) and Gibson (1995: 204) characterized the *urozonus* group somewhat differently, but both only in the context of females. For the purpose of this work the *urozonus*-group is differentiated primarily by features of the males. The *urozonus*-group is defined as comprising those species of *E*. (*Eupelmus*) with males having a line of distally curved setae along the pedicel ventrally (Fig. 56), a differentiated long seta below the malar sulcus (Figs 67, 69), and an extensively dark body, including the scape, maxillary and labial palpi, the tegulae, and the legs entirely or largely except often the pro- and mesotibiae being more extensively light-colored and usually the basal 1−4 tarsomeres being white (Figs 58−61). Within this definition the *urozonus*-group in North America consists of at least the following eight species — *E. annulatus*, *E. conigerae* Ashmead, *E. curticinctus* n. sp., *E. cushmani* (Crawford), *E. cyaniceps* Ashmead, *E. cynipidis* Ashmead, *E. pervius* n. sp. and *E. utahensis* Girault. Females belonging to the *urozonus*-group are macropterous, have a linea calva and the postmarginal vein at most only about 1.5× as long as the stigmal vein (Figs 8, 49b), the prepectus has at least a couple of longitudinal rows of setae (Figs 42–44), the mesotibia has black pegs apically, and the mesotarsus has black pegs arranged partly into two rows along either side of the basitarsus distally (Fig. 32). Except for *E. conigerae* (Fig. 22) and *E. cynipidis* (Fig. 21), females are also characterized by having hyaline or only slightly tinted (Fig. 49b) forewings and the posteromedian concave portion of the mesoscutal median lobe similarly sculptured (not distinctly smooth and shinier) than the convex anterior portion.

Length of the ovipositor sheaths relative to the metatibia has long been considered important for differentiating some species of the *urozonus*-group in Europe, e.g. couplet 38 in Kalina (1988) and couplet 7 in Askew and Nieves-Aldrey (2000). Based on my observations, European species of the *urozonus*-group having females with either comparatively short or long ovipositor sheaths can have the scrobal depression either largely smooth and shiny or reticulate-rugulose. *Eupelmus urozonus* (female lectotype and one paralectotype, designated by Graham, 1969: 92, NHRS, examined) is partly characterized by relatively short ovipositor sheaths (0.7× length of metatibia and 0.77× length of marginal vein for lectotype) and a smooth and shiny scrobal depression. The valid name for the *E. urozonus*-like species with females having comparatively short ovipositor sheaths and a reticulate scrobal depression is uncertain, but possibly is *E. afer* Silvestri (1919) or *E. martellii* Masi (1941). *Eupelmus martellii* was described originally from North Africa (Libya) as a parasitoid of the olive fruit fly, *Dacus oleae* (Rossi) (Diptera: Tephritidae) and was reported subsequently from France by Arambourg and Pralavorio (1975). I examined one female and two male syntypes (MNHN) of *E. martellii* and they are very similar to what I interpret as the *urozonus*-like species with a reticulate scrobal depression except that the female is unusually small. I did not examine type material of *E. afer*. This species was also described based on females and males reared from *Dacus oleae* in Eritrea, and subsequently was recorded from Italy by Viggiani (1975). Although the sculpture of the scrobal depression in females is unknown, the dorsal habitus illustration given by Silvestri (1919, fig. VI) and the same host relationship as *E. martellii* suggest the names may be synonymous. Revision of Palaearctic *Eupelmus* is required to verify this and whether specimens with a reticulate scrobal depression reared from *Dacus oleae* are conspecific with those reared from other hosts.

There has also been some confusion as to the application of the names *E. annulatus*, *E. nubilipennis* and *E. spongipartus* Förster in Europe, all of which are differentiated from *E. urozonus* and *E. martellii* by comparatively long ovipositor sheaths. Graham (1988) selected the female lectotype of *E. annulatus* Nees (1834) and considered it to be the senior synonym of *E. nubilipennis* Förster (1860), whereas Bouček (1970) considered that *E. annulatus* was the senior synonym of *E. spongipartus* Förster (1860). I examined one female syntype each of *E. nubilipennis* and *E. spongipartus* (NHMV). The *E. spongipartus* syntype has long ovipositor sheaths (1.03× length of metatibia and 1.25× length of marginal vein), a smooth and shiny scrobal depression, and a mesofemur that is dark brown except apically, which is similar to that of the pro- and metafemora but much darker than its respective, yellowish, mesotibia. The examined syntype of *E. nubilipennis* lacks both ovipositor sheaths, but the ovipositor remains and this is about as long as the metatibia and slightly longer than the marginal vein. It also has a reticulate scrobal depression and a yellowish mesofemur similar to the mesotibia, but much lighter than the pro- and metafemora. Graham (1988: 24) stated that the head of the lectotype of *E. annulatus* is missing. I did not examine the remaining lectotype, but according to James Hogan, curator of the Hope Entomological Museum, the “mesofemur is a uniform pale brown/yellow color with no trace of darkening” and the “ratio ovipositor/marginal = 1.24” (personal communication). These observations support the nomenclatural conclusions of Graham (1988), and that *E. annulatus* is the available name for the *urozonus*-group species having long ovipositor sheaths and a reticulate scrobal depression, whereas *E. spongipartus* is the available name for the species having long ovipositor sheaths and a smooth and shiny scrobal depression.

My concepts of nomenclature for North American *urozonus*-group species are based on the above observations. However, application of correct nomenclature will ultimately require a comprehensive revision of *Eupelmus* in the Palaearctic region, particularly because Ratzeburg (1844, 1848, 1852) described several species from Germany that are assignable to the *urozonus*-group, some of which were based only on males. Ratzeburg’s types apparently were lost during the Second World War, but some of the names, currently considered as *nomina dubia*, may ultimately be discovered to be senior synonyms of names currently considered as valid. Interestingly, neither *E. urozonus* nor *E. spongipartus*, the two European *urozonus*-group species with a smooth scrobal depression and, respectively, short or long ovipositor sheaths, are present in North America. However, both short and long ovipositor sheath forms with a reticulate scrobal depression are present in North America. This suggests that a reticulate scrobal depression is plesiomorphic within the *urozonus*-group and a smooth and shiny scrobal depression evolved independently in *E. urozonus* and in *E. spongipartus* in the Old World. Also, based on personal observations, it is possible to recognize the different *urozonus*-group species in Europe based on males as well as females, whereas except for *E. annulatus*, a possibly introduced species for North America, it is not or at least much more difficult to differentiate North American species of the *urozonus*-group based on males. Furthermore, even the morphological limits of females of some North American *urozonus*-group species are uncertain and the confident identification of all females tenuous. Although no formal phylogenetic analysis was attempted for this study, I suspect that most *urozonus*-group species in North America, including *E. conigerae* and *E. cynipidis*, evolved from a *E. cyaniceps/E. martellii*-like ancestor comparatively recently, with less time for morphological divergence than in the Palaearctic region.

One Old World species that has been recorded from North America, but which is not present, is *E*. (*Eupelmus*) *atropurpureus* Dalman. Ferrière (1954: 4) initially incorrectly recorded this species from the USA and this has been repeated in such catalogs by Peck (1963) and Noyes (2010), but I have not seen any specimens from North America.

Key to species of *E*. (*Eupelmus*) in North America north of Mexico

1	Female	2
-	Male	15

2(1) Brachypterous (Figs 11, 12) . . . . *E. dryorhizoxeni* **Ashmead**
- Macropterous. 3
3(2) Forewing distinctly infuscate from parastigma to beyond apex of postmarginal vein (Figs 21−23) 4
- Forewing hyaline with only a faint yellowish or brownish tint behind marginal vein (Fig. 49b) 6
4(3) Gaster with inner plate of ovipositor not projecting beyond apex, apparent length of ovipositor sheaths less than 0.75× length of metatibia, and sheath with medial whitish region between black basal and apical regions (Fig. 23); forewing with basal cell uniformly setose similar to disc (Fig. 23) . . . . ***E. nitifrons*** **n. sp.**
- Gaster with strigose inner plate of ovipositor projecting conspicuously beyond apex, apparent length of ovipositor sheaths at least 1.2× length of metatibia, and with about basal quarter to third black, the remaining light-colored or only graduated brownish apically (Figs 21, 22); forewing with basal cell at least obviously less densely setose than disc and usually bare except for a few dark setae basally and white setae apically below extreme base of parastigma. 5
5(4) Head and mesosoma strongly contrasting in color, the head dark but mesosoma yellowish-orange or rarely light brownish-orange (Fig. 22); antenna with at least basal half of scape, often pedicel, and sometimes funicle partly yellowish-orange (Fig. 22) . . . . ***E. conigerae*** **Ashmead**
- Head and at least dorsum of mesosoma not strongly contrasting and usually very similar in color, bright green to dark brown with variable metallic lusters (Fig. 21); antenna often entirely dark but at least pedicel and flagellum dark (Fig. 21) . . . . ***E. cynipidis*** **Ashmead**
6(3) Mesotarsus with ventral pegs restricted to basitarsus and second tarsomere, the basitarsus with asymmetrical pattern consisting of about 4−7 pegs along most of anterior margin and fewer pegs on posterior margin, and second tarsomere with at most 1 peg apically on either side (Fig. 19); tegula mostly translucent yellowish-brown to dark brown, but with slender, yellow to white region along most of inner margin adjacent to mesoscutum. . . . . ***E. microzonus*** **Förster**
- Mesotarsus with symmetrical rows of pegs along both anterior and posterior margins of at least basitarsus and second tarsomere, and often third and fourth tarsomeres also with one or more pegs (Figs 18, 32, 33); tegula often completely dark. 7
7(6) Forewing without linea calva (Fig. 20); acropleuron reticulate-alveolate posteriorly (Fig. 20); tegula brownish-yellow to distinctly yellow; basal tarsomere of mesotarsus in ventral view with single row of different length pegs on either side (Fig. 33) . . . . ***E. pini*** **Taylor**
- Forewing with linea calva (e.g. Fig. 8); acropleuron shallowly meshlike coriaceous to finely coriaceous-reticulate posteriorly; tegula usually dark; basal tarsomere of mesotarsus in ventral view with pegs segregated into longer basal row and shorter, slightly overlapping apical row on either side (Fig. 32) 8
8(7) Mesotibia without black pegs apically (Fig. 18); ovipositor sheaths short, only about half as long as metatibia and at most slightly brownish apically, without distinctly delineated apical dark region (Fig. 17); legs yellow beyond coxae excluding mesotarsal pegs, apical tarsomeres and small subbasal brownish region on tibiae (Fig. 17) . . . . ***E. stramineipes*** **Nikol'skaya**
- Mesotibia with row of black pegs apically (Figs 32, 33); ovipositor sheaths longer than half length of metatibia and/or often distinctly banded; front leg and often at least hind leg more extensively dark beyond coxae 9
9(8) Apparent ovipositor sheath length greater than half length of body and obviously longer than either gaster or combined length of head and mesosoma (Fig. 24); frons entirely meshlike coriaceous, shiny (Fig. 25). . . . . ***E. arizonensis*** **n. sp.**
- Apparent ovipositor sheath length less than half length of body and usually obviously shorter than gaster and/or combined length of head and mesosoma (Figs 34–41); frons variable, sometimes similar to above (Fig. 27) but usually at least somewhat wrinkled or roughened with sculpture in part delineated by raised margins (Figs 29, 30) and sometimes quite distinctly reticulate (Fig. 31) 10
10(9) Ovipositor sheaths, excluding projecting strigose part of inner plate of ovipositor, at least about 1.4× length of marginal vein, sometimes entirely dark brown except for lighter apex but at least dark brown basally for more than one-third length of sheath and medial light-colored region, if present, at most only about half as long as basal or apical dark regions (Fig. 41); upper face at least finely and usually quite distinctly meshlike reticulate (Fig. 31). . . . . ***E. curticinctus*** **n. sp.**
- Ovipositor sheaths variable in length, often shorter than or only about as long as marginal vein (Figs 38, 39), but if longer then basal black region of sheath extending for distance obviously less than one-third sheath length and/or medial light-colored region much longer than half length of basal dark region (Figs 34, 37); upper face sometimes coriaceous (Fig. 27). 11
11(10) Gaster laterally with white, slightly lanceolate setae contrasting with dark cuticle (Fig. 35) **and** ovipositor sheaths at least as long as metatibia and at least 1.25× as long as marginal vein (Fig. 34); protibia variably but quite extensively dark without discrete dorsal and ventral dark bands (Fig. 34); scape dark. . . . . ***E. utahensis*** **Girault**
- Gaster laterally with brownish, hairlike setae similar in color to cuticle (Figs 36−40) and/or ovipositor sheaths less than length of metatibia or marginal vein (Figs 38, 39); other features variable but not in combination, protibia sometimes entirely or mostly yellowish with at least anterior and posterior surfaces extensively yellowish; scape sometimes partly to entirely yellowish-orange 12
12(11) Frons entirely, finely meshlike coriaceous (Fig. 27); costal cell dorsally with line of dark setae extending at least half and often two-thirds length (Fig. 49a); scape dark and in outer view with ventral margin produced as very slender, thin flange along apical half to two-thirds; ovipositor sheaths at least 0.9× length marginal vein and graduated yellowish-orange to brownish apically (Fig. 36); forewing disc sometimes with yellowish to light brown tint behind marginal and/or stigmal veins (Fig. 49b) . . . . ***E. annulatus*** **Nees**
- Frons usually at least slightly imbricate or scabrous-wrinkled laterally along inner orbits (Fig. 28) and often more obviously reticulate-roughened (Figs 29, 30); costal cell dorsally only rarely with setae extending beyond about half length, often within only about apical third below parastigma (Fig. 45, arrows); scape sometimes yellowish-orange (Fig. 28), but at least in lateral view with inner ventral margin at most abruptly angulate; ovipositor sheaths sometimes obviously shorter than length of marginal vein (Figs 38, 39) and/or with quite abruptly delineated brown apical band (Figs 37, 40); forewing disc hyaline 13

13(12) Prepectus comparatively sparsely and inconspicuously setose, with only 2 or 3 rows of hairlike setae mediolongitudinally distinctly separated from ventral and apical margins (Fig. 42) **and** ovipositor sheaths as long as to conspicuously longer than marginal vein (Fig. 37); scape sometimes entirely to largely yellowish-orange in contrast to flagellum (Fig. 28); propodeum with lateral surface of callus comparatively sparsely setose (Fig. 50) . . . . ***E. cushmani* (Crawford)**

\- Prepectus usually quite conspicuously and extensively setose (Fig. 44) with at least 4 rows of very slightly lanceolate setae (Fig. 43), the apices of setae more or less extending to margins or at least ventral row of setae close to margin; ovipositor sheaths often less than 0.95× length of marginal vein (Figs 38, 39); scape dark similar to flagellum; propodeum with lateral surface of callus usually comparatively densely setose (Fig. 51) 14

14(13) Forewing often with linea calva a continuous bare band through mediocubital fold into vanal area, but if closed posteriorly by a few setae then base of forewing obviously less setose than disc with basal cell variably extensively bare apically and often with bare band extending posteriorly from parastigma along basal fold (Figs 45−47); southwestern USA (AZ, CA, NM, TX), associated with *Prodoxus* moth pollinators of *Yucca* . . . . ***E. pervius* n. sp.**

\- Forewing with basal cell and region below parastigma more or less uniformly and similarly setose as rest of disc with linea calva an isolated bare band distinctly separated from vanal area (Fig. 48); transcontinental, associated with varied hosts . . . . ***E. cyaniceps* Ashmead**

15(1) Scape entirely or mostly yellowish to yellowish-orange, usually contrasting distinctly with dark brown flagellum (Figs 54, 57); tegula uniformly though variably dark brown; maxillary and labial palpi usually dark brown though sometimes lighter yellowish-brown in small specimens; legs often mostly yellowish-orange beyond coxae, but if femora distinctly brown then at least pro- and mesotibiae yellowish-orange or at most only very light brownish-yellow (Fig. 54) . . . . ***E. dryorhizoxeni* Ashmead** [part]

\- Scape usually entirely dark similar to flagellum, but if partly yellowish to white then tegula also yellowish to white and/or maxillary and labial palpi white (Figs 52, 53) or legs with tibiae and/or femora mostly to entirely dark (Figs 58–61) 16

16(15) Tegula yellowish to white; maxillary and labial palpi white (Figs 52, 53); legs often mostly yellowish to white, but at least profemur or anterior surfaces of both pro- and mesofemora yellowish to white (Figs 52, 53); scape with at least outer surface light colored over about ventral half and sometimes more extensively yellowish 17

\- Tegula uniformly brown to dark brown; maxillary and labial palpi variably dark brown; legs with femora and at least meso- and metatibiae mostly to entirely dark (Figs 58−61); scape usually entirely dark 19

17(16) Flagellum comparatively short-clavate with very short, dense setae (Fig. 52), with fl1 at least subquadrate and similarly setose as other funiculars, funiculars beyond fl1 only slightly longer than wide basally to transverse apically, and clava broadly oval; scape dark except outer surface lighter colored ventrally over broad micropunctate sensory region extending length of scape (*cf.* Fig. 80) . . . . ***E. stramineipes* Nikol'skaya**

\- Flagellum elongate-filiform with outstanding, curved setae (Fig. 53), with fl1 very strongly transverse (disc-like), funiculars beyond fl1 at least about twice as long as wide basally and distinctly longer than wide apically (Fig. 55), and clava lanceolate; scape with inner surface also variably extensively yellowish basally, and outer surface ventrally with slender, inconspicuous micropunctate sensory region (*cf.* Fig. 79) 18

18(17) Marginal vein at least 3× length of stigmal vein; length of flagellum + pedicel at least 2× width of head and fl2 at least 3× as long as wide; legs with tibiae entirely yellow [not yet recorded from region] . . . . ***E. pini* Taylor**

\- Marginal vein only about 2× length of stigmal vein; length of flagellum + pedicel only about 1.8× width of head and fl2 less than 2.5× as long as wide; legs at least with subapical brown spot on anterior surface of mesotibia and extralimital specimens usually with more distinct dark band . . . . ***E. microzonus* Förster**

19(16) Lower face above malar sulcus with region of comparatively long, dense, and abruptly or sinuately curved brown setae (Fig. 67); costal cell dorsally with line of setae extending over at least apical half (*cf.* Fig. 49a), and ventrally with 2 rows of setae mesally; mesotibia more or less extensively dark dorsally and ventrally, but at least anterior and usually posterior surfaces light-colored longitudinally (Fig. 58) . . . . ***E. annulatus* Nees**

\- Lower face above malar sulcus with setae variable in length, but if quite long then evenly curved and usually quite distinctly white though sometimes brownish (Figs 63−70); costal cell dorsally with line of setae extending over less than apical half, usually only behind parastigma, and ventrally with single row of sometimes widely space setae over most of length; mesotibia almost always dark except for at most extreme base and apex 20

20(19) Propodeal plical region quite distinctly reticulate on either side of median carina at least posteriorly and usually completely (Fig. 71); outer surface of scape mostly smooth and shiny ventrally along scapular scrobe except for widely spaced, minute, pinprick-like micropunctures (Fig. 79); scrobal depression reticulate through scrobes over at least dorsal half of interantennal region above level of toruli (Fig. 70) . . . . ***E. curticinctus* n. sp.**

\- Propodeal plical region uniformly finely coriaceous or at most with some slight, shallow reticulation posteriorly (Fig. 72); outer surface of scape variably sculptured, but often appearing pitted or at least more coarsely sculptured (Figs 76–78) or with lanceolate, micropunctate sensory region ventrobasal to scapular scrobe (Figs 73, 74); scrobal depression sometimes with at least interantennal region very finely coriaceous to smooth and shiny (Fig. 69) 21

21(20) Flagellum with setae comparatively closely appressed to flagellomeres, hence appearing relatively inconspicuously setose and slender-clavate, the flagellomeres usually increasing slightly in width apically or at least with broadly oval clava with micropilose sensory region over almost entire ventral surface (usually collapsed in air dried specimens) (Figs 64, 66); outer surface of scape with slender, elongate region of distinct, circular to oval micropunctures along length of scapular scrobe (Fig. 78) . . . . ***E. pervius* n. sp.**

\- Flagellum with setae distinctly curved and projecting almost at right angle to flagellomeres, hence appearing densely setose and quite distinctly robust-filiform, the basal flagellomeres including setae as wide or slightly wider than clava (Figs 62, 63, 65); outer surface of scape sometimes with different sculpture pattern, either with lanceolate region mostly ventrobasal to scapular scrobe (Figs 73, 74) or with shallower, more irregular sculpture (Figs 75, 76). 22

22(21) Reared from gall wasp (Cynipidae) galls on oaks and roses; outer surface of scape with lanceolate micropunctate sensory region ventrobasal to scapular scrobe (sometimes difficult to see if scape partly yellow), but sensory region at most continued only partly to apex as single row of punctures along scrobe (Figs 73, 74). 23

\- Reared from other hosts; outer surface of scape ventrally with variably distinct micropunctate sensory band along scapular scrobe but at least not a lanceolate region largely restricted to region ventrobasal of scrobe (Figs 75–77). 24

23(22) Scape entirely dark; legs almost completely dark except some basal tarsomeres white (Figs 59, 61) . . . . ***E. cynipidis*** **Ashmead &** ***E. conigerae*** **Ashmead**

\- Scape with outer surface yellowish at least ventrobasally and usually yellowish ventrally along entire length through scapular scrobe, the inner surface sometimes also variably extensively yellowish apically; legs with at least protibia variably extensively yellowish, often distinctly dark only dorso- and ventrolongitudinally with posterior and/or anterior surfaces yellowish, and often with at least metatrochanter and trochantellus whitish . . . . ***E. dryorhizoxeni*** **Ashmead** [part]

24(22) Outer surface of scape with elongate band of distinct, circular to oval, punctures along entire length of scapular scrobe so as to appear micropunctate to more or less "pitted", with sculptured area often slightly enlarged ventrobasal to scrobe (Fig. 77). . . . . ***E. cyaniceps*** **Ashmead &** ***E. utahensis*** **Girault**

\- Outer surface of scape without elongate band of distinct punctures ventral to scapular scrobe, often with distinct micropunctures only apically (Fig. 75) or with micropunctures more or less coalesced so as to appear more elongate-strigose ventral to scapular scrobe (Fig. 76) . . . . ***E. cushmani*** **(Crawford)**

1. *Eupelmus* (*Eupelmus*) *annulatus* Nees

Figs 27, 36, 49, 58, 67, 80; Map 4

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

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

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

Eupelmus nubilipennis Förster, 1860: 121−122. Syntypes, female (NHMW, examined). Type data: Germany: region around Aachen. Synonymy by Graham, 1988: 24.

Description. FEMALE (Fig. 36). Length about 2.1−5.2 mm. Head (Fig. 27) at least partly metallic green to bluish-green but with variably extensive dark purple to black markings on some or all of following regions: interantennal region, clypeal region, lower face adjacent to malar sulcus, parascrobal region, upper face variably widely mesally below anterior ocellus and sometimes along inner orbit though usually with at least small greenish region remaining below level of posterior ocellus, between anterior ocellus to posterior ocelli, between posterior ocelli and inner orbit, and within ocellar triangle; maxillary and labial palpi dark brown. Antenna dark brown, the scape and pedicel usually with metallic green luster under some angles of light. Mesosoma with tegula brown and often with slight metallic luster; otherwise mostly metallic green to bluish-green similar to head, though convex anterior part of medial mesoscutal lobe, lateral lobe dorsolongitudinally, scutellum, and acropleuron posteriorly often variably extensively brownish, dark or with coppery luster under some angles of light. Forewing hyaline or at most slightly yellowish to light brownish variably extensively behind mv and/or stv (Fig. 49b); venation yellowish-brown; setae more or less uniformly brown, sometimes lighter yellowish within basal cell but at least setae on submarginal vein and dorsally within costal cell quite dark and conspicuous. Front leg with trochanter dark brown; femur sometimes with trochantellus yellowish but otherwise dark brown or with slight metallic luster similar to mesosoma except for extreme apex; tibia yellowish except for dark brown longitudinal region dorsally and ventrally, the ventral band sometimes almost extending to apex but dorsal band only within about basal half; and tarsus yellowish except for pulvillus or sometimes with apical for one or 2 tarsomeres brown. Middle leg sometimes entirely yellowish-orange beyond coxa except knee and apex of tibia usually somewhat lighter and mesotibial apical pegs and mesotarsal pegs black, but more often trochanter, short subbasal band on tibia, 1−3 apical tarsomeres, and sometimes trochantellus brown. Hind leg at least with femur mostly dark similar to profemur except more extensively yellowish apically (typically more so dorso- and ventroapically), but usually trochanter, tibia partly, and l−4 apical tarsomeres brown, with tibia usually dark brown at least dorsally and usually also ventrally within about basal half to two-thirds similar to protibia or sometimes dark regions almost or completely coalesced into complete band. Gaster mostly dark brown, often with distinct metallic green to bluish lusters anteriorly on basal tergum, but otherwise with only very limited, often obscure metallic lusters under some angles of light, and with brown hairlike setae similar in color to cuticle; ovipositor sheaths with very short dark basal region abruptly delineated from much longer lighter colored apical region, the lighter colored region white basally and variably conspicuously graduated yellowish-orange to brown apically, but these regions not abruptly delineated and variably darker apex at least obviously lighter than basal dark region.

Head (Fig. 27) with frons entirely, finely, meshlike coriaceous at least to level of posterior ocelli, in larger specimens vertex more transversely alutaceous-reticulate to reticulate-imbricate posteriorly, and laterally almost uniformly merged into parascrobal region with at most very slight undulation at junction of more reticulate sculpture of parascrobal region (Fig. 27, arrow); scrobal depression reticulate-rugulose; IOD = 0.35−0.4× head width; OOL: POL: LOL: MPOD = 0.6−1.0: 2.4−3.1: 1.5−2.1: 1.0. Antenna with combined length of pedicel + flagellum = 1.2−1.4× head width; scape about 4.0−5.2× as long as wide, in outer view ventral margin almost straight to slightly sinuate with very slender flange over at least apical half; pedicel in lateral view about 2.4−2.75× as long as wide; fl1 slightly transverse to quite distinctly (up to about 1.2×) longer than wide; fl2 about 1.6−2.5× as long as wide and about 2.0−3.0× as long as fl1; subsequent funiculars increasing in width to quadrate or slightly longer than wide (up to about 1.25×) fl8; clava about 1.9−2.6× as long as wide, 0.7−0.8× combined length of apical three funiculars, and 0.18−0.37× length of funicle. Mesoscutum sometimes almost uniformly meshlike reticulate except lateral lobe more minutely coriaceous mediolongitudinally and mesoscutal medial lobe usually more transversely reticulate-imbricate anteriorly. Scutellar-axillar complex sometimes meshlike reticulate similar to mesoscutum but axilla often more obliquely reticulate-imbricate and scutellum more longitudinally reticulate-imbricate on either side of median. Prepectus with white hairlike setae mediolongitudinally, the setal apices not normally extending to dorsal or ventral margins. Acropleuron finely meshlike reticulate anterior and posterior of medial microsculptured region, the cells partly larger and/or somewhat more elongate posteriorly than anteriorly but with flat surfaces defined by slightly raised ridges. Forewing (Fig. 49b) with linea calva but disc and basal cell otherwise uniformly setose; costal cell ventrally setose along length with 2 or 3 lines of setae medially, and dorsally with line of setae near leading margin over at least apical half and usually two-thirds (Fig. 49a, arrows); cc: mv: pmv: stv = 3.5−4.5: 3.2−4.1: 0.9−1.2: 1.0. Mesotibia with apical row of 4−6 pegs; mesotarsus ventrally with pegs on basal four tarsomeres, basitarsus with about 12−20 pegs arranged distally in double row on either side, second tarsomere with 4−6, third tarsomere with 2−4, and apical tarsomere with single apical peg on either side. Propodeum with U-shaped plical depression extending to foramen; callus with white hairlike setae not obscuring cuticle or sculpture. Gaster with inner plate of ovipositor extending at most only very slightly beyond apex, by distance only about equal to maximum width of ovipositor sheath; ovipositor sheaths about 0.84−0.94× length of metatibia and about 0.93−1.15× length of marginal vein.

MALE (Fig. 58). Length about 1.3−3.3 mm. Head usually with at least scrobal depression non-metallic or almost so, but at least frontovertex and gena under some angle of light variably distinctly and extensively dark metallic green to blue or partly purple; maxillary and labial palpi brown to sometimes extensively light yellowish-brown but not white. Antenna dark brown except scape often and pedicel sometimes with slight metallic luster similar to head capsule. Mesosoma mostly metallic green to blue or partly purple similar to head, the tegula at least dark brown and often also variably distinctly metallic. Front leg with trochanter, trochantellus and femur dark brown or dark with at least slight metallic luster similar to mesosoma; tibia extensively dark at least dorso- and ventrolongitudinally but anterior and usually posterior surface longitudinally yellowish; tarsus yellow to brownish-yellow or with apical 1 or 2 tarsomeres more distinctly brown. Middle leg with color pattern similar to front leg except basal 1−3 tarsomeres white and at least apical 2 tarsomeres brown (tarsomeres often increasingly dark brown distally beyond basitarsus), and sometimes tibia more uniformly yellowish. Hind leg, including tibia, dark except tarsus with similar color pattern to mesotarsus. Forewing hyaline. Gaster with basal tergum sometimes metallic green to bluish-green basally, but remainder brown.

Head with frons meshlike coriaceous or at most only finely coriaceous-reticulate; scrobal depression with distinct meshlike sculpture at least dorsally, the scrobes variably extensively and interantennal region only finely meshlike coriaceous or smooth and shiny; vertex rounded into occiput, quite distinctly reticulate to transversely reticulate-strigose but without evident transverse carina. Head with IOD about 0.43−0.46× head width: OOL: POL: LOL: MPOD = 0.5−0.7: 2.4−2.9: 1.4−1.5: 1.0; lower face (Fig. 67) with sparse, short, straight brownish setae mesally, but laterally between torulus and malar sulcus with region of much longer and therefore more conspicuous and at least superficially denser brownish setae, some of which distally are abruptly or sinuately curved; gena with one much longer seta below malar sulcus. Antenna (Fig. 58) with scape ovoid, about 1.9−2.0× as long as maximum width, the outer surface ventrally with distinct micropunctures extending along length of scapular scrobe in comparatively broad band and often along almost entire length of scape though sometimes minute basal to scrobe (Fig.

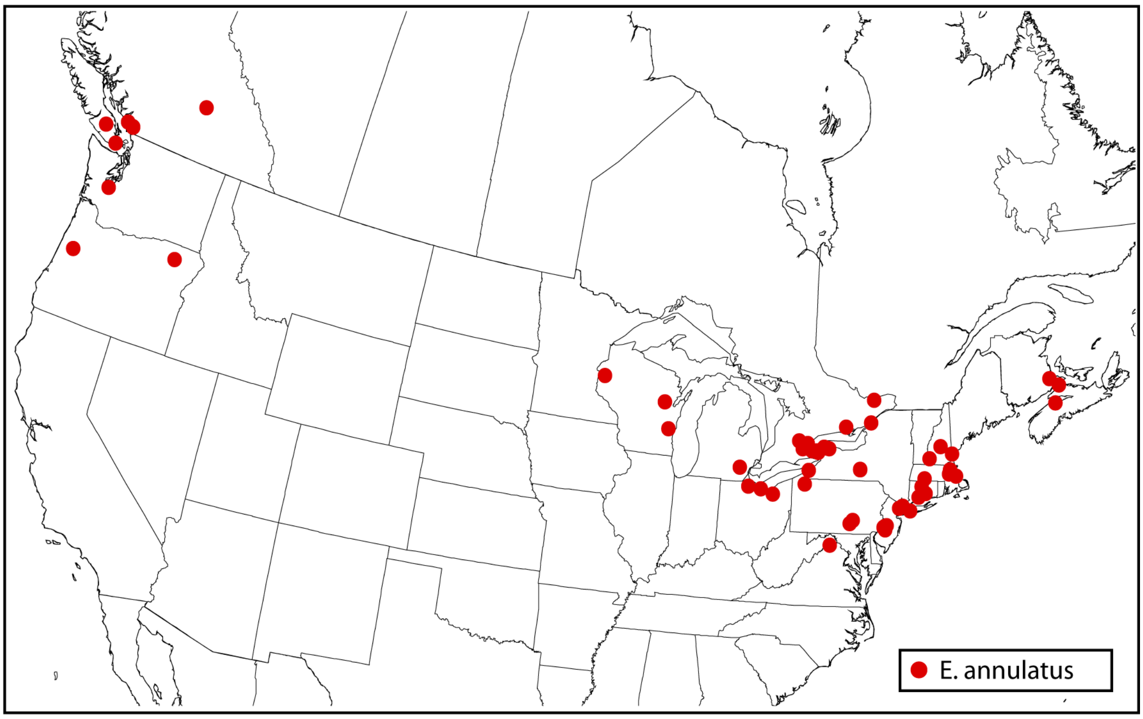
80); length of pedicel + flagellum about 1.2−1.3× head width; pedicel about 1.8−2.1× as long as wide, ventrally with line of 6 or 7 distally curved setae; flagellum slender-clavate with very short setae not extending conspicuously from flagellomeres; fl1 transverse-ringlike, but setose and usually quite distinct; fl2 about 1.25−1.5× as long as wide and subsequent funiculars decreasing in length and increasing slightly in width to quadrate or slightly transverse fl8; clava broadly oval with micropilose sensory region occupying entire ventral surface (usually collapsed in air-dried specimens), about 1.7−2.0× as long as wide and about 0.7−0.9× as long as apical three funiculars. Mesoscutum meshlike reticulate; axillae and scutellum more finely coriaceous-reticulate or slightly imbricate. Propodeal plical region meshlike coriaceous on either side of median carina or at most slightly reticulate-strigose posteriorly in large specimens, but callus finely sculptured with setae originating from tiny bumps. Forewing with cc: mv: pmv: stv = 3.3−4.1: 2.7−3.5: 1.0−1.2: 1.0; costal cell dorsally with line of dark setae extending over at least apical half and ventrally with dark setae continuously along length, mesally with 2 lines.

Regional material examined (173♀, 43♂). CANADA. **BRITISH COLUMBIA**: Blind Bay near Sorrento, 10-23.IX.87, C.A. Elsey (1♀). Cowichan Lake, 10.VIII.42 (1♀), 12 (2♀), 19 (4♀, 1♂).VIII.43, M.L. Prebble, *Apanteles solitarius* ex *Stilpnotia salicis* (2♀). New Westminster, Green Timbers, em. 7 (1♂), 12 (1♀).III.42 in lab., K. Graham, ex *Pissoides sitchensis*. Surrey, Hawthorne Park, 49º11.6543'N 122º49.5089'W, 6.VI.2008, N. Furness, from *Pinus contorta* (1♀). Vancouver, Point Grey, VII.73, J.R. Vockeroth (1♀). Victoria, 7.VII.87 (1♀), 18 (2♀), 24 (1♀).VIII.87, *P.* [*Pinus*] *contorta*, JWEH. **NEW BRUNSWICK**: Moncton, R.E. Balch, 18114C37, ex *Apanteles cocoon* (2♀, 4♂ CNC; 2♀, 2♂ USNM). **NOVA SCOTIA**: Aldershot — 25.VIII.50, A. McPhee, apple tree (1♀); 16.IX.52, K.H. Sanford, taken on apple (1♀). N. Sawler, 4.IX.51, taken on apple (1♀). Amherst, 29.VII.36, C.E. Atwood, ex *Apanteles solitarius* (1♀). **ONTARIO**: Ancaster, 19.VII.91 (1♂, CNC Photo 2010-23), 29.VII-10.VIII.94 (1♀), B. DeJonge. Guelph, 22.VIII.49, 12.IX.49, Forest Insect Survey No. 049-1244, ex *Diprion similis* (2♀). Beamsville, coll. 1.V.39, em. 5.VI.39, Creelman T.O.S., [Belleville Exp. No.] 18085H39 6B, host: *Carpocapsa pomonella* L. (1♀). Belleville, 16.VI.55, R.W. Smith, ex gum exudate from white pine (1♀). Hamilton — 15.VII.79, [Belleville Exp. No.] 10852P79 109C3, ex *Rhyacionia buoliana* (1♀). 28.VI-14.VII.82, M. Sanborne (1♀). McLean, 25.VII.91 (1♂), 14.VIII.91 (1♀), ex *Cotesia melanoscela*. Niagara Falls — Forest Insect Survey 1938, em. 24.VI.38, rec.: 3070, ex *R. buoliana* (1♀); VI-VII.93, D.E. Bright, ex *Pinus sylvestris* infested with *Tomicus piniperda* (1♀). Oakville, 12 (2♀), 15 (1♀), 17 (2♀), 18 (1♀), 27 (1♀), 31 (1♂).VIII.33, 1 (2♀), 2 (2♀), 3 (2♀), 4 (2♀), 6 (3♀).IX.33, [Belleville Exp. No.] 18134H33 129a6, ex *Diprion simile*. Ottawa, H. Goulet — 8-10.VI.86 (1♀, CNC Photo 2010-22); 45º21.360'N 75º45.405'W, 14-20.VIII.2010 (1♀). Saint Davids, 15.VI.82, W.H. Steenburgh (1♀). St. Lawrence Island, Grenadier Island, 11.VII.75, C.M. Yoshimoto (1♀). Vineland, H.R. Boyce — 7.VIII.41, ex *Ephialtes caudata* Ratz. (1♀); 21 (1♀), 29 (1♂).VII.44, ex *G. molesta* Busch.; 18 (1♂), 26.VII.44 (1♀), 1.VIII.44 (1♂), ex *Cremastus minor* Cush. (1♀). Vineland Station, 6.VI.38, W.L. Putman (1♂ USNM).

USA. S.R. [State Road ?] 143, ex Peach Moth, B.F. Driggers (1♀ USNM). **CONNECTICUT**: ***Hartford Co.***, 1933, ex *Macrocentrus* cocoon, Oriental Fruit Moth Par. Invest. (1♀ USNM). ***Middlesex Co.***, 8.VI.58, W.J. Morse (1♀ DENH). ***New Haven Co.***, New Haven, 30.VI.16, em. 25.VII.16, M.P. Zappe, in *Diprion simile* (1♀ USNM). **MASSACHUSETTS**: eastern Mass., 14.VI.17, 25.VII.17, ex *Apanteles melanoscelus*, Gypsy Moth Lab. (3♀ USNM). ***Hampden Co.***, Springfield, 24.V.32, 9.VI.32, 23.VIII.33, J. Pim (4♀ USNM). ***Middlesex Co.***, Melrose Highlands, 6.I.23, 30, 31.V.23, 25.VII.24, ex *Apanteles melanoscelus*, Gypsy Moth Lab. (1♀, 3♂ USNM). ***Plymouth Co.***, Scituate, 23.V.21, 2, 4.VI.21, Gypsy Moth Lab. (1♀, 3♂ USNM). ***Suffolk Co.***, Boston, Roslindale, R.L. Taylor — ex *Pissodes strobi* (2♀ USNM, paralectotypes of *E. pini*); V.28, VI.28 (11♀, 7♂ USNM; CNCI LB-specm 2010-005). **MICHIGAN**: ***Washtenaw Co.***, Ann Arbor, 93L-5, 9.XII.04, 11.I.05, L. Bauer & H. Liu, ex *Agrilus plannipennis* Fairmaire, lab. reared from cut logs (1♀). **NEW HAMPSHIRE**: ***Cheshire Co.***, Keene, 11, 12.VIII.33, J. P. M. (2♀ USNM). ***Merrimack Co.***, Franklin, 1924, ex *Apanteles melanoscelus*, Gypsy Moth Lab. (9♀, 4♂ USNM). ***Strafford Co.***, Durham — 17.VIII.21 (1♀ DENH); 12.VII.33, J. Pim (1♂ USNM). **NEW JERSEY**: ***Bergen Co.***, Rutherford, 9.VIII.29, Schott, in numbers on Linden infested with *Chrysoclista lariella* Clk. (1♀ USNM). ***Burlington Co.***, Oriental Fruit Moth Par. Invest., ex *Grapholita molesta* — Beverly, 1934 (3♀ USNM); Bridgeboro, 1940 (1♀ USNM); Burlington, 1940 (2♀ USNM), 1942 (1♀ USNM); Evesboro, 1934 (4♀ USNM); Marlton, 1940 (1♀ USNM); Moorestown, 1931 (7♀, 1♂ USNM), 1932 (1♀ USNM), 1933 (9♀, 2♂ USNM), 1934, (3♀ USNM), 1945 (6♀ USNM); Palmyra, 1945 (3♀ USNM); Parry, 1934. **NEW YORK**: ***Chautauqua Co.***, Westfield, 22.VII.32, ex parasite cocoon, Oriental Fruit Moth Par. Invest. (1♀ USNM). ***Nassau Co.***, Farmingdale, 30.VII.23 (1♀ USNM). ***Niagara Co.***, Olcott, 1933, ex *Glypta* cocoon, Oriental Fruit Moth Par.

Invest. (3♀, 3♂ USNM). ***Orleans Co.***, Ridgeway, 1933, Oriental Fruit Moth Par. Invest. — ex *Glypta* cocoon (2♀ USNM); parasite cocoon (1♀ USNM); *Laspeyrsia molesta* (1♂ USNM). N. Ridgeway, 27.VII.40 (1♀, 1♂ USNM), 1.VIII.40 (1♀ USNM), Fr. bud moth cage. ***Tompkins Co.***, Ithaca — 9.VIII.37, H.A. Scudder, on dead red oak (1♀ CASC); Cayuga Heights, 26.VII.64, P.P. Babiy (1♀ ZSMC). ***Westchester Co.***, Yonkers, 29.VI.38, 2.VII.38, from apple (2♀ USNM). **OHIO**: ***Lorain Co.***, Vermilion, 20.VII.32, ex parasite cocoon, Oriental Fruit Moth Par. Invest. (1♀ USNM). ***Ottawa Co.***, Oak Harbor, 1933, ex *Macrocentrus* cocoon, Oriental Fruit Moth Par. Invest. (1♂ USNM). ***Summit Co.***, West Richfield, 21.VII.32, ex parasite cocoon, Oriental Fruit Moth Par. Invest. (1♀ USNM). **OREGON**: ***Benton Co.***, 6 mi. S. Philomath, Decker Road, 4.VIII.78, J.B. Woolley, *Quercus garryana* (1♀ TAMU). ***Union Co.***, Mount Emily, 29.VII.87, T.R. Torgersen (1♀ AEIC). **PENNSYLVANIA**: ***Crawford Co.***, Centerville, 18.VII.32, ex parasite cocoon, Oriental Fruit Moth Par. Invest. (1♀ USNM). ***Dauphin Co.***, Penbrook, F.M. Trimble, pars. of *Diprion simile*, *Pinus* (1♀ USNM). ***York Co.***, 1933, ex *Macrocentrus* cocoon, Oriental Fruit Moth Par. Invest. (2♀ USNM). **WASHINGTON**: ***Thurston Co.***, 14.VII.77 (1♀ CUCR). **WISCONSIN**: ***Fond du Lac Co.***, T13N, R19E, S23, 4-9.IX.75 (♀ CNC Photo 2010-61), 2-9, 16-23.VIII.76, 12-19.VII.77, Gypsy moth M.T. (4♀, 1♂ IRWC). ***Polk Co.***, Gibson Lake, T34n R16w S34, em. 22.VIII.61, H.C. Coppel, *Diprion similis* Htg. (1♀ USNM). ***Shawano Co.***, Shawano Navarino State Wildlife Area, 10 mi. S., 44º39'11″N 88º34'49″W, 2-30.IX.2001, C.M. Brabant (1♀ IRCW). **VIRGINIA**: ***Frederick Co.***, Winchester, 1933, ex *Glypta* cocoon, Oriental Fruit Moth Par. Invest. (2♀ USNM).

Distribution. Possibly transcontinental in southern Canada, but at least present in British Columbia and widely distributed throughout eastern Canada and northeastern USA (Map 4). It is unknown whether *E. annulatus* is a naturally occurring Holarctic species or was introduced accidentally to North America from Europe, from which Noyes (2010) listed several countries as part of its distribution. I saw specimens of *E. annulatus* from Austria, Czech Republic, England, France, Germany, Greece, Hungary, Iran, Italy, Russia (Moscow region), Sweden, Switzerland and Turkey. I did not see any specimens from the eastern Palaearctic region (see further under hosts), which may support a hypothesis that the species was introduced accidentally to North America from western Europe.



Map 4. Regional distribution of *E. annulatus*.

Biology. Within North America, most literature on the biology of *E. annulatus* was published under the name *E. spongipartus*, a valid species that Noyes (2010) incorrectly listed as a synonym of *E. annulatus* following Bouček (1970). It was recorded as a primary parasitoid of *Diprion similis* (Hartig) (Hymenoptera: Diprionidae) under *E. spongipartus* (Raizenne 1957, Drooz *et al.* 1985) and *E. cyaniceps* (Finlayson 1962), but the records of both Drooz *et al.* (1985) and Finlayson (1962) are based on misidentifications of *E. cushmani*. Although I have not seen voucher specimens from Raizenne (1957), I can confirm *D. similis* as a host of *E. annulatus* through other labelled females. It has also been recorded in the literature as at least a facultative if not obligate hyperparasitoid of Lepidoptera through Hymenoptera primary parasitoids.

Literature records and hosts confirmed through examination of labelled specimens — LEPIDOPTERA. **Agonoxenidae**: *Chrysoclista “lariella* Clk” [? = *C. linneela* (Clerk). **Tortricidae**: **Carpocapsa pomonella* L., *Grapholitha* (= *Laspeyrsia*) *molesta* (Busck) (Brunson and Allen 1948, Allen 1962), **Rhyacionia buoliana* (Denis & Schiffermüller). **Lymantriidae**: *Nygmia phaeorrhoea* (Smith) (Proper 1934), *Lymantria dispar* (L.) (Muesebeck and Dohanian 1927), *Leucoma* (= *Stilpnotia*) *salicis* (L.) (Reeks and Smith 1956). COLEOPTERA: **Curculionidae**: **Pissodes strobi* (Peck) on white pine, *Pinus strobus* L. (Pinaceae) [recorded under the name *E. pini* by Taylor (1929)]. HYMENOPTERA. **Braconidae**: *Apanteles melanoscelus* (Ratzeburg), *A. solitarius* (Ratzeburg) (Muesebeck and Dohanian 1927), *Macrocentrus ancylivorus* Rohwer (Brunson 1948, Allan 1962), *Meteorus versicolor* (Wesmael) (Proper 1934). **Ichneumonidae**: *Glypta rufiscutellaris* Cresson (Burks 1979), **Liotryphon caudatus* (Ratzeburg), *Temelucha* (= *Cremastus*) *minor* (Cushman) (Allan 1962).

In addition to the above records, I saw one female labeled as associated with *Tomicus piniperda* (L.) (Coleoptera: Scolytidae) on Scots pine, *Pinus sylvestris* L. Collection records listed above from apple trees likely are associated with the codling moth, from which it was reared once.

Eupelmus annulatus has never been reared as a parasitoid of Cynipidae (Hymenoptera) galls in North America. Noyes (2010) listed several genera and species of cynipids as hosts of *E. annulatus* in Europe. Very likely most of these records are for *E. spongipartus*, described originally from a gall of *Cynips* L., but I did see females I identify as *E. annulatus* from Hungary (HNHM) labeled as reared from galls of *Andricus* (= *Cynips*) *kollari* (Hartig). I also saw one female (USNM) from Nanking, China, reared from the oriental chestnut gall wasp, *Dryocosmus kuriphilus* Yasmatsu on Chinese chestnut, *Castanea mollissima* Blume (Fagaceae), that is very similar to *E. annulatus* (see below under remarks) except the scape is angulate rather than having a ventral flange and the ovipositor sheaths are brownish subapically (apex yellowish-white similar to a longer yellowish-white region basal to the brownish region) rather than being graduated brownish. This female undoubtedly represents an undescribed species that is very similar to *E. annulatus* and possibly is the species that has been recorded as *E. spongipartus* parasitizing *D. kuriphilus* in China (Guo *et al.* 1997).

Remarks. My interpretation of *E. annulatus* relative to *E. spongipartus* and *E. urozonus* is discussed in the remarks section for *E.* (*Eupelmus*). Females are differentiated from other *E.* (*Eupelmus*) species by a combination of features, including the following: frons at least anterior to ocelli entirely, finely, meshlike coriaceous (Fig. 27); inner plate of ovipositor not projecting obviously beyond apex of the gaster (Fig. 36); ovipositor sheaths at least 0.8× as long, but not quite as long as metatibia, and almost as long to slightly longer than marginal vein, and though variably darkly graduated brown apically at least apical brownish region obviously lighter in color than very short basal dark region and not abruptly delineated from the more whitish medial region (Fig. 36); gaster with hairlike setae similar in color to dark cuticle (Fig. 36). In addition, Allen (1962) first noted (under the name *E. spongipartus*) that in females of *E. annulatus* the ventral margin of the scape is produced as a very thin and narrow flange over at least its apical half, though this sometimes is not very obvious. Furthermore, the forewing always has brown and therefore quite conspicuous setae on the submarginal vein and over at least the apical half and often two-thirds or more of the dorsal surface of the costal cell. Females share an entirely coriaceous frons with those of *E. arizonensis* (*cf.* Figs 25, 27), but because of their shorter ovipositor sheaths and more extensively setose prepectus they are more likely to be mistaken for *E. utahensis*, as discussed under the latter species.

Nees (1834) mentioned a variety with an oblique discal spot in the original description of *E. annulatus* and Askew and Nieves-Aldrey (2000) noted that some females of *E. annulatus* from Spain have relatively well developed forewing infuscation. Although I did not examine the lectotype of *E. annulatus*, the examined syntype of *E. nubilipennis* has a very slight brownish region below the stigmal vein and such specimens would key to *E. nubilipennis* using Kalina (1988). Females of *E. annulatus* in North America sometimes also have variably distinct, but at most light brown infuscation behind some or all of the stigmal and marginal veins (Fig. 49b). Because of this variation I include such specimens within my concept of *E. annulatus*.

Males of *E. annulatus* are differentiated from other *urozonus*-group males primarily by genal setal pattern. The setae between the torulus and malar space are not only brown, but long and abruptly or sinuately curved distally (Fig. 67). All other *urozonus*-group males in North America have the setae evenly curved, if long, and usually quite obviously white (Figs 62, 64, 68−70). In addition, *E. annulatus* males have at least the anterior surface of the mesotibia extensively light-colored (Fig. 58). Except for some *E. curticinctus* males, all other *urozonus*-group males have the mesotibia entirely dark except for the knee and apex narrowly. Males of *E. annulatus* also have a slightly less coarsely sculptured frons than other *urozonus*-group males and, similar to females (Fig. 49a), the costal cell dorsally with dark setae extending over at least its apical half and ventrally with at least two lines of setae extending along its entire length.

2. *Eupelmus* (*Eupelmus*) *arizonensis* n. sp.

Figs 24, 25; Map 13

Type material. HOLOTYPE (♀, WFBM: deposited in CASC on indefinite loan). [USA]: ARIZ [Arizona] Cochise Co., 2 mi. W. S.W.R.S. [Southwestern Research Station], VIII.18.1988, *Quercus* / W.F. Barr collector / CNC Photo 2010-66 / Holotype *E*. (*Eupelmus*) *arizonensis* Gibson. [Condition: point-mounted; entire, but left antenna detached and glued to point.]

PARATYPE. USA. **ARIZONA**: Chiric[ahua] Mts., 3.6, H.G. Hubbard (1♀ USNM, CNC Photo 2010-67).

Etymology. Named after state from which the type specimens were collected.

Description. FEMALE (Fig. 24). Length about 2.3–2.5 mm. Head dark with distinct metallic green to bluish-green luster on at least frontovertex and with limited violaceous and coppery lusters under some angles of light, particularly on frons along dorsal margin of scrobal depression (Fig. 25); maxillary and labial palpi dark brown. Antenna dark brown, the scape and pedicel with slight metallic luster. Mesosoma with tegula brown; otherwise mostly dark similar to head but mesonotum quite distinctly metallic green at least in part, with convex anteromedian lobe sometimes more purplish under some angles of light and lateral surface more dark brown with less distinct metallic lusters. Forewing hyaline, venation yellowish, and with brown setae. Legs with trochanters and trochantelli dark; femora and tibiae extensively dark except knees and tibiae apically yellowish; tarsi yellowish except for apical tarsomeres. Gaster dark brown except for distinct metallic green luster basally on basal tergum and less conspicuous greenish luster apicolaterally; ovipositor sheaths with about basal third of apparent sheath length dark brown and about apical half brown to yellowish-brown, the intervening lighter yellowish region obviously shorter than either basal or apical regions and less distinctly differentiated from apical than basal region.

Head with frons shiny and meshlike coriaceous to level of posterior ocelli (Fig. 25); vertex transversely coriaceous-alutaceous to strigose posteriorly; scrobal depression shiny, coriaceous, and interantennal region similar except smoother dorsally and laterally in scrobes; IOD about 0.4× head width; OOL: POL: LOL: MPOD = 0.6–9: 2.2–2.3: 1.5: 1.0. Antenna with combined length of pedicel + flagellum about 1.4–1.6× head width; scape about 4.3× as long as wide, in outer view ventral margin almost straight and without distinct flange; pedicel in lateral view about 2.5–2.75× as long as wide; fl1 slightly transverse to quadrate; fl2 about 2.7–2.8× as long as wide and 2.8–3.5× length of fl1; subsequent funiculars increasing in width to quadrate fl8; clava (compressed) about 2× as long as wide, slightly shorter than combined length of apical three funiculars, and 0.3–0.4× length of funicle. Mesoscutum more or less evenly, very finely, meshlike reticulate except anterior portion of median lobe more transversely coriaceous-alutaceous and lateral lobe more minutely meshlike coriaceous mediolongitudinally. Scutellar-axillar complex meshlike coriaceous to slightly imbricate or obliquely alutaceous laterally. Prepectus almost bare but with 2 inconspicuous setae in dorsal half. Acropleuron meshlike coriaceous to very finely meshlike reticulate anterior and posterior of medial microsculptured region, the cells larger posteriorly than anteriorly but with flat surfaces defined by at most slightly raised ridges. Forewing with linea calva but disc and basal cell otherwise setose; costal cell ventrally setose along length with 2 lines of setae medially, and dorsally with line of setae near leading margin over at least apical half and sometimes along almost entire length; cc: mv: pmv: stv = 4.4–4.5: 4.6–5.0: 1.1–1.2: 1.0. Mesotibia with apical row of 4 pegs; mesotarsus ventrally with pegs on basal four tarsomeres, basitarsus with 11 or 12 pegs arranged distally in double row along either side, second tarsomere with 5, third tarsomere with 2 or 3, and apical tarsomere with single apical peg on either side. Propodeum with U-shaped plical depression extending to foramen; callus with white hairlike setae not obscuring cuticle or sculpture. Gaster with strigose inner plate of ovipositor sheath extending distinctly beyond apex for distance at least equal to length of basitarsus of hind leg, the apparent sheath length about 1.6–1.7× length of body excluding sheaths; ovipositor sheaths about 1.9× length of metatibia and 1.9–2.0× length of marginal vein, but apparent sheath length about 2.2× length of metatibia and 2.25× length of marginal vein (Fig. 24).

MALE. Unknown.

Distribution. Known only from southeastern Arizona (Map 13).

Biology. Unknown.

Remarks. The two available females are insufficient to estimate variation reliably, but appear to be easily distinguished from those of other regional species by their very long ovipositor sheaths (Fig. 24) in combination with quite a shiny, completely coriaceous frons (Fig. 25). Apparent length and color pattern of the ovipositor sheaths is most similar to that of *E. curticinctus* (*cf.* Figs 24, 41), but *E. curticinctus* females have a reticulate frons (Fig. 31) as well as a more coarsely sculptured mesonotum and acropleuron. Although the legs beyond the trochanters are missing from the *E. arizonensis* paratype, at least the holotype has the mesofemur and tibia extensively dark (Fig. 24), unlike *E. curticinctus* females which have mostly yellowish-orange middle legs (Fig. 41). Further, the prepectus appears to have only 2 inconspicuous setae, unlike the more extensively setose prepectus of *E. curticinctus* females. The last two features, in addition their ovipositor sheaths, also help distinguish *E. arizonensis* females from those of *E. annulatus*, which also have a completely coriaceous frons (Fig. 27). Under some angles of light, the ovipositor sheaths of the paratype have the short medial light-colored region less distinctly differentiated from a much longer yellowish-brown apical region. It is possible that females may be found with the sheaths appearing essentially bicolored, with about the apical two-thirds yellowish-brown and the basal third dark brown.

3. *Eupelmus* (*Eupelmus*) *conigerae* Ashmead

Fig. 22; Map 5

Eupelmus conigerae Ashmead, 1885: xv. Holotype, female (USNM, examined). Type data: USA, Florida [Jacksonville]; reared from *Cynips conigera* Ashmead gall.

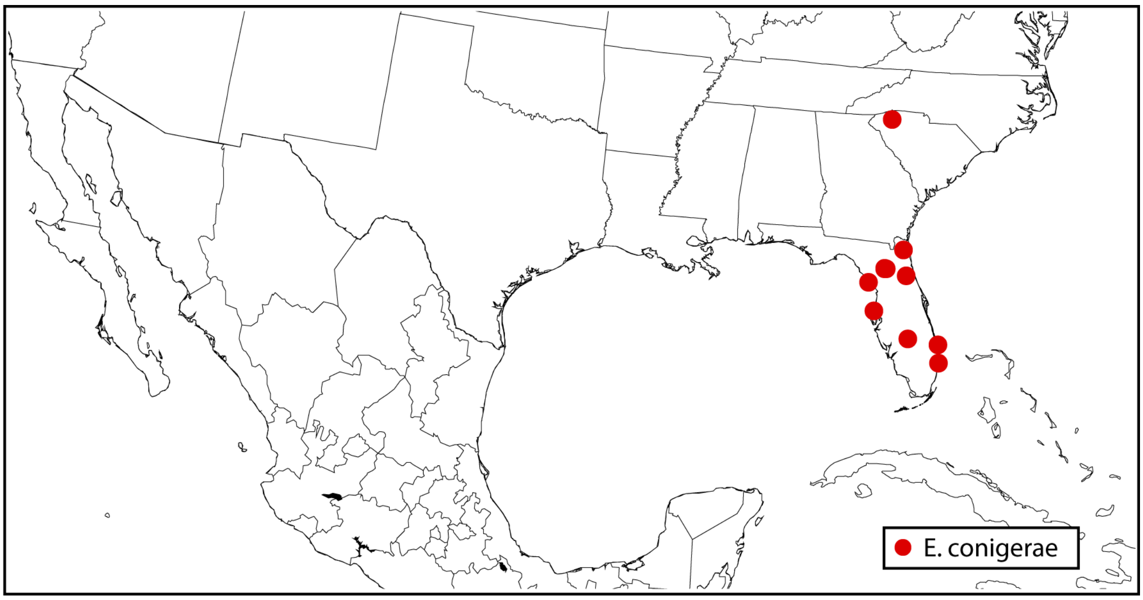
Description. FEMALE (Fig. 22). Length about 2.7−5.2 mm. Head of smallest specimen with quite distinct metallic green luster except for reddish-coppery region medially between level of posterior ocelli and scrobal depression under some angles of light, but usually mostly dark with limited green luster along inner orbit and within scrobal depression or, much more commonly, dark with variably extensive and bright reddish-coppery to somewhat violaceous lusters under some angles of light; maxillary and labial palpi dark brown. Antenna of smallest specimen mostly brown with scape yellowish basally, but usually at least entire scape, pedicel, and often funicle variably extensively yellowish-orange. Mesosoma usually completely yellowish-orange, though most of mesosoma of smallest specimen light brownish-orange with very slight and limited metallic green luster on mesonotum and lateral panel of pronotum under some angles of light. Forewing with base of costal and basal cells at most only obscurely yellowish, the wing usually hyaline basally and apically but broadly brown from level of base of parastigma to somewhat beyond pmv, the infuscation sometimes faded to absent posteriorly, and discal setae brown except for at least a few white setae behind extreme base of parastigma. Legs, including coxae, usually yellowish-orange except for black mesotibial apical pegs and mesotarsal pegs, though metacoxa of smallest specimen with very slight metallic green luster under some angles of light and femora and tibiae extensively brownish-orange to dark brown. Gaster dark brown with comparatively inconspicuous hairlike setae similar in color to cuticle; projecting strigose part of inner plate of ovipositor and about basal 0.1−0.15× of ovipositor sheaths black, hence about basal quarter to third of apparent sheath length dark and remainder yellowish-orange similar to mesosoma.

Head with frons sometimes uniformly meshlike coriaceous but more commonly variably extensively reticulate-coriaceous along inner orbits and smoothly, indistinguishably merged with parascrobal region, and vertex more transversely coriaceous-alutaceous to somewhat reticulate-imbricate; scrobal depression distinctly reticulate-rugulose; IOD about 0.32−0.36× head width; OOL: POL: LOL: MPOD = 0.5−0.6: 2.1−2.4: 1.2−1.4: 1.0. Antenna with combined length of pedicel + flagellum about 1.3−1.4× head width; scape about 5.7× as long as maximum width, in outer view ventral margin evenly curved and without evident flange; pedicel in lateral view about 2.1−2.2× as long as wide; fl1 transverse, up to about 1.2× as wide as long, to quadrate; fl2 about 2.5−3.4× as long as wide and 3.8−4.5× as long as fl1; subsequent funiculars increasing in width to quadrate or usually slightly longer than wide (up to about 1.2×) fl8; clava about 2.2× as long as wide, 0.6−0.8× as long as combined length of apical three funiculars, and 0.23−0.33× as long as funicle. Mesoscutum with convex anterior portion of medial lobe transversely reticulate-imbricate anteriorly to meshlike reticulate posteriorly, but posterior concave portion shiny and at most very finely meshlike coriaceous, usually the sculpture almost effaced posteriorly, and lateral lobes finely meshlike coriaceous, usually less distinctly on inner than outer inclined surface; scutellar-axillar complex with axillae reticulate-rugulose, but scutellum longitudinally reticulate-strigose to strigose on either side of median. Prepectus often bare or superficially bare, with at most 2 white, unobvious setae. Acropleuron shiny, very finely but at least obscurely meshlike coriaceous anterior of medial microsculptured region, posterior of microsculptured region with somewhat more elongate, longitudinally aligned coriaceous sculpture except meshlike coriaceous along posterior margin. Forewing with basal cell bare except for a few brownish setae basally and white setae distally behind extreme base of parastigma; costal cell ventrally with unobvious light-colored setae at least basally and apically, variably broadly bare or with much sparser setae medially, and dorsally bare excluding setae on submelanized band above parastigma; disc with linea calva; cc: mv: pmv: stv = 4.7−6.2: 4.0−4.6: 1.1−1.2: 1.0. Mesotibia with apical row of 4−7 pegs; mesotarsus ventrally with pegs on basal four tarsomeres, basitarsus with 14−18 pegs arranged distally in double row on either side, second tarsomere with 5−8, third tarsomere with 2 or 3, and fourth tarsomere with single apical peg on either side. Propodeum with U-shaped plical depression extending to foramen; callus with dense white setae obscuring cuticle. Gaster with strigose inner plate of ovipositor extending conspicuously beyond apex by distance similar to length of hind basitarsus and about 0.2× length of ovipositor sheaths; ovipositor sheaths about 1.1−1.25× length of metatibia and about 1.8−2.0× length of marginal vein, but apparent sheath length about 1.4−1.55× length of metatibia and 2.3−2.5× length of marginal vein.

MALE. See remarks.

Material examined (19♀, 1♂). USA. **FLORIDA**: ***Alachua Co.***, Gainesville — 24.III.48, H.V. Weems Jr., reared (1♀ USNM); 14.IV.63, H.V. Weems Jr., mixed mesophytic woods (2♀ FSCA); 5 mi. W., 30.VI.73, E.E. Grissell, ex *Amphibolips cinerea* galls on *Quercus cinerea* (1♀ UCDC). Beville Heights, 5-12.IV.86, L.A. Stange (1♀ FSCA). ***Duval Co.***, Jacksonville (♀ holotype of *E. conigerae*, 3♀ labelled "Type", USNM). ***Highlands Co.***, Archbold Biological Station, Lake Placid, G. Melika — 10.XI.94 (1♀), 14.XI.94 (1♂) ex galls of *Amphibolips murata* on *Quercus myrtifolia*; 14.IV.2008, ex galls of *Andricus femoratus* on *Q. laurifolia*, FL 1040 (1♀). ***Levy Co.***, Cedar Key, 21.III.76, em. 29.III.76, E.E. Grissell, *Amphibolips murata* on *Quercus myrtifolia* (1♀ USNM). ***Martin Co.***, J. [Jonathan] Dickinson State Park, 6.XII.94, G. Melika, ex galls of *Amphibolips murata* on *Quercus myrtifolia* (1♀). ***Palm Beach Co.***, Boca Raton, L.H. Weld, *Q. myrtifolia*, ex gall 367 *Amphibolips* gall bud (2♀ USNM). ***Pinellas Co.***, Tarpon Springs, ex 567, *Q. myrtifolia* (2♀, CNC Photo 2010-13). ***Putnam Co.***, Crescent City (1♀ USNM). **SOUTH CAROLINA**: ***Greenville Co.***, Greenville, X.52, L. & G. Townes (1♀ AEIC).

Distribution. Restricted to southeastern USA (Map 5).



Map 5. Regional distribution of *E. conigerae*.

Biology. A parasitoid in galls of Cynipidae (Hymenoptera), including **Amphibolips cinerea* (Ashmead), **Amphibolips murata* Weld, **Andricus femoratus* Ashmead and *Callirhytis quercusventricosa* (Bassett) (= *Cynips conigera*) (Ashmead 1885), on species of *Quercus*.

Remarks. As discussed under *E. cynipidis*, typical females of *E. conigerae* are differentiated by their unique color pattern (dark head contrasting strongly with yellowish-orange mesosoma and legs, Fig. 22) in combination with some features shared with *E. cynipidis* (conspicuously protruding inner plate of ovipositor, long ovipositor sheaths, and extensively bare basal cell, *cf.* Figs 21, 22) or *E. cynipidis* and *E. nitifrons* (forewing extensively, darkly infuscate behind marginal and stigmal veins, *cf.* Figs 21−23).

I have seen only a single male of *E. conigerae* reared in association with a female from the same host and locality, though a few days earlier. This male is insufficient to confidently characterize males of *E. conigerae*, particularly because it appears to be abnormally small for the species, only about 1.3 mm in length. It is similar to males of *E. cynipidis*, including having an entirely dark scape and dark legs, except for having an unusually gracile-filiform flagellum, which might be correlated with its small body size.

4. *Eupelmus* (*Eupelmus*) *curticinctus* n. sp.

Figs 31, 41, 70, 71, 79; Map 6

Type material. HOLOTYPE (♀, USNM). [USA] KS, [Kansas], Kansas City, Ironweed (*Vernonia*), Aug. 12, 1965, C.E. Stegmaier / Holotype *Eupelmus* (*Eupelmus*) *curticinctus* Gibson. ALLOTYPE (♂ USNM): same data as holotype.

PARATYPES (54♀, 22♂). USA. **ARKANSAS**: ***Clark Co.,*** Arkadelphia [?], IX.14, C.E. Hood, Hunter No. 1479 (1♂ USNM). **FLORIDA**: ***Alachua Co.***, Gainesville, 31.X.56, R.A. Morse, at *Bidens pilosa* (1♀ FSCA). ***Collier Co.***, Collier Seminole State Park, 22-26.V.78, N.F. Johnson; swept from bushes (1♀ UCFC). ***Miami-Dade Co.***, Everglades “Hole in Donut”, 30.XII.81, I. Klein (1♀ USNM). Matheson Hammock, 8.IV.55, F.W. Mead (1♀ FSCA). Miami, 22.III.84, L.C. Chong, ex *Pluchea* (1♀ FSCA). ***Hilsborough Co.***, Tampa, spec. Survey 6.V.67, ex larva in flower ovary in *Lantana aurora*, Griswald #1756 (1♀ USNM). ***Sarasota Co.***, I-II.44, Dr. Needham 248, ex flower heads *Bidens pilosa* (1♀ USNM). ***Seminole Co.***, Oviedo, 15.IX.94, S.M. Fullerton, rural yard (1♀ UCFC). **KANSAS**: ***Doniphan Co.***, Wathena, 11, 21, 27.VII.39, S.C. Schell, ironweed (3♀, 1♂ USNM). ***Geary Co.***, Konza Prairie Biological Station, Zolnerowhich & Kula — Watershead 2B or 20B, 39º04.332'N 96º34.637'W, 2-12.IX.2005 (1♀), 12-21.IX.2005 (3♀, CNC Photo 2010-11), 21-30.IX.05 (3♀);Watershed 20C, 39º04.254'N 96º33.639'W, 26.VIII-2.IX.05 (1♀), 11-25.X.05 (1♀). ***Pottawatomie Co.***, Onaga, Crevecoeur (1♀ USNM). ***Wyandotte Co.***, same data as holotype (3♀, 4♂ USNM). ***Riley Co.***, Manhattan, S.C. Schell — 26.VIII.38, swept *Helinanthus* (1♀ USNM); 26.VIII.39, ironweed (5♀ USNM). Manhattan, R. Schwitzgebel, reared from *Vernonia interior* Sm. — 28.VIII.39; 1, 5, 6, 13, 20.IX.39; 9, 12, 21 (CNCI LB-specm 2010-003), 27.VIII.40; 1, 7, 11, 16, 21, 25.IX.40 (15♀, 11♂ USNM; ♂ CNC Photo 2010-57). **LOUISIANA**: ***Natchitoches Co.***, 16.VIII.38, R.H. Beamer (1♀ USNM). **MISSOURI**: ***St. Louis Co.***, Webster Groves, 13.IV.33, issued 30.V.33, Satterthwaite, *H. grosseserratis* (1♂ USNM). **OKLAHOMA**: ***Latimer Co.***, IX.88, K. Stephan (1♀ FSCA). ***Marshall Co.***, Willis, 1 mi. W., 24.VII.72, em. 15.VIII.72, E.E. Grissell, ex flower heads of *Vernonia* (3♀, 4♂ TAMU). ***Oklahoma Co.***, Oklahoma City, 3.VIII.17, W.D. Pierce, *Helianthus* sp. (1♀ USNM). **TEXAS**: ***Brazos Co.***, College station near Easterwood airport, 16.IX.78, J.K. Weaver, ex *Pluchea* sp. (1♀ TAMU). ***Dallas Co.***, Dallas, 28.VIII.07, Cushman, cotton invol. nectary (1♀ USNM). ***McLennan Co.***, Waco, 19.VIII.49, Jess Radle exp. 2, 5 (369), P.A. Glick, coll. on cotton (1♀ USNM).

Uncertain species identity, excluded from type series. USA. **Oklahoma**: ***Marshall Co.***, Willis, 1 mi. W., 24.VII.72, em. 15.VIII.72, E.E. Grissell, ex flower heads of *Vernonia* (2♂ TAMU).

Etymology. A noun in apposition; combination of the Latin words *curtus* (short) and *cinctum* (girdle or belt) in reference to the very short medial white band of the ovipositor sheaths.

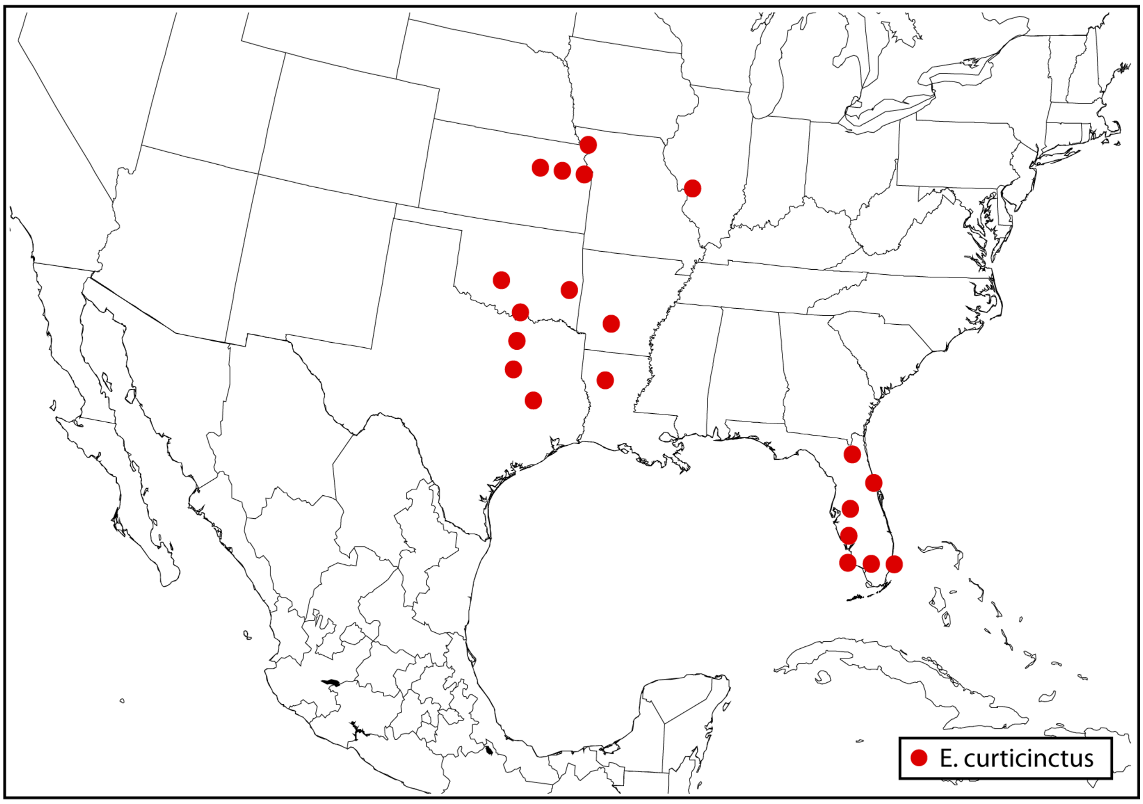
Description. FEMALE (Fig. 41). Length about 2.1−3.5 mm. Head of small specimens sometimes dark brown with obscure metallic lusters, more commonly metallic green to bluish-green with variably extensive dark purple, black or coppery markings on interantennal region, over most of parascrobal region from near malar sulcus to inner orbit above level of scrobal depression (often more or less separated into two regions by green to coppery spot below dorsal limit of scrobal depression), mesally below and surrounding anterior ocellus to within scrobal triangle and sometimes posteriorly onto vertex, and often between posterior ocellus and inner orbit, but at least with scrobes and region along inner orbit above level of scrobal depression green, bluish-green or coppery; maxillary and labial palpi dark brown. Antenna dark brown, the scape and pedicel usually with metallic green to blue lusters under some angles of light. Mesosoma with tegula brown and often with slight metallic luster; otherwise mostly dark brown with reddish-violaceous luster to green or bluish-green similar to head, but at least convex anterior part of medial mesoscutal lobe, lateral lobe dorsolongitudinally, and often scutellum partly dark or with coppery luster. Forewing hyaline, venation yellowish, and setae either uniformly yellowish to brown or more whitish basally within basal cell. Front leg with trochanter variably dark brown; femur excluding yellowish trochantellus and extreme apex dark brown or dark with metallic luster similar to body; tibia entirely yellow to yellowish-orange or variably distinctly and extensively brown dorsally and/or ventrally; and tarsus mostly yellowish but often slightly darkened toward brown apical tarsomere. Middle leg almost completely yellowish-orange beyond coxa except knee, apex of tibia, and at least basitarsus more whitish, mesotibial apical pegs and mesotarsal pegs black, and apical tarsomere brown. Hind leg similar in color to front leg except trochanter also yellowish, femur more extensively yellowish-orange apically, tibia often brownish-orange to dark brown submesally but at least ventral margin light-colored, and tarsus with basitarsus white and apical tarsomere brown but one or more intervening tarsomeres white to brown. Gaster dark brown or at most with slight metallic green to bluish luster apically and/or basally, and with brown hairlike setae similar in color to cuticle; ovipositor sheaths sometimes entirely dark brown except for lighter brown to brownish-yellow apex, but usually with comparatively short whitish medial region at most about one-half as long as apical or basal dark regions, even excluding projecting strigose portion of inner plate of ovipositor, and with basal dark region of sheath extending more than one-third length of sheath.

Head (Fig. 31) with frons quite distinctly meshlike (more or less isodiametric) reticulate (*cf.* Fig. 70), even in small specimens cells defined by low ridges, and merged into parascrobal region through at most very slight undulation; vertex, at least posteriorly, more transversely reticulate-imbricate; scrobal depression reticulate-rugulose; IOD = 0.4−0.45× head width; OOL: POL: LOL: MPOD = 0.5−0.75: 2.3−2.9: 1.4−2.0: 1.0. Antenna with combined length of pedicel + flagellum = 1.06−1.2× head width; scape 4.6−5.25× as long as wide, in outer view ventral margin almost straight and without distinct flange; pedicel in lateral view about 1.9−2.1× as long as wide; fl1 slightly transverse; fl2 about 1.66−1.75× as long as wide and about 3.0−3.2× as long as fl1; subsequent funiculars increasing in width to quadrate fl8; clava about 2.0−2.7× as long as wide, 0.65−0.9× combined length of apical three funiculars, and 0.26−0.36× length of funicle. Mesoscutum more or less uniformly meshlike reticulate except convex anterior portion of median lobe usually extensively transverse reticulate-imbricate and lateral lobe more minutely meshlike coriaceous mediolongitudinally. Scutellar-axillar complex meshlike reticulate similar to mesoscutum. Prepectus often quite broadly setose mediolongitudinally, but white setae not extending to margins so with bare dorsal and ventral band. Acropleuron finely meshlike reticulate anterior and posterior of medial microsculptured region, the cells larger posteriorly than anteriorly but with flat surfaces defined by slightly raised ridges. Forewing with linea calva but disc and basal cell otherwise uniformly setose; costal cell ventrally setose along length with 2 or 3 lines of setae medially, and dorsally with line of setae near leading margin over about apical half to three-quarters; cc: mv: pmv: stv = 4.6−5.0: 4.3−4.9: 1.2−1.4: 1.0. Mesotibia with apical row of 4−6 pegs; mesotarsus ventrally with pegs on basal four tarsomeres, basitarsus with about 11−14 pegs arranged distally in double row on either side, second tarsomere with 4−6, third tarsomere with 2, and apical tarsomere with single apical peg on either side. Propodeum with U-shaped plical depression extending to foramen; callus with white hairlike setae not obscuring cuticle or sculpture. Gaster with strigose inner plate of ovipositor sheath usually extending beyond apex for only short distance, but if sometimes for distance similar to length of basitarsus of hind leg then apparent sheath length less than half length of body excluding sheaths; ovipositor sheaths about 1.35−1.7× length of metatibia and about 1.45−1.86× length of marginal vein.

MALE. Length about 1.9−2.6 mm. Head dark metallic green to bluish-green or with limited purple luster; maxillary and labial palpi dark brown or apex of apical palpomeres at most yellowish-brown. Antenna dark brown except often scape and pedicel with metallic luster similar to head capsule. Mesosoma mostly metallic green to bluish-green and sometimes with some purple luster similar to head, the tegula at least dark brown and often also variably distinctly metallic. Front leg with trochanter, trochantellus and femur, except sometimes narrowly apically, brown to dark with at least slight metallic luster similar to mesosoma; tibia dark at least dorso- and ventrolongitudinally and then anterior and often posterior surfaces lighter colored, yellowish to yellowish-brown, longitudinally, but sometimes more uniformly dark basally with only about apical half distinctly light-colored; tarsus yellow to brownish-yellow or with apical 1 or 2 tarsomeres more distinctly brown. Middle leg color pattern rarely similar to front leg, but usually tibia uniformly brown except distinctly lighter-colored basally and apically, and basal 1−4 tarsomeres white. Hind leg, including tibia, dark except tarsus with basal 1−3 tarsomeres white. Forewing hyaline. Gaster with basal tergum sometimes metallic green to bluish-green basally, but remainder brown.

Head (Fig. 70) with frons reticulate; scrobal depression reticulate though scrobes over at least dorsal half of interantennal region above level of toruli; vertex rounded into occiput, reticulate to transversely reticulate-strigose but without evident transverse carina. Head with IOD about 0.5× head width: OOL: POL: LOL: MPOD = 0.5−0.7: 2.4−2.9: 1.4−1.6: 1.0; lower face with uniformly sparse and short white setae or at most with 1 or 2 obviously longer setae near malar sulcus opposite long seta below malar sulcus. Antenna with scape ovoid, about 2.8−3.0× as long as maximum width, the outer surface ventrally extensively smooth and shiny except for well separated, very fine pinprick-like micropunctures along scapular scrobe (Fig. 79); length of pedicel + flagellum about 1.2−1.25× head width; pedicel about 1.5−1.7× as long as wide, ventrally with line of 4 or 5 distally curved setae; flagellum variably conspicuously setose and slender-clavate to robust-filiform; fl1 strongly transverse-ringlike, sometimes superficially bare but at least with single line of setae along apical margin; fl2 about 1.3−1.8× as long as wide and subsequent funiculars decreasing in length and increasing slightly in width to only slightly longer than wide to quadrate fl8; clava broadly oval with micropilose sensory region occupying entire ventral surface (usually collapsed in air-dried specimens), about 2.1−2.2× as long as wide and about 0.7−0.8× as long as apical three funiculars. Mesoscutum meshlike reticulate; axillae and scutellum similarly reticulate. Propodeum usually quite distinctly reticulate on either side of median carina (Fig. 71) or at least reticulate posteriorly and shallowed to strongly coriaceous anteriorly, and callus usually more or less reticulate or roughened laterally with sculpture obscuring setal bases. Forewing with cc: mv: pmv: stv = 3.9−4.3: 3.1−3.4: 1.0−1.2: 1.0; costal cell dorsally with line of dark setae extending over only about apical one-quarter to one-third and ventrally with dark setae continuously along length, mesally with 1 line.

Distribution. Widely distributed throughout at least the southeastern half of USA to about 100ºW and 40ºN (Map 6).



Map 6. Regional distribution of *E. curticinctus* (●).

Biology. Arthropod hosts unknown, but apparently associated with flower heads of species of **Asteraceae** (*Bidens* L., *Helianthus* L., *Pluchea* Cassini, *Vernonia* Schreber, and possibly *Eupatorium* L.), **Verbenaceae** (*Lantana* L.), and possibly **Malvaceae** (*Gossypium* L.).

Remarks. Females of *E. curticinctus* are uniquely differentiated by structure and color pattern of their ovipositor sheaths in combination with sculpture of the frons. The comparatively long ovipositor sheaths are either completely dark brown or if banded then the medial light-colored region is distinctly shorter relative to the basal dark region than for most other species with long sheaths (*cf.* Fig. 41 with Figs 34, 36−40). The apparent sheath length and color pattern (Fig. 41) is similar to that of *E. arizonensis* females (Fig. 24), but even small, and then typically mostly dark brown *E. curticinctus* females, have the frons at least finely reticulate (Fig. 31) as compared to entirely coriaceous (Fig. 25) in *E. arizonensis*.

Recognition of *E. curticinctus* males is less certain than for females. Males of *E. curticinctus* are distinguished through a combination of two features. The propodeal plical region is quite obviously reticulate (Fig. 71), at least posteriorly, compared to only finely coriaceous for other *urozonus*-group males (e.g. Fig. 72) and the outer surface of the scape is smooth and shiny ventrally along the scapular scrobe except for widely separated, minute, pinprick like micropunctures (Fig. 79). However, two males from Oklahoma that were reared with other males and females of *E. curticinctus* have the plical region finely sculptured and a scapular sculpture pattern more similar to *E. cushmani* males. I exclude these two males from the type series because I am uncertain whether they demonstrate that sculpture of the scape and propodeum is more variable than is described or that males of more than one species were reared.

5. *Eupelmus* (*Eupelmus*) *cushmani* (Crawford)

Figs 9, 28, 37, 42, 50, 59, 63, 75, 76; Map 7

Cerambycobius cushmani Crawford, 1908: 158. Syntypes, female (BMNH and USNM, examined). Type data: USA, Texas, Victoria; reared from *Anthonomus grandis* Boh.

Cerambycobius townsendi Crawford, 1912: 166−167. Holotype, female (USNM, examined). Type data: Peru: Department of Piura; reared from ? *Anthonomus vestitus*. Synonymy by Gahan, 1951: 172.

Eupelmus cyaniceps amicus Girault, 1916b: 244. Syntypes, female (USNM, examined). Type data: USA, New Mexico, Las Cruces; reared from *Bruchus amicus* Horn. **N. syn.**

Eupelmus cushmani; Cotton & Good, 1937: 42, 61.

Eupelmus amicus; Burks, 1979: 881.

Description. FEMALE. (Fig. 37) Length about 2.1−5.2 mm. Head sometimes mostly dark brown, usually in smaller specimens, but more commonly (Fig. 28) with frontovertex dark mesally between scrobal depression and posterior ocelli except for variably extensive and distinct longitudinal greenish region along inner orbit (inner margin of region sometimes more yellowish, coppery or violaceous) extending mesally to at most about level of inner margin of posterior ocellus, though rarely mesal region green and laterally purple along inner orbit; parascrobal region, interantennal region and clypeal region also often variably extensively dark, and vertex posteriorly or along upper orbit more purple; maxillary and labial palpi dark brown. Antenna dark brown with slight metallic luster on scape and pedicel or often scape with at least slight yellowish-orange tinge apically to entirely yellowish-orange (Fig. 28). Mesosoma similar in color to head with tegula brown or dark with slight metallic luster, otherwise mostly dark brown with slight metallic green luster under some angles of light, usually in smaller specimens, to quite distinctly metallic green except lateral lobe at least dorsolongitudinally, scutellum variably extensively, and often convex or concave part of medial mesoscutal lobe variably dark, brownish to reddish-violaceous. Forewing hyaline; venation yellowish-brown; setae uniformly brownish or sometimes lighter in basal cell and on submarginal vein. Front leg with trochanter yellowish to dark brown; femur sometimes entirely dark brown in smaller specimens, more commonly with trochantellus and extreme apex yellowish; tibia often completely yellow or almost completely yellowish except for dorsal and ventral brown bands or, in smaller specimens, more extensively brown except knee and apex more widely yellowish; tarsus yellowish except for apical brown tarsomere to more or less uniformly yellowish-brown. Middle leg with mesotibial apical pegs and mesotarsal pegs dark, otherwise often yellowish to yellowish-orange at least beyond coxa and sometimes including coxa or, particularly in smaller specimens, femur and tibia in part more distinctly brownish but knee, tibia apically, and at least basal tarsomere lighter yellowish to white. Hind leg with trochanter yellowish to brown; femur commonly brown basally and yellowish-orange apically to a greater or lesser extent, though rarely entirely yellowish-orange to entirely brown; tibia usually yellowish-orange to variably extensively brown (except often ventral margin) except for knee and apically more whitish, though sometimes entirely brown except for about apical 0.2; tarsus with at least basitarsus white and apical tarsomere brown, but tarsomeres 2−4 variably white to dark brown. Gaster entirely dark brown or at most with metallic green luster anteriorly on basal tergum and sometimes laterally on terga, and with brown hairlike setae similar in color to cuticle; dark inner plate of ovipositor sometimes projecting distinctly beyond apex, but at least sheaths with short dark basal region abruptly delineated from longer medial whitish region, the whitish region variably abruptly and distinctly delineated from yellowish-brown to dark brown apical region, but at least apical darker region subequal in length or longer than lighter colored medial region.

Head with frons variably distinctly and coarsely sculptured, sometimes almost meshlike coriaceous (Fig. 28), though usually at least some cells slightly sunken so as to be delineated by rounded ridges or somewhat imbricate along inner orbits, to more extensively and conspicuously reticulate or transversely imbricate-wrinkled to reticulate-strigose along inner orbits, and merged into parascrobal region through slight undulation; vertex variably transversely alutaceous-reticulate in smaller specimens and rounded into occiput to quite strongly transversely strigose-carinate in larger specimens and continued above posterior ocelli in similar plane as frons and quite narrowly and abruptly angled relative to occiput (Fig. 37); scrobal depression reticulate-rugulose to transversely reticulate-strigose; IOD = 0.36−0.44× head width; OOL: POL: LOL: MPOD = 0.5−0.9: 2.3−2.9: 1.7−1.8: 1.0. Antenna with combined length of pedicel + flagellum = 1.06−1.3× head width; scape about 4.2−5.4× as long as wide, in outer view ventral margin often almost straight and angulate but sometimes slightly sinuate with very slender, inconspicuous flange over about apical half; pedicel in lateral view about 1.9−2.1× as long as wide; fl1 slightly transverse to quadrate; fl2 about 1.8−2.5× as long as wide and about 3.0−5.0× as long as fl1; subsequent funiculars increasing in width to quadrate or slightly longer than wide fl8; clava about 1.9−3.0× as long as wide, 0.8−1.2× combined length of apical three funiculars, and 0.25−0.45× length of funicle. Mesoscutum almost uniformly meshlike reticulate except lateral lobe more minutely coriaceous mediolongitudinally and mesoscutal medial lobe usually more transversely alutaceous-reticulate in smaller to reticulate-imbricate anteriorly in larger specimens. Scutellar-axillar complex with axillae obliquely alutaceous-reticulate to more coriaceous-imbricate, but at least scutellum mostly meshlike coriaceous to coriaceous- or somewhat reticulate-imbricate laterally. Prepectus sometimes superficially bare or only very inconspicuously setose, but if with 2 or 3 distinct lines of white, hairlike setae mediolongitudinally then setal apices not extending to margins (Fig. 42). Acropleuron finely meshlike reticulate anterior and posterior of medial microsculptured region, the cells sometimes somewhat larger posteriorly than anteriorly but with flat surfaces defined by slightly raised ridges. Forewing with linea calva variable, often a distinctly isolated bare band (*cf.* Fig. 45) but sometimes continuous or almost continuous through vanal area (*cf.* Fig. 48); costal cell ventrally setose along length, with 2 or 3 lines of setae medially, and dorsally either bare or much more commonly setose apically along leading margin for distance usually little greater than length of parastigma (*cf.* Fig. 45) or at most half length of cell; cc: mv: pmv: stv = 4.1−5.2: 4.1−5.3: 1.0−1.5: 1.0. Mesotibia with apical row of 3−8 pegs; mesotarsus ventrally with pegs on basal four tarsomeres, basitarsus with 10−24 pegs arranged distally in double row on either side, second tarsomere with 3−7, third tarsomere with 1−4, and apical tarsomere with 1 or very rarely 2 pegs on one side. Propodeum with U-shaped plical depression extending to foramen; callus with white, comparatively sparse hairlike setae not obscuring cuticle or sculpture (Fig. 50). Gaster with inner plate of ovipositor variable, not projecting beyond apex if ovipositor sheaths relatively short but usually extending beyond apex quite distinctly if sheaths long; ovipositor sheaths about 0.8−1.33× length of metatibia and about 0.97−1.7× length of marginal vein.

MALE (Fig. 59). Length about 1.5−3.3 mm. Head dark metallic green to bluish-green or smaller specimens more brown with variably distinct metallic luster; maxillary and labial palpi dark brown or apex of apical palpomeres at most yellowish-brown. Antenna dark brown except often scape and pedicel with metallic luster similar to head capsule, and outer surface of scape sometimes yellowish ventrally along scapular scrobe. Mesosoma similar in color to head, the tegula at least dark brown and often also variably distinctly metallic. Front leg with trochanter, trochantellus, and femur except sometimes narrowly apically, brown to dark except with at least slight metallic luster similar to mesosoma; tibia almost completely dark except for extreme base and apex to almost completely yellowish except usually for dorsolongitudinal dark band; tarsus yellow to brownish-yellow or with apical 1 or 2 tarsomeres more distinctly brown. Middle leg mostly dark except knee and apex of tibia variably distinctly lighter, and basal 1−4 tarsomeres white. Hind leg with similar color pattern as middle leg. Forewing hyaline. Gaster with basal tergum sometimes metallic green to bluish-green basally, but remainder brown.

Head with frons reticulate; scrobal depression reticulate at least though scrobes and sometimes over about dorsal half of interantennal region above level of toruli; vertex rounded into occiput, reticulate to transversely reticulate-strigose but without evident transverse carina. Head with IOD about 0.5× head width: OOL: POL: LOL: MPOD = 0.5−0.7: 2.5−3.1: 1.4−1.6: 1.0; lower face with uniformly distributed white setae, the setae usually longer and more distinctly curved laterally toward malar sulcus but sometimes with only one distinctly longer seta opposite long seta below malar sulcus. Antenna (Fig. 63) with scape ovoid, about 2.2−2.5× as long as maximum width, the outer surface ventrally with variably crowded, more or less pinprick micropunctures apically (Fig. 75), or if sculpture more extensive along length of scrobe then shallow and more or less elongate-strigose or rugulose rather than distinct pits (Fig. 76); length of pedicel + flagellum about 1.4−1.6× head width; pedicel subglobular, only about 1.2−1.4× as long as wide, ventrally with line of 4 or 5 distally curved setae; flagellum conspicuously, densely setose with projecting, curved setae so as to appear robust-filiform, the flagellomeres of equal width or including setae slightly tapered to narrower clava; fl1 very strongly transverse, disc-like, and at least superficially bare, at most with single line of setae along apical margin; fl2 and fl8 both oblong, about 1.1−1.8× and 1.3−1.5× as long as wide, respectively; clava lanceolate with micropilose sensory region occupying apical two claval subsegments (usually collapsed in air-dried specimens), about 2.2−2.8× as long as wide and about 0.6−0.7× as long as apical three funiculars. Mesoscutum variably deeply meshlike reticulate; axillae and scutellum usually more shallowly reticulate-imbricate to meshlike coriaceous in small specimens. Propodeum finely coriaceous to almost smooth and shiny, and callus similarly sculptured with setae originating from tiny bumps. Forewing with cc: mv: pmv: stv = 4.0−4.5: 3.0−3.9: 1.0−1.2: 1.0; costal cell dorsally with line of dark setae extending over only about apical one-quarter to one-third and ventrally with dark setae continuously along length, mesally with 1 or 2 lines.

Regional material examined (715 ♀, 290♂). CANADA. **ONTARIO**: Chatham, 26.VII.54, K.G. Davey, host plant red clover (1♀). Mainfleet Bog, 8 km S. Welland, 14-21.IX.87, A. Stirling (1♀). Kent Co., Rondeau Prov. Park, Southpoint Trail near East parking lot, 7.X.2003, S. Marshall (1♀).

USA. 4♀, 4♂ (MEMS). 25.VIII.20, 4, 5, 6, 9, 13, 14, 15, 16, 18, 19.X.20 (11♀, 2♂ MEMS). 218[01] (1♀ USNM). 5893[01] (2♀ USNM). 3593g Hopk U.S. (3♀ USNM). 4028º, 17.IX.1886 (1♂ USNM). P1906.0, [?], par. *Anthonomus grandis* (1♀ USNM). 19, 30.VIII.1893, 10.XI.1893, par. *Bruchus obsoletus* (4♀ USNM). Hunter No. — 1334, 17.IX.07, par. *Tyloderma foveolatum* (1♀ USNM); 1410, 28.VI.07, 21.VIII.07, par. *Bruchus prosopis* (1♀, 1♂ USNM); 1450 (2♀ USNM); 1454, 29, 30.IX.07, 1, 9, 10.X.07, par. *Bruchus* (11♀ USNM); 1455, 30.IX.07, 1, 10.X.07, par. *Bruchus* (3♀, 4♂ USNM); 1456 [?] (1♀ USNM). Calvert, June 1909, [?] July 7 (1♀ USNM). **ALABAMA**: ***Etowah Co.***, Attalla, 16.VIII.65, T.L. Chesnut, em. 9.II.65 from fallen cotton squares and bolls (1♀ USNM). ***Talladega Co.***, Coleta, H.H. Smith (1♀ USNM). **ARIZONA**: 2552, C.F. Baker (2♀ USNM). Huachuca Mountains, 6000', 14.VI.28, A.A. Nicol (1♀ CASC). S. Catalina Mountains, 21.XI.13, J.J. Thornber, par. *Anthon*[*omus*] *gr*.[*andis*] *thurb*.[*eriae*] (1♀ USNM). From USDA colony, southern Arizona, 1968, R.E. Fye (1♀ MEMS). ***Cochise Co.***, Cochise Stronghold, 14.X.73, C.D. Johnson, em. by 13.XI.73, reared seeds *Mimosa biuncifera* (1♂ TAMU). Douglas, W.W. Jones (1♀ USNM). 6 mi. NW Huachuca City, 6.X.72, em. by 18.XII.72, C.D. Johnson, reared seeds *Acacia constricta* (1♀ USNM). San Simion Road, 4 mi. NNW Portal, 31º58'N 109º9'W, 4600', 25.V.88, em. VI.88, H.A. Hespenheide, ex *Acacia constricta* Benth. seed (3♀, 1♂; 1♀ with adult *Stator pruininus* (Horn) glued to point below it). ***Gila Co.***, Roosevelt, 18.XI.40, R.L. Furniss, *Cercidium microphyllum* (2♀ USNM). ***Maricopa Co.***, Lone Mountain Road, 25.VII.83, M. Hetz, reared seeds *Cercidium microphyllum* (1♀ USNM, CNC Photo 2010-45). ***Pima Co.***, Quijotoa, 1 mi. N., 8.X.77, em. 17.VII.77, C.D. Johnson, reared seeds *Acacia constricta* (1♂ TAMU). South of Sells, 8.X.77, C.D. Johnson, em. 17.X.77, reared seeds *Nissolia schottii* (1♂ TAMU). Tucson — Kunze, Baker coll. (1♀ USNM); 1, 4.VIII.21, parasite of mesquite weevil (4♀ UAIC); 3.VIII.31, G.D. Butler, swept from cotton (1♀ UAIC). ***Pinal Co.***, E. of Florence, fall 1976, J. Holcomb, seeds in crop of Gambol's [?], *Stator pruininus* (1♀ UAIC). McCleary's Ranch, Stone Cabin Canyon, Santa Rita Mountains, 4.XII.13, ex *Anthonomus* (1♀ USNM). ***Santa Cruz Co.***, Pena Blanca Lake, 3 mi. W., 13.VI.72, em. by 5.VII.72, C.D. Johnson, reared seeds *Calliandra eriophylla* (1♂ TAMU). Ranch, 24.VI-14.VII.2009, E.E. Grissell (1♀). Ruby, 3 mi. NW, ca. 4200', 15.X.76, C.D. Johnson, em. by 10.XII.76, reared seeds *Mimosa biuncifera* (1♂ TAMU). Santa Rita Mountains, Amado, 8.III.67, R.E. Fye, em. from *Thurberia* weevils in *Gossypium thurberi* before 14.III.67 (1♀ MEMS). ***Yavapai Co.***, Bumble Bee Road, 25.VII.83, M. Hetz, reared seeds *Cercidium microphyllum* (2♀, 1♂ TAMU). Bull Pen Road, 2.IX.83, M. Hetz, reared seeds *Acacia constricta* (1♀ TAMU). Camp Verde, ca. 5 mi. S., 30.VI.69, C.W. Forister, em. 3.VII.69, reared seeds *Condalia lycioides* (1♂ UCDC). W. Clear Creek Campground, 7.5 mi. ESE Camp Verde, 3500', 8.IX.83, 10.X.83, M. Hetz, reared seeds *Acacia constricta* (2♀ TAMU). **ARKANSAS**: ***Benton Co.***, Bentonville, 23, 24.VI.18, 2, 4.VII.18, 15, 19, 29, 30.VI.19, 2.VII.19, VII.20, VII.23, D. Isley, par. *Mineola* (19♀, 5♂ USNM). Siloam Springs, 22.VIII.08, S.W. Foster (1♀ USNM). ***Clark Co.***, Gurdon, 26.IX.10, Hunter No. 1326, bred cotton square (1♂ USNM). ***Johnson Co.***, 8 mi. N. Clarksville, T10N, R23W, Sec. 2, 6.VII.97, R.L. Brown, sweeping *Coreopsis tinctoria* (1♀ MEMS). ***Miller Co.***, Texarkana, 11.VIII.09, C.E. Hood, par. *A. grandis* (1♀ USNM). ***Ouachita Co.***, Camden, 9.IX.08, C.E. Hood, par. *A. grandis* (1♀ USNM). **CALIFORNIA**: Camp Angeles, Hopk. US 20816-b, c, *Amorpha californica* (1♀, 2♂ USNM). ***Riverside Co.***, Gavilan Hills, NW of crossing Gavilan & Idaleona Roads, 19.III.98, D.C. Hawks & J.M. Heraty (1♂ UCRC). Menifee Valley, 1.V.81, J.D. Pinto (1♂). Menifee Valley, hills on W. end, 1800', 33º39'N 117º13'W — 27.VIII-1.IX.80 (3♂), 8-15.V.82 (1♂), J.D. Pinto; 1.X-1.XI.80, J.B. Woolley, J.D. Pinto & J. LaSalle (1♂ TAMU). Rubidoux Jurupa Rancho Co. Park, 27.VI.86, J. LaSalle (1♂). ***San Bernardino Co.***, 6 mi. E. Yermo, dry bed Mojave River, 18, 22.IX.52, H.B. Leech & J.W. Green, reared from seed pods of *Prosopis pubescens* Benth. infested by *Algarobius prosopis* (Leconte) (1♀, 1♂ CASC). ***San Diego Co.***, Bonsall, 1 mi. W., 8.VIII.79 — G. Gordh (1♂ UCRC); C. Melton (1♂ UCRC). Santee, Carlton Oaks Golf Course, 22.I.81, G.T. Scriven (1♀). Sentenac Canyon, 22.IV.81 — J. Woolley (1♂); J.T. Huber (2♂ UCRC). ***Ventura Co.***, Oxnard, 26.XII.34, Dunning, bred from *Mylabris pruininus* (2♀, 1♂ CASC). **DELAWARE**: ***New Castle Co.***, Wilmington, 18.VI.71, P.P. Babiy (1♀ ZSMC). **DISTRICT OF COLUMBIA**: Chain Bridge, 18.VIII.20, J.C. Bridwell, ex *Acanthoscelides perforatus* (3♀ USNM). Washington — 12.VII.08, 31.VII.07, par. *Tyloderma foveolatum* (4♀ USNM); 15.IX.07, on *Baptisia* sp. (3♀ USNM); 16, 17.IX.07, J.A. Hylsop, bred from *Baptisia tinctoria* (1♀, 1♂ USNM). **FLORIDA**: ***Alachua Co.***, 15.I.30, R.R. Mathews, Florida Fruit Fly Trap Survey (1♀ USNM). Gainesville, 13.V.75, *Rhyanconia frustrana*, *Pinus taeda* (1♀ FSCA). ***Baker Co.***, Glen St. Mary, 24.X.2007, E. Zoll & S. Fullerton (1♀ UCFC). ***Jefferson Co.***, Monticello — 22.VI.16, A.I. Fabis, bred 5, 7, 12.VII.16 from *A.*[*crobasis*] *hebescella* Hulst (2♀, 2♂ USNM); 27, 30.IV (3♀ FSCA), 1.VI.28 (4♂ FSCA), 30.VI.28 (1♂ FSCA), F.W. Walker; 3.VII.27, F.W. Walker, ex *Acrobasis caryae* Grote, secondary parasite (6♀ FSCA). ***Monroe Co.***, Big Pine Key, 6.III.92, D.M. Lott, D.H. Habbeck & J. Gillmore, *Rhyncosia* [!] *minima* seeds (1♀ FSCA). ***Orange Co.***, Orlando, 28.VII.199 [!] (1♀ UCFC), 5.VII.96 (1♂ UCFC) S.M. Fullerton. Wekiwa Springs State Park, 19.II.2001, 21.III.2001, P. Russell & S. Fullerton (2♀ UCFC). ***Pinellas Co.***, Dunedin, L.J. Bottimer — 15.II.30 (1♂ AEIC); 15, 24.II.30, 11.III.30, 18.IV.30, ex *Acanthoscelides floridae* in *Amorpha* seeds (3♀, 6♂ CNC; 4♀, 6♂ USNM). ***Seminole Co.***, Econ Wildlife Area, 6.V.2000, T.Smith, P. Russell & S.M. Fullerton (3♀ UCFC). ***Suwannee Co.***, Branford, 10.III.56, H.F. Howden, host *Acanthoscelides floridae* Horn (2♀). **GEORGIA**: ***Chattahoochee Co.***, Fort Benning, 8, 14.VI.95, B.T. Sullivan (2♀ USNM). ***Chattooga Co.***, Summerville, 16.VIII.65, T.L. Chestnut, em. 31.VIII.65 from fallen cotton squares and bolls (1♀ MEMS). ***Clarke Co.***, Athens, 9.VIII.91, J. Pickering, ex *Ceratomia catalpae* (1♀). ***Mitchell Co.***, Dewitt, 6.III.13, J.B. Gill, bred from *E.*[*narmonia*] *caryana* (1♀ USNM). ***Peach Co.***, Byron, 27.II.86, A.A. Amis, ex gall *Dryocosmus kuriphilus* (1♀ USNM). Fort Valley 15.III.37. G.F. Moznette, ex *Laspeyresia caryana* in pecan shucks (1♀, 1♂ USNM). ***Putnam Co.,*** Oconee National Forest, 18.VII.95, B.T. Sullivan (1♀). ***Spalding Co.***, 1.VII.37, T.L. Bissell, bred from *Bruchus pisorum* (2♀ USNM). ***Thomas Co.***, Thomasville, G.D. Smith, par. *A. grandis* (1♀, 1♂ USNM). ***Tift Co.***, Tifton (1♀ USNM). **ILLINOIS**: ***Greene Co.***, Carrollton, 5.VII.96, H.E. Anderson (1♀ UCRC). ***Iroquois & Ford Co.***, Loda and Prospect Cemetaries Prairie, VI.2001, J. Tooker, reared from *Silphium laciniatum* and *S. terebinthinaceum* (1♂ UCDC). ***Moultrie Co.***, XI.31, reared IV.32, Bigger, reared from *Desmoris fulvus* (1♀ USNM). **INDIANA**: ***Tippecanoe Co.***, Lafayette, X.38, Montgomery, issued from seed on red bud (1♀ USNM). **KANSAS**: ***Doniphan Co.***, Wathena, 27.VII.39, S.C. Schell, ironweed (4♀ USNM, 1♂). ***Riley Co.***, Manhattan, S.C. Schell — X.37, em. 28.III.38 from seed of *Hibiscus* (1♀ USNM); VIII.37, em. 28.III.38 from mummified apples (1♀ USNM); VIII.37, from pod *Cercis canadensis* (1♀ USNM); X.37, em. 20.IV.38 (2♀ USNM). **KENTUCKY**: ***Mason Co.***, 30.VII.50, N. Taylor (1♂ USNM). **LOUISIANA**: ***Avoyelles Parish***, Mansura,3.II.10, C.E. Hood, in Spanish moss (1♀ USNM). ***Caddo Parish***, Forbing, 18.IX.07, par. *Spermophagus robiniae* (1♀ USNM). Shreveport, 1907 (1♀ MEMS). ***Cameron Parish***, Jhnsn's Byu [Johnson Bayou], 26.VIII.06. par. *Anth. albopilosus* (1♀ USNM). ***DeSoto Parish***, Mansfield, 23, 24.VIII.06, par. *A. grandis* (18♀, 3♂ USNM). ***East Carroll Parish***, [Lake] Providence, 15, 25.VIII.14, 1.IX.14 (2♀, 1♂ MEMS). ***Lincoln Parish***, Ruston, 9.IX.08, W.D. Pierce, bred 10.IX.08, *A. grandis* (1♀ USNM). ***Madison Parish***, Tallulah — 3.IX.14, 28.VIII.14 (3♀ MEMS); 8, 10, 12, 13, 22, 29.VIII.32 (9♀ MEMS); par. *A. grandis* (1♀ USNM); 3.IX.09, 20.IX.13, bred cotton boll weevil (1♀, 1♂ USNM); 19.IX.09, 20.XII.09, bred cotton square (2♀ USNM); 24.IX.09, bred square (1♀ USNM); 10.VIII.10, R.A. Cushman, par. *A. grandis* (2♀ USNM). ***Rapides Parish***, Alexandria, 2, 8, 16, 20, 22.VIII.07, par. *A. grandis* (6♀, 3♂ USNM). Glenmora, 22, 23.VIII.07, par. *A. grandis* (5♀, 2♂ USNM). ***Sabine Parish***, Many, 23, 24.VIII.06, par. *A. grandis* (22♀, 6♂). near Noble, III.60, M.W. Sanderson, ex *Caryobruchus* in Sabel (1♀ USNM). **MARYLAND**: ***Calvert Co.***, Chesapeake Beach, 13.VI.85, L. Masner (1♀). ***Charles Co.***, Newburg, 17.VII.73, 3.VII.74, J. Lasomb (1♀, 1♂ MEMS). ***Harford Co.***, Riverside, iss. XII.26, seed pot of *Oenothera* (1♂ USNM). ***Montgomery Co.***, Ashton, 4 mi. SW, 39º06'36"N 77º01'30"W, 10.IV.2004, G. Gibson, on dead *Pru-*

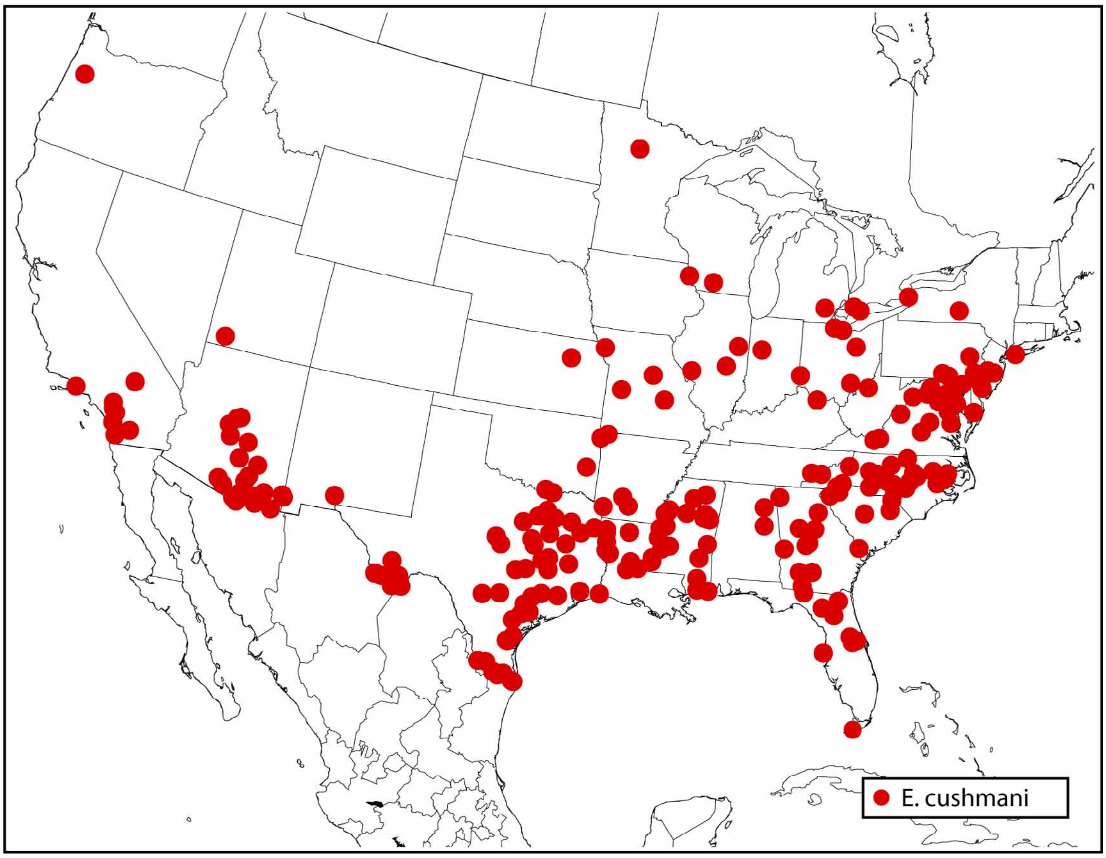
nus infested with scolytids/cerambycids (3♂). Plummers Island, III.61, Spangler, *Acanthoscelides alboscutellatus* in *Ludwigia* (3♀, 6♂ USNM). ***Prince George's Co.***, Beltsville, III.61, *Rhyanconia frustrana* material (1♀ USNM). Berwyn, 27.IX.1897, bred from *B. obtectus* in beans (5♀ USNM). College Park, 22.VII.18, from *L. molesta* (1♀ USNM). Patuxent Wildlife Preserve, 24.VI.86, D. Wahl (2♂). ***Wicomico Co.***, Salisbury, 2, 8, 11.IX.29, H.S. McConnell, *Laspeyresia molesta* (secondary) (1♀, 2♂ USNM). **MICHIGAN**: ***Washtenaw Co.***, Ann Arbor — 21-23.V.60, H. & M. Townes (1♀ AEIC); 12-21.VII.82, R. Wharton (1♀ TAMU). **MISSISSIPPI**: ***Adams Co.***, Natchez — 20, 21.VIII.33, Station (1♀, 1♂ MEMS); 30.VIII.33, 4, 5, 6.IX.33, Junkins (3♀, 1♂ MEMS). Sibley, 5.VII.20, A. Flemming (1♀ MEMS). ***Bolivar Co.***, Shaw, 1.IX.14 (1♂ MEMS). ***Carroll Co.***, Slaton Field — 9.I.65, em. fallen cotton squares and bolls (1♀ MEMS); 10.IX.65, 16.VIII.66,W.H. Cross, cultivated cotton (1♀ MEMS); 10.IX.66, experimental cotton plot, em. 21, 23, 25.I.67, H.C. Mitchell (1♀, 3♂ MEMS). ***Claiborne Co.***, Port Gibson, 29.VIII.14, 2.IX.14 (2♀, 1♂). ***Harrison Co.***, Gulfport, 28.III.57, J.F. Coyne, *Rhyanconia frustrana* (1♀ USNM). ***Hinds Co.***, Utica, VIII (1♀ USNM). ***Jackson Co.***, Pascagoula, 29.V.26, R.P. Colmer, reared from case-bearer ex larva, 19.VI.26 (1♀ MEMS). ***Jones Co.***, Laurel, 21.VII.12, Ellesville, W.D. Pierce coll. (1♀ USNM). ***Lauderdale Co.***, Arundel [Spring ?], 20.VIII.12, W.D. Pierce, par. *A. grandis* (1♀ USNM). ***Oktibbeha Co.***, 8.III.68, D.D. Hardee, in alfalfa (2♀ MEMS). A & M College, J.M. Langston, reared from L771, pecan — 16.VI.30 (1♀ MEMS); 28.VI.30, reared from Olethreutidae (1♀ MEMS); 20.VIII.30 (1♀ USNM). Bradley, 4 mi. WNW, 2.III.74, W.L. McGovern, em. 25.III.74 from boll weevil infested cotton (1♀, 1♂ MEMS). Dorman Lk, 16.IX.81, R.L. Brown, em.8.X.81. *Helianthus angustifolius* (1♀ MEMS). Maben, 4 mi. E., 4.VI.71, J.E. Leggett (1♀ MEMS). near Oktoc, 22, 27.II.64, W.H. Cross (2♀ MEMS). ***Pontotoc Co.***, Ecru, 20.XI.80, R.L. Brown, ex stems of *Oenothera biennis* infested with *Mompha eloisella*, em. 6.I.81 (1♀ MEMS). ***Sharkey Co.***, Rolling Fork, 27.VIII.14 (1♂ MEMS). ***Stone Co.***, Wiggins, 23, 25, 29.V.29, 1, 3, 8.VI.29, J.P. Kislanko, reared from *A. juglandis* (5♀, 1♂, MEMS; 1♀, 2♂ USNM). ***Washington Co.***, Delta Experimental Forest near Stoneville, 33º29'N 90º54'W, 18.IV-9.V.88, N.N. Schiff (1♀ UCDC). Stoneville — VI.78, W.H. Cross, lab. colony (14♀, 13♂ MEMS); 3 mi. W., 18.I.68, W.H. Cross, em. dry sqs + bolls from standing stalks cotton, 3.II.68 (1♀ MEMS); 3 mi. W., 28.IX.67, W.L. McGovern, em. *Croton lindheimeri*, dead in box, 2.II.67 (1♀ MEMS). ***Yalobusha Co.***, Water Valley, 27.II.25, C.G. Wallace (1♀ MEMS). **MISSOURI**: ***Boone Co.***, Columbia, 19, 25, 27.VIII.77, W.S. Craig, ex seed red bud (1♀, 2♂ UMRM). ***Henry Co.***, Chapel View Prairie, 29.VI.99, M. Gates (1♂ UCRC). ***Phelps Co.***, St. James, 14.VII.53, P.J. Spangler, ex *Chlamys gibbosa* cocoons (1♀ USNM). **NEW JERSEY**: ***Burlington Co.***, Beverly, 1934, Oriental Fruit Moth Par. Invest., *Grapholita molesta* (1♀ USNM). Bridgeboro, 1945, Oriental Fruit Moth Par. Invest., ex *G. molesta* (1♀ USNM). Browns Mills, 24.VII.35, L.J. Bottimer (1♀ USNM). Moorestown, 1931, Oriental Fruit Moth Par. Invest., ex *Macrocentrus* cocoon (1♀ USNM). ***Camden Co.***, Haddon Heights, VIII.31 (1♀ AEIC; 8♀, 9♂ CNC; 6♀, 3♂ USNM; 1♀ WFBM), 8.VIII.31 (5♀ USNM; 1♂ WFBM), L.J. Bottimer, ex *Bruchus brachialis*, in *Vicia villosa*. ***Cumberland Co.***, Cedarville, 2.VIII.76, K.W. Thorpe (1♀ USNM). **NEW MEXICO**: 2♀ USNM. ***Dona Ana Co***., Las Cruces, from *Bruchus amicus* Horn (2♀, 2♂ syntypes *E. cyaniceps amicus*). ***Hidalgo Co.***, 9.3 mi. W. Animas, 26-30.VII.92, 4400', G. Gibson (1♂). **NEW YORK**: ***Nassau Co.***, Farmingdale, 31.VII.38, H. & M. Townes (1♀ USNM). ***Tompkins Co.***, Ithaca, F.H. Chittenden (1♀ USNM). **NORTH CAROLINA**: ***Beaufort Co.***, Washington, J.P. Weyerhaeuser seed orchard, coll. as pupae 4.V.76, G.F. Fedde, in dying *Pinus taeda* L. twigs associated with weevil galleries (1♀ USNM). ***Burke Co.***, Pineola bridge at Linville Falls P.O., reared 24.X.80, A.T. Drooz, ex *Diprion similis* (6♀ NCSU). ***Cabarrus Co.***, 8.X.55, T. Daggy (1♀ NCSU). ***Craven Co.***, 2.VII.17, R.W. Leiby, bred material exp. No. 39-57 (1♀ NCSU). ***Cumberland Co.***, Fort Bragg, 16.V.67, J.D. Birchim (1♂ CASC). ***Edgecombe Co.*** — reared 314 (1♀ USNM); 26.VI.40, A. Barnes, pecan leaves (1♀ USNM). ***Guilford Co.***, Greensboro, J.S. Pinckney, reared from *M.*[*ompha*] *eloisella* (1♀ USNM). ***Harnett Co.***, Lillington, 13.VI.41, S.C. Schell (2♀ USNM). ***Iredell Co.***, Statesville, 12.VII.48, C.C. Hill, bred from *B. brachialis* (5♀, 1♂ USNM; ♂ CNC Photo 2010-25). ***Johnston Co.***, Clayton, Central Crops Research Station, 12.VIII.58, H.H. Neunzig (1♀ NCSU). ***Martin Co.***, S. of Jamesville, 19.XI.74, L.K. Lawrence, reared from pupa *Rhyacionia frustrana* (1♀ NCSU). ***Mecklenburg Co.***, Beverly Woods, P.P. Babiy — 2.VI.64, on *Dacus car.* (1♂ ZSMC), 12.VI.64 (1♀ ZSMC). ***Montgomery Co.***, Uwharrie National Forest, junction State Road 1179 & Government Road 597, 25.VI.93, R.L. Blinn, taken on *Pinus virginiana* (1♀ NCSU). ***Moore Co.***, Eagle Springs, 28.III.50, M.H. Farrier, shaken from peach (1♀ NCSU). ***Person Co.***, 18.VIII.84 — H.D. Blocker (1♀ NCSU); J.F. Cornell, *Solidago* (1♀ NCSU). ***Pitt Co.***, Grifton, 2.VII.75, R.J. Galloway (1♀ NCSU). ***Polk Co.***, Tryon, W.F. Fiske (3♀ USNM). ***Rowan Co.***, Salisbury, J.S. Pinckney, reared from *B. brachialis* (7♀, 3♂ USNM; ♂ CNCI LB-specm 2010-004). ***Scotland Co.***, 34.98013ºN 79.55366ºW, 138 m, 17.X.2010, G. Gibson (1♀). ***Swain Co.***, Smokemont, 6.VI.77, N.C.D.A. (1♀ NCSU). ***Wake***

Co., 27.XI.62, P. Kamnerdratana (1♀ NCSU). Raleigh — 27.VII.40, S.C. Schell (1♀ USNM); VI.41, S.C. Schell, par. Pine moth (1♀ USNM); II.59, H.H. Neuhzig (1♀ NCSU); IX.63-IV.64, J.F. Cornell, alfalfa field sticky trap (1♀ NCSU). **OHIO**: ***Athens Co.***, Athens, 4.XII.96, A.C. 2738 (14♀ USNM). ***Butler Co.***, Oxford, F.J. Rickey, em. 16.I.95, from *Cercis canadensis* seedpod (1♀ UCDC). ***Eire Co.***, Sandusky, H.G. Ingerson, 22.VIII.17, par. grape berry moth (1♀ USNM). ***Ottawa Co.***, Oak Harbor, 20.VII.32, ex *Macrocentrus* cocoon, Oriental Fruit Moth Par. Invest. (3♀ USNM). ***Wayne Co.***, Wooster, 8.II.97, A.C. 2738 (5♀ USNM). **OKLAHOMA**: ***Latimer Co.***, Red Oak, X.90, IX.94, K. Stephan (2♀). **OREGON**: ***Benton Co.***,Corvallis, em. 18.I.83 (1♀). **PENNSYLVANIA**: ***Adams Co.***, Arendtsville, VI-VII.40, J.H. Beacher, *Coleophora malivorella* (1♀, 9♂ USNM). ***Berks Co.***, em. 17.VIII.38, S.C. Schell, par. *Apion rostrum* (4♀ USNM). 10.IX.38, S.C. Schell, em. III.39, par. moth on *Smilax* (1♀ USNM). ***Chester Co.***, West Chester, 30.VI.25, F.F. Smith, *Malacasoma americana* Fab. (2♀ USNM). ***York Co.***, Hanover, 15.VI.30, Bridwell & Barber (1♀ USNM). **SOUTH CAROLINA**: ***Florence Co.***, Florence — 1924, E.W. Dunnam (11♀, 3♂ MEMS); 22.VII.26, A.R. Ground (1♀ MEMS); 2.VIII.29, C.F. Rainwater (3♀ MEMS). ***Greenville Co.***, Cleveland, 16.IX.75, 12.V.76, G.F. Townes (2♀ AEIC). Greenville, 7.VI.52, 5.IX.52, G. & L. Townes (2♀ AEIC). ***Jasper Co.***, Tillman, 10 mi. NW, 26.IV.87, H. Goulet (1♀). ***Marlboro Co.***, Bennettsville, cotton boll (2♀ USNM). Clio, cotton boll (3♂ USNM). ***Pickens Co.***, Clemson — III.75, R. Fox, *Rhyanconia* sp. on pine (1♀ UCRC); IV.93, R73-91, ex *R. frustrana* (1♂ UCRC). Clemson Collage, G. Ainslie, Webster no. 1831 (2♀ USNM). ***Richland Co.***, Columbia, 18.VIII.51, L. & G. Townes (1♀ AEIC). **TENNESSEE**: ***Blount Co.***, GSMNP [Great Smoky Mountains National Park], Cades Cove, Mill Creek, N35.34.60/W83.50.8, Steck & Sutton — 1.X.2003, 1792' (1♀ UCFC), 1.X.2004, 1720' (1♀UCFC). **TEXAS**: Kings Ranch, 4, 6.XI.78, R. Medved, ex *Acacia* seed (2♀, 1♂ UCRC). ***Anderson Co.***, Palestine, 10.VIII.06, par. *A. grandis* (21♀ USNM). ***Bee Co.***, Beeville, 12.VII.06, bred cotton square, par. *Bracon mellitor* (1♀ USNM). ***Bexar Co.***, San Antonio, 13.XII.84, Bezark, Kitayama & Orsack, ex legume pods (1♀, 2♂ UCDC). ***Bosque Co.***, Roswell, 28.X.06, par. *A. grandis* (1♀ USNM). ***Brazos Co.***, College Station — 1923, S.W. Bilsing, par. *Acrobasis caryivorella* (1♀ USNM); 2.VII.75, B. Cutter, emerged from nutlet with *A. nuxvorella* (1♀ TAMU); 15.VIII.15 (1♀ TAMU). ***Brewster Co.***, 17 mi. S. Alpine, 8.VIII.82, J.C. Schaffner (1♀ TAMU). Big Bend National Park — Basin, 23.V.83, R.S. Anderson (1♀, 1♂); 2.7 km NE Castolon, 760 m, 14.VIII.82, G. Gibson (1♀); Cottonwood campsite, 2300', 13-14.VII.82, G. Gibson (3♀), 13.VII.82, R.S. Anderson (1♀); Glenn Spring Road, 0.5 mi. in, 3000', 23.VI.82, G. Gibson (1♀); Govt, Springs, Grapevine Hills Road, 1.IX.71, E.E. Grissell & R.F. Denno (4♀ UCDC, CNC Photo 2010-24); 12.5 mi. SE Panther Junction, 2500', 10-18.VII.82, G. Gibson (1♀, 2♂); Rosillos Mountains, Buttrill Spring, 4-5.X.91, R. Wharton (1♀); Rosillos Mountains, Nine Mile Draw, 10 mi. W. 385, 29º35'N 103º16'W, 12.IX.93, E.E. Grissell & R.F. Denno (1♂ USNM). ***Brown Co.***, Brownwood, 25.VI.18, 4.VII.18, A.I. Fabis, par. *Acrobasis* sp. (1♀ USNM). ***Callahan Co.***, Pecan Bayou, 2.VII.18, 22.VII.18, A.I. Fabis, par. *Acrobasis* sp. (1♀ USNM). ***Cameron Co.***, Brownsville — 16.I.42, on *Malvastrum coromandelianum* (1♀ USNM). 15.VI.68, Board & Hefernik (1♀ TAMU); 11.VI.71, W.E. Clark (1♀ TAMU); 5.IX.06, par. *A. grandis* (1♂ USNM); 21.I.16, R.A. Vickery, reared from *Mantis* eggs (1♀ USNM); 18.X.09, par. *Bruchus exigua* bred from *Amorpha fructiosa* pods (1♀ USNM); IV.21, J.C. Bridwell, bred from *Bruchus* nr *limbatus* from Texas ebony (12♀, 15♂ USNM); 2.VII.27, Bridwell, ex *Bruchus sallei* in huisache (1♀, 1♂ USNM). Sabal Palm Grove, 20-22.X.89, R. Anderson & E. Riley (1♀). ***Chambers Co.***, N. shore Lake Charlotte, 10.IX.16, C. Heinrich, in *Cephelanthus occidentalis* (1♀ USNM). ***Collin Co.***, Plano, 12.XII.08, E.S. Tucker, bred from mistletoe I.09 (1♀ USNM). ***Colorado Co.***, 14.VIII.07, par. *A. grandis* (1♀ USNM). ***Dallas Co.***, Dallas — 29.I.03, 12.IX.06, 27.VII.07, par. *A. grandis* (2♀, 1♂ USNM); 12.IX.07, par. *Bruchus exiguua* (14♀, 26♂ USNM; ♂ CNCI LB-specm 2010-008). ***DeWitt Co.***, Cuero — 12, 24.VIII.07, par. *A. grandis* (2♀, 2♂ USNM); 12.VIII.07, par. *Bracon mellitor* (1♂ USNM). ***Fort Bend Co.***, Richmond, 15.VIII.07, par. *A. grandis* (2♂ USNM, CNCI LB-specm 2010-002). ***Goliad Co.***, Goliad, 3.IX.08, par. *A. grandis* (1♀ USNM). ***Grayson Co.***, Denison, 27.VIII.07, par. *Bracon mellitor* (1♂ USNM). Rock Creek, 5 mi. NW Gordonville, 22.VII.72, E.E. Grissell, on *Ambrosia psilostachya* DC (1♂ TAMU). ***Harrison Co.***, Marshall, 22.VIII.06, 10.VIII.07, par. *A. grandis* (8♀, 1♂ USNM). ***Hidalgo Co.***, Bentsen-Rio Grande [Valley] State Park, River hiking trail, 19.VI.86, J.B. Woolley (1♀). McAllen, 1921, J.C. Bridwell, bred from *Megacerus piger* (1♀, 1♂ USNM). Mercedes Hoblitzelle Farm, 21.V.83, C. Melton (1♂). Santa Ana National Wildlife Refuge, 150', 3.VII.82, G. Gibson (1♀). ***Hood Co.***, Granbury, 7, 17.VIII.07, par. *A. grandis* (2♂ USNM). ***Kaufman Co.***, Terrell, 26.VIII.07, par. *A. grandis* (2♀, 1♂ USNM). ***Kleberg Co.***, Kingsville, V.23, M.M. High, ex beans huisache (3♀ USNM). ***Lavaca Co.***, Hallettsville, 9, 30, 31.VIII.06, 13, 17, 18.VIII.07, par. *A. grandis* (9♀, 3♂ USNM). ***McLean Co.***, Waco, 25.VII.06, 28, 29.VIII.06, 20.IX.06, 2.VIII.07, par. *A. grandis* (13♀, 4♂ USNM), 16.IX.65, T.L. Chestnut (1♀ MEMS). ***Medina Co.***, D'Hanis, 11.VII.65, C.W.

O'Brian, ex pupa *Merobruchus julianus* (1♀ TAMU). ***Navarro Co.***, Corsicana — 21.VIII.08, par. *A. grandis* (1♀ USNM); III.04, C.M. Walker, par. *A. grandis* (1♀ USNM). ***Nacogdoches Co.***, 12 km SW Nacogdoches, SFA [Stephen F. Austin] Experimental Forest, Angelina National Forest, 47º31'N 94º47'W, 30.IV-16.V.2005, N. Schiif & C. Rudolph (1♀ UCDC). ***Nueces Co.***, 24.II.30 (1♀ TAMU). ***Presidio Co.***, Big Bend Ranch — SNA, 6mi. SE La Sauceda, 19.V.90, Wharton & Judd (1♀); 29º29'40″N 104º06'00″W, Agua Adentio Sprg, 3560', 20.VI.90, G. Zolnerowich (1♀). Big Bend Ranch State Natural Area, E.E. Grissell & R.F. Denno — Duck Pond 5 mi. W. Sauceda Ranch, 29º29'N 104º1'W, 4-5.IX.93, on *Juglans* sp (1♂ USNM); 1.7 mi. NE McGurks Tanks, 29º29'N 103º48'W, 4.IX.93, on *Rhus virens* (1♂ USNM). Presidio, 7.III.45, 14.VII.45, J.N. Russell, from tunnel in twig of *Koeberlinia spinosa* (2♀ USNM). ***Robertson Co.***, Calvert — 28.VIII.06, 30.IX.06, 21.VII.07, par. *A. grandis* (2♀, 1♂ USNM); 28.VIII.06, par. (accident) *Catolaccus incertus* (1♀ USNM). Easterly, 11 mi. N., Camp Cooley Ranch, 5.XII.80. J.C. Cuda, host: *Trichobaris bridwelli* Barber, Texas A&M voucher specimen #23 (1♂ TAMU). ***Rusk Co.***, Overton, 23.VIII.06, par. *A. grandis* (1♀ USNM). ***Starr Co.***, 30.VII.28, R.H. Beamer (1♀ USNM). ***Tarrant Co.***, Arlington — 6, 17, 25, 28.VIII.07, 2.IX.07, par. *A. grandis* (12♀, 8♂ USNM); 6, 28.VIII.07, par. *Bracon mellitor* (1♀, 2♂ USNM); 6.VIII.07, par. *Catolaccus incertus* (1♀ USNM); 6.VIII.08, F.C. Bishopp, par. *A. grandis* (1♀ USNM). ***Travis Co.***, vicinity Long Hollow Creek, 30º27'43"N 97º52'19"W, 23.VI.93, Alexander, Quinn, Riley, Wharton *et al.*, on *Juniperus ashei* (1♀ TAMU). ***Trinity Co.***, Trinity, 9, 30.VIII.06, par. *A. grandis* (4♀, 2♂ USNM). ***Victoria Co.***, Victoria — 14.3, E.A. Schwarz (1♀ USNM); 1.IX.06, 10.VIII.07, par. *A. grandis* (4♀ syntypes *E. cushmani*: 1 BMNH, 3 USNM); 25.VII.03, 1.IX.06, 5, 10, 11.VIII.07, par. *A. grandis* (17♀, 7♂ USNM); 22.IV.07, 24.VI.07, 10, 22.VII.07, 10.VIII.07 par. *Bruchus prosopis* (14♀, 2♂); 13.IX.07, par. *Bracon mellitor* (1♀, 1♂ USNM); 12.V.07, bred *Melia azed*. berry (1♀, 1♂ USNM); 10.VIII.07, par. *Anthonomus quadrigibbus* (1♂ USNM); 13.III.08, J.D. Mitchell (3♀ USNM); 13.III.08, J.D. Mitchell, bred *Iva ciliata* stem (1♂ USNM); 14.III.08, J.D. Mitchell, bred *Xanthium* stem (1♀ USNM). ***Williamson Co.***, Taylor, 22.X.33, J.E. Gillaspy (1♀ TAMU). ***Wood Co.***, Mineola, 20.VIII.07, par. *A. grandis* (1♀ USNM). ***Zapata Co.***, Falcon State Park, 250', 2.VII.82, G. Gibson (1♀). **UTAH**: ***Washington Co.***, Pintura, 11.VIII.29, R.H. Beamer (1♀ USNM). **VIRGINIA**: 29.VII.63, D.M. Harmon, *Pissodes strobi* (1♀ USNM). ***Arlington Co.***, Rosslyn, No. 1175.2 (1♀ USNM). ***Augusta Co.***, Deerfield, 6, 15, 16.VII.63, H.M. Kulman, ex *Pissodes strobi* on white pine (3♀). ***Clarke Co.***, Blandy Experimental Farm, 2 mi. S. Boyce, 15-30.IV.90, D.R. Smith (1♂). ***Cumberland Co.***, Cumberland State Park, 26.VI.64, O. Peck (1♀). ***Essex Co.***, 1 mi. SE Dunnsville, D.R. Smith — 37º52'N 76º48'W, 23.IV-6.V.96 (1♀ USNM); 27.III-11.IV.91, 12-24.IV.91, 30.IV-13.V.91, 14-24.V.91, 6-14.VI.91, 17.IX-10.X.91, 12-29.IV.92, 17-29.IV.92, 30.IV-13.V.91 (CNC Photo 2010-64), 13-29.V.92, 12-24.VI.92, 30.V-11.VI.92, 17.VII-2.VIII.96 (15♀, 9♂). ***Fairfax Co.***, near Annandale, D.R. Smith — 21-27.VIII.88, 9-15.VIII.89 (2♀); 6.VIII.83,19-25.VI.88 (2♀ USNM). Falls Church, reared 14.VIII.15, Heinrich, on *Trifolium* (1♂ USNM).Vienna, L.J. Bottimer — XII.26 (1♂), 9.XII.26 (1♀); 5.I.27 (1♀ USNM). ***Louisa Co.***, 4 mi. S. Cuckoo, J. Kloke & D.R. Smith — 6.VI.86, 16-31.VII.87, 21.VIII-2.IX.87, 21.IX-13.X.87, 1-12.VII.88, 12-23.VIII.88 (7♀); 25.V.85, 7, 14, 21.VII.85, 12-25.IV.88 (3♀, 2♂ USNM). ***Montgomery Co.***, 22.IX.64, 2.IV.65, K.R. Lewis, host *R. frustrana* (1♀, 1♂ TAMU). ***Prince William Co.***, Manassas, 15.X.86, J. Cronin, hyperparasitoid *Thyridopteryx ephemeraeformis* (1♀ USNM). ***Pulaski Co.***, 16.VII.64, 16, 21, 22.IX.64, K.R. Lewis, host *R. frustrana* (4♀, 3♂TAMU). **WEST VIRGINIA**: A.D. Hopkins (1♂ USNM). ***Hardy Co.***, 3 mi. NE Mathias, 38º55'N 78º49'W, D.R. Smith — 22.VIII-13.IX.2002 (1♀, CNC Photo 2010-46); 2400', 14.VIII-4.IX.95 (1♀). ***Jefferson Co.***, VI-VII.31, E. Gould, ex *Coleophora malivorella* (11♀, 3♂ USNM). ***Ritchie Co.***, Cairo, reared 28.V.13, A.D. Hopkins, Hopk. U.S. 9423b5, *Hicoria* (1♂ USNM). **WISCONSIN**: ***Fond du Lac Co.***, T18N, R19E, S23, 19-26.VII.17, Gypsy Moth M.T. (1♀ IRCW). ***Grant Co.***, T6N, R6W, S17, 26.VII-9.VIII.76, 19-26.VII.76, Gypsy Moth M.T. (3♀ IRCW). ***Green Co.***, T4N, R6E, S5, 29.VI.76, Gypsy moth proj. #760030A, em. 26.VII.76, *Juglans nigra* (1♀ IRCW).

Distribution. Widely distributed in southern USA and eastern North America (Map 7). In addition, *E. cushmani* has been recorded from throughout Central and South America as well as the Caribbean islands (Noyes 2010). It was also introduced intentionally into Hawaii from Guatemala as a biocontrol agent of the pepper weevil, *Anthonomus eugenii* Cano (Coleoptera: Curculionidae) (Swezey *et al.* 1939, Bess and Haramoto 1959, Duan *et al.* 1996).

Biology. Noyes (2010) listed *E. cushmani* as a primary parasitoid or, through Hymenoptera and Diptera, as a hyperparasitoid of 34 species in 14 families of 5 insect orders. However, the lists of hosts given for *E. cushmani* and *E. cyaniceps* are both partly inaccurate because Noyes (2010) included *E. cyaniceps amicus* as a synonym of *E. cyaniceps* and therefore hosts recorded in the original literature under *E. cyaniceps amicus* or *E. amicus* were listed for *E. cyaniceps* rather than *E. cushmani*. Most of the host records in Noyes (2010) were validated based on reference to such catalogs as Peck (1963) and Burks (1979), whose information came either from the original literature or label data of specimens in the USNM. Both of these authors listed *E. amicus* and its hosts separate from *E. cyaniceps*. I have seen specimens of *E. cushmani* labelled as from the following arthropod hosts and plant associates. Specimens indicated by an exclamation mark (!) are confirmed hosts for *E. cushmani* that were listed as hosts for *E. cyaniceps* in Noyes (2010).



Map 7. Regional distribution of *E. cushmani*.

Arthropod hosts — COLEOPTERA. **Apionidae**: !*Apion rostrum* Say (Pierce 1908b). **Bruchidae**: !*Acanthoscelides alboscutellatus* (Horn) (Bissell 1940, Ott 1991), !*Acanthoscelides floridae* (Horn) (Brett 1946), **Acanthoscelides obsoletus* (Say), !*Acanthoscelides obtectus* (Say) (Chittenden 1898), **Acanthoscelides perforatus* (Horn), **Algarobius prosopis* (Leconte), * *Acanthoscelides submuticus* (Sharp) (= *Bruchus exiguus* Horn) (Cushman 1911), !*Bruchus brachialis* Fahraeus (Bridwell 1933, Pinckney 1937), !*Bruchus pisorum* (L.) (Bissell 1938), **Caryobruchus* sp., **Megacerus* ? *impiger* (Horn) (= *M. piger*?), *Merobruchus julianus* (Horn) (Forister and Johnson 1971), !*Mimosestes amicus* (Horn) (Girault 1916b), *Mimosestes sallaei* (Sharp) (Pierce 1908b, Cushman 1911), !*Amblymerus robiniae* (Fabricius) (Pierce 1908b, Cushman 1911), **Stator* nr *limbatus* (Horn), **Stator pruininus* (Horn). **Chrysomelidae**: * *Neochlamisus bebbianae* (Brown) (= *Chlamys gibbosa* (Fabricius)). **Curculionidae**: !*Anthonomus albopilosus* Dietz (Pierce 1907, 1908a), !*Anthonomus grandis* Boheman (Crawford 1907, Hunter and Hooker 1907, Mitchell and Pierce 1911, Pierce *et al.* 1912, Fenton and Dunnam 1929, Chestnut and Cross 1971, Cross and Chestnut 1971, Mitchell *et al.* 1974), **Anthonomus grandis thurberiae* Pierce, **Anthonomus quadrigibbus* Say, **Pissodes strobi* (Peck), !*Smicronyx* (= *Desmoris*) *fulvus* LeConte (Bigger 1933), !*Tyloderma foveolatum* (Say) (Pierce 1908a), **Trichobaris bridwelli* Barber. HYMENOPTERA. **Braconidae**: !*Bracon mellitor* Say (Pierce 1908a, McGovern *et al.* 1974), !*Macrocentrus* sp. (McConnell 1934). **Cynipidae**: **Dryocosmus kuriphilus* Yasumatsu. **Diprionidae**: !*Diprion similis* (Hartig) (Finlayson 1962). **Pteromalidae**: !*Lyrcus incertus* (Ashmead) (Pierce 1908a). LEPIDOPTERA. **Coleophoridae**: !*Coleophora malivorella* Riley (Gould and Geissler 1940, Beacher 1947). **Lasiocampidae**: **Malacasoma americana* (Fabricius). **Momphidae**: !*Mompha eloisella* (Clemens) (Allan 1962). **Pyralidae**: *Acrobasis* (= *Mineola*) sp., **Acrobasis betulella* Hulst (=

A. hebescella Hulst), !*Acrobasis caryae* Grote (Nickels *et al.* 1950), !*Acrobasis caryivorella* Ragonot (Nickels 1951), **Acrobasis juglandis* (LeBaron), !*Acrobasis nuxvorella* Neuzig (Gunasena and Harris 1988). **Psychidae**: !*Thyridopteryx ephemeraeformis* (Haworth) (Baerg 1928). **Sphingidae**: **Ceratomia catalpae* (Boisduval). **Tortricidae**: !*Cydia caryana* (Fitch) (Reyes-Villanueva 1987), !*Grapholita molesta* (Busck) (McConnell 1932, Brunson and Allen 1948), !*Rhyanconia frustrana* (Scudder) (Schaffner 1959). MANTOIDEA. **Mantidae**: **Mantis* eggs.

In addition to the above confirmed host records, the following hosts listed by Noyes (2010) for *E. cyaniceps* likely also refer to *E. cushmani* based on the original identification of the parasitoid as *E. cyaniceps amicus* or *E. amicus* — COLEOPTERA. **Curculionidae**: *Chalcodermus aeneus* Boheman (Bissell 1940), *Chalcodermus inaequicollis* Horn (Bissell 1940). **Scolytidae**: *Scolytus multistriatus* (Marsham) (Hoffmann 1942). HYMENOPTERA: **Bethylidae**: *Goniosus punctaticeps* (Kieffer) (Nickels *et al.* 1950). **Braconidae**: *Agathis acrobasidis* (Cushman) (Nickels *et al.* 1950), *Bracon variabilis* (Provancher) (Nickels *et al.* 1950), *Macrocentrus ancylivorus* Rohwer (Brunson 1948), *Macrocentrus instabilis* Muesebeck (Nickels *et al.* 1950). **Ichneumonidae**: *Calliephialtes grapholithae* (Cresson) (Nickels *et al.* 1950), *Glypta* sp. (Driggers 1929). LEPIDOPTERA. **Pyralidae**: *Dioryctria disclusa* Heinrich (Farrier and Tauber 1953), *Pyrausta* (= *Ulophora*) *grotei* Munroe (Bissell 1940). **Tortricidae**: *Epiblema stenuana* (Walker) (Haden 1935).

Based on examined specimens it is also likely that at least two hosts recorded for *E. cushmani* actually belong *to E. cyaniceps* — COLEOPTERA. **Curculionidae**: *Microlarinus lypriformis* (Wollaston) and *Trichobaris texana* LeConte (see under *E. cyaniceps*).

Host records suggest that *E. cushmani* is usually a primary parasitoid or, through at least Braconidae, Ichneumonidae and rarely Pteromalidae, a hyperparasitoid of various Coleoptera and Lepidoptera. It appears to commonly be a hyperparasitoid and very possibly is an obligate hyperparasitoid of at least the cotton boll weevil, *Anthonomus grandis*, based on McGovern *et al.* (1974). Although McGovern *et al.* (1974) identified the hyperparasitoid as *E. cyaniceps*, examination of voucher specimens shows that this was a misidentification of *E. cushmani*, as appears to be all other literature recording *E. cyaniceps* from the cotton boll weevil. Similarly, all literature recording *E. cyaniceps* from various Bruchidae appear to be misidentifications of *E. cushmani*. Anomalous regional host records include *Mantis* eggs and *Dryocosmus kuriphilus*.

I can not confirm the extralimital host records for Diptera listed by Noyes (2010), though *E. cushmani* was stated to have quickly spread to other coleopteran hosts on all the major Hawaiian islands after being introduced (Stein 1983) as well as to *Procecidochares utilis* Stone and *P. alani* Steyskal (Tephritidae) (Duan *et al.* 1996). Both of these gall making species were introduced into Hawaii, the former species as a weed biocontrol agent. *Eupelmus cushmani* has also been reported from South America as a hyperparasitoid through *Paratheresia claripalpis* (Wulp) (Tachinidae) (De Santis 1979) and *Sarcodexia lambens* (Wiedemann) (= *S. sternodontis* Townsend) (Parker *et al.* 1953).

Plant associates — **Asteraceae**: *Helianthus angustifolius* L. (swamp sunflower), *Iva annua* L. (marshelder), *Vernonia altissima* Nuttal (ironweed), *Xanthium* L. (cocklebur), ? *Silphium laciniatum* L./*S. terebinthinaceum* L. [based on reared male]. **Euphorbiaceae**: *Crotoncapitatus* var. *lindheimeri* (Engelmann & Gray) (hogwort). **Fabaceae**: *Acacia constricta* Bentham (whitehorn acacia), *Amorpha californica* Nuttall (California false indigo), *Amorpha fructiosa* L. (desert false indigo), *Baptisia tinctoria* (L.) (yellow false indigo), *Calliandra eriophylla* Bentham (fairy duster), *Cercis canadensis* L. (eastern redbud), ? *Mimosa biuncifera* Bentham [based on reared males] (catclaw mimosa), ? *Niasolia schottii* (Torrey) [based on reared male] (Schott's yellowhead), *Parkinsonia microphylla* (Torrey) (yellow palo verde), *Pithecolobium flexicaule* (BenthAM) (Texas ebony), *Prosopis pubescens* Bentham (screwbean mesquite), *Rhynchosia minima* (L.) seeds (least rhychosia), *Trifolium pratense* L. (red clover), *Vachellia farnesiana* (L.) Fabaceae (huisache), *Vicia villosa* Roth (hairy vetch). **Juglandaceae**: *Hicoria* sp., *Juglans nigra* L. (eastern black walnut). **Koeberiniaceae**: *Koeberlinia spinosa* Zuccarini (crown of thorns). **Malvaceae**: *Gossypium thurberi* Todaro (Thurber's cotton). **Meliaceae**: *Melia azedarach* L. (Persian lilac). Fabaceae. **Onagraceae**: *Ludwigia* L. (primrose-willow), *Oenothera biennis* L. (common evening primrose). **Pinaceae**: *Pinus strobus* L. (white pine), *Pinus taeda* L. (loblolly pine). **Rhamnaceae**: ? *Zisiphus obtusifolia* (Hooker ex Torrey & A. Gray) (=*Condalia lycioides*) [based on reared male] (lotebush). **Rubiaceae**: *Cephelanthus occidentalis* L. (buttonbush). **Santalales**: ? *Phoradendron leucarpum* Reveal (mistletoe). **Smilacaceae**: *Smilax* L.

Remarks. Through crossing experiments Pierce and Cushman (1915) showed that *E. cushmani* and *E. cyaniceps* are reproductively isolated. Furthermore, *E. pervius* is supported as a distinct species from both *E. cushmani* and *E. cyaniceps* by host differences and a difference in male flagellar structure/setation (*cf.* Figs 62–64, 66). However, males of *E. cushmani* and *E. cyaniceps* are very similar except for what appears to be a slight difference in sculpture pattern of the scape. Typical *E. cyaniceps* males have an elongate region of quite distinct micropunctures ventrally along the entire length of the scapular scrobe (Fig. 77), whereas males of *E. cushmani* have this region more extensively smooth and shiny or at least with much shallower sculpture that appears more as tiny pin pricks and/or somewhat strigose (Figs 75, 76) rather than being pitted by distinct punctures. However, there is no distinct division between the two extremes and it is very possible my identification is unreliable for some males not definitely associated with females through rearing. For example, females collected from Menifee Valley (California, Riverside Co.) are identified as *E. cyaniceps*, whereas males from the same locality and similar dates are tentatively identified as *E. cushmani*.

I am equally uncertain of the morphological limits and differentiation of all *E. cushmani* and *E. cyaniceps* females. Although 'typical' females of *E. cushmani* and *E. cyaniceps* are morphologically quite distinct, all structural, color and sculptural features by which they are recognized appear to intergrade. I primarily use setal pattern of the prepectus in combination with relative length of the ovipositor sheaths to differentiate females. The prepectus of females that I include in *E. cushmani* is often virtually bare or only quite obscurely setose, but at most there are only 2 or 3 rows of comparatively inconspicuous setae mediolongitudinally such that the apices of the setae do not attain the margins and there is quite a wide bare band ventrally (Fig. 42). Most females, or at least larger females of *E. cyaniceps*, have the prepectus much more conspicuously and extensively setose (Fig. 44), usually with at least four or five rows of white setae and with the ventral-most row of setae near the ventral margin so that there is only a narrow bare band ventrally and/or the apices of the setae generally attain the ventral and/or dorsal margins of the prepectus. Females of *E. cyaniceps* usually also have the propodeal callus much more densely and conspicuously setose (*cf*. Fig. 51) than do *E. cushmani* females (Fig. 50). Because the setae are less numerous they are quite easy to count for *E. cushmani* females, but not so for typical *E. cyaniceps* females with a more densely setose callus. However, there is no distinct division between the two states and propodeal setation, although often diagnostic, is an even less reliable identifier of *E. cushmani* females than is prepectal setation.

It is sometimes difficult to assess the setal pattern of the prepectus in museum specimens because the setae are abraded, but regardless I believe this feature is insufficient to differentiate all females of *E. cushmani* and *E. cyaniceps*, at least in eastern North America. Almost all females that I include in *E. cushmani* based on quite a sparsely setose prepectus have ovipositor sheaths that are at least as long as the marginal vein (Fig. 37), whereas in eastern North America females that I identify as *E. cyaniceps* based on an obviously, extensively setose prepectus have ovipositor sheaths that are at least slightly shorter than (usually less than 0.9×) the length of the marginal vein (Fig. 39). Figure 38 is of a female from Texas that is about 3.2 mm in length, which has short ovipositor sheaths only about 0.88× the length of the marginal vein, but a comparatively inconspicuously setose prepectus with only about 3 rows of seta similar to some *E. cushmani* females. In other respects it differs little from other eastern North American females of *E. cyaniceps* having a more conspicuously setose prepectus, including having a uniformly brown scape, the frons somewhat meshlike coriaceous-imbricate (also almost entirely green except narrowly bluish-purple along inner orbits), the vertex broadly rounded into the occiput (see further below), the protibia extensively brown, and the metatibia mostly brown except for up to about the apical quarter white (*cf*. Figs 38, 39). I consider that smaller females of *E. cyaniceps* can sometimes have the prepectus less extensively and conspicuously setose than is typical for larger specimens and include in *E. cyaniceps* females from eastern North America with ovipositor sheaths less than 0.9× the length of the marginal vein in combination with a comparatively inconspicuously, sparsely setose prepectus.

Large females of *E. cushmani* tend to have longer ovipositor sheaths and the longest sheaths are usually correlated with the inner plate of the ovipositor projecting conspicuously beyond the apex of the gaster (Fig. 9). For example, the inner plate of the ovipositor projects obviously beyond the apex of the gaster in the syntypic series of *E. amicus* whose ovipositor sheaths are about 1.53−1.6× the length of the marginal vein, but not in the syntypes of *E. cushmani* whose ovipositor sheaths are only about 1.08−1.1× the length of the marginal vein. Although females of both are quite large, about 4.3 mm in length, ovipositor structure apparently is not entirely correlated with body size because the female from Camp Angeles (California) associated with *Amorpha californica* Nuttal (Fabaceae) is only 3 mm in length, yet the ovipositor sheaths are about 1.3× the length of the marginal vein and the inner plate of the ovipositor extends conspicuously beyond the apex of the gaster such that the apparent sheath length is about 1.6× the length of marginal vein.

In addition to typically different prepectal and propodeal setal patterns and relatively longer ovipositor sheaths, various other features help to distinguish females of *E. cushmani* from those of *E. cyaniceps*, though any single feature appears to form a continuum or overlaps in the two species. Females of *E. cushmani* are often distinguished by an entirely or almost entirely yellowish-orange scape (Fig. 28), whereas all except a single female of *E. cyaniceps* I examined (see under *E. cyaniceps*) have a uniformly and comparatively dark brown to somewhat orangey-brown scape that has at least a slight metallic green luster under some angles of light. However, scape color is highly variable. Females of *E. cushmani* from more southern localities commonly have at least a partly yellowish scape, though smaller females almost always have a dark scape similar to *E. cyaniceps* females and scape color does not seem to be completely correlated with either body size or geographical locality. For example, type specimens of *E. townsendi* and *E. cushmani* from Peru and Texas, respectively, have a yellowish-orange scape whereas the syntypes of *E. amicus* from New Mexico have quite a dark, only slightly orangey-brown scape. Larger females of *E. cushmani* usually also have the frontovertex dark mesally in distinct contrast with bright green or often variably distinctly multicolored metallic bands (Fig. 28) along the inner orbits, though the frons can be more uniformly colored without or with less conspicuous lateral bands, particularly in smaller females. Larger females typically also have the frons coriaceous to coriaceous-imbricate mesally and variously extensively reticulate-imbricate to roughened or transversely wrinkled with scattered setiferous punctures laterally toward the inner orbits (Fig. 28), though smaller females often have the frons more uniformly meshlike coriaceous. Larger, typical females of *E. cushmani* usually also have the vertex transversely reticulate-strigose to quite strongly strigose-carinate and in lateral view the vertex continued beyond the ocelli in a similar plane as the frons so that the highest point of the head is above the posterior ocelli or at least the vertex is quite abruptly and narrowly angled relative to the occiput (Fig. 37). Smaller females have the vertex variably sculptured but at least broadly rounded into the occiput such that in lateral view the posterior ocelli are dorsal on the head. Typical females of *E. cyaniceps* have a more uniformly colored frontovertex, often without or at least with less abruptly and distinctly delineated bluish to purple regions along the inner orbits (Fig. 29). Some females have a similar frontovertex color pattern to typical *E. cushmani* females, but unlike many such females the lateral metallic region is a single color. The frons is often also more extensively and distinctly reticulate in *E. cyaniceps* females (Fig. 29), though sometimes more or less uniformly meshlike coriaceous to slightly coriaceous-reticulate in smaller specimens similar to smaller specimens of *E. cushmani*. The vertex is always broadly rounded into the occiput in *E. cyaniceps* females (Fig. 39) and usually is more transversely reticulate-imbricate than distinctly strigose, though again this is similar to some smaller *E. cushmani* females.

Correct identification of *E. cushmani* from western North America is also complicated by some females, particularly those reared from *Acacia* seeds, having an elongate linea calva that is open or virtually so to the vanal area similar to females of *E. pervius* (*cf.* Fig. 45). However, these *E. cushmani* females have typical sparse setal patterns of the prepectus (Fig. 42) and propodeal callus (Fig. 50) compared to the much more extensively setose prepectus (*cf.* Fig. 44) and propodeal callus (Fig. 51) of *E. pervius* females, in addition to often having a yellowish-orange scape. It is likely such *E. cushmani* specimens are parasitoids of Bruchidae in the *Acacia* seeds whereas *E. pervius* are parasitoids of *Prodoxus* moths in *Yucca*. The similarity in forewing setal pattern either indicates introgression or that what I presently interpret as just three species, *E. cushmani*, *E. cyaniceps* and *E. pervius*, represents a species complex of more than three morphologically similar species. Female body size varies considerably within each putative species. I currently interpret this variation as at least partly correlated with different females being reared from different sized hosts and/or being a primary or a hyperparasitoid. However, observed variation could reflect unrecognized sibling species associated with different hosts. The collection of more material that is reliably associated with hosts through rearing and particularly the collection of morphologically diverse specimens from throughout North America that are suitable for molecular analysis are needed to test the species concepts proposed here to better assess diversity.

In addition to the similarities noted above, some females of *E. cushmani* with a dark scape and long ovipositor sheaths might be mistaken for *E. utahensis* females, but differ by several setal features as discussed under the latter species. Because of scape color and usually quite long ovipositor sheaths, females of *E. cushmani* are also similar to *E. cerris* Förster in Europe, but *E. cerris* females have the frons entirely finely coriaceous and a line of setae over most of the length of the costal cell dorsally, more similar to *E. annulatus* females, as well as the propodeal callus more densely setose.

6. *Eupelmus* (*Eupelmus*) *cyaniceps* Ashmead

Figs 29, 32, 38, 39, 48, 61, 62, 77; Map 8

Eupelmus cyaniceps Ashmead, 1886: 129. Holotype, female (USNM, examined). Type data: USA, Florida [Jacksonville].
Eupelmus momphae Gahan, 1910: 205−206. Syntypes, 4 females (BMNH and USNM, examined). Type data: USA, Alabama; reared from *Mompha brevivittella* infesting seed pods of *Enothera*. **N. syn.**
Eupelmus cyaniceps cyaniceps; Girault, 1916b: 244. Change in rank by inference through establishment of *E. cyaniceps amicus* Girault and *E. cyaniceps utahensis* Girault.
Eupelmus cyaniceps; Burks, 1979: 882.

Description. FEMALE. (Figs 38, 39) Length about 1.8−6 mm. Head of smallest specimens sometimes mostly dark brown, but more commonly (Fig. 29) frontovertex variably distinctly and extensively dark to rarely coppery mesally and green laterally, to often more or less uniformly green to blue or green to blue with variably large and distinct blue to purple region along inner orbit, and when partly metallic then parascrobal region, interantennal region and clypeal region often variably extensively dark; maxillary and labial palpi dark brown. Antenna with scape virtually always dark brown or at most dark orangey-brown with slight metallic green to bluish luster (see further under remarks); pedicel dark brown except usually for slight metallic luster, and flagellum dark brown. Mesosoma with tegula brown or dark with slight metallic luster, otherwise sometimes mostly brown though mesonotum usually with at least slight metallic green luster, and larger specimens usually more extensively green to greenish-blue similar to head except sometimes lateral lobe dorsolongitudinally, scutellum variably extensively, and convex or concave part of medial mesoscutal lobe dark to reddish-coppery. Forewing hyaline (Fig. 48); venation yellowish-brown; setae uniformly brownish or sometimes lighter in basal cell and on submarginal vein. Front leg with trochanter yellow or more commonly brown; femur sometimes extensively yellowish, at least dorsally, but usually dark brown except for yellow trochantellus and extreme apex; tibia yellow or almost completely yellowish except for dorsal and ventral brown bands, to more extensively brown except knee and apex more widely yellowish; tarsus yellowish except for apical brown tarsomere to more or less uniformly yellowish-brown. Middle leg with dark mesotibial apical pegs and mesotarsal pegs, otherwise often yellowish to yellowish-orange at least beyond coxa and sometimes including coxa, or femur and tibia in part more distinctly brownish, but knee, tibia apically, and at least basal tarsomere lighter yellowish to white. Hind leg with trochanter yellowish to dark brown; femur with trochantellus and apex variably extensively yellowish to yellowish-orange, often more so dorsoapically, but at least about basal half dark brown; tibia usually more or less dark brown mesally with knee and up to about apical third yellowish to white, though sometimes more extensively yellowish at least ventrally; tarsus with at least basitarsus white and apical tarsomere brown, but tarsomeres 2−4 variably white to dark brown. Gaster entirely dark brown or at most with metallic green luster anteriorly on basal tergum and sometimes laterally on terga, and with brown hairlike setae similar in color to cuticle; dark inner plate of ovipositor rarely projecting distinctly beyond apex, but at least ovipositor sheaths with short dark basal region abruptly delineated from much lighter, longer medial region, the medial region sometimes more or less evenly yellowish-orange to graduated brown apically but often more distinctly white compared to quite abruptly and distinctly delineated apical brownish region.

Head (Fig. 29) with frons usually imbricate-roughened to quite distinctly reticulate, even mesally below anterior ocellus, and merged into parascrobal region through slight undulation, though sometimes finely meshlike coriaceous and uniformly rounded into parascrobal region in smaller females; vertex variably transversely alutaceous-reticulate in smaller specimens to transversely reticulate-strigose or strigose in larger specimens, but broadly rounded into occiput (Fig. 39); scrobal depression reticulate-rugulose to transversely reticulate-strigose; IOD = 0.36−0.47× head width; OOL: POL: LOL: MPOD = 0.6−1.0: 2.1−3.0: 1.5−2.0: 1.0. Antenna with combined length of pedicel + flagellum = 1.1−1.3× head width; scape about 4.5−5.5× as long as wide, in outer view ventral margin often almost straight and angulate but sometimes slightly sinuate with very slender, inconspicuous flange over about apical half; pedicel in lateral view about 1.9−2.4× as long as wide; fl1 slightly transverse to quadrate; fl2 about 1.7−2.9× as long as wide and about 2.5−3.8× as long as fl1; subsequent funiculars increasing in width to quadrate or slightly longer than wide fl8; clava about 2.1−2.6× as long as wide, 0.8−1.1× combined length of apical three funiculars, and 0.25−0.43× length of funicle. Mesoscutum almost uniformly meshlike reticulate except lateral lobe more minutely coriaceous mediolongitudinally and mesoscutal medial lobe usually more transversely alutaceous-reticulate in smaller to reticulate-imbricate anteriorly in larger specimens. Scutellar-axillar complex with axillae obliquely alutaceous-reticulate to more coriaceous-imbricate, but at least scutellum mostly meshlike coriaceous to coriaceous- or somewhat reticulate-imbricate on either side of median. Prepectus usually extensively and conspicuously setose with slightly lanceolate white setae such that ventral-most line of setae close to ventral margin and/or apices of setae generally extend to or even slightly over ventral and often dorsal margins (Fig. 44), though sometimes less conspicuously setose in smaller females (Fig. 43). Acropleuron finely meshlike reticulate anterior and posterior of medial microsculptured region, the cells sometimes somewhat larger posteriorly than anteriorly but with flat surfaces defined by slightly raised ridges. Forewing (Fig. 48) with linea calva separated basally by several rows of setae from vanal area and basal cell usually uniformly setose; costal cell ventrally setose along length with 2 or 3 lines of setae medially, and dorsally bare or much more commonly setose apically along leading margin for distance usually little greater than length of parastigma or at most half length of cell; cc: mv: pmv: stv = 4.3−5.0: 4.6−5.2: 1.0−1.2: 1.0. Mesotibia with apical row of 3−6 pegs; mesotarsus (Fig. 32) ventrally with pegs on basal four tarsomeres, basitarsus with 10−17 pegs arranged distally in double row on either side, second tarsomere with 4−6, third tarsomere with 1−3, and apical tarsomere with 1 peg on one side. Propodeum with U-shaped plical depression extending to foramen; callus variably densely and conspicuously setose, but often quite densely setose with comparatively long and slightly lanceolate white setae. Gaster with inner plate of ovipositor only rarely extending beyond apex if sheaths comparatively long; ovipositor sheaths almost always about 0.75−0.9× length of metatibia and 0.72−0.93× length of marginal vein.

MALE (Fig. 61). Similar to *E. cushmani* except outer surface of scape with elongate band of distinct punctures ventrally along length of scapular scrobe so as to usually appear pitted (Fig. 77).

Regional material examined (574♀, 111♂). CANADA. **ONTARIO**: Brighton, 20.VII.56, J.C. Martin (1♀). Ottawa, G. Goulet — 1-6.VII.81, 17-27.VII.86 (4♀); 45º21.365'N 75º42.416'W, 16-26.VI.2007 (1♀). Shirley's Bay, 22-29.VII.88, M. Sanborne (1♀).

USA. iss. — 12.V.1897, 35^{08} (1♀USNM); 2.III.1882, Dept. no. 1014.a (1♂ USNM); V.89, Webster, 4421^{01} (1♀, 1♂ USNM); reared from *Xanthium* sp., XII.38 (1♀ USNM). **ALABAMA**: "1967", "1972", C.F. Baker (1♀, 1♂ USNM). Nov. 26, 112, Type No.13221 USNM, [? *Mompha brevivitella*] (5♀ syntypes of *Eupelmus momphae*, USNM). **ARIZONA**: "2340", "2512", "2522", "2572", C.F. Baker (5♀ USNM). 1981, J. Addicott, reared from *Yucca* (1♀). Fish Creek Hill, 29.IX.24, 2900', L.J. Bottimer, Hunter No. 9192A, on *Thurberia* (2♀ USNM). Top Salt River Hill, 26.IX.24, 1800', L.J. Bottimer, Hunter No. 9192B, sweeping *Thurberia* (1♀, 1♂ USNM). ***Cochise Co.***, Portal — 1.IX.87, H. & M. Towes (1♀ AEIC); 1 mi. E., 4700', 31.VII.82, G. Gibson, sweeping flowering *Acacia constricta* (1♀); 2 mi. NE, 29, 30.IX.60, M. Cazier (2♀ USNM). ***Graham Co.***, Bonita Creek, 3500', 17.VIII.76, D.S. Chandler (1♀ UAIC). ***Maricopa Co.***, Gila Bend, 29.VII.66, C.R. Kovacic (1♀ UCDC). Tempe — VIII.12, V.L. Wildermuth, Webster No. 8716, cage No. 16, *L*[*anguria*] *mozardi* (1♀ USNM); 7.III.29, par. *T. cylindrica* (2♀ USNM); 20.IIII.29, par. tobacco borer (1♀ USNM). ***Pima Co.***, Canoa, 21.VI.60, G. Butler, suck/cotton (1♀ UAIC). Tucson, 20.IX.37, R.H. Crandall (1♀ UAIC). Sabino Canyon, Santa Catalina Mountains, 3.VIII.82 (2♀). ***Santa Cruz Co.***, Patagonia, 31.53ºN 10.77ºW, Sonoita Creek Nature Conservancy Reserve, B. Brown & E. Wilk — 24.V.94, 10.VII.94, (2♀ LACM); 24.X.93, 24.XI.93, 4, 20.III.94, 14.IV.94, 16.VI.94, (5♀, 9♂). Patagonia — 8.V.94, B. Brown (1♀); 4.5 mi. NE on Hwy 83, 9.VIII.82, G. Gibson, sweeping *Baccharis glutinosa* and *Chrysothamnus* sp. (8♀). **ARKANSAS**: ***Benton Co.***, Bentonville, 20.VI.19, D. Isley, par. *Mineola* (1♀ USNM). ***Clark Co.***, 26.IX.10, bred cotton square (1♂ USNM. **CALIFORNIA**: 314, Coquillet (1♀ USNM). Sta [Santa] Cruz Mountains (1♀ USNM). ***Alameda Co.***, Berkeley, 10.VI.21, E.O. Essig (1♀ USNM). ***Butte Co.***, Lake Madrone, 5.VI.77, R.O. Schuster & E.C. Toftner (1♀, 1♂ UCDC). ***Contra Costa Co.***, Antioch, 28.VIII.76, B. Villegas (1♀ UCDC). Martinez, 6.VII.59, T.R. Haig, ex fruit fly pupa on *Baccharis pilularis* (1♀ CASC). Pittsburg, 2 mi. W., 19.IX.57, J.A. Powell (1♀ UCRC). ***Fresno Co.***, Friant, Lost Lake Recreation Area, 9.VI.82, J.A. Halstead (1♀). Panoche Road at San Benito County line, 24.VIII.83, J.A. Halstead, on spurge (*Euphorbea*) (1♀ CASC). ***Imperial Co.***, Coachella Canal Road, 1.6 km N. highway 78, 11.6 km W Glamis, 32º59'N 115º11.7'W, 19-22.IX.2008, T.J. Zavortink & R.B. Kimsy (1♂ UCDC). ***Inyo Co.***, Bishop, 7.IX.87, H. Andersen, sweeping alfalfa (1♂ UCRC). ***Los Angeles Co.***, Claremont, Baker (17♀ USNM). El Segundo Sand Dunes, Biological Survey L.A. County Museum, 18.V.38, 29.VI.38, W.D. Pierce (2♀ LACM). Placerita Canyon, Walker Ranch, 34.38ºN 118.44ºW, 24.V.99, B. Brown & I. Swift (2♀ UCRC). ***Napa Co.***, Lake Hennessey, 11 km ESE St. Helena, 7.VII.90, 28.X.90, S.L. Heydon, on *Baccharis* (8♂ UCDC). ***Orange Co.***, Fullerton, 2.VIII.30, Bartholomen (2♀ CASC). Huntington Beach, 1.IX.84, H. Andersen (1♀ UCRC). Irvine, 10.VIII.83, H. Andersen (1♀ UCRC). Newport Beach, 23.VII.84, H. Andersen (1♂ UCRC). ***Placer Co.***, Roseville — Dry Creek, 38.73438N 121.30065W, 19.VI.2008, 21.VIII.2007, G.W. Forister (1♀, 1♂ UCDC); Maidu Park, 38.73769, 121.24457, 8.VIII.07, G.W. Forister (1♀ UCDC). ***Riverside Co.***, Beaumont, 4 mi.W., Hwy 79, 2000', 3.VII.82, N.J. Smith (1♀ UCDC). Hemet, T55, R1W, S12, 30.I.69, Goeden & D.W. Ricker, insectary reared on *Ambrosia acanthicarpa* Hook., parasite of AA-69-4A (3♀ UCRC). Lake Skinner, NE end, 33º36'7"N 117º2'5"W, 7-21.V.96, J.D. Pinto (1♀ UCRC). Menifee Valley, hills on W. end, 1800', 33º39'N 117º13'W, J.D. Pinto — 27.VIII-1.X.80 (1♀); 18.IV.82, 30.V.82 (2♀ UCRC). Riverside — [?].1943, A.J. Baringe[?], ex ragweed borer (1♀ UCRC); 4.II.34, reared 3.V.34, Timberlake, ex *Euura* gall on *Salix lasiolepis* (1♀ UCRC); 28.X.66, R. Sunderman, ex *Datura* seedpod in assocation with Curculionidae (1♀ UCRC). Salt Creek, Salton Sea, 14.IV.74, M. Wasbaurer, ex *Salticornia* sp. (1♀ CASC). ***Sacramento Co.***, Sacramento, 11.V.60, W.E. Simonds, *Salix hindsiana* (2♀ CASC). ***San Bernardino Co.***, Apple Valley — 26.V.80, N.J. Smith (1♀ UCDC); 18.VIII.82, H. Andersen (1♀ UCRC). Hesperia, 9 mi. S., Mojave River Forks, 3.V.84, J. D. Pinto (1♀ UCRC). Mill Creek, T15 R7W S13, 21.VI.82, L. Constantino (2♀ UCRC). Oak Glen, 1500 m, R.E. Wagner — 19.VII-2.VIII.84, 31.VIII-6.IX.84 (2♀); 34º2'N 116º57'W, 2-16.VIII.84 (1♀ CASC). Ontario, 26.XII.08, bred with *Mordellistena* on Alkali (1♀ USNM). ***San Diego Co.***, Anza Borrego State Park, 15 mi. N. Borrego, 24.IV.80, J.B. Woolley (2♂ TAMU). Goeden & D.W. Ricker, insectary reared on *Ambrosia psilostachya* de Candolle — Pala, T10S, R3W, S1, 16.IX.69, parasite of AP-69-115A (1♀ UCRC); Valley Center, T11S, R1W, S21, 11.II.69, R.D., parasite of AP-69-9A (1♀ UCRC). Lake Wohlford, 24.IV.74, H. & M. Townes (1♀ AEIC). Santee, 9.X.71, G. Scriven, on *Pinus radiata* (1♀ UCRC). Warner Springs, Agua Caliente Creek, 3100', 26-28.VIII.80, M. Wasbauer & P. Adams (1♀ CASC). Wm [William] Heise Co. [County] Park, 25.VII.79, C. Melton (1♀ UCRC). ***San Luis Obispo Co***., Pozo, 6 mi. SE, R16E T31S sections 4-5, 1500', 9-21.IV.90, W.E. Wahl (1♀). ***San Mateo Co.***, Stanford —6641, *R. californica* (1♂ USNM); University, Jasper Ridge Biological Preserve, 37º24'03"N 122º14'30.5"W, 110 m, 5-8.IX.2005, P.H. Arnaud (1♀ CASC). ***Santa Barbara Co.***, Coaloil Point Reserve, 22-29.VI.82, K. Chaseman (1♀). Goleta, 22.VI.59, R.M. Bohart (1♀ UCDC). ***Solano Co.***, 6 km SE Suisun City — 11.VIII.90, S.L. Heydon (2♂ UCDC); Suisun Marsh, 22.VI.93, S.L. Heydon & L. Guo (1♀ UCDC). ***Sonoma Co.***, 15.X.70, T. Griswold (1♂ CASC). ***Stanislaus Co.***, Del Puerto Canyon, 9.IV.72, L.A. Lacey (1♀ FSCA). ***Tulare Co.***, Ash Mountain Kwh Power Station #3, 14.VI.83, R.D. Haines (1♀). 31.VIII.83, 21.IX.83, R.D. Haines, on *Helianthus annuus* — Farmersville (5♀, 2♂ CASC; ♂ CNC Photo 2010-29); Visalia (1♀ CASC, CNC Photo 2010-28). ***Yolo Co.***, Davis, 3.VIII.55, A.T. McClay (1♀ UCDC). N. bank Putah Creek, Road 98, 5.II.71 (1♀ UCDC). Woodland, 10, 14.IX.70 (2♀, 1♂ UCDC). Yolo, N. bank Putah Creek, Mace Boulevard, 11.II.71, J.E. Lanck, reared from *Xanthium strumarium* (4♀, 5♂ UCDC). **COLORADO**: ***Chaffee Co.***, Poncha Springs, 22.VI.99, D. Leatherman (2♀ CSUC). **DELAWARE**: ***Kent Co.***, Felton, J.H. Davis, 15.VIII.32, W.R. Haden (1♂ FSCA). ***New Castle Co.***, Newark, P. Rice —24.IX.35, ragweed borer material; 10.VI.35, found as pupa in ragweed stem (1♂ FSCA); 8.IX.35 (1♀ FSCA). ***Sussex Co.***, Bridgeville, W.R. Haden — Alvin C. Baker, 10.VIII.32 (1♀ USNM); O.A. Newton & Son, 9.VIII.32, ex *Epiblema strenuana* (1♀ FSCA; 2♀ USNM). Milton, Leroy Lynch, 8.VIII.32, W.R. Haden (1♀ USNM). **DISTRICT OF COLUMBIA**: 24.VIII.1879 (1♀); 17.V.1897, from seedpods of *Oenothera biennis* [?] (1♀, 3♂ USNM). Washington, 12.VIII.07, Hunter No. 1334, W114.I.2, 26.VIII.07, par. *Tyloderma foveolatum* (1♀ USNM). **FLORIDA**: ***Alachua Co.***, 17.IV.56, R.A. Morse, at *Melilotus alba* (3♀ FSCA). 24.V.58, F.W. Mead, Medicago (4♀ FSCA). Gainesville, J.B. Heppner, ex *Aristotelia absconditella* — 2 mi. S., 27.XI.72, em. 3, 4.XII.72 (1♀, 1♂ FSCA); 12.I.73, JBH rearing no. 73A1, pupa 12.I.73, adult 24.I.73 (1♀ FSCA). Gainesville, H.V. Weems — 30.IX.67, *Balduina angustifolia* (1♀ FSCA); 22.IV.68, *Pyracantha* (4♀ FSCA). Gainesville, Doyle Conner Building — 8.IX.72, Dodge (1♂ FSCA); 5, 13.X.71, 17.XI.71, H.V. Weems & C.R. Artaud (5♀ FSCA); 13-17.XII.76, E.E. Grissell (1♀ FSCA). Gainesville — 4.V.37, L.J. Bottimer (1♀ USNM); American Entomological Institute, 10-17.IV.86, G. Gibson (5♀); Millhopper Road, 27.IV.73, G.B. Fairchild (1♀ FSCA); Pierce’s homestead, S9, T10S, R18E, 24.III.76, 4-6.XI.75, W.H. Pierce (2♀ FSCA). Newnan’s Lake, 3.IV.86, D.B. Wahl (1♀). ***Baker Co.***, Glen St. Mary, 30º18'00"N 82º00'55"W, 18.III.2007, E. Zoll & S. Fullerton (1♀ UCFC). ***Broward Co.***, Hollywood, 22.XII.82, W. Gregory (1♀). ***Charlotte Co.***, Punta Gorda, 12.IV.52, O. Peck (1♀). ***Collier Co.***, Copeland, Fakahatchee Strand State Preserve, 12-27.V.87, VIII.87, V. Gupta (2♀). ***Columbia & Baker Co.***, line, junction Route 90, Osceola National Forest, 26-29.X.76, 21.X-22.XI.76, 29.III-13.IV.77, J.R. Riley (4♀ FSCA). ***Dixie Co.***, Jena, 1.VIII.76, E.E. Grissell, *Iva frutescens* L. (3♀ USNM). ***Duval Co.***, 6.V.63, F.W. Mead (2♀ FSCA). Jacksonville (♀ holotype of *E. cyaniceps*; 1♀ USNM). ***Gadsen Co.***, Chattahoochee — 30.IV.52, O. Peck (1♀); 5.X.60, F.W. Med (1♀ FSCA). ***Highlands Co.***, Archbold Biological Station — 19-20.IV.78, L.L. Lampert (1♀ FSCA); 8-12.78, S.J. Chance (1♀ FSCA); 7.XII.78, W.V. Weems & S.J. Chance (1♂ FSCA); 22.VIII.78, H.V. Weems & W.C. Conner (1♀, 1♂ FSCA); 30.XII.78, 30.XII-1.I.79, 5, 6, 11, 17.I.79, 8-9, 22.II.79, 22.III.79, 18.IV.79, 5, 23.V.79, 6.VI.79, H.V. Weems & S. Halkin (13♀, 4♂ FSCA); 26.V.78, 2.VI.78, H.V. Weems & K.K. Klein (2♀ FSCA); 12-13.II.80, J.V. Weems & F.E. Lohrer (1♀ FSCA); 14.VI.79, 21, 30.VI-1.VII.79, 27.IX.79, 10, 22.X.79, J.V. Weems & T.A. Weber (5♀ FSCA); 20.IV.82, G. Gordh (2♀ UCRC). ***Indian River Co.***, Verra Beach, SW 21 Street, 31.VIII.2004,

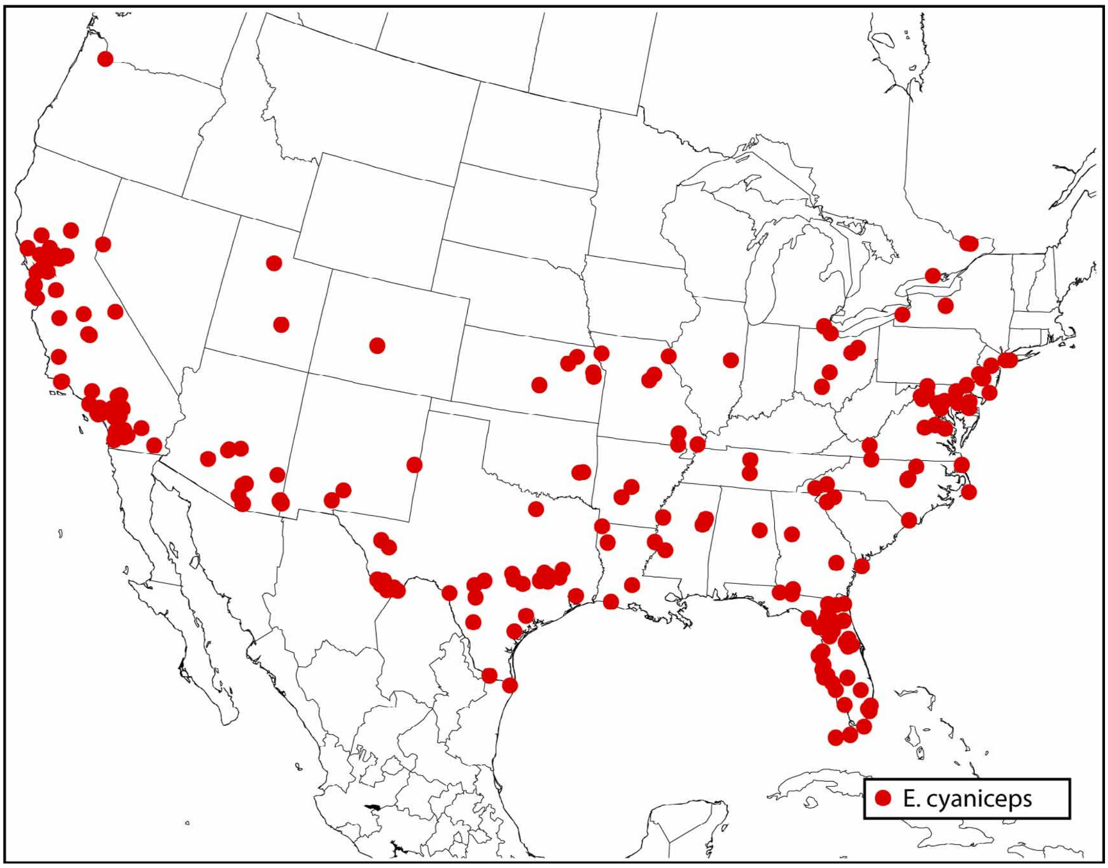
K. Hibbard & J. Brambila (1♀ FSCA). ***Lee Co.***, Fort Myers, 8.IV.71, P.P. Babiy (1♀ ZSMC). ***Leon Co.***, Tall Timber Research Station — 7, 14, 21.VII.71, 4, 19, 27, 28.VIII.71, D.L. Harris (13♀ FSCA); 23.IX.77, G.J. Wibmer, ex *Tyloderma foveolata* in *Oenothera biennis* (1♂ USNM). ***Levy Co.***, 17 mi. NE Cedar Key, 25.V.70, D.L. Bailey (1♀ FSCA). ***Manatee Co.***, Bradenton, 16.IV.86, D. Schuster (1♀). ***Marion Co.***, Ocala —18.III.50, H.T. Townes (1♀ AEIC); 9 mi. SSW, Kingsland country estates, 19.IX-2.X.75, J. Wiley (1♀ FSCA). ***Miami-Dade Co.***, Hialeah, 16.XI.67, Stegmaier (1♀ USNM). Miami, C.C. Stegmaier — 17.VII.65 (1♀ FSCA); 15.IV.72 (CNCI LB-specm 2010-010), 28.V.72, em. 23.IV.72, ex larva of *Microlarinus lypriformis* (2♀, 2♂). Paradise Key, 21.II.19, Schwarz & Barber (1♀). ***Monroe Co.***, Key Largo, 31.III.52, G. S. Walley (1♀). Key Vaca, 28.XII.55, H.V. Weems, at *Bidens pilosa* (1♀ FSCA). Key West, 29.XII.54, H.V. Weems, on *Flaveria linearis* (1♀ FSCA). ***Orange Co.***, Orlando — 29.III.91, 22.II.93, 1.VII.93, 26.IX.93, S.M. Fullerton (3♀, 1♂ UCFC); 25.I.99, 5, 26.IV.99, P. Russell & S. Fullerton (3♀ UCFC); 22.III.2002, S. Fullerton, J. Heymon & T. Sims (1♀ UCFC). Wekiwa Springs State Park, S26 T20S R28E, 6.III.2001, P. Russell & S. Fullerton (1♀ UCFC). ***Palm Beach Co.***, Belle Glade, 15.III.73, 1.IV.73, W.G. Genung, ex *Languria erythrocephalus* larvae in stems of *Panicum hemitomon* (2♀ FSCA). ***Pasco Co.***, Moon Lake, 16.IV.52, J.R. Vockeroth (1♀). ***Pinellas Co.***, Crystal Beach, 18.V.52, O. Peck (3♀, 2♂). ***Putnam Co.***, Orange Springs, 2 mi. NW, 13.X-5.XI.75, J. Wiley (2♀ FSCA). Palatka, 28.IV.37, L.J. Bottimer (1♀ USNM). ***Sarasota Co.***, Myakka River State Park, 5.VI.54, H.V. Weems (2♀ FSCA). Oscar Scherer State Recreation Area, 27-29.V.78, N.F. Johnson (1♀). ***Seminole Co.***, Astor Farms, 2.5 mi. N., 11, 18, 25.V.2000, 7.VI.2000, 19.VII.2000, S. Fullerton & T. Sims (7♀ UCFC). Econ Wild Area, 18.III.2000, T. Smith (1♀ UCFC). ***Union Co.***, Worthington Springs, 23.III.75, 10.IX-2.X.75, M.H. Greenbaum, sweeping ferns (1♀ FSCA). **GEORGIA**: ***Chatham Co.***, Tybee Island, 7.IV.84, G.F. & J.F. Hevel (1♀ USNM). ***Grady Co.***, Cairo — 8.III.07, bred with *Plodia* from ragweed (1♀, 1♂ USNM); 11.VIII.43, em. 25.VIII.43, C.H. Hoffmian, par. golden-rod stem borer (1♀ USNM). ***Spalding Co.***, Bledsoe Research Farm near Griffin, 22.V.96, 4.VI.96, ex canola seed pods (2♀, 2♂). ***Tattnall Co.***, Reidsville, 60 km W. Savannah, 10.XI.72, D. Williams (1♀). **ILLINOIS**: ***Champaign Co.***, Champaign — 28.VII.09, D.M. Tuttle (1♀ UAIC); 30.VII.51, C. Waster (1♀, 1♂ USNM); 19.VII.51, H. Andersen (1♀ UCRC). **KANSAS**: ***Doniphan Co.***, Wathena — 14, 21.V.39, S.C. Schell (2♀ USNM); 27.VII.38, ironweed (3♀ USNM). ***Douglas Co.***, Baldwin, 2 mi. N., 14.X.78, L. Masner & G. Gibson (1♀). Lawrence, 1.IX.39, L.J. Lipovsky (1♀ USNM). ***Pottawatomie Co.***, Onaga, Crevecoeur (1♀ USNM). ***Reno Co.***, Medora, sand dunes, gall coll. 17.IV.32, C.W. Sabrozky, em. 2.V.32 (1♀ USNM). ***Riley Co.***, IX.21, J.B. Norton (1♀ USNM). Sep. 9, E.E. Faville (1♀ USNM). Manhattan, S.C. Schell — 26.IX.38, swept *Helianthus* (3♀ USNM); X.77, em. 11, 20, 27.IV.38 (10♀, 3♂ USNM). **LOUISIANA**: ***Caddo Parish***, Gilliam, galls coll. 9.IV.35, W.O. Pierce, ex *Phylloxera devastratrix* (2♀ USNM). ***Cameron Parish***, Grand Chenier, 4.8 km W., 5.X.80, L. Masner (2♀). ***Madison Parish***, Tallulah — 11.VIII.09, V.14.3, Hunter no. 1082, par. *Lixus musculus* (1♀ USNM); 10.IX.09, lot I.4, 8.VIII.09, bred *Polygonum pennsyl*.[*vanicum*] stem (1♀ USNM). ***Red River Parish***, Williams, 1.V.45, W.S. Pierce, Rd-cage parasitized shoot, *Curculio* larvae-5-11, 15.VI.45 (1♀ USNM). ***St. Landry Parish***, Opelousas Pilate, No. 4-97, No. 203-97, C.F. Baker (2♀ USNM). **MARYLAND**: ***Charles Co.***, 10.VII.73, J. Lashomb (1♂ MEMS). Marshall Hall, 10.X.1899, par. on Pyralid in stems of *Ambrosia trifida* (2♀ USNM). ***Harford Co.***, Edgewood, II.53, Moser, gall on *Baccharis* (1♀). ***Montgomery Co.***, Takoma Park, 11.IX.13, H. & M. Townes (1♀ AEIC). ***Prince George's Co.***, Beltsville — 2.VII.54, W.M. Mann (1♀ USNM); IX.83, P. Gross, ex *Rhyacionia frustrana* on loblolly pine (1♀ USNM). ***Queen Anne's Co.***, Grasonville, 23.IX.30, Oriental peach moth invest. Exp. No. 131-2P, *E. strenuana* infested *Ambrosia* (1♀ USNM). ***Washington Co.***, Williamsport, 12.VI.16, W.R. McConnell (1♀ USNM). **MICHIGAN**: ***Monroe Co.***, Erie, 22.IV.32, L.G. Jones, ex *Microbracon caulicola*, ex *Pyrausta penitalis* (2♀, 1♂ USNM). **MISSISSIPPI**: ***Hinds Co.***, Utica, Aug. (1♀ USNM). ***Oktibbeha Co.***, Craig Springs, 7.X.80, P.R. Miller (1♀ MEMS). Starkville — 27.VII.81, W.H. Cross (1♀ MEMS); 12.IX.81, R.L. Brown (1♀ MEMS). Trim Cane Creek, 14.IV.81, P.R. Miller, em. 4, 11.V.81, *Ambrosia trifida* stems (3♀, 2♂ MEMS). ***Washington Co.***, Delta Experimental Forest, Stoneville, N.M. Schiff — 33º27'N 90º54'W, 9.XI-1.XII.98, (1♀ UCDC); 33º28'N 90º54'W, 26.IX-1.XI.97, 14-28.IV.97, 12-25.V.97, 26.IX-1.XI.97 (5♀ UCDC); 33º29'N 90º54'W, 27.IV.-12.V.97, 17.V-2.VI.99 (3♀ UCDC). **MISSOURI**: Woodmora [?], 20.VIII.19, issued 6.IX.19, Satterthwait coll., *Cyperus erythrorhizos* (1♀ USNM). ***Boone Co.***, Centralia, 4.IV.72, W.S. Craig, ex gall of *Walshia amorphella* in false indigo (1♀ UMRM). Columbia, 10.II.69, W.S. Craig, ex ragweed stem (1♀ UMRM). ***Butler Co.***, 4 mi. S. Neelyville, 5.IX.82, P.R. Miller (1♀ MEMS). ***Lewis Co.***, Wakonda State Park, 6.IX.67, ex larva of *Walshia amorphella* on *Amorpha fruticosa* (1♀ UMRM). ***New Madrid Co.***, New Madrid, issued 12.IX.27, Satterthwait coll., *Ambrosia artemisifolia* (1♀ USNM). ***Wayne Co.***, Williamsville, 8.VII.55, VII.87, J.T. Becker (2♀). **NEVADA**: ***Washoe Co.***, Reno, 1936-1937, L. LaRivers, *Tetradymia glabrata* gall (1♀ USNM). **NEW JERSEY**: "2071", C.F. Baker (1♀). ***Atlantic Co.***, Pleasantville, 28.VII.38, H.P. Hopper

(1♀ USNM). ***Burlington Co.***, Masonville, 1934, Oriental fruit moth par. inventory, ex evening primrose borer (1♀ USNM). Moorestown — 20.IV.30, 29, 31.VIII.30, 3, 5, 6, 8, 10, 15, 17.IX.30, ex *E*[*piblema*] *strenuana* infested *Ambrosia* (18♀ USNM); 1932, Oriental fruit moth par. invest., ex *Glypta cocoon* (2♀ USNM). ***Middlesex Co.***, New Brunswick, 19.III.24 (1♀). **NEW MEXICO**: ***Doña Ana Co.***, Las Cruces, Ckll. 4903, 5038 (2♀ USNM). ***Hidalgo Co.***, Rodeo, 18 mi. W., 26.VIII.74, R.M. Bohart (1♀ UCDC). ***Otero Co.***, White Sands National Monument, 24.VIII.71, E.E. Grissell & R.F. Denno, *Chrysothamnus* (1♀ UCDC). ***Roosevelt Co.***, Blackwater Draw near Portales, 4000', 24-30.V.91, O'Hara & Jergensen (1♀). **NEW YORK**: ***Chautauqua Co.***, Fredonia, VI.66, E.F. Taschenberg, *Janus integer* (1♀ USNM). ***Nassau Co.***, Farmingdale, 29.VII.38, H. & M. Townes (1♀ AEIC). Floral Park, Long Island, 14.VI.86, D. Yanega (1♀ UCRC). ***Ontario Co.***, Geneva, 23.V.17, H. Glascow, *Phylloxera caryaecaulis* (4♀ USNM). **NORTH CAROLINA**: ***Brunswick Co.***, near Longwood, 14.VIII.79, E. Powell & E. Bridges, beat cloth soybean field (1♀ NCSU). ***Currituck Co.***, Church Island, 14.X.18, W.M. McAtee (1♀ USNM). ***Dare Co.***, Buxton, 16.VIII.80, L. Masner (1♀, 1♂). ***Haywood Co.***, Pisgah Ridge, 17.X.04, bred, Hopk. U.S. 3280, W.F. Fiske (2♀ USNM). ***Macon Co.***, Franklin, 24.V.57, W.R.M. Mason (1♀). ***Surry Co.***, Mount Airy, 1.VIII.65, W.F. Mead, *Populus alba* (1♀ FSCA). ***Wake Co.***, Raleigh — 27.VII.40, 1, 12.VIII.40, S.C. Schell (5♀ USNM). 26.IX.78, T.J. Bradway (1♀ NCSU); Lake Wheeler Park, 6.VI.91, R.L. Blinn, on black willow, *Salix nigra* (1♀ NCSU). ***Warren Co.***, S. of Vicksboro, road 1134, 28.VI.79, S.E. Smith & W.C. Warrick, Ransom soybeans (1♀ NCSU). **OHIO**: ***Franklin Co.***, 2.VII.41, J. E. Gillaspy (1♀ USNM). ***Highland Co.***, 15.IX.30, Greenfield, Oriental peach moth invest. Exp. No. 131-10, *E. strenuana* infested *Ambrosia* (1♀ USNM). ***Ottawa Co.***, 1937, C 4/7 E 6/2, R.B. Neiswander, Giant ragweed (1♂ USNM). ***Summit Co.***, Barberton, 22.VI.36, L.J. Lipovsky (1♀ USNM). ***Wayne Co.***, 1937, C 8/25 E 9/4, R.B. Neiswander, gravel pit ragweed (1♀ USNM). 1944, 5-6 5-29, N.D. Blackburn, smartweed (3♀, 1♂ USNM). OAES Nursery, 1943, 8-10 8-31, N.D. Blackburn, host: ragweed borer (A.O.) (1♀ USNM). Wooster, 2.VIII.1897, A.C. 2771 (1♂ USNM). **OKLAHOMA**: ***Latimer Co.***, K. Stephan — IV.94 (3♂), V.94 (1♀); Red Oak environs, , XI.94 (1♀). **OREGON**: ***Multnomah Co.***, Portland (1♀ USNM). **PENNSYLVANIA**: "2014", C.F. Baker (1♀, 1♂ USNM). ***Montgomery Co.***, Willow Grove, G.B. Sleesman, par. *Rhyacionia frustrana* (1♀ USNM). **SOUTH CAROLINA**: ***Greenville Co.***, Greenville, 19.IV.52, 12.VI.52, 27.V.56, L. & G. Townes (3♀ AEIC). ***Pickens Co.***, Clemson College — 22, 23, 24, 25, 27.IV.34, 1, 2, 3, 4, 11.V.34 (11♀, 3♂ USNM); 23.VIII.32, W.C. Nettles, ex *L. molesta* (1♀ USNM); 26.IV.34, ex *L. molesta* (1♀ USNM; another 12♀ and 2♂ dated 22.IV-11.V.37 but without host label). **TENNESSEE**: ***Davidson Co.***, 15.VI.67, 4.VII.67, P.P. Babiy (2♀ ZSMC). ***Marshall Co.***, Caney Spring, 27.IV.17, G.G. Ainslie (1♀ USNM). **TEXAS**: ***Bandera Co.***, Lost Maples State Park, 18.IV.87, G. Zolnerowich (1♀). ***Bastrop Co.***, Colorado River at Hwy 71, 9.V.84, R.L. Brown (1♀ MEMS). ***Brazos Co.***, Bryan, 29-30.V.76, H.R. Burke (1♀ TAMU). Navasota River, 0.4 mi. W. on State Road 21, 14.VII.74, H. Geenbaum (1♀ TAMU). ***Brewster Co.***, Big Bend National Park — 12.5 mi. SE Panther Junction, 2500', 23-26.VI.82 (1♀), 10-16.VII.82 (2♀, CNC Photo 2010-47), G. Gibson; Chisos Mountains, Mount Lodge, 17-21.III.92, J.B. Woolley & R. Wharton (1♀); Trap Spring, 29º10'N 103º25'W, 9.IX.93, E.E. Grissell & R.F. Deno (1♀ USNM). Castolon, 6 mi. W., 2.IX.71, E.E. Grissell & R.F. Denno, *Sphaeralcea angustifolia* (1♀ UCDC). ***Burleson Co.***, State Road 36 & Yogua Creek, 1.9 mi. S. Somerville, 16.VI.74, H. Greenbaum (1♀ FSCA). ***Cameron Co.***, Southpoint Nursery, 1 mi. S. Southmost Ranch, 5-6.VII.82, G. Gibson (3♂). ***Chambers Co.***, Lake Charlotte, 22.IX.22, L.J. Bottimer, ex *Phalonia cephalanthana* (1♀ USNM). N. shore Lake Charlotte, 10.IX.16, C. Heinrich, in *Cephelanthus occidentalis* (2♀ USNM). ***Denton Co.***, Denton, III-IV.53, Chada, ex *Amorpha fruticosa* (1♀ USNM). ***Dimmit Co.***, Chaparall WMA [wildlife management area], 30.IX.90, R. Wharton (2♀). ***Grimes Co.***, Carlos, 5 mi. W., 18.IV.70, V.V. Board (1♀ TAMU). ***Hidalgo Co.***, Bentsen Rio Grande Park, 20.IV.85, J.B. Woolley (2♀). ***Jeff Davis Co.***, Kent, 33 mi. S. on 166, 16.VIII.81, T.L. & T.A. Friedlander (1♀ TAMU). Toyahvale, 7 mi. S., 10.VI.76, H. Evans, W. Rubink & D. Gynne (1♀ CSUC). ***Kerr Co.***, Kerrville — 20.VI.07, F.C. Pratt (1♀ USNM); 13.IV.59, W.R.M. Mason (1♀). ***Presidio Co.***, Alamita Creek, 1-9 mi. N. on US 67, 20.VIII.74, H. Greenbaum (1♀ TAMU). Big Bend Ranch — SNA Smith House Spring, 20.VI.90, R. Wharton (1♀); Agua Adentio Springs, 29º29'40"N 104º06'00"W, 3560', 20.VI.90, G. Zolnerowich (1♀); 1 mi. NE McGuriks Tanks, 29º28'56"N 103º48'14"W, 4320', 19.VI.90, J.B. Woolley (1♀). ***San Patricio Co.***, Welder Wildlife Refuge, 28.VI.84, J. Schaffner, Hackberry Motte (1♂ TAMU). ***Travis Co.***, Austin — 23.IX.39, em. 9.X.39 (1♀ USNM), 15.X.40, em. 15.X.40 (1♀ USNM), em. 20.X.40 (2♀ USNM), Breland, lep. remains *B. fusicola*, sunflower; 20 NW, 15.II.48, White coll., *Lasioptera* sp. on *Aster spinosus* (2♀ USNM); 24.IX.88, P.S. Fiuzaf [with twig borer host remains] (1♀ TAMU). ***Ulvalde Co.***, Sabinal, X.10, F.C. Pratt (1♀ USNM). ***Val Verde Co.***, Sycamore Creek, 12 mi. E. Del Rio, 6.V.88, W.F. Barr (1♀ WFBM). ***Victoria Co.***, Victoria, J.D. Mitchell, — 21.VI, 6, 9, 20, 23, 24, 25.VII, 14, 20, 21, 22, 23, 25, 27.IX, 16, 21.X (12♀, 7♂ USNM); 31.I.10 (1♀ USNM); III.14, Hunter No. 3471 (4♀ USNM); 24.I.10, bred

Solanum [?], par. *Trichobaris* [*texanum* crossed out] (1♀ USNM); 24.V.13, bred *Solanum rostrat*.[*um*] stem, par. *Trichobaris texana* (5♀ USNM). ***Walker Co.***, Ellis Prison — 13, 14, 29.VII.77, 17.X.77, W.L. Sterling (5♀ TAMU); 27.V.80, D.A. Dean (1♀ TAMU). New Waverly, 8 mi. W., 3.VI.70, V.V. Board (1♀ TAMU). ***Washington Co.***, Rocky Creek, Somerville Reservoir, H. Greenbaum — 23.VI.74, (1♀ FSCA); 16, 22, 23.VI.74 (6♀ TAMU). Washington-on-the-Brazos State Park, 15.III.87, R.S. Anderson, ex *Ambrosia* stem, likely parasite of *Lixus* sp. (1♀). **UTAH**: ***Emery Co.***, Wild Horse Creek, near Goblin Valley State Park, 2-7.VIII.97, M. & J. Wasbauer (2♀ UCDC). ***Salt Lake Co.***, C.N. Ainslie, Webster No. 5595 (1♀ USNM). **VIRGINIA**: VIII.63, Harmon, *Pissodes strobi* mat. (1♀ USNM). ***Arlington Co.***, Rosslyn — Note no. 1132[04] (1♀ USNM); ex *Tyloderma foveolatum* (1♀ USNM). ***Caroline Co.***, Milford, reared 14.VII.15, A.D. Hopkins, ex *Eretria* sp. in *Pinus taeda* (1♂ USNM). ***Clarke Co.***, Blandy Experimental Farm, 2 mi. S. Boyce, 29.IX.-22.X.90, 12.IX-3.X.95, D.R. Smith (3♀, CNC Photo 2010-54). ***Essex Co.***, Dunnsville, 1 mi. SE, D.R. Smith — 30.IV-13.V.91, 15-27.VI.91, 12-24.VI.92 (2♀, 1♂); 37º52'N 76º48'W, 3-20.VIII.96 (1♀ USNM). ***Fairfax Co.***, near Annandale, 6-15.VI.87, D.R. Smith (1♀). Falls Church, 21.VII.24, 19.IV.25, R.A. Cushman, ex *Rhyacionia frustrana* (3♀ USNM). Vienna, R.A. Cushman — 6, 10.VII.11, superparasite of *Conotrachelus nenuphar* through braconid cocoon (3♀ USNM); VII.11, par. plum curculio (1♀ USNM); 19, 25.VIII.11, par. *Tyloderma foveolatum* (2♀ USNM); 9, 18, 28.III.12, 2.IV.12, par. *Mompha* (7♀, 6♂ CNC; 3♀, 8♂ USNM, CNCI LB-specm 2010-001). ***Louisa Co.***, Cuckoo, 4 mi. S., J. Kloke & D.R. Smith — 27.V.86, 23.VIII-11.IX.99, 12.IX-6.X.99 (3♀); 11.V.85, 7, 14, 21.VII.85, 3.VIII.85 (6♀ USNM). ***Pulaski Co.***, 16.VII.64, K.R. Lewis, host: *R. frustrana* (1♀ TAMU). ***Winchester Co.***, Winchester, 1931, W.S. Hough, ex *Coleophora malivorella* (2♀ USNM). **WEST VIRGINIA**: ***Jefferson Co.***, VI-VII.31, E. Gould, ex *Coleophora malivorella* (1♀ USNM).

Specimens of uncertain species identity. USA. **TEXAS**: ***Liberty Co.***, 25.IX.23, L.J. Bottimer, Exp. no. 69, ex larva in stem of *Eupatorium serotinum* (1♀ USNM).

Distribution. Widely distributed throughout USA and eastern Canada (Map 8). In addition, Noyes (2010) recorded *E. cyaniceps* from Mexico, Cuba and Brazil, plus China based on Liao *et al*. (1987) (see under “Remarks”).



Map 8. Regional distribution of *E. cyaniceps*.

Biology. Noyes (2010) listed *E. cyaniceps* as a primary parasitoid or, through Hymenoptera, as a hyperparasitoid of 76 species in 21 families of 4 insect orders. Most of the host records were validated based on reference to such catalogs as Peck (1963) and Burks (1979), whose information came either from the original literature or label data of specimens in the USNM. I have seen specimens of *E. cyaniceps* from far fewer hosts than listed by Noyes (2010), but this is largely because Noyes (2010) included the hosts originally recorded for *E. cyaniceps amicus* under *E. cyaniceps* (see further under Biology for *E. cushmani*). Verified host records and plant associates for *E. cyaniceps* are listed below.

Arthropod hosts — COLEOPTERA. **Curculionidae**: ? *Ceutorhynchus obstrictus* (Marsham) (Gibson *et al.* 2006), **Conotrachelus nenuphar* (Herbst), **Curculio* sp., *Lixus musculus* Say (Pierce 1907), ? *Lixus* sp., **Microlarinus lypriformis* (Wollaston), **Pissodes strobi* (Peck), *Trichobaris texana* LeConte (Pierce 1908a, Mitchell and Pierce 1911), *Tyloderma foveolatum* (Say) (Pierce 1908a. **Languriidae**: *Languria erythrocephala* Blatchley (Genung *et al.* 1980), **L. mozardi* Latreille. **Mordellidae**: **Mordellistena* sp. DIPTERA. **Cecidomyiidae**: **Lasioptera* sp. HEMIPTERA: **Phylloxeridae**: **Phylloxera caryaecaulis* (Fitch), *P. devastratrix* Pergande. HYMENOPTERA. **Braconidae**: **Bracon caulicola* (Gahan) ex *Pyrausta penitalis*. **Cephidae**: **Janus integer* (Norton). **Ichneumonidae**: *Glypta* sp. (Burks 1979). **Tenthredinidae**: **Euura* sp. LEPIDOPTERA. **Bucculatrigidae**: *Bucculatrix fusicola* Braun (Breland and Schmitt 1948). **Coleophoridae**: *Coleophora malivorella* Riley (Gould and Geissler 1940; Beacher 1947). **Gelechiidae**: **Monochroa absconditella* (Walker). **Momphidae**: ? *Mompha brevivitella* (Clemens) (Gahan 1910), *Walshia amorphella* Clemens (Brandhorst 1962). **Noctuidae**: ? **Papaipema duovata* (Bird). **Pyralidae**: *Acrobasis* sp. (= *Mineola*), **Eretria* sp., **Plodia* sp., **Ostrinia* (= *Pyrausta*) *penitalis* (Grote). **Tortricidae**: *Epiblema strenuana* (Walker) (Haden 1935, Allan 1962), *Grapholita molesta* (Busck) (Allan 1962), *Phtheochroa cephalanthana* (Heinrich), *Rhyacionia frustrana* (Scudder) (Cushman 1927, Harman 1972, Wells *et al.* 2001).

The only Diptera host listed by Noyes (2010) for *E. cyaniceps* is an extralimital host, *Procecidochares utilis* Stone (Tephritidae), which was based on Bess and Haramoto (1959) through Herting (1978). Bess and Haramoto (1959, p. 245) recorded *E. cyaniceps* as a host of *P. utilis* through "personal correspondence" of N.L.H. Krauss, who stated he reared *E. cyaniceps* from "*P. utilis* during 1944−45 at Cuernavaca, Morelos, Mexico". The USNM collection has a single female collected by Krauss from this locality, April, 1945, which I identify as *E. cyaniceps*. Although there is no label stating that the female was reared, it is very possibly from the rearings referred to by Krauss in Bess and Haramoto (1959).

Plant associates — **Agavaceae**: *Yucca* sp. **Amaranthaceae**: *Salticornia* sp. (glasswort). **Asteraceae**: *Ambrosia acanthicarpa* Hooker (flatspine bur ragweed), *A. artemisifolia* L. (common ragweed), *A. psilostachya* de Candolle (perennial ragweed), *A. trifida* L. (great ragweed), *Baccharis pilularis* de Candolle (coyote brush), *Chloracantha spinosa* (Bentham) (spiny chloracantha), *Tetradymia glabrata* Torry and Grey (littleleaf horesbrush), *Xanthium strumarium* L., (common cocklebur). **Asteraceae**: *Baccharis* sp., *Xanthium* sp. **Brassicaceae**: *Brassica napus* L. (canola). **Cyperaceae**: *Cyperus erythrorhizos* Muhlenberg (redroot flatsedge). **Fabaceae**: *Amorpha fruticosa* L. (desert false indigo). **Onagraceae**: *Oenothera biennis* L. (common evening primrose), *Oenothera* sp. **Poaceae**: *Panicum hemitomon* Schultes (maidencane). **Pinaceae**: *Pinus taeda* L. (loblolly pine). **Polygonaceae**: *Polygonum pennsylvanicum* Latreille (smartweed). **Salicaceae**: *Salix lasiolepis* Bentham (Arroyo willow). **Rubiaceae**: *Cephelanthus occidentalis* L. (buttonbush). **Solanaceae**: *Datura* sp., *Solanum rostratum* Dunal (buffalo bur).

Remarks. I do not provide a detailed description for *E. cyaniceps* males because I was unable to find any reliable differences between these and *E. cushmani* males other than the described difference in sculpture of the outer surface of the scape ventral to the level of the scapular scrobe. Pierce and Cushman (1915) demonstrated that *E. cyaniceps* and *E. cushmani* are valid species through crossing experiments (see under *E. cushmani*) and described the oviposition behavior of *E. cyaniceps*. Features that differentiate *E. cyaniceps* from those of *E. cushmani* are discussed under the latter species. All *E. cyaniceps* females have ovipositor sheaths that are less than the length of the marginal vein (Figs 38, 39; Gibson *et al.* 2006, fig. 7). Females from eastern North America with ovipositor sheaths as long as or longer than the marginal vein more likely are *E. cushmani* (Fig. 37) or *E. annulatus* (Fig. 36). However, under material examined for *E. cyaniceps* I list one female from Texas as "of uncertain species identity". This female lacks its ovipositor sheaths, but the remaining stylets are at least 1.45× the length of the marginal vein. If the ovipositor sheaths were of similar length they would be more similar to those of *E. cushmani*, *E. curticinctus* or some *E. pervius*. However, the prepectus is entirely setose (*cf.* Fig. 44) and the propodeum is relatively densely setose similar to typical *E. cyaniceps*. This female is not likely *E. curticinctus* because of its more extensively setose prepectus and shallowly, transversely wrinkled-reticulate frons (*cf.* Fig. 29), or *E. pervius* because of the plant associate and broadly closed linea calva. More likely the remaining stylets are not indicative of the true length of the missing sheaths and it is a *E. cyaniceps* female, though it is possible it is a *E. cushmani* female with an abnormally setose prepectus. Perhaps even more aberrant is a single female from California (Riverside Co., Salt Creek) that I identify as *E. cyaniceps* based on its short ovipositor sheaths and typical prepectal and propodeal callus setal patterns, but with an entirely yellowish-orange scape similar to that of *E. cushmani*. I also saw a single *E. cyaniceps* female from New York (Fredonia) that has the costal cell setose dorsally for its entire length similar to some *E. annulatus*. This female is also unusual because a stem sawfly, *Janus integer*, is implicated as its possible host. As mentioned under *E. cushmani*, what I presently interpret as only two morphologically diverse species, *E. cyaniceps* and *E. cushmani*, may in fact represent a species complex of cryptic species associated with different hosts.

Eupelmus cyaniceps and *E. pervius* may well constitute sister species based on females sharing a more extensively setose prepectus (Fig. 44) and more densely setose propodeal callus (Fig. 51) than other *urozonus*-group species. The two species are differentiated by host differences and males are quite readily distinguished by flagellar structure and setation (*cf.* Figs 61, 62 with 64, 66) as discussed under *E. pervius*. Females, however, are very similar, being distinguished primarily by a single variable feature, forewing setal pattern, which alone appears to be insufficient to differentiate all females of the two species (see further under *E. pervius*).

In addition to the synonymy listed above for *E. cyaniceps*, the subspecies *E. cyaniceps scolyti* Liao was described in Liao *et al*. (1987: 194–195) from China, reared from *Scolytus seulensis* Murayana (Coleoptera: Scolytidae). I examined the female holotype (IZCAS) and determined it is not conspecific with *E. cyaniceps*. Although superficially similar to *E. cyaniceps*, the ovipositor sheaths being about 0.66× the length of the marginal vein and 0.62× the length of the metatibia, the scape is yellow, as are the legs except for the metafemur being extensively infuscate. As such, the holotype appears to be very similar to what Ashmead (1904) described from Japan as *Eupelmus formosae* (type USNM, not examined). Until such time as the Palaearctic species are revised I treat *E.* (*Eupelmus*) *scolyti* as a valid species **n. stat.** Both sexes of *E. cyaniceps* are, however, very similar to those of the European species *E. martellii*. Males of both species have a robust-filiform, conspicuously setose flagellum with dense, curved setae (Fig. 63), the outer surface of the scape with an elongate band of distinct micropunctures along the length of the scapular scrobe (Fig. 77), evenly curved white setae on the lower face rather than setae that distally are abruptly or sinuately curved (Fig. 67), the basal three or four tarsomeres of the tarsi white (Fig. 59), and the vertex evenly curved into the occiput without a transverse carina. Females of *E. cyaniceps* and *E. martellii* are also morphologically very similar, but I believe two species are represented rather than a single Holarctic species. This is partly because *E. martellii* females have a somewhat less extensively setose prepectus than *E. cyaniceps* females, but largely because I suspect that except for *E. annulatus* the North American *urozonus*-group species have all evolved from a common ancestor, which may have resembled and shared a common ancestor with *E. martellii* and which once had a Holarctic distribution.

7. *Eupelmus* (*Eupelmus*) *cynipidis* Ashmead

Figs 21, 65, 68, 74; Map 9

Eupelmus cynipidis Ashmead, 1882: 36−37. Holotype, female (USNM, examined). Type data: USA, Florida [Jacksonville]; reared from *Cynips q. batatoides* Ashmead live-oak gall.

Eupelmus quercus Ashmead, 1886: 130. Holotype, female (USNM, examined). Type data: USA, Florida, [Jacksonville]; taken on an oak, April, 1881. **N. syn.**

Description. FEMALE (Fig. 21). Length about 2.2−5.9 mm. Head varying from mostly bright metallic green to dark brown with variably bright and extensive green, reddish-coppery, bluish or violaceous lusters; maxillary and labial palpi dark brown. Antenna with at least pedicel and flagellum dark brown, the scape dark brown to entirely yellowish-orange, and scape and pedicel often with metallic lusters similar to head. Mesosoma with at least dorsal surface not much lighter than head and usually similar in color with variable metallic lusters as head, though prepectus and/or acropleuron sometimes lighter brown to orangey-brown or mesosoma dark compared to more distinctly metallic green head. Forewing with base of costal and basal cells usually at least slightly brown, but at least disc broadly brown from level of base of parastigma to beyond pmv, the infuscation not extending to apex of wing and often faded to absent posteriorly, and discal setae brown except for at least a few white setae behind extreme base of parastigma. Legs with at least pro- and metacoxa dark with metallic lusters similar to body, otherwise varying from mostly yellowish-orange to mostly dark brown except at least basitarsus of hind leg white and mesotibial apical pegs and mesotarsal pegs black, and sometimes mesofemur yellowish-orange in distinct contrast to mostly dark brown remainder of legs. Gaster dark brown with comparatively inconspicuous hairlike setae similar in color to cuticle; projecting strigose part of inner plate of ovipositor and about basal 0.1−0.15× of ovipositor sheaths black, hence about basal quarter to third of apparent sheath length dark and either remainder yellowish-orange or somewhat darker brown distally.

Head with frons meshlike coriaceous, in smaller specimens sometimes shiny with almost effaced, obscure sculpture, and smoothly, indistinguishably merged with parascrobal region; but vertex transversely coriaceous-alutaceous to slightly imbricate in larger specimens; scrobal depression distinctly reticulate-rugulose; IOD about 0.33−0.4× head width; OOL: POL: LOL: MPOD = 0.5−1.0: 2.4−2.9: 1.3−1.5: 1.0. Antenna with combined length of pedicel + flagellum about 1.25−1.4× head width; scape about 5.5−5.8× as long as maximum width, in outer view ventral margin evenly curved and without evident flange; pedicel in lateral view about 1.9−2.1× as long as wide; fl1 transverse, up to about 1.2× as wide as long, to quadrate; fl2 about 2.0−3.5× as long as wide and 2.8−3.7× as long as fl1; subsequent funiculars increasing in width to quadrate or usually slightly longer than wide (up to about 1.2×) fl8; clava about 2.2−2.4× as long as wide, 0.7−0.9× as long as combined length of apical three funiculars, and 0.22−0.35× as long as funicle. Mesoscutum with convex anterior portion of medial lobe transversely reticulate-imbricate anteriorly to meshlike reticulate posteriorly, but posterior concave portion shiny and at most very finely meshlike coriaceous, usually the sculpture almost effaced posteriorly, and lateral lobes finely meshlike coriaceous; scutellar-axillar complex with axillae reticulate-rugulose, but scutellum longitudinally reticulate-strigose to strigose on either side of median. Prepectus with at least a couple of setae and usually with 2 or more rows of white setae. Acropleuron shiny, meshlike coriaceous anterior of medial microsculptured region and with elongate, longitudinally aligned coriaceous sculpture posterior to microsculptured region except more meshlike coriaceous along posterior margin. Forewing with basal cell sometimes setose along length, but at least obviously more sparsely setose than disc, and usually mostly bare except for dark setae basally and white setae distally; costal cell ventrally setose at least apically and basally, sometimes more or less continuously setose along entire length but at least with only single line of more widely separated setae medially than basally and apically, and dorsally bare, excluding setae on submelanized band above parastigma, or at most with 2 or 3 dark seta along leading margin apically; disc with linea calva; cc: mv: pmv: stv = 4.9−5.5: 3.6−4.4: 1.0−1.3: 1.0. Mesotibia with apical row of 4−7 pegs; mesotarsus ventrally with pegs on basal four tarsomeres, basitarsus with 11−20 pegs arranged distally in double row on either side, second tarsomere with 5−10, third tarsomere with 2−4, and fourth tarsomere with single apical peg on either side. Propodeum with U-shaped plical depression extending to foramen; callus with dense white setae obscuring cuticle. Gaster with strigose inner plate of ovipositor extending beyond apex, usually by distance at least equal to half length of hind basitarsus and about 0.2× length of ovipositor sheaths; ovipositor sheaths about 0.95−1.2× length of metatibia and about 1.4−1.9× length of marginal vein, but apparent sheath length about 1.1−1.45× length of metatibia and 1.6−2.4× length of marginal vein.

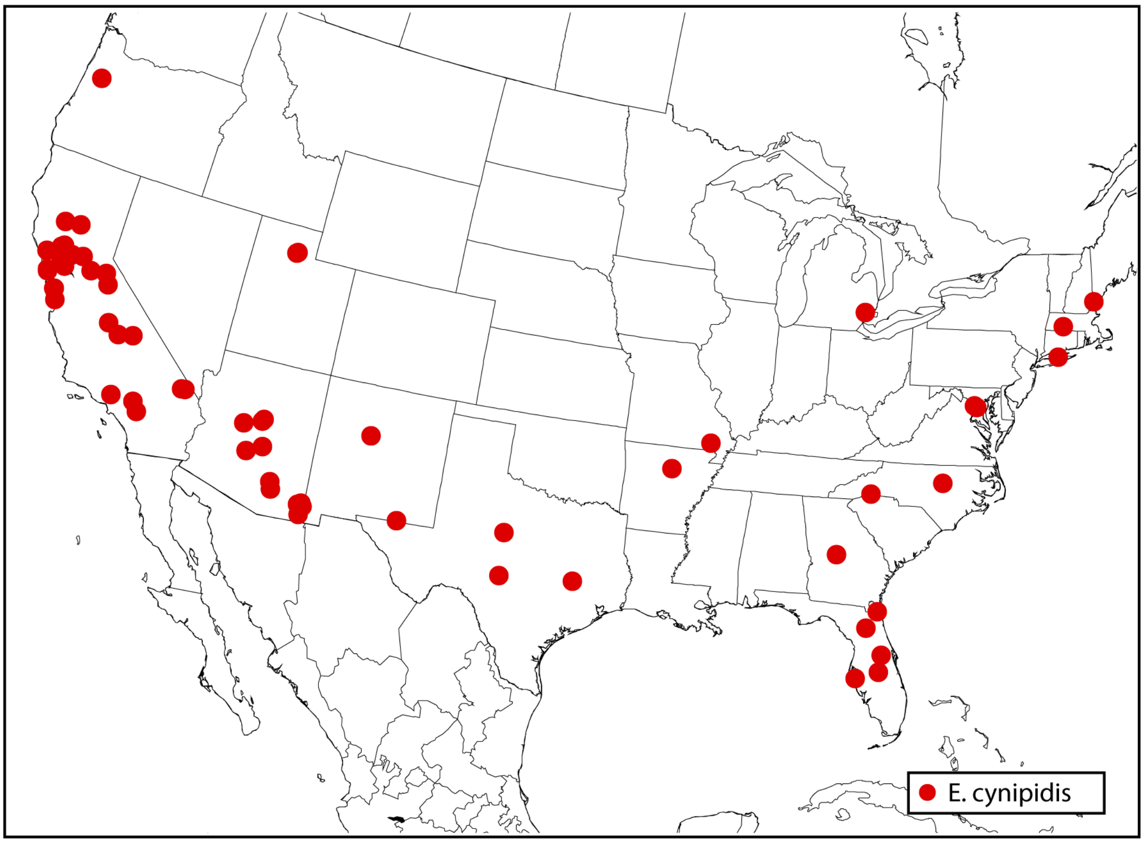
MALE. Length about 1.6−2.7 mm. Head variably brown to dark with slight metallic luster in small specimens, but usually green to bluish-green or purple; maxillary and labial palpi dark brown or apex of apical palpomeres at most yellowish-brown. Antenna dark brown except often scape and pedicel with metallic luster similar to head capsule. Mesosoma similarly colored as head, usually mostly metallic green to bluish-green or sometimes with some purple luster, the tegula at least dark brown and often also variably distinctly metallic. Front leg entirely dark brown to dark with slight metallic luster except sometimes knee and apex of tibia very narrowly lighter-colored, and tarsus at least basally yellowish or yellowish-brown. Middle leg dark except basal 3 tarsomeres white. Hind leg similar in color to middle leg except basal 1−3 tarsomeres white. Forewing hyaline. Gaster with basal tergum sometimes metallic green to bluish-green basally, but remainder brown.

Head (Fig. 63) with frons reticulate; scrobal depression extensively reticulate but interantennal region shiny and only very finely coriaceous; vertex rounded into occiput, reticulate to transversely reticulate-strigose but without evident transverse carina. Head with IOD about 0.5× head width: OOL: POL: LOL: MPOD = 0.5−0.7: 2.7−3.0: 1.2−1.5: 1.0; lower face with sparse white setae, the setae shortest mesally and variably conspicuously longer laterally, but evenly curved when long; gena with one much longer seta below malar sulcus. Antenna (Fig. 65) with scape ovoid, about 2.0−2.3× as long as maximum width, the outer surface ventrally with broadly lanceolate region of micropunctures ventrobasal to scapular scrobe, but punctures extending apically along scapular scrobe at most in single line (Fig. 74); length of pedicel + flagellum about 1.5−1.7× head width; pedicel subglobular, at most only about 1.2× as long as wide, and ventrally with line of 4 or 5 distally curved setae; flagellum conspicuously, densely setose and robust-filiform, the flagellomeres often quite distinctly separated by short pedicel and/or setae dorsally slightly longer and more conspicuous, but flagellomeres of equal width or basal funiculars (including setae) appearing slightly wider than clava; fl1 strongly transverse, disc-like, often superficially bare but at least with single line of setae along apical margin; fl2 about 1.2−1.9× as long as wide and fl8 at least slightly oblong, about 1.2−1.7× as long as wide; clava lanceolate with micropilose sensory region occupying apical two claval subsegments or about apical two-thirds of ventral surface (usually collapsed in air-dried specimens), about 2.5−3.0× as long as wide and about 0.6−0.8× as long as apical three funiculars. Mesoscutum meshlike reticulate, but axillae and scutellum more shallowly reticulate-imbricate. Propodeum variably distinctly but finely coriaceous and shiny, and callus similarly finely sculptured with setae originating from tiny bumps. Forewing with cc: mv: pmv: stv = 3.6−4.0: 2.4−3.7: 1.0−1.1: 1.0; costal cell dorsally with line of dark setae extending at most over about apical half and ventrally with dark setae continuously along length, mesally with 1 line.

Material examined (83♀, 30♂). USA. 21.I.1886, 3769[x] (1♀ USNM), 3769[xi] (1♂ USNM). **ARIZONA**: Sycamore Flat reared 4.VI.19, *Quercus oblongifolia*, G. Hofer, Hopk. U.S. 10781[s] (2♀, 1♂ USNM). ***Cochise Co.***, Chiricahua Mountains — summit, 7.IV.2008, ex galls of *Andricus reticulatus* on *Q. arisonica*, G. Melika (1♂); Cave Creek Canyon, 6 mi. W. Portal, 6700', 31º55'N 109º15'W20.VII.81, H.A. Hespenheide, *Quercus* (1♂); Pinery Canyon, 7000', 18.VIII.78, M. Wasbauer, J. Slansky & C. Freeburg (1♀ CSCA); near Portal, 6.IV.2008, ex *Disholcaspis edura* galls on *Q. arizonica*, G. Melika (1♀). Lower Oak Creek Canyon, S. of Portal, 11.IV.2008, G. Melika — ex galls of *Andricus spicatus* on *Q. arizonica* (1♂), ex galls of *Disholcaspis rubens* on *Q. arizonica* (1♀). Portal, 2.IX.74, H. & M. Townes (1♀ AEIC). Oak Creek Canyon, S. of Flagstaff, G. Melika — 11.IV.2008, ex galls of *Disholcaspis rubens* on *Q. gambelii* (3♀); 1.XI.2007, ex galls of ? *Andricus scutella* on *Q. gamelli* (1♂). ***Coconino Co.***, 25 mi. S. Flagstaff on [Hwy] 17, 31.X.2007, G. Melika, ex *Andricus tecturnarum* galls on *Q. turbinella* (1♀, 2♂). ***Gila Co.***, Tonto National Forest, G. Melika, ex *Andricus wheeleri* Beut., *Q. turbinella* — coll. 5.I.95, em. 10, 12.II.95 (2♀, 1♂; ♂ CNC Photo 2010-58); coll. 6.I.95, em. 12.II.95 (1♀, 1♂). ***Maricopa Co.***, Cave Creek, Camp Creek, L.H. Weld, ex 917a – *Diplol. acrashiformis* Weld (1♀ USNM). ***Pima Co.***, Santa Catalina Mountains, Molino Basin campground, 9.IV.2008, G. Melika, ex *Disholcaspis sulcata* galls on *Q. oblongifolia* (1♀). ***Pinal Co.***, Oracle, reared 28.IX.22, *Quercus arizonica*, Hopk. U.S. 15639[d] (1♀ USNM). ***Yavapai Co.***, Prescott, reared 8.V.18, L.H. Weld, Hopk. U.S. 15604[a] (1♀, 1♂ USNM). Stoneman Lake Road at 17, 10.IV.2008, ex galls of *Andricus capronae* on *Q. turbinella*, G. Melika (1♂). **ARKANSAS**: ***Cleburne Co.***, Post Oak, vi [?].53, W.J. Baerg (1♀ USNM). **CALIFORNIA**: Sta [Santa] Cruz Mountains (1♂ CASC). Towie, 20.VIII.38, R.H. Beamer (1♀ USNM). ***Amador Co.***, Jackson, 27.IV.61, reared from *Q. chrysolepis*, D.Q. Cavagnaro (1♂ UCDC). ***Butte Co.***, Chico, 2.V.75, T.R. Haig (1♀ CSCA). ***Calaveras Co.***, Arnold, 30 km NE, 6.XI.2007, G. Melika, ex *Andricus reniformis* gall on *Q. vaccinifolia* (1♀). ***Colusa Co.***, Williams, 30 km SW, 2.XI.2007, ex *Disholcaspis mamillana* gall on *Q. douglassii*, G. Melika (1♀). ***Fresno Co.***, Piedra, 17.I.82, J.A. Halstead, ex *Disholcaspis eldoradensis* gall on *Quecus lobata* (2♀). ***Glen Co.***, Elk Creek, 5 mi. N., 7.VI.81, J.D. Pinto (1♀ UCRC). ***Inyo Co.***, Lone Pine, 7 mi. W., 19.III.72, em. 26.III.72, R.F. Denno, *Diplolepis* galls on *Rosa* (3♀, 1♂ UCDC). ***Los Angeles Co.***, Placerita Canyon, Walker Ranch, 34.38ºN 118.44ºW, 24.V.99, B. Brown & I. Swift (1♀ UCRC). ***Marin Co.***, Carson Ridge, near Alpine Lake, 3.IV.72, em. 13.IV.72, E.E. Grissell, ex *Disholcaspis plumbella* on *Quercus durata* (1♀ FSCA). Mount Tamalpais State Park, 28.II.58, em. 25.III.58, *C.* [*Callirhytus*] *perdens*, *Quercus wislenzii fructescens*, R.L. Doutt (1♀ UCRC). ***Napa Co.***, Monticello Dam — 2 mi. W., em. 7.II.68, *Andricus crystallinus* Bassett, *Quercus dumosa* Nutt., E.E. Grissell (1♂ UCDC); 4 mi. SW, em. 30.XI.69, *Antron echinus*, E.E. Grissell (1♀ UCDC); 7 mi. SW, 4.IV.61, ex *Q. aerifolia*, D.Q. Cavagnaro (1♀ UCDC). Knoxville, 1 mi. S., em. 5.VII.65, *Andricus californicus* Ashmead, *Quercus lobata*, E.E. Grissell (1♀ UCDC). Pope Valley, 10.IX.98, L.S. Kimsey, ex leaf galls *Quercus* (1♀ UCDC). ***Placer Co.***, Roseville, Dry Creek, 38.734073 – 121.301154, 8.IX.07, G.W. Forister (1♂ UCDC). ***Riverside Co.***, San Timoteo Canyon, 14.IX.72, M. Wasbauer & A. Hardy (1♀ CSCA). ***San Bernardino Co.***, Cajon Summit, 12.X.80, J. Luhman, ex oak bullet galls (1♀). Howe Spring, N Y [New York] Mountains, em. 10.IV.70, cynipid gall, *Quercus turbinella*, E.E. Grissell & R.F. Denno (1♂ UCDC). 8 mi. W. 29 Palms, 1984, J. Huber (1♂). ***Santa Clara Co.***, Los Altos, 1.V.76, ex *Quercus chrysolepis*, R.T. Ross (1♀ UCDC). Mountain View, summer 1885, E.M. [?] (1♀ UCRC). ***Solano Co.***, 28.VIII.67, em. 2.II.68, *Sphaeroteras trimaculosum* McC. & Egb., *Quercus lobata* Nee, E.E. Grissell (2♂ UCDC). ***Sonoma Co.***, 545[o] (1♀, 2♂ USNM). ***Tulare Co.***, Ash Mountain Power Station, 22.IX.82, 1.X.82, J.A. Halstead (3♀). ***Tuolumne Co.***, 8.X.19, R.D. Hartman, *Quercus chrysolepis*, Hopk. U.S.

10782f (2♂ USNM). ***Yolo Co.***, Woodland, 5 mi. E., 10.IX.70, S.R. Sims (1♀ UCDC). **DISTRICT OF COLUMBIA**: 1♀ (USNM). **FLORIDA**: ***Alachua Co.***, Gainesville — 1.IV.62, G.Q. Platt, *Q. cinerea* emerged 85 (1♂ FSCA). IV.91, D.B. Wahl (1♀, CNC Photo 2010-14). ***Duval Co.***, Jacksonville, W.H. Ashmead — 1♀ (USNM); "type" (1♀ USNM); from *c.* [*Cynips*] *q.* [*quercus*] *batatoides* (1♀ holotype of *E. cynipidis*); on oak [?sk????], May/81 (♀ holotype of *E. quercus*). ***Manatee Co.***, Bradenton, 11.XI.85, D. Schuster (1♂). ***Orange Co.***, Orlando, UCF, 11.IV.93 (2♀ UCFC), 23.IV.93 (1♀ UCFC), S.M. Fullerton, Sand Pine-Rosemary Scrub. ***Polk Co.***, Tiger Creek Preserve, Babson Park, NE Pfundstein Road, 27º48'36"N 81º29'01"W, 5.V.07, B. Pace-Aldana & A. Petersen, Sandhill/Xeric Oak Hammock (1♀ UCFC). **Georgia**: ***Peach Co.***, Byron, 28.III.86, A.A. Amis, ex gall on *Quercus* (1♀ USNM). **MARYLAND**: ***Montgomery Co.***, Cabin John, 23[?].VI.1889, C.L. Marlatt (1♀ USNM). **MASSACHUSETTS**: ***Hampden Co.***, 19.I.11, reared Feb.+ Mar., em. galls *Amphibolips ilicifoliae* on *Q. ilicifolia*, 2407-C, G. Dimmock (1♀ USNM). **MICHIGAN**: 1037, Gillette (1♀ CSUC). **MISSOURI**: 6.VI.1883 (1♀ USNM). ***Butler Co.***, Poplar Bluff, reared 12.II.19, 4.VI.19, S.A. Rohwer, *Quercus minor*, ex twig gall of *Loxaulus* sp., Hopk. U.S. 1077[a] (2♀ USNM). **NEW HAMPSHIRE**: ***Strafford Co.***, Durham, 1 mi. SW, water tower, 10.VIII.88, W.J. Morse (1♀ DENH). **NEW MEXICO**: ***Bernalillo Co.***, 2.X.22, L.H. Weld, ex *Disholcaspis* sp., *Quercus pungens* (1♀ USNM). **NEW YORK**: ***Suffolk Co.***, Wading River, LI [Long Island], 27.VI.72, F.M. Shott (1♀ USNM). **NORTH CAROLINA**: ***Polk Co.***, Tryon, W.F. Fiske, Hopk. U.S. 3523 (1♀ USNM). ***Wake Co.***, Raleigh, em. 5.V.40, S.C. Schell (9♀ USNM). **OREGON**: ***Benton Co.***, ex *Weldia washingtonens*., em. 25.II.83 (1♀). Corvallis, P. Hanson — IV.82 (1♂), V.82 (1♂), VI.82 (1 ♂ CNCI LB-specm 2010-007), ex *Disholcaspis simulata* (3♂); 13.VII.82, *Disholcaspis washington* (1♀). **TEXAS**: ***Brazos Co.***, College Station, 15.IV.65, J.C. Schaffner (1♀ TAMU). ***Culberson Co.***, Guadalupe National Park, McKitrick Canyon, 22.X.85, P. Hanson, *Disholcaspis*, *Q. muehlenberg*. (1♀). ***Kimble Co.***, Junction, 29-30.IV.83, J.C. Schaffner (1♀ TAMU). ***Taylor Co.***, Tuscola, 2.5 mi. S., 24.X.63, D. Cavagnaro, 256B-36 (1♀ CASC). **UTAH**: ***Davis Co.***, 2.VIII.83, P. Hanson, ex *Dish. rubens*, *Q. gambelii* (1♀). Kysvll [Kaysville], 1.IX.29, em. 1.XI.29, *Q. utahensis*, ex *Dishol. globulus*, Kinsey coll. (2♀ USNM).

Distribution. Widely distributed throughout USA except central plains (Map 9).



Map. 9. Regional distribution of *E. cynipidis*.

Biology. A parasitoid of **Diplolepis variabilis* (Bassett) (Hymenoptera: Cynipidae) on *Rosa pisocarpa* A. Gray (Rosaceae) plus the following species of Cynipidae on *Quercus* spp. (Fagaceae) — **Amphibolips quercusil-*

icifoliae (Bassett), **Andricus crystallinus* Bassett, **Andricus quercuscalifornicus* (Bassett), **Andricus reniformis* McCracken and Egbert, **Andricus reticulata* Bassett, **Andricus spicatus* (Bassett), **Andricus tecturnarum* Kimsey, **Andricus wheeleri* Beutenmüller, **Antron acraspiformis* (Weld), **Antron quercusechinus* (Osten Sacken), **Atrusca capronae* (Weld), **Callirhytus perdens* (Kinsey), *Callirhytis quercusbatatoides* (Ashmead) (Ashmead 1882), **Disholcaspis edura* Weld, **Disholcaspis eldoradensis* (Beutenmüller), **Disholcaspis mamillana* Weld, **Disholcaspis plumbella* Kinsey, *Discholcaspis quercusvirens* (Ashmead) (Ashmead 1886), **Disholcaspis rubens* (Gillette), **Disholcaspis simulata* Kinsey, **Disholcaspis sulcatus* (Ashmead), **Disholcaspis washingtonensis* (Gillette), **Loxaulus* sp., **Sphaeroteras trimaculosa* (McCracken and Egbert), and **Synergus batatoides* (Ashmead).

Remarks. Darker females of *E. cynipidis* superficially most closely resemble those of *E. nitifrons* except for having comparatively much longer ovipositor sheaths (*cf.* Figs 21, 23), partly because the sheaths themselves are longer but also because the inner plate of the ovipositor extends beyond the gaster to form part of the apparent sheath length. Females of *E. cynipidis* usually are also much larger than those of *E. nitifrons*, but at least they have a somewhat longer antenna with comparatively shorter clava, less densely setose to largely bare basal cell, and usually more distinctly coriaceous upper face. Phylogenetically, *E. cynipidis* is more likely the sister species of *E. conigerae*, females differing primarily only in color pattern. Females of *E. conigerae* typically have the antennae, more or less extensively, as well as the mesosoma and legs yellowish-orange, whereas they are much darker in typical *E. cynipidis* females (*cf.* Figs 21, 22). However, some *E. cynipidis* have a yellowish scape, the mesosoma laterally comparatively light yellowish-brown, and the legs yellowish-orange except for the pro- and metacoxa, whereas smaller *E. conigerae* sometimes have the antennae almost completely dark brown, the mesosoma brownish-orange with a slight metallic green luster dorsally and on the metacoxae under some angles of light, and with the femora and tibiae brownish rather than the legs, including the coxae, being completely yellowish-orange. The color patterns of females of the two species therefore intergrade to some extent, but females of *E. conigerae* always have the head and mesosoma conspicuously different in color whereas female *E. cynipidis* have the head and at least dorsum of the mesosoma similarly dark even though rarely the head is sometimes quite distinctly metallic green whereas the mesosoma is mostly dark brown. Most females of *E. conigerae* also have the upper face somewhat more coarsely sculptured, slightly reticulate, at least along the inner orbits compared to the variably distinctly but entirely coriaceous upper face of *E. cynipidis*. Based on much fewer specimens, females of *E. conigerae* also always have the basal cell broadly bare, whereas some females of *E. cynipidis* have the basal cell more or less completely setose, though always less densely setose than the disc. *Eupelmus cynipidis* and *E. conigerae* are the only two *Eupelmus* known to parasitize cynipid galls in North America. Unlike the Palaearctic region most of the eupelmid parasitoid diversity in cynipid galls in North America is comprised of species of *Brasema*.

Even though females of *E. cynipidis* and *E. conigerae* are morphologically very different from other *urozonus*-group females, males of *E. cynipidis* are very similar to those of most other *urozonus*-group species. If the host is unknown, males are most likely to be mistaken for those of *E. cyaniceps* and *E. cushmani* because of their very similar, conspicuously and densely setose, robust-filiform flagellum (*cf.* Figs 63, 65). However, males of *E. cynipidis* have the micropunctate sensory region of the scape developed as a distinct, lanceolate region ventrobasal to the scapular scrobe but not along the scrobe itself (Fig. 74), whereas males of *E. cyaniceps* have a distinct band of punctures along the scrobal depression (Fig. 77). Males of *E. cushmani* often lack distinct punctures along most of the length of the scapular scrobe (Fig. 75) but if developed then similar to *E. cyaniceps* they also lack a distinct region of micropunctures ventrobasal to the scrobe (Fig. 76). Some males of *E. dryorhizoxeni* are atypically dark in color and therefore more closely resemble typical *urozonus*-group males. Such males could easily be mistaken for *E. cynipidis* males because of a similar scapular sculpture pattern (*cf.* Figs 73, 74), but are distinguished by the color differences given in the key. Milliron (1949) stated that in the opinion of A.B. Gahan the male syntype of *E. ficigerae* (Ashmead) was possibly a male of *E. cynipidis*, likely because it was reared from a cynipid gall. However, I believe it is an abnormally dark *E. dryorhizoxeni* male and revise the synonymy accordingly (see under *E. dryorhizoxeni*).

I have only seen a single male of *E. conigerae* tentatively associated with a female through rearing, which is insufficient to confidently propose differences to distinguish males of the two species (see further under *E. conigerae*). It has an unusually gracile-filiform flagellum compared to most *E. cynipidis* males, though it is conspicuously setose and the more gracile-filiform structure likely is correlated with its comparatively small, 1.3 mm length. Individual males that are not reared for host association or that are collected individually and not associated with females are most likely to be confused with *E. cyaniceps* or *E. cushmani* males, but unlike these males and more similar to *E. dryorhizoxeni* males the outer surface of the scape has a more or less lanceolate or enlarged region of micropunctures ventrobasal to the scapular scrobe that does not extend apically along the scrobe except at most as a single irregular line of punctures.

8. *Eupelmus* (*Eupelmus*) *dryorhizoxeni* Ashmead

Figs 10−15, 54, 57, 73; Map 10

Eupelmus dryorhizoxeni Ashmead, 1886: 129. Syntypes, one male, two females (USNM, examined). Type data: USA, Florida, [Jacksonville]; reared from *Dryorhizoxenus floridanus* Ashmead oak gall.

Megastigma ficigerae Ashmead, 1887b: 185. Syntypes, 2 males (1♂ ANSP; 1♂ USNM, examined). Type data: USA, Florida, [Jacksonville]; one reared in 1886 from *Amphibolips femorata* Ashmead (manuscript name) and one in 1885 from *Holcaspis ficigera* Ashmead galls. **N. syn.**

Eupelmus dryorrhizoxeni Dalla Torre, 1898: 275. Unjustified emendation.

Eupelmus rhizophelus Brues, 1903: 186. Unknown type status, female. Type data unstated, species attributed to Ashmead by Brues. Synonymy by Burks, 1967: 246.

Eupelmus melanderi Brues, 1907: 54−55. Syntypes, female (MCPM, examined). Type data: USA, Washington, Pullman; reared from *Rhodites* sp. rose gall on *Rosa piscocarpa*. Synonymy by Gibson, 1990: 837, 842.

Cerambycobius ficigerae; Milliron, 1949: 346. Stated as possibly the male of *E.* (*Eupelmus*) *quercus* Ashmead based on opinion of A.B. Gahan.

Description. FEMALE (Fig. 12). Length about 2.0−4.1 mm. Head of smaller specimens sometimes light brown with metallic green luster only within scrobal depression, but at least larger specimens with frontovertex and often entire head dark brown to green with yellowish, coppery or reddish to violaceous lusters under some angles of light (Fig. 10); maxillary and labial palpi dark brown. Antenna with scape entirely yellowish-orange or more white apically (Fig. 12); pedicel usually dark brown with green to bluish luster under some angles of light, but sometimes variably light brown to orangey-yellow in southern specimens; flagellum dark brown. Mesosoma variable in color, smaller specimens sometimes almost uniformly light brown similar to head and gaster, or mostly brown including acropleuron but pleurosternum below acropleural sulcus distinctly contrasting yellowish-orange, of entirely yellowish-orange or orangey-brown or brownish with at most slight metallic luster laterally, but at least dorsally with scutellar-axillar complex and often pronotum and/or mesoscutum excluding outer inclined surface of lateral lobe partly to entirely darker with metallic green to reddish-violaceous lusters. Legs with mesotibial apical pegs and mesotarsal pegs black; otherwise mostly variably dark brown to orangey-brown similar to mesosoma, except mesotibia with at least short subbasal darker brown region and variably extensively much lighter, often white, apically; metatibia sometimes also extensively dark brown but at least more narrowly whitish or lighter colored apically than mesotibia; and at least mesotarsus and often all tarsi white to yellowish. Forewing hyaline mesally but extreme base usually at least slightly brownish and reflexed apical part more obviously brown. Gaster light to dark brown with brown hairlike setae similar in color to cuticle; ovipositor sheaths with short dark basal region, whitish-yellow mesal region and at least very slightly brownish apical region.

Head with frons usually entirely meshlike coriaceous, but specimens from southwest sometimes variably distinctly roughened, reticulate-imbricate to reticulate; scrobal depression reticulate-rugulose to transversely reticulate-strigose (Fig. 10); IOD = 0.32−0.43× head width; OOL: POL: LOL: MPOD = 0.5−1.5: 2.4−3.7: 1.7−2.7: 1.0. Antenna with combined length of pedicel + flagellum = 1.2−1.4× width of head; pedicel about 1.2−2.5× as long as wide; fl1 slightly transverse to slightly longer than wide; fl2 about 1.33−1.9× longer than wide and 2.3−2.7× as long as fl1; subsequent funiculars increasing in width to quadrate or only slightly transverse fl8; clava about 2.0−2.9× as long as wide, about 0.7−0.9× as long as apical three funiculars, and 0.25−0.33× length of funicle. Pronotum with short, variably distinctly inclined transverse region differentiated near posterior margin by rounded rather than angulate margin (Fig. 11), the region with variably distinct transverse row of white to dark setae. Mesoscutum (Fig. 11; Gibson 1999, fig. 25) with medial lobe in single plane, reticulate-punctulate anteriorly to finely coriaceous or shiny and almost smooth posteriorly; lateral lobe strongly raised above level of median lobe (Figs 11, 12) and carinately angled dorsolongitudinally, with inner inclined surface finely coriaceous but outer surface often somewhat more coarsely coriaceous-alutaceous. Scutellar-axillar complex (Fig. 11; Gibson 1999, fig. 25) with axilla elongate-triangular, obliquely reticulate-strigose; scutellum strongly convex above level of axillae, mostly reticulate or reticulate anteriorly to longitudinally reticulate-imbricate on either side of midline and more coriaceous-imbricate posteriorly. Prepectus usually bare, only very rarely with 1 or 2 white setae. Acropleuron usually meshlike coriaceous to coriaceous-imbricate anterior of and meshlike coriaceous posterior of medial microsculptured region (Fig. 14), but specimens from southwest usually more strongly reticulate-punctate anteriorly and quite distinctly meshlike reticulate with larger cells posteriorly (Fig. 15) and sometimes with medial region smooth and shiny rather than microcoriaceous. Brachypterous (Figs 11, 12). Forewing (Fig. 11) extending less than half length of gaster if flattened, but normally about apical half recurved vertically at level of parastigma or about level of between mesosoma and gaster; costal cell dorsally bare and ventrally with 1 or 2 rows of light-colored setae mediolongitudinally; basal cell sometimes with 1 to rarely a few scattered white setae within about basal half bare, but with white setae apically below apex of submarginal vein and parastigma, and recurved apical portion uniformly densely setose with brown setae or sometimes with slender, inconspicuous linea calva; mv and pmv forming uniformly broad vein to wing apex, with stv usually reflexed at right angle to mv at about four-fifths length or very rarely not developed. Hind wing (Fig. 11) reduced similar to forewing, but more slender and apically less distinctly recurved and only very slightly brownish. Mesotibia with apical row of 4−8 pegs; mesotarsus ventrally with pegs on basal four tarsomeres, basitarsus with symmetrical pattern of 9−20 pegs on either side, the pegs arranged in double row distally, second tarsomere 4−6 pegs, third tarsomere with 2 or 3 pegs and fourth tarsomere with 1 peg on either side. Metacoxa densely setose with white, slightly lanceolate setae dorsally and ventrally. Metanotum (Fig. 11) transverse with dorsellum raised vertically over scutellar apex. Propodeum (Fig. 11) with broadly V-shaped plical depression not quite extending to foramen; callus with white setae and usually densely setose similarly to metacoxa. Gaster with inner plate of ovipositor not projecting conspicuously beyond apex; ovipositor sheaths about 0.5−0.75× length of metatibia.

MALE (Fig. 54). Length about 1.0−2.5 mm. Head variably dark brown, often with slight violaceous or greenish tinge, to bright metallic green or bluish-green; maxillary and labial palpi light yellowish-brown to dark brown. Antenna with flagellum and pedicel usually dark brown and then contrasting with entirely or mostly yellowish to yellowish-orange scape, but sometimes light brown in smaller specimens and not distinctly contrasting or sometimes scape extensively brown to dark with slight metallic luster except outer surface at least yellowish ventrobasally and usually yellowish along length (region consisting of scapular scrobe and region ventral and basal to scrobe). Mesosoma, including tegula, similarly brown to metallic green or bluish-green as head. Legs with basal 3 or 4 tarsomeres of at least middle and hind legs white, but otherwise variable in color, sometimes mostly yellowish-orange except trochantelli and often trochanters more distinctly white, or with femora and sometimes tibiae variably extensively and variably dark brown, the femora sometimes with metallic luster similar to mesosoma, but at least protibia lighter colored apically and hind leg with trochanter and trochantellus quite distinctly white. Forewing usually hyaline but sometimes disc with slight brownish infuscation. Gaster with basal tergum sometimes metallic green basally, but remainder brown.

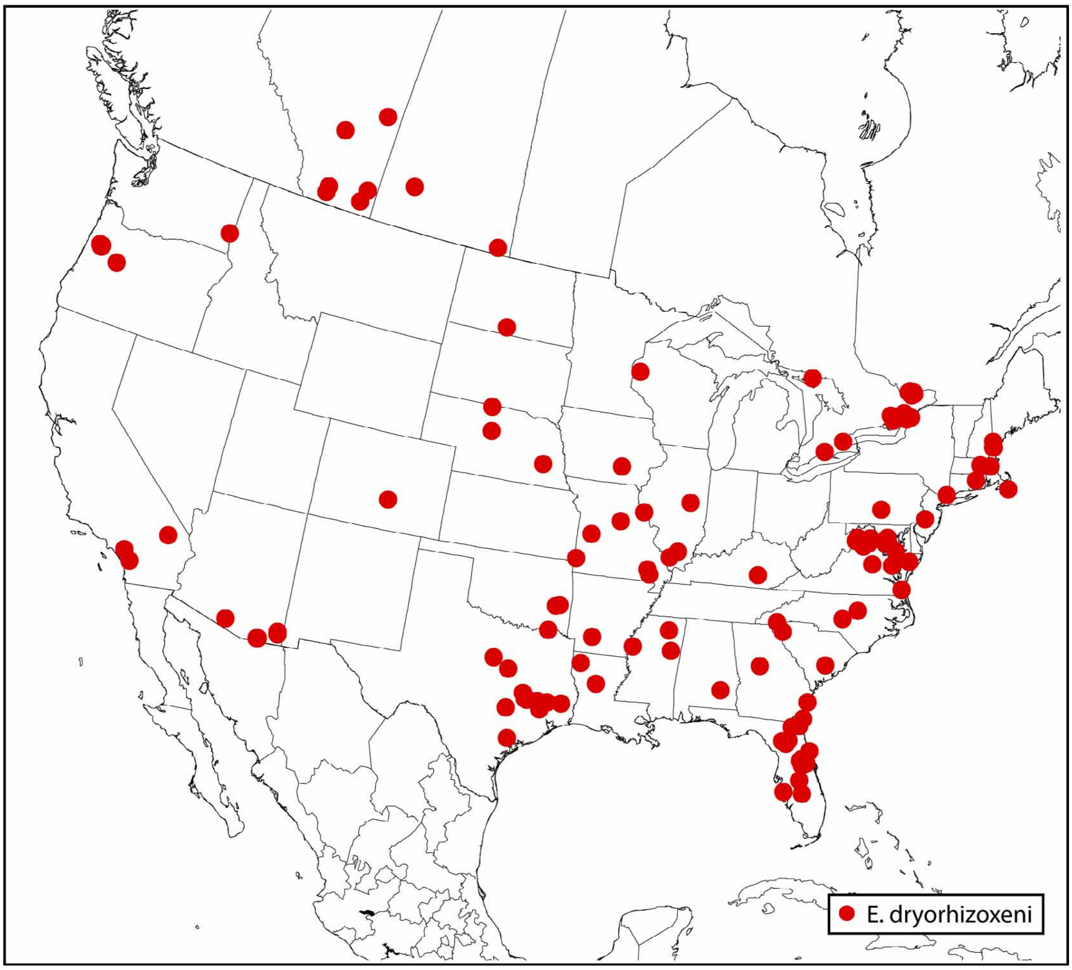
Head with frons and scrobal depression finely coriaceous-alutaceous in smallest specimens to distinctly meshlike reticulate in largest specimens (Gibson 1999, fig. 44). Head with IOD about 0.5× head width; OOL: POL: LOL: MPOD = 0.5−1.0: 2.3−2.7: 1.3−1.5: 1.0; lower face with setae sparse, short, straight and whitish to brown mesally but longer and evenly or distally curved laterally above malar sulcus; gena with one much longer seta below malar sulcus (Gibson 1999, figs 44, 45). Antenna with scape ovoid, about 2.3−2.5× maximum width, the outer surface with distinct micropunctures only ventrobasal to scapular scrobe (Fig. 73), though often continued apically along scapular scrobe as single line of pits (Gibson 1999, fig. 61); length of pedicel + flagellum about 1.3−1.7× head width; pedicel about 1.5−1.7× as long as wide, ventrally with 4 or 5 distally curved setae in a line (Fig. 57); flagellum variably elongate-gracile filiform with conspicuous, curved, semierect setae extending out for distance equal to about half width of flagellomere (Fig. 57); fl1 very strongly transverse, disc-like, bare or at most with transverse line of setae only on ventral surface (Fig. 57); fl2−fl8 all oblong, about 1.25−1.75× as long as wide; clava lanceolate with slender micropilose sensory region extending over apical two claval subsegments, about 1.7−3.5× as long as wide and 1.5−2.1× as long as last funicular. Mesonotum (Gibson 1999, figs 52, 53) more or less uniformly, finely meshlike coriaceous-reticulate in smaller specimens and more distinctly reticulate in larger specimens except scutellum usually finely coriaceous to coriaceous-reticulate at least mesally. Propodeal plical region finely meshlike coriaceous to alutaceous on either side of median carina, and callus similarly or slightly more coarsely sculptured. Forewing with cc: mv: pmv: stv = 3.3−3.5: 2.7−2.9: 1.1−1.3: 1.0; costal cell dorsally with line of setae extending at most over apical half, and ventrally with setae continuously along length, mesally with 1 straight line or with setal bases slightly offset so to obscurely suggest 2 lines.

Material examined (205♀, 303♂). CANADA. **ALBERTA**: 8 [?] S. Lethbridge, coll: 138-72, fall emergence, ex gall *D. bicolor* (1♂). Magrath, 16 km S. McIntyre Ranch, 2-9.VIII.90, D. Griffiths (1♀). Orion, 49º29'N 110º50'W, 6.VI.55, J.R. Vockeroth (1♀). Sandy Point campground, 4.VII.85, Anderson (1♀). Tolman Bridge Recreational Area, 17 km E. on Hwy 585 at Red Deer River, 16-18.VII.89, J. E. O'Hara (2♂). Wainwright, 27.VII.57, A.R. & J.E. Brooks (1♀). **SASKATCHEWAN**: Oxbow, 18.VI.07, F. Knab (1♀ USNM). Sask.[atchewan] Landing, 25.VII.56, O. Peck (1♀). **ONTARIO**: Aylmer West, 8.VI.73 (1♂). Chaffey's Locks, 7-21.X.80, S. Peck (1♀). Constance Bay — 6-13.VII.73, G. Gibson (1♂); 7-21.IX.73, L. Masner (1♀); 26.VIII-7.IX.83, M. Sanborne (1♂). Hamilton, 14.VIII.80 (1♂), 19-28.VIII.80 (3♂), 17-30.VII.82 (4♂), 27.VII.82 (6♂), 10-23.VIII.82 (3♂), 23.VIII-5.IX.82 (1♂), M. Sanborne. Manitoulin Island, 2 km SW Tower Road, 16.V.96, J.D. Shorthouse & S.E. Brooks, ex *Diplolepis rosaefolii* (Cockerell) gall on *Rosa acicularis* (4 ♀). Shirley's Bay, 15 km W. Ottawa, 1-15.VII.84 (8♀, 14♂), 16-31.VII.84 (1♀, 1♂), M. Kaulbars. St. Lawrence Island National Park — Grenadier Island, Centre, 22, 29.VII.75, 14.VIII.75 (5♂), E. Sigler & G.T. Hall; McDonald Island, 29.VIII.76, 1.IX.76, Read (2♂); Milton Island, 31.VIII.75, Reid & Turner (1♀). Tweed, 15 km E., 23.VI.2006, 8.VII.2006, Fuller (8♂ UCRC). **QUÉBEC**: Gatineau Park, Luskville Falls — 300 m, 19-24.VI.86, Denis & Dumouchel (1♀); 9-16.VI.92, CNC Hym. Team (1♂). Hull, VII.65 (1♂). Old Chelsea, J.R. Vockeroth — 15.VI (1♀), 30 (1♀ AEIC; 1♀).VIII.61; Summit of King Mountain, 1150', 22.VI.61 (1♂).

USA. **ALABAMA**: ***Pike Co.***, Troy — X-XI.19 (6♀, 1♂ USNM), 13-20, 23.V.20 (3♀ USNM), Weld No. 592, *Quercus minor* (3♀ USNM). **ARIZONA**: ***Cochise Co.***, Chiricahua Mountains — Cypress Park, 6000', 30.VII-8.IX.88, T.D. Miller (1♀ WFBM); Red Rock Canyon, 5800', 4-10.IX.87, T.D. Miller (1♀ WFBM). Ramsey Canyon — Huachuca Mountains, mid June 1920, 7.X. Williams (1♀ UCRC); 12 km. S. Sierra Vista, 1700 m, 25.IV-7.V.87, B.V. Brown (1♂). S. of Sierra Vista, base of Carr Canyon Road, 10-11.VII.1987, B.V. Brown, 5200' (1♀, CNC Photo 2010-51). ***Pima Co.***, Kitt Peak, T.17S. R.7E. Sec. 11, 6300', 10.IX.87, T.D. Miller (1♀ WFBM). **ARKANSAS**: AZ [sic], O[u]achita Co. [? = ***Nevada Co.***], Bluff City, Sandhills, 21.VII-30.IX.94, N.W. Robison (1♀). **CALIFORNIA**: ***Orange Co.***, 2 mi. S. Corona, Santa Ana Mountains, 275 m, 19-27.V.87, N.S. Beal (1♀). ***Riverside Co.***, Temecula Canyon, Sta. Margarita Ecological Reserve, 33º26'N 117º11'W, 23.IX.2000, Yanega & Osborne (1♀ UCRC). ***San Bernardino Co.***, Granite Mountains, Granite Springs, 34º48'20″N 115º39'50″W, 4200', 14.V.84, J. Heraty (2♀, CNC Photo 2010-49). **COLORADO**: 1♀ (BMNH); 1112 (1♀ USNM). ***Custer Co.***, Wetmore, 29.IX.22, L.H. Weld, *Quercus gambellii*, Hopk U.S. 15635c (1♀ USNM). **CONNECTICUT**: ***Windham Co.***, Canterbury, 30.VIII.36, M. Chapman (1♀ AEIC). **DISTRICT OF COLUMBIA**: Washington — (1♀ USNM); 1.7 (1♀ USNM); 13.IV.1879, *Rhodites rosae* (L.) (1♀ USNM); IX.23, M.T. VanHorn, ex *Rhodites ignotus* O.S. (1♀ LACM, 1♀ USNM). **FLORIDA**: E. Fla., Ashmead, (1♀ MNHW, labelled "Ashmead Type, *E. dryorhizoxeni*"). ***Alachua Co.***, 21.X.56, R.A. Morse (1♀ FSCA). Gainesville — 12.X.76, P.M. Choate & R.E. Woodruff (1♀ FSCA); 5.IX.58, K.W. Cooper (1♀ USNM); 24-30.IV.86, J. LaSalle (1♀); 14.XII.86 (1♂), 7.I.87 (1♂), 12-20.I.87 (2♂), 8-15.III.87 (1♂), 15-22.III.87 (1♂), W.R. Mason; 15.I.86, D. Schuster (1♂); 5.XII.84 (1♂), 11-18.VI.87 (1♂), 15.V-10.VI.93 (1♀), D. Wahl. Gainesville, AEI — 10-17.IV.85 (1♀ AEIC), 20.XI.86, G. Gibson (1♂); 15.V.80, H. Howden (1♀); 13-23.X.97, L. Masner (2♂); 2-10.IV.86, M. Sanborne (6♂, CNC Photo 2010-65); 2-19.IV.86, M. Sharkey (1♂); 7-17.IV.87 (1♂), 4-11.VI.87 (1♂), 20.XI.87-20.II.88 (1♀, 1♂), 23.II-2.VI.88 (1♀), D. Wahl. Gainesville, IFAS [Institute of Food and Agricultural Sciences], 29.X-18.XI.87, BRC Hym. Team (1♀). Gainesville, Doyle Conner Bldg. — 4-8.X.76 (1♀ FSCA), 27.IX-1.X.76 (1♂ FSCA), E.E. Grissell; 7.XII.71, H.V. Weems Jr. & C.R. Artaud (1♂ FSCA). Gainesville, DPI [Department of Primary Industries] — 22-30.IV.87 (2♂), 1-7.V.87 (1♀), 18-27.V.87 (1♀, 1♂), 13-26.VI.87 (1♂), D.B. Wahl; 22-31.III.87, W. Mason (2♂). Gainesville, Paynes Prairie [Preserve State Park], 5-10.IV.86, M. Sanborne (1♀). Gainesville, U.F. [University of Florida] Honey Plant, 24.VIII.81, T. Hayakawn (1♀ FSCA). Gainesville — 610 NW 54 Terrace, 5.IX.94 (1♂ FSCA), 10.III.97 (1♀ FSCA), L. Stange; S9 T10S R18E, 2.IV.76, W.H. Pierce (1♀ UCDC). ***Baker Co.***, Glen St. Mary, 30º18'00″N 82º00'55″W, 28.XII.2006, 1, 15, 22.II.2007, 8, 18, 29.III.2007, 5.IV.2007, 4, 17.X.2007, E. Zoll & S. Fullerton (11♂ UCFC). ***Duval Co.***, Jacksonville (♀ syntype of *E. dryorhizoxeni*; ♂ syntype of *E. ficigerae*; 3♀ USNM). ***Highlands Co.***, Archbold Biological Research Station, 1-18.IX.87 (1♀, 1♂), 1-29.II.88 (5♂), 22.III-4.IV.88 (1♂), 6-11.IV.88 (1♂), D.B. Wahl. ***Nassau Co.***, Fort Clinch State Park, 15.I.V.99, L. Stange (1♀ FSCA). ***Orange Co.***, Orlando, 10.VII.91, 20, 26.VIII.91, 26.IX.91, 31.X.91, 17.XII.91, 6, 31.I.92, 12.II.92, 23.III.9213, 20, 27.IX.96, 4, 30.X.96, 16.II.97, 1-7.III.97, 6.X.97, S.M. Fullerton (3♀, 19♂ UCFC). Rk. Spr. Rn. St. Res. [Rock Springs Run State Reserve], 10.X.84, 21, 28.XI.84, 13.IX.85, J.C. Longhurst & S.M. Fullerton (4♂ UCFC). Wekiwa Springs State Park, S22 T20S R28E, 5.III.2001, P.J. Russell & S.M. Fullerton (1♀ UCFC). ***Polk Co.***, Tiger Creek Preserve, Babson Park, NE of Pfundstein Road, 2.X.2006, B. Pace-Aldana & A. Peterson (1♂ UCFC). ***Sarasota Co.***, Myakka River State Park, 25.VI-3.VIII.81, S. & J. Peck (1♀). ***Seminole Co.***, Econ Wilderness Area, 15, 30.VII.2000, T. Smith, P. Russell & S. Fullerton (2♂ UCFC). Longwood, 28.II.75, W.R.M. Mason (1♀). Lower Wekiva River State Preserve, S39 T19S R29E, 14, 28, 29.IV.2001, 21.VII.2001, 18.VIII.2001, 16, 30.IX.2001, 4.XI.2001, P.J. Russell & S.M. Fullerton (8♀, 1♂ UCFC). Oviedo, 31.VII.84, 12, 25.VIII.84, 25.IX.84, 5.X.84, 20.XI.84, 15.XII.84, S.M. Fullerton (5♀, 2♂ UCFC). ***Volusia Co.***, Daytona [Beach], 12.V.20, L.H. Weld, Hopk U.S. 15634g, ex *Callirhytis infuscata* (Ashm.) on *Quercus larifolia* (1♀ USNM). **GEORGIA**: ***McIntosh Co.***, Sapelo Island, 28.V-VI.87 (1♂), 29.V-20.VII.87 (1♀), 9-21.IX.87 (1♂), BRC Hym. Team. ***Monroe Co.***, Forsyth, 3-10.VIII.71, F.T. Naumann (1♂). **ILLINOIS**: ***Franklin Co.***, West Frankfort, XI.46, S. Lienk, ex gall *Diplolepis bicolor* (Har.) (1♀ USNM). ***Piatt Co.***, White Heath, 9.VII.39, J.C. Dirks (1♀ USNM). ***Union Co.***, Shawnee Ridge top, Pine Hill, 1-8 (1♂), 8-22 (2♀).V.82, T.T. Vogt. **IOWA**: ***Mahaska Co.***, Oskaloosa, 24.IV.57, W.S. Craig, ex rose gall of *Diplolepis multispinosa* (1♀ UMRM). **KENTUCKY**: ***Laurel Co.***, 15 mi. W. London, 4-30.VI.84, S. Marshall (1♀). **LOUISIANA**: ***Bossier Parish***, Barksdale AFB, 32º29'06"N 93º35'30"W, 22-30.IV.96, D. M. Pollock (1♂ MEMS). ***Grant Parish***, Alexandria, 48 km N., Iatt Lake Upland, 15-30.XI.98, A. Brazee & N. Schiff (1♀ UCDC). **MAINE**: ***York Co.***, West Lebanon, 17-23.VI.91, D.W. Barry (3♀ DENH). **MARYLAND**: ***Calvert Co.***, Prince Frederick — 4 mi. S., 16.IV-7.V.87, L. Masner (1♂); 7 km S., 7-19.V.87 (1♂), 7.V-7.VII.87 (2♂), BRC Hym. Team. ***Montgomery Co.***, Ashton, 4 mi. SW, 24.V.85, G.F. & J.F. Hevel (1♀ USNM). Plummers Island — 18.VIII.12, J.R. Malloch (1♀ USNM); 15.VIII.19, 6.VIII.22, H. Barber (2♀ USNM); 21.VI.60, K.V. Krombein (1♀ USNM).Widewater, 22.VI.58, A.W. Yazquez, cut out of case of *Attelabus bipustulatus* July 9 (1♀ USNM). ***Prince George's Co.***, Patuxent Research Station, 18-26.V.86, 25.V-1.VI.86, 24.VI.86, 25.V-6.VI.86, 10, 21.VII.86, 27.VII-31.VIII.86, 3.VIII.86, D.B. Wahl (10♂). ***Somerset Co.***, Jackson Island, 30.VI.14, R.C. Shannon (1♀ USNM). **MASSACHUSETTS**: ***Nantucket Co.***, Nantucket, 21.VI.[?], J.H. Emerton (1♀ USNM). ***Suffolk Co.***, Forest Hills, 22.V.16, F.X. Williams (1♀ USNM). ***Worcester Co.***, Boylston, 30.VII.21, Gypsy moth lab. 11605h, ex cocoon *A. melanoscelus* (1♂ USNM). **MISSISSIPPI**: ***Oktibbeha Co.***, Starkville, 20.VI.82, R.L. Brown (1♀ MEMS). ***Pontotoc Co.***, Ecru, 1 mi. SE, 21.VIII.82, P.R. Miller (1♀ MEMS). ***Washington Co.***, near Stoneville, Delta Experimental Station, 33º28'N 90º54'W, 5-20.IV.99, 17.V-2.VI.99, N.N. Schiff (2♂ UCDC). **MISSOURI**: ***Butler Co.***, Poplar Bluff, 14.V.19, S.A. Rowher, *Quercus minor*, Hopk U.S. 10777d (1♀ USNM). ***Boone Co.***, Columbia, 19.V.70 (2♀, 1♂ UCDC), 4, 27.IX.70 (3♀ USNM), F.D. Parker. ***Henry Co.***, Chapel View Prairie, 29.VI.99, M. Gates (1♂ UCRC). ***Jasper Co.***, Joplin, 11.VII.96, H.E. Anderson (1♀ UCRC). ***Pike Co.***, Louisiana, 2, 3.IV.70, W.S. Craig, ex blackberry knot gall (3♀ UMRM). ***Wayne Co.***, Williamsville, X-XI.68 (12♂), 16-26.VI.69 (1♂), 26-29.VI.69 (2♂), 26.V-16.VI.69 (4♂), 1-5.VII.69 (7♂), 15.VIII-10.IX.69 (1♂), VI.70 (2♂), V.87 (2♂), VI.87 (3♂), VII.87 (1♂), VIII.87 (5♂), 10-26.IX.87 (1♀), V.88 (2♂), 15.VI.88 (1♀, 3♂), 1-19.VIII.88 (3♂), 16.VIII.88 (1♀), 21.X-11.XI.88 (1♀). **NEBRASKA**: ***Blaine Co.***, Halsey, 12.VI.58, R. Henzlik (1♀ USNM). ***Cherry Co.***, Valentine Refuge, 5.VI.72, H. & M. Townes (1♀ AEIC). ***Seward Co.***, Seward, Brandhorst, Rose gall (1♀ USNM). **NEW HAMPSHIRE**: ***Strafford Co.***, Durham — 18.VIII.58, R. Blenk, reared from spiny rose gall (1♀ DENH); 8.IV.69, B. Ingraham (1♀ DENH); 1 mi. SW, 8.X.90, W.J. Morse (1♀ DENH); 3 mi. SW, Spruce Hole, 10-23.VII.87, D.S. Chandler (1♀ DENH). **NEW JERSEY**: ***Burlington Co.***, Moorestown, 21, 26.VI.39, H. & M. Townes (2♀ AEIC). **NEW YORK**: ***Westchester Co.***, 19.VI.36, H.K. Townes (1♀ AEIC). **NORTH CAROLINA**: ***Jackson Co.***, Whiteside Mountain, near Highlands, 1600 m, 1.V-20.VII.87 (13♂, CNCI LB-specm 2010-006), VII-13.IX.87 (2♂), BRC Hym. Team. ***Moore Co.***, 15.X.57, H.H. Neunzig (1♀ NCSU). ***Wake Co.***, Raleigh, 3.V.81, D.L. Stephan (2♀ NCSU). **NORTH DAKOTA**: ***Sioux Co.***, T132 R.79 Sec. 32, 14.VII.54, G.C & J.N. Wheeler (1♀). **OKLAHOMA**: ***Latimer Co.***, K. Stephan — VI.87, V.89, VI.89 (2♀, 1♂ FSCA); IV.94, VI.94, VII.94, (2♀, 6♂); Red Oak, IX.93 (1♀, 3♂). **OREGON**: ***Benton Co.***, ex bud gall on *Rosa pisocarpa*, coll. 11.II.83, em. 6.III.83 (1♀). Corvallis, Timberhill, 2.III.81, K. West (1♀). Corvallis, I.83, P. Hanson — *Diplolepis* (4♀, 5♂); Chip Ross Park, ex *Diplolepis inconspicuous* (2♀, 1♂), ex *Diplolepis variabilis* on *Rosa pisocarpa* (1♀, 1♂). Oak Creek Road, 5 mi. W. Corvallis, 2.III.81, R.J. West, ex gall of *Diplolepis rosae* on *Rosa rubidginosa* (3♀, 2♂). ***Lane Co.***, H.J. Andrews Experimental Forest, road 320, 17.VIII.84, M.E. Schauff & E.E. Grissell (1♂ USNM). **PENNSYLVANIA**: Blain, 17.V.57, ex gall of *Sphaeroteris cashuliformis* (1♀ USNM). **SOUTH CAROLINA**: ***Anderson Co.***, Pendleton, BRC Hym. Team — 250 m, 17-27.VI.87 (1♂); 225 m, 6-14.VIII.87 (1♂). ***Dorchester Co.***, Francis Beidler forest near Harleyville, 1-10, 22.IX.87, L. Masner (2♀). **TEXAS**: ***Bastrop Co.***, Bastrop State Park — 24-27.V.83, M. Kaulbars (1♀); 4-16.V.91, R. Wharton (1♀). ***Bosque Co.***, Laguna Park, 13.IV.84, J.B. Woolley (2♂ TAMU). ***Brazos Co.***, College Station — 26.IX-6.X.82, P. Trap & R. Wharton (1♀); Lick Creek Park, 17-30.IV.87, 22.V-23.VI.87, Heraty & Woolley (2♂ TAMU), 19.IX-2.X.88, R. Wharton (1♂ TAMU), 4.X.92, J.B. Woolley (1♀). Junction Hwy 30 with Navasota River, 15.IV.83, P.W. Kovarik (1♀ TAMU). ***Erath Co.***, Stephanville, 5 mi. N., 21-23.V.80, P.T. Riherd (1♂ TAMU). ***Lamar Co.***, Camp Maxey, 21.V-21.VI.2004, W. Godwin, in *Equisetum* bog (1♀, 1♂). ***Montgomery Co.***, Jones State Forest, 8 mi. S. Conroe, 13-19.IV.87, Wharton, Wang &

Praetorius (1♂ TAMU). ***Robertson Co.***, 8 mi. E. Hearne, 17-30.XI.90 (1♀), 1-21.IV.91 (5♀, 1♂; ♀ CNC Photo 2010-48), 27.IV-4.V.91 (1♀ UAIC), M. Hallmark. ***San Jacinto Co.***, Coldspring, 5 km S., Double Lake Campground, 22-24.V.83, M. Kaulbars (1♀ AEIC). ***Tyler Co.***, Kirby State Forest, 30.III-27.IV.2003, E. Riley (1♂ UCRC). ***Victoria Co.***, 15.IX.19, J.D. Mitchell, ex cocoons on *Amphiachyris dracunculoides* (1♀ USNM). ***Walker Co.***, Stubblefield Lake, Sam Houston National Forest, 7.IV.85, J.B. Woolley (1♀). **VIRGINIA**: ***Clarke Co.***, Univ. Va. Blandy Experimental Farm, 2 mi. S. Boyce, 8-18.VI.80 (1♀), 19-30.VI.80 (1♂), 8-27.VIII.80 (2♀, 1♂), 19.VIII-2.IX.84 (1♀), D.R. Smith. ***Essex Co.***, Dunnsville, 1 mi. SE, 37º52'N 76º48'W, 12-29.IV.91 (3♂), 30.IV-13.V.91 (6♂), 18-31.V.96 (2♂ USNM), 12-21.VI.96 (2♂ USNM), D.R. Smith. ***Fairfax Co.***, near Annandale, 6.V.87 (1♂ USNM), 11-17.V.87 (1♂), 14-20.VI.87 (1♂), 29.V-4.VI.88 (1♂), 21-27.VIII.88 (1♂), 27.VIII-2.IX.88 (1♂), 16-22.VII.89 (1♂), 20-26.VIII.89 (2♂ USNM), 27.VIII-2.IX.89 (1♂), D.R. Smith. Barcroft [Hill], 27.V.28, J.C. Bridwell, on oak leaf (1♀ USNM). E. Falls Church, 30.IV.48, ex *Rhodites dischlocerus* (3♀ USNM). Vienna, 1.V.41, Bridwell, ex gall *Rhodites* [?] (1♀ USNM). Dunn Loring, 15.VII.51, K.V. Krombein (1♀ USNM). ***Louisa Co.***, Cuckoo, 4 mi. S., 1-12.V.87 (1♂), 13-27.V.87 (2♂), 16.VI.87 (1♀, CNC Photo 2010-15), 12-25.IV.88 (2♂), 25.IV-13.V.88 (3♂), 13-27.VII.88 (1♂), 12-23.VIII.88 (1♀), 23.VIII-11.IX.89 (1♂), 12.IX-6.X.89 (1♂), J. Kloke & D.R. Smith. ***Page Co.***, Luray, Shenandoah foot hills, 13.VI.92, L. Masner (1♀). ***Warren Co.***, Shenandoah National Park, Compton Gap, BRC Hym. Team — 800 m, VII-23.VII.87 (6♂, CNC Photo 2010-16); 1300 m, 22.V-2.VI.87 (2♂). ***Virginia Co.***, Alexandria, May, bred from gall of *Diastrophus cuscutaeformis* (3♀ USNM). **WEST VIRGINIA**: ***Hardy Co.***, 4-17.VI.2002, D. Smith (1♀). Lost River State Park, 1-14.VIII.60, K.V. Krombein (1♀ USNM). Mathias, 3 mi. NE, D.R. Smith — 38º55'N 78º49'W, 26.VI-8.VII.2001 (1♀), 14-28.VIII.94 (1♀); 38º54.6'N 78º52.89'W, 6.IX-2.X.2007 (1♂), 1-18.VIII.2008 (1♀), 19.VIII-8.IX.2008 (1♂). **WASHINGTON**: ***Whitman Co.***, Pullman, A.L. Melander, ex gall of *Rhodites* sp. on *Rosa piscocarpa* (2♀ syntypes of *E. melanderi*). **WISCONSIN**: ***Polk Co.***, Gibson Lake, T34n R16W S34, 1969, H.O. Coppel, host I-143, *Diprion similis* Htg. (1♀ USNM) (see further under Biology).

Distribution. Transcontinental (Map 10).



Map 10. Regional distribution of *E. dryorhizoxeni*.

Biology. Primarily a parasitoid in galls of various species of Cynipidae (Hymenoptera) on *Quercus* (Fagaceae) and *Rosa* (Rosaceae), though apparently also reared rarely from other hosts. Felt (1915) reported that *E. dryorhizoxeni* was reared from galls of *Rabdophaga salicistriticoides* (Osten Sacken) and possibly from *Dasineura lysimachiae* (Beutenmüller) (Diptera: Cecidomyiidae). Although I have not seen voucher specimens to confirm these gall midges as hosts they quite likely are correct. Coppell (1960) also reported that *E. dryorhizoxeni* parasitized *Glyptoscelis* sp. (Coleoptera: Chrysomelidae) larvae that had hatched from eggs deposited in abandoned *Diprion similis* (Hartig) (Hymenoptera: Diprionidae) cocoons. According to Coppel (1960), individuals of *Glyptoscelis* feed on needles of white pine and females deposit their eggs in large numbers into cocoons of *D. similis* after the adult sawfly has emerged, covering the opening through which the adult escaped with a disc of wood-chip material for protection. It is very possible that the female listed above from Wisconsin, reared in 1969 by Coppel, was similarly reared from some insect using an abandoned *D. similis* cocoon rather than *D. similis* itself because in a subsequent paper Mertins and Coppel (1971) listed only *E. annulatus* and *E.* (*Macroneura*) *vesicularis* (Retzius) as parasitoids of *D. similis* in Wisconsin. Because of this, *D. similis* is listed below as a questionable host.

Arthropod hosts — COLEOPTERA. **Attelabidae**: **Attelabus bipustulatus* Fabricius. HYMENOPTERA. **Cynipidae**: **Andricus femoratus* Ashmead (= *Amphibolips femorata*), *Belonocnema treatae* Mayr (= *Dryorhizoxenus floridanus*) (Ashmead 1886), **Callirhytis infuscatus* (Ashmead) (spiny rose gall wasp), **Diastrophus cuscutaeformis* Osten Sacken, **Diplolepis bicolor* (Harris), *Diplolepis dichlocerus* (Harris) (Burks 1979), *Diplolepis ignota* (Osten Sacken) (Burks 1979), **Diplolepis inconspicuis* Dailey and Campbell, **Diplolepis rosae* (L.) (Bedeguar gall wasp), *Diplolepis rosaefolii* (Cockerell) on *Rosa acicularis* Lindley (Shorthouse & Brooks 1998), **Diplolepis spinosa* (Ashmead) (= *D. multispinosa*), **Diplolepis variabilis* (Bassett) and **Disholcaspis quercusvirens* (= *Holcaspis ficigera*) (Ashmead). **Diprionidae**: ? **Diprion similis* (Hartig). **Braconidae**: **Apanteles melanoscelus* (Ratzeburg). LEPIDOPTERA. **Lymantriidae**: **Lymantria dispar* (L.) (secondary).

Based on label data, *E. dryorhizoxeni* apparently was also reared from some unknown insect in a knot gall of *Rubus* sp. (Rosaceae) (blackberry), unknown cocoons on *Amphiachyria dracunculoides* (DC.) Nuttal (Asteracea) (prairie broomweed), and from "*Sphaeroteris cashuliformis*".

Remarks. *Eupelmus dryorhizoxeni* is the only recognized North American species of *E.* (*Eupelmus*) with brachypterous females. For this reason the description is not rigorously comparable with those given for the other species of the subgenus and includes also features to help distinguish them from females of *E.* (*Macroneura*). Females are most likely to be mistaken for those of *E.* (*Macroneura*) *vesicularis* (Retzius) because of similarly reduced forewings that normally are bent at an abrupt angle (Figs 11, 12). However, females of *E. vesicularis* are distinguished by a very shallowly concave (plate-like) mesoscutum, almost flat scutellum in a similar plane as the axillae (Gibson 1990, figs 26, 27), and by their reduced and asymmetrical tarsal peg pattern, the mesotarsus having pegs in a complete row along its anterior margin but only within its basal half along the posterior margin, and the subsequent two or three tarsomeres with only a single apical peg (Gibson 1990, fig. 38). The only other described species of *E.* (*Eupelmus*) normally with brachypterous females is *E. atropurpureus* Dalman, which does not occur in North America (see "Remarks" for *E.* (*Eupelmus*)). Females of *E. atropurpureus* are readily differentiated from those of *E. dryorhizoxeni* by several features, including the antennae, head and body being dark, the mesoscutal lateral lobes low convex, the scutellum almost flat and in same plane as the axillae, and the forewings being flat, hyaline, and apically truncate.

Females are quite variable in color and there also appears to be regional variation in sculpture of the frons and acropleuron. Known females from Arizona and one female from California (Orange Co., near Corona) have the acropleuron unusually strongly sculptured (Fig. 15), being distinctly reticulate except that the medial microsculptured region is quite smooth and shiny in two of the females compared to typical females (Fig. 14). All but one of the Arizona females (Pima Co., Kitt Peak) also have the frons at least slightly roughened to reticulate (Fig. 13) rather than coriaceous (Fig. 10). I currently consider the two correlated sculptural differences to represent infraspecific variation within a population at the periphery of the range of *E. dryorhizoxeni* (Map 10).

Males of *E. dryorhizoxeni* are usually quite easily distinguished from most other North American *Eupelmus* males by a combination of antennal and leg color pattern. Typically the dark brown flagellum contrasts distinctly with a light-colored scape except rarely for some small males, and the legs are extensively yellowish to yellowish-orange beyond the coxae. However, some males are unusually dark with a color pattern very similar to typical *urozonus*-group males (Figs 58–61). Such males could be mistaken for those of *E. cyaniceps*, *E. cushmani* or, particularly, *E. cynipidis*/*E. conigerae* because they share a similar host range, a conspicuously setose, filiform flagellum (*cf.* Figs 57, 65), and a similar sculpture pattern of the outer surface of the scape (*cf.* Figs 73, 74), though this is often difficult to discern for *E. dryorhizoxeni* males because the micropunctures are less visible when the cuticle is yellowish rather than dark.

The single examined USNM male syntype of *E. ficigerae* lacks its antennae except for a single pedicel and scape glued with its outer surface to the point. Milliron (1949) stated that in the opinion of A.B. Gahan the specimen was possibly a male of *E. cynipidis*, likely because it was reared from a cynipid gall. Because of the condition of the syntype neither the sculpture pattern nor color pattern of the outer surface of the scape is visible, though the inner surface of the scape is brown similar to the pedicel. All femora and the meso- and metatibiae are also brown, but the protibia appears to be extensively yellowish except dorsolongitudinally and at least the trochantellus of the metafemur is whitish. Even though I have not seen specimens of *E. dryorhizoxeni* reared subsequently from the two hosts that Ashmead (1887b) listed for *E. ficigerae* I believe it is a junior synonym of *E. dryorhizoxeni* rather than *E. cynipidis* because of the apparent color pattern of male syntype.

Regional males of *E. microzonus* might also be confused with *E. dryorhizoxeni* males because the legs are almost entirely white beyond the coxae and they have a similarly setose filiform flagellum (*cf.* Figs 55, 57). However, the scape, palpi and tegula have a different color pattern and the flagellum is slightly longer than for *E. dryorhizoxeni* males. Using the key to males of *Macroneura* in Gibson (1990), males of *E. dryorhizoxeni* would key to *E.* (*Macroneura*) *epicaste* (Walker) and *E.* (*Macroneura*) *tanyaris* (Gibson), but both of these have distinctly banded meso- and metatibiae, about the basal half and apices narrowly of the tibiae being white and separated by a subapical brown band. Males of *E. dryorhizoxeni* are perhaps superficially most similar to those of *E.* (*Macroneura*) *meteori* (Gahan) in structure and color pattern, but *E. meteori* males lack the line of distally curved setae from the pedicel and the long genal seta which are characteristic of other *E.* (*Eupelmus*) and *E.* (*Macroneura*) males.

9. *Eupelmus* (*Eupelmus*) *microzonus* Förster

Figs 16, 19, 53, 55; Map 11

Eupelmus microzonus Förster, 1860: 125−126. Syntypes, female (NHMW, examined). Type data: Germany: region of Aachen.
Eupelmus insulae Masi, 1919: 302−305. Holotype, female (MCSN, examined). Type data: Italy: Tuscany, Giglio Is. **N. syn.**

Description. FEMALE (Fig. 16). Length about 2.5–3.0 mm. Head primarily metallic green but scrobal depression, upper face mesally to anterior ocellus and between anterior ocellus and each posterior ocellus black or with coppery luster under some angles of light; vertex and lower face under some angles of light also variably dark or with coppery luster; maxillary and labial palpi brown. Antenna dark brown except scape and pedicel green to bluish-green under some angles of light. Mesosoma with tegula narrowly creamy white basomesally adjacent to mesoscutal margin, but yellowish-brown and translucent laterally and apically; otherwise metallic green similar to head, with slight brownish or coppery luster under some angles of light. Forewing hyaline with white setae and yellowish-white venation. Front leg with most of trochanter, about basal three-quarters of femur and apical tarsomere brown to dark brown, the remainder yellowish-white. Middle leg mostly yellowish-white between brown trochanter and apical tarsomere, with most of femur more distinctly yellow compared to somewhat lighter, more white trochantellus and most of tibia and tarsus. Hind leg similar in color pattern to fore leg except femur variably extensively yellowish-white apically and always narrowly yellowish-white dorsolongitudinally. Gaster similar in color to mesosoma, metallic green to partly brownish depending on angle of light, but with quite conspicuous hairlike white setae; ovipositor sheaths distinctly banded, with medial white region abruptly delineated from short, dark brown basal region and somewhat lighter brown apical region, the white region occupying slightly more than half length of sheath and about twice length of apical brown region.

Head with frons and scrobal depression similarly meshlike coriaceous to very slightly meshlike reticulate, with frons indistinguishably merged into parascrobal region; IOD about 0.4× head width; OOL: POL: LOL: MPOD = 1.0: 1.65–1.75: 2.4–2.6: 1.0. Antenna with combined length of pedicel + flagellum about 1.25–1.3× head width; scape about 3.8–4.0× as long as maximum width, in outer view ventral margin almost evenly curved in basal half, with at most very slender, uniform flange over apical two-thirds; pedicel in lateral view about 2× as long as wide; fl1 slightly transverse, about one-third length of pedicel; fl2 about 2.5× as long as wide and about 3× as long as fl1; subsequent funiculars increasing in width to subquadrate fl8; clava about 2.75× as long as wide, subequal in length to apical three funiculars, and about 0.33× length of funicle. Mesoscutum almost uniformly meshlike reticulate-coriaceous except lateral lobe more distinctly coriaceous with smaller cells dorsolongitudinally. Scutellar-axillar complex mostly reticulate-imbricate, but scutellum more coriaceous along midline. Prepectus setose over at least dorsal half but more broadly bare ventrally than dorsally. Acropleuron shallowly, meshlike reticulate anterior and posterior of medial microsculptured region, the cells only slightly larger posterior than anterior of medial region. Forewing setose except for linea calva; costal cell ventrally setose with at least 3 lines of setae along length toward leading margin, and dorsally with line of obscure whitish setae over about apical three-quarters; cc: mv: pmv: stv = 3.5–3.7: 2.3–2.4: 1.4–1.5: 1.0. Mesotibia with apical row of 5–7 brown pegs (Fig. 19); mesotarsus ventrally with only a few brownish pegs (Fig. 19), the basitarsus with row of 4–7 pegs along anterior margin and 2 or 3 pegs along posterior margin within basal half, second tarsomere with at most 1 apical peg on one or both sides and subsequent tarsomeres without pegs. Propodeum with U-shaped plical depression extending to foramen; callus with comparatively sparse white setae not obscuring cuticle or sculpture. Gaster with inner plate of ovipositor not extending conspicuously beyond apex; ovipositor sheaths about 1.0–1.1× length of marginal vein and about 0.65–0.7× length of metatibia.

MALE (Fig. 53). Length about 2 mm. Head with at least face metallic green to bluish-green, but vertex and lower face usually more purple under some angles of light; maxillary and labial palpi white. Antenna with pedicel brown dorsally and white ventrally; scape partly white to yellowish-white basally and ventrally, but brown or brown with metallic luster dorsoapically; flagellum brown. Mesosoma with tegula white; otherwise similar in color to head, variably green to purple dorsally but laterally more brown with metallic luster and with variably distinct Y-shaped lighter line extending from anterolateral angle of mesocoxa along mesopleuron and transepisternal line. Legs with coxae similar in color to mesosoma laterally, but otherwise entirely white except for brownish apical 1 or 2 tarsomeres and subapical brownish spot on anterior surface of mesotibia. Gaster mostly brown, but with metallic luster basally and apically under some angles of light.

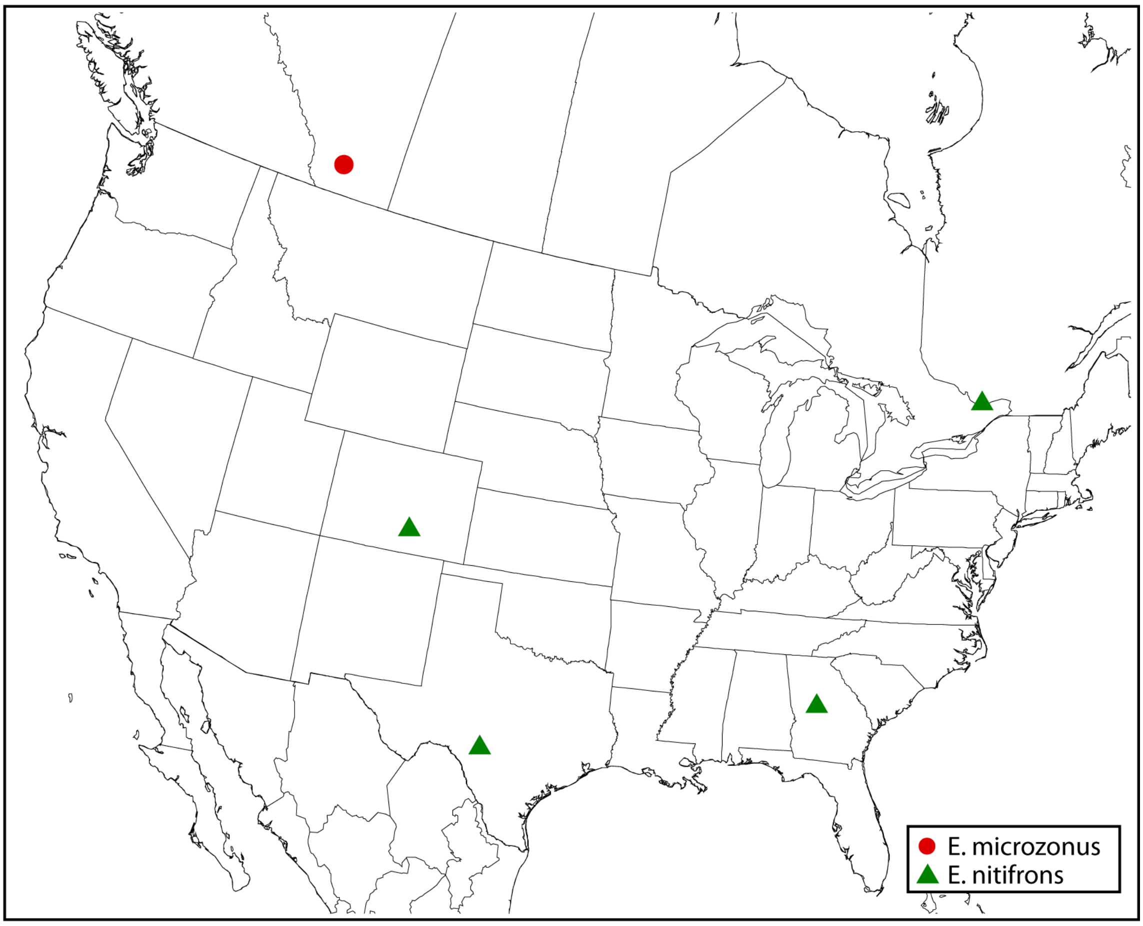
Head with frons and scrobal depression meshlike reticulate-coriaceous. Head with IOD about 0.5× head width; OOL: POL: LOL: MPOD = 1.0–1.25: 2.9–3.0: 1.4–1.5: 1.0; lower face with setae sparse, short, straight and white below torulus, though slightly longer laterally above malar sulcus; gena with one much longer seta below malar sulcus near base of mandible. Antenna with scape ovoid, about 2.25−2.4× as long as wide, the outer surface ventrally variably extensively micropunctate apically to more elongate-strigose or alutaceous basally, but sculpture inconspicuous because very shallow, often almost effaced ventrobasal to scapular scrobe; length of pedicel + flagellum about 1.7–1.8× as long as head width; pedicel subglobular, only about as long as apical width and with line of 4 or 5 apically curved setae (Fig. 57); flagellum elongate-filiform with conspicuous, curved, semierect white setae at least half as long as width of respective flagellomere (Fig. 55); fl1 very strongly transverse, disc-like, bare (Fig. 57); fl2–fl8 all oblong, about 1.8−2.2× as long as wide; clava lanceolate with only small micropilose sensory region ventroapically, about 2.75−3.0× as long as wide and 1.6−1.9× as long as last funicular. Mesonotum meshlike reticulate-coriaceous or scutellar-axillar somewhat more finely coriaceous. Propodeum very finely meshlike coriaceous to alutaceous on either side of median carina, and callus similarly sculptured with setae originating from tiny bumps. Forewing with cc: mv: pmv: stv = 3.3−3.5: 1.8−1.9: 1.3−1.4: 1.0; costal cell dorsally with line of whitish setae over about apical half or less, and ventrally with variably conspicuous setae along length, mesally with 1 or 2 lines.

Regional material examined (2♀, 3♂). CANADA. **ALBERTA**: Haney's Farm near Lethbridge, 4.VII.97, K. Floate (2♀, 3♂; ♀ CNC Photo 2010-17, 2010-18; ♂ CNC Photo 2010-19).

Distribution. The single collection record from southern Alberta (Map 11) represents the first for North America. Noyes listed the species as occurring throughout Europe and North Africa east to Iran and Kazakhstan. Based on the over 300 specimens I examined it appears to be quite a common species in the Palaearctic region, including in the following countries not recorded in Noyes (2010): Cyprus, Greece, Romania, Turkmenistan and Uzbekistan.

Biology. Hosts unknown in region, but Noyes (2010) listed several host species in Cynipidae and Eurytomidae (Hymenoptera), plus Apionidae, Bruchidae and Curculionidae (Coleoptera), Cecidomyiidae, Chloropidae and Tephritidae (Diptera) and Lasiocampidae, Psychidae and Pyralidae (Lepidoptera).

Remarks. Females of *E. microzonus* are readily distinguished from other *E.* (*Eupelmus*) species by their reduced mesotarsal peg pattern, including having an asymmetrical pattern on the basitarsus (Fig. 19). Including variability of the more numerous Palaearctic specimens examined, the basitarsus has up to 8 pegs along the anterior margin but only 1–4 pegs, including very rarely an apical peg, along the posterior margin. There are also 1 or 2 pegs apically on one or both sides of the second tarsomere and although extremely rarely there is a single apical peg on one side of the third tarsomere, at least the fourth and fifth tarsomeres lack pegs. European females also often have the femora variably extensively dark except apically and sometimes the tibiae light to dark brown within the basal half (excluding knees). The tegula sometimes appears entirely dark brown similar to most other *Eupelmus* species, but usually there is at least a very slender, short, whitish to yellowish band along the inner margin, though this sometimes is concealed by the overlying marginal flange of the mesoscutal lateral lobe. The forewing often also has more conspicuous, brownish setae.



Map 11. Regional distribution of *E. microzonus* (●) and *E. nitifrons* (▲).

Males of *E. microzonus* from Europe are also more variable in color than the only three known males from North America. European males always have a distinct subapical brown region on the mesotibia and sometimes the metatibia, and usually have at least the meso- and metafemora variably extensively dark. European males usually also have the head and mesosoma more strongly metallic green to bluish-green. Because of their extensively light-colored legs and gracile-filiform flagellum (Fig. 53), regional males of *E. microzonus* most closely resemble those of *E. pini* in North America, as discussed under the latter species.

I examined the holotype of *E. insulae* Masi (1919) in 1984, at which time all that remained of the female was one middle leg and one antenna glued to two separate cards. The mesotibia has nine black apical pegs, whereas the mesotarsus has eight pegs along the length of its anteroventral margin and two pegs on the posteroventral margin within its basal half. Masi (1919) also described the ovipositor sheath as being yellowish with the basal quarter and apical third black. It is because of this color pattern and the mesotarsal peg pattern that I place *E. insulae* in synonymy under *E. microzonus*. Nikol'skaya (1952) described *E. nigricauda* from Crimea [Ukraine], stating that the female was 2 mm in length. Kalina (1988) distinguished *E. nigricauda* and *E. microzonus* by the ovipositor sheaths being "wholly black" in the former compared to "with a distinct yellow ring" in the latter. European females of *E. microzonus* range in length from about 1.9−4 mm and the ovipositor sheaths are variable in color pattern, the apical dark band often being about as long as or, particularly in smaller specimens, sometimes even longer than the medial light-colored band. Furthermore, the USNM has a series of females and males that are labelled “Ex Alfalfa seed”, “Poltava Russia” [= Ukraine], “M. N. Nikolskaja coll”. The females are only about 2 mm in length and the sheaths vary from having a distinct medial light-colored band to having a only small yellowish spot submedially or being uniformly brown. I have not examined type material of *E. nigricauda* and I hesitate to synonymize the names formally without a Palaearctic revision of *Eupelmus*, but I suspect *E. nigricauda* represents a color form of *E. microzonus* correlated with body size and perhaps host.

10. *Eupelmus* (*Eupelmus*) *nitifrons* n. sp.

Figs 23, 26; Map 11

Type material. HOLOTYPE (♀, CNC no. 23947). [CANADA], PQ [Québec], Luskville Falls, 3-10.VI.1986, Denis & Dumouchel, pan trap, 300m / CNC Photo 2010-12 / Holotype *Eupelmus* (*Eupelmus*) *nitifrons* Gibson, CNC Type no. 23947. [Condition: point-mounted; entire].

PARATYPES (3♀). USA. **COLORADO**: ***Huerfano Co.***, 7.0 mi. N. La Veta Pass, Pass Creek Road, 8000', 17-18.VI.82, G. Gibson (1♀). **GEORGIA**: ***Monroe Co.***, Forsyth, 11-21.VII.71, F.T. Naumann (1♀). **TEXAS**: ***Uvalde Co.***, Garner State Park, 16.IV.89, J. Heraty (1♀ UCRC).

Etymology. A combination of the Latin words *niteo* (shine, glitter) and *frons* (forehead) in reference to the smooth and shiny frons.

Description. FEMALE (Fig. 23). Length about 2.0–2.3 mm. Head (Fig. 26) dark, shiny with variable metallic lusters under different angles of light, the frontovertex usually mostly violaceous to purple except variably extensively green or bluish-green along inner orbit dorsally to oblique boundary between anterior and posterior ocellus, and scrobal depression and lower face often more distinctly green to bluish-green; maxillary and labial palpi brown. Antenna dark brown, the scape and pedicel at most with very slight bluish luster. Mesosoma with tegula dark brown; mesoscutum with convex anterior part of median lobe at least slightly greenish to bluish-green, the remainder of mesoscutum brown or with similar metallic lusters as frontovertex under some angles of light, and lateral lobes sometimes dark with very slight greenish luster; scutellar-axillar complex similar in color to convex portion of medial lobe or axillae more purple; laterally mesosoma brown with at most slight metallic lusters under some angles of light. Forewing with extreme base of costal and basal cells at least slightly brownish with brown setae, otherwise hyaline with white setae basally to about level of base of parastigma, the disc otherwise with brown setae and with dark brown infuscation between anterior and posterior margins from level of base of parastigma to about midway between apex of pmv and wing margin. Legs with trochantelli white, otherwise similarly brown as mesosoma laterally except metatarsus and sometimes protarsus brownish-white, and sometimes mesofemur lighter yellowish-brown to brownish-white. Gaster dark brown except basal tergum sometimes with metallic green to blue luster anteriorly, and with comparatively inconspicuous hairlike setae similar in color to cuticle. Ovipositor sheaths distinctly banded, the mesal light region abruptly delineated from very short dark region basally and variably long apical dark region.

Head (Fig. 26) with frons smooth and shiny with at most virtually effaced meshlike sculpture between scrobal depression and ocelli except laterally near inner orbit with fine but more distinct meshlike sculpture, the interocellar triangle also quite shiny but usually with fine meshlike sculpture, and indistinguishably merged into parascrobal region; vertex somewhat more distinctly, transversely coriaceous-alutaceous and scrobal depression reticulate-rugulose. Head with IOD = 0.46× head width; OOL: POL: LOL: MPOD about 1.3: 3.5: 2.2: 1.0. Antenna with combined length of pedicel + flagellum about 1.2× head width; scape about 4× as long as maximum width, in outer view outer margin almost evenly curved, with at most very slender, almost linear flange along about apical two-thirds; pedicel in lateral view about 1.8–2.0× as long as wide; fl1 quadrate to slightly transverse, ringlike; fl2 about 1.1–1.2× as long as wide and about 2× as long as fl1; subsequent funiculars increasing in width to slightly transverse fl8; clava about 1.9–2.5× as long as wide and about 0.44–0.5× as long as funicle. Mesoscutum with convex anterior portion of medial lobe transversely reticulate-imbricate anteriorly to reticulate posteriorly, but posterior concave portion of medial lobe and inner inclined surface of lateral lobe much more finely sculptured, reticulate-coriaceous anteriorly to variably extensively shiny and smooth or with almost effaced meshlike sculpture posteriorly, and inclined out surface of lateral lobe finely meshlike coriaceous. Scutellar-axillar complex with axilla and scutellum similarly reticulate-punctate. Prepectus bare or at most with single seta. Acropleuron finely meshlike coriaceous to slightly reticulate-coriaceous anterior of medial microsculptured region, the sculpture posterior of microsculptured region similar but cells somewhat larger or at least longitudinally aligned. Forewing setose except for linea calva; costal cell ventrally with complete line of setae and dorsally with line of setae only within about apical third or less; cc: mv: pmv: stv = 4.0–4.3: 2.8–3.2: 0.8–1.1: 1.0. Mesotibia with apical row of 3–6 black pegs; mesotarsus ventrally with black pegs on basal four tarsomeres, the basitarsus with 9 or 10 pegs arranged distally in irregular or more distinct double row on either side, second tarsomere with 3 or 4 pegs and third tarsomere with 2 or 3 pegs in row along either side, and fourth tarsomere with single peg apically on either side. Propodeum with U-shaped plical depression extending to propodeal foramen; callus with dense white setae essentially obscuring cuticle. Gaster with inner plate of ovipositor not extending beyond apex; ovipositor sheaths about 0.75–0.8× length of marginal vein and about 0.54–0.65× length of metatibia.

MALE. Unknown.

Distribution. Although very rare, apparently widely distributed throughout North America at least east of the Rocky Mountains (Map 11). The distribution suggests the species is native to North America rather than being an unrecognized, accidentally introduced species from elsewhere (see further under “Remarks”).

Biology. Host unknown, but possibly a parasitoid in some gall based on presumed close relationship with *E. cynipidis*.

Remarks. Within North America, females of *E. nitifrons* most closely resemble the usually much larger females of *E. cynipidis* except for having much shorter ovipositor sheaths (*cf.* Figs 21–23) and a uniformly setose basal cell. Both *E. cynipidis* and *E. conigerae* are included in the *urozonus*-group because of structure and color pattern of their males even though their females are very different from other, typical *urozonus*-group females. Because females of *E. nitifrons* and *E. cynipidis* are at least superficially similar it is possible that males of *E. nitifrons* also resemble *urozonus*-group males. If so, *E. nitifrons* likely is closely related to *E. cynipidis*.

Based on the key, description, and images given in Kalina (1988, plate III, figs 1, 2, 6, 8) for *E. claviger* Nikol’skaya, which Kalina stated is very similar to *E. tryapitzini* Kalina, it is very likely that females of *E. nitifrons* also closely resemble females of the Palaearctic species *E. tryapitzini.* The basal cell of *E. claviger* was shown to be extensively bare basally (Kalina 1988, plate III, fig. 6), rather than uniformly setose as in *E. nitifrons*, and the flagellum also appears to be shorter, the pedicel + flagellum being described as slightly shorter than the width of the head, and with the basal three funiculars all about the same length and transverse (Kalina 1988, fig. 19). Furthermore, Kalina (1988, p. 12) stated that the head of *E. claviger* has the “frons including scrobes raised reticulate, sculpture in ocellar area obliterated”, whereas females of *E. nitifrons* have the upper face almost smooth above the reticulate-rugulose scrobal depression.

11. *Eupelmus* (*Eupelmus*) *pervius* n. sp.

Figs 30, 40, 45−47, 51, 60, 66, 69, 72, 78; Map 12

Type material. HOLOTYPE (♀, LACM). [USA] CA. [California], San Diego Co., 5 mi. W. Escondido, 7.II.1977, D. C. Pierce / collected from *Yucca whipplei* / LACM ENT 266844 / Holotype *Eupelmus* (*Eupelmus*) *pervius* Gibson. ALLOTYPE (♂, LACM). CA., San Diego Co., 3 mi. E. Fallbrook, 7.II.1977, D. C. Pierce, reared from *Yucca whipplei* pods 12.II.1977, LACM ENT 267146 / Allotype *Eupelmus* (*Eupelmus*) *pervius* Gibson.

PARATYPES (251♀, 182♂). USA. Parasite in l. [larva] of *Macrancylus linearis* Lec., a snout beetle from *Yucca* stems, [?] Mrch 0/87 (1♀ USNM). AF-1, 26.II.77 (1♀ LACM). AJ-11, 5.III.77 (1♀ LACM). E-4, 5.II.77 (1♂ LACM). Frnck, 72-25 (1♀ LACM). **ARIZONA**: Joshua Tree National Forest, em. 24.III-5.IV.64, N. Sloan, ex pods of *Yucca brevifolia* (2♀ AEIC). ***Coconino Co.***, Williams, U.S.D.A. 9245 — Yucca (6♀ USNM); 1.VIII.01, chalcid on *Praetonus coloradensis* ?, 9425$^{\underline{02}}$ (1♀ USNM). Williams, 9245$^{\underline{0}}$ — 8.VII.01 (3♀ USNM); 8.VIII.01 on *Prodoxus* (2♀ USNM); Barber & Schwarz, on *Prodoxus* in *Yucca* (1♀ USNM). ***Santa Cruz Co.***, Patagonia, 31.53ºN 110.77ºW, 23.X.94, B. Brown & E. Wilk (1♀ LACM). **CALIFORNIA**: ***Inyo Co.***, Darwin Falls — 17.V.70, E.E. Grissell, *Eriogonum inflatum* (1♀ UCDC); 9.IV.73, R.M. Bohart, *Salix* (1♀ UCDC); 24.V.80, N.J. Smith & A.J. Gilbert (1♀ UCDC). ***Los Angeles Co.***, June, July, September, 96º (5♀, 2♂ USNM). Claremont, 14.II.77, D.C. Force, *Yucca whipplei* pods — collected from (4♀, 7♂ LACM); reared 14, 26.II.77, 14, 18, 22, 26.III.77 (8♀, 13♂ LACM). 1 mi. S. Coldbrook Station, San Gabriel Canyon, 12.III.72, D.C. Frack, reared from *Y. whipplei* pods (1♀, 1♂ LACM). E. Fork Road, 0.4 mi. E. San Gabriel Canyon Road, 14.II.77, D.C. Force, reared from *Y. whipplei* pods 30.V.77 (1♀ LACM). Gorman, 16.IV.79, D.C. Force, reared from *Yucca brevifolia* pods (4♀, 1♂ LACM). Mount Baldy Village, 14.II.77, D.C. Force, *Y. whipplei* pods — collected from (4♀, 1♂ LACM); reared 14.II.77, 5, 22.III.77 (4♀, 1♂ LACM). Placerita Canyon Park, Walker Ranch, 34º38'N 118º44'W, 21.VII-2.VIII.99, B. Brown & I. Swift (1♀ UCRC). San Gabriel Canyon, Rincon Guard Station, Camp Rincon, 12 mi. N. canyon entrance, 11.V.46, San Gabriel Canyon Biological Suvery (7♀, 3♂ LACM). ***Monterey Co.***, 6 mi. N. Santa Lucia Memorial Park on Indians Arroyo Seco road, 13, 14, 15, 22.XII.66, H.B. Leech, emerged from dead stem of *Y. whipplei* (7♀, 3♂ CASC). ***Orange Co.***, Hwy 74, 16 mi. E. freeway 5, 17.I.77, D.C. Force, reared from *Y. whipplei* pods 18, 29.I.77, 5, 12, 26.II.77, 18.III.77 (11♀, 14♂ LACM). Santa Ana Mountains, 6.II.72, D.C. Frick (6♀, 5♂ LACM). Santiago Canyon, 17.I.77, D.C. Force, reared from *Y. whipplei* pods 18, 21, 29.I.77, 5, 19, 26.II.77 (19♀, 20♂ LACM). Silverado Canyon, 17.I.77, D.C. Force, reared from *Y. whipplei* pods 18, 21, 29.I.77, 5, 12, 16, 26.II.77, 18.III.77 (14♀, 15♂ LACM). ***Riverside Co.***, ex *Yucca* stems (2♀ USNM). Bautista Canyon, D.C. Force, *Y. whipplei* pods — 24.I.77, collected from (5♀, 3♂ LACM); 24.I.77, reared 29.I.77 (CNC Photo 2010-62), 5, 12.II.77, 22.III.77 (8♀, 8♂ LACM); 23.IV.77, collected from (1♀, 2♂); 14.IV.78, collected from (1♂ LACM). Stream from junction Deep Creek & Horsethief Creek to 0.5 mi. N. junction Deep Canyon, Sec. 6, T. 7S, R.6E, 11.IV.75, J.B. Tucker (1♂ UCRC). Hwy 74, 5.3 mi. W. Lake Elsinore lookout, 24.I.77, D.C. Force, reared from *Y. whipplei* pods, 24.I.77, 12.II.77, 5.III.77 (6♀, 3♂ LACM). Mayhew Canyon, 1 mi. S. Glen Ivy Hot Springs, 19.II.66, G.R. Ballmer, ex *Yucca* stalk (4♀, 1♂ UCRC). Menifee Valley, hills on W. end, 33º39'N 117º13'W — 20.VII-27.VIII.80, J.D. Pinto (1♀ CNC Photo 2010-63); 3-17.VII.81 (1♀), 1.X-8.XI.81 (2♀), J.D. Pinto; 1-30.IX.81, Woolley, Huber & Pinto (1♀); 1800', 29.V.78, J.D. Pinto, *Keckiella* (1♀ UCRC, CNC Photo 2010-53); 1800', 7.XII.80, 19-31.VII.95, 1-29.II.96, J.D. Pinto (4♀ UCRC). Palm Springs, 19.IV.24, ex Lepidoptera in *Y. whipplei*, L. Bruner (1♂ UCRC). Pinyon Flat campground, 26.XI.71, R.C. Frack, reared from *Y. whipplei* galls (1♂ LACM). Riverside — 22, 24.XI.72, G. Gordh, ex *Y. whipplei* pods (2♀, 1♂ UCRC); 28 mi. S., 12.XII.72, G. Gordh, ex *Yucca* sp. (1♀, 1♂ UCRC); 30 mi. S., 16.XII.72, Gordh & Pinto, ex *Y. scyoigera* (5♀, 2♂ UCRC). San Bernardino National Forest, 8.XI.37, J.E. Patterson, Hopk. U.S. 31978-1A, Lot No. 88-17957 (1♂ USNM). San Bernardino National Forest, Bautista Canyon — 2.III.79, J.D. Pinto (1♀ UCRC); 8.VIII.88, A. de la Garza, *Yucca* sp. (1♀ UCRC); 750 m, 33º39'57″N 118º49'50″W, 4.X.2008, E. Murray (4♀, 2♂ UCRC). Junction 234 & Twin Pine Road, 24.I.77, D.C. Force, reared from *Y. whipplei* pods 29.I.77 (1♀ LACM). Valle Vista, 8 mi. E., 24.I.77, D.C. Force, reared from *Y. whipplei* pods 29.I.77, 5, 19.II.77 (1♀, 3♂ LACM). ***San Bernardino Co.***, Baker, 14 mi. SE, 18.V.82, sweep desert willow, lava beds, J.B. Woolley (1♀). Devore [Heights], 23.X.77, J.B. Woolley (12♀, 12♂ CNC; 2♀ 2♂ LACM). Helendale, 21.V.55, W.R.M. Mason (1♀). Junction Route 138-195, 24.VII.71, D.C. Frack, reared from *Y. whipplei* pods (1♀ LACM). Kelso, 7.V.77, L.E. Guenther (1♀ UCDC). Lone Pine Canyon, W.L. Thompson — coll. 21.II.77, reared from *Y. whipplei* 29.IV.77 (5♀, 2♂ LACM); 4.VIII.77, collected from *Y. whipplei* (6♀ LACM). Mill Creek Canyon, Hwy 38 — 34º06'02″N 117º01'29″W, 994 m, 27.IX.2008, L. Bemiker (1♀ UCRC); 34º06'01″N 117º01'29″W, 996 m, 27.IV.2008, E. Murray (1♀ UCRC); 34º05'59″N 117º01'59″W, 996 m, 27.IX.2008 (3♀ UCRC), 23.XI.2008E.S. Ballman (3♀, 1♂ UCRC; ♀ CNC Photo 2010-26, ♂ CNC Photo 2010-27). Morongo Valley, 29.I.39, W.D. Pierce, *Cleistoyucca arborescens* (1♀, 1♂ LACM). San Gabriel Mountains, 1 mi. N. Mount Baldy Village, 4.II.65, R.J. Hamton (2♀, 1♂ CASC; ♀ CNC Photo 2010-55, 2010-56). ***San Diego Co.***, 4.9 mi. E. junction Hwy 99 & 188 on 94, 26.I.78, C. Force, reared from *Y. whipplei* pods 6.III.78 (1♂ LACM). Junction Hwy 15 & S-13, 7.II.77, C. Force, reared from *Y. whipplei* pods 26.II.77 (2♀, 3♂ LACM). Hwy 79, Oak Grove, 29.VIII.76, C. Force, reared from *Y. whipplei* pods 5.II.77 (1♀, 2♂ LACM). Border, Cleveland National Forest, Hwy 78, 7.II.77, D.C. Force, reared from *Y. whipplei* pods 12, 19.II.77 (4♂ LACM). Rd 79, 2 mi. S. Julian, 7.II.77, C. Force, reared from *Y. whipplei* pods, 19, 26.II.77, 18.III.77 (1♀, 2♂ LACM).. Fallbrook, 2 mi. W., 7.II.77, C. Force, *Y. whipplei* pods — collected from (1♂ LACM); reared 12 (♂ CNCI LB-specm 2010-009), 29, 26.II.77 (3♀, 2♂ LACM); Fallbrook, 3 mi. E., 7.II.77, C. Force, *Y. whipplei* pods — collected from (5♀, 4♂, LACM); reared 12, 19.II.77, 5, 14.III.77 (6♀, 10♂ LACM). Fallbrook, 5 mi. W., 7.II.77, C. Force, *Y. whipplei* pods — collected from (4♀, 4♂ LACM); reared 12, 19, 26.II.77, 14, 18.III.77 (7♀, 4♂ LACM). Santa Ysabel, 0.5 mi. E., 7.II.77, C. Force, reared from *Y. whipplei* pods, 19.II.77 (1♂ LACM). Scissors Xing [Crossing], 3 mi. W.R. & A.R. Hardy (1♀ CASC). ***Tulare Co.***, Ash Mountain Kwh Power Station #3 — 9.IX.82, R.D. Haines (1♀, 1♂); 20.II.83, J.A. Halstead (1♀). **NEW MEXICO**: ***Chaves Co.***, Mescalero Sands, 3.VI.74, H. Evans (1♀ CSUC). ***Hidalgo Co.***, mile 4.1, Hwy 9, VII.98, Gates & Carey (1♀ UCRC). ***Valencia Co.***, 20 mi. W. Los Lunas, Carrizo Arroyo, 1-23.VIII.77, S. & J. Peck & M. Talong (1♂). **TEXAS**: ***Brewster Co.***, Big Bend National Park — through Canyon, 16.VI.91, R. Wharton (1♀); 0.5 mi. in Glenn Spring Road, 3000', 23.VI.82, G.A.P. Gibson (1♀); Panther Junction, 12 mi. SE, 2500', 10-16.VII.82, G.A.P. Gibson (1♀). ***San Patricio Co.***, Welder Wildlife Refuge near Verna Mills, 3.V.89, J. Heraty (1♂ UCRC). ***Travis Co.***, vicinity Long Hollow Creek, 30º27'43″N 97º52'19″W, 13.VII.94, on *Quercus virginiana*, M. Quinn, E. Riley & R. Wharton (1♀ TAMU). ***Zapata Co.***, Falcon State Park, 250', 5.VII.82, G. Gibson (1♂). **UTAH**: ***Washington Co.***, Shivwitts, 37.032ºN 113.913ºW, coll. 2.X.2003, em. 13.V.2005 [?], D.M. Althoff — ex *Prodoxus weethumpi* from fruit *Y. brevifolia*, #1469 (1♀), #1685 (1♀), #1688 (1♂); ex *Prodoxus sordidus* from inflorescence stalk *Y. brevifolia*, 1660 (1♂), 1659 (1♂), 1663 (1♀).

Uncertain species identity, excluded from type series. USA. **ARIZONA**: ***Cochise Co.***, Bisbee, 1.VI.33, Bryant, em. 1.VI.33 ex *Agave* weevil ? (1♀ CASC; ovipositor sheath: marginal vein length = 1.4×). ***Pinal Co.***, Ray, 1.III.14, H. Bar[?], par. in *Prodoxus* in stem of *Agave* (1♀ USNM; ovipositor sheath: marginal vein length = 1.3×). **CALIFORNIA**: ***Santa Clare Co.***, Stevens Creek Park, 15.II.76, R.T. Ross, ex *Baccharis* gall (1♀ UCDC; ovipositor sheath: marginal vein length = 1.07×). **TEXAS**: ***Travis Co.***, Austin, Bilker Park, 20.IX.86, J. Heraty (1♀ TAMU; ovipositor sheath: marginal vein length = 1.1×).

Etymology. From the Latin word *pervius* (affording a passage, or open) in reference to the linea calva of females that is often open posteriorly to the vanal area.

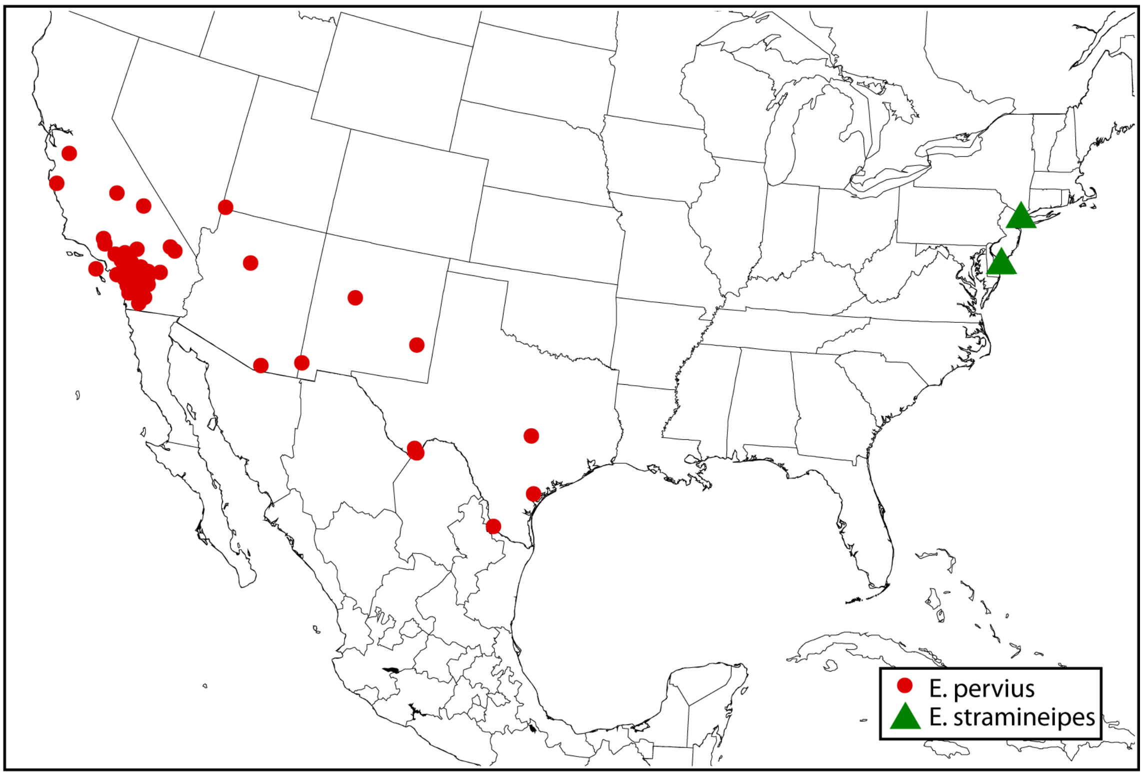
Description. FEMALE (Fig. 40). Length about 2.9−6.0 mm. Head (Fig. 30) mostly metallic green or green with blue to purple region laterally along inner orbit to variably distinctly and extensively dark mesally below ocelli and green to bluish-green laterally along inner orbit, and then also one or more of parascrobal region, interantennal region and clypeal region also variably extensively dark; maxillary and labial palpi dark brown. Antenna with scape usually dark with variably distinct metallic green luster though rarely dark orangey-brown apically; pedicel dark brown except usually for slight metallic luster, and flagellum dark brown. Mesosoma with tegula brown or dark with slight metallic luster, otherwise metallic green to bluish-green similar to head except lateral lobe dorsolongitudinally, scutellum variably extensively, and convex or concave part of medial mesoscutal lobe often dark to reddish-coppery and acropleuron often darker brown with less distinct metallic luster than mesonotum. Forewing hyaline; venation yellowish-brown; setae uniformly brownish or sometimes lighter in basal cell and on submarginal vein. Front leg with trochanter brown; femur dark brown or, more commonly, trochantellus and extreme apex lighter, usually yellowish; tibia often entirely yellowish or with dorsal and ventral brown regions, but sometimes brown in smaller specimens except knee and apically more widely yellowish; tarsus yellowish except for apical brown tarsomere to uniformly brown. Middle leg with dark mesotibial apical pegs and mesotarsal pegs, otherwise often yellowish to yellowish-orange at least beyond coxa and sometimes including coxa, or femur and tibia in part more distinctly brownish, but knee, tibia apically, and at least basal tarsomere lighter yellowish to white. Hind leg with trochanter yellowish to dark brown; femur with trochantellus and apex variably extensively yellowish to yellowish-orange, often more so dorsoapically, but at least about basal half dark brown; tibia usually more or less dark brown mesally with knee and up to about apical third yellowish to white, though sometimes more extensively yellowish at least ventrally; tarsus with at least basitarsus white and apical tarsomere brown, but tarsomeres 2−4 variably white to dark brown. Gaster entirely dark brown or at most with distinct metallic green luster anteriorly on basal tergum and laterally on terga, and with brown hairlike setae similar in color to cuticle; ovipositor sheaths with short dark basal region abruptly delineated from much lighter region, the lighter region sometimes almost uniformly yellowish to only very slightly brownish apically, but usually more or less distinctly differentiated into lighter colored medial region and darker brown apical region, with the darker apical region often definitely shorter than medial region.

Head (Fig. 30) with frons at least very finely, usually quite distinctly, meshlike reticulate to somewhat reticulate-imbricate, even mesally below anterior ocellus, and usually merged into parascrobal region through slight undulation though sometimes smoothly merged in smaller specimens; vertex variably transversely alutaceous-imbricate in smaller specimens to transversely reticulate or reticulate-strigose in larger specimens, but broadly rounded into occiput; scrobal depression reticulate-rugulose to transversely reticulate-strigose; IOD = 0.35−0.41× head width; OOL: POL: LOL: MPOD = 0.5−1.0: 2.1−3.0: 1.5−1.9: 1.0. Antenna with combined length of pedicel + flagellum about 1.1−1.2× head width; scape about 4.6−5.2× as long as wide, in outer view ventral margin often almost straight and angulate but sometimes slightly sinuate with very slender, inconspicuous flange over about apical half; pedicel in lateral view about 2.0−2.3× as long as wide; fl1 slightly transverse to quadrate; fl2 about 2.1−2.9× as long as wide and about 3.0−4.3× as long as fl1; subsequent funiculars increasing in width to slightly transverse or quadrate fl8; clava about 2.0−2.5× as long as wide, 0.8−0.9× combined length of apical three funiculars, and 0.25−0.33× length of funicle. Mesoscutum almost uniformly meshlike reticulate except lateral lobe more minutely coriaceous mediolongitudinally and mesoscutal medial lobe usually more transversely alutaceous-reticulate in smaller to reticulate-imbricate anteriorly in larger specimens. Scutellar-axillar complex with axillae obliquely alutaceous-reticulate to more coriaceous-imbricate, but at least scutellum mostly meshlike coriaceous to coriaceous- or somewhat reticulate-imbricate on either side of median. Prepectus extensively and usually quite conspicuously setose with slightly lanceolate white setae such that ventral-most line of setae close to ventral margin and/or apices of setae generally extend to ventral and/or dorsal margin (*cf.* Fig. 44). Acropleuron finely meshlike reticulate anterior and posterior of medial microsculptured region, the cells sometimes somewhat larger posteriorly than anteriorly but with flat surfaces defined by slightly raised ridges. Forewing (Figs 45−47) with linea calva usually continuous through vanal area or at least only narrowly closed by a few setae posteriorly, and then usually basal cell variably extensively bare apically adjacent to submarginal vein, mediocubital fold broadly bare, and often with variably distinct bare band extending at least partly along basal fold; costal cell (Figs 45−47) ventrally setose along length with 2 or 3 lines of setae medially, and dorsally bare or much more commonly setose apically along leading margin for distance usually little greater than length of parastigma or at most half length of cell; cc: mv: pmv: stv = 4.0−5.5: 3.7−5.5: 1.1−1.3: 1.0. Mesotibia with apical row of 4−6 pegs; mesotarsus ventrally with pegs on basal four tarsomeres, basitarsus with 12−18 pegs arranged distally in double row on either side, second tarsomere with 4−7, third tarsomere with 2−4, and apical tarsomere with 1 or 2 pegs on one side. Propodeum with U-shaped plical depression extending to foramen; callus variably densely and conspicuously setose, but often quite densely setose with comparatively long and slightly lanceolate white setae (Fig. 51). Gaster with inner plate of ovipositor extending at most extending slightly beyond apex; ovipositor sheaths about 0.77−0.97× length of metatibia and 0.84−1.2× length of marginal vein.

MALE (Fig. 60). Length about 1.8−3.6 mm. Head (Fig. 69) sometimes with at least scrobal depression dark, non-metallic or almost so, but at least frontovertex and gena under some angle of light variably distinctly and extensively metallic green to bluish-green; maxillary and labial palpi dark brown or apex of apical palpomeres at most yellowish-brown. Antenna dark brown except scape often and pedicel sometimes with slight metallic luster similar to head capsule. Mesosoma mostly metallic green to bluish-green similar to head, the tegula at least dark brown and often also variably distinctly metallic. Front leg mostly dark brown or dark with at least slight metallic luster similar to mesosoma except knee and tibia very narrowly apically, or posteroapical and anteroapical surfaces of tibia more widely yellowish to brownish-yellow, and tarsus yellow to dark brownish-yellow. Middle and hind legs dark except sometimes knees and apices of tibiae very narrowly, and basal 1−3 (usually basal 2 or 3) tarsomeres white. Forewing hyaline. Gaster with basal tergum sometimes metallic green to bluish-green basally, but remainder brown.

Head (Fig. 69) with frons shallowly but quite distinctly reticulate; scrobal depression extensively reticulate, the scrobes more finely meshlike coriaceous and interantennal region sometimes almost smooth and shiny; vertex rounded into occiput, often transversely reticulate-alutaceous to finely reticulate-strigose but without evident transverse carina. Head with IOD about 0.42−0.46× head width: OOL: POL: LOL: MPOD = 0.5−0.7: 2.6−3.2: 1.4−1.8: 1.0; lower face with sparse, straight white setae mesally, the setae between torulus and malar sulcus variably distinctly increasing in length but similarly sparse and evenly curved; gena with one much longer seta below malar sulcus. Antenna (Fig. 66) with scape ovoid, about 2.3−2.7× as long as maximum width, the outer surface ventrally with elongate, slender region of micropunctures along most or all of length of, but not basal to, scapular scrobe (Fig. 78); length of pedicel + flagellum about 1.1−1.3× head width; pedicel about 1.3−1.5× as long as wide, ventrally with line of 5 or 6 distally curved setae; flagellum slender but at least slightly clavate with short setae more or less appressed to flagellomeres so at least not appearing conspicuously, densely setose and often appearing quite sparsely setose; fl1 transverse, ringlike, but usually quite distinct and with at least a single line of setae; fl2 about 1.5−1.9× as long as wide and subsequent funiculars decreasing in length and increasing slightly in width to only slightly longer than wide to quadrate fl8; clava broadly oval with micropilose sensory region occupying entire ventral surface (usually collapsed in air-dried specimens), about 2.2−2.5× as long as wide and about 0.7−0.8× as long as apical three funiculars. Mesoscutum meshlike reticulate; axillae and scutellum more finely coriaceous-reticulate or slightly imbricate. Propodeum (Fig. 72) very finely meshlike coriaceous on either side of median carina, and callus coriaceous to coriaceous-alutaceous with setae originating from tiny bumps. Forewing with cc: mv: pmv: stv = 3.8−4.4: 3.0−3.7: 1.1−1.3: 1.0; costal cell dorsally with line of dark setae extending over only about apical one-quarter to one-third and ventrally with dark setae continuously along length, mesally with 1 line.

Distribution. Currently known only from southwestern USA (Map 12), but probably similar to the distribution of *Yucca* and its *Prodoxus* pollinators.



Map 12. Regional distribution of *E. pervius* (●) and *E. stramineipes* (▲).

Biology. Multiple rearings indicate *E. pervius* is at least primarily a parasitoid of *Prodoxus* Riley (Lepidoptera: Prodoxidae) pollinating *Yucca* L. (Agavaceae). The holotype and allotype were selected from the material obtained by Force and Thompson (1984), who reported it as a multivoltine, solitary, larval, facultative secondary ectoparasitoid of a "number" of *Prodoxus* species from seed pods and fruiting stalks of *Y. brevifolia* Engelmann, *Y. schidigera* Roezl, and *Y. whipplei* Torrey, and the stalks of *Y. schottii* Engelmann. They also stated that adults can be found throughout the entire year and discussed sex ratio, egg production and oviposition behavior. Some of the results were taken from Thompson (1980), who suggested that "at least two species of *Eupelmus*" were involved but without providing supporting data. One *E. pervius* female from Arizona was also supposedly reared from a *Macrancylus linearis* Le Conte (Coleoptera: Curculionidae) larva in a *Yucca* stem. The identification is based on forewing and prepectal setal pattern, but the female lacks its metasoma so that length of the ovipositor sheaths is unknown. See further under "Remarks" for other possible hosts.

Remarks. The paratypes from Utah are from the rearings by Althoff (2008). Females of *E. pervius* most closely resemble *E. cyaniceps* females because both typically have a more extensively and conspicuously setose prepectus (Fig. 40) and propodeal callus (Fig. 51) than *E. cushmani* females (Figs 42, 50). *Eupelmus pervius* appears to be supported as a distinct species from *E. cyaniceps* based on host biology (parasitoids of *Yucca* moths) and a difference in male flagellar structure/setation (see below). However, females are differentiated primarily by a single variable feature, forewing setal pattern, and correct identification of some females based on this single feature is uncertain. Females of *E. pervius* characteristically have the linea calva either completely open to the vanal area or only narrowly closed posteriorly by a few setae (Fig. 45). When the linea calva is narrowly closed the forewing also is characteristically less densely setose basally than the disc, the mediocubital fold being broadly bare, the basal cell more or less bare apically (usually as triangular area adjacent to the submarginal vein and basal fold), and often with a more or less developed bare region below the parastigma along the basal fold (Figs 45, 46). Typical females of *E. cyaniceps* have the forewing uniformly setose behind the marginal and submarginal veins, with the linea calva an obviously isolated bare band separated from the vanal area by several lines of setae including along the mediocubital fold (Fig. 48). This includes a single *E. cyaniceps* female from Arizona that was apparently reared from *Yucca*. In contrast, one female from Tallulah, Georgia, reared from *Lixus musculus* Say has an elongate linea calva open to the vanal area (*cf.* Fig. 45) similar to typical *E. pervius* females. Forewing setal patterns appear to by highly variable with no distinct separation between the two extremes of an open or broadly closed linea calva. Some females from western USA have ovipositor sheaths that are shorter than the marginal vein and a broadly closed linea calva similar to typical *E. cyaniceps* females, but to a greater or lesser extent the forewing is partly bare basally similar to those *E. pervius* females in which the linea calva is only narrowly closed by setae. Two females from California (San Gabriel Mountains) that were caught the same day in a Malaise trap with a male of *E. pervius* illustrate the variation. One of the females has its linea calva isolated from the vanal area by at least four lines of setae, but the basal cell and mediocubital fold are quite obviously bare (Fig. 46). The other also has the mediocubital fold broadly bare but the linea calva is isolated from the vanal area even more broadly by setae and the basal cell is only somewhat less densely setose than the disc (*cf.* Fig. 47). Unfortunately, both females lack their ovipositor sheaths, though based on the remaining ovipositor stylets the sheaths likely were the same length or slightly longer than the marginal vein. I include these two females within the type series of *E. pervius* in part because of their presumed sheath length and collection with a male identified as *E. pervius*. However, some other very similar females with slightly shorter ovipositor sheaths from Arizona, California and Texas I identify as *E. cyaniceps*. In contrast, one female from California and one from Texas I examined have extensively setose forewings similar to typical *E. cyaniceps* females, but ovipositor sheaths that are as long as the marginal vein and host associations that appear aberrant for the known biology of *E. pervius*. One was reared from a gall of *Baccharis* L. (Asteraceae) and the other has what appears to be a stem gall from some unidentified plant pinned with it. I exclude these two females from the type series of *E. pervius*, but list them above along with the length of their ovipositor sheaths relative to the marginal vein (in parenthesis) to bring attention to their uncertain species identity. Further, some females of *E. cushmani* from western USA, in particular those reared from *Acacia* seeds, very likely from bruchids, have a posteriorly open or very narrowly closed linea calva similar to *E. pervius* females. I include these females in *E. cushmani* because of their prepectal and propodeal setal patterns. However, because of the variability of females that I include in *E. pervius*, *E. cyaniceps* and *E. cushmani*, it is certainly possible that sibling species associated with specific hosts remain unrecognized under these three names. Two females from Arizona that I exclude from the type series and description of *E. pervius* are associated with *Agave* rather than *Yucca*, though possibly as parasitoids of *Prodoxus* and/or the agave weevil, *Scyphophorus acupunctatus* Gyllenhal (Coleoptera: Curculionidae). Although the linea calva is isolated from the vanal area by a few lines of setae the membrane below the parastigma is bare adjacent to the basal fold and the basal cell is obviously less setose than the disc similar to some females I include in *E. pervius*. The two females are at least as large as the largest females I include in the type series of *E. pervius* (about 6 mm in length), but have longer ovipositor sheaths (slightly longer than metatibia and about 1.3−1.4× length of marginal vein) and appear to have a somewhat more elongate-slender gaster with the apex of the hypopygium within its basal half rather than beyond its midline as for other females I include in *E. pervius*. However, these two females are insufficient to conclude whether the unusual features represent infraspecific variation within *E. pervius* correlated possibly with body size or a different host association, or indicate a separate sibling species.

As noted above, males of *E. pervius* differ from *E. cyaniceps* and other similar *urozonus*-group males by flagellar structure. Males of most *urozonus*-group species in North America have a conspicuously, densely setose, robust-filiform flagellum because the curved setae project obviously out from each flagellomere and the flagellum is at least of equal width if not tapered slightly distally (Figs 59–63, 65). In contrast, males of *E. pervius* have the flagellar setae more appressed to the flagellum so that this usually appears slightly clavate and certainly less conspicuously setose (Figs 64, 66). Flagellar structure and setation of *E. pervius* males is more similar to *E. annulatus* males, but these have different setal patterns of the lower face and costal cell, and the anterior and posterior surfaces of the mesotibia light-colored.

12. *Eupelmus* (*Eupelmus*) *pini* Taylor

Figs 20, 33; Map 13

Eupelmus pini Taylor, 1927: 205−207. Lectotype, female (USNM, examined), here designated. Lectotype data: "Ex. *Pissodes strobi* / Roslindale, Boston, Mass / R.L. Taylor coll. / Cotype No. 42028 U.S.N.M. / *Eupelmus pini* Taylor ♀ cotypes / Lectotype *Eupelmus pini* Taylor, Gibson 2011" [in terminal shoots of white pine taken October, 1926].

Eupelmus Aloysii Russo, 1938: 229−230. Syntypes, female (not examined). Type data: Italy, Salerno Prov., Pisciotta; five females reared from *Phloeotribus scarabaeoides* (Bern.). **N. syn.**

Eupelmus sculpturatus Nikol'skaya, 1952: 502 (1963: 515). Unknown type status, female (ZINR, not examined). Type data: Southern part of European part of USSR; western Europe. Synonymy with *E. aloysii* by Kalina, 1988: 3. **N. syn.**

Eupelmus suecicus Hedqvist, 1963: 137−138. Holotype, female (KHPC, not examined). Type data: Sweden, Uppland, Lovön; reared from *Hylesinus toranio* (Coleoptera: Scolytidae). Synonymy with *E. aloysii* by Bouček, 1968: 237. **N. syn.**

Eupelmus carinifrons Yang, 1996: 215−216, 326. Holotype, female (NWCF, paratype examined). Type data: Peoples' Republic of China, Beijing, Yunnan, Henan; ex *Cryphalus* sp. on *Pinus bungeana*, *Tomicus piniperda* on *Pinus yunnanensis* and *Phloeosinus aubei* on *Platycladus orientalis*. **N. syn.**

Description. FEMALE (Fig. 20). Length about 1.8−4.3 mm. Head of smaller specimens brown with limited green luster, but more commonly partly to almost entirely metallic green or bluish-green, the parascrobal and interantennal regions often with coppery luster under some angles of light and frontovertex usually at least obscurely non-metallic dark in part, with variably distinct, narrow dark band between posterior ocellus and inner orbit and/or dark band from posterior ocellus toward scrobal depression on either side of anterior ocellus, to more extensively dark between level of posterior ocelli and scrobal depression except variably extensively green along inner orbit and often with green spot or vertical band below anterior ocellus; maxillary and labial palpi dark brown. Antenna dark brown except scape and pedicel sometimes with variably distinct metallic luster. Mesosoma with tegula partly yellow to yellowish-brown with basal, outer, and apical margins variably widely brown; mesonotum of smaller specimens sometimes mostly brownish, but usually at least outer inclined surface of mesoscutal lateral lobe metallic green, the mesoscutum medially variably extensively reddish-brown to purple or violaceous and scutellar-axillar complex often green with coppery or reddish luster under some angles of light; acropleuron of small specimens sometimes with only slight metallic luster, but usually quite distinctly green at least anteriorly or green with coppery luster under some angles of light, and sometimes non-metallic brown or more blue to purple posteriorly. Forewing hyaline with dark brown setae and yellowish to brownish-yellow venation. Front leg with femur mostly variably brown except trochantellus and apex lighter, tibia narrowly yellow apically but otherwise at least dorsal and ventrally surfaces variably extensively darker brown, and tarsus yellow to brownish-yellow except for more distinctly dark apical tarsomere. Middle leg, including coxa, sometimes completely yellowish except for dark mesotibial apical pegs and mesotarsal pegs, but more commonly at least partly darker brown, the femur variably extensively, tibia at least narrowly subapically, and apical one or two tarsomeres. Hind leg sometimes with trochanter, but at least trochantellus and up to about dorsoapical half of femur yellowish, the remainder variably dark brown, tibia yellowish at least basally and apically and often dorsal and ventral surfaces yellowish or at least lighter in color than darker brown outer and inner surfaces, and tarsus yellowish except for apical one or two tarsomeres. Gaster usually entirely or mostly brown with slight coppery or green luster under some angles of light, most commonly anteriorly on basal tergum, and usually with quite conspicuous, very slightly lanceolate white setae; ovipositor sheaths distinctly banded, the medial yellowish region much longer than very short basal dark region and about twice as long as light to dark brown apical region.

Head with frons variably sculptured, sometimes almost entirely meshlike coriaceous in smaller specimens, to variably extensively reticulate to reticulate-imbricate, but at least coriaceous medially below anterior ocellus and near transverse undulation, and even in smallest specimens differentiated from parascrobal region by quite distinct undulation or transverse ridge; vertex transversely coriaceous-alutaceous in smaller specimens to transversely imbricate-strigose in larger specimens; scrobal depression shiny and smooth or only very finely coriaceous in part; IOD about 0.42−0.5× head width; OOL:POL:LOL:MPOD = 0.7−1.0: 2.3−3.2: 1.3−1.8: 1.0. Antenna with combined length of pedicel + flagellum = 1.2−1.3× head width; scape about 4.4−5.3× maximum width, in outer view ventral margin almost straight over basal half, with at most almost linear flange apically; pedicel in lateral view about 2.6−2.7× as long as wide; fl1 slightly transverse in smaller specimens to very slightly longer than wide; fl2 about 1.4−2.5× as long as wide and about 2.0−2.6× as long as fl1; subsequent funiculars increasing in width to slightly longer than wide fl8; clava about 2.6−2.77× as long as wide, about 0.8−1.1× combined length of apical three funiculars, and 0.3−3.7× length of funicle. Mesoscutum almost uniformly meshlike reticulate except lateral lobes more meshlike coriaceous with smaller cells dorsolongitudinally. Scutellar-axillar complex meshlike reticulate or scutellum laterally more reticulate-imbricate, the cells with distinctly raised inner but not outer edges. Prepectus completely setose with apices of very slightly lanceolate, white setae extending beyond ventral margin. Acropleuron comparatively coarsely sculptured, more or less reticulate-alveolate anterior and posterior of medial microsculptured region, with most cells somewhat concave rather than flat between distinct ridges and cells larger posteriorly than anteriorly. Forewing completely setose, without linea calva; costal cell ventrally setose with at least 3 lines along length toward leading margin, and dorsally with at least two lines of dark setae along leading margin and usually third line mesally over about apical half; cc: mv: pmv: stv = 4.0−4.5: 3.7−4.2: 1.2−1.5: 1.0. Mesotibia with apical row of 3 or 4 pegs; mesotarsus ventrally (Fig. 33) with pegs on basal four tarsomeres, basitarsus with about 12−17 pegs, distally the pegs varying in length so as to form slightly irregular row along either side, second tarsomere with row of 4−6 pegs, third tarsomere with 2 or 3 pegs apically, and fourth tarsomere with 1 or 2 pegs apically on either side. Propodeum with U-shaped plical depression extending to foramen; callus with quite sparse white setae not obscuring cuticle or sculpture. Gaster with inner plate of ovipositor not extending beyond apex; ovipositor sheaths about 0.8−0.85× length of metatibia and 0.85−0.96× length of marginal vein.

MALE (based on single extralimital specimen). Length 2 mm. Head metallic green; maxillary and labial palpi yellow. Antenna with scape extensively yellowish but darker brown dorsoapically; pedicel and flagellum dark brown. Mesosoma metallic green similar to head, except tegula brownish to more distinctly yellowish-hyaline laterally and apically. Legs mostly yellowish beyond coxae, but mesofemur along most of ventral length and apical 2 tarsal segments dark. Forewing essentially hyaline but with very slight, inconspicuous infuscation over setose area behind marginal vein. Gaster with basal tergum having slight metallic green luster basally, but remainder brown.

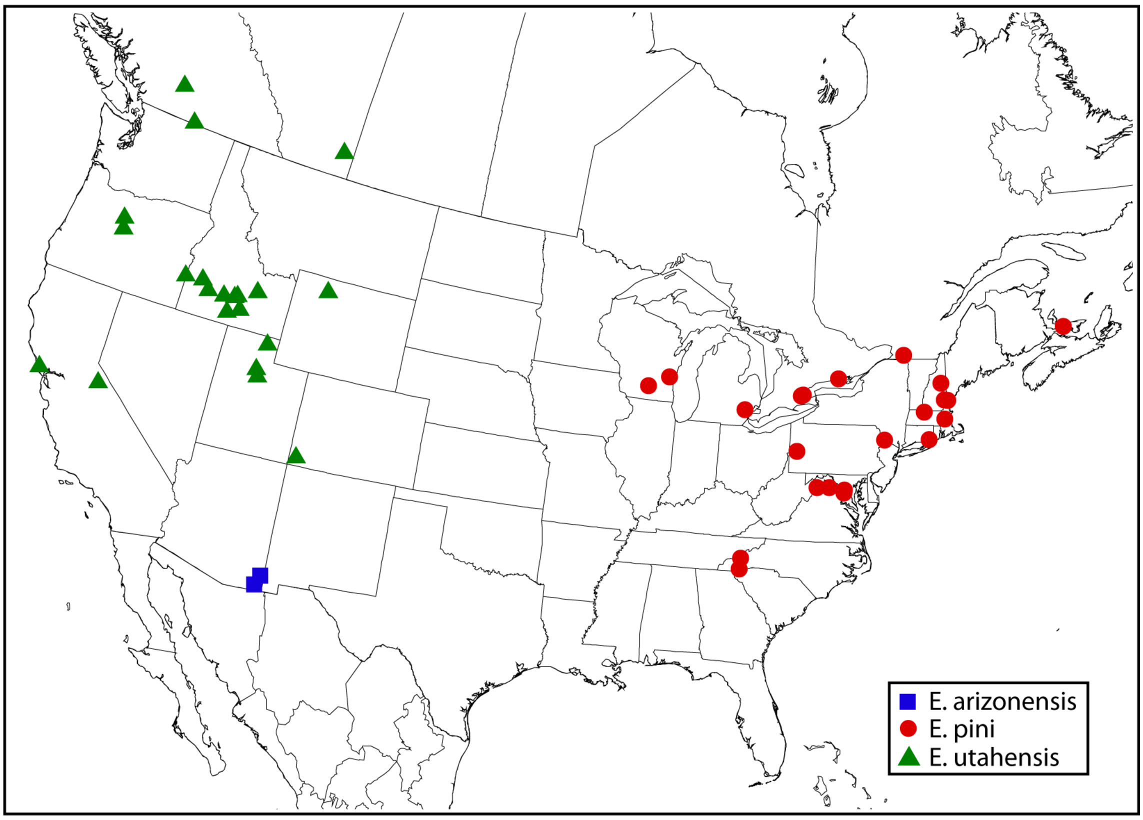
Head with frons and scrobal depression quite strongly and distinctly meshlike reticulate. Head with IOD about 5× head width; OOL: POL: LOL: MPOD = 1.5: 3.2: 1.5: 1.0; lower face with uniformly distributed, short, white setae except for one distinctly longer seta below malar sulcus. Antenna with scape ovoid, about 2.5× maximum width; the outer surface mostly smooth and shiny, with only single line of obscure micropunctures ventrobasal to scapular scrobe; length of pedicel + flagellum about 2× head width; pedicel about 1.3× as long as wide, ventrally with 4 distally curved setae in a line; flagellum elongate-filiform with conspicuously projecting curved setae (*cf.* Fig. 56); fl1 very strongly transverse, disc-like, and at least superficially bare; fl2 about 3.5× as long as wide and apical funiculars only slighter shorter, fl8 about 3× as long as wide; clava lanceolate, about 1.75× as long as last funicular. Mesonotum with mesoscutum distinctly meshlike reticulate similar to frontovertex, but scutellum with shallower sculpture and more reticulate-imbricate laterally. Propodeal plical region finely meshlike coriaceous on either side of median carina, and callus similarly sculptured. Forewing with cc: mv: pmv: stv = 3.7: 3.3: 1.2: 1.0; costal cell dorsally with line of setae extending over about apical third, and ventrally with setae continuous along length, mesally with 2 lines.

Regional material examined (45♀). CANADA. **ONTARIO**: Ancaster, 10-23.VIII.91, DeJong, MT (1♀). Brighton, 21.VI.55, A.P. Arthur (1♀). Dundas Valley near Ancaster, 26.VII.93, 15.VIII.93, B. DeJonge, MT ex black walnut (2♀). Hamilton, 19-28.VIII.80, M. Sanborne (1♀, CNC Photo 2010-60). **PRINCE EDWARD ISLAND**: Crapaud, 10.VII.91, E.E.M. Smith (1♀). **QUÉBEC**: St. Clothilde, AAFC [Agriculture & Agri-Food Canada], 45E10'05"N 73E40'53", 30.VII-13.VIII.2001, 60 m, L. Black & H. Goulet (1♀).

USA. **CONNECTICUT**: ***New London Co.***, Groton, 25.VI.48 (1♀ NHRS). **MARYLAND**: ***Montgomery Co.***, Plummers Island, 1.IX.50, K.V. Krombein (1♀ USNM). ***Prince George's Co.***, Patuxent Research Station, 27.VII.86, D. Wahl (1♀). **MASSACHUSETTS**: ***Franklin Co.***, Erving, 12.VII.33, 37-12733, coll. J.P.M. (2♀ USNM). ***Suffolk Co.***, Boston, Roslindale, R.L. Taylor, ex *Pissodes strobi* (♀ lectotype of *E. pini*). **MICHIGAN**: ***Wayne Co.***, Livonia, Bicentennial Park, 42E25.77N 83E23.71W, 237 m, 30.VI.04, on dying ash tree, M. Gates, G. Gibson (1♀). **NEW HAMPSHIRE**: ***Carr Co.***, 1 mi. N. Wonalancet, E. Fk. Spring Brk. [East Fork Spring Brook], 1900', 22.VI-1.VII.85, D.S. Chandler (1♀ DENH). ***Rockingham Co.***, Northwood, 2 mi. SE, 31.VIII-2.IX.82, A.T. Eaton (1♀ DENH). ***Strafford Co.***, Durham — 22.II.54, W.J. Morse, reared from *Rhus* (1♀ USNM); 17.IV.54, J.G. Conklin, reared from weeviled W. [white] pine (1♀ USNM); 25.VI.65, 7.VII.65, collected on apple tree bark, W.J. Morse (6♀ DENH). **NORTH CAROLINA**: ***Haywood Co.***, GSMNP [Great Smoky Mountains National Park], The purchase near house, N35.35.8 W83.4.23, 1945', 12-18.2004, cut lawn-forest edge, Steck, Sutton & Super (1♀ UCFC). ***McDowell Co.***, 37E00'N 81E30'W, VII-IX.87, 9.VII-17.XI.87, FIT, Oak-Rhododendron, BRC Hym. Team (2♀). ***Jackson Co.***, Whiteside Mountain, near Highlands, 1600 m, VII-13.IX, BRC Hym. Team (1♀). **PENNSYLVANIA**: ***Butler Co.***, Cranberry Township, 40E40'52.15"N 80E05'53.13"W, 23.IX.2008, ex *Fraxinus pennsylvanica* bark infested with EAB, J. Wildonger (1♀). ***Pike Co.***, Milford, A.D. Hopkins, Hopk. U.S. 2652a (1♀ USNM). **VIRGINIA**: ***Clarke Co.***, Univ. Va. Blandy Experimental Farm, 2 mi. S. Boyce, 20.V-1.VI.95 (1♀), 8-27.VIII.80 (2♀), D.R. Smith. ***Fairfax Co.***, near Annandale, D.R. Smith, MT — 3850'N 77E12'W, 20-26.V.2001 (1♀ USNM); 14-20.VI.87 (1♀), 12-18.VII.87 (1♀), 17-23.VII.88 (1♀, CNC Photo 2010-20), 20-26.VII.89 (1♀), 27.VII.86 (1♀), 2-8.VIII.87 (1♀), 16-22.VIII.87 (1♀ USNM), 13-19.VIII.89 (1♀), 25-31.VIII.91 (1♀). **WISCON-**

SIN: ***Dane Co.***, Madison, UW campus picnic point, 16-19.IX.99, N.D. Flowers & M.S. Mackay, abandoned apple orchid (1♀ IRCW). ***Fond du Lac Co.***, T13N, R19E S23, 9.IX-2.X.75, Gypsy moth-M.T. (1♀ IRCW).

Distribution. Fusu (2009) stated that this species is very rarely collected but is widely distributed in Europe from Italy and Spain in the south to Sweden in the north. I examined 14 specimens from Austria, France, Czech Republic, England, Hungary and Spain as well as 3 females from the eastern Palaearctic region in China and South Korea (CNC). Consequently, *E. pini* might be a naturally Holarctic species, though perhaps more likely it was introduced accidentally into northeastern North America (Map 13).



Map 13. Regional distribution of *E. arizonensis* (■), *E. pini* (●) and *E. utahensis* (▲).

Biology. *Eupelmus pini* was reared in Italy as an early instar larval parasitoid of the introduced citrus longhorn beetle, *Anoplophora chinensis* (Förster) (Coleoptera: Cerambycidae) (Haack *et al.* 2010). Duan *et al.* (2009) also collected a single female associated with the emerald ash borer, *Agrilus plannipennis* Fairmaire (Coleoptera: Buprestidae) on ash trees in Pennsylvania and subsequently induced females to parasitize late instar larvae. However, most definitive rearing records are from bark beetles (Coleoptera: Scolytidae). The mixed type series of *E. pini* was reared from white pine, *Pinus strobus* L., which was infested with *Pissodes strobi* (Peck). The type series of *E. aloysii* was reared from *Phloeotribus scarabaeoides* (Bernard), that of *E. suecicus* from *Hylesinus toranio* (Danthoine), and that of *E. carinifrons* from *Cryphalus* sp., *Phloeosinus aubei* Perris, and *Tomicus piniperda* (L.). Fusu (2009) also reported the species from *Scolytus* spp., *Pityogenes bistridentatus* (Eichhoff), and *Pityophthorus buyssoni* Reitter. Two other collection records suggest some association with apple trees.

Remarks. Females of *E. pini* are readily distinguished from all other North American and European species of *E.* (*Eupelmus*) by the absence of a linea calva from the forewing (e.g. Russo 1938, fig. CXXI; Hedqvist 1963, fig. 73) in addition to having the acropleuron more strongly reticulate-alveolate (Fig. 20) than females of other species.

Taylor (1927) described *E. pini* from five female syntypes that were stated to be in the Bussey Institution, Forest Hills, Boston, MA, but three of the syntypes are in the USNM. Based on these three females *E. pini* was described from a mixed type-series. One of the females is *E. pini*, in the present sense, whereas the other two are *E. annulatus*. I hereby designate the former female, the only one having the label "*Eupelmus pini* Taylor ♀ cotypes", as lectotype of *E. pini* in order to establish the identity of the name and resolve synonymy. The lectotype mesosoma is mounted dorsoventrally by a minutien pin through the scutellum and has the head and gaster detached but glued to the cork mount into which the minutien pin is fixed. This female was in the type collection of the USNM, whereas the other two females were in the general collection. I do not know who decided which female to place in the type collection, but the newly designated lectotype most closely fits the original description based on the head being "purple between scapes and eyes" and the acropleuron (= mesoepisternum *sensu* Taylor) being described as "rugose medially to coarsely reticulate posteriorly and finely reticulate anteriorly". Furthermore, the lateral image of *E. pini* given in Taylor (1929, fig. 1) shows the ovipositor sheaths as obviously shorter than the marginal vein (Fig. 20), whereas the ovipositor sheaths are at most only very slightly shorter than the marginal vein in *E. annulatus* females (Fig. 36). The figure is not detailed enough to be certain whether the forewing is drawn without a linea calva, though Taylor (1929) obviously missed the presence of a linea calva in the *E. annulatus* females of the mixed type series.

I have not seen any males of *E. pini* from North America, though Fusu (2009) reared a single male in Romania that he described and imaged (Fusu 2009, fig. 2c) under the name *E. aloysii*. My concept and description of *E. pini* males is based on another male he identified plus his published description of the male. Comparison of his description with the male at hand indicates some variation in the extent the scape, mesofemur and metafemur are darkened, which is taken into account for the key features. Males might most easily be confused with those of *E. microzonus* or perhaps *E. dryorhizoxeni* because of their extensively light colored legs and filiform flagellum, but as noted by Fusu (2009) males of *E. pini* have unusually long flagellomeres for a species of *E.* (*Eupelmus*). A relatively much longer marginal vein and somewhat different color pattern also differentiates them from *E. microzonus* (Fig. 53) males, and the absence of a lanceolate micropunctate region ventrobasal to the scapular scrobe from males of *E. dryorhizoxeni* (Fig. 73).

Examination of 1 of 11 paratypes of *E. carinifrons* determined that this name is a junior synonym of *E. pini*. I did not examine type material of the other three names newly synonymized under *E. pini*, but the synonymies are based on the original description and habitus image of *E. aloysii* by Russo (1938, fig. CXXI) and the synonymy of *E. sculpturatus* and *E. suecicus* under *E. aloysii* by previous authors.

13. *Eupelmus* (*Eupelmus*) *stramineipes* Nikol'skaya

Figs 17, 18, 52; Map 12

Eupelmus stramineipes Nikol'skaya, 1952: 498 [Russian], 512 [English]. Syntypes, both sexes (ZINR, not examined). Type data: USSR: Soviet Central Asia.

Eupelmus velenceensis Erdős, 1955: 36 [Hungarian], 45 [Latin]. Lectotype female, designated by Thuróczy, 1992: 140 (HNHM, not examined). Type data: Hungary: Gárdony. Synonymy by Bouček, 1965a: 546.

Description. FEMALE (Fig. 17) Length about 2.8–3.5 mm. Head metallic green with variably extensive coppery luster under some angles of light; maxillary and labial palpi yellowish-white. Antenna dark brown except scape with metallic green luster under some angles of light. Mesosoma metallic green to bluish-green except tegula yellow, depressed posteromedian portion of mesoscutum and lateral panel of pronotum sometimes with coppery luster, acropleuron more brownish with limited green luster under some angles of light, and propodeal plical region brown. Forewing hyaline with yellowish-brown setae similar to venation. Legs yellow beyond coxae except for dark mesotarsal pegs, small subbasal brownish region on all tibiae, and apical tarsomere of at least metatarsus. Gaster similar in color to mesosoma except hypopygium brown and dorsally sometimes brown or with limited coppery luster under some angle of light, and with comparatively inconspicuous hairlike setae; ovipositor sheaths with about basal third dark brown, the apical two-thirds yellowish to variably distinctly brownish distally, but without distinctly delineated apical brown region.

Head with frons largely meshlike coriaceous and smoothly, indistinguishably merged into parascrobal region, but vertex more transversely coriaceous-alutaceous to somewhat imbricate posteriorly; scrobal depression slightly more strongly sculptured than frons, shallowly reticulate to reticulate-punctate; IOD about 0.4× head width; OOL: POL: LOL: MOD = 0.8: 2.2: 1.4: 1.0. Antenna with combined length of flagellum + pedicel about 1.25–1.3× head width; scape about 3.2× as long as maximum width, in outer view ventral margin distinctly sinuate in ventral half, delineating expanded flange subbasally; pedicel in lateral view about 2.5× as long as wide; f1 about 1.25–1.3× as long as wide, and about 0.45× length of pedicel; f2 about 1.8–1.9× as long as wide and 1.4–1.7× as long as f1; subsequent funiculars increasing in width to slightly transverse fl8; clava about 1.5–1.7× as wide as long, 0.7–0.8×

combined length of apical three funiculars, and 0.25–0.3× length of funicle. Mesoscutum almost uniformly meshlike coriaceous to very slightly reticulate-coriaceous except lateral lobe minutely coriaceous dorsolongitudinally. Scutellar-axillar complex with axillae reticulate to reticulate-imbricate, but scutellum meshlike coriaceous, the cells similar in size to dorsolongitudinal cells on lateral lobe. Prepectus bare. Acropleuron very finely, meshlike coriaceous anterior and posterior of medial microsculptured region, the cells larger posterior than anterior of the medial region. Forewing setose except for linea calva; costal cell ventrally setose with at least 3 lines along length toward leading margin and dorsally with line of whitish setae near leading margin over about apical two-thirds; cc: mv: pmv: stv = 3.9–4.3: 3.6–4.0: 1.6–1.7: 1.0. Mesotibia without apical pegs (Fig. 18); mesotarsus ventrally with brownish rather than black pegs on basal three tarsomeres, the basitarsus with about 20–25 pegs arranged in irregular double row over most of length on either side, second tarsomere with 6–8 pegs and third tarsomere with 3 or 4 pegs in row on either side. Propodeum with short plical region and median carina behind dorsellum, the V-like plical depression not extending to foramen, callus with comparatively sparse white setae not concealing cuticle or sculpture. Gaster with inner plate of ovipositor not extending beyond apex; ovipositor sheaths about 0.6–0.7× length of marginal vein and about 0.5–0.6× length of metatibia.

MALE (Fig. 52). Length about 3 mm. Head metallic green to bluish-green with coppery luster on frontovertex under some angles of light; maxillary and labial palpi white. Antenna dark brown except about ventral half of outer surface of scape (concave portion) light colored, yellowish to white. Mesosoma metallic green except tegula yellow, mesoscutal medial lobe and axillae anteriorly, and scutellum laterally, with purple luster under some angles of light, and mesopleuron with acropleuron and band along anterior margin of femoral depression and transepisternal line brownish. Legs extensively yellowish beyond coxae, the pro- and mesofemur dark brown ventrally over most of length, the mesofemur also slightly brownish dorsally, and metafemur more extensively brown, yellowish only basally, apically, and narrowly long ventral surface; tibiae, except variably widely basally and apically, brown dorsally and ventrally with lateral surfaces yellowish; and tarsi with apical tarsomeres brownish. Forewing hyaline. Gaster with basal tergum metallic green, the remainder brown.

Head with frons meshlike coriaceous to very slightly reticulate, the scrobal depression slightly more distinctly reticulate. Head with IOD about 0.5× head width; OOL: POL: LOL: MPOD = 0.8: 2.8: 1.5: 1.0; lower face with sparse white setae below torulus and with one longer seta laterally above malar sulcus opposite long seta on gena below malar sulcus near base of mandible. Antenna with scape ovoid, about 2.25× as long as maximum width, with broad scapular scrobe and broad micropunctate region extending almost entire length of scape; length of pedicel + flagellum at most about 1.2× head width (approximate because flagellum curved); pedicel about 2.4× as long as wide, subequal in length to basal two flagellomeres, and with about ten, straight to only slightly distally curved setae along ventral margin; flagellum short-clavate with very short, dense setae not extending conspicuously from flagellomere; fl1 setose, slightly longer than wide and only slightly shorter than fl2; fl2 about 1.2× as long as wide and subsequent funiculars decreasing in length and increasing in width to transverse (1.6× as wide as long) fl8; clava broadly oval with micropilose sensory occupying entire ventral surface, about 1.3× as long as wide and about as long as apical three funiculars. Mesonotum and axillae finely, meshlike reticulate; scutellum broadly coriaceous mesally to very slightly imbricate laterally, but without differentiated frenum. Propodeal plical region finely meshlike coriaceous on either side of median carina, and callus similarly coriaceous with setae originating from tiny bumps. Forewing with cc: mv: pmv: stv = 3.7: 2.6: 1.5: 1.0; costal cell dorsally with line of dark setae extending over about apical two-thirds, and ventrally with dark setae continuously along length, mesally with at least 3 lines.

Regional material examined (4♀, 1♂). USA. **DELAWARE**: ***Sussex Co.***, Dewey Beach, 27.VIII-1.IX.72, L. Knutson, Malaise Trap (3♀, 1 ♂ USNM; ♀ CNC Photo 2010-9, ♂ CNC Photo 2010-10). **NEW YORK**: ***Richmond Co.***, Staten Island, 21.VI.74, B. Saffer (1♀ FSCA).

Distribution. Known only from coastal Delaware and New York (Map. 12). Based on its regional distribution, *E. stramineipes* was undoubtedly introduced accidentally into the USA from the Palaearctic region sometime prior to 1972. Noyes (2010) listed 11 countries in Europe and central Asia for its distribution.

Biology. Unknown from region, but in Europe reared from *Phragmites* Adanson (Poaceae), including the common reed *Phragmites australis* (Cavanilles) [= *P. communis* (Trinius)] (Bouček 1965a, 1977).

Remarks. My concept of the name *E. stramineipes* is based on two females and one male reared from *Phragmites* in Romania by Lucian Fusu (AICF) who identified them following comparison with a female paralectotype of *E. velenceensis*. Females of *E. stramineipes* are uniquely differentiated from other regional species by their color pattern (head and body primarily green but palpi yellowish-white and tegula and legs beyond coxa yellow, Fig. 17) in combination with absence of mesotibial apical pegs (Fig. 18). Males (Fig. 52) are also differentiated by color of the labiomaxillary complex, tegula, and legs in combination with a comparatively short and strongly clavate flagellum. In addition, the scape has an unusually broad micropunctate sensory region that extends almost the entire length of the scape, being even larger than that illustrated for *E. annulatus* (Fig. 80), and the long pedicel has an unusually large number of straight or only very slightly distally curved setae along its ventral length.

The short plical region behind the somewhat V-shaped propodeal plical depression, bare prepectus, lack of mesotibial pegs, and more brown than black mesotarsal pegs in females all suggest that *E. stramineipes* represents a comparatively basal clade of *E.* (*Eupelmus*) that retains several symplesiomorphic features resembling those of females of *E.* (*Episolindelia*).

14. *Eupelmus* (*Eupelmus*) *utahensis* Girault

Figs 34, 35; Map 13

Eupelmus cyaniceps utahensis Girault, 1916b: 244. Syntypes, 2 females (USNM, examined). Type data: USA: Utah, American Fork, July.
Eupelmus utahensis; Burks, 1979: 884.

Description. FEMALE (Fig. 34). Length about 2.0−4.3 mm. Head partly to entirely metallic green to bluish-green, though usually with variably extensive dark purple to black markings on some or all of: interantennal region, clypeal region, lower face adjacent to malar sulcus, parascrobal region, upper face variably widely mesally below anterior ocellus and sometimes along inner orbit, between anterior ocellus to posterior ocelli, between posterior ocelli and inner orbit, and within ocellar triangle; maxillary and labial palpi dark brown. Antenna dark brown, the scape and pedicel usually with metallic green luster under some angles of light. Mesosoma with tegula brown and often with slight metallic luster; otherwise mostly metallic green to bluish-green similar to head, though lateral lobe usually dorsolongitudinally and sometimes convex anterior part and/or concave posterior part of medial lobe and scutellum partly dark. Forewing hyaline or sometimes slightly brownish behind mv and stv; venation yellowish-brown; setae variably distinctly brown beyond level of parastigma, but at least more yellowish to white within basal cell, on submarginal vein, and within cubital cell except possibly apically. Front leg with trochanter dark brown; femur sometimes with trochantellus partly yellowish but otherwise dark brown or with slight metallic luster similar to mesosoma except for extreme apex; tibia mostly dark brown except extreme base and apex or apex more extensively yellowish, often more so on anterior or posterior surfaces, but at least extensively brown rather than with dark bands dorsally and ventrally; and tarsus yellowish except for pulvillus or sometimes with apical for one or 2 tarsomeres brown. Middle leg sometimes entirely yellowish-orange beyond coxa except knee and apex of tibia usually somewhat lighter and mesotibial apical pegs and mesotarsal pegs black, but more often trochanter, trochantellus, tibia variably extensively subbasally, and 1−3 apical tarsomeres brown. Hind leg with color pattern similar to front leg, the tibia extensively brownish and only rarely almost completely yellowish ventrally. Gaster often with distinct metallic green to bluish lusters anteriorly on basal tergum and laterally on terga, but mostly dark brown and with white hairlike setae contrasting quite conspicuously with dark cuticle (Fig. 35); ovipositor sheaths with very short dark basal region abruptly delineated from much longer lighter colored apical region, the lighter colored region sometimes almost uniformly yellowish but usually graduated variably darker brown apically.

Head with frons entirely, finely, meshlike coriaceous to level of posterior ocelli or sometimes somewhat imbricate to very slightly imbricate-reticulate along inner orbit, but merged into parascrobal region though at most very slight undulation; vertex transversely alutaceous-reticulate to reticulate-imbricate posteriorly, and rounded into occiput; scrobal depression reticulate-rugulose; IOD = 0.37−0.4× head width; OOL: POL: LOL: MPOD = 0.7−0.8: 2.3−2.5: 1.5−1.6: 1.0. Antenna with combined length of pedicel + flagellum = 1.3−1.4× head width; scape about 4.4−5.5× as long as wide, in outer view ventral margin almost straight to slightly sinuate with very slender flange over at least apical half; pedicel in lateral view about 1.9−2.3× as long as wide; fl1 transverse (up to about 1.6× as wide as long) to subquadrate; fl2 about 1.6−2.0× as long as wide and about 2.6−3.5× as long as fl1; subsequent funiculars increasing in width to slightly longer than wide fl8; clava about 2.6−2.9× as long as wide, 0.74−0.86× combined length of apical three funiculars, and 0.27−0.33× length of funicle. Mesoscutum almost uniformly meshlike reticulate except lateral lobe more minutely coriaceous mediolongitudinally and mesoscutal medial lobe usually more transversely reticulate-imbricate anteriorly. Scutellar-axillar complex with axilla reticulate to obliquely reticulate-imbricate and scutellum more longitudinally coriaceous to reticulate-imbricate on either side of median. Prepectus with white hairlike to slightly lanceolate setae, the setal apices not extending beyond margins and usually with quite distinct dorsal and even broader ventral bare band. Acropleuron meshlike reticulate anterior and posterior of medial microsculptured region, the cells somewhat larger posteriorly than anteriorly but with flat surfaces defined by slightly raised ridges. Forewing with linea calva but disc and basal cell otherwise uniformly setose; costal cell ventrally setose along length with 2 or 3 lines of setae medially, and dorsally with line of setae near leading margin over at least apical half, though comparatively inconspicuous because of light color except apically; cc: mv: pmv: stv = 3.6−4.2: 3.2−3.7: 0.9−1.1: 1.0. Mesotibia with apical row of 5−7 pegs; mesotarsus ventrally with pegs on basal four tarsomeres, basitarsus with about 9−16 pegs arranged distally in double row on either side, second tarsomere with 3−6, third tarsomere with 2−3, and apical tarsomere with single apical peg on either side. Propodeum with U-shaped plical depression extending to foramen; callus variably densely setose with, white, slightly lanceolate setae often obscuring cuticle. Gaster with inner plate of ovipositor extending at most slightly beyond apex by distance about equal to maximum width of ovipositor sheath; ovipositor sheaths about 1.0−1.16× length of metatibia and about 1.3−1.7× length of marginal vein.

MALE. See under “Remarks”.

Material examined (43♀, 8♂). CANADA. **ALBERTA**: Medicine Hat, 13.V.80, G. Gibson (1♀). **BRITISH COLUMBIA**: 15 road km NW Lower Nicola, 11.VII.88, J.A. Santiago-Blay, ex *Artemisia tridentata* gall, emerged after 27 days (1♀ USNM). Osoyoos, Mount Kobau, 990 m, 8-13.VII.91, D. Blades, C. Maier, SOCAP-MM3 (1♀, CNC Photo 2010-21).

USA. **ARIZONA**: Casey bequest (1♀ USNM). **CALIFORNIA**: ***Los Angeles Co.***, 0.5 mi. N. of Mile High and S. of Largo Vista, Angeles National Forest 5180', T4N, R9W, S4, 1, 7, 22.V.96, 13.III-9.IV.97, R. Goeden & J. Teerink, reared as parasite of *Oxyna palpalis* in bud gall of gall midge on branch of *Artemesis tridentata* (6♀ UCRC). ***Tuolome Co.***, Stan. Natl For. [Stanilaus National Forest], Hayes Station, 38º20'28″N 119º46'56″W, 6127', 16.VII.2006, Jeffrey Pine/meadow, S. Fullerton, E. Zoll, S. Kelly & P. Russell (1♀ UCFC). **COLORADO**: ***Montezuma Co.***, Arriola, 3 mi. W., 6000', T. Marquardt (1♀ CSCU). **IDAHO**: ***Ada Co.***, 12 mi. NW Regina, 11.VII.52, W.F. Barr, *Helianthus* (1♀ WFBM). ***Blaine Co.***, 3 mi. W. Carey, 21.VI.68, R. G. Jones, *Artemesia tridentata* (4♀ WFBM). ***Butte Co.***, 6 mi. S. Howe, 1.VII.81, M. Stafford (2♀ WFBM). ***Camas Co.***, 12 mi. S. Fairfield, 25.VI.68, R.G. Jones, *Artemesia tridentata* var. *vaseyana* (2♀ WFBM). ***Elmore Co.***, 3mi. N. Mountain Home, R.G. Jones, reared from *Artemesia tridentata* — 18.V.68, ex 19-22.V.68 (1♂ WFBM); 24.III.69, ex 12.IV.69 (5♂ WFBM). ***Lincoln Co.***, 11 mi. N. Richfield, 7.VII.68, R.G. Jones, reared from gall of *Artemesia tridentata* 10.III.69 (3♀, 2♂ WFBM). ***Minidoka Co.***, Adelaide, 21.VII.27, W. Carter, *S.* [*Sorbus* ?] *filipes*, 4395 SAR (1♀ USNM). ***Twin Falls Co.***, 5.5 mi. E. Twin Falls, 5.VI.68, R.G. Jones, *Artemesia tridentata* var. *tridentata* (3♀ WFBM). **OREGON**: ***Deschutes Co.***, Smith Rock, 9.VII.83, P. Hanson, ex *Eutreta diana* (4♀). ***Jefferson Co.***, Warm Springs, 3 mi. W., Hwy 26, 22.VI.88, R.H. Velten (1♀). ***Malheur Co.***, Succor Creek State Recreation Area, 20.VII.82, J.B. Johnson & R.L. Gillespie, possibly assoc. with Tephritidae (2♀ WFBM). **UTAH**: ***Cache Co.***, Logan Canyon between 3rd Dam + Temple Fork Road, 15.IV.200, P.J. Russell (1♀ UCFC). ***Salt Lake Co.***, 3.VII.13, 17.XI.13,17.I.14, Timberlake, on tephritid in *Artemesia* (4♀ UCRC). ***Utah Co.***, American Fork, VII (2♀ syntypes of *E. utahensis*, USNM Type and Paratype No. 20092). **WYOMING**: ***Park Co.***, N. side of Buffalo Bill reservoir, 19.VII.57, sagebrush gall (1♀ USNM).

Specimens of uncertain species identity. **CALIFORNIA**: ***Inyo Co.***, Grays Meadow Camp, 6000', 14.VII.85, A.S. Menke (1♀ USNM). ***Lassen Co.***, Hallelujah Junction, 28.VII.76, R.M. Bohart (1♀ UCDC). **OREGON**: ***Deschutes Co.***, Terrebonne, 4.4W., 19.VII.86, P. Hanson (1♂). ***Malheur Co.***, Sucker Creek Canyon, 15-18.VI.51, B. Malkin (1♀ CASC).

Distribution. Although relatively rare, widely distributed from about 37º–50ºN in western North America (Map 13).

Biology. Primary parasitoid of Tephritidae (Diptera), including *Metatephritis fenestrata* Foote on *Artemesia nova* A. Nelson (black sagebrush) (Fronk *et al.* 1964), *Oxyna palpalis* (Coquillett) inquiline in rosette galls of *Rhopalomyia florella* Gagné (Diptera: Cecidomyiidae) on *Artemisia tridentata* Nuttal (common sagebrush) (Goeden 2002), and *Eutreta diana* (Osten Sacken) and likely other Tephritidae on *Artemisia* L. (Asteraceae) (Santiago-Blay 1989).

Remarks. *Eupelmus utahensis* has quite a different host range than *E. annulatus*, but females are morphologically very similar to each other. Among other features individuals share comparatively long ovipositor sheaths with a similar color pattern (*cf*. Figs 34, 36) as well as an entirely or mostly coriaceous frons (*cf*. Fig. 27) and quite a distinct though slender flange along the ventral margin of the scape in outer view. Perhaps the most conspicuous difference between females of the two species is that in *E. annulatus* at least the gastral setae are similarly brown as the cuticle and therefore not very conspicuous (Fig. 36), whereas in *E. utahensis* the gastral setae are white in quite a distinct contrast to the dark brown cuticle (Figs 34, 35). However, this may be less conspicuous in smaller or dirty specimens and the gastral setae may be whitish in some females of other species (see further below). Females of *E. utahensis* also have even longer ovipositor sheaths than females of *E. annulatus*, being at least as long (1.0−1.16×) as the hind tibia and obviously longer (1.3−1.7×) than the marginal vein as compared to at least slightly shorter (0.84−0.94×) than the hind tibia and at most slightly longer (0.93−1.15×) than the marginal vein in *E. annulatus*. Females of *E. annulatus* also have the anterior and posterior surfaces of the protibia yellowish so that there are discrete dorsal and ventral dark bands, whereas the protibia is more extensively dark without discrete bands in *E. utahensis* females (*cf*. Figs 34, 36). Furthermore, the setae on the submarginal vein and on the dorsal surface of the costal cell are darker brown and therefore more evident in *E. annulatus* than for *E. utahensis* females. Females of *E. utahensis* could also be mistaken for smaller females of *E. cushmani* that have long ovipositor sheaths in combination with a dark scape and a relatively extensively brown protibia, but in addition to the difference in gastral setal color, females of *E. cushmani* have a less extensively setose prepectus (Fig. 42) and sparsely setose propodeal callus, the costal cell dorsally usually setose for distinctly less than half its length (*cf*. Fig. 45), and the frons usually quite distinctly reticulate to reticulate-imbricate (*cf*. Fig. 29).

Three females listed above under “Uncertain species identity” that I observed are in most respects very similar to typical *E. utahensis* females, including color pattern and having a slender flange ventrally on the scape. However, at least two of the females have obviously shorter ovipositor sheaths, about 0.74−79× length of the metatibia and about 0.81−0.88× length of the marginal vein. The third (Oregon) female lacks its gaster but like the other two females its forewings have completely white discal setae and its prepectus is more extensively and conspicuously setose, the apices of the white setae projecting distinctly beyond the ventral margin. Further specimens are required to more confidently assess the status of these three females, though quite possibly they are females of *E. cyaniceps* with white gastral setae. I include the specimens here to bring attention to them.

Based on the very few males associated with females through rearing, males of *E. utahensis* appear very similar to those of *E. cyaniceps*, including the outer surface of the scape having a band of distinct, circular, separated micropunctures along at least the entire length of the scapular scrobe ventrally (*cf*. Figs 77, 78). I include one male from Oregon that is not associated with a female under “Uncertain species identity” because of this scapular sculpture pattern and where it was collected.

Species excluded from *Eupelmus*

Anastatus (*Anastatus*) *ashmeadi* (Melander & Brues) n. comb.

Eupelmus Ashmeadii Melander & Brues, 1903: 21. Syntypes, female (1♀ USNM, examined, and 2♀ MCZC, not examined). Type data: USA, Massachusetts, Woods Hole; on the burrows of *Halictus pruinosus* (Apoidea: Halictidae).

Brasema aurata (Ashmead) n. comb.

Eupelmus auratus Ashmead, 1886: 128. Syntypes, female (USNM, examined). Type data: USA, Florida, [Jacksonville]; reared from *Andricus rugosus* oak galls.

Brasema barda (Girault) n. comb.

Eupelmus bardus Girault, 1917c: 4. Holotype, female (USNM, examined). Type data: USA, California, Pasadena; reared from *Bruchophagus* sp. [*B. funebris* (Howard) according to label].

Reikosiella (*Reikosiella*) *biguttata* (Girault) n. comb.

Eupelmus 2-guttus Girault, 1917b: 256. Holotype, female (USNM, examined). Type data: USA, Maryland, Glendale. [Specific epithet given as *biguttus* on p. 494 in index.]
Eupelmus duoguttus Peck, 1963: 485. Unjustified emendation discovered by Burks, 1979: 881.

Brasema brevicauda (Crawford) n. comb.

Cerambycobius brevicauda Crawford, 1908: 158 [*C. brevicaudus* in key, p. 157]. Holotype female (USNM, examined). Type

data: USA: Texas, Victoria; reared from *Bruchus exiguus* Horn.
Eupelmus brevicaudus; Girault, 1916a: 223. Change of combination.
Brasema brevicauda; Noyes, 2010.

Brasema bruchivora (Crawford) n. comb.

Cerambycobius bruchivorus Crawford, 1908: 158. Syntypes, female (USNM, examined). Type data: USA, Texas, Victoria; reared from *Bruchus* sp. [specimen with label "par. *Bruchus prosopis*"] on *Vachelia* [probably *Mimosestes sallaei* according to Peck (1963: 479)]. Described: female.
Eupelmus bruchivorus; Beal & Massey, 1945: 78.

Reikosiella (_Reikosiella_) _charitopoides_ (Girault) n. comb.

Eupelmus charitopoides Girault, 1916b: 244−245. Holotype, female (USNM, examined). Type data: USA, West Virginia, Harper's Ferry.

Brasema coccidis (Girault) n. comb.

Eupelmus coccidis Girault, 1916a: 223. Holotype, female (USNM, examined). Type data: USA, Texas, Dallas. [Girault designated the holotype from the syntypic series of *Cerambycobius brevicaudus* Crawford (1908)].

Brasema dryophantae (Ashmead) n. comb.

Eupelmus dryophantae Ashmead, 1886: 130. Syntypes, both sexes (USNM, examined). Type data: USA, Florida, [Jacksonville]; reared from oak gall of *Dryophanta laurifoliae* Ashmead.

Brasema flavovariegata (Ashmead) n. comb.

Eupelmus flavovariegatus Ashmead, 1888: iv. Syntypes, both sexes (BMNH and USNM, examined). Type data: USA, [Kansas, Riley Co.]; reared from ? *Andricus dimorphus* Ashmead gall on *Quercus prinus*.

Brasema fonteia (Walker) n. comb.

Eupelmus Fonteia Walker, 1847: 19−20. Lectotype, female (BMNH, examined) designated by Burks, 1975: 149 [paralectotype is a different species belonging to *E.* (*Eupelmus*)]. Type data: North America [USA, Florida, St. John's Bluff].

Brasema juglandis (Ashmead) n. comb.

Eupelmus juglandis Ashmead, 1894: 340. Syntypes, female (USNM, examined). Type data: USA, West Virginia, Morgantown; reared from unknown larva in walnut (*Juglans*).

Brasema inyoensis (Girault)

Eupelmus inyoensis Girault, 1916a: 223. Syntypes, female (USNM, examined). Type data: USA, California, Inyo Co.
Brasema inyoensis; Lampson & Morse, 1992: 386. Change of combination.
Eupelmus inyoensis; Noyes, 2010.

Brasema lamachus (Walker) n. comb.

Eupelmus Lamachus Walker, 1847: 20. Lectotype, female (BMNH, examined), designated by Burks, 1975: 150. Type data: North America [USA: Florida, St. John's Bluff].

Brasema limneriae (Howard) n. comb.

Eupelmus limneriae Howard, 1897: 39, 56. Syntypes, both sexes (USNM, examined). Type data: USA, District of Columbia; reared from cocoons of *Limneria valida* parasitizing *Orgyia leucostigma*.

Brasema macrocarpae (Ashmead) n. comb.

Eupelmus macrocarpae Ashmead, 1888: iv. Syntypes, female (USNM, examined). Type data: USA, [Kansas, Riley Co.]; reared from *Acraspis pezomachoides* and *A. erinacei* from *Quercus macrocarpa* and *Q. prinus*, respectively.

Brasema neococcidis (Peck) n. comb.

Eupelmus brevicauda Gahan, 1910: 205. Syntypes, female (USNM, examined). Type data: USA, Texas, Galveston; Maryland, College Park; reared from eggs of *Mantis*. Homonym of *Eupelmus brevicauda* (Crawford, 1908) discovered by Girault, 1917a: 6.
Eupelmus coccidis Girault, 1917a: 6. Replacement name. Homonym of *Eupelmus coccidis* Girault (1916a) discovered by Peck, 1951: 510.

Eupelmus neococcidis Peck, 1951: 510. Replacement name for *Eupelmus coccidis* Girault (1917a).

***Brasema neomexicana* (Girault) n. comb.**

Eupelmus neomexicanus Girault, 1916c: 307. Syntypes, female (USNM, examined). Type data: USA, New Mexico, Las Cruces.

***Brasema rosae* (Ashmead) n. comb.**

Eupelmus rosae Ashmead, 1882: 36. Holotype female (USNM, examined). Type data: USA, Florida, [Jacksonville]; reared from *Rhodites r. lucidae* (Ashmead MS) [= *Diplolepis* sp.] rose gall.

***Brasema speciosa* (Girault) n. comb.**

Eupelmus speciosus Girault, 1916b: 243−244. Syntypes, female (BMNH and USNM, examined). Type data: USA, Washington, D.C. ?.

***Brasema sphaericephalus* (Ashmead) n. comb.**

Eupelmus sphaericephalus Ashmead, 1886: 129. Holotype female (USNM, examined). Type data: USA, Florida, [Jacksonville].

Unrecognized names

Eupelmus floridanus* Howard *nomen dubium

Eupelmus floridanus Howard, 1880: 209. Holotype, male (USNM, lost). Type data: USA, Florida, Jacksonville; reared from unidentified tineid larva on orange.

Remarks. The description of *E. floridanus* states that the antenna was dark brown, the head and mesosoma metallic green, the coxae yellow, the legs mostly yellow except the metafemur was broadly dark medially, the mesotibia was dark brown except at either end, and the metatibia was dark except apically. The body was also stated as rather slender (thorax and abdomen long and narrow), the antenna thick, cylindrical and somewhat shorter than the thorax, and the top of the head rather coarsely punctured. Males of *E*. (*Macroneura*) tend to have a more elongate-slender mesosoma than those of *E*. (*Eupelmus*) and males of *E*. (*Macroneura*) *meteori* (Gahan) often have the coxae yellowish, but they also have the scape and the legs almost entirely light-colored, the head is finely sculptured, and although the flagellum is cylindrical it is comparatively slender. I know of no species of *Eupelmus* whose males match the description of *E. floridanus*. The thorax of *E. floridanus* was compared to that of males of *Anastatus reduvii* (Howard) and the thick, cylindrical flagellum and coarsely punctured top of the head might indicate the male actually belonged to *Anastatus*. However, I know of no male *Anastatus* with yellow coxae and males typically have quite a robust rather than slender thorax. The rearing record from a larva would also be aberrant if an *Anastatus*.

Acknowledgments

The curators listed in materials and methods are gratefully acknowledged for the loan of specimens, including classical type material, on which this study is based. I particularly thank Richard (Dick) Askew (retired) and Lucian Fusu for the gift of representatives of several *Eupelmus* species from the Palaearctic region and for valuable discussions and information on extralimital species. I also thank Zhong-Qi Yang (NWCF) for the gift of paratypes of the *Eupelmus* species he described from China and James Hogan (OXUM) for providing information on the lectotype of *E. annulatus*. I thank John Noyes (BMNH) and Andreas Taeger for consultation on emendation of scientific names. As always, Lisa Bartels (CNC) is very gratefully acknowledged for her essential technical assistance, including the superb plates of photomacrographs, scanning electron photomicrographs, and maps of species distributions. Finally, two anonymous reviewers are thanked for reading the manuscript and providing valuable corrections.

References

Allen, H.W. (1962) Parasites of the oriental fruit moth in the eastern United States. *United States Department of Agriculture, Technical Bulletin*, 1265, 2 + 139 pp.

Althoff, D.M. (2008) A test of host-associated differentiation across the 'parasite continuum' in the tri-trophic interaction among yuccas, bogus yucca moths, and parasitoids. *Molecular Ecology*, 17, 3917−3927.

Arambourg, Y. & Pralavorio, R. (1975) Les chalcidiens ectophages (Hym., Chalcidoidea) parasites de *Dacus oleae* Gmel. (Dipt., Trypetidae). *Annales de l'Institut Phytopathologique Benaki*, 11, 30−46.

Ashmead, W.H. (1882) On the Chalcididae of Florida. (Paper No. 2.). *The Canadian Entomologist*, 14, 35−37.

Ashmead, W.H. (1885) Studies on North American Chalcididae, with descriptions of new species from Florida. (Paper No. 5.). *Transactions of the Entomological Society of America*, 12, x−xix.

Ashmead, W.H. (1886) Studies on the North American Chalcididae, with descriptions of new species from Florida. (Paper No. 7.). *Transactions of the Entomological Society of America*, 13, 125−135.

Ashmead, W.H. (1887a) Studies on the North American Proctotrupidae, with descriptions of new species from Florida. (Part I.). *Entomologica Americana*, 3, 73−76, 97−100, 117−120.

Ashmead, W.H. (1887b) Studies on the North American Chalcididae, with descriptions of new species, chiefly from Florida. *Transactions of the Entomological Society of America*, 14, 183−203.

Ashmead, W.H. (1888) Descriptions of some unknown parasitic Hymenoptera in the collection of the Kansas state agricultural college, received from Prof. E. A. Popenoe. *Bulletin of the Kansas State Agricultural College*, 3, Appendix, i−viii.

Ashmead, W.H. (1893) A monograph of the North American Proctotrypidae. *Bulletin of the United States National Museum*, 45, 1−472.

Ashmead, W.H. (1894) Descriptions of new parasitic Hymenoptera. (Paper No. 1.). *Transactions of the Entomological Society of America*, 21, 318−344.

Ashmead, W.H. (1904) Descriptions of new Hymenoptera from Japan. — II. *Journal of the New York Entomological Society*, 12, 146−165 + 2 pls.

Askew, R.R. & Blasco-Zumeta, J. (1997) Parasitic Hymenoptera inhabiting seeds of *Ephedra nebrodensis* in Spain, with descriptions of a phytophagous pteromalid and four other new species of Chalcioidea. *Journal of Natural History*, 31, 965−982.

Askew, R.R. & Nieves-Aldrey, J.L. (2000) The genus *Eupelmus* Dalman, 1820 (Hymenoptera, Chalcidoidea, Eupelmidae) in peninsular Spain and the Canary Islands, with taxonomic notes and descriptions of new species. *Graellsia*, 56, 49−61.

Baerg, W.J. (1928) Three Shade Tree Insects. *Bulletin of the University of Arkansas Agricultural Experiment Station*, 224, 25 pp.

Beacher, J.H. (1947) Studies of pistol case-bearer parasites. *Annals of the Entomological Society of America*, 40, 530−544.

Beal, J.A. & Massey, C.L. (1945) Bark beetles and ambrosia beetles (Coleoptera: Scolytoidea): with special reference to species occurring in North Carolina. *Bulletin of the Duke University School of Forestry*, 10, 1−178.

Belanovsky, I.D. & Dyadechko, N.P. (1951) New parasite of the *Panicum* cecidomyiid. *Dopovidi Akademiy Nauk Ukrainskoy RSR*, 1951(4), 291−296.

Bess, H.A. & Haramoto, F.H. (1959) Biological control of pamakani, *Eupatorium adenophorum*, in Hawaii by a tephritid gall fly, *Procecidochares utilis*. 2. Population studies of the weed, the fly, and the parasites of the fly. *Ecology*, 40, 244−249.

Bigger, J.H. (1933) Parasites of the sunflower weevil. *Journal of Economic Entomology*, 26, 652.

Bissell, T.L. (1938) The host plants and parasites of the cowpea curculio and other legume infesting weevils. *Journal of Economic Entomology*, 31, 534–536.

Bissell, T.L. (1940) Curculionidae, Bruchidae, Lepidoptera, and their parasites, infesting the seed pods of cowpea and various wild plants. *Journal of Economic Entomology*, 33, 844−847.

Blanchard, E. (1840) *Histoire naturelle des Insectes*, 3, 672 pp. + 155 plates.

Bouček, Z. (1965a) Synonymic and taxonomic notes on some Chalcidoidea (Hymenoptera), with corrections of my own mistakes. *Acta Entomologica Musei Nationalis Pragae*, 36, 543−554.

Bouček, Z. (1965b) A review of the chalcidoid fauna of the Moldavian S.S.R., with descriptions of new species (Hymenoptera). *Acta Faunistica Entomologica Musei Nationalis Pragae*, 11, 5−37.

Bouček, Z. (1968) Contributions to the Czechoslovak fauna of Chalcidoidea (Hym.). *Acta Faunistica Entomologica Musei Nationalis Pragae*, 12, 231−260.

Bouček, Z. (1970) Contribution to the knowledge of Italian Chalcidoidea, based mainly on a study at the Institute of Entomology in Turin, with descriptions of some new European species. *Estratto dalle Memorie della Società Entomologica Italiana*, 49, 35−102.

Bouček, Z. (1976) Changes in the classification of some African Chalcidoidea (Hymenoptera). *Journal of the Entomological Society of South Africa*, 39, 345–355.

Bouček, Z. (1977) A faunistic review of the Yugoslavian Chalcidoidea (Parasitic Hymenoptera). *Acta Entomologica Jugoslavica*, 13 (Supplement), 1−145.

Bouček, Z. (1988) *Australasian Chalcidoidea (Hymenoptera). A Biosystematic Revision of Genera of Fourteen Families, with a Reclassification of Species*. CAB International Institute of Entomology, The Cambrian News Ltd., Aberystwyth, 832 pp.

Brandhorst, C.T. (1962) The microcommunity associated with the gall of *Walshia amorphella* (Lepidoptera: Cosmopterygidae)

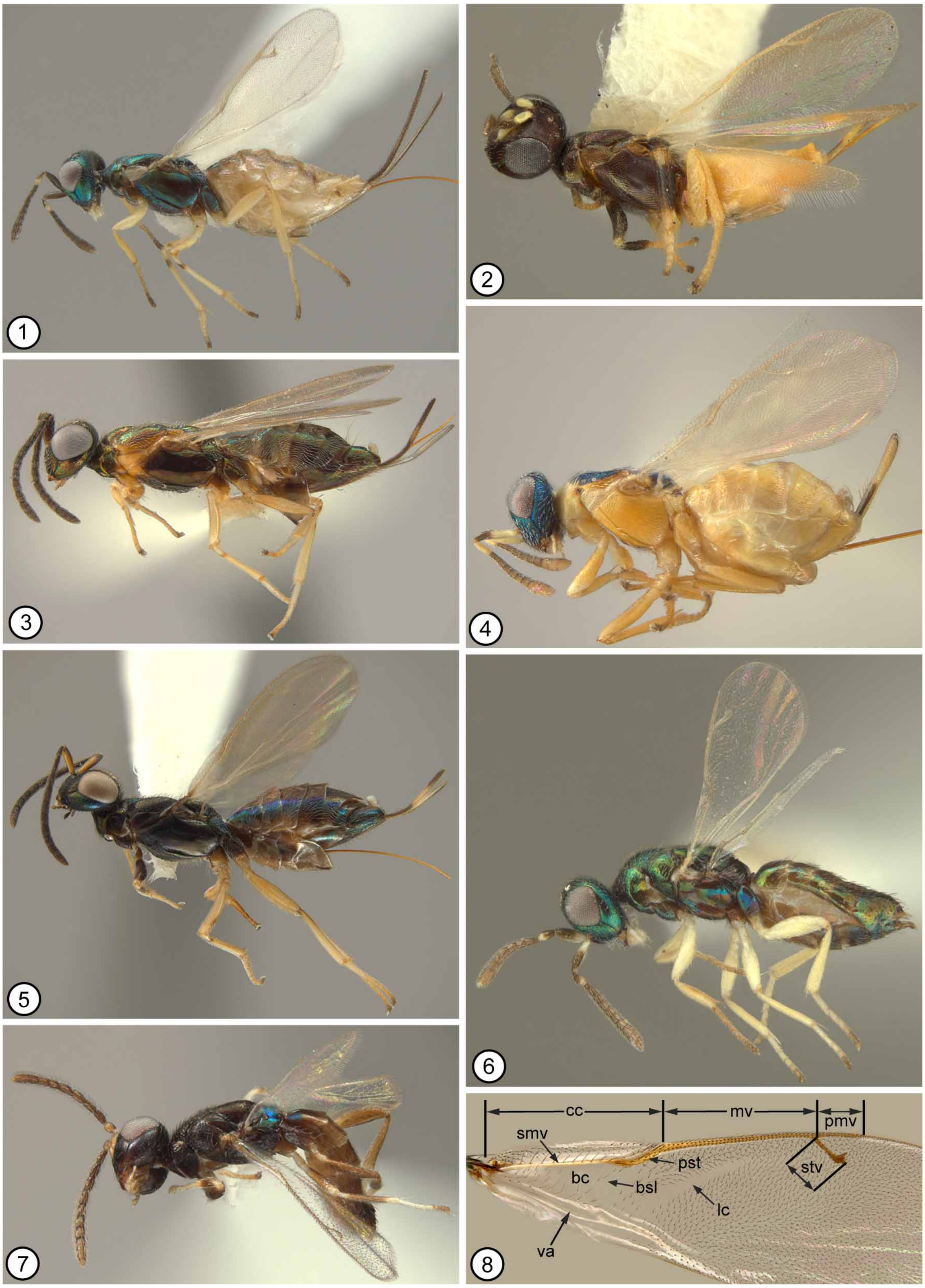
on *Amorpha fruticosa*. *Annals of the Entomological Society of America*, 55, 476–479.
Breland, O.P. & Schmitt, L.H. (1948) The biology of two sunflower gall makers (Diptera: Cecidomyiidae; Lepidoptera: Lyonetiidae). *Entomological News*, 59, 225–234.
Brèthes, J. (1916) Hyménoptères parasites de l'Amérique Méridionale. *Anales del Museo Nacional de Historia Natural de Buenos Aires*, 27, 401–430.
Brett, C.H. (1946) Insecticidal properties of the indigobush (*Amorpha fruticosa*). *Journal of Agriculture Research*, 73, 81–96.
Bridwell, J.C. (1918) Notes on the Bruchidae and their parasites in the Hawaiian islands. *Proceedings of the Hawaiian Entomological Society*, 3, 465–505.
Bridwell, J.C. (1933) The hairy-vetch bruchid, *Bruchus brachialis* Fahraeus, in the United States. *Journal of Agricultural Research*, 46, 739−751.
Brues, C.T. (1903) The structure and significance of vestigial wings among insects. *Biological Bulletin*, 4(4), 179−190.
Brues, C.T. (1907) Notes and descriptions of North American parasitic Hymenoptera. III. *Bulletin Wisconsin Natural History Society*, 5, 54−62.
Brunson, M.H. (1948) Secondary parasites of the Oriental fruit moth through *Macrocentrus ancylivorus*. *Journal of Economic Entomology*, 41, 119−120.
Brunson, M.H. & Allen, H.W. (1948) Oriental fruit moth cocoon parasites. *Journal of Economic Entomology*, 41, 445−449.
Burks, B.D. (1967) Family Eupelmidae. *In*: Krombein, K.V. & Burks, B.D. (Eds.), *Hymenoptera of America North of Mexico—synoptic catalog*. United States Department of Agriculture Monograph No. 2 (second supplement), pp. 245−247.
Burks, B.D. (1975) The species of Chalcidoidea described from North America north of Mexico by Francis Walker (Hymenoptera). *Bulletin of the British Museum (Natural History), Entomology*, 32, 137−170.
Burks, B.D. (1979) Family Eupelmidae. *In*: Krombein, K.V., Hurd, P.D., Smith, D.R. & Burks, B.D. (Eds.), *Catalog of Hymenoptera in America North of Mexico, Vol. I*. Smithsonian Institute Press, Washington, USA, pp. 878−889.
Burks, R.A., Gibson, G.A.P. & La Salle, J. (2005) Nomenclatural changes in Neotropical Eulophidae, Eupelmidae and Torymidae (Hymenoptera: Chalcidoidea) relating to parasitoids of *Cecidoses eremita* (Lepidoptera: Cecidosidae). *Zootaxa*, 1082, 45−55.
Callan, E. McC. (1941) The gall midges (Diptera, Cecidomyiidae) of economic importance in the West Indies. *Tropical Agriculture, Trinidad*, 18, 117−127.
Cameron, P. (1884) Hymenoptera (Families Tenthredinidae—Chrysididae). *Biologia Centrali-Americana. Insecta*, 1, 1−487 + 20 pls.
Cameron, P. (1905) On some new genera and species of Hymenoptera from Cape Colony and Transvaal. *Transactions of the South African Philosophical Society*, 15, 195–257.
Chestnut, T.L. & Cross, W.H. (1971) Arthropod parasites of the boll weevil, *Anthonomus grandis*: 2. Comparisons of their importance in the United States over a period of thirty-eight years. *Annals of the Entomological Society of America*, 64, 549−557.
Chittenden, F.H. (1898) Parasites of bean and cowpea weevils. *In*: Howard, L.O. (Ed). Some miscellaneous results of the work of the division of entomology. *United States Department of Agriculture, Bulletin (n.s.)*, 10, 92.
Coppel, H.C. (1960) Empty cocoons of the introduced pine sawfly, *Diprion similis*, as habitat niches for arthropods. *Annals of the Entomological Society of America*, 53, 847−849.
Cotton, R.T. & Good, N.E. (1937) Annotated list of the insects and mites associated with stored grain and cereal products, and of their arthropod parasites and predators. *United States Department of Agriculture, Miscellaneous Publication*, 258, 1−81.
Crawford, J.C. (1907) New hymenopterous parasites of *Anthonomus grandis* Boh. *Canadian Entomologist*, 39, 133−134.
Crawford, J.C. (1908) Some new Chalcidoidea. *Proceedings of the Entomological Society of Washington*, 9, 157−160.
Crawford, J.C. (1912) Descriptions of new Hymenoptera, No. 5. *Proceedings of the United States National Museum*, 43, 163−188.
Crawford, J.C. (1913) Descriptions of new Hymenoptera, No. 6. *Proceedings of the United States National Museum*, 45, 241–260.
Crosby, C.R. (1909) Chalcis-flies reared from galls from Zumbo, East Africa. *Bróteria (Series Zoologica)*, 9, 77–90.
Cross, W.H. & Chestnut, T.L. (1971) Arthropod parasites of the boll weevil, *Anthonomus grandis*: 1. An annotated list. *Annals of the Entomological Society of America*, 64, 516−527.
Cushman, R.A. (1911) Notes on the host plants and parasites of some North American Bruchidae. *Journal of Economic Entomology*, 4, 489–510.
Cushman, R.A. (1927) The parasites of the pine tip moth, *Rhyacionia frustrana* (Comstock). *Journal of Agricultural Research*, 34, 615–622.
Dahms, E.C. (1983) A checklist of the types of Australian Hymenoptera described by Alexandre Arsene Girault: II. Preamble and Chalcidoidea species A—E with advisory notes. *Memoirs of the Queensland Museum*, 21, 1−255.
Dahms, E.C. (1984) A checklist of the types of Australian Hymenoptera described by Alexandre Arsene Girault: III. Chalcidoidea species F—M with advisory notes. *Memoirs of the Queensland Museum*, 21, 579−842.
Dalla Torre, K.W.v. (1898) *Catalogus Hymenopterorum Hucusque Descriptorum Systematicus et Synonymicus. Vol V: Chalcididae et Proctotrupidae*. Leipzig, Germany. 598 pp.
Dalman, J.W. (1820) Försök till uppställning af insect-familjen Pteromalini, i synnerhet med afseende på de i Sverige funne arter. *Kungliga Svenska Vetenskapsakademiens Handlingar*, 41, 123−174, 177−182, 340−385.

De Santis, L. (1971) La fauna de chalcidoides de America del Sur. *Boletín de la Sociedad Entomológica del Perú*, 6(2), 57–63.
De Santis, L. (1979) Catálogo de los himénopteros calcidoideos de América al sur de los Estados Unidos. *Publicación Especial Comisión de Investigaciones Cientificas Provincia de Buenos Aires*, 488 pp.
Driggers, B.F. (1929) Some parasites of the oriental peach moth in New Jersey. *Journal of the New York Entomological Society,* 37, 169–170.
Drooz, A.T., Ghent, J.H. & Huber, C.M. (1985) Insect parasites associated with the introduced pine sawfly, *Diprion similis* (Hartig) (Hymenoptera: Diprionidae), in North Carolina. *Environmental Entomology*, 14, 401–403.
Duan, J.J., Purcell, M.F. & Messing, H. (1996) Parasitoids of non-target tephritid flies in Hawaii: implications for biological control of fruit fly pests. *Entomophaga*, 41, 245−256.
Duan, J.J., Fuester, R.W., Wildonger, J., Taylor, P.B. Barth, S. & Spichiger, S.E. (2009) Parasitoids attacking the emerald ash borer (Coleoptera: Buprestidae) in western Pennsylvania. *Florida Entomologist*, 92, 588−592.
Erdős, J. (1955) Megfigyelések a nád kártevőiről és azok parazitáiról. Observationes de insectis nocivis eorumque parasitis in Phragmite vulgari Lam. *Allattani Közlemények*, 45, 33−48.
Farrier, M. & Tauber, O. (1953) *Dioryctria disclusa* Heinrich, n. sp. (Phycitidae) and its parasites in Iowa. *Iowa State University Journal of Science*, 27, 495–507.
Felt, E.P. (1915) Twenty-ninth report of the state entomologist, 1913. *Bulletin of the New York State Museum, Albany,* 175, 275 pp.
Fenton, F.A. & Dunnam, E.W. (1929) Biology of the cotton boll weevil at Florence, S.C. *United States Department of Agriculture*, *Technical Bulletin,* 112, 75 pp.
Ferrière, Ch. (1954) Eupelmides brachyptères (Hym. Chalcidoidea). *Mitteilungen der Schweizerischen Entomologischen Gesellschaft*, 27, 1−21.
Finlayson, T. (1962) Taxonomy of cocoons and puparia, and their contents, of Canadian parasites of *Diprion simils* (Htg.) (Hymenoptera: Diprionidae). *The Canadian Entomologist*, 94, 271−282.
Force, D.C. & Thompson, M.L. (1984) Parasitoids of the immature stages of several southwestern *Yucca* moths. *The Southwestern Naturalist*, 29, 45−56.
Forister, G.W. & Johnson, C.D. (1971) Bionomics of *Merobruchus julianus* (Coleoptera: Bruchidae). *Coleopterists Bulletin*, 24, 84−87.
Förster, A. (1860) Eine Centurie neuer Hymenopteren. *Verhandlungen naturhistorischen Vereines der preussischen Rh*, 17, 93−153.
Fronk, W.D., Beetle, A.A. & Fullerton, D.G. (1964) Dipterous galls on the *Artemisia tridentata* complex and insects associated with them. *Annals of the Entomological Society of America* 57, 575−577.
Fusu, L. (2009) Romanian Eupelmidae (Hymenoptera, Chalcidoidea): new cytogenetic, faunistic and host records. *North-Western Journal of Zoology,* 5, 307−320.
Gahan, A.B. (1910) Four new species of Hymenoptera. Chalcidoidea, Encyrtidae. *The Canadian Entomologist*, 42, 205−208.
Gahan, A.B. (1951) Some synonymy and new combinations in Chalcidoidea (Hymenoptera). *The Canadian Entomologist*, 83, 170−176.
Genung, W.G., Woodruff, R.E. & Grissell, E.E. (1980) *Languria erythrocephalus*: host plants, immature states, parasites, and habits (Coleoptera: Languriidae). *Florida Entomologist*, 63, 206−210.
Gibson, G.A.P. (1986) Mesothoracic skeletomusculature and mechanics of flight and jumping in Eupelminae (Hymenoptera, Chalcidoidea: Eupelmidae). *The Canadian Entomologist*, 118, 691–728.
Gibson, G.A.P. (1990) Revision of the genus *Macroneura* Walker in America north of Mexico (Hymenoptera: Eupelmidae). *The Canadian Entomologist*, 122, 837−873.
Gibson, G.A.P. (1995) Parasitic wasps of the subfamily Eupelminae: classification and revision of world genera (Hymenoptera: Chalcidoidea, Eupelmidae). *Memoirs on Entomology, International*, 5, i−v + 421 pp.
Gibson G.A.P (1997) Chapter 2. Morphology and terminology. *In*: Gibson G.A.P., Huber J.T., Woolley J.B. (Eds). *Annotated Keys to the Genera of Nearctic Chalcidoidea (Hymenoptera)*. NRC Research Press, Ottawa, pp. 16–44.
Gibson, G.A.P. (2009) Revision of New World Spalangiinae (Hymenoptera: Pteromalidae). *Zootaxa*, 2259, 1–159.
Gibson, G.A.P. (2010) *Calosota* Curtis (Hymenoptera, Chalcidoidea, Eupelmidae) − review of the New World and European fauna including revision of species from the West Indies and Central and North America. *ZooKeys*, 55, 1−75.
Gibson, G.A.P., Gates, M.W. & Buntin, G.D. (2006) Parasitoids (Hymenoptera: Chalcidoidea) of the cabbage seedpod weevil (Coleoptera: Curculionidae) in Georgia, USA. *Journal of Hymenoptera Research*, 15, 187−207.
Girault, A.A. (1913) Diagnoses of new chalcidoids Hymenoptera from Queensland, Australia. *Archiv für Naturgeschichte*, 79A, 90−107.
Girault, A.A. (1914). Some new genera and species of chalcidoid Hymenoptera of the family Encyrtidae from Australia. *Societas Entomologica*, 29, 22−24.
Girault, A.A. (1915) Australian Hymenoptera Chalcidoidea—VII. The family Encyrtidae with descriptions of new genera and species. *Memoirs of the Queensland Museum*, 4, 1−184.
Girault, A.A. (1916a) Descriptiones Hymenopterorum Chalcidoidicorum variorum cum observationibus. III. *Entomological News*, 27, 223−228.
Girault, A.A. (1916b) Descriptions of and observations on some chalcidoid Hymenoptera. *The Canadian Entomologist*, 48, 242−246.

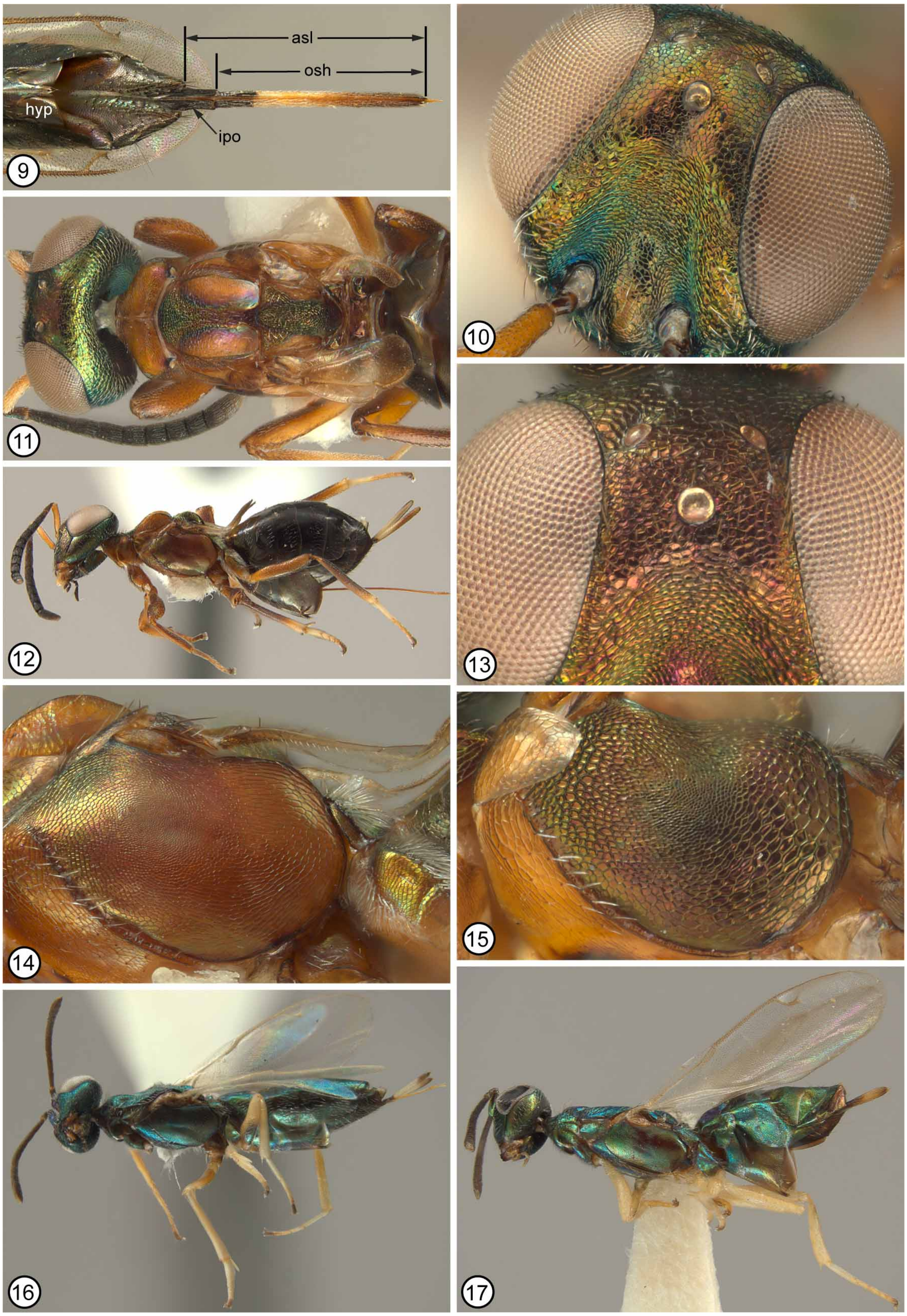
Girault, A.A. (1916c) New miscellaneous chalcidoid Hymenoptera with notes on described species. *Annals of the Entomological Society of America*, 9, 291−308.
Girault, A.A. (1917a) Descriptiones stellarum novarum. Private, 22 pp.
Girault, A.A. (1917b) New chalcid flies from Maryland, II (Hym.). *Entomological News*, 28, 255−257.
Girault, A.A. (1917c) Descriptiones Hymenopterorum Chalcidoidicarum variorum cum observationibus. V. Private, 16 pp.
Goeden, R.D. (2002) Life history and description of immature stages of *Oxyna aterrima* (Doane) (Diptera: Tephritidae) on *Artemisia tridentata* Nuttall (Asteraceae) in southern California. *Proceedings of the Entomological Society of Washington*, 104, 510−526.
Gould, E. & Geissler, G.H. (1940) Parasites of the pistol case-bearer. *Journal of Economic Entomology*, 33, 814−815.
Gourlay, E.S. (1928) Notes and descriptions of New Zealand Hymenoptera. *Transactions and Proceedings of the New Zealand Institute*, 59, 368–373.
Graham, M.W.R. de V. (1969) Some Eupelmidae (Hymenoptera: Chalcidoidea) new to Britain, with notes on new synonymy in this family. *Proceedings of the Royal Entomological Society of London (B)*, 38(7−8), 89−94.
Graham, M.W.R. de V. (1988) The remains of Nees von Esenbeck's collection of Hymenoptera in the University Museum, Oxford. *Entomologist's Monthly Magazine*, 124, 19−35.
Gunasena, G.H. & Harris, M.K (1988) Parasites of hickory shuckworm and pecan nut casebearer with five new host-parasite records. *The Southwestern Entomologist*, 13, 107–111.
Guo, S., Qu, A. & Sun, W. (1997) A preliminary study on the parasitic wasps of *D. kuriphilus* Y. *Scientia Silvae Sinicae*, 33, 242−246.
Haack, R.A., Hérard, F., Sun, J. & Turgeon, J.J. (2010) Managing invasive populations of Asian longhorned beetle and citrus longhorned beetle: A worldwide perspective. *Annual Review of Entomology*, 55, 521−546.
Haden, W.R. (1935) Parasitism of the Oriental fruit moth with special reference to the importance of certain alternate hosts. *Bulletin of the University of Deleware Agricultural Experiment Station*, 194, 42 pp.
Harman, D.M. (1972) Parasites of the Nantucket pine tip moth, *Rhyacionia frustrana* on three pine species in Maryland. *Chesapeake Science*, 13, 223−226.
Harris, R.A. (1979) A glossary of surface sculpturing. *Occasional Papers in Entomology, Sacramento California*, 28, 1−31.
Haseman, L. (1933) The sorghum worm in Missouri. *Bulletin of the Missouri Agricultural Experiment Station*, 32, 1−8.
Hedqvist, K.J. (1963) Die Feinde der Borkenkäfer in Schweden. I. Erzwespen (Chalcidoidea). *Studia Forestalia Suecica*, No. 11, 1−176.
Herting, B. (1978) Neuroptera, Diptera, Siphonaptera. *A catalogue of parasites and predators of terrestrial arthropods. Section A. Host or Prey/Enemy.* Commonwealth Agricultural Bureaux, Commonwealth Institute of Biological Control, 5, 156 pp.
Hoffmann, C.H. (1942) Annotated list of elm insects in the United States. *United States Department of Agriculture*, *Miscellaneous Publication*, 466, 20 pp.
Howard, L.O. (1880) Two new species of *Eupelmus*, with remarks upon *E.* (*Antigaster*) *mirabilis* Walsh. *The Canadian Entomologist*, 12, 207−210.
Howard, L.O. (1897) A study in insect parasitism: A consideration of the parasites of the white-marked tussock moth, with an account of their habits and interrelaionships, and with descriptions of new species. *United States Department of Agriculture, Technical Series*, 5, 1−57.
Hunter, W.D. & Hooker, W.A. (1907) Information concerning the North American fever tick, with notes on other species. *United States Department of Agriculture, Bureau of Entomology, Bulletin*, 72, 63 pp.
Kalina, V. (1981) The Palearctic species of the genus *Macroneura* Walker, 1837 (Hymenoptera, Chalcidoidea, Eupelmidae), with descriptions of new species. *Sbornik Vedeckeho Lesnickeho Ustavu Vysoke Skoly Zemedelske v Praze*, 24, 83–111.
Kalina, V. (1984) New genera and species of Palearctic Eupelmidae (Hymenoptera, Chalcidoidea). *Silvaecultura Tropica et Subtropica*, 10, 1–28.
Kalina, V. (1988) Descriptions of new Palearctic species of the genus *Eupelmus* Dalman with a key to species (Hymenoptera, Chalcidoidea, Eupelmidae). *Silvaecultura Tropica et Subtropica*, 12, 3−33.
Lampson, L.J. & Morse, J.G. (1992). A survey of black scale, *Saissetia oleae* [Hom.: Coccidae] parasitoids [Hym.: Chalcidoidea] in southern California. *Entomophaga*, 37, 373–390.
Liao, D.X., Li, X.L., Pang. X.F. & Chen, T.L. (1987) Hymenoptera: Chalcidoidea (1). *Economic Insect Fauna of China*, No 34**,** x + 241 pp.
Lotfalizadeh, H., Rasplus, J.-Y. & Delvare, G. (2007) Rose gall wasps and their asssociated fauna (Hymenoptera) in Iran. *Redia*, 89, 73−85.
Masi, L. (1919) Materiali per una fauna dell'Arcipelago Toscano. XI. Calcididi del Giglio. Seconda serie: Eurytominae (seguito), Eucharidinae, Encyrtinae, Eupelminae (partim.). *Annali del Museo civico di Storia naturale Giacomo Doria, Genova*, 48, 277–337.
Masi, L. (1941) Un nuovo *Eupelmus* parassita del *Dacus oleae* nella cirenaica. (Hymen. Chacididae). *Bollettino della Società Entomologica Italiana*, 73, 109−111.
Masi, L. (1946) Nuova specie di *Eupelmus* (Hymen. Chalcididae). *Bollettino della Società Entomologica Italiana*, 76, 27−28.
McConnell, H.S. (1932) Oriental fruit moth parasites in Maryland. *Journal of Economic Entomology*, 25, 367–370.
McConnell, H.S. (1934) The oriental fruit moth in Maryland. *Bulletin of the Maryland Agricultural Experiment Station*, 364**,** 411−456.

McGovern, W.L., Cross, W.H. & Mitchell, H.C. (1974) *Eupelmus cyaniceps* (Hymenoptera: Eupelmidae), a hyperparasite. *Journal of the Georgia Entomological Society*, 9, 68–69.
Melander, A.L. & Brues, C.T. (1903) Guests and parasites of the burrowing bee *Halictus*. *Biological Bulletin Marine Biology Laboratory*, 5, 1−27.
Mertins, J.W. & Coppel, H.C. (1971) The insect parasites of the introduced pine sawfly, *Diprion similis* (Hartig) (Hym., Diprionidae) in Wisonsin, with keys to the adults and mature larval remains. *Transactions of the Wisconsin Academy of Sciences, Arts and Letters*, 59**,** 127−168.
Milliron, H.E. (1949) Taxonomic and biological investigations in the genus *Megastigmus*, with particular reference to the taxonomy of the Nearctic species (Hymenoptera: Chalcidoidea; Callimomidae). *American Midland Naturalist*, 41, 257−420.
Mitchell, J.D. & Pierce, W.D. (1911) The weevils of Victoria County, Texas. *Proceedings of the Entomological Society of Washington*, 13, 45−62.
Mitchell, W.L, Cross, W.H. & Mitchell, H.C. (1974) *Eupelmus cyaniceps* (Hymenoptera: Eupelmidae), a hyperparasite. *Journal of the Georgia Entomological Society*, 9, 68−69.
Muesebeck, C.F.W. & Dohanian, S.M. (1927) A study in hyperparasitism, with particular reference to the parasites of *Apanteles melanoscelus* (Ratzeburg). *United States Department of Agriculture, Bulletin*, 1487**,** 35 pp.
Nees ab Esenbeck, C.G. (1834) *Hymenopterorum Ichneumonibus affinium monographiae, genera europaea et species illustrantes. Vol. 2*. Stuttgart, Germany, 448 pp.
Nickels, C.B. (1951) Notes on the life history and habits of the pecan nursery casebearer in Texas. *Journal of Economic Entomology*, 44, 433−434.
Nickels, C.B., Pierce, W.C. & Pinkney, C.C. (1950) Parasites of the pecan nut casebearer in Texas. *United States Department of Agriculture, Technical Bulletin*, 1011, 21 pp.
Nikol'skaya M.N. (1952) Khaltsidy fauny SSSR. Opredel. po faune SSSR, 44. Moscow: Akademiia Nauk SSSR (Chalcidoidea), 575 pp. [In Russian, English translation: The Chalcid Fauna of the USSR. Israel Program for Scientifi c Translations, Jerusalem, 1963, 593 pp.]
Noyes, J.S. (2010) *Universal Chalcidoidea database*. Available from: http://www.nhm.ac.uk/research-curation/research/projects/chalcidoids [accessed 14 March 2011].
Ott, J.R. (1991) The biology of *Acanthoscelides alboscutellatus* (Coleoptera: Bruchidae) on its host plant, *Ludwigia alternifolia* (L.) (Onagraceae). *Proceedings of the Entomological Society of Washington*, 93, 641−651.
Parker, H.L., Berry, P.A. & Silveira Guido, A. (1953) Host-parasite and parasite-host lists of insects reared in South American parasite laboratory during the period 1940-1946. *Revista de la Asociación (Federación) Rural del Uruguay (Ingenieros Agrónomos)*, 92, 101 pp.
Peck, O. (1951) Family Eupelmidae. *In*: Muesebeck, C.F.W., Krombein, K.V. & Townes, H.K. (Eds), *Hymenoptera of America north of Mexico—synoptic catalog*. United States Department of Agriculture Monograph, 2, pp. 507−514.
Peck, O. (1963) A catalogue of the Nearctic Chalcidoidea (Insecta: Hymenoptera). *The Canadian Entomologist, Supplement* 30, 1092 pp.
Pierce, W.D. (1907) Contributions to the knowledge of *Rhychophora*. *Entomological News*, 18, 356–363.
Pierce, W.D. (1908a) Studies of Parasites of the cottom boll weevil. *United States Department of Agriculture, Bureau of Entomology, Bulletin*, 73, 63 pp.
Pierce, W.D. (1908b) A list of parasites known to attack American *Rhynchophora*. *Journal of Economic Entomology*, 1, 380−396.
Pierce, W.D. & Cushman, R.A. (1915) A few notes on the habits of parasitic Hymenoptera. *Proceedings of the Entomological Society of Washington*, 17, 164−167.
Pierce, W.D., Cushman, R.A., Hood, C.E. & Hunter, W.D. (1912) The insect enemies of the cotton boll weevil. *United States Department of Agriculture, Bureau of Entomology, Bulletin*, 100, 99 pp.
Pinckney, J.S. (1937) The vetch bruchid, *Bruchus brachialis* Fahraeus. *Journal of Economic Entomology*, 30, 621−632.
Proper, A.B. (1934) Hyperparasitism in the case of some introduced lepidopterous tree defoliators. *Journal of Agricultural Research*, 48, 359−376.
Raizenne, H. (1957) Forest sawflies of southern Ontario and their parasites. *Publication of the Canada Department of Agriculture*, 1009**,** 45 pp.
Ratzeburg, J.T.C. (1844) *Die Ichneumonen der Forstinsecten in forstlicher und entomologischer Beziehung*, 1. Berlin, 224 pp. + 4 pls.
Ratzeburg, J.T.C. (1848) *Die Ichneumonen der Forstinsecten in forstlicher und entomologischer Beziehung*, 2. Berlin, vi + 238 pp., 4 tables + 3 pls.
Ratzeburg, J.T.C. (1852) *Die Ichneumonen der Forstinsecten in forstlicher und entomologischer Beziehung*, 3. Berlin, v−xviii + 272 pp., 3 tables.
Reeks, W.A. & Smith, C.C. (1956) The satin moth, *Stilponotia salicis* (L.), in the maritime provinces and observations on its control by parasites and spraying. *The Canadian Entomologist*, 88, 565−579.
Reyes-Villanueva, F. (1987) Insect parasites of the lepidopterous pests of pecan in Nuevo Leon; analysis of their potential as biological control agents. *Folia Entomológica Mexicana*, 72, 111–120.
Ruschka, F. (1921) Chalcididenstudien I. *Verhandlungen der Zoologisch-Botanischen Gesellschaft in Wien*, 70, 234−315.
Russo, G. (1938) VI. Contributo alla conoscenze dei Coleotteri Scolytidi. Fleotribo: *Phleotribus scarabaeoides* (Bern.) Fauv.

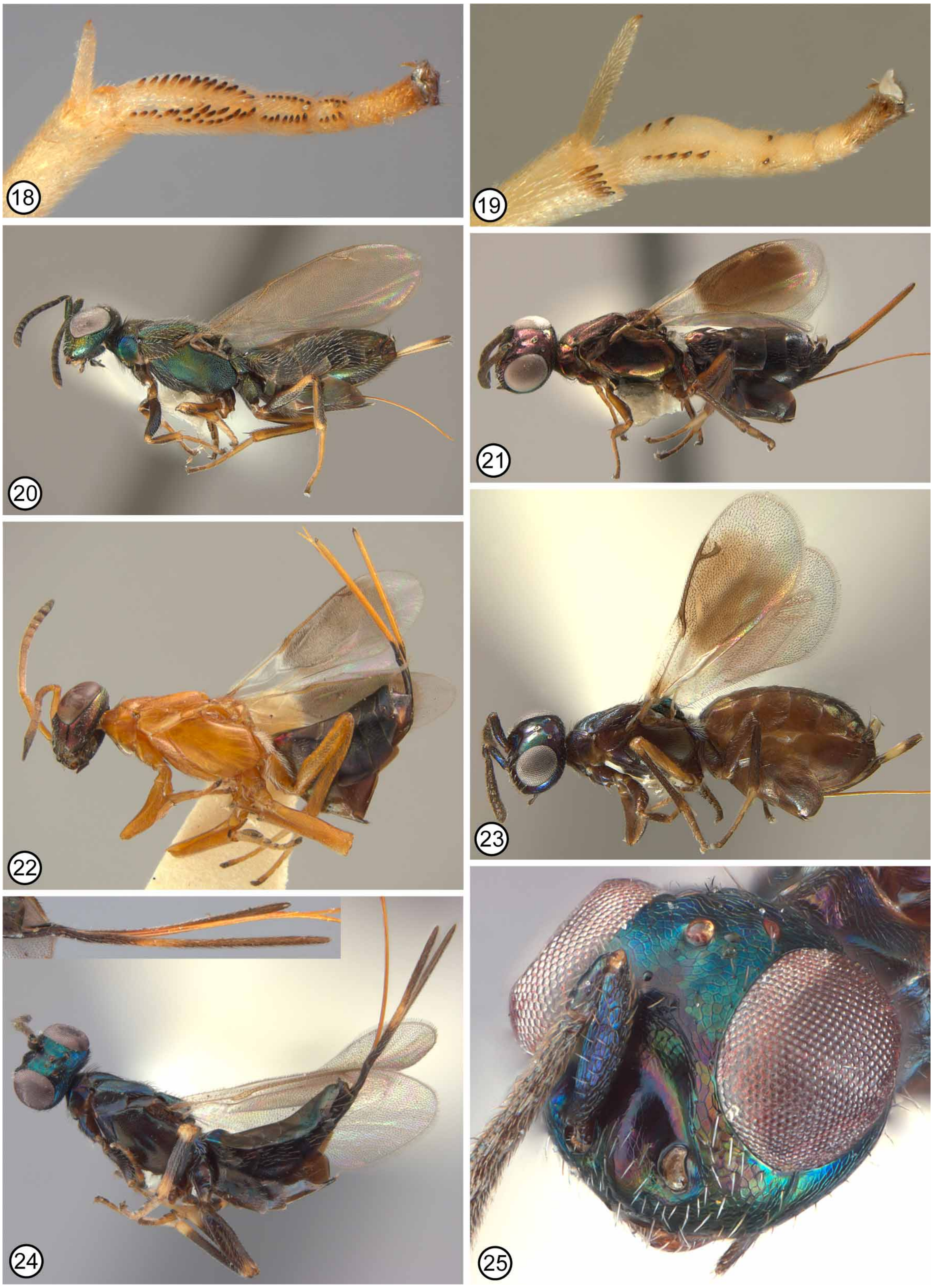
Parte secunda. Biografia, simbionti, dani e lotta. *Bollettino del R. Laboratorio di Entomologia Agraria di Portici*, 2, 3−420.
Santiago-Blay, J.A. (1989) Chalcidoids (Hymenoptera) reared from *Artemisia tridentata* (Asteraceae) galls from British Columbia, Canada. *Journal of the Entomological Society of British Columbia*, 86, 80−81.
Schaffner, J.V. (1959) Microlepidoptera and their parasites reared from field collections in the northeastern United States. *United States Department of Agriculture*, *Miscellaneous Publication*, 767, 97 pp.
Shorthouse, J.D. & Brooks, S.E. (1998) Biology of the galler *Diplolepis rosaefolii* (Hymenoptera: Cynipidae), its associated component community, and host shift to the shrub rose Thérèse Bugnet. *Canadian Entomologist*, 130, 357–366.
Silvestri, F. (1914) Viaggio in Eritrea per cercare parassiti della mosca dell olive. *Bollettino del Laboratorio di Zoologia Generale e Agraria della R. Scuola Superiore d'Agricoltura, Portici*, 9, 186–226.
Spinola, M. (1811) Essae d'une nouvelle classification des Diplolepaires. *Annales du Muséum d'Histoire Naturelle*, 17, 138−152.
Stein, J.D. (1983) The biology, host range, parasites, and hyperparasites of koa seed insects in Hawaii: a review. *Proceedings of the Hawaiin Entomological Society*, 24, 317–326.
Swezey, O.H., Fullaway, D.T., Mason, A.C., Holdaway, F.G. & Sakimura, K. (1939) Recent records of the introduction of beneficial insects into the Hawaiian Islands. *Proceedings of the Hawaiian Entomological Society*, 10, 349–352.
Taylor, R.L. (1927) A new species of parasitic Hymenoptera (Chalcidoidea, Eupelmidae). *Bulletin of the Brooklyn Entomological Society*, 22, 205−207.
Taylor, R.L. (1929) The biology of the white pine weevil, *Pissoides strobi* (Peck), and a study of its insect parasites from an economic viewpoin. *Entomologica Americana*, 10, 1−83.
Thompson, M. L. (1980) Parasitoids of the bogus yucca moth (*Prodoxus marginatus* Riley). Master of Science Thesis, California State Polytechnic University, Pomona.
Thuróczy, C. (1992) The types of Chalcidoidea described by Hungarian authors, preserved in the Hungarian Natural History Museum. *Folia Entomologica Hungarica*, 52, 123−179.
Timberlake, P.H. (1926) Hymenoptera. *In*: Insects of Hawaii, Johnston Island and Wake Island. *Bernice P. Bishop Museum, Bulletin*, 31, 17–43.
Trjapitzin, V.A. (1963) A new hymenopteran genus from Baltic amber. *Palaeontological Journal*, 3, 89–95. [In Russian.]
Viggiani, G. (1975) La lotta biologica di tipo convenzionale. *Atti del X Congresso Nazional Italiano di Entomologia, Sassari, 20-25 Maggio 1974*, 161–187.
Walker, F. (1837) Monographia Chalciditum. *Entomological Magazine, London*, 4, 349−364, 439−461.
Walker, F. (1847) Characters of undescribed Chalcidites collected in North America by E. Doubleday, Esq., and now in the British Museum. *Annals and Magazine of Natural History*, 20, 19−29.
Wells, M.L., Hagan, D.V. & McPherson, R.M. (2001) Survey of parasitoids associated with *Rhyacionia frustrana* (Comstock) in Bulloch County, Georgia. *Journal of Entomological Science*, 36, 101−104.
Westwood, J.O. (1839) *Synopsis of the genera of British insects*. London, England, 158 pp.
Woodruff, L.C. (1929) *Eupelmus popa* Girault, a parasite of the sorghum midge, *Contarinia sorghicola* Coquillet. *Journal of Economic Entomology*, 22, 160−167.
Yang, Z.-Q. (1996) *Parasitic wasps on bark beetles in China (Hymenoptera)*. Science Press, Beijing, iv + 363 pp.



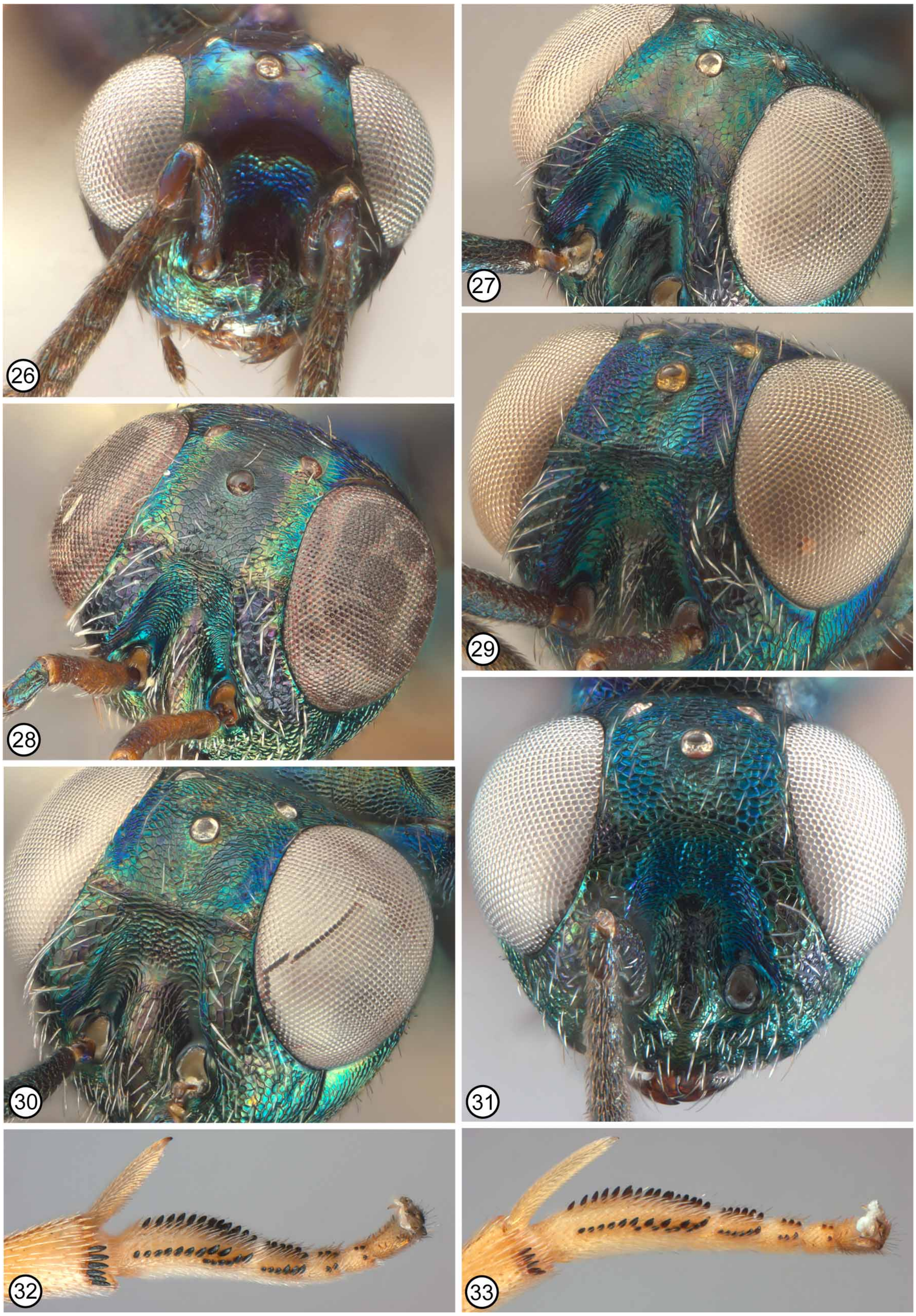
FIGURES 1−8. 1−7, lateral habitus *Eupelmus* (*Episolindelia*): **1**, *E. australiensis* ♀ (1); **2**, *E. grisselli* ♀ (52); **3**, *E. rubicola* ♀ (3); **4**, *E. varicauda* ♀ (7); **5**, *E. fuscipectus* ♀ (5); **6**, *E. australiensis* ♂ (2); **7**, *E. rubicola* ♂ (4). **8**, *E.* (*Eupelmus*) *pervius* ♀ forewing venation (26). No. in parenthesis = CNC Photo no. (**bc** = basal cell, **bsl** = basal setal line, **cc** = costal cell, **lc** = linea calva, **mv** = marginal vein, **pmv** = postmarginal vein, **pst** = parastigma, **smv** = submarginal vein, **stv** = stigmal vein, **va** = vanal area).



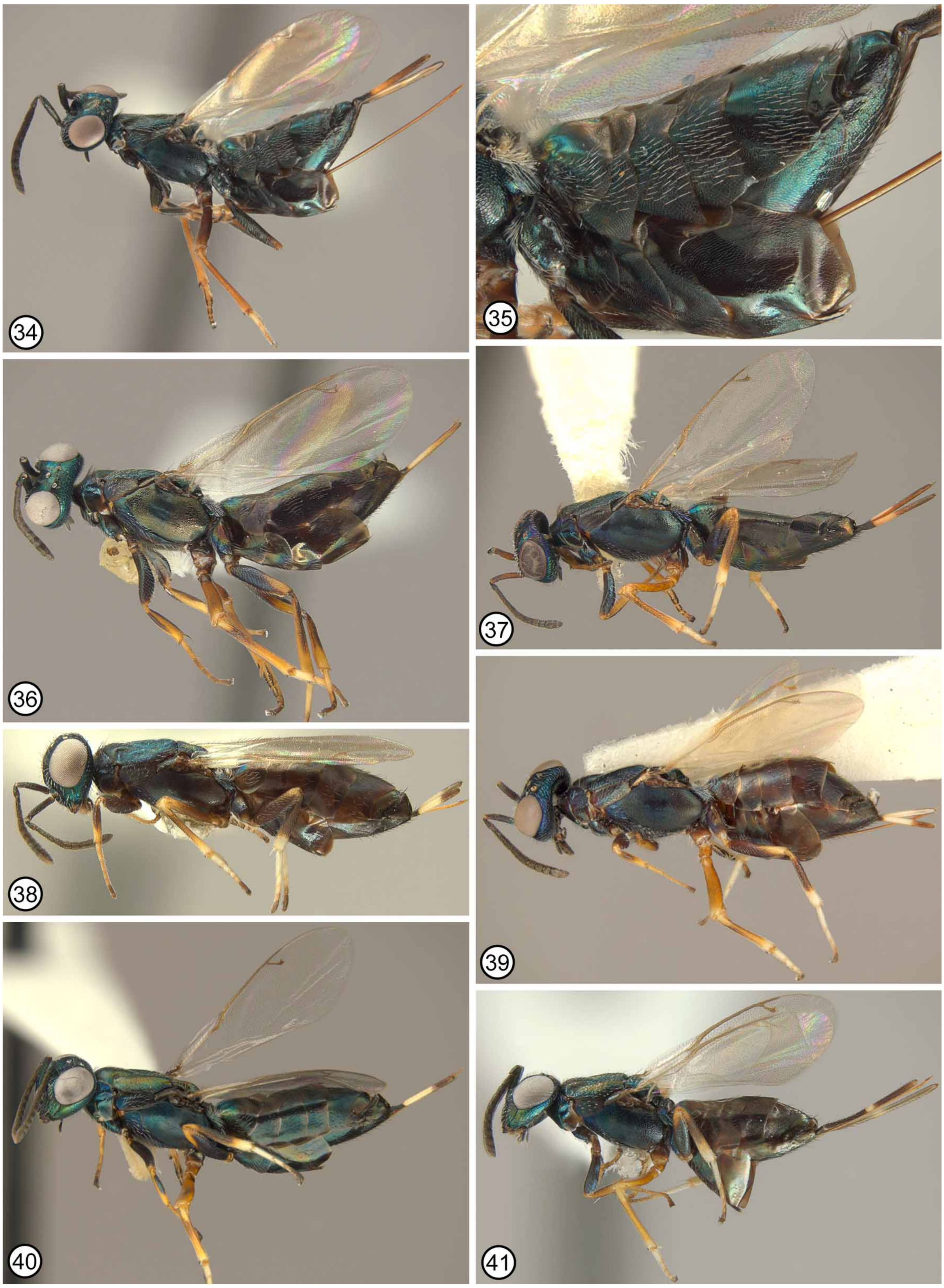
FIGURES 9−17. *E.* (*Eupelmus*) ♀. **9**, *E. cushmani*, apex of gaster, ventral view (45). 10−15, *E. dryorhizoxeni*: **10**, head, frontodorsal view (48); **11**, head and gaster, dorsal view (48); **12**, lateral habitus (15); **13**, frontovertex, dorsal view (51); **14**, acropleuron (15); **15**, acropleuron (51). 16 and 17, lateral habitus: **16**, *E. microzonus* (17); **17**, *E. stramineipes* (9). No. in parenthesis = CNC Photo no. (**asl** = apparent sheath length, **hyp** = hypopygium, **ipo** = inner plate of ovipositor, **osh** = ovipositor sheath)



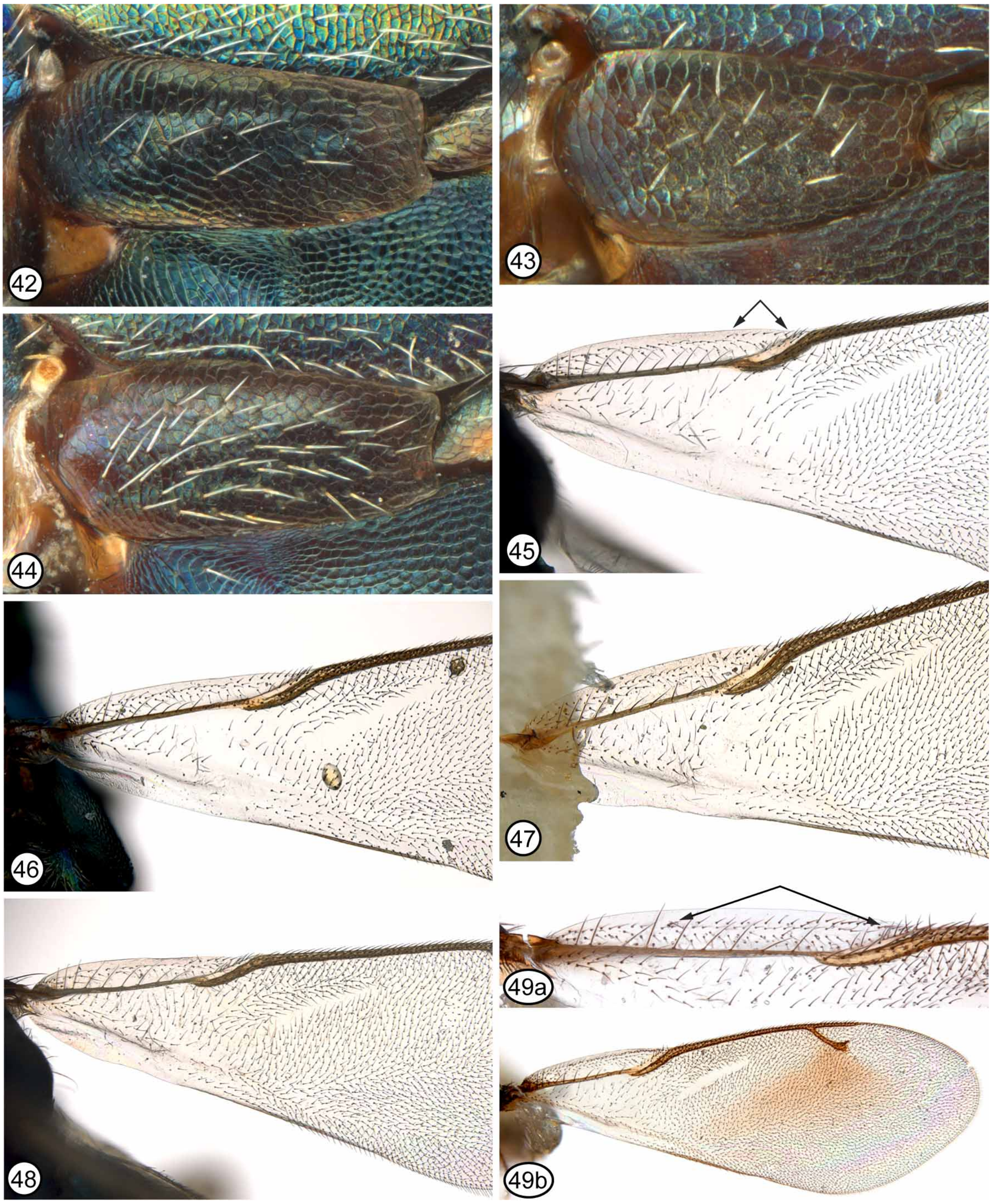
FIGURES 18−25. *E.* (*Eupelmus*) ♀. 18 and 19, mesotibial and mesotarsal peg pattern: **18**, *E. stramineipes* (9); **19**, *E. microzonus* (18). 20−24, lateral habitus: **20**, *E. pini* (20); **21**, *E. cynipidis* (14); **22**, *E. conigerae* (13); **23**, *E. nitifrons* (12); **24**, *E. arizonensis* (66) (insert: ovipositor sheaths of paratype (67)). **25**, *E. arizonensis*, head, frontodorsal view (66). No. in parenthesis = CNC Photo no.



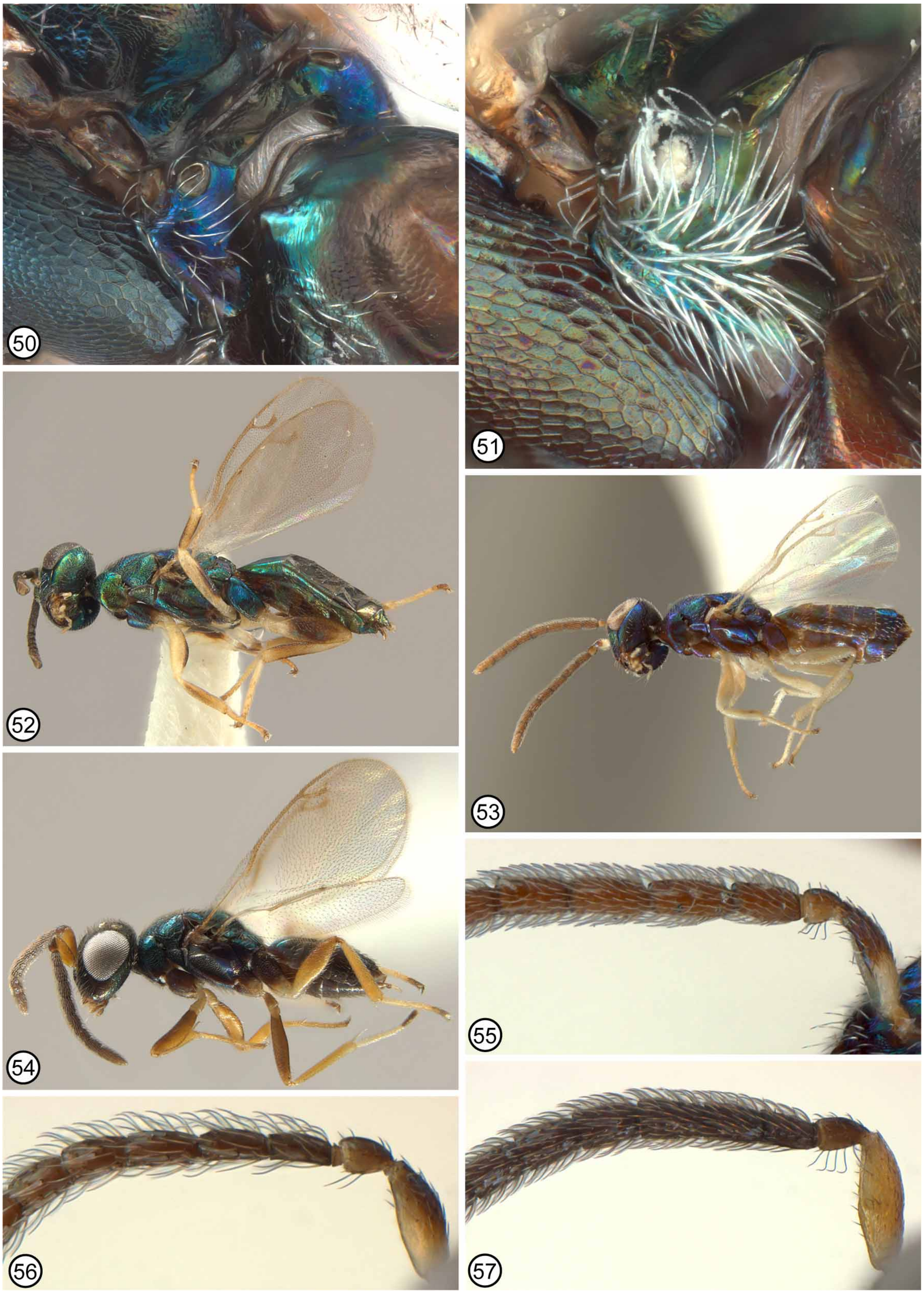
FIGURES 26−33. *E.* (*Eupelmus*) ♀. **26**, *E. nitifrons*, head, frontal view (12). 27−31, head, frontodorsal view: **27**, *E. annulatus* (22); **28**, *E. cushmani* (24); **29**, *E. cyaniceps* (28); **30**, *E. pervius* (26). **31**, *E. curticinctus* (11). 32 and 33, mesotibial and mesotarsal pegs: **32**, *E. cyaniceps* (28); **33**, *E. pini* (60). No. in parenthesis = CNC Photo no.



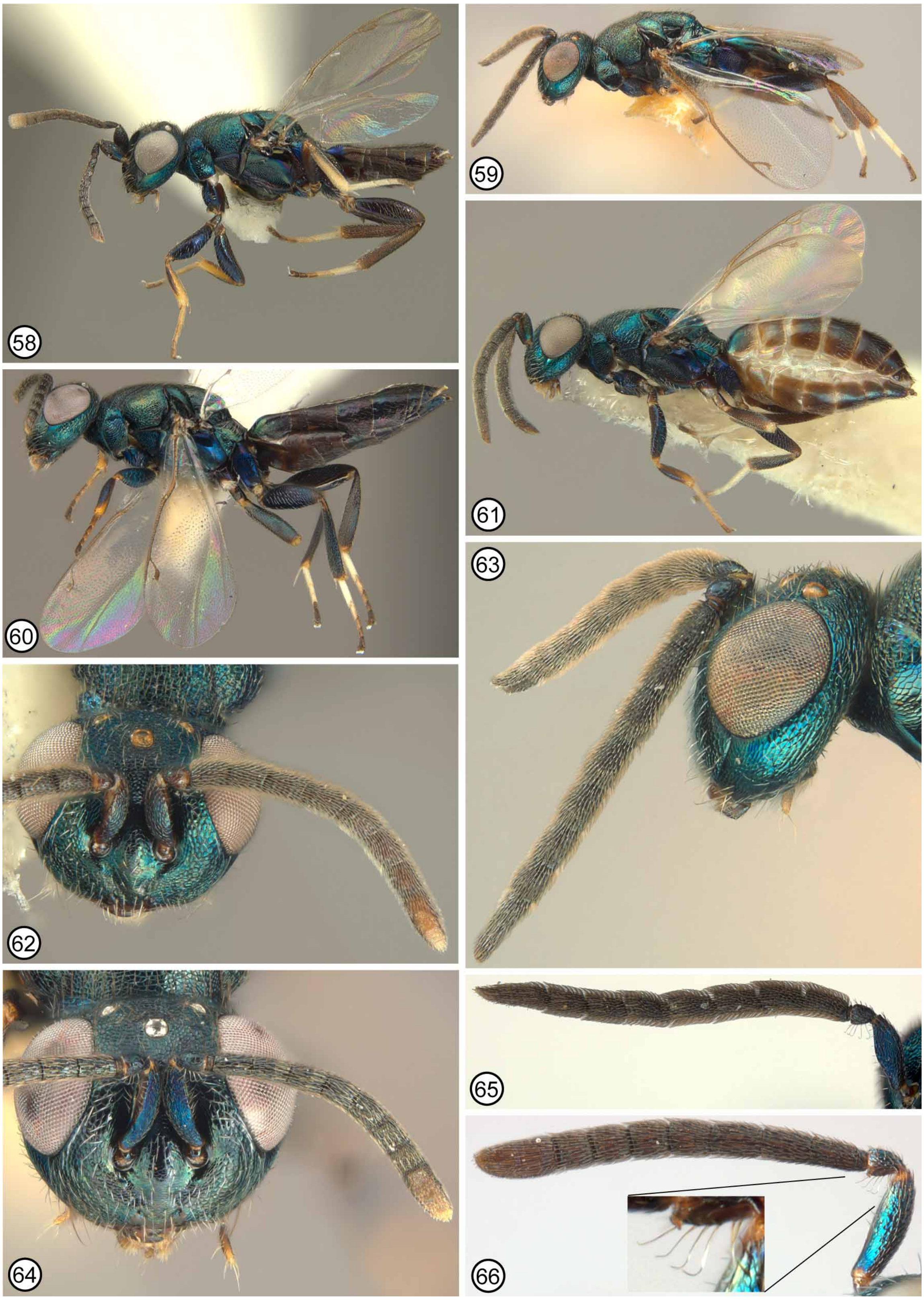
FIGURES 34−41. *E.* (*Eupelmus*) ♀. 34 and 35, *E. utahensis* (21): **34**, lateral habitus; **35**; gaster, lateral. 36−41, lateral habitus: **36**, *E. annulatus* (22); **37**, *E. cushmani* (24); **38**, *E. cyaniceps* (47); **39**, *E. cyaniceps* (28); **40**, *E. pervius* (26); **41**, *E. curticinctus* (11). No. in parenthesis = CNC Photo no.



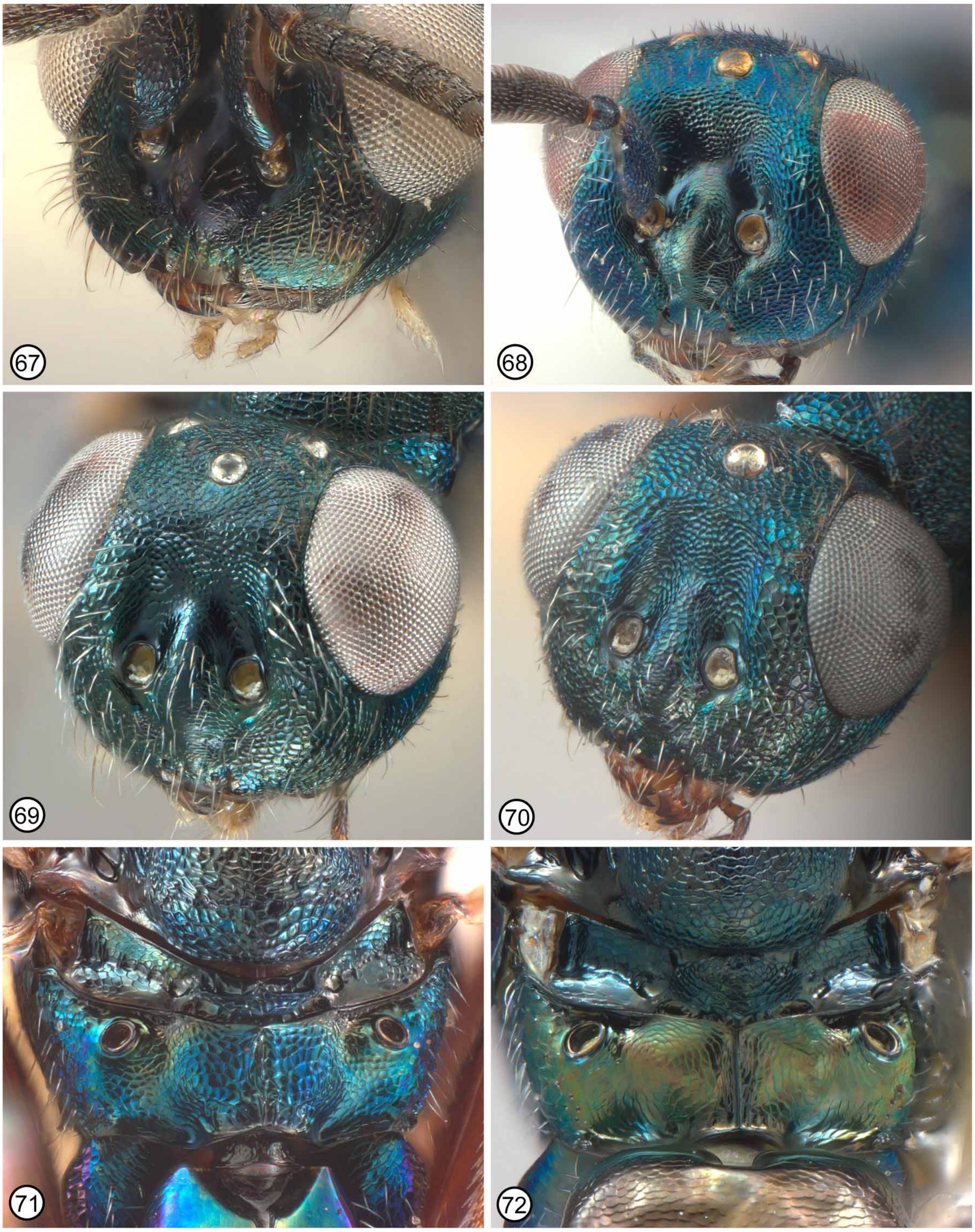
FIGURES 42−49. *E.* (*Eupelmus*) ♀. 42−44, prepectus: **42**, *E. cushmani* (46); **43**, *E. cyaniceps* (47); **44**, *E. cyaniceps* (28). 45−48, forewing base: **45**, *E. pervius* (26); **46**, *E. pervius* (56); **47**, *E. pervius* (53); **48**, *E. cyaniceps* (54). **49**, *E. annulatus* (61): 49a, costal cell; 49b, forewing. No. in parenthesis = CNC Photo no. (Arrows point to limits of setae on dorsal surface of costal cell.)



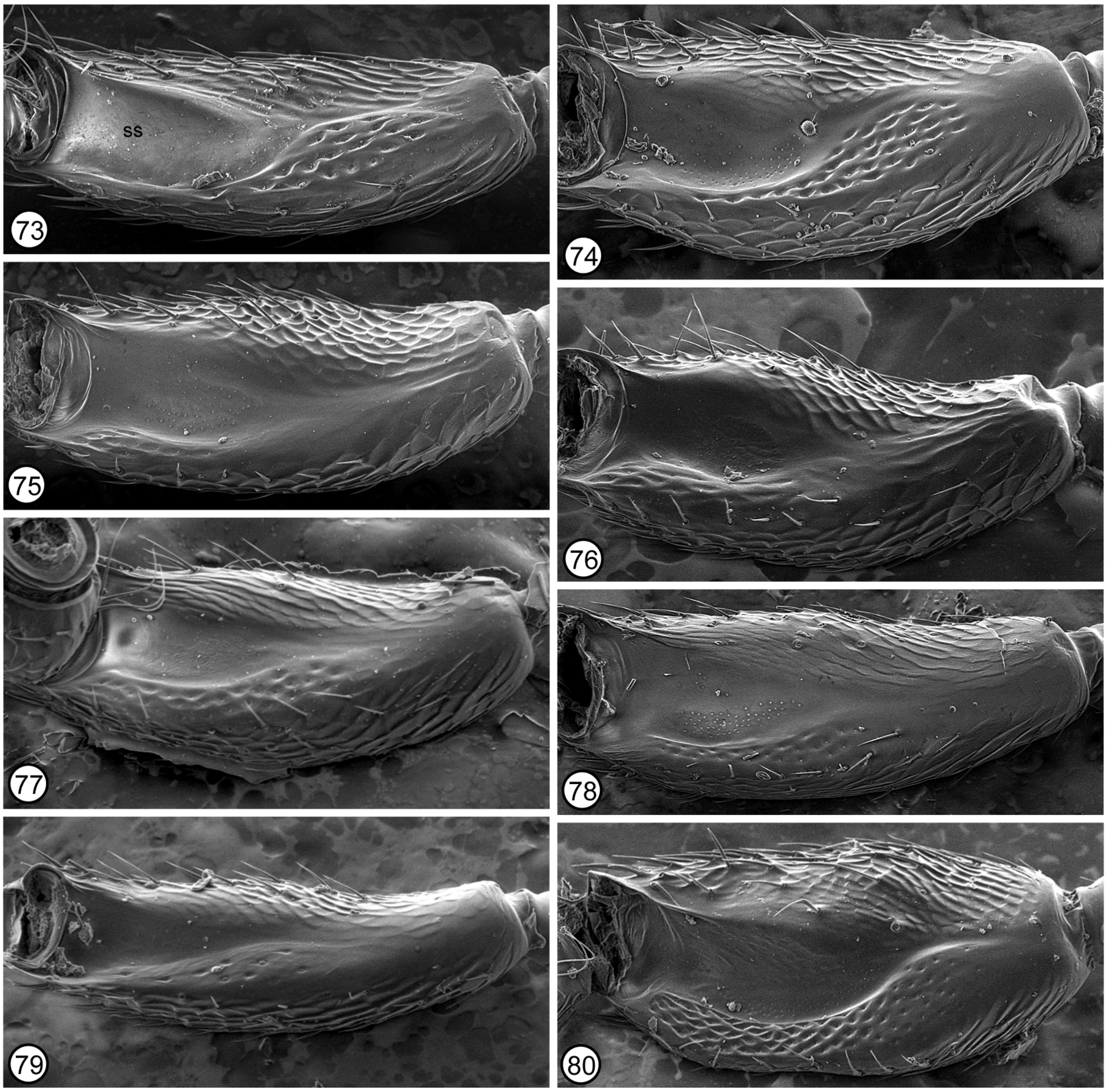
FIGURES 50–57. *E.* (*Eupelmus*). 50 and 51, propodeal-metanotal setation, ♀: **50**, *E. cushmani* (64); **51**, *E. pervius* (63). 52−54, lateral habitus, ♂: **52**, *E. stramineipes* (10); **53**, *E. microzonus* (19); **54**, *E. dryorhizoxeni* (16). 55−57, antenna with pedicular setae, ♂: **55**, *E. microzonus* (19); **56**, *E. rubicola* (4); **57**, *E. dryorhizoxeni* (65). No. in parenthesis = CNC Photo no.



FIGURES 58–66. *E.* (*Eupelmus*) ♂. 58−61, lateral habitus: **58**, *E. annulatus* (23); **59**, *E. cushmani* (25); **60**, *E. pervius* (27); **61**, *E. cyaniceps* (29). 62−64, head and antenna: **62**, *E. cyaniceps* (29); **63**, *E. cushmani* (25); **64**, *E. pervius* (27). 65 and 66, antenna: **65**, *E. cynipidis* (58); **66**, *E. pervius* (insert: enlargement of pedicular setae) (62). No. in parenthesis = CNC Photo no.



FIGURES 67–72. *E.* (*Eupelmus*) ♂. **67**, *E. annulatus* (23), lower face. 68−70, head, frontolateral view: **68**, *E. cynipidis* (58); **69**, *E. pervius* (27); **70**, *E. curticinctus* (57). 71 and 72, propodeum: **71**, *E. curticinctus* (57); **72**, *E. pervius* (27). No. in parenthesis = CNC Photo no.



FIGURES 73–80. *E.* (*Eupelmus*) ♂. 73−80, outer surface of scape (pedicel on left): **73**, *E. dryorhizoxeni* (006); **74**, *E. cynipidis* (007); **75**, *E. cushmani* (008); **76**, *E. cushmani* (004); **77**, *E. cyaniceps* (001); **78**, *E. pervius* (009); **79**, *E. curticinctus* (003); **80**, *E. annulatus* (005). No. in parenthesis = CNCI LB-specm. no. (**ss** = scapular scrobe)