Zootaxa 3948 (3): 422–450
www.mapress.com/zootaxa/

Article

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

http://dx.doi.org/10.11646/zootaxa.3948.3.4
http://zoobank.org/urn:lsid:zoobank.org:pub:E349818A-165B-4CA8-BA29-0E345AFDF6C6

The presence of *Notanisus* Walker (Hymenoptera: Pteromalidae) in North America and revision of the *oulmesiensis* species group

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

Abstract

The presence and distribution of two species of *Notanisus* Walker (Hymenoptera: Pteromalidae) in North America is reported. *Notanisus sexramosus* (Erdős), originally described from Hungary and previously reported from Maryland, USA, is recorded also from Massachusetts and Pennsylvania based on a male and macropterous and brachypterous females. Males of *Notanisus* are shown to have two types of flagellar structure, ramose and pedicellate, and diagnostic features are given for the previously unknown males of *N. clavatus* Bouček to differentiate these from those of *N. sexramosus* and *N. versicolor* Walker. Five other species are newly described, *Notanisus kansensis* **n. sp.** based on a female from Nebraska, USA, and four species from Sub-Saharan Africa and the Arabian Peninsula—*Notanisus brevipetiolus* **n. sp.** based on two females from Uganda and Zambia, *Notanisus longipetiolus* **n. sp.** based on a female from Zimbabwe and a female and two males from Mozambique, *Notanisus vanharteni* **n. sp.** based on a female and several males from United Arab Emirates, and *Notanisus yemenensis* **n. sp.** based on a female and male from Yemen. The latter five species are included with the Palaearctic species *N. oulmesiensis* (Delucchi) and *N. gracilis* (Yang) in the *oulmesiensis* species group, defined by the presence of reduced stigmal and postmarginal veins in both sexes. The seven *oulmesiensis*-group species are differentiated in a key and all treated species are illustrated through macrophotography. Monophyly and relationships of *Notanisus* within Cleonymini are discussed, including features that indicate it could be paraphyletic relative to *Callocleonymus* Masi.

Key words: Chalcidoidea, Cleonyminae, *Cleonymus*, *Callocleonymus*, *Dasycleonymus*, *Zolotarewskya*

Introduction

Walker (1837) described *Notanisus* (Hymenoptera: Pteromalidae: Cleonyminae: Cleonymini) for *N. versicolor* Walker from England. The genus has five junior synonyms (Noyes 2014), including *Pannonica* Erdős (1946), established for *P. sexramosa* Erdős from Hungary, and *Amarisca* Delucchi (1962), established for *A. oulmesiensis* Delucchi from Morocco. *Pannonica* was subsequently discovered to be a junior homonym by Erdős (1960a) and then proposed as a junior synonym of *Notanisus* by Bouček (1991), who synonymized it and its replacement name, *Pannoniella* Erdős (1960a), as well as *Amarisca* under *Notanisus*. Currently, there are 11 valid described species of *Notanisus*, including two from the Afrotropical, three from the Australasian, and six from the Palaearctic region. Mitroiu and Andriescu (2008) differentiated and illustrated the four species from Europe, not including *N. gracilis* (Yang 1996) or *N. grandis* Senatos (1996), which were described from China and Tajikistan, respectively.

Bouček and Heydon (1997) first recorded *Notanisus* in the Nearctic region, including the genus in their key to the genera of Nearctic Pteromalidae based on brachypterous females of *N. sexramosus* from Maryland, USA. Gibson (2003) subsequently reported a male of an unidentified species collected in Massachusetts, USA, and more recently BugGuide included images of what appeared to be brachypterous and macropterous females of *N. sexramosus* collected in Pennsylvania, USA. The Canadian National Collection held another unreported female of what was obviously a second species of *Notanisus* collected in Nebraska, USA. Comparison of this female with species keyed in Mitroiu and Andriescu (2008) revealed that it was similar to *N. oulmesiensis*, but that it differed in some respects. In order to more confidently determine whether the differences represented infra- or interspecific variation, *N. oulmesiensis* and other undescribed species similar to it were studied. This resulted in the discovery of

 Accepted by I. Miko: 17 Mar. 2015; published: 22 Apr. 2015

five new species that share several features with *N. oulmesiensis*, including some that are potentially informative for resolving relationships within Cleonymini. The aim of this paper is to more formally record the presence and distribution of *Notanisus* in North America and to revise a group of species characterized by reduced stigmal and postmarginal veins, which are here treated as the *oulmesiensis* species group.

Material and methods

This study is based on material deposited in the following institutions; the names of individuals who assisted in loans of material or provided information on material are given in parenthesis:

BMNH Natural History Museum, London, UK (N. Dale-Skey).
CNC Canadian National Collection of Insects, Arachnids and Nematodes, Ottawa, Ontario, Canada.
ETHZ Entomology Collection, Swiss Federal Institute of Technology, Zurich, Switzerland (R. Eastwood).
MICO Mitroiu Collection, Faculty of Biology, Alexandru Ioan Cuza, Iasi, Romania (M.-D. Mitroiu).
NMPC Narodni Muzeum v Praze, 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).
USNM United States National Entomological Collection, U.S. National Museum of Natural History, Washington, DC (M. Gates).

Terminology follows Gibson (2003). A backslash in citation of holotype data indicates separate labels, and new country records for previously described species are indicated by an asterisk.

Yang (1966) described the genus *Anacallocleonymus* and the species *A. gracilis* in Chinese, but provided English summaries (pp. 308–309) of these as well as line drawings of the dorsal habitus, fore wing and antenna of the holotype (Yang 1996, figs 144–146). At the time of the present study the unique holotype of *N. gracilis* (Yang) could not be located in NWCF except for a microscope slide with a fore wing and antenna (Zhong-qi Yang, pers. comm.). These were imaged by Dr. Yang and are included here as Figs 27 and 28. Dr. Yang also kindly provided English translations of the generic diagnosis and species description, which are included as part of the species treatment to supplement the English summaries given in the original description. Information provided between square brackets is new information based on the images of the fore wing and antenna. All other specimens were photographed with a Leica DFC 425C, 5 megapixel digital camera attached to a Leica Z16 APO motorized macroscope and illuminated with three Leica KL2500 LCD fibre optic light sources fitted with 250-watt cold light reflector lamps, filtered through a Styrofoam dome to reduce glare. Species descriptions other than for *N. gracilis* were made from specimens examined with a Nikon SMZ-U microscope fitted with a 10 mm ocular grid having 100 divisions for measurements, and two Leitz 50-watt tungsten halogen light sources used to illuminate specimens. A piece of translucent Mylar tracing acetate was taped to the objective between the light source and specimen to reduce glare. As a result, lighting of specimens for photography was more uniform than the more unidirectional lighting for observation, which affects appreciation of color and color pattern. Serial images used to prepare the plates of illustrations were combined with Zerene Stacker and digitally retouched as necessary using Adobe Photoshop to enhance clarity. Excluding holotypes, specimens used for photography were labeled with a "CNC Photo 2014-x" specimen label, which is cited in the figure captions. This is done so that the exact specimen imaged for any photo can be located by others in the future.

The only non-*oulmesiensis* group species included in the study, *N. sexramosus*, is treated first, followed by treatment of the *oulmesiensis* group with the species in alphabetical order. The specimens of *N. sexramosus* collected in Pennsylvania were kindly donated to the CNC by Mr. John Rosenfeld, an avid insect photographer.

Notanisus Walker, 1837

Synonymy. See Gibson (2003) or Noyes (2014). Graham (1969: 37) provided features in a key to differentiate both sexes of *Pannoniella* from *Notanisus*, but Bouček (1991: 204) synonymized *Pannoniella* and *Amarisca* under

Notanisus. *Antsingia* Risbec (1952) was synonymized under *Notanisus* by Rasplus in Bouček (1991), and Gibson (2003) synonymized *Anacallocleonymus* Yang (1996).

Recognition. Gibson (2003) provided keys to the tribes of Cleonyminae and the five world genera of Cleonymini—*Callocleonymus* Masi, *Cleonymus* Latreille, *Dasycleonymus* Gibson, *Notanisus* and *Zolotarewskya* Risbec. He stated that the petiole is at least subquadrate in *Notanisus*, but this description is inexact for *N. sexramosus* and *N. clavatus* Bouček, in which the body of the petiole is distinct and quadrangular but transverse (Figs 8, 14) (Bouček 1961, fig. 1). The key of Bouček and Rasplus (1991) readily differentiates *Notanisus* from the two other genera of Cleonymini in the Palaearctic region, *Callocleonymus* and *Cleonymus*, though not all species of the genera in other regions. The presence of *N. kansensis* in North America also makes correct keying of *Notanisus* difficult using Bouček and Heydon (1997). Females will not key correctly through couplet 55 because of their very short postmarginal vein (Figs 35, 36) and the absence of complete notauli (Fig. 33). Macropterous females of *N. sexramosus* have the postmarginal vein about 1.1× the length of the stigmal vein (Fig. 7), but because of the absence of complete notauli will also key through the second half of couplet 55 to couplet 154. They will then key to couplet 170 where they will not key further because of the mixture of features listed in each half of the couplet. However, females of *Notanisus* are distinguished easily from other keyed genera by the apical funicular being produced into at least a short projection below the base of the clava in combination with the clava either being tapered apically into a curved, somewhat finger-like projection (Figs 6, 19, 27, 43) or with a terminal, setose, spiniform projection (Figs 31, 59, 68, 83). If specimens are taken through the first half of couplet 55 to couplet 62, only one feature given, pronotum longer than mesoscutum, differentiates both sexes of *Notanisus* from *Cleonymus*. A second feature, bare versus setose eyes, differentiates only females of the two genera in North America (but not all world species), whereas the female feature given is valid only for brachypterous females of *N. sexramosus*. Males of *N. sexramosus* are distinguished by their ramose flagellum, the basal six funiculars being anelliform but each with an extremely long ramus (Fig. 10). Males of *N. kansensis* likely also have a ramose flagellum (but see further below).

Notanisus sexramosus (Erdős)

Figs 1–15

Pannonica sexramosa Erdős, 1946: 132–133 (figs 1a, b). Holotype ♂ (HNHM, not examined). Type data: Hungary, Hőgyész, 26.VI.1946.

Pannonica sexramosa; Erdős, 1957: 361–362 (♀ description, fig. 20 *nec* 10; host); Bouček, 1958: 269–370 (fig. 25: brachypterous ♀, dorsal habitus; fig. 26: macropterous ♀, fore wing; fig. 27: ♂ antenna).

Pannoniella sexramosa; Erdős, 1960a: 306; Erdős, 1960b: 178–179 (fig. 71: brachypterous ♀, dorsal habitus; fig. 72: ♂ dorsal habitus); Graham, 1969: 40–41 (synonymy, distribution, hosts).

Notanisus sexramosus; Bouček, 1991: 204; Bouček and Heydon, 1997 (fig. 67: brachypterous ♀, dorsal habitus); Bouček and Rasplus, 2009 (fig. 37: brachypterous ♀, dorsal habitus; fig. 39: ♂ antenna); Mitroiu and Andriescu, 2008: 312 (♀, ♂ keyed), 313 (distribution, description of male genitalia), 315 (fig. 4, dorsal habitus of brachypterous ♀), 316 (fig. 8, dorsal head and mesosoma of brachypterous ♀), 317 (fig. 9, lateral head and antenna of ♂), 318 (fig. 15, ♂ genitalia).

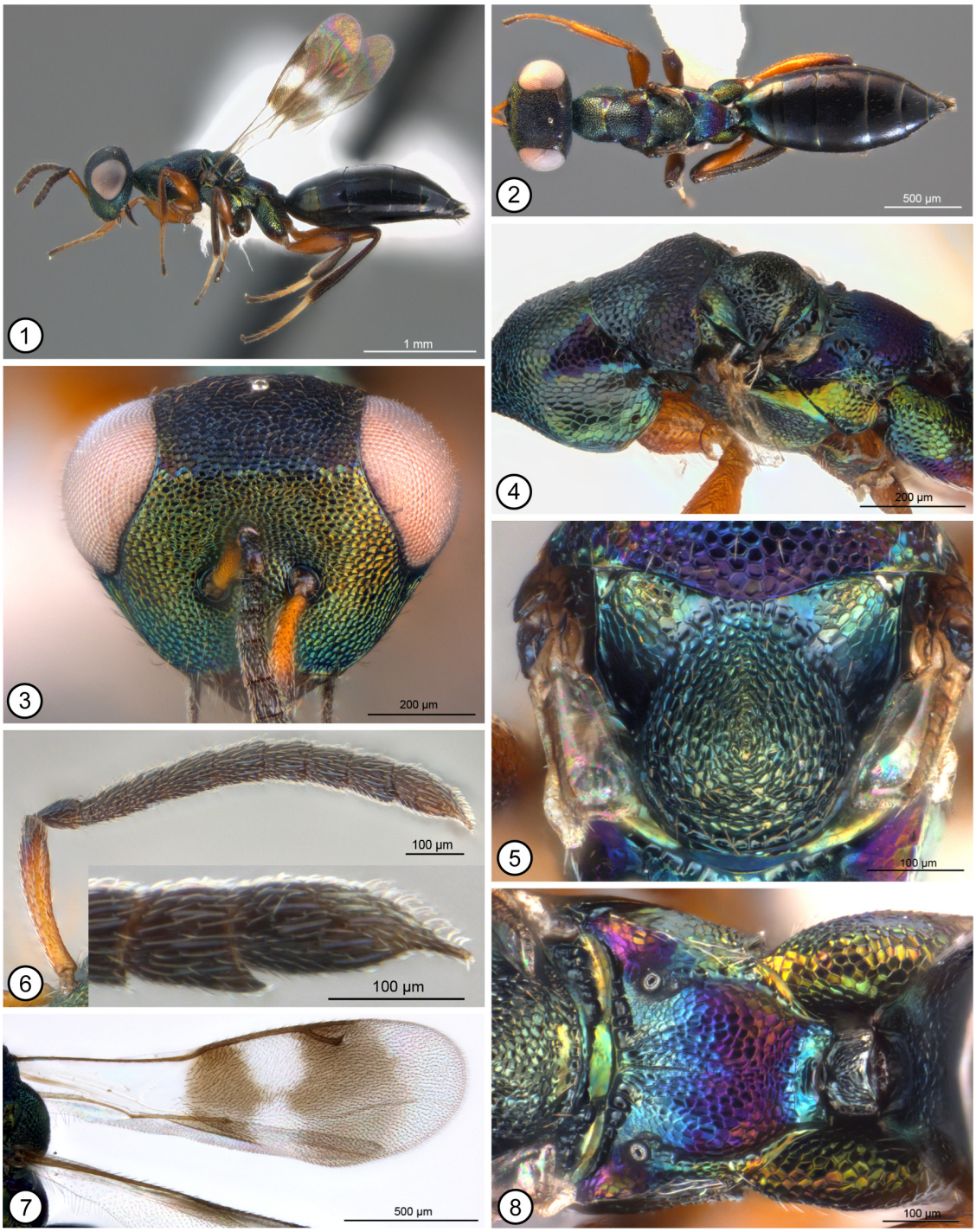
Distribution. NEARCTIC: USA. PALAEARCTIC: Europe (see Noyes 2014).

Material examined. NEARCTIC: **USA**. *Maryland*: Prince Georges Co., Laurel, 2mi. S., 13.VI.1986, M.E. Schauff (4 brachypterous ♀, USNM). *Massachusetts*: Middlesex Co., Lincoln, Int[ercept]. Tr[ap]., 3–17.v.1982, ET. Armst[?] (1♂, CNC). *Pennsylvania*: Allegheny Co., Allison Park, 40.59505°N 79.95483°W, 7, 10, 12.VII.2014, J. Rosenfeld (3 brachypterous and 1 macropterous ♀, CNC).

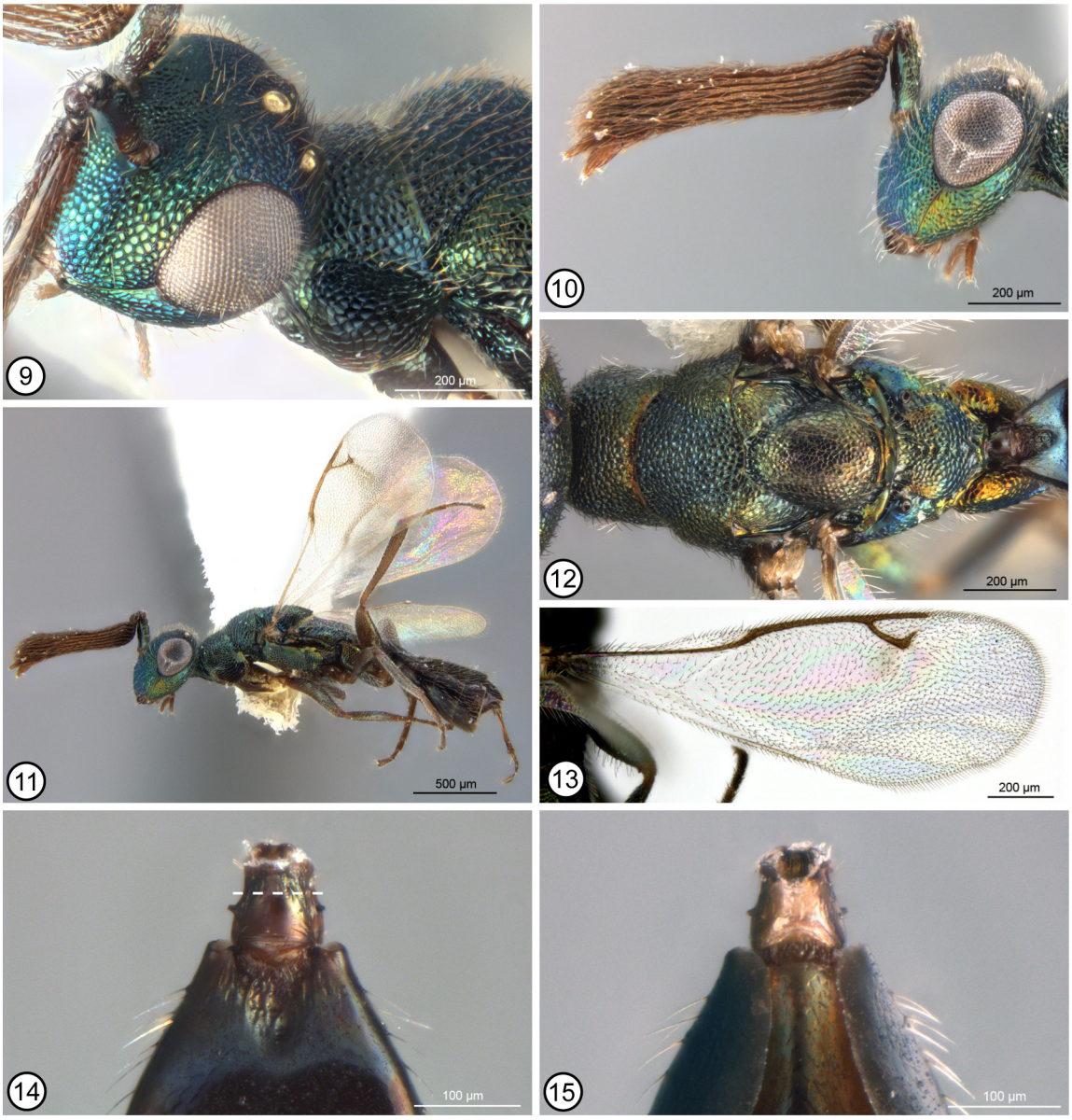
PALAEARCTIC: **CZECH REPUBLIC**. Bohemia, Týnistě n. orl., obora Bouček (1♂, ETHZ); Velký Vřeštov, 10.5.1958, Bouček (1 brachypterous ♀, ETHZ). **ESTONIA***. Koiva puisniit, 4.V.2001, V. Soon (1 brachypterous ♀, MICO). **HUNGARY**. Veszprém distr., env. Hegyesd, 46.92691°N 17.51883°E, 175 m, 27–28.VI.2010, H. Baur, G. Delvare, G. Gibson, P. Janšta, steppe, scrub, oaks (2♂, CNC). **ITALY***. Lazio, Viterbo, Barbarano Marturanum Park, 25.IX.–8.X.1960, Romano Nat. Region, M. Olmi, MT (1♂, CNC). **ROMANIA**. Dobr. Rezerv., Agigea, 16, 22–25.VII.1964, C.G. Nagy (1 brachypterous ♀ and 2♂, MICO).

Description. FEMALE (Figs 1, 2). Length = 2.2–3.6 mm. Head in lateral view (Fig. 1) slightly angulate at level slightly less than half distance between torulus and anterior ocellus, and in frontal view (Fig. 3) distinctly differentiated into face and frontovertex by sculpture and depending on angle of light color at level of angulation:

face green and strongly reticulate with smaller reticulations above level of toruli than laterally on gena; frontovertex dark bluish with some coppery to violaceous lusters under some angles of light, mostly along inner orbits, and with larger but shallower, more isodiametric meshlike reticulation than on face; in dorsal view (Fig. 2) OOL 2.4–3.4× maximum posterior ocellar diameter. Antenna (Fig. 6) with scape yellowish-orange except extreme apex dark dorsally, pedicel and flagellum uniformly dark; fl1 transverse, anelliform, but all funiculars slightly longer than wide and increasing slightly in width toward apical funicular; apical funicular ventrally protruding as short v-shaped angulation extending over base of clava (Fig. 6, inset); clava with slender, terminal, setose, spiniform process. Mandibles tridentate with three similar teeth.



FIGURES 1–8. *Notanisus sexramosus* ♀. 1, lateral habitus, macropterous form (2014-1). 2–5, brachypterous form (2014-2): 2, dorsal habitus; 3, head, frontal; 4, mesosoma, dorsolateral; 5, scutellar-axillar complex and wings. 6, antenna (2014-2) [insert: preclaval and claval segments, lateral (2014-1)]. 7, fore wing (2014-1). 8, apex of scutellum–base of gaster and metacoxae, dorsal (2014-2).



FIGURES 9–15. *Notanisus sexramosus* ♂. 9, head and pronotum, dorsolateral (2014-47). 10, head and antenna, lateral (2014-3). 11, lateral habitus (2014-3). 12, mesosoma, dorsal (2014-4). 13, fore wing (2014-4). 14 and 15, petiole and base of gaster (2014-4): 14, dorsal; 15, ventral (dashed line in Fig. 14 delimits posterior body from anterior neck of petiole).

Pronotum (Figs 2, 4) dark with slight greenish luster except usually with more or less triangular violaceous to purple region posterolaterally (Fig. 4); meshlike reticulate with collar uniformly low convex, not differentiated posterolaterally. Mesoscutum (Figs 2, 4) similarly colored and uniformly reticulate as pronotal collar, but variably broadly blue to purple or reddish-violaceous posteriorly along transscutal articulation and more extensively on lateral lobes, the lateral lobes sometimes with some coppery luster under some angles of light; scutellar-axillar complex (Fig. 5) dark with slight greenish luster, axillae almost completely obliquely angled, the dorsal surface reticulate and posteriorly oblique surface coriaceous, and scutellum convex (Figs 1, 4), reticulate-rugose to punctate-rugose (Fig. 5). Tegula brown to yellowish. Macropterous (Figs 1, 7) or brachypterous (Figs 2, 4, 5). Macropterous individual with fore wing (Fig. 7) entirely, uniformly setose beyond level of base of marginal vein, including adjacent to marginal vein and apically beyond stigmal vein; costal cell narrow, with inconspicuous pale setae along most of ventral length; stigmal and postmarginal veins conspicuously long, marginal vein only about 3.2× and about 2.4× length of stigmal and postmarginal veins, respectively; disc brownish-infuscate with dark brown setae behind venation except for slightly separated anterior and posterior hyaline spots with white setae, the anterior spot occupying more than half length of marginal vein and much nearer to stigmal vein than base of

marginal vein; marginal fringe entire and distinct. Brachypterous individual with wings (Fig. 5) extending only to about level of posterior margin of scutellum; fore wing variably distinctly truncate to obliquely truncate, without marginal fringe except sometimes for a few setae apically and usually narrowly setose and more brownish apically, with very slender costal cell and comparatively thick submarginal vein extending to wing margin apically, the submarginal vein with a few setae apically and sometimes slightly expanded, but without differentiated marginal, stigmal and postmarginal veins; hind wing lanceolate with sinuate, setose vein along anterior margin extending to acutely angled apex with much longer seta. Prepectus bare. Mesopleuron bare along posterior margin (Fig. 4). Metapleuron (Fig. 4) bare, variably extensively reticulate ventrally, but smooth and shiny or at most with obscure, effaced meshlike sculpture dorsally. Legs (Figs 1, 2) with at least pro- and sometimes mesocoxae entirely, and metacoxa ventroapically similarly pale as scape and most of femora, but femora at least dorsoapically and at least meso- and metatibiae dark brown; protarsus darker brown apically than basally, but at least basitarsi of middle and hind legs and sometimes up to subsequent two tarsomeres whitish or at least distinctly paler than subsequent darker brown tarsomeres. Propodeum (Fig. 8) green to bluish-green at least anteriorly mesal to spiracles, but variably extensively blue or purple to reddish-violaceous posteriorly and on callus anterolateral to spiracles, though admarginal strip also green to blue; propodeal panels completely reticulate except for crenulate furrow along anterior margin and median carina extending at most two-thirds distance to admarginal strip; callus smooth and shiny or at least more finely coriaceous anterolateral to than posterior of spiracle.

Petiole (Fig. 8) similarly dark as gaster, body transverse, finely sculptured dorsally and uniformly sclerotized ventrally. Gaster (Figs 1, 2) uniformly dark brown except basally usually with variably distinct green to bluish luster under some angles of light; presyntergal tergites isodiametric meshlike coriaceous except smoother along extreme posterior margins and basal two tergites less distinctly sculptured, with Gt2 strongly transverse, much shorter than other tergites, and Gt4 the largest tergite (Fig. 2).

MALE (Fig. 11). Length = 1.7–2.2 mm. Similar in color to female except head (Figs 9, 10) and mesosoma (Fig. 12) more uniformly dark with slight metallic green to coppery lusters, the frontovertex often with slight bluish luster, but mesosoma without patterning as described for female; legs (Fig. 11) with all coxae, femora and tibiae dark similar to mesosoma; fore wing (Fig. 13) hyaline or at most with only slight brownish infuscation. Setation similar to female, including bare prepectus, except as follows: head, including eye, and thorax and gaster dorsally much more conspicuously setose; fore wing with costal cell much broader and setose dorsally and ventrally, and basal cell also setose. Structure similar to female except as follows: petiole body smooth and shiny dorsally (Fig. 14) and ventrally quite broadly membranous mediolongitudinally over at least anterior half (Fig. 15); antenna (Fig. 10) 12-segmented with ramose flagellum, fl1 strongly transverse (anelliform), basal six funiculars (fl2–fl7) also anelliform but with long ramus uniformly covered with brown setae similar to remaining flagellum, and fl8 at least about 3.8× as long as similarly long fl9 and fl10. Sculpture similar to female except median carina of propodeum absent to entire (Fig. 12).

Hosts. *Tetramesa calamagrostidis* (Schlechtendal) (Hymenoptera: Eurytomidae) developing in stems of reed grass, *Calamagrostis* sp. (Poaceae) (Bouček 1958).

Remarks. Although not an *oulmesiensis*-group species, females of *N. sexramosus* usually have posterolateral regions of the pronotum differentiated by color, though not sculpture. Mitroiu and Andriescu (2008) did not have males of *N. clavatus*, but the CNC has four males from Iran* identified as this species by Z. Bouček in 1989 as well as males from Croatia (8 CNC) and Greece (2 CNC, 1 BMNH) that appear to be the same species. Similar to conspecific females and males of *N. sexramosus*, the transverse petiolar body is dorsally smooth and shiny, and ventrally incompletely sclerotized mediolongitudinally (*cf*. Figs 14, 15). Males of *N. versicolor* have a quadrate to slightly longer than wide petiolar body that usually is quite distinctly sculptured dorsally (Mitroiu and Andriescu 2008, fig. 12), but which is at least uniformly sclerotized, tube-like. Unlike males of *N. sexramosus* but like those of *N. versicolor*, males of *N. clavatus* have only five flagellar rami.

Notanisus oulmesiensis species group

Diagnosis. *Both sexes*. Fore wing (Figs 20, 25, 27, 36, 44, 50, 60, 69, 76, 84) with stigmal and postmarginal veins both very short, the marginal vein about 6–8× stigmal vein length; bare basad level of parastigma; costal cell slender, bare dorsally but ventrally with variable number of inconspicuous setae within about basal third (Figs 25,

36, 50, 60, 69, 76, 84) to half (Fig. 27) and only very rarely with 1 or 2 setae within about apical third. *Female*. Antenna with clava either tapered apically into somewhat curved, finger-like projection (Figs 6, 19, 28, 43) or with a more spiniform, setose terminal process (Figs 31, 59, 68, 83), but at least preclaval funicular ventrally extended as process under clava for most of length excluding terminal process. Eye at most very sparsely and inconspicuously setose. Mesoscutum anteriorly between incomplete notauli similarly densely sculptured as pronotum dorsomedially, more minutely punctate-reticulate compared to obviously larger mesh-like reticulation posteriorly. Pronotum (except *N. gracilis*) with variably developed smoother, shinier, and usually differently colored regions posterolaterally (Figs 23, 33, 38, 55, 63, 80), sometimes differentiating distinct "shoulder-like" angulations. Axilla not uniformly sculptured, variably broadly reticulate anterodorsally but with obliquely angled posterior surface much more finely sculptured to smooth and shiny (Figs 22, 40, 57, 65, 81). Fore wing disc usually comparatively sparsely setose (except *N. gracilis*, Fig. 27), and dorsally usually with variably distinct, elongate bare region beyond level of stigmal vein (Figs 26, 45, 61, 70, 85) (ventral surface of region always with setae and dorsal surface sometimes with one or two setae in region, e.g. Figs 61, 85) and often with obviously shorter, less conspicuous setae posterior of cubital fold and/or distally (Figs 25, 45, 70, 85); with variably developed infuscate region posterior to venation, but without well delineated anterior and posterior hyaline spots behind marginal vein. *Male*. Antenna 11-segmented, either ramose (Fig. 75) or pedicellate (Fig. 49).

Remarks. Of the above diagnostic features, the only one shared by all members of the *oulmesiensis* group and by no other species of *Notanisus* is conspicuously reduced stigmal and postmarginal veins in both sexes. Based on the description and images of *N. gracilis*, females of this species differ from other *oulmesiensis*-group females in at least three features, the absence of posterolaterally differentiated regions on the pronotum, a ventrally more extensively setose costal cell (Fig. 27), and a uniformly setose fore wing disc (Fig. 27). These features could indicate *N. gracilis* is the basal lineage of the *oulmesiensis*-group. Alternatively, the reduced stigmal and postmarginal veins of *N. gracilis* could represent an independent convergence rather than a putative synapomorphy supporting common ancestry with other *oulmesiensis*-group species.

The only previously described species of *Notanisus* from Africa are *N. cyaneus* (Risbec, 1952) and *N. sylvaticus* (Risbec, 1952). Although I did not examine type material of these two species, they are not members of the *oulmesiensis* group because the marginal vein is described as three times as long as the postmarginal vein in *N. cyaneus* and twice the length of the stigmal vein in *N. sylvaticus*. Similarly, the stigmal vein is illustrated and/or described as comparatively long in the three described species from the Australasian region (Bouček 1988, fig. 405) and *N. grandis* (Senatos 1996, fig. 1).

Key to *oulmesiensis*-group species

1 Female 2
- Male 8

2(1) Gastral petiole yellowish to orange, contrasting with propodeum and gaster (Figs 18, 42); antennal clava tapered apically into curved, finger-like process (Figs 19, 28, 43); gaster with Gt2 strongly transverse, strap-like compared to much longer Gt1 and Gt3 (Yang 1996, fig. 144); [[1]metapleuron partly setose and dorsally distinctly meshlike coriaceous to shallowly reticulate (Figs 24, 41); mesepimeron at least partly setose dorsally along extreme posterior margin (Figs 24, 41); mesocoxa inserted only slightly anteriad level of base of metacoxa, the apex extending conspicuously beyond base of metacoxa; metacoxa partly green dorsally]. 3

- Gastral petiole dark, not contrasting with propodeum and gaster (Figs 32, 67, 78); antennal clava with slender, setose, terminal spiniform process (Figs 31, 59, 68, 83); gaster with Gt2 at least similarly as long as Gt3 and not distinctively short; metapleuron bare and dorsally shiny and smooth or at most with obscure, effaced, meshlike sculpture (Figs 32, 56, 66, 80); mesepimeron bare along posterior margin (Figs 32, 56, 66, 80); mesocoxa inserted conspicuously anteriad level of base of metacoxa, the apex extending only slightly beyond base of metacoxa; metacoxa yellowish to darker brown dorsally but without metallic luster 5

3(2) Flagellum with funicle yellowish but clava dark (Fig. 28); pronotal collar posteriorly without smooth and shiny region; fore wing costal cell extensively setose within basal half; fore wing disc with distinct basal infuscate region extending width of wing separated from apical infuscate region by broad hyaline region, and dorsally uniformly setose beyond stigmal vein (Fig. 27); propodeal panels on either side of median carina mostly smooth posterior to anterior crenulate band (Yang 1996, fig. 144) . . . . . ***Notanisus gracilis* (Yang)**

- Flagellum with funicle and clava similarly yellowish (Figs 19, 43); pronotal collar posterolaterally with obliquely angled

1. Features unknown and possibly different for *N. gracilis*.

smooth and shiny triangular region having transverse anterior margin so as to delineate broadly V-like convergent posterior margin of median reticulate region (Figs 23, 38); fore wing costal cell bare or ventrally with at most 3 setae within about basal third; fore wing disc with basal infuscate region comparatively small and inconspicuous (Figs 25, 44) or if more extensive then continuous with apical region posteriorly (Fig. 20), and dorsally with large bare region beyond stigmal vein (Figs 25, 45); propodeal panels extensively sculptured posteriorly on either side of median carina anterior to foramen (Figs 18, 42). 4

4(3) Petiole about as long as wide, subquadrate (Fig. 18); gaster with two lighter, more yellowish transverse bands basally, one across apical smoother part of Gt1 and Gt2, and one across apical smoother part of Gt3 (Figs 16, 17) . . . . . .***Notanisus brevipetiolus* n. sp.**

- Petiole conspicuously longer than wide (Fig. 42); gaster uniformly dark (Fig. 37) . . . .***Notanisus longipetiolus* n. sp.**

5(2) Pronotum with differentiated posterolateral region comparatively small, slender, and mostly sculptured with variably effaced reticulation such that setae not distinct (Fig. 78, 80); head uniformly green with only very limited coppery luster under any angle of light (Fig. 79); pronotum (except for differentiated regions) and mesonotum mostly green (Figs 78, 80); propodeum with medial sculptured region rugulose anteriorly and minutely punctulate over at least posterior half (Fig. 82); fore wing with single infuscate region behind discal venation, though hyaline band along marginal vein somewhat wider subbasally (Fig. 84); metacoxa dorsobasally with at most 2 setae . . . .***Notanisus yemenensis* n. sp.**

- Pronotum posterolaterally with large, triangular, smooth or at most finely coriaceous but shiny differentiated region bearing several conspicuous setae (Figs 33, 55, 63); head sometimes with face or at least frontovertex in dorsal view extensively reddish-violaceous (Figs 54, 64); propodeum with medial sculptured region entirely rugose to rugulose-reticulate along length of median carina (Figs 34, 58, 67); fore wing sometimes with infuscate region obviously interrupted by hyaline region behind marginal vein subbasally (Fig. 60); metacoxa dorsobasally sometimes with patch of several setae (Figs 58, 66, 67). 6

6(5) Fore wing with infuscate region obviously interrupted by hyaline region extending at least half distance to medial fold behind marginal vein subbasally (Fig. 60). . . . . .***Notanisus oulmesiensis* (Delucchi)**

- Fore wing with broad infuscate region behind discal venation (Figs 36, 69) 7

7(6) Metacoxa dorsobasally with patch of several setae (Figs 66, 67); head in frontal view and mesosoma extensively reddish-coppery (Figs 63, 64); scutellum punctulate-reticulate anteromesally but with larger reticulations laterally and posteriorly (Fig. 65); OOL only about 1.3× maximum diameter of posterior ocellus; head in lateral view with gena and lower face similarly strongly sculptured and colored [Arabian Peninsula]. . . . . .***Notanisus vanharteni* n. sp.**

- Metacoxa dorsobasally with only single seta (Figs 32, 34); head in frontal view and mesosoma mostly green to bluish-green (Figs 30–33); scutellum uniformly reticulate (Fig 34); OOL fully 2× maximum diameter of posterior ocellus; head in lateral view with gena posterior to malar sulcus much more finely sculptured and reddish-violaceous compared to reticulate, greenish lower face [USA]. . . . . .***N. kansensis* n. sp.**

8(1) Flagellum pedicellate (Fig. 49), each funicular spindle-like and with a whorl of long brownish setae medially; metapleuron with evident sculpture and scattered setae over about dorsal half (Fig. 52); propodeal panels reticulate on either side of median carina (Fig. 51); petiole conspicuously sculptured, more or less reticulate (Fig. 51) . . . .***N. longipetiolus* n. sp.**

- Flagellum ramose (Figs 71, 75), with six long rami having long white setae along length dorsally; metapleuron with dorsal half completely smooth, shiny and bare (Fig. 74); propodeal panels shiny and almost smooth except for subeffaced meshlike sculpture on either side of median carina (Fig. 73); petiole smooth and shiny (Fig. 73) . . . . . .***N. vanharteni* n. sp. & *N. yemenensis* n. sp.**

Notanisus brevipetiolus n. sp.

Figs 16–26

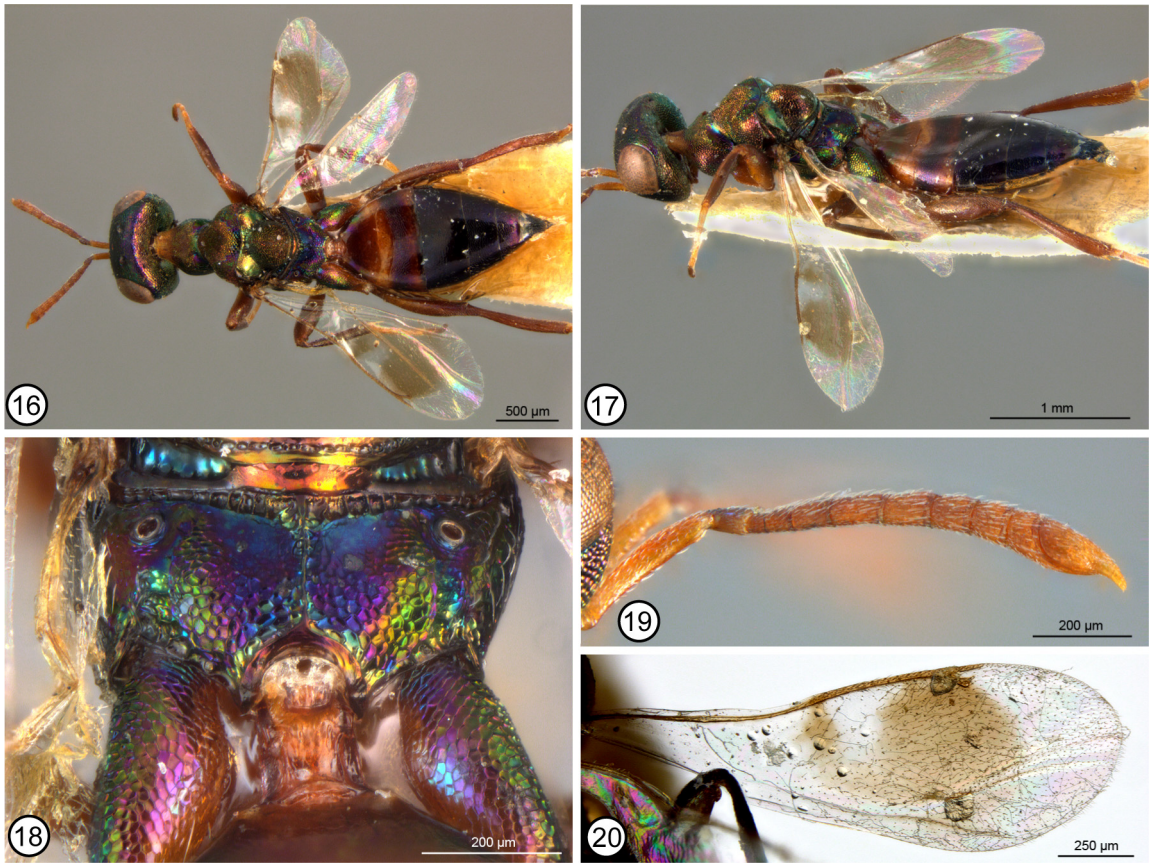
Type material. Holotype ♀ (NMPC). N. Rhodesia [Zambia]: Congo Border, Niankasa / 126.29 / 22.XI.1929, H. Silvester Evans / Pres. by Imp. Inst. Ent., Brit. Mus. 1932.1545 [entire but glued ventrally along length to point, with mouthparts and some other ventral features obscured by glue].

Paratype. **UGANDA**. Lake Victoria, XI.1971, H. Falke (1♀ CNC).

Etymology. Formed from the Latin words *brevis* (short) and *petiolus* (stalk) in reference to its comparatively short petiole.

Description. FEMALE (Figs 16, 17). Length about 1.9 mm. Head in frontal view (Fig. 21) with face and frontovertex mostly dark or with slight violaceous luster under some angles of light, except face above scrobes and sometimes scrobes somewhat more distinctly green, and frontovertex sometimes more extensive green to partly reddish-violaceous; frontovertex distinctly differentiated by difference in sculpture at level about midway between toruli and anterior ocellus, with larger, shallower, more isodiametric meshlike reticulation dorsad level compared to much smaller, more transversely punctate-reticulate sculpture ventrad level; in lateral view lower face and gena posterior to malar sulcus similarly strongly sculptured and colored; in dorsal view OOL 2.1–2.2× maximum diameter of posterior ocellus. Antenna (Fig. 19) yellow; fl1slightly transverse, fl4 almost 0.8× length of fl2 and fl3, and funiculars increasing in width and beyond fl4 decreasing in length such that apical funicular slightly transverse in dorsal view; apical funicular ventrally extending under clava as apically tapered, ventrally sparsely setose,

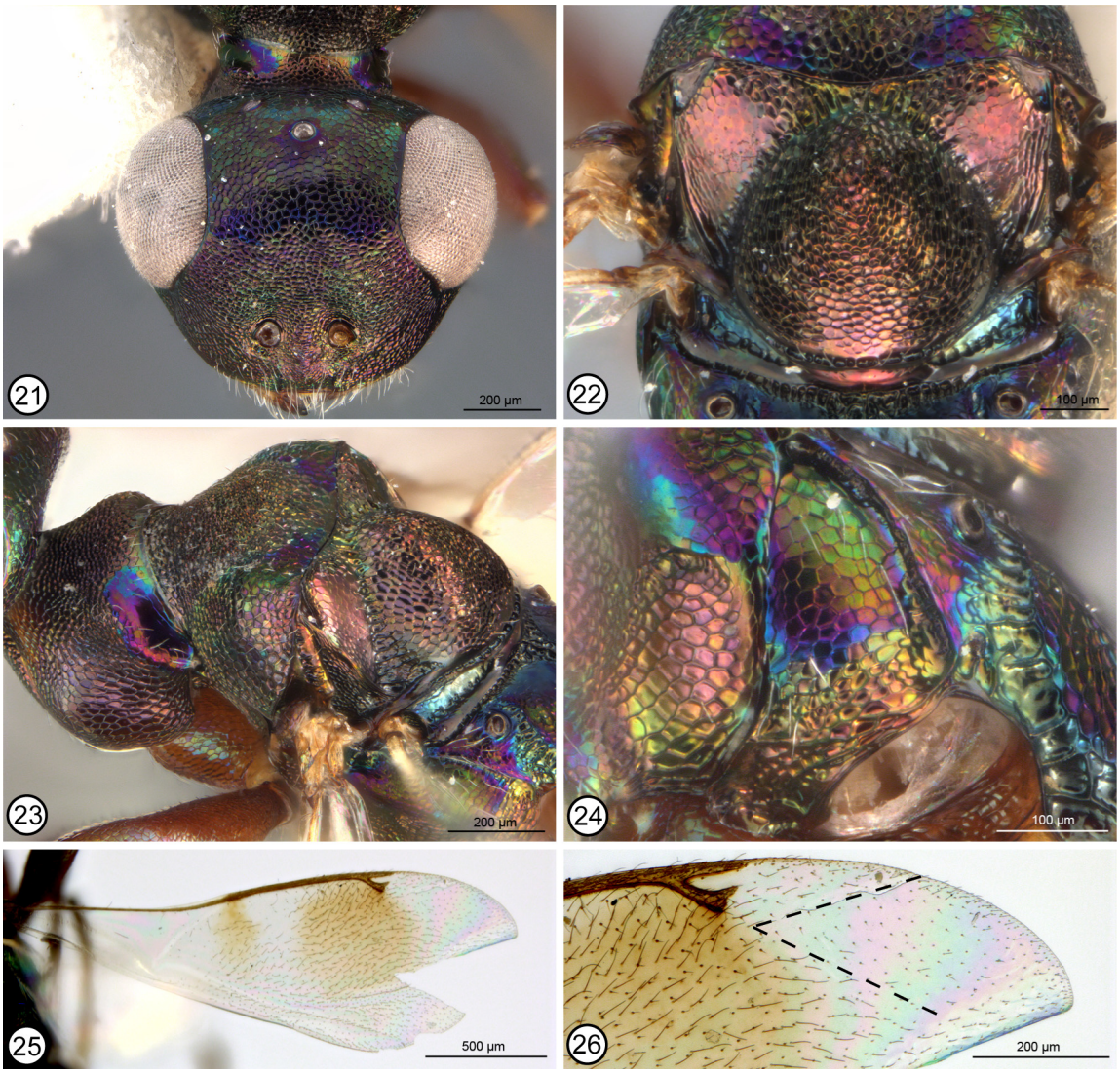
finger-like projection to level where clava tapers into terminal, setose, ventrally curved finger-like process. Mandibular dentition not clearly visible.



FIGURES 16–20. *Notanisus brevipetiolus*, ♀ holotype. 16, dorsal habitus. 17, dorsolateral habitus. 18, propodeum, petiole and metacoxae, dorsal. 19, antenna, lateral. 20, fore wing.

Pronotal collar (Figs 16, 23) in lateral view flat but in dorsal view with abruptly declivitous concave regions posterolaterally such that pronotum appears more or less "shoulder-like" on either side; dorsally punctulate-reticulate and mostly dark or green with coppery luster except neck yellowish and much more finely sculptured and shinier posterolateral declivitous regions violaceous to partly blue or green laterally where more distinctly meshlike coriaceous, with each region having line of obvious white setae along lateral margin and transversely across region behind transverse anterior margins that together delineate posterior margin of broadly V-like convergent dorsal sculptured region. Mesoscutum (Figs 16, 23) anteromesally between incomplete notauli dark and similarly punctulate-reticulate as pronotum dorsally, but over about posterior half and on lateral lobes posteriorly with larger, more mesh-like reticulations and mostly dull to bright greenish-coppery, though with some reddish-violaceous anterior to axilla; scutellar-axillar complex (Fig. 22) dark with coppery to green or reddish-violaceous lusters depending on angle of light, particularly axillae, axilla with slender dorsal reticulate surface at most about as long as length of median crenulate region between axillae and with obliquely angled posterior surface much more finely meshlike coriaceous, and scutellum convex (Fig. 23), reticulate-punctate dorsally but more reticulate to reticulate-imbricate laterally and posteriorly (Fig. 22), the dorsal sculpture intermediate in size between anteriorly and posteriorly on mesoscutum. Tegula brown. Macropterous; fore wing (Figs 20, 25, 26) marginal vein about 6.2–7.5× length of stigmal vein; postmarginal vein extending slightly but distinctly beyond level of uncus; uncus (Fig. 26) diverging from stigmal vein apically so distinct stigma not differentiated and apex separated from posterior margin of postmarginal vein by distance slightly greater than width of postmarginal vein or uncus and subequal to or less than maximum height of stigma plus uncus; costal cell bare; disc (Figs 20, 25) with variably large yellowish-brown region behind parastigma and larger, similarly colored region behind about apical half of venation anterior to medial fold, the two infuscate regions sometimes continuous posteriorly to form a U-shaped region (Fig. 20), with longer brownish setae in infuscate regions and shorter, less conspicuous setae apically, except bare behind

parastigma and marginal vein basally, the bare region conspicuously expanded posteriorly within hyaline area between infuscate regions, and dorsally with comparatively large, elongate bare region beyond stigmal vein (Fig. 26); marginal fringe present except anteroapically beyond postmarginal vein. Prepectus bare or with a few short, inconspicuous setae posteroapically. Mesepimeron in dorsal half (upper mesepimeron) with short white setae along extreme posterior margin (Fig. 24). Metapleuron (Fig. 24) reticulate ventrally but more finely sculptured, almost isodiametric meshlike coriaceous over at least dorsal two thirds and with sparse white setae anteroventrally and dorsally and posteriorly in more finely sculptured region. Metasternum comparatively short, with bases of meso- and metacoxae about on same level and apex of mesocoxa projecting conspicuously beyond base of metacoxa. Legs (Figs 16, 17) with procoxa orange to orangey-brown, mesocoxa darker brown with slight metallic luster, and metacoxa dorsally dark brown with variably distinct reddish-violaceous or green lusters depending on angle of light but yellowish- to orangey-brown ventrally; femora, tibiae and tarsi orangey-brown to dark brown except basal three or four tarsomeres of meso- and metatarsi more yellowish compared to somewhat more darker brown apical tarsomeres; metacoxa bare dorsally (Fig. 18). Propodeum (Fig. 18) with crenulate band along anterior margin recurved posteromedially into narrowly V-shaped rugose to crenulate region on either side of partial to complete median carina; panels otherwise reticulate except for comparatively small smooth and shiny region anteromesally on either side of median sculptured region, and multicolored, variably blue to purple anteriorly in smoother regions to partly green or reddish-violaceous over sculptured part of panels; callus finely though quite distinctly coriaceous and multicolored similar to panels.



FIGURES 21–26. *Notanisus brevipetiolus*, ♀ paratype. 21, head and pronotum. 22, scutellar-axillar complex. 23, pronotum and mesonotum, dorsolateral. 24, mesepimeron and metapleuron. 25, fore wing. 26, fore wing apex (dashed lines delimit dorsal bare region).

Petiole (Fig. 18) yellowish-brown, subquadrate with parallel sides, only slightly longer than wide. Gaster (Figs 16, 17) dark brown except for two lighter, more yellowish bands basally, one across apical smoother part of Gt1 and Gt2, and one across apical smoother part of Gt3; presyntergal tergites isodiametric mesh-like coriaceous except smoother along posterior margins and basal two tergites smooth and shiny or Gt1 with only subeffaced mesh-like sculpture basally, with Gt2 strongly transverse, much shorter than other tergites, and Gt4 the largest tergite.

MALE. Unknown.

Host. Unknown.

Remarks. Minimally, colour of the petiole, structure of the antennal clava (Fig. 28), and a distinctively short, transverse-bandlike Gt2 (Yang 1996, fig. 144) are shared between *N. brevipetiolus*, *N. longipetiolus* and *N. gracilis*. However, the latter feature is also shared with *N. kansensis* and *N. oulmesiensis* within the *oulmesiensis*-group, and the total number of features that females of the three species share is uncertain because the holotype of *N. gracilis* was not studied for comparison. Females of *N. brevipetiolus* and *N. longipetiolus* are most easily separated from each other by relative length of the petiole (*cf*. Figs 18, 42) and gastral color pattern (*cf*. Figs 16, 17, 37). Additional females are needed to determine whether the apparently less extensively setose posterior margin of the mesopleuron (*cf*. Figs 24, 41) is an additional differential feature for *N. brevipetiolus*. Among observed *Notanisus,* setae along the posterior margin of the mesopleuron is unique to females of *N. brevipetiolus* and *N. longipetiolus*. Such setae are also possessed by many species of *Cleonymus*, but not observed *Callocleonymus*. Males of *N. brevipetiolus* are unknown, but based on presumed relationships with *N. longipetiolus* they likely have a pedicellate flagellum, the metapleuron partly setose (similar to females) but the posterior margin of the mesopleuron bare, and the pronotum entirely reticulate, though possibly with a difference in color differentiating posterolateral regions.

Notanisus gracilis (Yang)

Figs 27, 28

Anacallocleonymus gracilis Yang, 1996: 84–86, 308–309. Holotype ♀ (NWCF, not examined). Type data: Xiangshan Mountain, Lueyang County, Shaanxi Province, 1986-VII-20, Yang Zhongqi leg.

Notanisus gracilis; Gibson, 2003: 93.

Diagnostic characters of *Anacallocleonymus* (English translation of Yang 1996: 85)**.** Its characters are between *Callocleonymus* and *Cleonymus*. Body shape and most characters similar to *Callocleonymus*. Antennae 11-segmented; last claval segment with apex curved and cuspidal, without spicula; segment preceding clava having a tapering cuspis, which is similar to that of *Cleonymus*. Mid lobe of mesoscutum protruding forward to greater extent; pronotum considerably elongate, collar longer than wide and lateral panel angled downwards steeply similar to *Heydenia*. Head distinctly wider than mesosoma and metasoma. Fore wing elongate, with three brown spots (fig. 146); marginal vein more than 7× as long as stigmal vein. Petiole long, with length obviously greater than width. Other characters are similar to *Callocleonymus.*

Description of *A. gracilis* (English translation of Yang 1996: 85)**.** FEMALE. Body length 3.3 mm. Body golden green with bronze metallic luster; vertex, and propodeum with "the mirror-like areas" (two regions on either side of median carina) purple; gaster purple to brown except second tergite and basal part of third tergite golden green; petiole yellow; antenna with scape to subapical flagellum segments yellow and apex dark brown [funicle apparently entirely yellow and clava dark except for extreme base (Fig. 28)]; mouth palps purple; all legs pale red-brown; wings hyaline, fore wing with three brown spots (fig. 146) [a distinct band behind parastigma extending width of wing and a larger infuscate region behind about apical half of marginal vein and stigmal and postmarginal veins subdivided longitudinally by hyaline cubital fold (Fig. 27)].

Head in dorsal view slightly and evenly curved anteriorly; occiput anteriorly slightly incised medially; temple 0.23× as long as eye; frontovertex dorsally and vertex smooth with superficial reticulation. In frontal view inner orbits divergent ventrally from about 1/2 height of eye; lower frons and face with raised, delicate reticulation; toruli situated beneath lower ocular line. For antenna see fig. 145.

In dorsal view, pronotum 1.2× as long as wide with dorsum gradually descending anteriorly to neck, the posterior margin slightly curved anteriorly and without a smooth and shining narrow band along posterior margin. In lateral view, pronotum with height about the same as its median length in dorsal view. Mesosoma with mesoscutum and scutellum considerably convex; mesoscutum 1.6× as wide as long with mid lobe curved forward

anteriorly; notauli absent. Scutellum rounded and convex and 1.15× as long as wide; the dorsum with reticulation more delicate than on mesoscutum, arranged approximately as concentric circles. Axilla with only inner-anterior corner having reticulation, otherwise smooth and shining. Propodeum with obvious median carina and narrowly groove-like along and beside the median carina, with some short, transverse striation dispersed in the groove; concave to groove-like along anterior margin, with several longitudinal carinae in the transverse groove; spiracular sulcus conspicuous; "the mirror areas" large; posterior margin carinated with several short, longitudinal carinae extending anteriorly; nucha short but distinct. Fore wing (fig. 146) with marginal vein 7.6× as long as stigmal vein, 6.6× as long as postmarginal vein [costal cell extensively setose (about 17 setae) within basal half and with 2 setae apically anterior to base of parastigma; disc uniformly setose (including dorsally beyond stigmal vein and posterior of cubital fold) except for bare region over about anterior half of hyaline region behind basal half of marginal vein (Fig. 27)]. Legs stout with length of hind coxa 2.0× times that of fore coxa and 2.4× that of mid coxa, and width 1.3× that of both fore- and mid- coxa respectively; hind tibia 1.1× as long as femur with inner apical spur longer than outer apical spur.

Petiole long, length 1.2× width and saddle-shaped. Gaster with dorsum evenly convex, not collapsed, and with distinct engraved reticulation except tergites 1 and 2 smooth and shining; gaster 2.6× as long as wide (excluding petiole), and as long as head plus mesosoma, with tergite 2 the shortest and tergite 4 the longest. Ovipositor slightly protruded.

MALE. Unknown.

FIGURES 27 and 28. *Notanisus gracilis*, ♀ holotype. 27, fore wing. 28, antenna.

Host. Probably parasitoids of the larva of the bark beetle, *Phloeosinus aubei* Perris (Coleoptera: Curculionidae: Scolytinae) attacking *Platycladus orientalis* (L.) (Cupressaceae).

Remarks. As noted under Material and methods, the description of *N. gracilis* given above is a translation of the original diagnosis of *Anacallocleonymus* and description of *N. gracilis* by Yang (1996), supplemented by information (between square brackets) derived from images of the fore wing and antenna of the holotype.

Although some features are unknown for *C. gracilis*, females are distinguished from those of other recognized *oulmesiensis*-group species by at least the features given in couplets two and three of the key to species. Females differ from all other *oulmesiensis*-group females in at least three features as discussed under Remarks for the *oulmesiensis* species group.

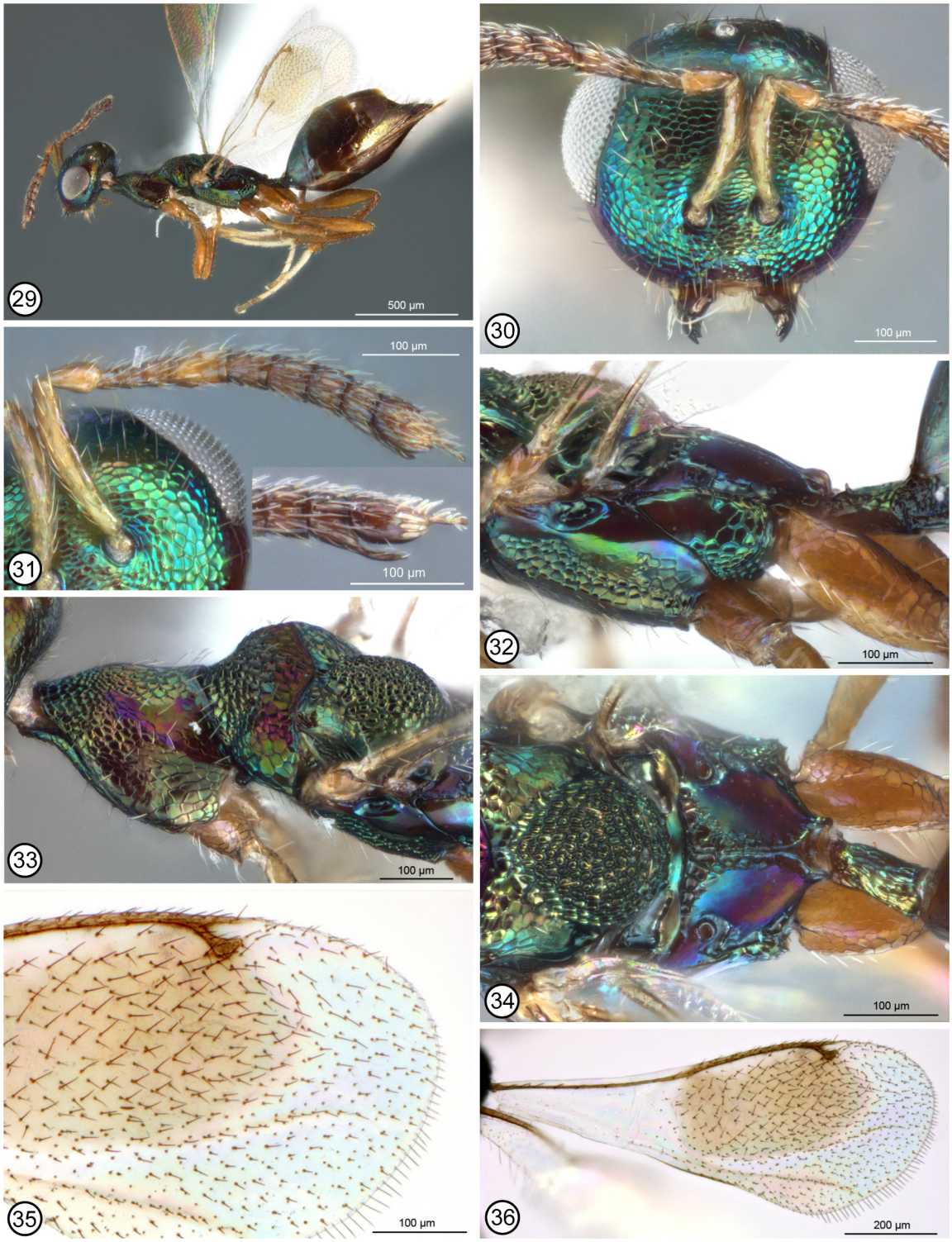
***Notanisus kansensis* n. sp.**
Figs 29–36

Type material. Holotype ♀ (CNC). USA: KS [Kansas], Kiowa Co., 5 mi. N. Greenburg, 11–20.ix.2005, canopy trap, G.A. Salsbury [point mounted; entire].

Etymology. Named after the state from which it was collected.

Description. FEMALE (Fig. 29). Length about 1.9 mm. Head in frontal view (Fig. 30) green to somewhat bluish-green, but with variably distinct coppery luster above level of toruli under some angles of light and in dorsal view vertex more reddish-coppery to reddish-violaceous; frontovertex distinctly differentiated by difference in sculpture at level about two-thirds distance between toruli and anterior ocellus, with much finer, more isodiametric meshlike coriaceous sculpture compared to distinctly reticulate sculpture ventrad level; in lateral view lower face green with distinct meshlike sculpture, but gena near fine malar sulcus reddish-violaceous and with much finer, subeffaced meshlike sculpture; in dorsal view OOL twice maximum diameter of posterior ocellus. Antenna (Fig. 31) with scape, pedicel, and basal four funiculars yellow to yellowish-brown compared to darker brown terminal four funiculars and clava; fl1 very slightly longer than wide, fl4 about twice combined length of fl2 and fl3, and funiculars increasing in width and beyond fl4 decreasing in length such that apical funicular slightly transverse in dorsal view; apical funicular ventrally extending under clava as apically tapered, ventrally bare and shiny, finger-like projection to level almost equal with apex of clava excluding slender, terminal, setose, spiniform process (Fig. 31, insert). Mandible bidentate with two similar teeth ventrally and obliquely angled margin dorsally (Fig. 30).

Pronotal collar in lateral view (Fig. 33) almost flat and in dorsal view not distinctly "shoulder-like" posterolaterally; mostly reticulate and green with coppery luster except for much more finely sculptured, meshlike coriaceous, elongate-triangular region posterolaterally, the posterolateral regions variably extensively and distinctly reddish-violaceous under different angles of light, but with scattered, distinct setae and with longitudinal inner margins differentiating quadrangular median sculptured region over length of collar, the median region minutely punctulate-reticulate anterior of posterolateral regions but with obviously larger meshlike reticulations over about posterior half of collar between inner margins of posterolateral regions. Mesoscutum (Fig. 33) anteromesally between incomplete notauli greenish with coppery luster under some angles of light and coarsely reticulate, the reticulations of similar size but deeper than on pronotum posteromesally, and more posteriorly with much larger meshlike reticulations and broadly reddish-coppery to reddish-violaceous along transscutal articulation and posteriorly on lateral lobes; scutellar-axillar complex (Fig. 34) green with coppery luster on axillae, axilla with reticulate dorsal surface transverse but longer than median crenulate region between axillae, and much longer obliquely angled surface meshlike coriaceous to smooth ventrally, and scutellum low convex (Fig. 33), almost uniformly, coarsely, punctate-reticulate. Tegula yellow. Macropterous; fore wing (Figs 29, 35, 36) marginal vein about 7.6× length of stigmal vein; apex of postmarginal vein distinct, extending at most to level of apex of uncus; uncus (Fig. 35) diverging from stigmal vein virtually at apex so distinct stigma not differentiated posterior to uncus and apex separated from posterior margin of postmarginal vein by distance greater than width of postmarginal vein but by slightly less than maximum height of stigma plus uncus; costal cell ventrally with single seta basally; disc (Fig. 36) with elongate-oval brownish region between venation and medial fold except narrowly hyaline behind much of marginal vein mesally, and with lighter, more inconspicuously brownish infuscation posterior to cubital fold, with distinct brownish setae, the setae shorter posteriorly but not spiculate, except for narrow bare band behind parastigma and about basal two-thirds of marginal vein, but dorsally without distinct bare band beyond stigmal vein (Fig. 35); marginal fringe present except anteroapically beyond postmarginal vein (Fig. 35). Prepectus with several, inconspicuous white setae posteriorly toward tegula. Mesepimeron bare along posterior margin (Fig. 32). Metapleuron bare, with about ventral half reticulate and dorsal half smooth and shiny (Fig. 32). Metasternum comparatively long, with base of mesocoxa distinctly anterior to, and apex of mesocoxa about level with, base of metacoxa. Legs, including coxae, yellowish-brown except basal three tarsomeres of each leg lighter, those of meso- and metatarsi white; metacoxa dorsobasally with single seta (Figs 32, 34). Propodeum (Fig. 34) with crenulate band along anterior margin recurved posteromedially into similarly but more finely sculptured slender band on either side of median carina along most of length; panels otherwise smooth and shiny, and callus almost completely smooth and shiny; callus anteriorly and propodeal panels posteriorly and laterally between foramen and spiracle variably extensively reddish-violaceous depending on angle of light, but callus posterior to spiracle and panels anteriorly green to bluish.



FIGURES 29–36. *Notanisus kansensis*, ♀ holotype. 29, lateral habitus. 30, head, frontal. 31, antenna [insert: apical two funiculars and clava, lateral]. 32, mesopleuron, metapleuron, metacoxa and petiole, lateral. 33, pronotum and mesonotum, dorsolateral. 34, scutellum–petiole and metacoxae, dorsal. 35, fore wing apex. 36, fore wing.

Petiole (Figs 32, 34) with greenish luster and dorsally sculptured, sides diverging slightly posteriorly, and about 1.8× as long as median width. Gaster (Fig. 29) uniformly dark brown; presyntergal tergites very finely meshlike coriaceous except posterior margins smooth and basal tergites more extensively smooth, with Gt2 similar in length to Gt1 or Gt3, not distinctively short.

MALE. Unknown.

Host. Unknown.

Remarks. The only known female of *N. kansensis* is one of the smallest *oulmesiensis*-group females examined, slightly less than 2 mm in length. It differs from *N. oulmesiensis* females most conspicuously in having a single, elongate-oval infuscate region behind the venation (Fig. 36) and only a single seta dorsally on the metacoxa (Figs 32, 34), but also in having only a single seta ventrobasally within the costal cell and the gena near the malar sulcus reddish-violaceous with subeffaced sculpture rather than similarly green and distinctly sculptured as the lower face. Most females of *N. oulmesiensis* examined are larger and have the infuscate region behind the venation quite obviously interrupted anteriorly by a hyaline region near the base of the marginal vein (Fig. 60) as well as having a patch of several setae dorsally on the metacoxa (Figs 66, 67) and more numerous setae ventrobasally within the costal cell. However, a female from Greece (NMPC) that is the same size as the *N. kansensis* holotype has only two dorsal metacoxal setae and the fore wing infuscate region less conspicuously interrupted than for larger females, which suggests that these two features could be correlated with size. Some females also have only 2 setae ventrobasally in the costal cell, demonstrating infraspecific variation also in this feature. However, observed females of *N. oulmesiensis*, including smaller ones, have the lower face and gena uniformly sculptured and similarly green to reddish-violaceous. The unique holotype of *N. kansensis* also has a longer OOL and more finely sculptured frontovertex than examined *N. oulmesiensis*, though smaller females have a longer OOL and more finely sculptured frontovertex than larger females, again indicating these two features are size correlated. Based on all observed differences I describe the female collected in Nebraska as a new species, but additional specimens and molecular studies are required to more confidently evaluate morphological variation and assess its status relative to *N. oulmesiensis*. Definitive resolution of its species status is important to answer the questions of how or why there is a species of *Notanisus* in Nebraska. *Notanisus* has been considered to be strictly an Old World genus, not native to either the Nearctic or Neotropical regions. The presence of *N. sexramosus* in eastern, coastal states of USA is readily explained by one or more relatively recent accidental introductions prior to 1982. Accidental introduction into a mid-western state such as Kansas might be considered less likely.

***Notanisus longipetiolus* n. sp.**
Figs 37–52

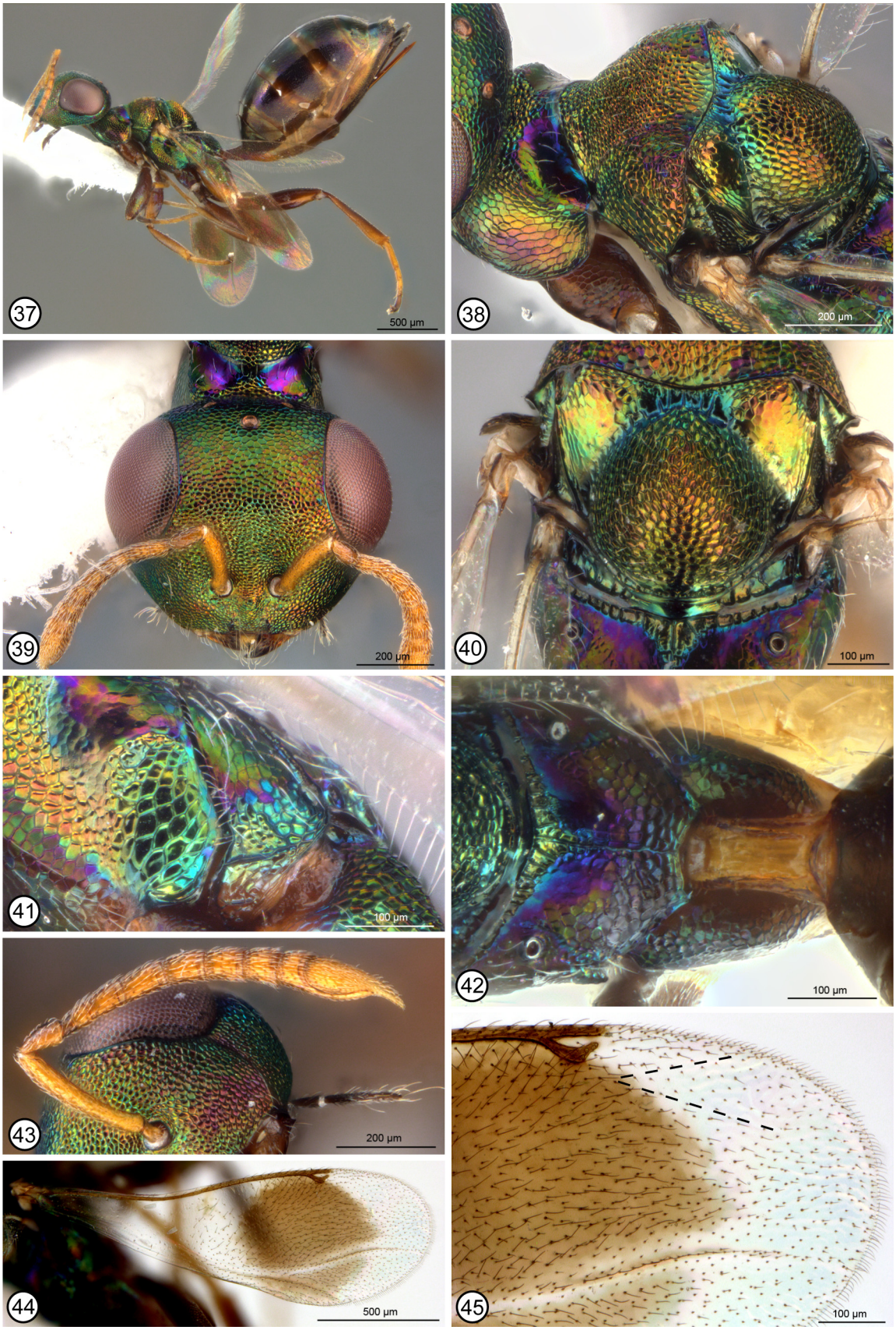
Type material. Holotype ♀ (CNC). MOZAMBIQUE: Niassa Prov., Cuamba, Mituque, 7–26.ix.2008, N. Olmi, MT [point-mounted; entire, but gaster unnaturally inflated due to critical point drying].

Paratypes. **MOZAMBIQUE**. Niassa, Cuamba, Catholic University of Mozambique, farm, 4.II–4.III.2005, 600 m, M. Olmi (2♂ CNC). **ZIMBABWE**. Rhodesia, Salisbury, A. Watsham (1♀, 6♂ NMPC [1♂ also with "IX.1978"]). Rhodesia, Chishawasha Nr. Salisbury / XII.1978, A. Watsham (1♀, 2♂ NMPC).

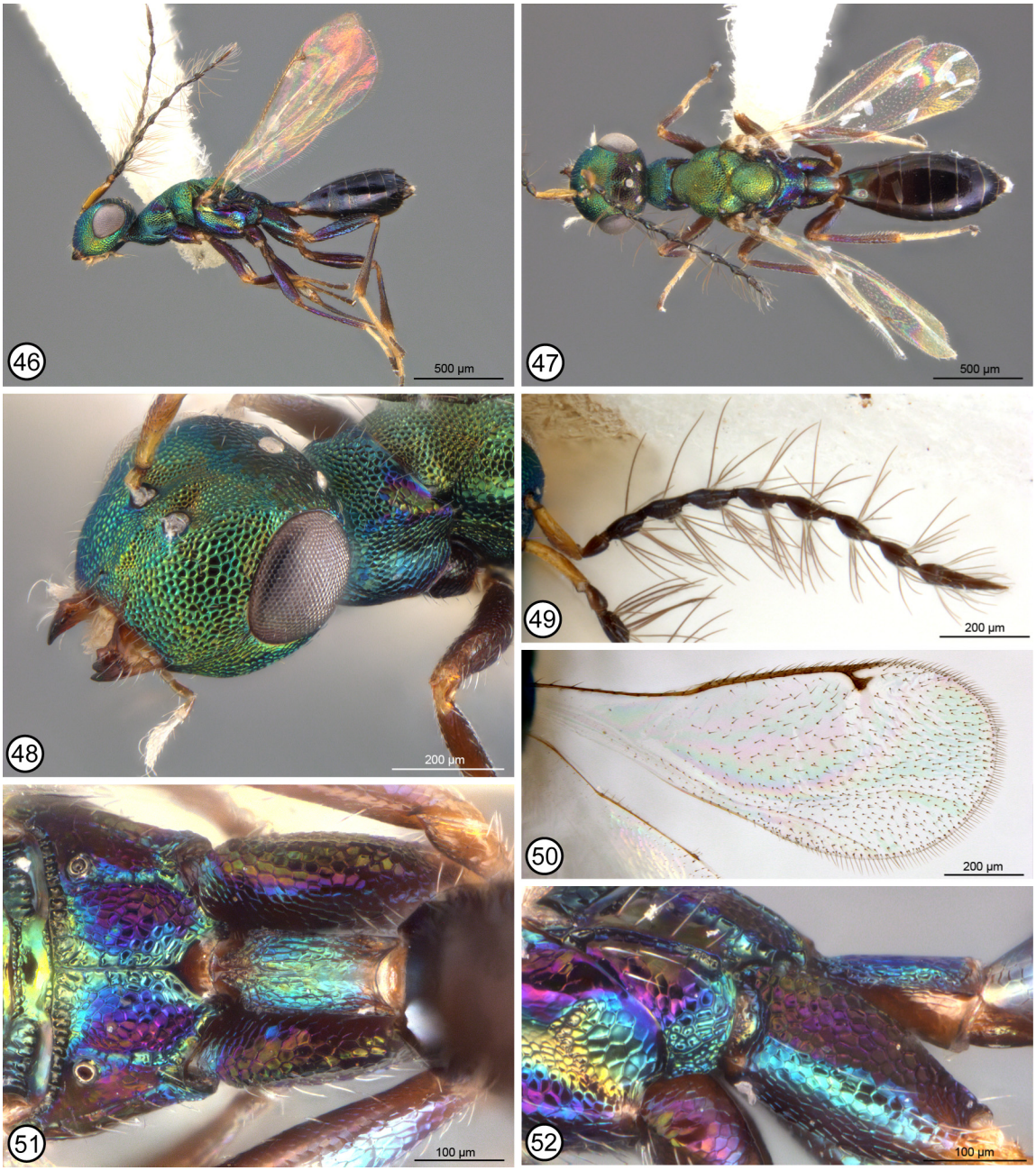
Etymology. Formed from the Latin words *longus* (long) and *petiolus* (stalk) in reference to its comparatively long petiole.

Description. FEMALE (Fig. 37). Length about 2.5–3.5 mm. Head in frontal view (Fig. 39) with face and frontovertex green with variably distinct coppery to reddish-violaceous lusters under some angles of light; frontovertex distinctly differentiated by difference in sculpture at level about midway between toruli and anterior ocellus, with larger, shallower, more isodiametric reticulation dorsad level compared to much smaller, more transversely punctate-reticulate sculpture ventrad level; in lateral view lower face and gena posterior to malar sulcus similarly strongly sculptured and colored; in dorsal view OOL about 2.25–2.5× maximum diameter of posterior ocellus. Antenna (Fig. 43) yellow or pedicel and/or fl1 sometimes slightly brownish; fl1slightly transverse, fl4 about 0.8× length of fl2 and fl3, and funiculars increasing in width and beyond fl4 decreasing in length such that apical funicular slightly transverse in dorsal view; apical funicular ventrally extending under clava as apically tapered, ventrally sparsely setose, finger-like projection to level where clava tapers into terminal, setose, ventrally curved finger-like process. Mandible indistinctly tridentate, the ventral two teeth more acutely angled.

Pronotal collar (Fig. 38) in lateral view flat but in dorsal view with abruptly declivitous concave regions posterolaterally such that pronotum appears more or less "shoulder-like" on either side; dorsally punctulate-reticulate and mostly green with variably distinct coppery luster except neck more brownish and much more finely sculptured and shinier posterolateral declivitous regions partly reddish-violaceous to more blue posteriorly and often green laterally where more distinctly meshlike coriaceous, with each region having line of obvious white setae along lateral margin and transversely across region behind transverse anterior margins that together delineate



FIGURES 37–45. *Notanisus longipetiolus* ♀. 37–41, holotype: 37, lateral habitus; 38, pronotum and mesonotum, dorsolateral; 39, head and pronotum; 40, scutellar-axillar complex; 41; mesepimeron and metapleuron. 42, propodeum–base of gaster and metacoxae, dorsal (2014-45). 43–45, holotype: 43, antenna, lateral; 44, fore wing; 45, fore wing apex (dashed lines delimit dorsal bare region).



FIGURES 46–52. *Notanisus longipetiolus* ♂. 46, lateral habitus (2014-37). 47, dorsal habitus (2014-38). 48, head and pronotum, frontolateral (2014-38). 49, antenna, lateral (2014-46). 50, fore wing (2014-46). 51, propodeum–base of gaster and metacoxae, dorsal (2014-38). 52, mesepimeron–petiole and metacoxa, lateral (2014-37).

posterior margin of broadly V-like convergent dorsal sculptured region. Mesoscutum (Fig. 38) anteromesally between incomplete notauli similarly punctulate-reticulate as pronotum dorsally, but posteriorly and on lateral lobes with larger mesh-like reticulations and with variably bright and distinct coppery luster and usually with at least some reddish-violaceous luster anteriad axillae; scutellar-axillar complex (Figs 38, 40) similarly colored as mesoscutum, axilla with slender dorsal reticulate surface less than length of median crenulate region between axillae, and with obliquely angled posterior surface mostly meshlike coriaceous to smooth, and scutellum convex, reticulate-punctate dorsally but more reticulate to reticulate-imbricate laterally and posteriorly, the dorsal sculpture intermediate in size between anteriorly and posteriorly on mesoscutum Tegula brown. Macropterous; fore wing (Fig. 44) marginal vein about 8.0–9.4× length of stigmal vein; postmarginal vein extending to or slightly beyond level of uncus; uncus (Fig. 45) diverging from stigmal vein apically so distinct stigma not differentiated and apex separated from posterior margin of postmarginal vein by distance distinctly less than width of postmarginal vein or

maximum height of stigma plus uncus; costal cell ventrally with 0–3 setae basally; disc (Fig. 44) with large brown region behind somewhat more than apical half of venation extending width of wing except for hyaline medial fold, and sometimes also with very small and inconspicuous lighter brownish region behind parastigma, with brown setae in infuscate regions and shorter, less conspicuous setae apically, except bare behind parastigma and marginal vein basally, the bare region conspicuously expanded posteriorly behind marginal vein adjacent to infuscate region, and dorsally with comparatively large, elongate bare region beyond stigmal vein (Fig. 45); marginal fringe present except anteroapically beyond postmarginal vein (Fig. 45). Prepectus mostly bare but usually with a few short, inconspicuous white setae posteroapically. Mesepimeron variably setose along posterior margin, sometimes with line of short white setae along entire margin (Fig. 41) but with at least one seta within dorsal half (upper mesepimeron) and lower half (lower mesepimeron). Metapleuron (Fig. 41) mesh-like reticulate ventrally and much shallower coriaceous-reticulate dorsally, and with sparse white setae anteroventrally and dorsally and posteriorly in more finely sculptured region. Metasternum comparatively short, with bases of meso- and metacoxae about on same level and apex of mesocoxa projecting conspicuously beyond base of metacoxa. Legs (Fig. 37) with procoxa orangey-brown to brown or sometimes with reddish-violaceous luster, mesocoxa usually somewhat darker brown and with some metallic luster, and metacoxa yellowish ventrally; femora, tibiae and tarsi brown to yellowish-brown except basal three or four tarsomeres of meso- and metacoxae more yellowish compared to darker brown apical tarsomeres; metacoxa bare dorsally (Fig. 42). Propodeum (Fig. 42) with crenulate band along anterior margin recurved posteromedially into narrowly V-shaped crenulate band on either side of complete median carina; panels otherwise reticulate except for comparatively small smooth and shiny region anteromesally on either side of median sculptured region, and multicolored with anterior crenulate band greenish and depending on angles of light panels variably extensively reddish-violaceous anteriorly to greenish or somewhat coppery laterally and blue to purple posteriorly; callus finely coriaceous and multicolored similar to panels.

Petiole (Fig. 42) yellow to yellowish-brown, with sides slightly divergent posteriorly but distinctly oblong, about twice as long as wide. Gaster (Fig. 37) uniformly dark brown; basal two tergites shiny and smooth or with at most effaced mesh-like sculpture and remaining presyntergal tergites isodiametric mesh-like coriaceous except smooth along posterior margins (mesal tergites also smooth along basal margins, but the result of exposure due to gaster being inflated), with Gt2 strongly transverse, much shorter than other tergites, and Gt4 the largest tergite.

MALE (Figs 46, 47). Length = 1.8–2.5 mm. Head (Fig. 48) mostly green but with variably extensive and distinct coppery to reddish-violaceous luster, usually most distinctly on frontovertex and within and/or mesally above scrobes; sculpture of face and frontovertex similar to female or more uniformly mesh-like reticulate. Antenna (Fig. 49) 11-segmented; scape mostly yellow, though sometimes partly brownish dorsally, pedicel yellowish-brown to brown, at least dorsally, and flagellum dark brown except for more yellowish, strongly transverse, anelliform fl1; funiculars all conspicuously longer than wide, pedicellate, and smooth and shiny except for finely, transversely strigose apical pedicel and whorl of long brown setae mesally, with apical-most funiculars uniformly spindle-like and more basal funiculars having convex dorsal and flat ventral surfaces; clava about twice as long as apical funicular, basally expanded and with three successive whorls of setae (two usually distinct). Mandible tridentate with three similar teeth (Fig. 48). Labial and at least apical maxillary palpi white (Fig. 48) and sometimes ventral surfaces of all palpomeres white.

Pronotum (Figs 47, 48) green or with slight coppery luster and punctate-reticulate except usually with somewhat more finely sculptured reddish-violaceous to purple region posterolaterally (Fig. 48). Mesonotum (Fig. 47) green or with variably distinct coppery luster and comparatively uniformly mesh-like reticulate or anteriorly reticulations smaller, more punctate-reticulate similar to pronotum dorsally. Fore wing (Fig. 50) with marginal vein about 6.2–7.8× length of stigmal vein; hyaline; disc obliquely bare behind parastigma and about basal half of marginal vein, and discal setae shorter and more uniform than female. Prepectus and posterior margin of mesepimeron (Fig. 52) bare. Metapleuron (Fig. 52) similarly sculptured and setose as female. Metasternum comparatively short, mesocoxa projecting conspicuously beyond base of metacoxa. Front leg with coxa dark with blue to violaceous luster; femur and tibia dark brown with violaceous luster usually at least on femur under some angles of light, except knee and sometimes tibia apically pale; tarsus yellowish-brown basally to dark brown apically. Middle leg similar in color to front leg except basal three tarsomeres pale. Hind leg with coxa entirely dark with metallic luster, often more blue ventrally and green to reddish-violaceous laterally or dorsally, but otherwise similar in color to middle leg. Propodeum (Fig. 51) with complete median carina; panels entirely mesh-like reticulate and usually mostly reddish-violaceous except usually variably blue to greenish anteriorly along

crenulate furrow, mesally within crenulate furrow on either side of median carina, and within postspiracular sulcus; callus shiny, virtually smooth and reddish-violaceous.

Petiole (Figs 51, 52) similarly dark as rest of body with blue to purple or green luster, more or less mesh-like coriaceous to reticulate, and about 2.0–2.5× as long as wide.

Biology. Unknown.

Remarks. See under *N. brevipetiolus*.

Notanisus oulmesiensis (Delucchi)

Figs 53–61

Amarisca oulmesiensis Delucchi, 1962: 12–13, 21 (figs 2, 3). Holotype ♀ (ETHZ; paratypes examined); Baur, 2001: 66 (type data). Baur (2001) stated that the holotype is labelled "ex 1. 28.VIII.51 Maroc Oulmès 3703; Regragui; s/xylophages s/ prunus"; AMARISCA oulmesiensis n. V. Delucchi det.; HOLOTYPUS [red]". The original description stated the following for the type series: "Moyen Atlas, 1250 m ... laboratory reared from cherry wood infested with *Scolytus mediterraneus* Eggers (Col., Scolytidae) and *Anthaxia* sp. (Col., Buprestidae) between June 13 and August 28, 1951, B. Regragui leg.".

Notanisus oulmesiensis; Bouček, 1991: 204; Mitroiu and Andriescu, 2008: 312 (♀ keyed), 313 (distribution), 315 (fig. 2, ♀ dorsal habitus), 316 (fig. 6, ♀ dorsal head and mesosoma).

Distribution. Western Palaearctic (see Noyes 2014).

Material examined. CYPRUS. Kalopanayiotis, 2500 ft., 23.IX.1963 / Mavromoustakis (1♀ BMNH). **GREECE**. Pelopone, Gythion, 13–16.V.1979, Hladilcvi lgt. (1♀ NMPC). Pelop., Petalidion, 27.VIII.1979, Bouček (1♀ NMPC). Samos, Oros Thios, 15.X.1989, M. Koponen leg. (1♀ NMPC). Thessalia, Kalambaka, hillside meadow, 14–20.VII.1979 / BM 1979-312, M.C. Day, G.R. Else, D. Morgan (1♀ BMNH). **MOROCCO**. 4 ♀ paratypes (3703): 2 ex. 21.VII.51 and 2 ex. 23.VII.51 (ETHZ). **ROMANIA**. Dobr. Reserv. Agigea [Agigea Nature Reserve], 29–30.VI.1973, C.G. Nagy legit (1♀ MICO). **TURKEY***. Asia Minor, Tr. Çesme, V.1979, T.E. Leiler (1♀ BMNH). ?**UZBEKISTAN***. Šsafrikan, 28.IV.1980, Kyzyl-kum des., J. Hladil lgt. (1♀ NMPC). **YUGOSLAVIA**. Mljet, Nacional Park, 19.VIII.1980, A. Hoffer (1♀ NMPC). Ulcinj, Crna Gora, 22.VI.1969, Hoffer (1♀ NMPC).

Description. FEMALE (Fig. 53). Length 1.9–3.5 mm. Head in frontal view green (Fig. 54) or with variably extensive coppery to reddish-violaceous lusters, most commonly on frontovertex, face above toruli and on parascrobal region, but sometimes with limited luster also on lower face and gena; frontovertex distinctly differentiated by difference in sculpture at level about two-thirds distance between toruli and anterior ocellus, with larger, more isodiametric and much finer reticulations (shallow but noticeably delineated by raised ridge) dorsad level compared to distinctly reticulate sculpture ventrad level, the sculpture between frontovertex and torulus in particular more transverse reticulate-imbricate; in lateral view lower face and gena posterior to malar sulcus similarly strongly sculptured and colored; in dorsal view OOL 1.1–1.7× maximum diameter of posterior ocellus. Antenna (Fig. 59) variable in color, rarely entirely yellowish, but at least scape largely yellow, the pedicel and flagellum sometimes entirely dark (smaller females) but usually at least fl2–fl4 yellowish and clava and apical three or four funiculars usually dark; fl1 at least quadrate and usually slightly longer than wide, fl4 slightly shorter than combined length of fl2 and fl3, and funiculars increasing in width and beyond fl4 decreasing in length such that apical funiculars slightly transverse in dorsal view; apical funicular ventrally extending under clava as apically tapered, ventrally bare and shiny, finger-like projection to level equal with apex of clava excluding slender, terminal, setose, spiniform process. Mandible bidentate with two similar teeth ventrally and obliquely angled margin dorsally.

Pronotal collar in lateral view shallowly concave to flat (Fig. 53) and in dorsal view not distinctly "shoulder-like" posterolaterally; mostly reticulate and green to bright coppery (Figs 54, 55) except for much more finely sculptured, meshlike coriaceous to smooth, elongate-triangular region posterolaterally, the posterolateral regions usually mostly reddish-violaceous, though rarely green or often with some coppery or bluish luster, but with scattered distinct setae and with longitudinal inner margins differentiating quadrangular median sculptured region over length of collar, the median region mostly punctulate-reticulate to reticulate except extreme posterior margin often more finely sculptured. Mesoscutum (Fig. 55) anteriorly between incomplete notauli similarly sculptured and colored as pronotum dorsomedially, but with much larger reticulations posteriorly and with broad reddish-

violaceous band posteriorly along transscutal articulation extending onto lateral lobes; scutellar-axillar complex green with variably distinct and bright coppery luster to mostly coppery or reddish-violaceous except at least for green to bluish median crenulate region between axillae (Fig. 57), axilla with reticulate dorsal surface longer than median crenulate region between axillae, and with obliquely angled posterior surface very finely meshlike coriaceous to smooth, and scutellum low convex to distinctively flat (Fig. 53) and more or less uniformly punctate-reticulate to reticulate (Fig. 57), though reticulations sometimes smaller mesally or more elongate mediolongitudinally and more reticulate-imbricate laterally. Tegula variably extensively yellowish to brown. Macropterous; fore wing (Fig. 60) marginal vein about 6.0–7.2× length of stigmal vein; apex of postmarginal vein extending to or slightly beyond apex of uncus; uncus (Fig. 61) diverging from stigmal vein at or near apex so as to at most differentiate small, rounded stigma posterior to uncus, and apex separated from posterior margin of postmarginal vein by distance greater than width of postmarginal vein but less than maximum height of stigma plus uncus; costal cell ventrally with 2–9 setae within about basal third and rarely with 1 or 2 setae within about apical third; disc (Fig. 60) with distinct brownish region behind venation except narrowly hyaline behind marginal vein mesally, with hyaline band within basal half of marginal vein extended posteriorly for at least half distance to medial fold as variably conspicuous tapered hyaline region, and with cubital fold and often membrane behind cubital fold variably extensively similarly or lighter brown, and with distinct brown setae, the setae at most only slightly shorter in hyaline regions, except for narrow bare band behind parastigma and about basal half of marginal vein, but dorsally without distinct bare band beyond stigmal vein (Fig. 61); marginal fringe present except anteroapically beyond postmarginal vein (Fig. 61). Prepectus extensively setose with short white setae. Mesepimeron (Fig. 56) bare along posterior margin. Metapleuron (Fig. 56) bare, with about ventral half reticulate and dorsal half smooth and shiny. Metasternum comparatively long, with base of mesocoxa distinctly anterior to, and apex of mesocoxa about level with base of metacoxa. Legs (Fig. 53), including coxae, yellowish- to orangey-brown or with meta- and/or mesofemora and tibiae darker brown, but basal three tarsomeres of meso- and metatarsi white and apical two tarsomeres of all legs darker brown; metacoxa with at least 2 setae dorsobasally and usually with distinct patch of several white setae in larger specimens (Figs 56, 58). Propodeum (Fig. 58) with crenulate band along anterior margin recurved into posteriorly tapered, V-shaped crenulate-rugulose region on either side of complete median carina; panels otherwise smooth and shiny, and callus smooth and shiny; callus anteriorly and propodeal plical region laterally between foramen and spiracle variably dark reddish-violaceous to purple, though callus posterior to spiracle often variably extensively green, median sculptured region often coppery to green, and smooth region adjacent to medial sculptured region usually variably green or greenish-coppery to blue or purple depending on angle of light.

Petiole dark with at least slight green to bluish-green lusters, dorsally sculptured, and about 1.4–2.0× as long as median width. Gaster uniformly dark brown or basally with green to reddish-violaceous lusters; presyntergal tergites very finely meshlike coriaceous except posterior margins smooth and basal tergite usually with more obscure, effaced sculpture (base of Gt2 often also variably extensively smooth depending on extent covered by Gt1), with Gt2 at least similar in length and often longer than Gt1 or Gt3 depending on extent covered by Gt1.

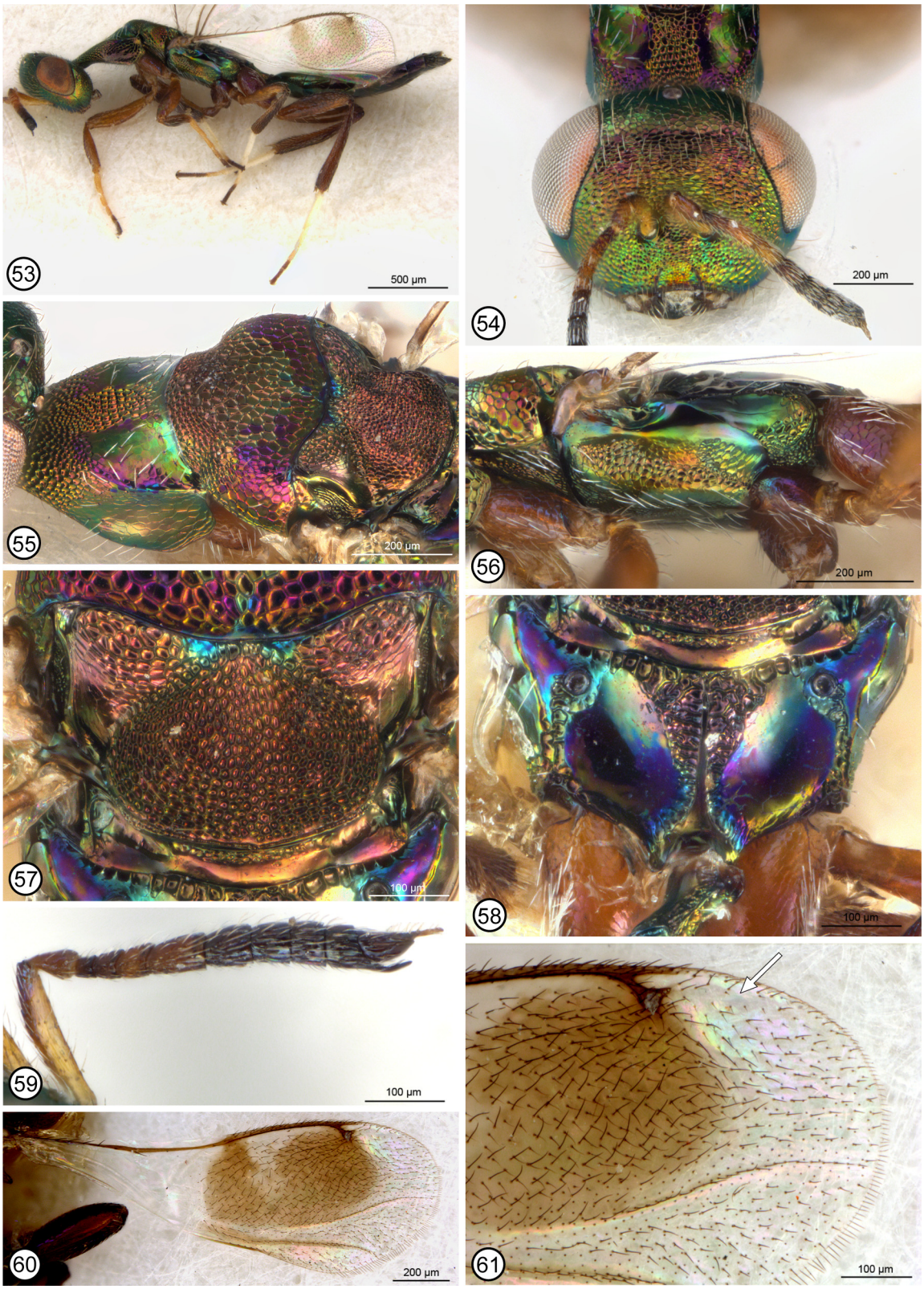
MALE. Unknown.

Hosts. Type material was reared originally from the wood of cherry, likely *Prunus avium* (L.) (Rosaceae), infested with *Scolytus rugulosus* (Mueller) (= *Scolytus mediterraneus* (Eggers)) (Coleoptera: Curculionidae: Scolytinae) and *Anthaxia* sp. (Coleoptera: Buprestidae).

Remarks. The original description includes line drawings of the female antenna and fore wing (Deluchhi 1962, figs 2, 3), and states that the species was described from the holotype and eight paratypes, of which Baur (2001) located all but one paratype. I examined four paratypes, all of which are covered with particulate matter and incomplete to varying extents. The gaster was missing from three and only two had one complete antenna each.

Although not given as part of the description, females of *N. oulmesiensis* vary in how compressed the head and mesosoma appear, some female having these quite conspicuously compressed such that the dorsal surface of the mesosoma is almost flat (Figs 53, 56). Specific status and putative features differentiating females from those of *N. kansensis* are discussed under the latter species. Mitroiu and Andriescu (2008) noted that of the species with associated males, *N. versicolor* and *N. sexramosus*, males were much more common than females. It therefore seems unusual that males are unrecognized for such a relatively commonly collected species as *N. oulmesiensis*. Although at least some of the shared features listed in couplet two of the key likely represent symplesiomorphies, several suggest *N. oulmesiensis* (and *N. kansensis*) is more closely related to *N. yemenensis* and *N. vanharteni* than

to *N. brevipetiolus* and *N. longipetiolus*. Based on this assumed relationship, the unknown males of *N. oulmesiensis* therefore more likely have a ramose than a pedicellate flagellum. However, if with another type of flagellar structure they may not be readily associated with females or recognized as *Notanisus* males.



FIGURES 53–61. *Notanisus oulmesiensis* ♀. 53, lateral habitus (2014-41). 54, head and pronotum (2014-39). 55, pronotum and mesonotum, dorsolateral (2014-39). 56, mesosoma including coxae, lateral (2014-41). 57, axillar-scutellar complex (2014-39). 58, propodeum and coxae, dorsal (2014-39). 59, antenna, lateral (2014-40). 60, fore wing (2014-39); 61, fore wing apex (2014-39) (arrow points to dorsal bare region).

***Notanisus vanharteni* n. sp.**
Figs. 62–76

Type material. Holotype ♀ (CNC). UNITED ARAB EMIRATES: 24.36N 55.01E, in light trap, 27.V–26.VI, 2006, Malaise trap, Anthony van Harten, 10024 (point-mounted; entire).

Paratypes (9♂ CNC). **UNITED ARAB EMIRATES**: same data as holotype (1♂). Al-Ajban, 24.36N 55.01E, 01.IV–02.V.2006, Malaise trap, A. van Harten, UAE#5653 (3♂); same data except collected, 26.VI–25.VII.2006, UAE#4682 (1♂); same data except collected 09.XI–07.XII.2005, light traps & MT (1♂). SSW of ad-Dhaid, 24–30.V.2006, light trap, coll. AvH, UAE#6161 (1♂). Fujairah, 25.08N 56.21E, 20–27.V.2006, light trap, Anthony van Harten, 10028 (1♂). Sharjah Desert Park, 25.17N 55.42E, 06–30.IV.2005, light trap, Anthony van Harten (1♂).

Etymology. Named in honor on Antonius (Anthony) van Harten, who collected the type series of two of the species described herein, and in recognition of his collecting efforts that were instrumental in the description of the arthropod biodiversity of U.A.E.

Description. FEMALE (Fig. 62). Length about 2.8 mm. Head with face and frontovertex variable in color depending on angle of light, mostly uniformly reddish-coppery from direct view (Fig. 64) but increasingly green with less distinct reddish-coppery luster from increasingly oblique angle; frontovertex distinctly differentiated by difference in sculpture at level about midway between toruli and anterior ocellus, with larger, and more isodiametric meshlike reticulations dorsad level and smaller, more transverse reticulations ventrad level, the sculpture between frontovertex and torulus in particular more transverse reticulate-rugose; in lateral view lower face and gena posterior to malar sulcus similarly strongly sculptured and colored; in dorsal view OOL almost 1.3× maximum diameter of posterior ocellus. Antenna (Fig. 68) with scape, pedicel, and basal five funiculars lighter yellow compared to darker brown apical three funiculars and clava; fl1slightly but distinctly longer than wide, fl4 about 0.7× length of fl2 and fl3, and funiculars increasing in width and beyond fl4 decreasing in length such that apical funicular slightly transverse in dorsal view; apical funicular ventrally extending under clava as apically tapered, ventrally bare and shiny, finger-like projection to claval apex; clava with slender, terminal, setose, spiniform process. Mandible with two similar teeth ventrally and shallowly concave, obliquely angled margin dorsally.

Pronotal collar (Fig. 63) in lateral view shallowly concave and in dorsal view not distinctly “shoulder-like” posterolaterally; almost uniformly coarsely punctate-reticulate mediolongitudinally, the reticulations only slightly larger posteriorly than anteriorly, and similarly reddish-coppery as face, with extreme posterior margin greenish and large, elongate-triangular, blue to purple or reddish-violaceous regions posterolaterally, these virtually smooth except for some effaced meshlike sculpture, with numerous distinct setae, and with longitudinal inner margins conspicuously differentiating quadrangular median sculptured region over length of collar. Mesoscutum (Fig. 63) anteriorly between incomplete notauli similarly reddish-coppery and punctate-reticulate as pronotum, but posteriorly with much larger reticulations and more reddish-violaceous along transscutal articulation and posteriorly on lateral lobes; scutellar-axillar complex (Fig. 65) reddish-coppery except anterior crenulate region between axillae bright green to bluish-green, axilla with reticulate dorsal surface longer than medial crenulate region between axillae, and with obliquely angled posterior surface increasingly finely sculptured to smooth ventrally, and scutellum comparatively flat dorsally, punctulate anteromesally, but with larger, more distinctly reticulate sculpture laterally and with transverse reticulations posteriorly. Tegula yellow. Macropterous; fore wing (Fig. 69) marginal vein about 7.5× length of stigmal vein; apex of postmarginal vein indistinct, but at most extending only slightly beyond level of uncus; uncus (Fig. 70) diverging from stigmal vein before apex so as to differentiate distinct stigma similar in length to uncus, and apex separated from posterior margin of postmarginal vein by distance at most equal to width of postmarginal vein or uncus and much less than width of uncus plus stigma; costal cell ventrally with up to 8 setae within about basal third; disc (Fig. 69) with oval brown region behind venation to medial fold and with somewhat lighter brownish infuscation posterior to cubital fold, but narrowly hyaline along marginal vein, with distinct brown setae except for much shorter, more spiculate setae apically and behind medial fold, and with narrow bare band along parastigma and marginal vein, and elongate bare region dorsally beyond stigmal vein (Fig. 70); marginal fringe distinct only along posteroapical margin. Prepectus extensively setose with relatively inconspicuous, short white setae. Mesepimeron bare along posterior margin (Fig. 66). Metapleuron bare, with about ventral half reticulate and dorsal half smooth and shiny (Fig. 66). Metasternum comparatively long, with base of mesocoxa distinctly anterior to, and apex of mesocoxa about level with base of

metaxcoxa. Legs (Fig. 62), including coxae, mostly orange to somewhat brownish-orange, but basal three tarsomeres of meso- and metatarsi white; metacoxa dorsobasally with patch of several short white setae. Propodeum (Fig. 67) with crenulate band along anterior margin recurved posteromedially into anteriorly broad, posteriorly tapered, V-shaped rugose region on either side of complete median carina; panels otherwise smooth and shiny, and callus smooth and shiny; callus anteriorly and propodeal plical region posteriorly and laterally between foramen and spiracle purple to blue or reddish-violaceous under some angles of light, but callus posterior to level of spiracle and plical region anteriorly variably extensively green or with some coppery luster depending on angle of light.

Petiole (Fig. 67) dorsally brown with slight greenish luster, shiny and almost smooth though with subeffaced sculpture, and about 1.4× as long as median width. Gaster (Fig. 62) uniformly dark brown; presyntergal tergites isodiametric meshlike coriaceous except smooth along posterior margins, with Gt2 slightly longer than Gt3.

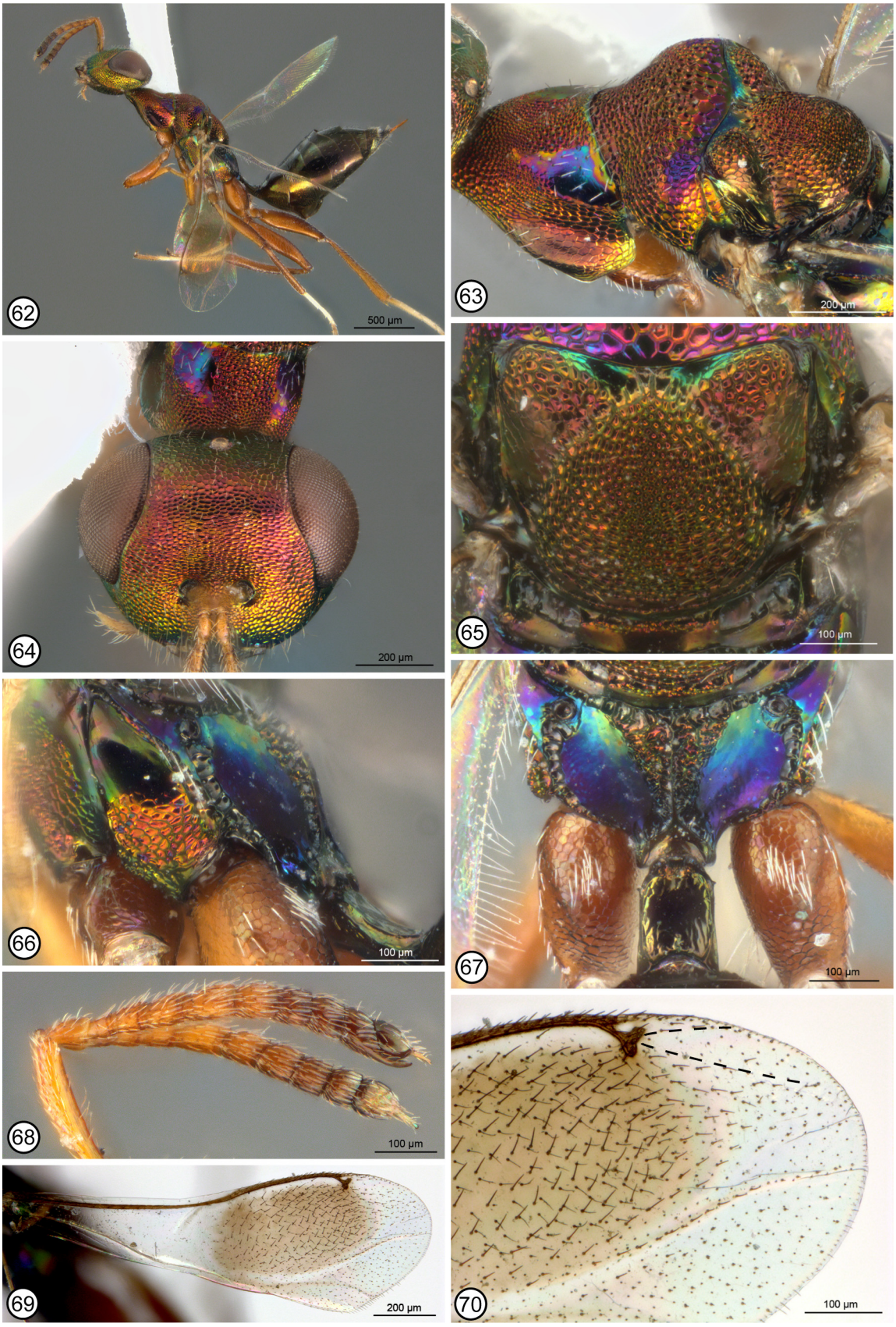
MALE (Fig. 71). Length = 1.4–3.0 mm. Head (Fig. 72) color variable, sometimes with frontal surface mostly green though usually variably extensively blue to bluish-green ventrally and more distinctly green with slight coppery luster dorsally, and vertex usually with some reddish-violaceous luster, at least in region of ocellar triangle; sculpture of face and frontovertex similar to female. Antenna (Figs 71, 75) with scape and pedicel often yellowish but at least scape somewhat lighter brown than flagellum; 11-segmented with flagellum having 6 long rami; fl1 anelliform; fl2–fl7 each with long ramus, with f12–fl5 anelliform, fl6 slightly longer than wide and fl7 about 3–4× as long as wide; fl8 about 4–5.5× as long as fl7 and about 1.5–1.8× as long as fl9 (terminal flagellomere); flagellum (Fig. 75) with conspicuous, long white setae along inner surfaces of rami and funiculars, and more uniformly around clava. Mandible similarly structured as for female. Maxillary and labial palpi yellowish-brown to dark brown but at least apical maxillary palpomere white.

Pronotum green to bluish-green or with coppery to reddish-violaceous lusters medially and posterolaterally, the color difference sometimes differentiating posterolateral regions similar to female but uniformly mesh-like reticulate (Fig. 72). Mesonotum mostly green with some coppery luster to variably extensively coppery to reddish-violaceous; mesoscutum meshlike reticulate, with smaller reticulations anteriorly between incomplete notauli and large reticulations posteriorly; scutellum (Fig. 73) somewhat flatter dorsally than female and more uniformly mesh-like reticulate, though reticulations larger laterally and posteriorly and all much smaller than on mesoscutum posteriorly; axilla similarly mesh-like reticulate anteriorly as female but more distinctly coriaceous posteroventrally. Fore wing (Fig. 76) with marginal vein about 5.7–7× as long as stigmal vein; hyaline; disc with much broader bare region behind parastigma and marginal veins than female and comparatively inconspicuously setose with short white setae and marginal fringe distinct only along posteroapical margin; uncus slender and more distantly separated from wing margin than for female. Prepectal, mesepimeral and metapleural setation, metapleural sculpture, and relative placement of mesocoxa as for female (Fig. 74). Legs (Fig. 71) with coxae dark with distinct metallic luster; femora and tibiae brown to dark brown and at least metafemur and sometimes all femora and tibiae with variably distinct purple luster, except basal four tarsomeres of middle and hind legs white and apical tarsomeres dark brown. Propodeum (Fig. 73) with similar colors as female and with complete median carina, but median sculptured region much less developed than for female, distinctly coriaceous to shallowly reticulate anteriorly between spiracles and usually narrowly on either side of median carina, the panels otherwise shiny and smooth or with at most subeffaced mesh-like sculpture.

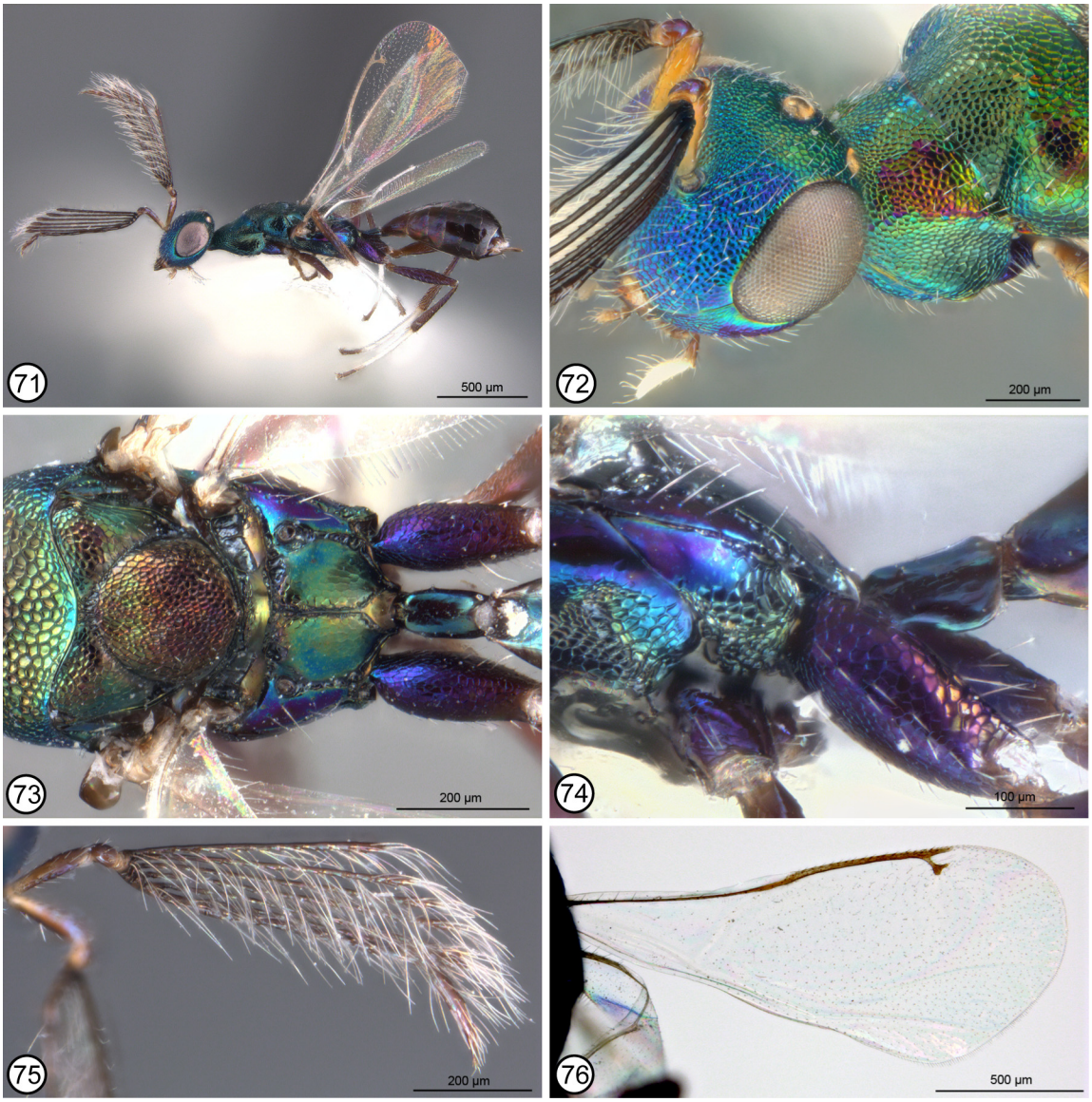
Petiole (Figs 73, 74) sometimes dark brown, but usually with variably distinct blue to bluish-green lusters under at least some angles of light, smooth and shiny, and about 1.6–2× as long as wide.

Biology. Unknown.

Remarks. *Notanisus vanharteni* and *N. yemenensis* comprise a species pair from the Arabian Peninsula that are more similar to *N. kansensis* and *N. oulmesiensis* than the Sub-Saharan African species (see under latter species). Females are quite similar, but the unique female of *N. yemenensis* differs conspicuously from that of *N. vanharteni* in head and mesosomal color, structure and sculpture of the differentiated posterolateral region of the pronotum, sculpture pattern of the median sculptured region of the propodeum, and structure of the stigmal vein. Additional females are required to evaluate variation and which features are truly differential. Distinct color, structural or color features do not appear to distinguish males of the two species and for this reason a separate description or images of the single *N. yemenensis* male is not given.



FIGURES 62–70. *Notanisus vanharteni*, ♀ holotype. 62, lateral habitus. 63, pronotum and mesonotum, dorsolateral. 64, head and pronotum. 65, scutellar-axillar complex. 66, mesepimeron, metapleuron, metacoxa and petiole, lateral. 67, propodeum, petiole and metacoxae, dorsal. 68, antennae (upper antenna lateral). 69, fore wing. 70, fore wing apex (dashed lines delimit dorsal bare region).



FIGURES 71–76. *Notanisus vanharteni* ♂. 71, lateral habitus (2014-48). 72, head and pronotum, dorsolateral (2014-49). 73, scutellar-axillar complex–petiole and metacoxae, dorsal (2014-50). 74, mesepimeron, metapleuron, metacoxa and petiole, lateral (2014-51). 75, antenna, inner view (2014-48). 76, fore wing (2014-49).

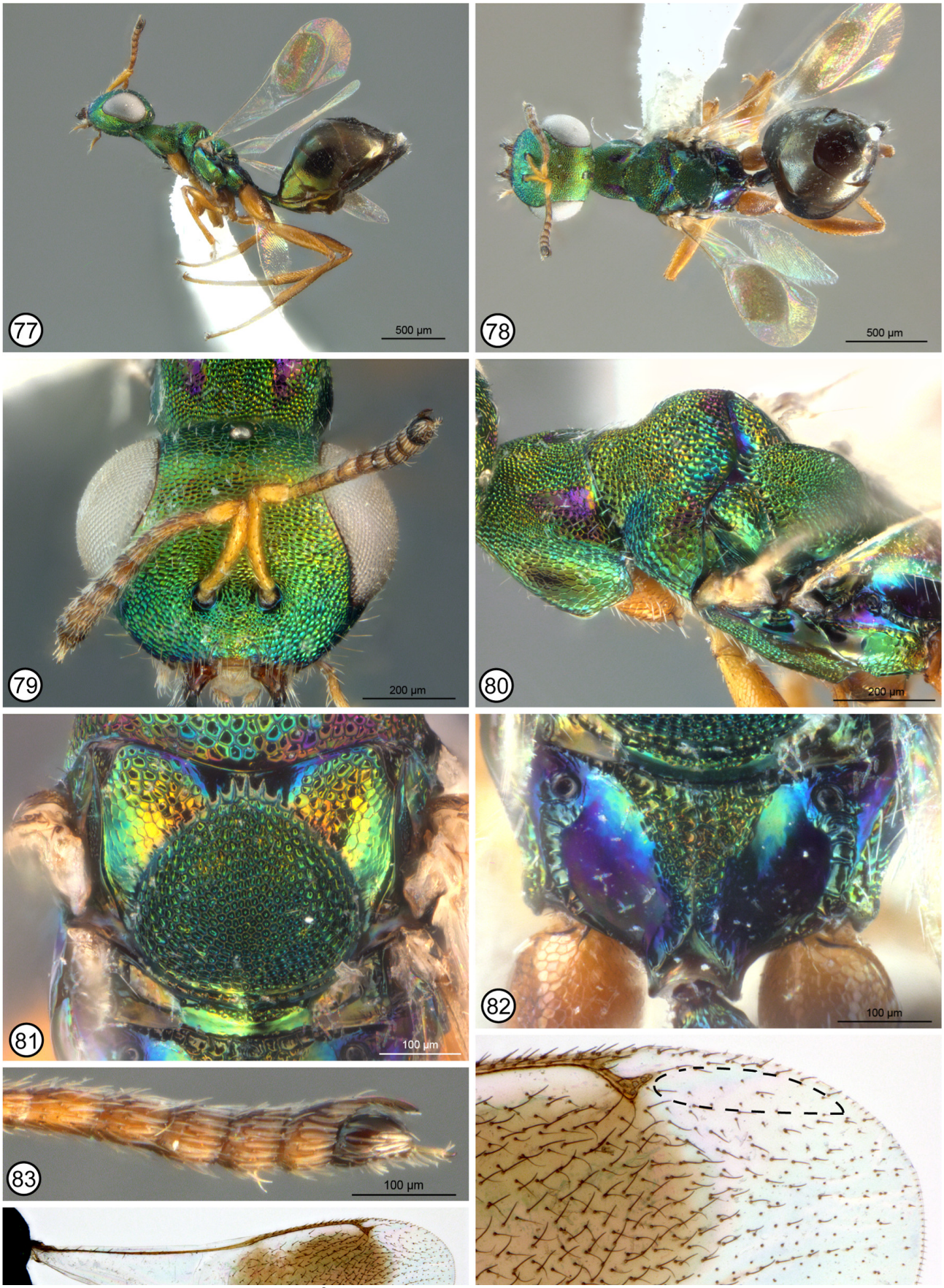
***Notanisus yemenensis* n. sp.**
Figs 77–85

Type material. Holotype ♀ (CNC). YEMEN Lahj, IX.2000, A. van Harten, A. Sallam, MT (point-mounted; entire).

Paratype (1♂ CNC). Same data as holotype.

Etymology. Named after the country from which the species was collected.

Description. FEMALE (Fig. 77). Length about 2.7 mm. Head with face and frontovertex green from direct or oblique viewing angle (Figs 78, 79), though with slight coppery luster above level of toruli, and in dorsal view with small reddish-violaceous region behind anterior ocellus within ocellar triangle; frontovertex distinctly differentiated by difference in sculpture at level about midway between toruli and anterior ocellus, with larger, and more isodiametric meshlike reticulations dorsad level and smaller, more transverse reticulations ventrad level, the sculpture between frontovertex and torulus in particular more transverse reticulate-rugose; in lateral view lower face and gena posterior to malar sulcus similarly strongly sculptured and colored; in dorsal view OOL only about



FIGURES 77–85. *Notanisus yemenensis*, ♀ holotype. 77, lateral habitus. 78, dorsal habitus. 79, head, antennae and pronotum. 80, pronotum and mesonotum, dorsolateral. 81, scutellar-axillar complex. 82, propodeum. 83, apical five funiculars and clava, lateral. 84, fore wing. 85, fore wing apex (dashed lines delimit dorsal bare region except for single seta).

1.1× maximum diameter of posterior ocellus. Antenna with scape and pedicel yellow, funicle somewhat darker yellowish-brown and clava dark brown; fl1 slightly but distinctly longer than wide, fl4 slightly longer than combined length of fl2 and fl3, and funiculars increasing in width and beyond fl4 decreasing in length such that apical funicular slightly transverse in dorsal view; apical funicular ventrally extending under clava as apically tapered, ventrally bare and shiny, finger-like projection to claval apex; clava with slender, terminal, setose, spiniform process (Fig. 83). Mandible with two similar teeth ventrally and more obscure, obliquely angled margin dorsally.

Pronotal collar (Figs 78, 80) in lateral view shallowly concave and in dorsal view not distinctly "shoulder-like" posterolaterally; almost uniformly punctulate-reticulate mediolongitudinally and mostly green with slight coppery luster except for elongate-triangular and though comparatively slender, more shallowly reticulate to partly smooth, violaceous regions posterolaterally, these with only a couple of distinct setae but with longitudinal inner margins differentiating quadrangular median sculptured region. Mesoscutum (Fig. 80) anteriorly between incomplete notauli similarly colored and punctate-reticulate as for pronotum dorsomedially, but with much larger reticulations posteriorly and partly bluish to reddish-violaceous along transscutal articulation and posteriorly on lateral lobes; scutellar-axillar complex (Fig. 81) mostly green with variably distinct coppery luster on axillae under different angles of light except crenulate region between axillae bright purple to reddish-violaceous laterally, axilla with reticulate dorsal surface longer than medial crenulate region between axillae, and with obliquely angled posterior surface increasingly finely sculptured ventrally, and scutellum comparatively flat dorsally (Fig. 77) and similarly uniformly punctate except for slightly larger punctures, more reticulate-punctate, laterally (Fig. 81). Tegula yellow. Macropterous; fore wing (Fig. 84) marginal vein about 7.5× length of stigmal vein; postmarginal vein shorter than stigmal vein; uncus (Fig. 85) diverging from stigmal vein apically so distinct stigma not differentiated and apex separated from wing margin by about width of stigma plus uncus, but by more than twice width of uncus; costal cell ventrally with 6 setae within about basal third; disc (Fig. 84) with oval brown region behind venation to medial fold and cubital fold also infuscate, but narrowly hyaline along marginal vein, the hyaline region slightly expanded posteriorly behind marginal vein subbasally but not distinctly subdividing infuscation, and with distinct brownish setae except for mostly much shorter, more spiculate setae apically and toward posterior margin, and with narrow bare band along parastigma and marginal vein, and elongate bare region dorsally beyond stigmal vein (Fig. 85); marginal fringe distinct only along posteroapical margin. Prepectus extensively setose dorsoapically, but with relatively inconspicuous, short white setae. Mesepimeron bare along posterior margin (Fig. 80). Metapleuron bare, with about basal half reticulate and dorsal half smooth and shiny (Fig. 80). Metasternum comparatively long, with base of mesocoxa distinctly anterior to, and apex of mesocoxa about level with base of metacoxa. Legs (Fig. 77), including coxae, mostly orange with dorsal surface of metacoxa and metafemora more brownish-orange under some angles of light, but both meso- and metatarsi paler, the basal three tarsomeres yellowish-white and apical two tarsomeres more distinctly yellow; metacoxa dorsobasally bare or (right coxa) with only two white setae (Fig. 82). Propodeum (Fig. 82) with crenulate band along anterior margin recurved posteromedially into anteriorly broad, posteriorly tapered, V-shaped sculptured region on either side of complete median carina, the region anteriorly crenulate to rugose but minutely rugulose to punctulate over about posterior half; panels otherwise smooth and shiny, and callus smooth and shiny; callus anteriorly and propodeal plical region posteriorly and laterally between foramen and postspiracular furrow reddish-violaceous, with medial sculptured region green with coppery luster anteriorly and callus posterior to level of spiracle and smooth part of panel anteriorly adjacent to medial sculptured region variably blue to greenish.

Petiole (Figs 77, 80) dorsally blue to bluish-green and quite extensively and distinctly reticulate, with sides slightly divergent posteriorly, but about 1.66× as long as medial width, uniformly dark brown; presyntergal tergites isodiametric meshlike coriaceous except smooth along posterior margins, with Gt2 subequal in length to Gt3.

MALE (Figs). See description of *N. vanharteni*.

Biology. Unknown.

Remarks. See under *N. vanharteni*.

Discussion

Bouček (1988: 261) discussed possible relationships and synonymy of *Notanisus* relative to *Amarisca* and stated he

saw a species of the latter genus from southern Africa whose males have "simple antennae with whorls of long setae" (= *N. longipetiolus*). At that time he suggested this antennal structure might differentiate males of *Amarisca* from those of *Notanisus*. However, because a ramose flagellum is shared by non-*oulmesiensis* group males and those of *N. vanharteni* and *N. yemenensis*, this flagellar structure is indicated as the groundplan structure for *Notanisus*. The pedicellate flagellar structure of *N. longipetiolus* (and likely *N. brevipetiolus*) is therefore indicated as secondarily derived in *Notanisus* and Bouček's (1991) synonymy of *Amarisca* under *Notanisus* is supported.

Females of *N. brevipetiolus*, *N. gracilis* and *N. longipetiolus* have the clava narrowed apically into a finger-like projection, as opposed to the terminal spiniform projection of females of the other four species included in the *oulmesiensis* species-group. Females of *Callocleonymus* also have a spiniform claval process, but those of *Cleonymus* and *Zolotarewskya* have an apically tapered claval process. The latter structure is thus indicated as the likely groundplan structure for *Notanisus* and the spiniform process as secondarily derived within the genus. Regardless, the feature appears to be homoplastic in *Notanisus* because females of some non-*oulmesiensis* group species, such as *N. clavatus* and *N. versicolor*, also have a slender spiniform claval process. Females of the latter two species have the preclaval funicular projecting ventrally only to about midlength of the clava, unlike *oulmesiensis*-group females, though some other *Notanisus* females with a tapered claval projection do have the preclaval funicular projecting ventrally to the claval apex.

Bouček (1988) suggested that *Notanisus* was more closely related to *Callocleonymus* because they "have the forewing mainly bare in the basal third or two-fifths" (p. 261) and "female gaster is distinctly petiolate, although in the latter genus [*Callocleonymus*] it is sometimes transverse, and the stigmal vein is much shorter than the marginal one and branching off at a wider angle than in *Cleonymus*" (p. 262). He even suggested that *Notanisus* might eventually be synonymized with *Cleonymus*, stating it "is possible that a future re-evaluation of the relationships of the species-groups will make it necessary to unite them [*Cleonymus*, *Notanisus* and *Zolotarewskya*] again, or at least *Cleonymus* with *Zolotarewskya*" (Bouček 1988: 263). *Callocleonymus* is indicated as a monophyletic taxon based on two putative autapomorphic features. The bare metapleuron uniquely has distinct, multisided, meshlike sculpture defined by impressed lines (Gibson 2003, fig. 112). Members of other genera have the metapleuron bare to variably extensively setose, but at least with different sculpture patterns (Gibson 2003). Further, although females of *Callocleonymus* have a slender, setose, spiniform claval process similar to some *Notanisus*, this originates from the dorsal surface of the clava at about its midlength so in lateral view the process is on the opposite side of a similarly spiniform process projecting ventrally from the preclaval funicular (Gibson 2003, figs 93, 94). This positional difference could indicate the claval spiniform processes evolved independently in *Callocleonymus* and *Notanisus*; however, it is equally possible that a spiniform process was derived in some common ancestor of the two and a dorsal rather than apical position evolved secondarily in the common ancestor of *Callocleonymus*. Bouček (1988: 262) also noted that both sexes of *Callocleonymus* have the mesonotum dorsally densely and deeply reticulate other than the axillae being more or less smooth, and that there are subtriangular areas differentiated on the pronotum, stating "behind the lateral angulations (shoulders) have the sculpture more or less obliterated, sometimes the shiny areas uniting behind across the middle". Because the smoother areas are transverse in *Callocleonymus* they most closely resemble those of *N. brevipetiolus* and *N. longipetiolus*. Consequently, monophyly of *Callocleonymus* is supported by at least two autapomorphies, but no known autapomorphies support monophyly of *Notanisus*. Rather, several features shared by some or all species of *Notanisus* and those of *Callocleonymus* suggest the two might comprise a monophyletic group, but that recognition of *Callocleonymus* could render *Notanisus* paraphyletic. The features include: 1) fore wing basal cell partly to entirely bare; 2) clava with slender spiniform process (if dorsal position in *Callocleonymus* secondarily derived); 3) pronotum dorsally and mesoscutum at least anteriorly coarsely sculptured, punctate-reticulate; 4) pronotum with differentiated smoother and shinier region posteriorly to posterolaterally (if region secondarily lost in *N. gracilis*); 5) axilla not uniformly sculptured, but with posterolateral surface at least partly smoother and shinier; and 6) gaster with non-metallic and at least distinct, quadrangular, even if transverse petiole. Of these, at least features three and four could indicate species of *Callocleonymus* are more closely related to the *oulmesiensis* species-group of *Notanisus* or even to the *N. brevipetiolus*-*N. longipetiolus* species-pair within *Notanisus*. *Notanisus* has priority over *Callocleonymus* so that ultimate classification will not affect nomenclature of the newly described species if the two names are synonymized eventually. However, prior to any synonymy more comprehensive knowledge of character-state distribution for species of both putative genera as well as for *Cleonymus* and *Zolotarewskya* is required to more confidently assess homoplasy versus symplesiomorphy and synapomorphy. As noted by Gibson (2008), only

Callocleonymus is demonstrably monophyletic among the five genera recognized in Cleonymini. Consequently, the recognition of *Notanisus* + *Callocleonymus* as a single genus might well render at least *Cleonymus* paraphyletic.

Acknowledgements

Thanks are given to the curators of the collections listed under Materials and methods for the loan of specimens on which this study is based. I am also indebted to Dr. Zhong-Qi Yang for the English translations he provided for *N. gracilis* and the images of the fore wing and antenna of the holotype. Ms Lisa Bearss and Caroline Boudreault (Agriculture & Agri-Food Canada, Ottawa, Canada) photographed the specimens and Ms. Bearss prepared the plates of figures that illustrate this study.

References

Baur, H. (2001) The Hymenoptera (Chalcidoidea, Ichneumonoidea, Platygastroidea) described by Vittoro Delucchi: an annotated catalogue. *Journal of Natural History*, 35, 55–125. http://dx.doi.org/10.1080/002229301447899

Bouček, Z. (1958) Eine Cleonyminen-Studie; Bestimmungsstabelle der Gattungen mit Beschreibungen und Notizen, eingeschlossen einige Eupelmidae (Hym. Chalcidoidea). *Sborník Entomologického Oddeleni Národního Musea v Praze*, 32, 353–386.

Bouček, Z. (1961) A new species of *Notanisus* Walk from Georgia, USSR (Hym. Pteromalidae). *Sborník Entomologického Oddeleni Národního Musea v Praze*, 34, 471–474.

Bouček, Z. (1991) Four new genera of European Pteromalidae (Hymenoptera), with some taxonomic changes. *Bollettino di Zoologia Agraria e Bachicoltura, Milano (2)*, 22 (2), 195–206.

Bouček, Z. & Heydon, S.L. (1997) Chapter 17. Pteromalidae. *In*: Gibson, G.A.P., Huber, J.T. & Woolley, J.B. (Eds.), *Annotated keys to the genera of Nearctic Chalcidoidea (Hymenoptera)*. National Research Council of Canada, NRC Research Press, Ottawa, pp. 541–692.

Bouček, Z. & Rasplus, J.-Y. (1991) *Illustrated key to West-Palaearctic genera of Pteromalidae (Hymenoptera: Chalcidoidea)*. Institut National de la Recherche Agronomique, Paris, 140 pp.

Delucchi, V. (1962) Hyménoptères chalcidiens du Maroc. II. Pteromalidae (suite). *Al Awamia*, 4, 7–25.

Erdős, J. (1946) Genere nova et species novae chalcidoidarum (Hym.). *Annales Historico-Naturales Musei Nationalis Hungarici*, 39, 131–165.

Erdős, J. (1957) Miscellanea chalcidologica hungarica. *Annales Historico-Naturales Musei Nationalis Hungarici (Series Nova)*, 8, 347–374.

Erdős, J. (1960a) Synonymiae novae Eurytomidarum et Cleonymidarum, nec non species novae Encyrtidarum, praesertim in territorio reservato Batorliget collectarum. *Acta Zoologica Hungarica*, 6 (3–4), 305–313.

Erdős, J. (1960b) Magyarország Allatvilága. XII. Kötet. Hymenoptera II. 3. Füzet. Fémfürkészek II. Chalcidoidea II. Torymidae, Eurytomidae, Agaonidae, Cleonymidae, Eupelmidae. *Fauna Hungariae*, 52, 1–230 + 6 pp.

Gibson, G.A.P. (2003) Phylogenetics and classification of Cleonyminae (Hymenoptera: Chalcidoidea: Pteromalidae). *Memoirs on Entomology, International*, 16, 1–v + 339.

Graham, M.W.R. de V. (1969) The Pteromalidae of north-western Europe (Hymenoptera: Chalcidoidea). *Bulletin of the British Museum (Natural History) (Entomology),* Supplement 16, 1–908.

Mitroiu, M.-D. & Andreiscu, I. (2008) A faunistic review of *Notanisus* Walker (Hymenoptera: Pteromalidae) in Romania, with a key to European species. *North-Western Journal of Zoology*, 4 (2), 311–319.

Noyes, J.S. (2014) Universal Chalcidoidea Database. World Wide Web electronic publication. Available from: http://www.nhm.ac.uk/chalcidoids (accessed 4 March 2015)

Risbec, J. (1952) Contribution á l'étude des chalcidoides de Madagascar. *Mémoires de l'Institut Scientifique de Madagascar (E)*, 2, 1–449.

Senatos, A. (1996) A new species of the genus *Notanisus* (Hymenoptera, Pteromalidae) from Tadjikistan. *Vestnik Zoologii, Kiev*, 1996 (4–5), 93–94.

Walker, F. (1837) Monographia Chalciditum. (Continued.) *Entomological Magazine*, 4 (4), 349–364.

Yang, Z.Q. (1996) *Parasitic wasps on bark beetles in China (Hymenoptera)*. Science Press, Beijing, iv + 363 pp.