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PRELIMINARY ANALYSIS OF THE COLOR VARIATION IN *CYPARIUM TERMINALE* FROM MEXICO, WITH COMMENTS ON *C. PALLIATUM*, AND A NEW RECORD FOR *C. YAPALLI* (COLEOPTERA: STAPHYLINIDAE, SCAPHIDIINAE)[1]

Juan Márquez[2]

ABSTRACT: Preliminary analysis of the color pattern of the body, antennae, head, pronotum, pronotal hypomeron, elytra, elytral epipleura, and last two visible pregenital tergites of *Cyparium terminale* Matthews is presented based on specimens from four Mexican states. Taxonomical remarks are included for *C. palliatum* Erichson based on study of the holotype. To augment the poor original description of *C. palliatum,* the holotype is compared to specimens of *C. terminale. Cyparium yapalli* Fierros-López is reported from the state of Guerrero for the first time and from a new locality in the state of Oaxaca.

KEY WORDS: Staphylinidae, Scaphidiinae, taxonomy, Mexico

Cyparium Erichson, 1845, the only genus of the tribe Cypariini (Leschen and Löbl, 1995; Löbl, 1997), was based on *C. palliatum* Erichson, 1845, a species reported from Mexico, but without a precise locality. The original description of this species is rather poor, and it is possible that the specimen studied is teneral, because of its pale color (Matthews, 1888; Fig. 1f). The genus includes 50 species. Five are distributed in Mexico: *C. navarretei* Fierros-López, 2002 from Veracruz; *C. palliatum* from "Mexico"; *C. sallaei* Matthews, 1888 from Oaxaca and Veracruz; *C. terminale* Matthews, 1888 from the states of Mexico, Jalisco, Michoacan, Morelos, Oaxaca and Veracruz (also recorded from Guatemala and Panama); and *C. yapalli* Fierros-López, 2002 from Oaxaca (Navarrete-Heredia et al., 2001; Fierros-López, 2002; Márquez, in press).

Since the original description of *C. palliatum* (Erichson, 1845) nothing has been documented about this species. Recently, four specimens of *Cyparium* were collected from three localities in Oaxaca and another three specimens were collected in the Sierra de Atoyac, Veracruz, Mexico. These specimens are orange, red or yellow and resemble *C. palliatum* more than any other Mexican species of *Cyparium* (Fig. 1b, f). Additionally, several typical specimens (body black with red bands on pronotum and elytra) of *C. terminale* were collected at the same sites (Fig. 1a, c). The seven paler specimens were difficult to assign either to *C. palliatum* or to *C. terminale*, due to the lack of published information about the former species, known only by the holotype, and because *C. terminale* presents wide variation in its color pattern.

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The goal of this work is to assess the variation in color pattern of *C. terminale* through the study of specimens from four Mexican states and to include taxonomical remarks for *C. palliatum* based on the study of the holotype, in order to distinguish it from *C. terminale. Cyparium yapalli,* until now known only from the type locality, is reported from two new localities.

METHODS

The holotype specimen of *C. palliatum* was obtained on loan from the Museum of Natural History of Berlin, Germany (MNHUB; J. Frisch). The other specimens studied were obtained on loan from the following collections (acronyms identify the collections in the text): American Museum of Natural History, New York (AMNH; L. Herman); Colección de Coleoptera, Universidad Autónoma del Estado de Hidalgo, Pachuca, Hidalgo (CC-UAEH; J. Márquez); Colección Entomológica, Instituto de Ecología, A. C., Xalapa, Veracruz (IEXA; L. Delgado); Colección de Coleoptera del Museo de Zoología, Facultad de Ciencias, UNAM, México, D. F. (MZFC-UNAM; J. J. Morrone); and Colección Nacional de Insectos, Instituto de Biología, UNAM, México, D. F. (CNIN; S. Zaragoza).

Taxonomical characteristics were taken from Matthews (1888), Fierros-López (2002) and Leschen and Löbl (1995). This study can be considered as a preliminary analysis of the variation in color pattern of *C. terminale,* due to the reduced number of specimens studied (28), and the lack of specimens of the states of Mexico and Jalisco, Mexico, and from Guatemala and Panama.

RESULTS AND DISCUSSION

Cyparium terminale Matthews, 1888

The color pattern of the species is highly variable and is documented herein so as to permit separation of the species from similar ones of the genus (Fig. 1a-e). Also, it can be a precedent of a variable species that can be studied with respect to its geographic distribution, and with respect to its association with mushrooms at different sites.

Variation of the color pattern is presented in descending frequency with respect to the dominant color pattern and is based on 28 specimens among which are 1 from Michoacan, 5 from Morelos (1 teneral), 8 from Oaxaca (4 reddish, pattern color documented herein for the first time), and 14 from Veracruz (3 of them teneral).

1. General body color

a) Body black, or black with some red areas on pronotum and/or elytra: 20 specimens: Michoacan (1); Morelos (4); Oaxaca (4); Veracruz (11); Fig. 1a, c-e.

b) Body red, or red with reduced black areas on head and/or on last two visible abdominal tergites: 4 specimens from Oaxaca indicated below as "red"; Fig. 1b.

c) Body yellow, or yellow with pale (nearly white) spots on basal and apical corners of elytra: 4 specimens indicated below as "teneral": Morelos (1); Veracruz (3).

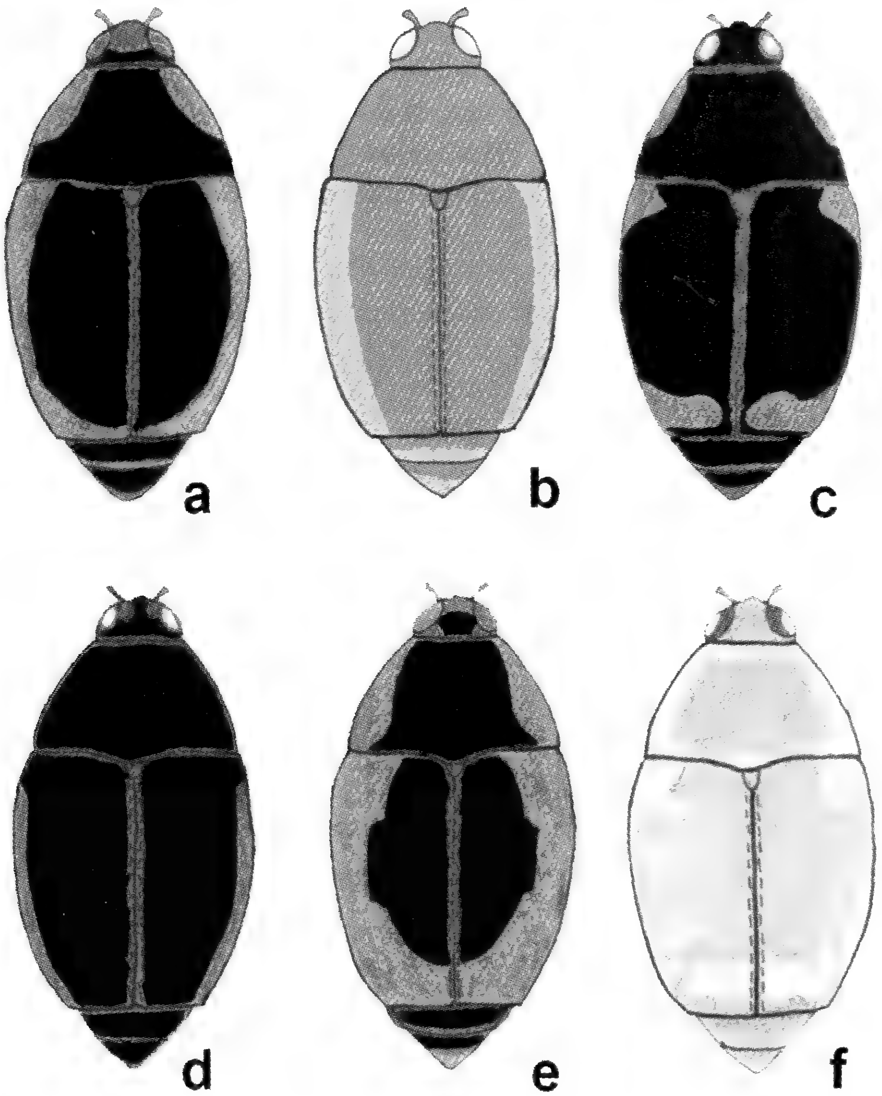

Figure 1. Schematic representations of color patterns of head, pronotum, elytra and last visible tergites of *Cyparium terminale* (a-e) and *C. palliatum* (f; holotype; antennae and legs omitted).

2. Last antennomere (one specimen from Veracruz without antennae)

a) Basal half black contrasting strongly with yellow apical half: 20 specimens: Morelos (5); Oaxaca (4); Veracruz (11, three of them teneral).

b) Basal half brown, but not contrasting strongly with reddish brown apical half: 6 specimens: Oaxaca (4, red); Veracruz (2).

c) Basal half reddish brown, not contrasting strongly with pale red apical half: Michoacan (1).

3. Head

a) Head black, with frontoclypeal region and labrum reddish brown: 9 specimens: Morelos (3); Oaxaca (3); Veracruz (3).

b) Head red, with brown to black color beginning at posterior margin adjacent to neck, and ending behind eyes: 8 specimens: Michoacan (1); Oaxaca (4, red); Veracruz (3).

c) Head black, only with anterior half of frontoclypeal region and labrum reddish brown: 7 specimens: Morelos (1); Oaxaca (1); Veracruz (5).

d) Head uniformly yellow: 4 teneral specimens: Morelos (1); Veracruz (3).

4. Pronotum

a) Pronotum black, with red band on anterior 2/3 of lateral borders: 9 specimens: Morelos (3); Oaxaca (2); Veracruz (4); Fig. 1a.

b) Pronotum black, with red band along entire lateral borders, red band wider than band of specimens of 4a): 6 specimens: Michoacan (1); Veracruz (5); Fig. 1e.

c) Pronotum uniformly black: 5 specimens: Morelos (1); Oaxaca (2); Veracruz (2); Fig. 1d.

d) Pronotum uniformly red: 4 specimens: Oaxaca (red); Fig. 1b.

e) Pronotum red pale or yellow, with lateral borders slightly paler than remaining area: 4 specimens: Morelos (1, teneral); Veracruz (3, teneral).

5. Elytra

a) Elytra black, with red band along lateral border, widest at anterior and posterior corners (about as wide as 1/3 of width of elytra) narrower at midlength (about as wide as 1/4 of total width of elytra): 11 specimens: Morelos (3); Oaxaca (4); Veracruz (4); Fig. 1a.

b) Elytra black, with red spot at antero-lateral corner and red spot at postero-lateral corner: 7 specimens: Veracruz; Fig. 1c.

c) Elytra red, with same band as indicated above, but pale: 5 specimens: Morelos (1, teneral); Oaxaca (4, red); Fig. 1b.

d) Elytra yellow, with white spot at antero-lateral corner and white spot at postero-lateral corner: 3 specimens: Veracruz.

e) Elytra with similar color pattern as in 5a), but with red band evenly narrow, about as wide as 1/5 of width of elytra: 1 specimen: Morelos; Fig. 1d.

f) Elytra with similar color pattern as in 5a), but with red band wider, and black area of elytra forming a frontal silhouette of a human head when both elytra are contiguous: 1 specimen: Michoacan; Fig. 1e.

6. Pronotal hypomeron

a) Pronotal hypomeron dark brown to black, with red band near upper line: 19 specimens: Morelos (4); Oaxaca (4); Veracruz (11).

b) Pronotal hypomeron uniformly red (pale in teneral specimens): 9 specimens: Morelos (1, teneral); Michoacan (1); Oaxaca (4, red); Veracruz (3, teneral).

7. Color of elytral epipleura

a) Superior and inferior carinae of elytral epipleura black, contrasting strongly with red area between carinae: 17 specimens: Michoacan (1); Morelos (4); Oaxaca (3); Veracruz (9).

b) Superior and inferior carinae of elytral epipleura reddish brown to yellow (teneral specimen), contrasting with red area between carinae, but less strongly than in specimens indicated above: 9 specimens: Morelos (1, teneral); Oaxaca (5, four of them red); Veracruz (3, teneral).

c) Superior and inferior carinae of elytral epipleura black, contrasting strongly with anterior half of area between carinae, and contrasting slightly with almost black posterior half of area between carinae: 2 specimens: Veracruz.

8. Legs

a) Legs red or reddish brown, with coxae black to brown, darker than remaining segments of leg: 11 specimens: Michoacan (1); Morelos (4); Oaxaca (6, two of them red).

b) Legs yellow, or yellow with red coxae: 6 specimens: Morelos (1, teneral); Oaxaca (2, red); Veracruz (3, teneral).

c) Legs with coxae, trochanters and basal half of femora black; apical half of femora, tibiae and tarsi red: 6 specimens: Veracruz.

d) Legs black, with tibiae and tarsi red: 5 specimens: Veracruz.

9. Visible abdominal sternites

a) Abdominal sternites dark brown to black, with red or reddish brown posterior and lateral margins: 20 specimens: Michoacan (1); Morelos (4); Oaxaca (4); Veracruz (11).

b) Abdominal sternites red, with yellow posterior and lateral margins: 4 specimens: Oaxaca (red).

c) Abdominal sternites uniformly yellow: 4 teneral specimens: Morelos (1); Veracruz (3).

10. Last two visible pregenital tergites

a) Penultimate tergite black with red or reddish brown posterior border; last tergite with black basal half and red or reddish brown apical half: 12 specimens: Michoacan (1); Morelos (4); Oaxaca (3, one of them red); Veracruz (4); Fig. 1a, c, e.

b) Two last tergites uniformly black: 8 specimens: Oaxaca (2); Veracruz (6); Fig. 1d.

c) Two last tergites uniformly red or yellow: 7 specimens: Morelos (1, teneral); Oaxaca (2, red); Veracruz (4, three of them teneral).

d) Penultimate tergite red; last tergite red, with transverse black band on basal 1/4: 1 specimen: Oaxaca (red).

Cyparium terminale presents three principal color patterns that overlap. The dominant pattern is mainly black, with red spots or bands on the elytra and pronotum (Fig. 1a, c, d); the second is red, with some poorly marked pale spots or bands distributed identically to the red spots of the black form (Fig. 1b); and the third pattern is represented only by one specimen from Michoacan, which displays an equal distribution of black and red color on the elytra and, to a lesser degree, the pronotum (Fig. 1e). Teneral specimens of *C. terminale* are difficult to distinguish from the pale yellow specimen of *C. palliatum;* possible diagnostic differences are described below under *C. palliatum.* Teneral specimens of *C. terminale* might be confused also with adults of the red pattern type, but they may be distinguished because they are pale yellow, with some whitish spots on pronotum and elytra; whereas adults red specimens lack spots and are slightly browner than teneral specimens. Specimens with red pattern color are known at present only from Oaxaca, from two localities of the Sierra Madre del Sur and one locality of the Mexican Pacific Coast Provinces (Fig. 3).

In contrast, the aedeagi of several red and black specimens do not differ (Fig. 2a-b), but the teneral specimens are all females. Additionally, all specimens have the same punctational pattern on the head, pronotum and elytra, and the antennae show the same proportion and form in each anntenomere. A future revision of a long series of specimens from more localities can provide a better knowledge of the variation of this species.

Cyparium terminale is found in several Mexican states and extends to Guatemala and Panama. In Mexico, it has been documented from the following biogeographic provinces (Fig. 3): Trans-Mexican Volcanic Belt (states of Mexico, Jalisco and Michoacan), Balsas Basin (Mexico and Morelos), Sierra Madre del Sur

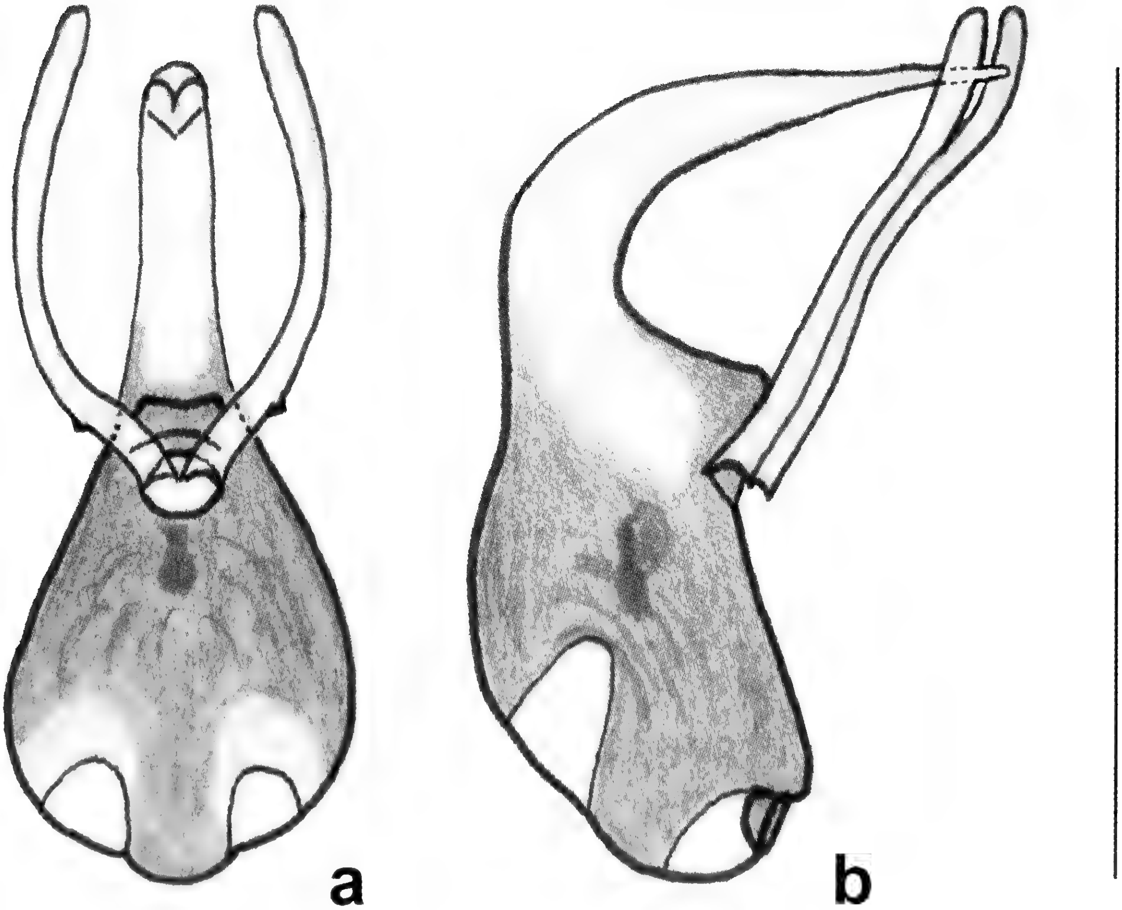

Figure 2. Aedeagus of *Cyparium terminale*: a) ventral view, b) lateral view. Scale bar 0.95 mm.

(Oaxaca), Mexican Pacific Coast (Oaxaca), and Gulf of Mexico (Veracruz). It may be predicted to occur also in Chiapas Province, since its distributional pattern is similar to other staphylinids (Márquez and Morrone, 2003; Márquez and Asiain, in press). It is also possible that *C. terminale* is present in several Central American countries such as Belize, Honduras, El Salvador, Nicaragua and Costa Rica, because the apparent disjunction in the distribution from Guatemala to Panama is not a common pattern in Neotropical staphylinids. The disjunction for *C. terminale* may be the result of a lack of sampling or the Mexican and Central American specimens may not be conspecific, as was documented for species of *Homalolinus* (Márquez, 2003).

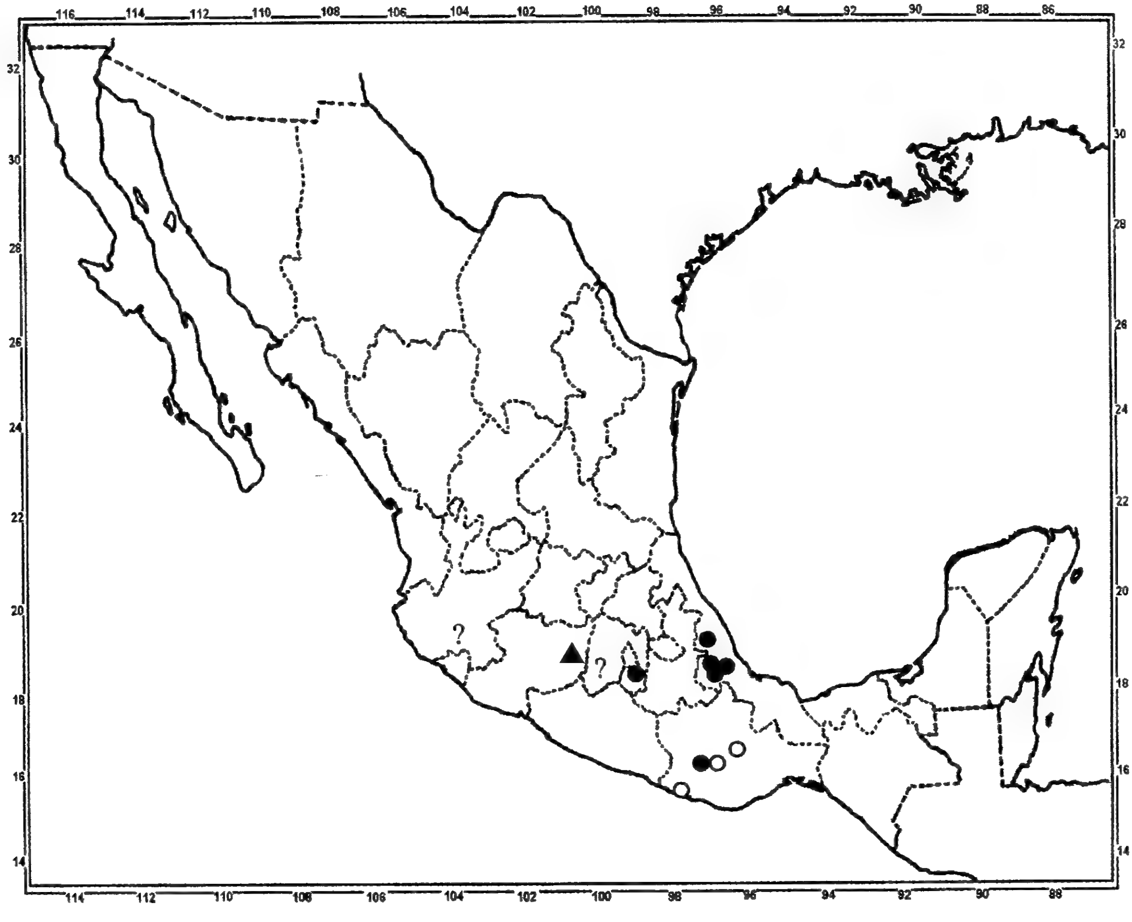

Figure 3. Geographical distribution of *Cyparium terminale* in Mexico. Black circles: black pattern color (16 specimens), white circles: red pattern color (four specimens), and black triangle: black/red pattern color (one specimen). Teneral specimens are excluded. Question marks: state records only (Jalisco and Mexico; Navarrete-Heredia et al., 2002).

Material Studied: "México: Michoacán, Ocampo, Laguna Seca. Bosque mixto. N 19° 32'37", W 100° 22'38.9". En hongos. 22-VII-2000. S. Bautista y J. Asiain cols." (1, CC-UAEH). "México: Morelos, Tlayacapan, San José de los Laureles. Bosque mesófilo de montaña. Localidad 3. 15-08-1998. En hongos diversos. R. Toledo y J. Márquez cols." (3, MZFC). Same data as previous, except: "Necrotrampa permanente (calamar). Localidad 1. Bosque de encino-pino, 1 a 30 de septiembre de 1996. J. Márquez col." (1, MZFC). Same data as previous, except: "1 a 30 de octubre de 1995. K. Villavicencio y J. Márquez cols." (1, MZFC). "México: Oaxaca, Santiago Yosondua, camino a El Vergel, La Cascada. Bosque de encino. 1917 m. N 16° 50' 49.6", W 97° 34' 47.5". En trampa de intercepción de vuelo. 10 a 13-VII-2005. J. Asiain y J. Márquez cols." (5, CC-UAEH). Same data as previous, except: "En *Russula* sp. 12-VII-2005. J. Asiain y J. Márquez cols." (1, CC-UAEH). "México: Oaxaca, Santiago Jamiltepec, El Monroy. 10-14-julio-2005. Alt. 100 m. Trampa de intercepción. L. Delgado col." (1, IEXA). "México: Oaxaca, km 3 Carr. Santo Domingo Tepuxtepec-Juquila Mixes. 19-VIII-2003. Alt. 2000 m. Trampa de intercepción. Q. Santiago y L. Delgado cols." (1, IEXA). "México: Veracruz, Sierra de Atoyac, Atoyaquillo. 30-VI-2003. Alt. 650 m. En hongos. A. y L. Delgado cols." (2, IEXA). Same data as previous, except: "30-VI-2-VII-2003. En agarical" (3, IEXA). "México: Veracruz, Huatusco, km 30 Carr. Fortín-Huatusco. 12-Julio-2001. Alt. 1490 m. Bosque mesófilo. L. Delgado col." (1, IEXA). Same data as previous, except: "24-VI-2003. Alt. 1500 m. En hongos y tronco. A. y L. Delgado cols." (1, IEXA). "México: Veracruz, Fortín, Barranca de Metlac. 25-28-VI-2003. Alt. 1000 m. Trampa de intercepción. A. y L. Delgado cols." (1, IEXA). "México: Veracruz, Chocaman. 1200 msnm. 6-I-2000. H. Brailovsky, E. Barrera / Colección del Instituto de Biología, UNAM, México, D. F." (2, CNIN). "Mexico: Jalapa, W. Schaus, Coll´r. / *Cyparium terminale* Matth. Det. J. F. Cornell '67." (3, AMNH). "Mexico: Jalapa. Hoege. / *Cyparium terminale* Matt. / Donated by F. Du C. Godman. 1907. (1, AMNH).

Cyparium palliatum Erichson, 1845

This species is known only from the female holotype. I agree with Matthews (1888) that this specimen may be teneral, which, together with the lack of additional males and females, make it difficult to interpret this species. The problem is made more difficult when teneral specimens are collected, as occurred with *C. terminale* described above. Initially and erroneously I considered that these teneral specimens to be *C. palliatum,* since it is not easy to detect conspicuous differences between the holotype of *C. palliatum* and the 28 specimens of *C. terminale* included herein.

The holotype of *C. palliatum* is more similar to the red and teneral specimens of *C. terminale* than to the others. The two species can be distinguished because the apical half of the last antennomere of *C. palliatum* is scarcely flattened and with the basal half reddish brown, not contrasting strongly with its pale red apical half. On the other hand, the apical half of the last antennomere of *C. terminale* is clearly flattened, yellow and contrasts strongly with the black basal half.

If the holotype of *C. palliatum* is really teneral, it is probable that a mature adult may have some pale spots on the elytra and on the borders of the pronotum, because the specimen studied shows several pale to near transparent areas in a vague pattern (Fig. 1f). Similar pale areas were detected in the teneral specimens and the red form of *C. terminale.* Only by collecting and studying additional material of

C. palliatum might the validity of the species be verified and the characters by which the species is distinguished be clearly known.

Type Material. Holotype female: "7689 / Mexico Deppe / Type / *palliatum* Er. / *Cyparium* Er. / Zool. Mus. Berlin / Hist-Coll (Coleoptera) Nr. 7689 *Cyparium palliatum* Erichson. Mexico, Deppe. Zool. Mus. Berlin / Holotypus *Cyparium palliatum* Erichson, 1845, labelled by MNHUB 2005."

Cyparium yapalli Fierros-López, 2002

This species has been recorded only from the type locality, "km 164, carretera Sola de Vega – Puerto Escondido," state of Oaxaca (Fierros-López, 2002). Two new localities for the species are reported here: "México: Oaxaca, Santiago Jamiltepec, El Monroy. 10-14-julio-2005. Alt. 100 m. Trampa de intercepción. L. Delgado col." (1, IEXA). "México: Guerrero, Chilpancingo, Barranca Las Juntas. 27 / 29-VIII-2003. Trampa de intercepción. Alt. 900 m. Q. Santiago y L. Delgado cols." (1, IEXA). This species now known at two localities in the Sierra Madre del Sur Province and one locality in the Mexican Pacific Coast Province (Fig. 4).

Figure 4. Geographical distribution of *Cyparium yapalli* (black circles).

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EIGHT NEW SPECIES AND A KEY TO SPECIES OF THE *ALEIODES PILOSUS* SPECIES-GROUP (=*TETRASPHAEROPYX* ASHMEAD) (HYMENOPTERA, BRACONIDAE, ROGADINAE) IN NORTH AMERICA,[1] PART 2

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Abstract: This is the second of a two-part series, which is intended as an introduction to a future revision of the *Aleiodes pilosus* (Cresson) species-group. Here eight new species are described and a key to described and undescribed species is provided. Species described are as follows: *A. anatariatus, A. cartwrightensis, A. haematoxyloni, A. halifaxensis, A. jaliscoensis, A. provancheri, A. quickei,* and *A. shawi.* Host information is included.

KEY WORDS: *Aleiodes, pilosus,* species-group, Hymenoptera, Braconidae, Rogadinae, North America, new species, new combination, Cheloninae, Rhogas, taxonomy, systematics, Geometridae, endoparasitoid

Aleiodes Wesmael is a large group of parasitic wasps, comprising about 300 species worldwide and found on every continent except Antarctica (Chen and He 1997). Like other members of the tribe Rogadini, *Aleiodes* are koinobiont endoparasitoids of lepidopteran larvae that mummify the host larva when it dies and pupate inside the mummy. The mummy is composed of the larval host's skin, often lined inside with an inner silken cocoon (Shaw and Huddleston 1991). Before it pupates, the parasitoid larva usually cuts a hole in the ventral thoracic region of the host mummy, through which the mummy is glued to a substrate (leaf, twig, etc.). The adult *Aleiodes* exit hole is smoothly, roundly cut in the dorso-posterior area of the mummy (Shaw 1997).

The *A. pilosus*-group is defined by the carapace-like fourth abdominal tergite that covers all tergites posterior to it (Fortier 2006b). *A. pilosus*-group species were previously known only from western North America (Shaw 1997) until the current investigation. *Aleiodes pilosus*-group specimens are infrequently collected (Shaw 1997), and their host associations remained unknown until recently (Fortier 2006a).

The purpose of this paper is to describe 8 new *A. pilosus*-group species and to provide a key to all described and undescribed species. This is intended as the second part of an introductory series to a future revision of the *A. pilosus*-group.

METHODS

Specimens were borrowed from the following museums: The American Entomological Institute (AEI), the Academy of Natural Sciences at Philadelphia (ANSP), the Albert J. Cook Arthropod Research Collection at Michigan State University (ARC), the Canadian National Collection (CNC); the Cornell University Insect Collection (CUIC), the Entomology Research Museum at the University of California at Davis (ERM), the Insect Research Collection at the University of Wisconsin, Madison (IRC), the Snow Entomological Museum, of the University of Kansas at Lawrence (SEMC), the Smithsonian National Museum of Natural History (NMNH), the National Museum of Scotland (NMS), the Rocky Mountain Systemic Entomology Laboratory (RMSEL), the Texas A&M University Entomology Collection (TAMU), the Essig Museum of Ento-

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mology at the University of California at Berkeley (UCB), and the Bohart Museum of Entomology at the University of California at Davis (UCD). Observations and measurements were made with a Leica MZ 12.5 stereomicroscope. An ocular micrometer in the eyepiece of the microscope was used for measurements. Images were made with a Syncroscopy Automontage photo-imaging system. Morphological terms follow Sharkey and Wharton (1997). Sclerite surface sculpturing terminology follows Harris (1979).

SYSTEMATIC ENTOMOLOGY

Key to *Aleiodes pilosus*-group species

For species that include specimens collected in the U.S. and Canada, postal abbreviations for states and provinces are included in the key. For species that include specimens collected in Mexico, the name of the state follows the abbreviation "MEX." Species with polymorphic characters will come out at more than one point in the key. New species not yet described have been designated numbers, thus "n. sp. 1" refers to an undescribed species designated the number 'one.' Figures of wings for described species that come out in couplets 1-13, 37, 74, and 79 can be found in Fortier (2006b).

1 Entire dorsum of metasoma punctate or foveolate (Figs. 2, 4, 7) 2
— Entire dorsum of metasoma not punctate or foveolate, 1 or more tergites rugocostate, rugose, or areolate (Figs. 1, 3, 5, 6, 8, 12, 14, 15, 16) 11
2(1) Entire metasomal dorsum black, foveolate 3
— Metasomal dorsum either entirely yellow-orange, orange, or bicolored 6
3(2) Mesopleuron entirely yellow-orange including venter NM) .... *A. dorsofoveolatus*
— Mesopleuron venter black 4
4(3) Mesopleuron entirely yellow-orange except venter (AZ, CO) .... *A. citriscutum*
— Mesopleuron above venter with black 5
5(4) Head, pronotum yellow-orange, scutum bicolored, black with yellow notauli, scutellum, propleuron and venter of mesopleuron black (CA), second submarginal cell of forewing small and square, length of vein r greater than 3RSa length (CA) .... *A. flavinotaulus*
— Head, pronotum yellow-orange, scutum, scutellum yellow-orange, most of esopleuron, all of propodeum and metasomal dorsum black, forewing vein r long, length greater than 3RSa length, second submarginal cell small, square (TX) .... *A. brevicellula*
6(2) Bicolored orange and black head, scutum, and scutellum, and/or metasoma with mostly black tergite IV 7
— Dorsum of body entirely yellow-orange or orange, sometimes propodeum and/ or base of MT I with black 8
7(6) Bicolored orange and black head, scutum and scutellum; yellow-orange pronotum, orange metasomal dorsum, tergite I with black highlights, second submarginal cell of forewing small and square, length of vein r greater than 3RSa length (AZ) .... *A. cochisensis*
— Yellow-orange head, bicolored metasoma with extensive black on tergites III and IV (WY) .... *A. aquaedulcensis*
8(6) Wings infumate 9
— Wings clear 10
9(8) All orange-yellow, ocelli small, wings fumate, scutum shiny smooth punctate (CO, TX, NM, MEX, WY) .... *A. pilosus*
— As above except black propodeum, sometimes dark tergite I (TX, WY) .... *A. fernaldellavorax*
10(8) Scutum sculpturing areolate over minutely areolate surface, legs yellow (MEX, Oaxaca) .... *A. oaxacensis*
— Legs black (MEX, Oaxaca; TX) .... *A. tulensis*

11(1) All yellow or dark orange; sometimes with irregular dark mottling on tergites, or black on propodeum 12
— Bicolored or black other than irregular dark mottling or black propodeum 21
12(11) Unicolored dark orange, metasomal tergite II coarsely rugose, tergite I short and wide, apical width greater than or equal to 1.8 tergite length 13
— Unicolored yellow or orange-yellow, apical width less than 1.8 tergite length 14
13(12) Legs black (GA, SC) .... *A. catherinensis*
— Legs orange or yellow (MEX, Nuevo Leon; NM) .... n. sp. 33
14(12) Large ocelli, diameter of lateral ocellus greater than 0.9 length of ocelli ocular space (Fig. 11) 15
— Small ocelli, diameter of lateral ocellus less than (Fig. 9) or equal to (Fig. 10) 0.9 length of ocelli-ocular space 18
15(14) All yellow soma, usually pale yellow, metasomal tergite II broadly costate, ocelli large, almost touching eyes (Figs. 11, 12, 13, 22) (MEX, Oaxaca .... *A. haematoxyloni*
— Metasomal tergite II rugocostate to finely rugulocostate, not broadly costate 16
16(15) Carapace shallow, sometimes nearly flat (Fig. 6) (TX) .... n. sp. 15
— Carapace deep, rounded (Fig. 7) 17
17(16) Bright, light yellow dorsum, metasomal tergites I-III delicately rugulocostulate, tergite II lightest, white metasomal venter, yellow legs, ocelli large, longest diameter of lateral ocellus greater than or equal to ocelli ocular distance (Figs. 5, 27) (TX) .... *A. quickei*
— Yellow-orange dorsum, rugulocostate, metasomal venter yellow or brown, often with brown or black tergite IV and/or irregular dark mottling on other tergites (TX) .... n. sp. 11
18(14) Carapace shallow, flattened, flange poorly defined apically (IA) .... n. sp. 50
— Carapace deep, rounded, flange well defined, recurved apically 19
19(18) Metasomal tergite II broadly, coarsely costate, or otherwise with strongly defined longitudinal carinae (ND, NE, SD) .... n. sp. 8
— Metasomal tergite II rugose or rugocostate, no strong longitudinal carinae, usually yellow-orange 20
20(19) Wings hyaline, wing venation honey yellow (IA) .... n. sp. 56
— Wings infumate, basal wing venation black (TX) .... n. sp. 43
21(11) Head, mesosoma all black or nearly so, each tergite all or mostly black 22
— Either head and mesosoma with more yellow than black, and/or one or more tergites with more yellow than black 26
22(21) Metasomal tergite II with a few widely spaced, deep, parallel costae, black often with yellow highlighting (AB, BC) .... n. sp. 13
— Metasomal tergite II rugocostate, no extremely well defined costae as above 23
23(22) All black head, soma, legs yellow-orange except black coxae and trochanters; submarginal cell square, ocelli small, tergite II sculpturing rugulocostate (Figs. 14, 21) (LABRADOR) .... *A. cartwrightensis*
— Head sometimes all black, usually with a yellow-orange eye-ring, second submarginal cell variously shaped 24
24(23 Second submarginal cell nearly square, metasomal tergite IV yellow apically in male; female similar except with more extensive yellow at apices of tergites III and IV and tergite II with yellow highlighting (BC) .... n. sp. 47
— Second submarginal cell elongate, metasoma entirely black 25
25(24) Face all or mostly black (AB, BC.) .... n. sp. 39
— Face yellow orange (MD) .... n. sp. 60
26(21) Head, mesosoma color not all black, usually mostly yellow or orange; metasomal tergite color all black; sometimes with orange or yellow highlights on some tergites 27
— Head, mesosoma color variable; some metasomal tergites with no black 42
27(26) Diameter of lateral ocellus greater than 0.9 of ocell-ocular distance 28
— Diameter of lateral ocellus less than or equal to 0.9 of ocell-ocular distance 34
28(27) Carapace as deep as long, rounded 29
— Carapace shallow, not as deep as long, not rounded apically 31

29(28) Metasomal tergite II coarsely rugose-areolate, dark orange propleuron, middle and hind legs (CO)........................n. sp.19
— Metasomal tergite II finely rugulocostulate........................30
30(28) Middle and hind legs black, black propleuron, body length about 4.5mm (MEX, Durango)........................n. sp. 1
— Middle and hind legs mostly yellow, honey yellow propleuron, body length about 3.5 mm (TX, NM)........................n. sp. 4
31(28) Mostly black mesosoma, black metasoma, areolate rugulose metasomal tergite II (WY, AZ)........................n. sp. 21
— Mostly yellow or bicolored mesosoma, tergite II sculpturing costate........................32
32(31) Mesosoma mostly yellow, metasoma extensively washed with yellow; body length less than or equal to 3 mm., tergite II sculpturing areolate-costate (TX)........................n. sp. 2
— Tergite II sculpturing rugocostate........................33
33(32) Tergite II distinctly bicolored yellow and black, shallowly rugocostate (TX)......n. sp. 20
— Tergite II black, coarsely rugocostate, with deep, distinct dorso-posteriorly running costae (Figs. 15, 16, 23) (MEX, Jalisco)........................*A. jaliscoensis*
34(28) Carapace deeper than long, rounded apically........................35
— Carapace shallow, not deeper than long, not rounded apically........................38
35(34) Scutum mostly black........................36
— Scutum mostly orange or yellow........................37
36(35) Tergite II coarsely rugocostate, second submarginal cell elongate, 3RSa longer than 2RS, yellow palps (ON, QC)........................n. sp. 12
— Tergite II coarsely rugocostate, second submarginal cell short, trapezoidal, 3RSa less than or equal to 2RS, black palps (NC)........................n. sp. 59
37(35) Metasomal tergites II and III coarsely rugose-areolate, metasoma black, sometimes with yellow highlight (NM, TX)........................*A. carlsbadensis*
— Metasomal tergites II and III rugocostate, if areolae present, elongate, metasoma black (CA, WY)........................n. sp. 37
38(34) Carapace flat when viewed from side, scutum black, metasoma black washed with orange (Fig. 24) (NS)........................*A. halifaxensis*
— Carapace shallow, rounded when viewed from side (Figs. 5, 6, 29)........................39
39(38) Scutum black, coarsely rugocostate tergite II, coarsely rugose-areolate tergite III (MD)........................n. sp. 26
— Scutum bicolored black and yellow, or completely yellow........................40
40(39) Scutum bicolored, head often with extensive black, postocciput with black, tergite II coarsely rugocostate (CA)........................n. sp. 52
— Scutum yellow-orange, tergite II rugocostate-areolate (CA)........................n. sp. 34
41(27) Diameter of lateral ocellus greater than or equal to ocell-ocular distance, basal tergite yellow-orange, sometimes brown basally or washed with black, or with irregular dark mottling, never with solid, symmetrical black coloration........................42
— If diameter of lateral ocellus greater than or equal to ocell-ocular distance, then basal tergite with solid black symmetrical coloration; if smaller than ocell-ocular distance; basal tergite with or without solid symmetrical black coloration........................49
42(41) Metasomal tergites I and II yellow-orange or mostly yellow-orange, tergites III and IV black........................43
— Either metasomal tergites III and IV not both black, or tergite II also black........................44
43(42) Diameter of lateral ocellus less than or equal to ocell-ocular distance, metasomal tergite II heavily rugose, orange, tergites I and II orange, washed with black (OR).n. sp. 49 male
— Tergite II with finely rugose-areolate sculpturing, lateral ocellar diameter greater than or equal to 2.5 of ocell-ocular distance, soma completely or almost completely yellow-orange except for black metasomal tergites III and IV, yellow fore- and mid-femora (CA, TX)........................n. sp. 29
44(42) Metasomal tergite II tightly rugulocostate, no prominent longitudinal costae, diameter of lateral ocellus greater than ocell-ocular space, tergite IV almost always brown or black,

sometimes tergite I and/or tergite III also with brown or black, asymmetrical black mottling almost never present; if present, faint (MEX: Chihuahua; TX)..........n sp. 7

— Asymmetrical black mottling or black bordering present on one or more tergites, or diameter of lateral ocellus less than or equal to ocell-ocular space..........45

45(44) Diameter of lateral ocellus about equal to ocell-ocular diameter, metasomal tergite II with widely spaced longitudinal costae (VA)..........n. sp. 3

— Tergite II rugocostate..........46

46(45) Diameter of lateral ocellus greater than or equal to ocell-ocular diameter, metasomal tergite II rugocostate, tergites II, III, and IV almost completely black (TX)..........n. sp. 10

— Tergite II mostly yellow-orange..........47

47(46) Diameter of lateral ocellus greater then ocell-ocular diameter, metasomal tergite II rugocostate, black band along each side of metasomal tergites I to III joining a postero-lateral black band on tergite III (TX)..........n. sp. 17

— Metasomal tergites without lateral borders; otherwise mottled with black..........48

48(47) Metasomal tergite II sculpturing finely rugulose-areolate, to rugulocostulate, costae shallow, dense; metasomal coloration entirely yellow, yellow with irregular black mottling, or a combination of the above with black tergite IV (TX)..........n. sp. 11

— Metasomal tergite II sculpturing broadly rugocostate to rugo-areolate, some costae deep, widely separated (TX)..........n. sp. 48

49(41) Ocelli large or medium: diameter of lateral ocellus greater than or equal to ocelli-ocular distance..........50

— Ocelli small: diameter of lateral ocellus less than ocell-ocular distance..........65

50(49) Fore-femora black (MEX, Durango)..........n. sp. 31

— Fore femora yellow, yellow-orange, or light brown..........51

51(50) Second metasomal tergite light yellow to white, lightest tergite of soma..........52

— Second metasomal tergite yellow-orange; one or more tergites with equally light coloration..........57

52(51) Diameter of median ocellus 3-4x ocell-ocular distance..........53

— Diameter of median ocellus 2x or less ocell-ocular distance..........55

53(52) Diameter of lateral ocelli about 4x ocell-ocular distance, metasomal tergite II rugocostate, longitudinal costae not coarser, thicker than other rugae and costae (TX)..........n. sp. 32

— Diameter of alter ocelli about 3x ocell-ocular distance..........54

54(53) Tergite II rugocostate with longitudinal costae deep, thick, coarse ridges, carapace deep, flange fully recurved apically (AZ, NM, TX)..........n. sp. 28

— Tergite II rugocostate, longitudinal carinae not deep, carapace shallow, flange not recurved apically (MD, MS, TN)..........n. sp. 24

55(52) Shallow carapace, longer than deep, not rounded apically, flange not recurved, mesoscutum black (MD)..........n. sp. 27

— Deep carapace, not longer than deep, at least somewhat rounded apically, mesoscutum yellow..........56

56(55) Metasomal tergite II rugose-areolate, mesopleuron foveolate anterior to nitid central disc (Figs. 3, 10, 26) (AR)..........*A. shawi*

— Metasomal tergite II rugocostate, mesopleuron rugocostate anterior to nitid central disc (TX)..........n. sp. 5 female

57(51) Metasomal tergite II rugose, few or no longitudinal costae..........58

— Tergite II rugocostate, longitudinal costae present..........59

58(57) Metasomal tergite II finely rugulose; body with contrasting yellow-orange and black coloration (AZ, CA, WY)..........some n. sp. 9

— Metasomal tergite II coarsely rugose, body with dark orange coloration (MEX, Sonora)..........n. sp. 44

59(57) Metasomal tergite IV shallow, depth less than length, and/or flange incompletely recurved..........60

— Tergite IV deep, depth greater than or equal to length, flange completely recurved..........2

60(59) Metasomal tergite II shallowly rugulocostulate (MD, MS, TN)..........n. sp. 24

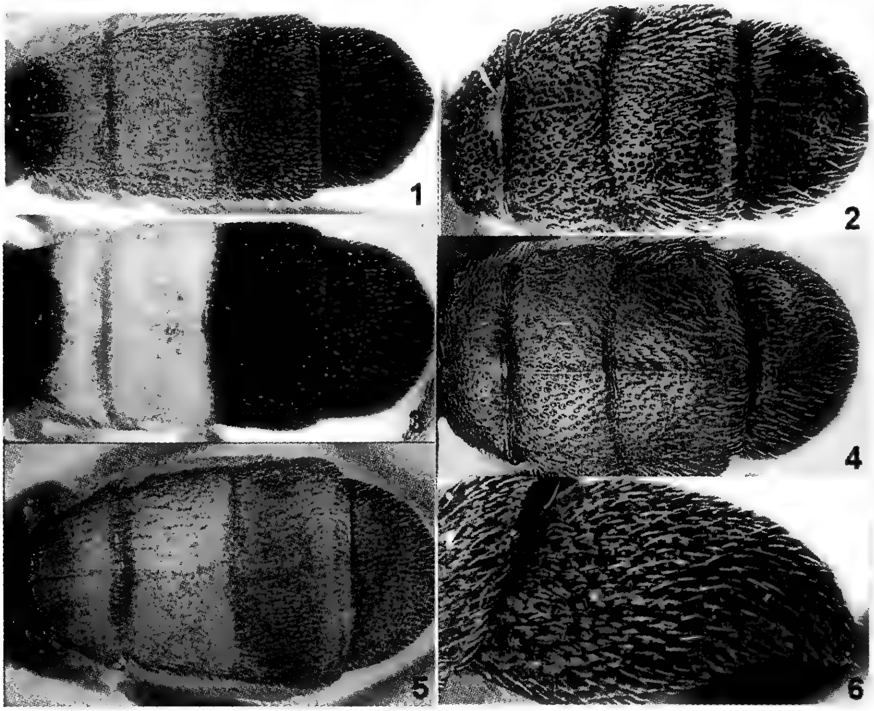
— Tergite II with deep, bold longitudinal costae 61
61(60) Carapace strongly concave apically; flange incompletely recurved (CA)............n. sp. 53
— Carapace flat, not concave apically (BC)..n. sp. 36
62(59) Metasomal tergite II delicately rugulo-costulate..63
— Metasomal tergite II with a few bold longitudinal costae 64
63(62) Diameter of lateral ocellus greater than ocell-ocular distance, metasomal tergite III not completely black, head yellow except black inter-ocellar area (TX) ....n. sp. 7
— Diameter of lateral ocellus about equal to ocell-ocular distance, head bicolored yellow-orange and black including on vertex and postocciput (AZ, CA, WY)...........some n. sp. 9
64(62) Diameter of lateral ocellus more than twice length of ocell-ocular diameter, tergite III completely black (TX)..n. sp. 30
— Diameter of lateral ocellus about equal to ocellar-ocular diameter (CA)................n. sp. 18
65(49) Metasomal tergite IV all or mostly yellow-orange 66
— Tergite IV all or mostly black 69
66(65) Metasomal tergite II heavily rugocostate with strong longitudinal carinae, carapace as deep as long, flange entirely recurved 67
— Tergite II rugulocostulate, or strong longitudinal carinae, or areolate; if rugulocostulate or with strong longitudinal carinae, then carapace longer than deep; if tergite II areolate, then carapace as deep as long and flange entirely recurved...68
67(66) Head yellow (ND, SD)..some n. sp. 8
— Head black (CA)...n. sp. 40
68(66) Metasomal tergite II rugulocostulate, rugose anteromedially, shallow, "northern pattern" scutum color pattern (Fig. 18), almost flat carapace (Figs. 19, 25) (QC) .....*A. provancheri*
— Metasomal tergite II with strongly developed longitudinal carinae, not rugose (ON) some ....n. sp. 42
69(65) Metasomal tergite II rugose; dark orange on tergites I and II (OR)......................n. sp. 49
— Tergite II rugocostate or areolate 70
70(69) Mesoscutum yellow or mostly yellow..71
— Mesoscutum black or mostly black, metasoma with "*anatariatus* color pattern" black except usually apical section of tergite I, and always all of tergite II yellow-orange (Fig. 1) 79
71(70) All legs black 72
— Some or all legs yellow or yellow-orange 73
72(71)Metasomal tergite II shallowly rugocostate, carapace as deep as long MEX, Durango) ....n. sp. 31
— Metasomal tergite II with a few bold, widely spaced longitudinal costae (CA) .....n. sp. 18
73(71) Metasomal tergite II rugocostate with finely developed longitudinal carinae that are neither with strongly developed nor deep (ON) ....n. sp. 23
— Tergite II either with longitudinal costae heavily defined and deep, or with heavily rugose or areolate sculpturing...74
74(73) Metasomal tergite II with areolate sculpturing (NM, OR, ID)........................*A. areolatus*
— Tergite II either with heavily defined longitudinal costae or with heavily rugose sculpturing 75
75(74) Metasomal tergite II with heavily defined, deep longitudinal costae 76
— Tergite II with heavily rugose sculpturing; sometimes with longitudinal costae well defined 77
76(75)Venter of mesopleuron black (ON)...n. sp. 42
— Venter of mesopleuron yellow (IL)...n. sp. 55
77(75) Black vertex, coxae, mesopleuron (BC)..n. sp. 45
— Yellow vertex, coxae, and mesopleuron 78
78(77) Carapace deep, not longer than deep, rounded posteriorly, flange entirely recurved (NC) ....n. sp. 25
— Carapace deep, flange not entirely recurved (CA)...n. sp. 51
79(70) Metasomal tergite II areolate or areolate with some longitudinal costae that do not reach

tergite apex (UT)..some *A. areolatus*
— Metasomal tergite II rugocostate..80
80(79) Metasomal tergite II sculpturing finely, narrowly rugocostate, costae shallowly developed (ALTA)...n. sp. 14
— Tergite II sculpturing coarsely, widely rugocostate, costae more deeply developed.........81
81(80) Procoxae black (AB)..n. sp. 41
— Procoxae yellow (Figs. 1, 6, 9, 18, 19, 20) (BC, YT)..................................*A. anatariatus*

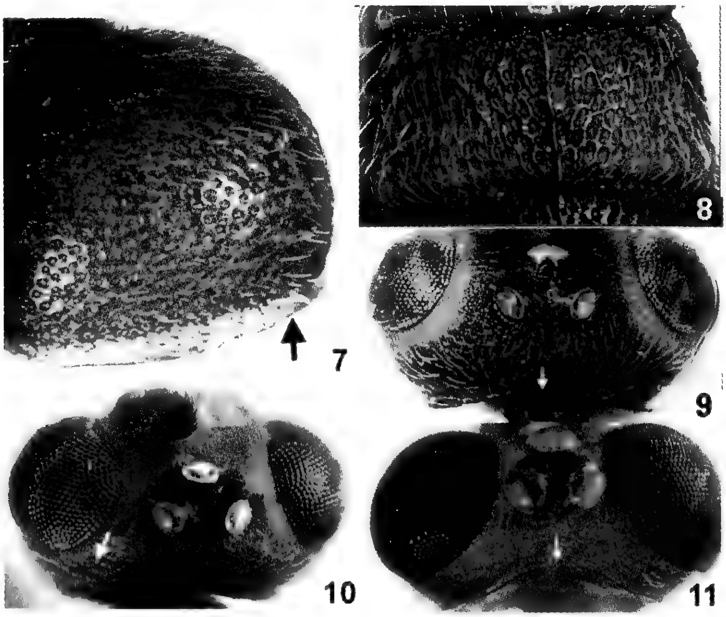
Aleiodes anatariatus NEW SPECIES

Figs. 1, 6, 9, 18, 19, 20

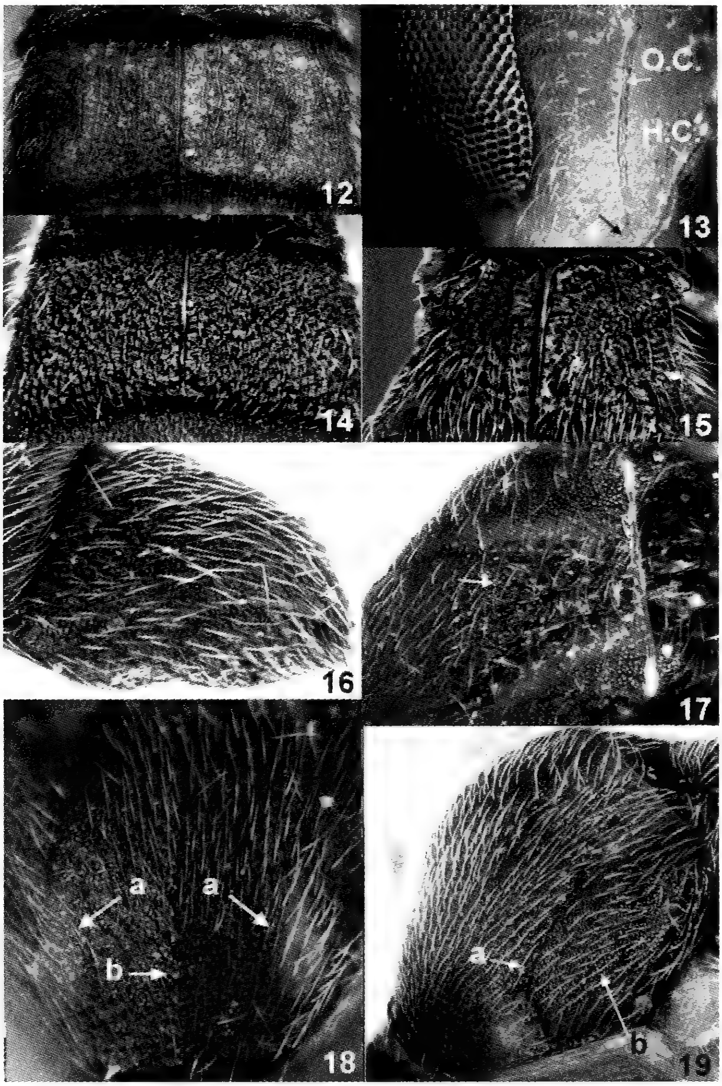
Female. Body color: face orange except mandibles black ventrally; black facial area above and lateral to clypeus; ventral margin of gena black; frons, vertex black except orange border around eye; occiput black to reddish brown; pronotum black anteriorly and posteroventrally, otherwise orange; propleuron black; scutum black except yellow-orange spots at anteromedial corners of notauli, thin areolate medial stripe extending to yellow-orange posteromedial area; scutellar disc yellow-orange in basal two-thirds, black apically; mesopleuron yellow-orange or bicolored with black, mesopleuron venter black; propodeum black; metapleuron yellow-orange or bicolored with black; basal half metasomal tergite I with black, semicircular area, apical half of metasomal tergite I yellow-orange; metasomal tergite II entirely yellow-orange; metasomal tergite III yellow-orange along base, otherwise black; metasomal tergite IV black; coxae, trochanters, trochantellae and tarsi of front legs black, femora and tibiae yellow, middle and hind legs entirely yellow except black tarsi; wings hyaline, stigma and veins brown except front wing (RS+M)b, veins surrounding second submarginal vein, 3RSb, 3M, and hind wing RS colorless. **Body length:** 5.0–5.3 mm; forewing length: 3.7-3.9 mm. **Head:** 44-45 flagellomeres, all slightly longer than wide; malar space long, 1.6-1.8 times basal width of mandible and 0.5 times eye height; temple wide, 0.8 eye width; occipital carina complete at vertex, reaching hypostomal carina; oral space small, circular, about equal to basal width of mandible; clypeus broad, flattened, medial height about equal to medial length of oral opening; ocelli small, ocellocular distance 1.3-1.4 diameter of lateral ocellus; face rugose medially, minutely areolate laterally; frons rugose dorsally with vertical carinae arising from near antennae over minutely areolate surface; vertex strongly rugocostate, temple minutely areolate. **Mesosoma:** anterior half of ventral edge of pronotum with scrobiculate flange, posteromedial area of pronotum nitid, bordered with a vertical carina on each side and bisected with an additional vertical carina, this scrobiculate pattern continuing laterally along sulci dividing ventrolateral and dorsolateral areas on each side, ventrolateral areas scabrous medially, becoming areolate-rugose laterally, dorsolateral area porcate, anteromedial area scabrous; mesoscutum minutely areolate except notauli scrobiculate, medial stripe areolate-rugulose, median posterior area rugose; scutellar disc areolate; mesopleuron coriaceous ventrally, areolate-rugose anteriorly, more finely areolate-rugulose postero-dorsally, mid-dorsal area nitid, subbalar sulcus roughly scrobiculate, sternaular area concave, minutely areolate; propodeum heavily sculptured, areolate-rugose, median carina complete; metapleuron areolate-rugulose. **Legs:** inner spur of hind tarsus about 0.25 length of hind basitarsus; hind coxae areolate-rugulose dorsally. **Wings:** front wing with vein r 0.6 length of 3Rsa and 0.85 to equal to length of m-cu, vein 1cu-a beyond 1M by distance less than length of 1cu-a, 1CUa 0.15 to 0.25 length of 1CUb; hind wing with marginal vein slightly recurved, marginal cell narrowest in middle, 1M about 1.7 length of r-m, M+CU about 1.3 length of 1M, vein m-cu present, pigmented or unpigmented, 0.5-0.8 length of r-m and adjoining it. **Metasoma:** first ter-



Figs. 1-6. Metasomal tergite variation in *Aleiodes pilosus* species-group. 1. *A. anatariatus.* 2. *A. dorsofoveolatus.* 3. *A. shawi.* 4. *A. oaxacensis.* 5. *A. quickei.* 6. *A. anatariatus.* Lateral view of tergite IV.



Figs. 7-11. *Aleiodes pilosus* species-group features. 7. *A. pilosus,* carapace. Arrow indicates recurved flange. 8. *A. areolatus,* metasomal tergite II. 9. *A. anatariatus,* vertex. Arrow indicates complete occipital carina. Also note small ocelli. 10. *A. shawi,* vertex. Arrow indicates rugocostate sculpturing. Also note ocelli with diameter about equal to ocell-ocular diameter. 11. *A. haematoxyloni,* vertex. Arrow indicates incomplete occipital carina. Also note large ocelli.



Figs. 12-19. *Aleiodes pilosus* species-group features. 12. *A. haematoxyloni,* metasomal tergite II. 13. Gena of *A. haematoxyloni.* O.C.: Occipital carina. H.C.: Hypostomal carina. Arrow indicates that carinae do not meet. 14. *A. cartwrightensis,* metasomal tergite II. 15. *A. jaliscoensis,* metasomal tergite I. 16. *A. jaliscoensis,* lateral view of carapace. 17. *A. anatariatus,* scutum, lateral view. Arrow indicates rugose median posterior area. 18. *A. anatariatus,* scutum, anterodorsal view. Arrows 'a' indicate 'northern color pattern' found in most Canadian species. Arrow 'b' indicates median rugose stripe. 19. *A. provancheri,* scutum, lateral view. Arrow 'a' indicates scrobiculate notaulus. Arrow 'b' indicates minutely areolate sculpturing.

gite areolate-rugulose basomedially in black area, rugocostate laterally and apically in orange area, median carina complete; second tergite rugocostate, several prominent costae running the length of the tergite, median carina originating basally from a small triangular raised area and complete apically; third tergite rugocostate in basal 2/3, areolate-rugose in apical 1/3, median carina complete; fourth tergite entirely areolate-rugose, shallowly carapace-like, completely covering remaining tergites, ventral flange complete, weakly recurved laterally, scrobiculate sculpturing discontinuous with tergite sculpturing laterally, continuous apically; ovipositor about 0.4 length of hind basitarsus. Body and legs extensively covered with pubescence of white setae.

Male. Unknown.

Material Examined. Holotype female. British Columbia, Milepost 54 Atlin road, emerged 30/IV/1959. Paratype females. Yukon Territory, Alaska Highway Milepost 926, emerged 30-IV-1959; British Columbia, Frazier Canyon, 12-III-1951; British Columbia, T.V.S., 2/II/1950; British Columbia, Lillooet, 8-IX-1948; Yukon Territory, Whitehorse (McRae), 30/IV/1959; British Columbia, Hope, 12-VII 1955; British Columbia, Okeover, 19/V/1952. Paratype male. British Columbia, Coombs, 11/III/ 1952.

Distribution. Known from type localities in southern Yukon Territory and British Columbia, Canada.

Host Association. All known hosts are geometrids. Holotype female was reared from *Itame anataria* (Swett). Paratype females reared from *Semiothisa hebetata* (Hulst) and *S. granitata* (Guenee). The Lillooet specimen was reared from an unknown geometrid host taken from *Pseudotsuga menziezii.*

Comments. A relatively large species, with more antennomeres than most *A. pilosus*-group species. The coarsely rugocostate sculpturing with prominent, widely spaced costae on metasomal tergite II distinguish this species from other similar species that also have the combination of extensive black on head and thorax, and yellow-orange tergite II such as undescribed new species 14, 41, and 79.

Etymology. Name refers to host species consumed by the holotype specimen.

Aleiodes cartwrightensis NEW SPECIES

Figs. 14, 21

Female. Body color: head, thorax, and abdomen almost completely black except narrow orange border around eye extending from dorsolateral corner of eye, medially and down along medial edge, then around ventral edge to dorsolateral corner, thus not extending along lateral edge of eye; labrum orange, maxillary palps light brown, labial palps black; base of scape orange laterally, annelli yellow-orange; second and third metasomal tergites with orange highlights under strong light; ventral flange of fourth metasomal tergite yellow-orange; coxae, trochanters all black; trochantelli, femora, tibiae, and tarsi all yellow-orange except apical tarsomeres all black; wings slightly smoky brown, wing veins brown except forewing veins r-m and (RS+M)b not pigmented, and hind wing RS and posterior half of cu-a not pigmented. Body and legs extensively covered with pubescence of white setae. **Body length:** 4.6 mm; forewing length: 3.7 mm. **Head:** 39 flagellomeres, all slightly longer than wide; malar space long, 1.7 mandibular basal width and 0.7 eye height; temple wide, 0.9 eye width; occipital carina incomplete at vertex, reaching hypostomal carina; oral space small, circular, horizontal diameter slightly larger than mandibular basal width, medial height of clypeus 0.6 of medial height of oral opening; ocelli small, ocellocular distance about twice diameter of lateral ocellus; face, clypeus coarsely rugulose; frons minutely areolate; vertex with a crease between lateral ocelli, a carina extending from medial edge of occipital carina forward about halfway toward midpoint between posterior edges of lateral ocellae, otherwise vertex rugulose; temples coriaceous near eyes becoming rugulose posteriorly; genae minutely areolate dorsally, rugulose ventrally. **Mesosoma:** scrobiculate flange running along ventral edge of pronotum along anterior half, mid-medial area of pronotum minutely areolate-rugulose, posteromedial area scrobiculate, scrobiculate pattern continuing laterally along a sulcus on each side dividing ventro-lateral and dorso-lateral areas, ventro-lateral areas rugulose becoming sequentially minutely areolate, then costate laterally; dorsolateral areas costate; scutum areolate-rugulose over a more minutely areolate surface except scrobiculate notauli and more coarsely ruglose postero-medial area; scutellar disc rugulose over minutely areolate surface; mesopleuron rugulose except posterior half of subalar sulcus carinate becoming nitid posteriorly; propodeum areolate-rugulose, postero-lateral humps blunt; metapleuron areolate-rugose ventrally, with faint rugulae over a minutely areolate surface dorsally. **Legs:** inner apical spurs of hind tibiae about 0.4 length of hind basitarsi; hind coxae areolate-rugulose dorsally. **Wings:** forewing with vein r 0.6 length of 3Rsa and about 0.8 length of m-cu, vein 1cu-a beyond 1M by distance about equal to length of 1cu-a, 1CUa about 0.2 length of 1CUb; hind wing with marginal vein not tubular and slightly recurved, marginal cell narrowest in middle, 1M about 1.7 length of r-m, M+CU about 1.7 length of 1M, vein m-cu present and pigmented, about 0.7 length of r-m and adjoining it. **Metasoma:** first tergite heavily areolate-rugose, median carina complete; second tergite rugulocostate, median carina originating basally from a small triangular raised area and complete apically; fourth tergite finely areolate-rugulose, shallowly carapace-like, completely covering remaining tergites, ventral flange broad with irregular scrobiculation, discontinuous with sculpturing of tergite, strongly recurved anteriorly, weakly apically; ovipositor sheaths completely covered by fourth tergite, ovipositor about 0.9 of length of hind basitarsus.

Male. Unknown.

Material Examined. *Holotype female.* LABRADOR, Cartwright, 25/VII/1955, E. F. Cashman. Deposited in CNC.

Host Information. Unknown.

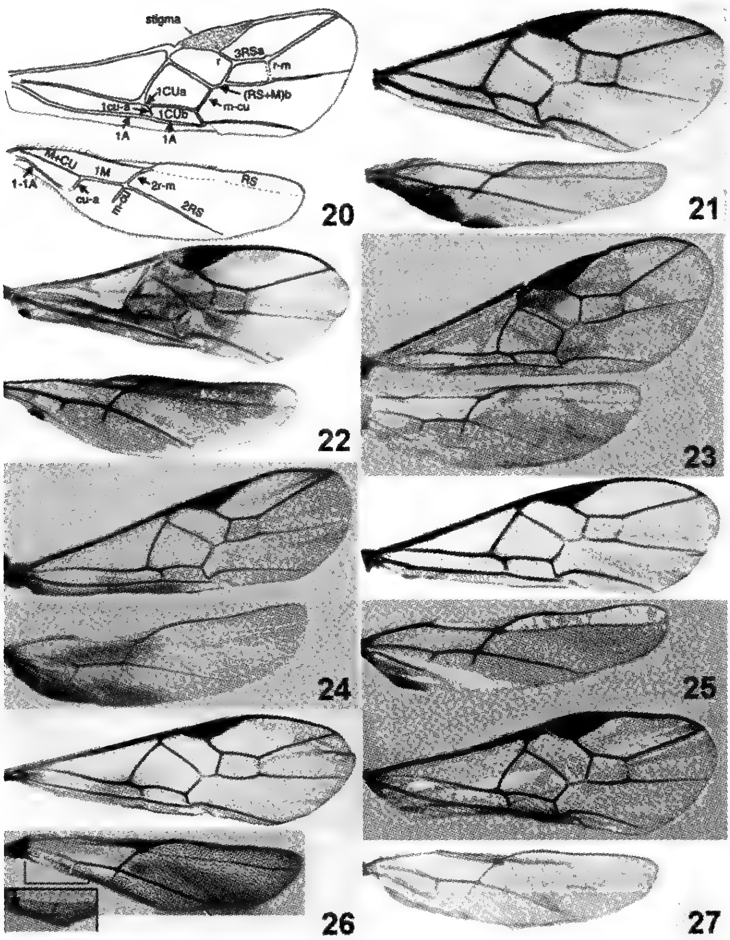
Comments. The entire black body with yellow-orange legs, is also characteristic of *A. arcticus* and *A. itamevorus.* Heavily areolate-rugulose sculpturing on first metasomal tergite is also characteristic of *A. itamevorus.* Both of those species are in the sister-group cluster to the *A. pilosus*-group (Fortier and Shaw 1999).

Etymology. The specific name refers to the type locality.

Aleiodes haematoxyloni NEW SPECIES

Figs. 11, 12, 13, 22

Female. Body color: Body yellow-orange except black ocellar triangle; brown antennal pedicel and flagellomeres; pronotum, propodeum, and metasomal tergites I – III yellow; legs yellow except apical halves of hind tibiae brown and hind tarsi brown; wings hyaline; stigma light brown in basal quarter, otherwise dark brown, forewing C+SC+R, M+CU, 1A yellow basally becoming brown apically, other apical veins brown except (RS+M)b and r-m clear; hind wing veins yellow to light brown except slightly darker R1. **Body length:** 4.4 mm, forewing length 3.9 mm. **Head:** 41 flagellomeres, all longer than wide, large eyes, temple width 0.3 eye width, malar space 0.7 mandibular basal width and 0.2 eye height, occipital carina incomplete at vertex, not reaching hypostomal carina; oral space small, circular, width about 0.8 basal width of mandible; clypeus broad, flattened, protruding slightly from face, height about equal to height of oral opening; ocelli large, almost touching eyes, ocellocular distance about 0.2 ocellar diameter; facial ridge present, running about halfway down face, face minutely areolate with dorsal punctation; frons minutely areolate; vertex minutely areolate, punctate posteriorad, faint median carina running from midpoint between lateral ocelli to open area of occipital carina; temples with sparse punctation over minutely areolate surface. **Mesosoma:** pronotum shelflike, rugulose anteriorly with scrobiculate ventral flange upturned anteriorly becoming smooth anterolaterally, pronotum finely rugulose ventrolaterally; and areolate-rugulose dorsolaterally, dorsolateral and ventrolateral areas



Figs. 20-27. Wings of *A. pilosus*-group. 20. *A. anatariatus.* Veins referred to in this study are labeled. 21. *A. cartwrightensis.* 22. *A. haematoxyloni.* 23. *A. jaliscoensis.* 24. *A. halifaxensis.* 25. *A. provancheri.* 26. *A. shawi.* 27. *A. quickei.*

separated by scrobiculate lateral sulcus on each side; scutum, scutellum minutely areolate, scrobiculation in notaular grooves faint, notauli extending posteriorly, lateral to rugulose dorso-posterior area, terminating just anterior to pre-scutellar carina; scutellar disc finely areolate-rugulose; mesopleuron smooth-punctate anteriorly and posteriorly to central disc, central disc nitid posteriorly, sternaular area slightly concave, shallowly rugulose centrally, shallowly costate posteriorly; propodeum rugulose, median carina complete; metapleuron finely areolate. **Legs:** inner spurs of hind tarsi 0.3 of length of hind basitarsus, hind coxae minutely areolate dorsally. **Wings:** forewings with vein r 0.6 length of 3Rsa and 0.9 length of m-cu, vein 1cu-a beyond 1M by distance equal to 1cu-a, 1CUa about 0.3 length of 1Cub; hind wing with marginal vein slightly recurved, marginal cell narrowest in middle, 1M about 1.4 length of r-m, M+CU about 1.5 length of 1M, vein m-cu present, pigmented, about 0.5 length of r-m, immediately posterior to r-m, joining it. **Metasoma:** first tergite rugulocostulate, median carina complete, terminating on raised posteromedial area at short carina along posteromedial edge of tergite; second tergite rugulocostulate, median carina originating from a small basal raised triangular area, complete apically; third tergite rugulocostulate, median carina incomplete, terminating just basad of apical flange; fourth tergite finely areolate-rugulose, shallowly carapace-like, but completely covering remaining tergites, ventral flange well demarcated, scrobiculate, colorless laterally becoming yellow apically; ovipositor about 0.6 length of hind basitarsus. Body and legs extensively covered with pubescence of white setae.

Male. Unknown.

Material Examined. Holotype female: MEXICO: Oaxaca, 2km W. Guellaguichi, July 13, 1990, P. G. daSilva and T. Eager, deposited in TAMU collection. Paratype female: MEXICO: Oaxaca, 5 mi. W. Tequisistlan, 1100 ft., 23/VIII/1973, A. Newton coll., blacklight.

Distribution. Known only from type locality in Oaxaca, Mexico.

Host Information. Reared from geometrid host (D. Adamski, personal communication) associated with *Haematoxylon brasiletto* Karsten (Fabaceae, Brazil wood).

Comments. A nearly all yellow wasp with large ocelli and fine sculpturing, similar to *Aleiodes quickei* Fortier. Can be distinguished by occipital carina not complete at vertex, ocellar triangle black, abdomen narrower, antennal pedicel dark (yellow in *A. quickei*), forewing stigma mostly dark brown (mostly yellow in *A. quickei*), and hind tibiae dark apically (yellow in *A. quickei*).

Etymology. Named after the genus of a rare, economically valuable tree species utilized by host.

Aleiodes halifaxensis NEW SPECIES

Fig. 24

Female. Body color: face yellow-orange except faint brown spot immediately above clypeus, tips of mandibles reddish brown, frons brown medially, yellow-orange laterally, interocellar area black, vertex yellow-orange except broad brown stripe running from between posterior margins of lateral ocelli to occipital carina, temples brown, genae yellow-orange, occiput yellow-orange dorsally, brown laterally, and yellow-orange ventrally such that color pattern is continuous with that of vertex, temples, and genae; pronotum yellow-orange, propleura brown, scutum black except yellow-orange spot at anteromedial corners of notauli; scutellar disc black, propodeum black, mesopleura, mesosterna black; metapleura black; metasomal dorsum brown except yellow-tan basomedial area; coxae, trochanters, trochantelli, femora of all legs yellow-orange, tibiae of forelegs yellow-orange, tibiae of middle and hind legs brown, tarsi of all legs brown; wings hyaline, all veins yellow basally becoming darker brown apically except forewing veins (RS+M)b and r-m colorless, hind wing RS not tubular and colorless, posterior portion of cu-a colorless. **Body length:** 4 mm; forewing length: 3.2 mm. **Head:** 40 flagellomeres, all slightly longer than wide; malar space long, length 2 times basal width of mandible and about 0.4 eye height; temple broad, about 0.6 eye width; occipital carina effaced medially at vertex, meeting hypostomal carina; oral space small, horizontal width 0.8 basal width of mandible; clypeus broad, flattened, medial height about 1.3 medial height of oral opening; ocelli small, ocellocular distance about 1.3 diameter of lateral ocellus; a thick, well-defined ridge descending from midpoint between anterior of bases of antennae a short distance down middle of face; face minutely areolate; frons minutely areolate except circular nitid area below median ocellus and 3 short, faint carinae radiating from median ocellus laterally of nitid area; vertex minutely areolate, faint laterally running carinae; temples minutely areolate. **Mesosoma:** anterior half of ventral edge of pronotum with scrobiculate flange, pronotum minutely areolate anteromedially and ventrolaterally, scrobiculate posteromedially continuing laterally along sulci for a short distance, unsculptured lateral portions of sulci dividing ventrolateral and dorsolateral areas on each side, dorsolateral areas smooth with 3 or 4 shallow carinae; scutum minutely areolate except notauli scrobiculate, medial areolate-rugulose stripe absent, median posterior area obliterated by pin; scutellar disc minutely areolate; mesopleuron coriaceous except posterior half of central disc nitid, subalar sulcus shallowly rugulose becoming scrobiculate anteriorly, mesopleuron weakly, finely costulate ventral to sulcus, sternaular area weakly concave; propodeum areolate-rugose, median carina complete; metapleuron rugulose. **Legs:** inner spurs of hind tibiae about 0.4 length of hind basitarsus; hind coxae minutely areolate dorsally. **Wings:** front wing with vein r about 0.6 length of 3Rsa and about 0.8 length of m-cu, vein 1cu-a beyond 1M by distance of 1.5 length of 1cu-a, 1CUa about 0.3 length of 1Cub; hind wing with marginal vein not tubular, slightly recurved, marginal cell narrowest in middle, 1M about 2 times length of r-m, vein m-cu present, unpigmented, about 0.8 length of r-m and immediately posterior to it, adjoining it. **Metasoma:** first tergite areolate-rugose, median carina complete; second tergite rugocostate in basal 3/4, areolate-rugose in apical 1/4, median carina originating basally from a small triangular raised area and complete apically; third tergite entirely finely areolate-rugulose, median carina neither complete to basal nor apical tergite margin; fourth tergite with sculpturing similar to third tergite, completely covering remaining tergites, shallowly carapace-like, ventral flange broad, sculpturing fainter, shallower than rest of tergite, no recurvation; ovipositor about 0.6 of length of hind basitarsus. Body and legs extensively covered with pubescence of white setae.

Male. Unknown.

Material Examined. Holotype female: CANADA: NOVA SCOTIA, Halifax, emerged 16-III-1949. Deposited in CNC.

Distribution. Known only from the type locality in Nova Scotia.

Host Information. Reared from *Semiothisa granitata* Guenee (Geometridae).

Comments. Unique head coloration with color pattern of yellow-orange vertex, brown temples, and yellow-orange genae continuing posteriorly onto occiput. Yellow spots at anteromedial margins of notauli are found in nearly all Canadian Tetrasphaeropyx species examined.

Etymology. Named after the type locality of Halifax, Nova Scotia.

Aleiodes jaliscoensis NEW SPECIES

Figs. 15, 16, 23

Female. Body color: head orange; mandibles orange with black tips, other mouthparts orange except galeae black, ocellar triangle black; scapes orange basally, otherwise black, pedicels black, annelli orange, flagella black; mesosoma orange except metanotum and metapleuron with black and propodeum entirely black; metasoma black; front coxae, trochanters orange; femora, tibiae, and tarsi darker orange brown dorsally, orange ventrally; middle coxae orange, trochanters orange basally, brown apically; trochantelli, femora, tibiae, tarsi brown; hind coxae, trochanters, trochantelli orange and brown; femora black; tibiae black except orange basally; tarsi black except basitarsomeres orange basally; wings hyaline, veins light yellow basally becoming dark brown except fore wing r-m, and (RS+M)b unpigmented, stigma dark brown, hind wing veins light yellow basally becoming dark brown except posterior 1/2 of cu-a, m-cu, RS, and 1M apicad of r-m unpigmented. Body and legs extensively covered with pubescence of white setae. **Body length:** 4.7 mm. Forewing length 4.2 mm. **Head:** malar space moderate, equal to basal width of mandible and about 0.3 eye height; temple width about 0.5 eye width; oral opening nearly circular, small, horizontal diameter 1.4 mandibular basal width, medial height of clypeus about equal to medial height of oral space; occipital carina incomplete medially, meeting hypostomal carina ventrally; 42 flagellomeres, all slightly longer than wide, first of equal length to second, scape laterally flattened; ocelli large, ocellocular space 0.6 diameter of lateral ocellus; face minutely areolate, median facial ridge originating at midpoint between anterior edges of antennae, wide, running about halfway down face; frons minutely areolate, shiny; vertex rugulose anteriorly, carinae running laterally across vertex, shiny-foveolate posteriorly; temples with one or two transverse carinae anteriorly, foveolate posteriorly; occiput smooth, faintly coriaceous and shining. **Mesosoma:** pronotum minutely areolate anteromedially, scrobiculate sculpturing in lateral sulci discontinuous medially, sulci dividinig lateral areas of pronotum into dorsolateral and ventrolateral sections, ventrolateral section minutely areolate, dorsolateral section shallowly areolate-rugulose, ventral flange upturned medially, scrobiculate; scutum finely areolate-rugulose except rugulocostulate posterior medial area, notauli unsculptured terminating in posterior medial area, median carina arising at top of anterior declivity of scutum and running into posteromedial area; scutellar disc minutely areolate; mesopleuron costate anterior of nitid central disc, carinae running dorso-ventrally, rugulose posterior to central disc area, sternaular area concave, finely coriaceous-nitid; propodeum areolate-rugose in basal half, rugocostate apically, median carina prominent, straight in basal half, becoming wavy, weak apically; metapleuron rugose. **Legs:** inner spur of hind tibia about 0.3 length of hind basitarsus, hind coxae finely areolate-rugulose dorsally. **Wings:** hyaline, second submarginal cell elongate, r 0.5 length of 3RSa, 0.8 length of m-cu, 1cu-a beyond 1M by a distance slightly greater than length of 1cu-a, 1CUa 0.3 length of 1CUb; hind wing RS slightly recurved, marginal cell narrowed medially, 1M 1.6 length of r-m, M+CU 1.4 length of 1M, m-cu unpigmented, 0.7 length of r-m. **Metasoma:** first tergite areolate-costate, costae prominent compared with shallower areolation except at posterolateral corners, where costae shallower, median carina complete, intersecting with raised area of short lateral carina at apicomedial edge of tergite; second tergite areolate-costate, costae more prominent, straighter than those of first tergite, median carina continuous with that of third tergite; third tergite rugulocostate, costae less prominent, more irregular than those of second tergite, median carina weakly complete apicad; fourth tergite finely areolate-rugulose, shallowly carapace-like, completely covering tergites apical to it, ventral flange scrobiculate, orange, wider, better defined laterally than apically; ovipositor length 0.6 length of hind basitarsus.

Male. Differs from female in having black mesosomal venters.

Material Examined. Holotype female: MEXICO, Jalisco, 16 km N. Autlan, July 12-14, 1983, at black light, Kovarik, Harrison, Schaffner. Deposited in NMNH. Paratypes: 2 Males. MEXICO, Durango: 23 mi. S. 6000' July 3, 1964, W.R.M. Mason. Deposited in the NMNH. MEXICO, Durango: 6 mi. E. VII/14/1964. W.R.M. Mason. Deposited in NMNH.

Distribution. Known only from the type locality at Jalisco, Mexico.

Host Information. Unknown.

Comments. Distinguished by usually vivid yellow-orange head and mesosoma contrasting with black metasoma combined with moderately large ocelli, occipital carina incomplete medially, propodeal sculpturing areolate in basal half becoming costate apically with median carina obfuscated apically, and coarsely areolate-costate metasomal tergites.

Etymology: Named for the type locality of the holotype.

Aleiodes provancheri NEW SPECIES

Figs. 19, 25

Female. Body color: face yellow-orange except large black area extending from top of inter-antennal groove along the groove, broadening into large medial patch, running down to and laterally along sides of yellow-orange clypeus; frons black, vertex black except near eyes, temples, genae yellow-orange, antennae black except yellow-orange annelli; pronotum dark anteriorly becoming yellow-orange posterolaterally; propleuron black; scutum black except yellow-orange patches medial to bases of notauli, dark yellow-orange apicomedially; scutellum black; mesopleuron black except anterodorsal corner yellow-orange; mesopleural venter black; propodeum, metapleuron black; first metasomal tergite black except narrow yellow-orange lateral bands, yellow-orange median apical flange; second metasomal tergite with dark brown patch covering most of tergite, yellow-orange laterally and apically; third metasomal tergite yellow-orange along basal edge, otherwise brown on basal third, yellow-orange in apical two-thirds, fourth metasomal tergite yellow-orange; legs yellow-orange except fore coxae black, tarsi with brown; stigma brown, forewings with brown veins except clear (RS+M)b, r-m, and 2RS veins; hind wings brown except cu-a clear posteriorly. **Body length:** 4.4 mm; forewing length: 3.4 mm. **Head:** 40 flagellomeres, all slightly longer than wide; malar space long, length 1.8 times basal width of mandible and about 0.8 length eye height; temple broad, about 0.9 eye width; occipital carina effaced medially at vertex, not meeting hypostomal carina; oral space small, horizontal width slightly smaller than basal width of mandible and about 0.4 eye height; clypeus broad, medial height about 0.8 median height of oral space; ocelli small, ocellocular distance about 1.7 ocellar diameter; face rugulose, median cleft below antennae, facial carina below antennae absent; frons minutely areolate; vertex rugulose; temple rugulose posteriorly, minutely areolate anteriorly. **Mesosoma:** anterior half of ventral edge of pronotum with a scrobiculate flange, pronotum rugose anteromedially, median dorsal area nitid and scrobiculate, scrobiculation narrowing and continuing laterally in sulci on each side of pronotum, each scrobiculate sulcus dividing each side of pronotum into ventrolateral and dorsolateral areas, finely areolate ventrolaterally, costate dorsolaterally; scutum, scutellum weakly, finely rugulose over minutely areolate surface, notauli scrobiculate basally becoming rugulose apically, terminating apically in rugose posteromedial area; mesopleuron with rugocostate subalar sulcus, rugose anteriorly, rugulose in middle, minutely areolate anteroventrally, ventrally, and posteriorly, nitid central disc, sternaular area weakly concave; metapleuron areolate; propodeum heavily areolate-rugose, median carina forked basally, complete. **Legs:** inner spur of hind tibiae about 0.4 of length of hind basitarsi; hind coxae minutely areolate dorsally. **Wings:** forewing with r about 0.6 length of 3Rsa and about 0.7 length of m-cu, vein 1cu-a beyond 1M by about the same length as 1cu-a, length of 1CUa about 0.3 length of 1CUb; hind wing vein RS present as a fold, slightly recurved, marginal cell narrowest at midpoint, vein 1r-m about 0.7 length of 1M, vein 1M about 0.7 length of vein M+CU, vein m-cu distinct, pigmented, directly posterior to r-m. **Metasoma:** first tergite rugose, median carina complete, terminating apically at the end of a raised apical-medial flange of the first tergite; second tergite entirely rugose, median carina complete, weakly continuous with median carina of third tergite; third tergite rugulose, median carina terminating apically in basal 3/5 of length of tergite; fourth tergite finely areolate-rugose, shallowly carapace-like, covering remaining tergites, although barely covering fifth tergite, ventral flange scrobiculate; ovipositor about 0.6 length of hind basitarsus.

Male. Unknown.

Material Examined. *Holotype female:* QUEBEC, Mount Albert, near Ste. Anne des Monts, Gaspe Peninsula, 303 miles NE of Quebec, July 12, 1954, W. J. Brown. Deposited in CNC.

Distribution. Known only from type locality in Quebec.

Host Information. Unknown.

Comments. Characterized by the metasomal color pattern, short flagellomeres, and nearly square second submarginal cell of the forewing.

Etymology. Named after Leon Provancher, eminent 19th century Quebecois naturalist and entomologist, founder of *Le Naturaliste,* the first French natural history periodical published in North America, and founder of Provancher's collection of insects, held in the Quebec Provincial Museum.

Aleiodes quickei NEW SPECIES

Figs. 5, 27

Female. Body color: Body nearly uniformly yellow-orange, pronotum and 1st and 2nd metasomal tergites paler yellow; antennal flagellomeres dark brown, scape and pedicel yellow; mouthparts yellow; interocellar triangle dark orange, inner borders of ocelli black; legs yellow except for dark orange hind tarsi; wings hyaline, stigma mostly yellow except wide brown border along marginal cell; forewing veins except costal vein pale yellow basally becoming brown apically except forewing vein (RS+M)b and r-m unpigmented; hind wing veins pale except r-m, R brown, R1 dark apically. Body and legs extensively covered with pubescence of white setae.

Body length: 4.6 mm, wing length 3.8 mm. **Head:** malar space 0.9 of basal width of mandible and about 0.3 length of eye; temple narrow, about 0.4 eye width; oral opening nearly circular, small, horizontal diameter 0.8 length of malar space; clypeus broad, medial height 1.2 medial height of oral space; occipital carina complete medially, meeting hypostomal carina ventrally; face, minutely areolate except punctate in dorsomedial area, medial ridge extending about halfway down face including expanded bulbous terminus of ridge; frons minutely areolate; vertex rugulocostate, costae running transversely; 40 flagellomeres, all slightly longer than wide; ocelli large, ocellocular space 0.3 diameter of lateral ocellus; occiput nitid. **Mesosoma:** pronotum widely colliculate anteromedially, small elevations corresponding to setal bases, scrobiculate sculpturing in lateral sulci discontinuous medially, sulci dividing lateral areas of pronotum into dorsolateral and ventrolateral sections, ventrolateral section rugulocostulate, dorsolateral section rugulose-areolate, ventral scrobiculate flange upturned medially; scutum finely areolate-rugulose over minutely areolate surface, median longitudinal stripe of transversely scrobiculate sculpturing, notauli scrobiculate becoming confluent with rugulose posterior region apically; scutellum minutely areolate; mesopleuron costate antero-dorsally, central disc minutely areolate anteriorly, nitid posteriorly, sternaular area concave, coriaceous, bare of pubescence; metapleuron minutely areolate; propodeum with few rugae over minutely areolate surface basally, rugulose apically, postero-lateral protuberances well defined, median carina complete. **Legs:** inner spur of hind tibia 0.3 length of hind basitarsus, hind coxae rugulose-costulate dorsally. **Wings:** hyaline, second submarginal cell trapezoidal, not elongate, r 0.6 length of 3RSa, 0.9 length of m-cu, 1cu-a beyond 1M by a distance of 0.8 length of 1cu-a, 1CUa 0.2 length of 1CUb; hindwing RS slightly recurved, marginal cell narrowed medially, 1M 1.7 length of r-m, M+CU 1.6 length of 1M, m-cu unpigmented, 0.8 length of r-m. **Metasoma:** tergites I-III rugulocostulate, median carinae complete, median carina of 1st tergite terminating at its intersection with short lateral carina at apex of tergite, third tergite with costulation more dense than two basad tergites; fourth tergite finely areolate-rugulose, moderately deeply carapace-like, wider at mid-depth than lateral constriction in recurved ventral flange, ventral flange well defined, recurved, entirely scrobiculate; ovipositor 0.8 length of hind basitarsus. *Male.* Essentially as in female.

Material Examined. *Holotype female:* TEXAS: Hildago County, Bentson-Rio Grande State Park, May 8, 1991, T. Carlow and E. Riley at UV light. Deposited in NMNH. Paratypes: 10 Females. TEXAS: Kenedy Co. Kenedy Ranch, April 21, 2001, Wharton. 1 Female. TEXAS: Dimmit Co., Chaparral Wildlife Mgt. Area, 30/IX/ 1989, at light, J. C. Schaffner. Deposited in NMNH. 1 Female. TEXAS: Kenedy Co., Kenedy Ranch, Jaboncillos Pasture, dune area, 21/IV/2001, 27°01'10"N, 97°43'20"W. 1 Female. TEXAS: Hidalgo Co. Bentsen-Rio Grande Valley St. Pk. 21/IV/1984, L. G. & T. P. Friedlander. 1 Female. NEW MEXICO: Eddy Co. 32°19.7'N, 103°46.9' W (Site 7), 15-16/VII/1979, at light, Delorme, McHugh, Schaffner. 1 Male. TEXAS: Bee Co. Beeville, 11/VI/1953. University of Kansas Mexico Expedition. 1 male, TEXAS: Kenedy Co., Kenedy Ranch, April 21, 2001, Wharton at light. 1 Male, TEXAS: Kenedy Co., Kenedy Ranch, Jabocillos Pasture, dune area, April 21, 2001, 27°01'10"N, 97° 43'20"W. All material except holotype and 10 paratype females deposited in TAMU.

Distribution. Besides the type locality in Hidalgo Co., Texas, also known from Texas counties Kenedy, Dimmit, and Bee, and Eddy Co., New Mexico.

Host Information. Unknown.

Comment. A nearly all-yellow wasp with large ocelli and fine sculpturing, similar to *Aleiodes haematoxyli* Fortier except for darker yellow coloration, the fourth abdominal tergite being more deeply carapace-like, and the metasomal sternites being nearly white.

Etymology. Named after Donald L. J. Quicke, Fellow in Hymenoptera studies and author of *Parasitic Wasps* 1997.

Aleiodes shawi NEW SPECIES

Figs. 3, 10, 26

Female. Body color: Head yellow-orange except ventral extremities of genae; mandibles, clypeus, labrum, and palps pale yellow; interocellar triangle black; scapes yellow-orange basally, black apically, pedicels black, anelli light brown, flagellae black; pronotum yellow-orange, propleuron yellow-orange; scutum yellow-orange except black spot on each postero-lateral "shoulder" and black horizontal mark at anteromedial extremity of scutum; scutellar disc yellow except apical extremity black; mesopleuron mostly yellow-orange except black along dorsal portion of anterior carina posterior to subalar sulcus, black along dorsal edge above central disc, running into posterior half of central disc and area posterior to it, mesopleural venter mostly black with central yellow orange spots, contiguous pale white spots apicomedially; metanotum apical of scutellum black; metapleuron black; propodeum black; black semicircular area in basomedial area of first metasomal tergite, otherwise tergite pale yellow-white; second metasomal tergite pale yellow-white; third and fourth metasomal tergites black; front coxae, trochanters and trochantellae pale yellow-white, femora, tibiae, and basal 3 segments of tarsi yellow, fourth segment darker yellow, apical segment dark brown, mid coxae yellow, mid trochanters, trochantelli, tibiae pale yellow-white, femora yellow, tarsi brown, hind coxae yellow, hind trochanters pale yellow-white, hind femora mostly yellow except black apically, hind tibiae pale whitish-tan, hind basitarsomeres dark brown medially, pale basally and apically, second to fourth tarsomeres mostly dark brown except pale apically, apical tarsomere dark brown; wings hyaline, forewing veins pale yellow at base of wing, otherwise dark brown, stigma blackish brown, vein r-m colorless medially, (RS+M)b colorless; hind wing RS colorless, veins basal of cu-a colorless, then gradually becoming darker, veins including and apical to r-m dark, m-cu faintly pigmented. Body and legs extensively covered with pubescence of white setae.

Body length: 4.3 mm; forewing length: 3.6 mm. **Head:** 42 flagellomeres, all slightly longer than wide; malar space medium, about equal to basal width of mandible and 0.6 times the eye height; temple medium, about 0.6 eye width; occipital carina incomplete at vertex, reaching hypostomal carina; oral space small, circular, horizontal diameter about equal to mandibular basal width; medial height of clypeus 0.8 medial height of oral opening; ocelli medium ocellocular space only slightly larger than diameter of lateral ocellus; face with faint shallow carinae over a minutely areolate surface, narrow carina extending from point midway between anterior edges of antennal bases down 3/4 of length of face; frons with faint, shallow carinae over minutely areolate surface; vertex rugocostate, with costae running laterally, crease between lateral ocelli; temples minutely areolate, punctate adjacent to occipital carina. **Mesosoma:** scrobiculate flange running along anterior half of ventral edge of pronotum, midmedial area of pronotum areolate-rugulose, posteromedial area of pronotum areolate-rugulose, extreme posterior area scrobiculate, scrobiculate pattern continuing laterally along shallow sulcus on each side of pronotum, scrobiculate pattern becoming faint laterally, sulci becoming nitid, dividing ventrolateral and dorsolateral areas of pronotum, mid-dorsolateral areas extending dorsally toward tegulae smooth-punctate, posterior dorsolateral area scrobiculate, ventrolateral area shiny, smoothly, faintly rugulose; scutum faintly areolate-rugulose over a minutely areolate surface except notauli scrobiculate, faintly defined median ridge extending from anterior edge of scutum to top of anterior declivity, continuing posteriorly as a crease to postero-medial rugose area into which notauli terminate; scutellar disc areolate-rugulose; metanotum areolate basally, smooth-costate apically; mesopleuron rugulose anteriorly becoming smooth-punctate dorsally anterior to and on anterior portion of central disc, otherwise central disc nitid, area posterior to central disc punctate, sternaular area concave, shining with faint vertically running costae; propodeum areolate-rugulose; metapleuron areolate-rugulose. **Legs:** length of inner spurs of hind tibiae about 0.3 of hind basitarsi; hind coxae faintly areolate-rugulose dorsally. **Wings:** front wing with vein r 0.5 length of 3Rsa and about 0.7 length of m-cu, vein 1cu-a beyond 1M by distance about equal to length of 1cu-a, 1CUa about 0.2 length of 1CUb; hind wing marginal vein not tubular and slightly recurved, marginal cell narrowest in middle, 1M about 1.5 length of r-m, M+CU about 1.3 length of 1M, vein m-cu present, faintly pigmented, about 0.6 length of r-m and immediately posterior to it, adjoining it. **Metasoma:** first tergite areolate-rugose, areolae small and divided by thick, rounded carinae, sculpturing similar to propodeum but areolae smaller, median carina complete, terminating apically on medial upwardly buckled carina running along apical edge of tergite; second tergite areolate-rugose, areolae larger than those on first tergite, median carina complete, arising from a small raised triangular area at base of tergite and terminating apically in a raised carina that runs laterally along apical edge of carina for short distance; third tergite areolate-rugose, carinae finer than first two tergites, tergite without any superior medial carina; fourth tergite sculpturing closely similar to third, deeply carapace-like, completely covering remaining tergites, ventral flange broad, scrobiculate, well defined, recurved except at apical tip; ovipositor sheaths about 0.5 length of hind basitarsus.

Male. Unknown.

Material Examined. *Holotype female:* ARKANSAS: Washington Co., Mt. Sequoyah, 600 m, 1-10/VIII/1994, J. B. Whitfield, coll. Deposited in NMNH.

Distribution. Known only from the type locality in Arkansas.

Host Information. Reared from geometrid host feeding on *Cercis* sp. (Fabaceae, Redbud)

Comments. The pale yellow-white coloration on metasomal tergites I and II, foreleg coxae, and trochanters and trochantellae of all legs distinguish this species, except for some *A.* new species 24 females *A.* new species 24 also occurs in Arkansas. *A. shawi* may be distinguished from this species by its deeper carapace and narrow carapace flange, in contrast to the flatter carapace and wide carapace flange of *A.* new species 24.

Etymology. Named after Scott Shaw, curator of the Rocky Mountain Systematic Entomology Laboratory in Laramie, Wyoming, and Professor of Entomology at the University of Wyoming. Dr. Shaw supervised my dissertation research, and has offered invaluable help and advice with respect to the present research.

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SPECIES DIVERSITY OF BUTTERFLIES IN TURKISH *PINUS BRUTIA* FOREST ECOSYSTEMS AFTER FIRE[1]

Burçin Yenisey Kaynaş[2] and Behzat Gürkan[2]

ABSTRACT: This study aimed to determine changes in the species diversity of butterflies after fire in *Pinus brutia* forests. At four study sites representing different successional stages, butterflies were sampled by line transect method using sweep nets and by visual observation. In total, 18 species and 114 individuals were found at all sites. Although the species richness and species diversity of butterflies were higher in middle successional stages, abundance decreased with successional age. The changes in butterfly abundance, species richness and diversity with successional age resulted mostly from structural differences in the vegetation.

KEYWORDS: East Mediterranean, habitat change, plant architecture, succession, fire-affected habitats

Fire has been one of the most crucial ecological factors in Mediterranean-type ecosystems for thousand of years. Fire causes the removal of litter, vegetation and canopy according to its intensity in a very short time. Mediterranean vegetation is resilient to fire and the reestablishment of pre-fire communities is very rapid (Trabaud, 1994). *Pinus brutia* Ten., 1811 forests, one of the most common ecosystems in the East Mediterranean basin, are destroyed by wildfires frequently. These forests have morphological and physiological adaptations for regeneration after fire. *Pinus brutia* is well equipped with two significant traits adaptive to fire, namely on-plant seed storage and fire-stimulated seed dispersal, and in-soil seed storage and fire-stimulated germination (Neyişçi, 1993).

Although the recovery of vegetation after fire has been studied intensively in Mediterranean-type ecosystems (i.e. Naveh, 1967; Thanos et al., 1989; Ne'eman et al., 1992; Pausas, 1999; Tavşanoğlu and Gürkan, 2005), changes in insect communities after fire have received little attention in the Mediterranean basin (Prodon et al., 1987; Broza et al., 1993). Insects respond more rapidly to disturbances than vertebrates and therefore have potential as early indicators of environmental change (Kremen, 1992; Kremen et al., 1993). Changes in the structure and composition of vegetation cause parallel changes in the community structure of insects. Because each plant species may represent one or more resources for herbivores, herbivore insect diversity in particular is driven by changes in vegetation (Murdoch et al., 1972; Cates, 1980; Lawton, 1983; Siemann et al., 1999).

Butterflies are considered the most suitable insect for indirect measures of environmental variation because of their high sensitivity to local weather, climate, light levels and other parameters affected by habitat change (Erhardt, 1985; Weiss et al., 1987; Hill et al., 1995; Blair and Launer, 1997; Wood and Gilman, 1998). Dramatic habitat changes caused by fire and post-fire vegetation devel-

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opment affect the species diversity of butterflies intensively. Butterflies can serve as a valuable barometer of overall community complexity. Because they are used by numerous arthropods and vertebrates as food resources, they can potentially suggest much more about the complexity of the community than can vegetative structure and herbaceous plants alone (Huntzinger, 2003).

This study aimed to determine the changes in species diversity in the butterfly community during successional stages after fire.

METHODS

Study area

The study was conducted within the Marmaris National Park (N 36° 50', E 28° 17'), which is located on the Mediterranean coast of southwestern Turkey. The area has a typical Mediterranean climate with hot and dry summers and mild winters, and is mostly covered by *P. brutia* forests. It covers approximately 34,000 ha and, like many other Mediterranean ecosystems, many parts of it have been burnt in different years. In the National Park *P. brutia* forests are predominant; the other major vegetation types are maquis and *Liquidambar orientalis* forests.

There are two main approaches to the study of succession: static (synchronic) and dynamic (diachronic). The static approach involves the determination of trends from data collected at one point in time. The dynamic approach is based on repeated observations at the same site over time (Austin, 1977). We used the synchronic method to determine changes in succession after fire. The study was conducted at four sites (three representing different stages of succession at post-fire sites and one representing unburnt forest): I. Burnt 1 year before (N 36° 50' 11", E 28° 18' 10"), II. Burnt 5 years ago before (N 36° 51' 16", E 28° 17' 14"), III. Burnt 21 years before (N 36° 49' 37", E 28° 19' 34"), and IV. The control plot (not burnt for at least 45 years) (N 36° 50' 47", E 28° 17' 24'). These sites are located on the same geological material (ophiolitic rock) and have the same soil type (non-calcic brown forest soil). All sites are below 100 m altitude. At all sites, after burning, branches and cones were spread over on the ground to constitute suitable conditions for seedling establishment.

Vegetation

Tavşanoğlu (2002) described dominant plant species for all sites according to percentages of cover. *Quercus infectoria* Olivier, 1801 and *Phyllarea latifolia* L., 1753 are the dominant at all sites. Excluding these two species, *Cistus salvifolius* L., 1753 and *C. creticus* L., 1762 are dominant one year after fire, *P. brutia, C. salvifolius,* and *Smilax* aspera L., 1753 five years after fire, *P. brutia, C. salvifolius,* and *C. creticus* 21 years after fire, and *P. brutia* and *S. aspera* at the control site.

Although opportunistic species appearing after fire increased total plant species richness, the species richness of all sites remains similar (Table 1).

Table 1. Dominant plant species, total species richness of plants (TSRP), and mean height of vegetation (MHV±SE cm) for the 4 study sites. Different superscript letters on mean vegetation height values point out significant differences between study sites (Kruskal-Wallis, P<0.001).

	Time since fire (years)			
Sites	**1**	**5**	**21**	**≥45**
DPS	*Quercus infectoria* *Phillyrea latifolia* *Cistus salvifolius* *Cistus creticus*	*Quercus infectoria* *Phillyrea latifolia* *Cistus salvifolius* *Similax aspera* *Pinus brutia*	*Quercus infectoria* *Phillyrea latifolia* *Cistus salvifolius* *Cistus creticus* *Pinus brutia*	*Quercus infectoria* *Phillyrea latifolia* *Similax aspera* *Pinus brutia*
TSRP[t]	41	36	32	34
MHV	96,0±6,1a	128,5±3,6b	184,4±4,4c	-

[t] Data was taken from Tavşanoğlu et al., 2002.

Mean vegetation height was used to assess vegetation complexity. Mean vegetation height may indicate enhanced biomass and the architectural complexity of plants (Kruess and Tscharntke, 2002). It was lowest at the site burnt a year before and increased with successional age. At the control site, vegetation height was not measured. Since the trees were generally above 10 m in height, a mean vegetation height of 10 m was used in the statistical estimations (Kaynaş and Gürkan, 2004) (Table 1).

Sampling

We used the sweep net method, following a line transect to collect butterflies. At each site sweeps were taken while walking along 100 m in 3 sampling line transects in a 100 x 50 m area (0.5 ha). During the sweep net sampling, visually observed species were also recorded. Sampling was conducted at the same time of day and by the same person. Individuals caught were placed in envelopes and taken to the Ecology Laboratory in the Biology Department of Hacettepe University for identification. Sampling was done monthly from August 2000 to September 2001.

Data Analysis

Total abundance, species richness and the Brillouin diversity index (Krebs, 1999) were used to compare the butterfly community between different successional stages. Morishita's index of similarity (Krebs, 1999) was used to examine whether butterfly community composition at the sites varied with successional age.

RESULTS

In total 18 species and 114 individuals were collected from all sites. Although butterfly species richness was higher in the middle successional stages, the total abundance of the sites decreased with successional age (Fig. 2). Species diversity of butterflies displayed a trend similar to that of species richness. It was highest at the site burnt 21 years before and lowest at the site unburnt for at least 45 years (Fig. 2). The similarity index was highest between sites burnt 1 and 5 years before (Cλ= 0.982). The sites burnt 21 years before and the site unburnt for at least 45 years had the second highest similarity index (Cλ= 0.711). Similarity index values among the other sites were lower and close to each other when compared to the above sites (time since fire 1-21: 0.312; 1-45<: 0.540; 5-21: 0.311).

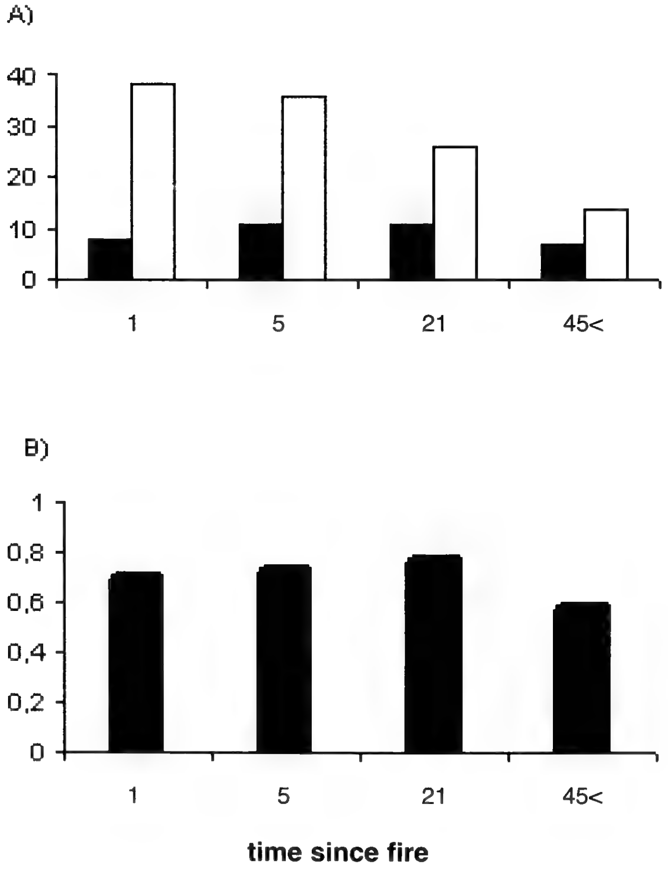

Figure 2. A) Species richness (solid bar) and abundance (open bar) of butterflies, B) Brillouin diversity values of butterflies in successional ages.

With regard to the species observed, *Vanessa atalanta* and *Colias crocea* were the most common at all sites. Their abundances were close to each other among the sites. At the site burnt a year before the most abundant species were *Pieris rapae* and *Pontia edusa,* and at the site burnt 5 years before *Pontia edusa* was dominant. *Callimorpha quadripunctaria* and *Lasiommata megera,* which were similar in terms of abundance, were the most abundant species at the site burnt 21 years before. *Colias crocea* was the most abundant at the site unburnt for at least 45 years. Abundances of butterfly species sampled in this study are listed in Table 2.

Table 2. Abundances of butterfly species sampled in this study.

	Time since fire (years)			
Species	**1**	**5**	**21**	**≥45**
Callimorpha quadripunctaria (Poda, 1761)	-	-	6	2
Azuritis reducta (Higgins, 1932)	-	-	-	1
Vanessa atalanta (Linnaeus, 1758)	1	2	3	1
Eynnis tages (Linnaeus, 1758)	-	1	-	-
Gegenes nostradamus (Fabricius, 1793)	-	-	1	-
Polyommatus icarus (Rottemburg, 1775)	6	3	-	1
Lymantria dispar (Linnaeus, 1758)	-	-	2	-
Archon apollinus (Herbst, 1798)	-	-	2	-
Papilio machaon (Linnaeus, 1758)	-	1	1	-
Colias crocea (Geoffroy, 1785)	4	3	2	4
Pieris brassicae (Linnaeus, 1758)	2	1	-	-
Pieris rapae (Linnaeus, 1758)	8	3	-	2
Pontia edusa (Fabricius, 1777)	10	13	-	-
Eumenis syriaca (Staudinger, 1871)	-	-	1	-
Lasiommata megera (Linnaeus, 1767)	5	4	5	-
Maniola jurtina phormia (Fruhstorfer, 1909)	2	-	1	-
Neohipparchia fatua (Freyer, 1844)	-	4	1	3
Pararge aegeria tircis (Godart, 1821)	-	1	-	-

DISCUSSION

Because each species of butterfly requires specific host plants (Huntzinger, 2003), a diverse plant community may support a diverse community of butterflies. In most ecosystems, seral communities mostly consist of different plant species and each seral stage has a distinct species composition. However, in Mediterranean-type ecosystems, succession after fire is different from that in many other ecosystem types. There is no real succession in the sense of substitution of species or communities, but only progressive return towards a stage similar to that existing before fire (Trabaud et al., 1985). At sites representing different successional ages, plant species richness and species composition were similar among the sites despite the small difference in the site burnt a year before. Although the species richness of plants among sites is strikingly similar, the structural complexity of vegetation changes with successional age.

The abundance and species diversity values of butterflies displayed different trends with successional age after fire. While abundance decreased with succession, species richness and species diversity were higher in the middle successional stages. The decrease in abundance with successional age may be a result of butterflies' preference for open habitats, which do not vary in terms of resources and do not have a canopy. High sunlight requirements are common for most butterflies (Huntzinger, 2003). Certain butterflies must maintain a body temperature between 30 and 40°C in order to sustain their flight and feeding activity (Schmitz, 1994). Higher sunlight at open sites burnt a year before and 5 years before could explain the dominancy at these sites of butterflies with a white dorsal surface, like *Pontia edusa and Pieris rapae.*

With the removal of the canopy due to fire, obligate seeders like *Cistus* species recolonize densely in the first year after fire. Except *P. brutia,* all the obligate seeder species in these sites are entomophyllous and they need insects for pollination. The higher abundance of butterflies whose adults feed with nectars feeders could be the result of dense recolonization by pollen-rich *Cistus* species (Ne'eman and Dafni, 1999) in early succession stages.

Plant communities constitute a promising variable for the description of habitat quality for butterflies. Vegetation is the main physical interface between butterflies and their environment (Sawchick et al., 2003). With successional age, an increase in vertical layers with vegetation height provides a more heterogeneous environment for butterflies, allowing them to avoid adverse abiotic conditions. The higher species richness and diversity in middle successional stages are a result of the characteristics of the vegetation. Since butterflies often have specific host and nectar plants and require certain structural elements for orientation or basking, they would be expected to show a much stronger response to the vegetation than to variables like nutrient richness or pH of soils (Oostermeijer and van Swaay, 1998). Although the composition of plant species contributing as food resources for herbivores does not vary greatly among successional ages, the spatial and architectural complexities of plant communities are different. Lawton (1983) stated that insect species diversity was maintained by the structural diversity of plants and a high correlation between number of insect species and the structural complexity of vegetation across successional stages could be shown.

Vegetation height may indicate the architectural complexity of plants and is the best predictor of both species richness and abundance of butterfly adults and lepidopteran larvae (Kruess and Tscharntke, 2002). Similarly, Waltz and Covington (2004) stated that nectar sources are not the main contributing factor to adult butterfly distributions, and butterflies are very fast to respond to habitat changes. At burnt and open sites that do not have a canopy, increasing plant structural complexity with increasing vegetational height may explain the higher values of butterfly species richness and diversity of middle successional stages. Shrubs, which are characterized for middle successional stages, have been shown to be an important structural resource component of a butterfly species' habitat (Dennis and Sparks, 2006; Dover et al., 1997).

The selection of habitats among butterflies is almost certainly caused by a wide range of factors, which may vary between species and between regions. Woodland cover may be a critical factor governing the habitat selection of many species (Warren, 1985) and correlate with the flower-feeding specialism of butterflies (Tudor et al., 2004). In the present study, *Vanessa atalanta* and *Colias crocea* were generalist species that occurred at all successional sites. *Vanessa atalanta* is a common species that demonstrates high tolerance to environmental variables (Oostermeijer and van Swaay, 1998). The open habitat species *Lasiommata megera* and *Maniola jurtina,* known to be generalist (Tudor et al., 2004) and to feed on grasses (Pollard et al., 1998), were found at successional sites without a canopy layer. *Polyammatus icarus,* which was found at early successional sites and in unburnt forest, is stated to be a generalist species and the best process indicator because it shows a clear response to changes in soil nutrient status, acidity or moisture (Oostermeijer and van Swaay, 1998). Warren (1985) stated that, despite *Pieris rapae* preferring solely open habitats, *Pieris brassicae* was most abundant in quite shady rides where food-plants were absent and nectar sources were less abundant. In the present study, no difference was found between these two species in terms of habitat selection.

Prescribed burns that maintain the structure of shrubland habitat will often increase the quantity of specific resources required by Lepidoptera, i.e. larval host plants and adult nectar sources (New, 1997 cited in Wagner et al., 2003). Considering the habitat requirements of butterfly species, *P. brutia* ecosystems in southwestern Turkey consist of a mosaic including habitats burnt at different times. These post-fire sites had different habitat attributes affecting butterfly species diversity positively.

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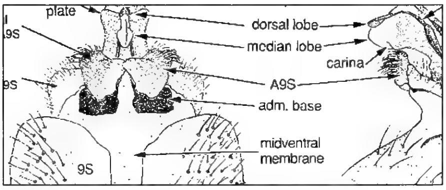

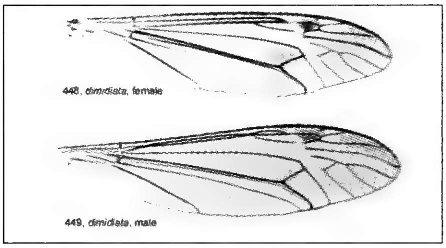

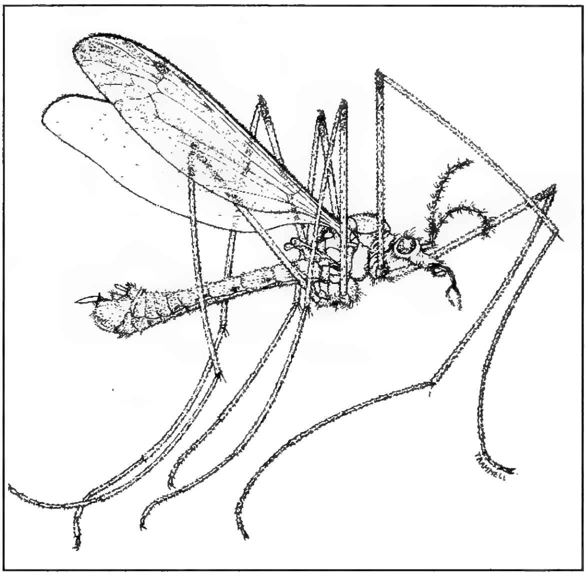

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USE OF SOLDIER PRONOTAL WIDTH AND MITOCHONDRIAL DNA SEQUENCING TO DISTINGUISH THE SUBTERRANEAN TERMITES, *RETICULITERMES FLAVIPES* (KOLLAR) AND *R. VIRGINICUS* (BANKS) (ISOPTERA: RHINOTERMITIDAE), ON THE DELMARVA PENINSULA: DELAWARE, MARYLAND, AND VIRGINIA, U.S.A.[1]

Susan Whitney King,[2] James W. Austin, [2] and Allen L. Szalanski[3]

ABSTRACT: Termite alates and accompanying soldiers were collected during a 5-year period from diverse habitats on the Delmarva Peninsula, including inland hardwood sites (Newark, Delaware, U.S.A.; Galena, Maryland, U.S.A.), and a pine scrub beach (Lewes, Delaware, U.S.A.). Alates from 34 colonies were identified to species based on taxonomic keys. Pronotal width was measured for 1,447 accompanying soldiers from 33 of the colonies and compared to similar studies in Florida, U.S.A. Mitochondrial DNA 16S sequencing was conducted on soldiers from 31 of the colonies. *Reticulitermes flavipes* and *R. virginicus* were identified from pine scrub, whereas only *R. flavipes* was collected from the hardwood sites. DNA sequences showed three lineages of *R. virginicus,* two of which matched that from specimens previously reported to be a new species (*R. malletei nomen nudum*). Soldier pronotal width ranges at the 95% confidence level were: *R. flavipes*, 0.84-1.04 mm; *R. virginicus,* 0.63-0.83 mm. Statistical analyses indicated that species identification could be based on a sample of 5 soldiers with a confidence level of >95%. The observed pronotal width range for *R. virginicus* overlapped with that reported for *R. hageni* Banks in Florida, U.S.A.

KEY WORDS: Identification, taxonomy, sample size, subterranean termites, Isoptera, Rhinotermitidae, soldier, pronotal width, mitochondrial DNA, *Reticuliternes flavipes, R. virginicus,* Delmarva Peninsula, Delaware, Maryland, Virginia, U.S.A.

It is difficult to distinguish species of *Reticulitermes* in a study site when alates are not present. Worker termites have no morphological characteristics that can be used to separate species. Soldiers' pronotal measurements have been used to distinguish species; however, there is overlap between *R. flavipes* and *R. virginicus* (Hostettler et al., 1995). This study was initiated to (1) determine how many subterranean termite species are present in Lewes, Delaware, and inland sites on the Delmarva Peninsula and (2) genetically and morphometrically characterize soldiers of each species.

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Mailed on April 27, 2007

METHODS

Six study sites were established during 1995 on a 15-acre pine scrub beach at Cape Henlopen on the Delaware Bay in Lewes, Delaware, U.S.A. Soils in each site were sand. Three inland hardwood study sites, approximately one acre each, also were established: one on the University of Delaware (UD) farm in Newark, Delaware, in 1994 and two on a private farm near Galena, Maryland, U.S.A. in 1997. Soils in the hardwood sites were silt loam (Newark) and clay loam (Galena). From 1997 through 2001, subterranean termite alates and soldiers were collected from the nine sites.

Monitoring stakes (*Picea* sp., 2.0 cm x 3.5 cm x 45 cm) were vertically driven into the ground to a depth of approximately 30 cm at each site. Stakes were placed randomly around vegetation at approximately one meter intervals. Approximately 100 stakes were used at each inland site and approximately 1,500 stakes were used in Lewes. Stakes were examined weekly from March of each year through November for signs of termite infestation.

Stakes that became termite-infested were subsequently driven deeper into the ground leaving 3-4 cm exposed. A one-gallon plastic bucket (19.0 cm x 17.5 cm diameter) with the bottom cut off was placed around each infested stake and sunk 10 cm into the soil. Soil was then removed from the bucket, a pine block "sandwich" was placed inside on the ground next to the exposed stake, and the bucket was capped. Each sandwich was constructed of six Southern Yellow Pine, *Pinus taeda* L., boards (9.0 cm x 2.0 cm x 12.5 cm). Two boards served as "bookends" that held the other four boards in the center perpendicular to the bookends. Six dowels (3.0 mm diameter x 11.0 cm) were placed between the inner four boards and the sandwich was nailed together. The dowels created crevices between the boards within which workers constructed their tunnels.

Buckets were monitored weekly for termite activity from March through November each year from 1997 through 2001. When alates were observed, they were collected and the wood block sandwich was dismantled and examined for soldiers. Alates and soldiers were collected and preserved in 80% ethanol.

Previous mark-release-recapture studies (King, unpublished data) showed that marked worker termites moved less than one meter in Lewes and less than 30 meters at inland sites. Buckets that yielded alates for this study were more than one meter from each other in Lewes and those in inland sites were more than 30 meters from each other; thus, each bucket with alates was designated a separate colony.

Termites were examined at 62.5x using a dissecting microscope equipped with an ocular micrometer. Species identification on alates from 34 colonies was made using taxonomic keys (Scheffrahn and Su 1994). The distance of the ocellus from the compound eye was determined for alates. Furthermore, alate body color was compared with *R. hageni* alates collected on 4/28/2001 from Cumberland Island, Georgia, U.S.A. Pronotal width was measured on 1,447 soldiers. The mean pronotal width for *R. flavipes* in both pine scrub and hardwood was calculated as was the mean pronotal width for *R. virginicus*. Confidence intervals (95, 99, and 99.9%) for these means and their margins of error were calculated. The sample size needed to separate these species was determined. Voucher specimens were deposited in the University of Delaware Insect Reference Collection in Newark, Delaware, U.S.A.

Alcohol-preserved soldiers from each of 31 colonies were sent to the University of Arkansas for species identification using mtDNA 16S sequences (Szalanski et al., 2003). Specimens were dried on filter paper, and DNA was extracted according to Liu and Beckenbach (1992) and Jenkins et al. (1999) on individual whole termites with the Puregene DNA isolation kit D-5000A (Gentra, Minneapolis, Minnesota, U.S.A.). Extracted DNA was resuspended in 50 ml of Tris: EDTA and stored at –20°C. Polymerase chain reaction was conducted using the primers LR-J-13007 (5'-TTACGCTGTTATCCCTAA-3') (Kambhampati and Smith 1995) and LR-N-13398 (5'-CGCCTGTTTATCAAAAACAT-3') (Simon et al. 1994). These PCR primers amplify an approximately 428 bp region of the mtDNA 16S rRNA gene. The PCR reactions were conducted with 1 µl of the extracted DNA (Szalanski et al., 2000), having a profile consisting of 35 cycles of 94°C for 45 s, 46°C for 45 s and 72°C for 60 s. Amplified DNA from individual termites was purified and concentrated with minicolumns (Wizard PCRpreps, Promega) according to the manufacturer's instructions. Samples were sent to The University of Arkansas Medical Center DNA Sequencing Facility (Little Rock, Arkansas, U.S.A.) for direct sequencing in both directions. GenBank accession numbers were DQ422137 and DQ422138 for the two new haplotypes corresponding to *R. malletei* found in this study. DNA sequences were aligned using CLUSTAL W (Thompson et al., 1994). Mitochondrial DNA haplotypes were aligned by MacClade v4 (Sinauer Associates, Sunderland, Massachusetts, U.S.A.).

Voucher specimens preserved in 100% ethanol were deposited at the Arthropod Museum, Department of Entomology, University of Arkansas, Fayetteville, Arkansas.

RESULTS AND DISCUSSION

Alates were collected from 26 colonies in Lewes (Table 1). These were morphologically identified as either *R. flavipes* (7 colonies) or *R. virginicus* (19 colonies) applying the taxonomic keys of Scheffrahn and Su (1994). Alates were collected from eight colonies in the hardwood sites. These were all identified as *R. flavipes*. Only *R. flavipes* and *R. virginicus* were present on the Delmarva Peninsula sites; *R. hageni* was not found.

Table 1. Pronotal width of *Reticulitermes* soldiers

Species[a]	Haplotype[b]	# of Colonies	Site	# of Soldiers	Observed Range	Pronotal Width (mm) mean ± SD
R. flavipes	Z	7	Pine scrub[c]	586	0.76 - 1.09	0.94 ± 0.05
R. flavipes	Z, KK, SS, TT	8	Hardwood[d]	267	0.80 - 1.09	0.94 ± 0.05
R. virginicus	RM1, RM2	18	Pine scrub[c]	594	0.62 - 0.91[e]	0.73 ± 0.04
R. virginicus	V6	1	Pine scrub[c]	72	0.73 - 0.87[f]	

[a] Determination based on taxonomic characteristics of accompanying alates.

[b] Determination based on DNA analysis. RM1, RM2 refers to cryptic species *R. malletei* shown genetically distinct (J. W. Austin, unpublished) and behaviorally and chemotaxonomically distinct (Clément et al. 1986).

[c] Six beach sites in Lewes, Delaware, U.S.A.

[d] Inland sites on the Delmarva Peninsula, including one site in Newark (Delaware), and two sites near Galena, Maryland.

[e] This range overlaps with that of Florida *R. virginicus* (0.71-0.87 mm and 0.70-0.84 mm) and that of Florida *R. hageni* (0.55-0.71 mm and 0.65-0.71 mm) (Hostettler et al., 1995).

[f] Haplotype V6 omitted from morphometric study.

Samples from 31 of the 34 colonies were subsequently subjected to DNA sequencing; three *R. flavipes* colonies were not included in the DNA analysis. Seven distinct haplotypes (lineages) were obtained: Z, KK, SS, TT, RM1, RM2, and V6 (Table 1). The most abundant haplotype was Z (*R. flavipes,* Genbank DQ001953) from nine samples. This is a common haplotype observed from the northeast United States (Austin et al., 2005). Three additional haplotypes of *R. flavipes* were obtained: KK (GenBank DQ001963), SS (GenBank DQ001971), and TT (GenBank DQ001972) (one sample each). Eighteen of the samples were identified as haplotypes RM1 (GenBank DQ422137) and RM2 (GenBank DQ422138). These lineages belong to a cryptic *Reticulitermes* species that has previously been reported to be a new species, *R. malletei* (Clément et al., 1986), but has not been described according to the International Code of Zoological Nomenclature (ICZN). The original description of *R. malletei* has been designated *nomen nudum* (Scheffrahn et al., 2001), but subsequent evaluation has determined that indeed it appears to bear all the necessary requirements as a discrete species (Austin, unpublished) and as such is being prepared for publication. One sample of *R. virginicus* was identified as haplotype V6 (GenBank AY257243). This haplotype is found in several other states (Austin et al., 2004a, b, c).

Pronotal width measurements for *R. flavipes* and *R. virginicus* soldiers are provided in Table 1 and Figure 1. Because only one colony of *R.virginicus* (haplotype V6) was recovered, this sample was not included in the morphometric analysis. For a sample size of five soldiers, the following margins of error were calculated for various confidence levels: 0.0403 (95%); 0.0530 (99%); 0.0677 (99.9%). The difference between the average pronotal widths for *R. flavipes* versus *R. virginicus* (haplotypes RM1, RM2) was 0.21; thus, a sample size of five should reliably separate these two species in Delaware.

Reported values for *R. virginicus* pronota (0.71-0.87 and 0.70-0.84mm) (Hostettler et al., 1995) appear to be supported by our measurements for this species too, with the pronota of 72 soldiers from the single colony (haplotype V6) in Lewes ranging 0.73-0.87mm in width. Pronotal width ranges at the 95% confidence level for *R. flavipes* were 0.84-1.04 mm. According to the taxonomic keys of Scheffrahn and Su (1994) and Hostettler et al. (1995), *R. flavipes* generally has a soldier pronotal width usually greater than 0.90 mm. Our morphological observations, supported with mtDNA sequence data, affirm these measurements. Both Scheffrahn and Su (1994) and Hostettler et al. (1995) describe measurements of *R. hageni* as generally ≤ 0.70 mm. At the 95% confidence level, the pronotal width range for *R. virginicus* (haplotypes RM1, RM2) soldiers in Lewes, Delaware (0.63-0.83 mm) overlaps with that of *R. hageni* in Florida (Hostettler et al., 1995). This could lead to termite misidentification if keys based on Florida specimens are used to identify termite soldiers from Delaware.

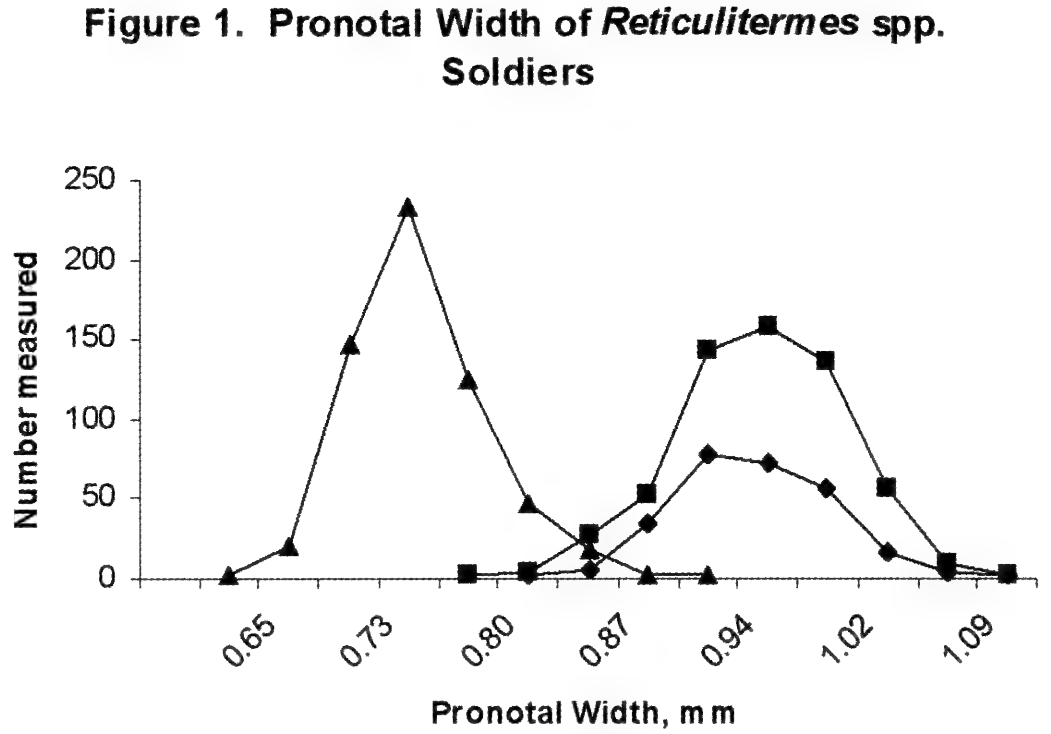

Figure 1. Pronotal width of *Reticulitermes* spp. soldiers. —◆— *R. flavipes,* Hardwood, Haplotypes Z, KK, SS, TT; —■— *R. flavipes,* Pine Scrub, Haplotype Z; —▲— *R. virginicus*, Pine scrub, Haplotypes RM1, RM2.

There are no published accounts of *R. hageni* in Delaware, which prompted a genetic inquiry for species confirmation. Evaluation of comparative sequence data and phylogenetic interpretation through Maximum Parsimony and Maximum Liklihood analyses (see Austin et al. 2005) suggest our samples identified as *R. virginicus* (haplotypes RM1, RM2) from morphological keys is likely incorrect and constitute a discrete species. This same observation has been recently discussed, where Vargo and Carlson (2006) determined that two residing populations of *R. hageni* constituted two distinct taxa, referring to one population as *R. hageni sensu stricto* and the other as *Reticulitermes* n. sp., since the two had not been formally split. We in like kind have resolved to describe these as a single species, *R. virginicus sensu stricto* until the completed description of *R. malletei* is available (Austin, unpublished) and because there are no known occurrences of *R. hageni* in Delaware. However, to clarify this important relationship, it should be understood that the specimens in Vargo and Carlson (2006) taken from Duke Forest, NC, share the same 16S rRNA haplotype (RM1) as found in Lewes, DE (Austin and Vargo, unpublished).

This research demonstrates the discrepancy between taxonomic keys which apply metrics from populations which may vary in size and shape due to the variable nature of the habitats which *Reticulitermes* occupy. Transitions in topography and environment can have significant influences on *Reticulitermes* phenology, distribution, and genetic composition. Recent studies demonstrate that underlying *Reticulitermes* phenology is a genetic component which influences both chemotaxonomy (Jenkins et al., 2000) and morphology (Heintschel et al., 2006), when evaluated with mtDNA sequence data. In essence, genes drive phenotypes, and reliance of morphology alone can be misleading when attempting species identification. From these results, there are likely 3 species of *Reticulitermes* which occupy the Delmarva Peninsula, and future investigations which clarify the abundance of these species should be considered.

ACKNOWLEDGMENTS

This research was supported, in part, by Dow AgroSciences. We thank Dr. Rudolf Scheffrahn, University of Florida, for providing samples of *R. hageni* soldiers and alates; Dr. John Pesek, Assistant Professor, Food & Resource Economics, University of Delaware, for statistical analysis of data; and Melody Euparadorn, University of Delaware, for laboratory and field assistance.

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A REVIEW OF THE PLANTHOPPER GENUS *NILAPARVATA* (HEMIPTERA: DELPHACIDAE) IN THE NEW WORLD[1]

Charles R. Bartlett[2]

ABSTRACT: The delphacid genus *Nilaparvata,* previously recorded in the New World only from Puerto Rico and Nicaragua, is here reported from a variety of localities from Wisconsin and New Hampshire in the United States, south to Bolivia and Paraguay. *Euides gerhardi* is here transferred to *Nilaparvata,* and a revised key and diagnoses for the four New World species are provided.

KEY WORDS: Planthoppers, Homoptera, Auchenorrhyncha, Fulgoromorpha, Fulgoroidea, *Euides*

The delphacid genus *Nilaparvata* Distant, 1906, consists of 18 species, with most occurring in the Oriental, Australian and Afrotropical regions (Claridge and Morgan 1987 list 16 species, omitting *N. serrata* Caldwell, plus *N. terracefrons* Guo and Liang was described by Guo et al., 2005). Three species have been previously recorded from the New World, with a fourth species here transferred to *Nilaparvata* (for a total of 19 species). *Nilaparvata* is an extremely important genus economically, with one of its members, *N. lugens* (Stål), a major pest of rice (*Oryza sativa* L., Poaceae, Oryzeae; e.g., Claridge and Wilson 1982, Hill 1983, Wilson and Claridge 1985, 1991; Suzuki 2004). Two other species, *N. bakeri* (Muir) and *N. muiri* China, are also found in rice (Wilson and Claridge 1991). The New World species, however, have not been reported from rice (Wilson and O'Brien 1987, Wilson and Claridge 1991), and the only host associations reported are sugarcane (*Saccharum officinarum* L., Poaceae: Andropogoneae) and malojillo grass (*Panicum molle* Swartz, Poaceae: Paniceae) for *N. wolcotti* Muir and Giffard (Muir and Giffard 1924, Wolcott 1936, Wilson and O'Brien 1987). Old World *Nilaparvata* species are also known to feed on *Leersia* (Poaceae: Oryzeae) (Sogawa and Kilin 1984, Sogawa et al., 1984, Claridge and Morgan 1987, Wilson et al., 1994).

The published records of all three previously reported New World species are limited to Puerto Rico (Muir and Giffard 1924, Caldwell and Martorell 1951), except that *N. serrata* is reported from Nicaragua (Maes and O'Brien 1988). This investigation was initiated after discovering specimens of *Nilaparvata* in light samples from Hills County, New Hampshire. Here the New World species are reviewed, and *Euides gerhardi* (Metcalf) is transferred to *Nilaparvata*. A species key, diagnoses, and all available specimen records are presented for New World *Nilaparvata*.

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METHODS

The morphological terminology follows Asche (1985), but for descriptive purposes the parameres will be referred to as having a proximal "basal angle," and distal "inner" and "outer angles" (*sensu* Metcalf 1949); and the more precise "segment X" will be used instead of "anal tube" (= "analrohr"). A total of 216 New World *Nilaparvata* specimens were examined (Table 1), plus the primary types of all described species.

Table 1. Number and distribution of New World *Nilaparvata* specimens examined. States of the U.S.A. are indicated by standard US Postal Service abbreviations.

Species	Gender		Distribution
	Males	Females	
N. caldwelli	9	0	USA: FL, NC; Belize; Puerto Rico; Hispaniola.
N. gerhardi	14	4	USA: IL, NH, NJ, NC, VA; ? Guatemala.
N. serrata	53	31	USA: FL; Mexico; Belize; Costa Rica; Puerto Rico; Cayman Islands; ? Bolivia.
N. wolcotti	44	28	USA: AZ, CA, CO, DE, FL, MD, NJ, UT; Mexico; Puerto Rico.
N. spp.	—	33	USA: CA, CT, FL, MD, NY, WI; Belize; Costa Rica; Guatemala; Panama; Paraguay; Cuba.
Total	120	96	

The collections from which specimens were examined are abbreviated as follows (collection abbreviations according to Arnett et al., 1993):

BMNH - British Museum (Natural History), London, England, U.K.
CSCA - California State Collection of Arthropods, California Department of Food and Agriculture, Sacramento, California, U.S.A.
DENH - University of New Hampshire, Department of Entomology, Durham, New Hampshire, U.S.A.
EMEC - Essig Museum of Entomology, Department of Entomological Sciences, University of California, Berkeley, California, U.S.A.
FSCA - Florida State Collection of Arthropods, Florida Department of Agriculture and Consumer Services, Division of Plant Industry, Museum of Entomology, Gainesville, Florida, U.S.A.
INBC - Instituto Nacional de Biodiversidad, Santo Domingo de Heredia, Costa Rica.
LOBC - Lois O'Brien Collection (Associated with California Academy of Sciences, CASC), Green Valley, Arizona, U.S.A.

LSUC - Louisiana State University Insect Collection, Department of Entomology, Louisiana State University, Baton Rouge, Louisiana, U.S.A.
NCSU - North Carolina State University, Department of Entomology, Raleigh, North Carolina, U.S.A.
NYSM - New York State Museum, Biological Survey, Cultural Education Center, Albany, New York, U.S.A.
SEMC - University of Kansas, Snow Entomological Museum, Lawrence, Kansas.
UDCC - University of Delaware, Department of Entomology and Wildlife Ecology, Insect Reference Collection, Newark, Delaware, U.S.A.
UKYC - University of Kentucky, Department of Biology Insect Collection, Louisville, Kentucky, U.S.A.
USNM - US National Museum of Natural History, Smithsonian Institution, Washington, District of Columbia, U.S.A.
VGC - Vince Golia Collection, associated with Archbold Biological Station Collection (ABSC), Lake Placid, Florida, U.S.A.

Species diagnoses are provided with reference to New World taxa. Lengths reported are averages (n = 4) and ranges of total body length (in mm), including wings for macropters. All observed specimens are reported, although female specimens are either tentatively identified, or reported as "undetermined females." Reported specimen data follows the format of the specimen label, with added notes in square brackets. Label information for primary types is quoted, with each line break indicated by "/"and each label separated by "//". All specimens are macropterous unless otherwise noted.

Photographs and measurements were taken using a Nikon SMZ-1500 Digital Imaging Workstation with Nikon DS-U1 digital Camera and Eclipse Net Imaging software (version 1.16.6). Scale bar in all figures represents 0.5 mm.

SYSTEMATIC ENTOMOLOGY

The genus *Nilaparvata* Distant, 1906 (type species by original designation *Nilaparvata greeni* Distant, 1906, junior synonym of *Delphax lugens* Stål, 1854) can be separated from all other Delphacini by the presence of teeth on the hind basitarsus (Fig. 1, see also Caldwell and Martorell 1951: 194). There are usually 1-3 teeth on the proximal half of the ventral margin of the basitarsus, at least in New World species. Four New World species of *Nilaparvata* were found in this survey, the three species previously placed in *Nilaparvata*, with the fourth determined to be *Euides gerhardi* (Metcalf, 1923), and hence this species is here transferred to *Nilaparvata*. Each of these species was found to be much more widely distributed than has been previously reported.

Among New World Delphacini, *Nilaparvata* are relatively large and robust, and of a pale to deep brown color with conspicuous facial carinae. Among New World genera, *Nilaparvata* most closely resembles *Pareuidella* Beamer, and species currently, but doubtfully, placed in the Old World genus *Euides* Fieber. Asche (1985) considered *Euides* as consisting of four Palearctic plus one Oriental species, with all New World species in *Euides* at that time *incertae sedis* (four additional species were moved to *Euides* by Bartlett and Deitz 2000); hence there is a need for a revision of *Euides*, and there are some difficulties in finding features that consistently separate *Nilaparvata* from New World *"Euides"* as currently defined.

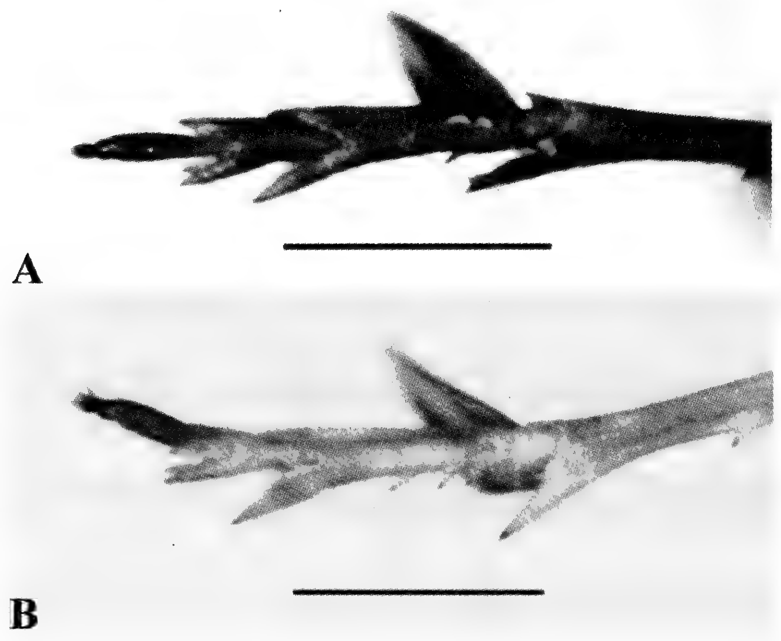

Figure 1. Basitarsus of species of *Nilaparvata*: A. *N. caldwelli* (from Florida) with a single tooth, and B. *Nilaparvata* sp. (female) from Belize with three teeth.

Nilaparvata can be recognized by the teeth on the basitarsus, a pair of processes on abdominal segment X (weakly developed in *N. wolcotti*) that are widely separated basally, two-branched parameres (*Pareuidella* and many *"Euides"* have multibranched parameres), and in having a weak genital diaphragm bearing poorly developed armature. All four New World *Nilaparvata* have a rounded tooth at opening of the pygofer at the ventral angles (*sensu* Metcalf 1949).

Nast (1984: 396) noted that the New and Old World species may belong in different genera, but since both New and Old World species share the teeth on the basitarus, possess similar male genitalia, and are comparable in build and general color features, the New World species appear properly placed in *Nilaparvata*.

The New World *Nilaparvata* can be identified according to the following key based on male genitalia.

Key to the New World species of *Nilaparvata*

1. Aedeagus appearing bifid from base to apex (Fig. 2G), without subapical serrate flange, parameres (Fig. 2E) relatively narrow, apex acute and directed dorsolaterally .... *N. caldwelli*

1'. Aedeagus not appearing bifid, with serrate flange originating on right side; parameres relatively broad, apex blunt and directed laterally 2

2. Segment X with long processes, approximated at base, originated subdorsally (Fig. 5G); parameres (Fig. 5F) in widest view broadly laterally projecting, lateral margin nearly truncate .... *N. serrata*

2'. Segment X with short processes or a pair of teeth, originating dorsally; parameres in widest view with dorsal margin broad and truncate, lateral margin acutely pointed, directed sublaterally 3

3. Segment X processes very short (Fig. 6G), often reduced to teeth; originating somewhat medially from dorsolateral margin (Fig. 6D); parameres (Fig. 6F) in widest view with dorsal margin gradually sloped upwards to a dorsolaterally directed apex .... *N. wolcotti*

3'. Segment X processes longer, curved (Fig. 4G); originating from dorsolateral margin of segment X (Fig. 4D); parameres with dorsal margin subtruncate, lateral apex directed sublaterally .... *N. gerhardi*

Nilaparvata caldwelli Metcalf, 1955

Figures 2, 3A

Nilaparvata muiri Caldwell, 1951 (in Caldwell and Martorell 1951): 192-194 (nec. China, 1925).

Nilaparvata caldwelli Metcalf, 1955: 262 (replacement name for unavailable *N. muiri* Caldwell).

Nilaparvata bis Nast 1984: 396 (replacement name for unavailable *N. muiri* Caldwell).

Type material examined. "P.R. Acc. No. /Ponce, P.R. / 6-29-48 // Maldonado // *Nilaparvata* / Holotype / *muiri* [red paper] // JSCaldwell / Collection / 1959 // *Nilaparvata* ♂/ *muiri* / det 49 Holotype/ JSCaldwell" (♂ holotype, allotype ♀, and paratype ♂; USNM).

Diagnosis. Length ♂: 3.88 (3.75-4.00). This species is readily recognized by the aedeagus somewhat flattened and appearing bifid, and the relatively small and narrow parameres. The parameres have a weakly developed basal angle, a broadly toothlike inner angle, and an acutely dorsolaterally directed outer angle. The genital diaphragm is comparatively well-developed in *N. caldwelli,* bearing a thin, caudally directed, scooplike armature (Fig. 3A). Segment X bears a pair of

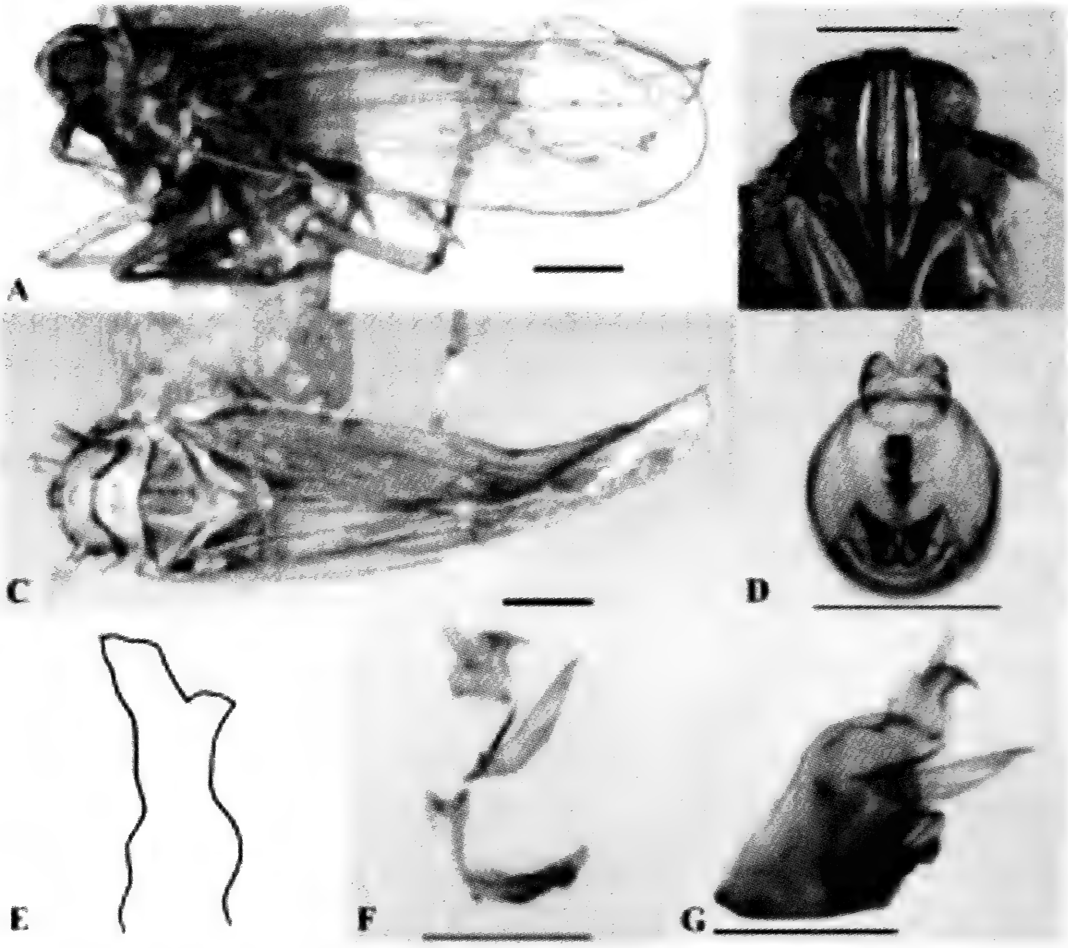

Figure 2. *Nilaparvata caldwelli*: A. lateral view, B. frons, C. dorsal view, D. pygofer, caudal view, E. left paramere, widest view, F. aedeagal complex with parameres and post genital segments, and G. pygofer, lateral view.

short, hooked processes from its dorsolateral margins. In color, this species is light brown with the prothorax somewhat paler between the lateral carinae. The median third of the mesonotum is faintly paler, suggesting a median vitta. Carinae on frons conspicuous, slightly paler than frons. Wings indistinctly infuscate, with a poorly developed darkened area at the end of the claval suture.

Remarks. The bifid appearing aedeagus, narrow parameres and relatively well-developed genital diaphragm make *N. caldwelli* distinctive among the New World species. Reports of this species from Africa need confirmation.

Distribution. USA: Florida, North Carolina; Belize, Puerto Rico and Hispaniola; also reported Senegal (Fennah 1961) and Sudan (Linnavuori 1973).

Specimens Examined. USA: NORTH CAROLINA: Bladen Co., White Lake @White Lake Campground, 15-IX-1995, C. R. Bartlett (1♂, UDCC). FLORIDA: Palm Beach Co., Lake Worth, Geneva Lakes Court, June 1, 2003, V. Golia, Black light (1♂, VGC) same July 25, 2003 (1♂, VGC). BELIZE (as British

Honduras): Rio Grande, June 1932 [♂Light trap], J. J. White, (1♂, NCSU), Rio Temas July 1937 [?light trap], A. J. White (2♂, NCSU). PUERTO RICO: Aguirre [as Acquirre], VIII-3-1948, J. S. Caldwell (1♂, USNM); Ponce, VI-29-1948, J. S. Caldwell (1♂, USNM). DOMINICAN REPUBLIC: Humachon Prov., Rio Nigua, Trujillo, Dec. 1955, J. Maldonado Capriles (1♂, USNM).

Nilaparvata gerhardi (Metcalf, 1923) New Combination

Figure 4

Liburnia gerhardi Metcalf, 1923: 210, pls. 62 and 70.

Euidella gerhardi (Metcalf): Metcalf, 1949: 58, pls. 1 and 4.

Euides gerhardi (Metcalf): Metcalf, 1952: 230-231.

Type material examined. "Beverly H's/ VIII:31:07 Ill // Col. by / WJGerhard // At light // Holotype / Euides / gerhardi / Metc [red paper]// Liburnia / gerhardi / Metc. / det. Z. P. M. [tan paper] // on indefinite loan / from N. Carolina / St. Univ. Raleigh" (♂ USNM).

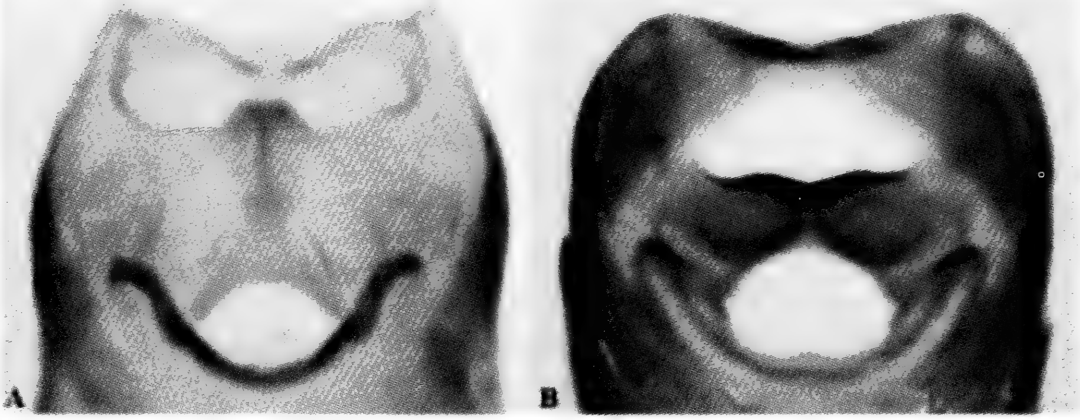

Figure 3. Genital diaphrams: A. *Nilaparvata caldwelli* (Belize), B. *Nilaparvata serrata* (Cayman Islands).

Diagnosis. Length ♂: 4.45 (4.30-4.60), ♀: 5.05 (4.45-5.40). This species closely resembles *N. wolcotti*, although it differs by the processes on segment X (longer and curved) and the shape of the parameres (dorsal margin subtruncate, lateral apex directed sublaterally). The parameres of both species are broad with a bluntly triangular, irregularly toothed basal angle, and a long, straplike dorsomedially directed inner angle, which in widest view appears to originate behind a broadly expanded outer angle. In *N. gerhardi*, the dorsal margin of the outer angle is subtruncate, having a two-stepped appearance, with the apex of the outer angle laterally directed. The aedeagus is terete with a large lateral flange on the

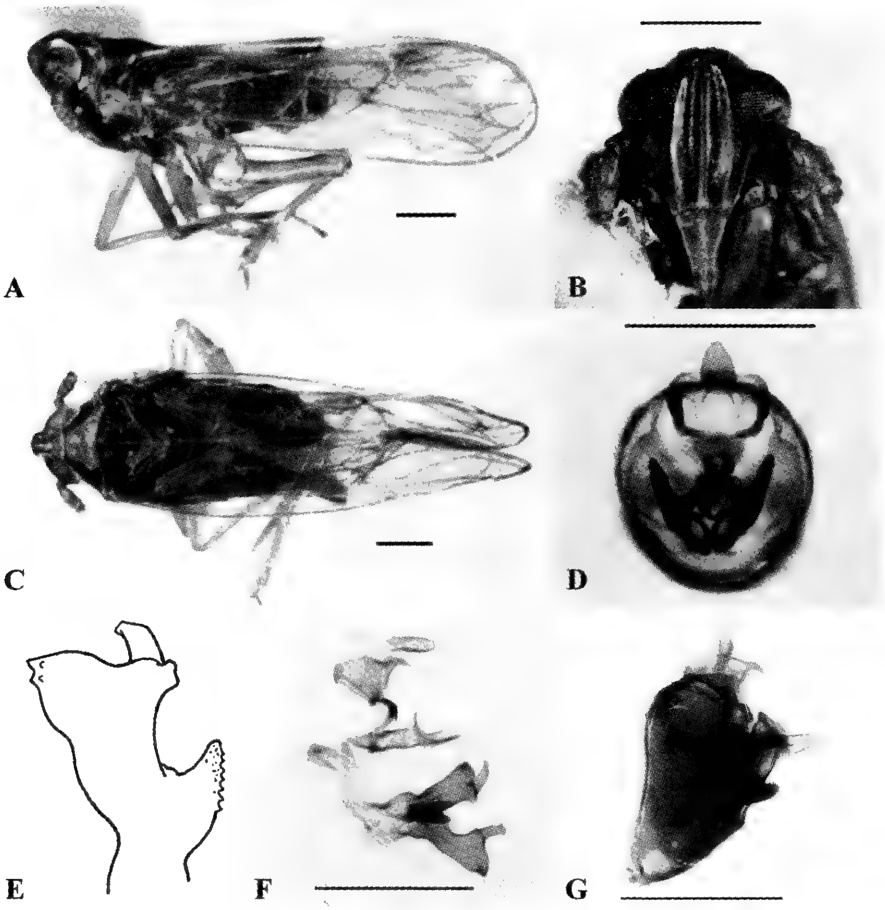

Figure 4. *Nilaparvata gerhardi*: A. lateral view, B. frons, C. dorsal view, D. pygofer, caudal view, E. left paramere, widest view, F. aedeagal complex with parameres and post genital segments, and G. pygofer, lateral view.

right side. In *N. gerhardi,* as in *N. wolcotti*, the proximal margin of the flange is strongly directed dorsad and conspicuous in left lateral view. The genital diaphragm is poorly developed (similar to Fig. 3B), bearing a slight, flattened, posteriorly directed armature. Dorsal margin of pygofer narrowed, segment X about 3/4 width of dorsal margin (Fig. 4D, vs. *N. wolcotti*). Segment X bears a pair short curved processes originating from the dorsolateral margins. In color, this species is similar to *N. wolcotti*, but less distinctly marked: brown to dark brown, with a paler vertex and prothorax, with a variably developed mesonotal vitta. Facial carinae slightly paler than frons. Wings mostly clear, with a melanistic spot at the apex of the claval suture. Females paler than males.

Remarks. This appears to be the most northerly distributed of the *Nilaparvata* species and it is likely that, based on both color and geographic indications, the Wisconsin and New York records among the undetermined females belong to this species.

The genitalia of the holotype are embedded in balsam within a gelatin capsule. The genitalia appear to match those described by Metcalf (1923, 1949); however, the associated specimen on the point is not a *Nilaparvata*. Female specimens, cited below, with identical locality information as the holotype closely match Metcalf's description, suggesting that the type specimen was lost and the wrong specimen later applied to the point. The specimen on the point is of similar appearance to *Delphacodes andromeda* (Metcalf), and may in fact be the type specimen of *Delphacodes xerosa* Caldwell, which is missing from its point although its genitalia are present in a microvial. Since the holotype male genitalia match the original description, further nomenclatural changes are not needed.

Distribution. USA: Illinois, Louisiana, New Hampshire, New Jersey, North Carolina, Virginia; and apparently Guatemala.

Specimens Examined. NEW HAMPSHIRE: Hills Co., 3 Mi SE Brookline, Nissitissit River, VIII-17-1995, UV Light, D. S. Chandler (1♂, DENH), same, VII-27-1995 (1♀, DENH). NEW JERSEY: Seabrook, 7/27/[19]65, B/L Ser. X (1♂, USNM). ILLINOIS: Beverly H's, VIII-31-[19]07, W J Gerhard, at light (2♀, USNM). VIRGINIA: Chantilly, 8/25/[19]64 (2♂, 1♀ all on same point, plus 1♂, USNM). NORTH CAROLINA: Cabarrus Co., Coddle Creek Reservoir, (VI-VII)-1995, NJ Light Trap, B. A. Harrison (4♂, UDCC); same VIII-1995 (2♂, UDCC), same IX-1995 (1♂, UDCC). LOUISIANA: Iberville Par., St. Gabriel, 29-IX-1990, J. Zhou (1♂, LSUC). Tentatively included: GUATEMALA: specific locality not given, Feb. 1934 (1♂, USNM).

Nilaparvata serrata Caldwell, 1951
Figures 3B, 5

Nilaparvata serrata Caldwell, 1951 (in Caldwell and Martorell 1951): 192-4.

Type material examined. "RPiedrasPR / 12-31-47 / JSCaldwell // *Nilaparvata* / holotype / serrata [red paper]// JSCaldwell / Collection / 1959 // *Nilaparvata* ♂/ serrata Holotype/ Caldwell '49" (♂ and ♂ paratype, USNM).

Diagnosis. Length ♂: 3.75 (3.50-4.00), ♀: 4.33 (4.25-4.50). This species is most easily recognized by the broad parameres with a relatively short thick process at the basal angle, a larger thumblike, irregularly toothed inner angle; and a broad, flattened, outer angle with a nearly truncate lateral margin, often bearing a few small teeth. A minute tooth is usually present on the ventrocaudal margin of the base of the inner angle. Aedeagus terete, somewhat enlarged preapically, with a large but variably developed serrate flange on the right side. This flange is present in both *N. wolcotti* and *N. gerhardi,* but in both these species the proximal margin of the flange is strongly directed dorsad, and conspicuous in left lateral view; whereas in *N. serrata,* this flange is less produced and inconspicuous in left lateral view. The genital diaphragm is poorly developed (Fig. 3B), bearing a slight, flattened, posteriorly directed armature. Segment X bears a pair of strongly developed, ventrally hooked processes from its midlateral margins, which are strongly medially, then laterally curved. In color, this species is dark brown with a paler prothorax, vertex and often mesonotal carinae. Carinae on

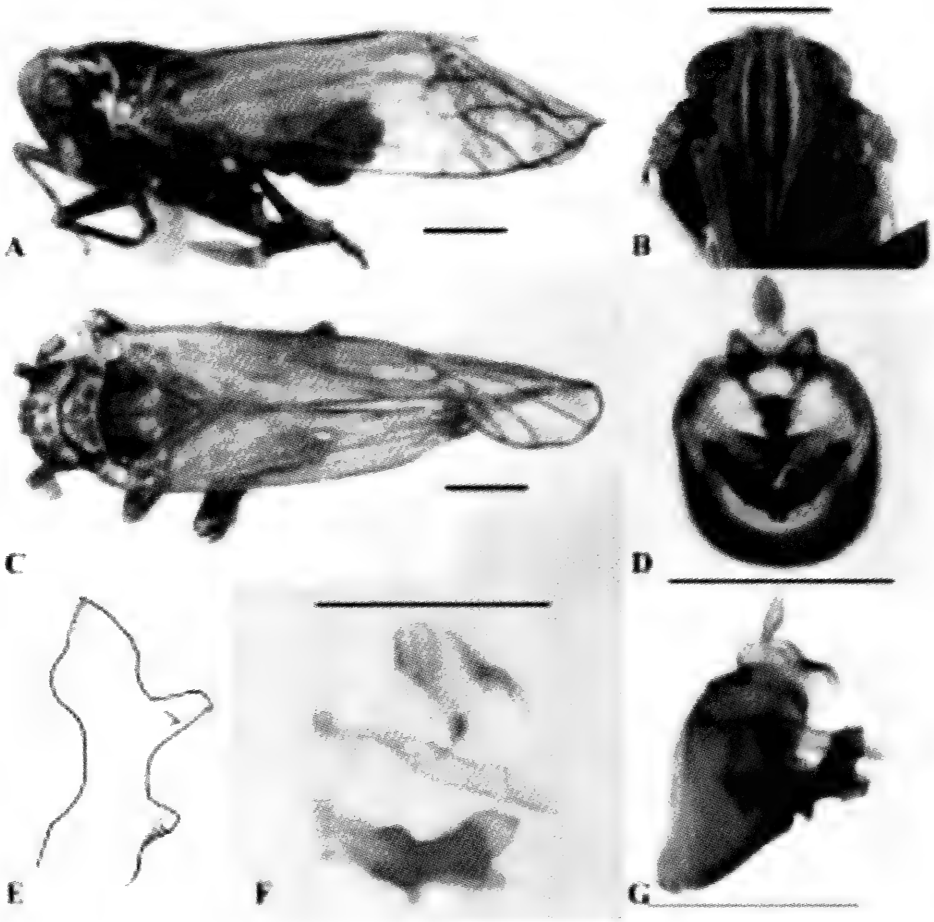

Figure 5. *Nilaparvata serrata*: A. lateral view, B. frons, C. dorsal view, D. pygofer, caudal view, E. left paramere, widest view, F. aedeagal complex with parameres and post genital segments, and G. pygofer, lateral view (scale bar = 0.5 mm).

frons conspicuously paler than frons. Wings somewhat infuscate, with little suggestion of the darkened area at the end of the claval suture. Females tend to be paler than males.

Remarks. One specimen, from Florida, was collected from "rice & grasses," suggesting habitat, if not host, for this species. The Bolivian specimen differs in subtle ways from the other specimens, most significantly by having the processes on segment X more closely approximated at the base, and by being overall much paler than *N. serrata* is generally.

Distribution. USA: Florida; Mexico, Belize, Costa Rica, Puerto Rico, Cayman Islands, and apparently Bolivia. Also reported from Nicaragua (Maes and O'Brien, 1988).

Specimens Examined. USA: FLORIDA: Belle Glade, Rabbit Is., 15-IX-1957 [J. Kramer], rice & grasses (1♂, USNM). MEXICO: Oax., 13 mi SE Oaxaca, 5180', VI-2-1974; C.W. & L. O'Brien & Marshall (1♂, LOBC); Ver., 27mi NW Veracruz, 300', Dec. 26, 1963, L. & C. W. O'Brien (1♂, LOBC); Mexico City

Area (MB-151), 1940's, D. M. De Long (2♂, UKYC); Chiapas, 5 mi S San Carlos, III-6-1953, at light, R. C. Bechtel, E. I. Schlinger (10♂, 11♀, EMEC). BELIZE (as British Honduras): Punta Gorda, May 1930 [? Light trap], J. J. White (2♂, NCSU); Rio Grande, June 1932 [? Light trap], J. J. White (1♂, NCSU); Cayo District, Esperanza, 12.4.1967, at light, D. J. McGr [? illegible] (1♂, BMNH). COSTA RICA: Heredia, nr Puerto Viejo, La Selva Biological Station., 10°25'N 84°00W, 179 ft, Station Grounds, (18-19)-VIII-2003, C. R. Bartlett, J. Cryan, J. Urban (3♂, UDCC); same 15-VIII-2003 (1♂, 1♀, INBC); same 25-II-2004, C. R. Bartlett, (2♂, UDCC); La Selva, (22-24)-I-2000, A. E. Short (1♂, UDCC); Guanacaste, Estacion Experimental Enrique Jimenea Nunez, VI/15/[19]92; F. Parker (2♂, 1♀, UKYC). CAYMAN ISLANDS: Cayman Brac, The Creek, 18-XI-1995, UV Light, C. R. Dilbert (2♂, 6♀, FSCA); same, 22-XI-1995 (1♀, FSCA); same, 28-XI-1995 (2♂, 2♀, FSCA); same, 6-XII-1995 (3♂, 3♀, FSCA); same, 8-XII-1995 (1?, FSCA); same, 15-XII-1995 (9♂, 3♀, FSCA); same, 23-XII-1995 (2♂, 2♀, FSCA); same, 27-XII-1995 (5♂, 1♀, FSCA). Tentatively included: BOLIVIA: Santa Cruz, 10 mi. W. Portachuelo, March 26, 1978, UV Light, C. W. O'Brien (1♂, LOBC).

Nilaparvata wolcotti Muir and Giffard, 1924.

Figures 6, 7

Nilaparvata wolcotti Muir and Giffard, 1924: 17, 51.

Type material examined. "Barceloneta, P.R. / April 9, 1920 // G. N. Wolcott, / Collector. // on cane // Paratype [yellow paper] / Muir Coll. / Brit. Mus.1932-279." (1 male, missing from point, male terminalia and abdomen mounted in balsam between cover slides on card stock with annotation "Nilaparvata / wolcotti / ♂m.g." [handwritten]). "Pt. Cangrejos, P.R. / March 12, 1920. // G. N. Wolcott, / Collector." (BMNH, missing abdomen.)

Diagnosis: Length macropter ♂: 4.81 (4.50-5.20), ♀: 4.89 (4.75-5.00); brachypter ♂: 2.68 (2.50-2.85), ♀: 3.16 (2.10-3.25). This species closely resembles *N. gerhardi* in many respects, but is most readily separated by the processes on segment X (very short) and the shape of the parameres (dorsal margin gradually sloped to a dorsolaterally directed apex). The parameres of both species are broad with a bluntly triangular, irregularly toothed basal angle, and a long, strap-like, dorsomedially directed inner angle, which in widest view appears to originate behind a broadly expanded outer angle. In *N. wolcotti*, the dorsal margin of the outer angle is inclined to an acute, dorsolaterally directed apex, compared to a more truncate, two-stepped appearance of *N. gerhardi*, terminating in a more laterally directed apex. The aedeagus is terete and somewhat enlarged preapically, with a large lateral flange on the right side. In both *N. wolcotti* and *N. ger-*

hardi, the proximal margin of the flange is strongly directed dorsad and conspicuous in left lateral view. The genital diaphragm is poorly developed (similar to Fig. 3B), bearing a slight, flattened, posteriorly directed armature. Dorsal margin of pygofer wide, segment X about 3/5 width of dorsal margin (Fig. 6D, vs. *N. gerhardi*). Segment X bears a pair of variably developed teeth originating somewhat lateroventrad from the dorsolateral margins. In color, macropters of this species are brown to dark brown, with a conspicuously paler vertex and prothorax, with a variably developed but conspicuous mesonotal vitta. Facial carinae paler than frons. Wings mostly clear, with a well-developed melanistic spot at the end of the claval suture. Females tend to be paler than males with the median vitta of the mesothorax less distinct.

Remarks. The specimen collected in the Gulf of Mexico was found approximately 46 km from the Louisiana coast. The specimen from California cited in undetermined females appears to be this species. This is the only species for which brachypterous specimens were located. Most of the brachypterous specimens (22 of 25), were from a single series from Plain City, Utah, which also included a single nymph. Reported on sugarcane (*Saccharum officinarum* L., Muir and Giffard 1924) and malojillo grass (*Panicum molle* Swartz, Wolcott 1936).

This species was "[d]escribed from one male and one female (types) from Pt. Congrejos [sic - Cangrejos], Porto Rico (G. N. Wolcott, February, 1920) and one male from Barceloneta, Porto Rico (G. N. Wolcott, April 1920), on sugar cane" (Muir and Giffard 1924: 17). The specimens provided from BMNH consists of the Barceloneta specimen, labeled as a paratype, and a specimen from Pt. Cangrejos, P.R. missing the abdomen, collected March 12, 1920. The specimens reported by Muir and Giffard (1924), evidently were collected March 3, 1920 (♂) and March 20, 1920 (♀) (not February), and both these specimens are missing their abdomen (M. Webb, BPBM, pers. comm.) (requested on loan, not available). Since the Barceloneta male was clearly in Muir and Giffard's (1924) type series and bears the diagnostic features of the male genitalia; and because Muir and Giffard (1924) did not specify which specimen was the holotype, I have treated the Barceloneta male as the primary type with respect to maintaining a stable species concept.

Distribution. USA: Arizona, California, Colorado, Delaware, Florida, Maryland, New Jersey, Utah; Mexico; Puerto Rico.

Specimens Examined. USA: NEW JERSEY: Seabrook, 7/27/65, B/L Ser. X, B200 (1♂, USNM). DELAWARE, New Castle Co., Middletown, Brick Mill Farm, 522 St. Michael Dr., 07-VI-2004, A. Gonzon, Collected at porch light (2♂, UDCC); same 29-VIII-2003 (1♂, UDCC); Sussex Co., Nanticoke WMA, Phillips Landing, 12-VII-2005, A. Gonzon, Hg Vapor Light, xeric sand ridges (4♂, 2♀ UDCC). MARYLAND: Crisfield, 8-5-32, F. C. Bishop, Mosq. Trap (3♂, USNM); Chestertown, 6-29-32, F. C. Bishop, Mosq. Trap (1♂, USNM). COLORADO: Ft. Collins, 9 10 [19]01 (1♂ [missing from point, genitalia in microvial], 1♀brachypter, USNM). UTAH: Utah Co., Goshen Ponds, SW of Santaquin, 15-VII-2000, J. A. Robertson (UDCC, 1♂, 1♀); Utah Co., Provo, BYU, 18-VII-2000, I. S. Winkler, at light (1♂, 1♀, UDCC); Richfield, July 15, 1930, Light Trap (4♂, 2♀, USNM); Farmington, 8-19-1936, G. F. Knowlton (1♂, USNM); Plain City, 8-5-[19]03 (6♂, 16♀, 1 broken, 1 nymph; all brachypterous; USNM). FLORIDA: Palm Beach Co., Boyton Beach, Nautica Sound, Sept. 3, 1999, Black Light, V. Golia (1♂, VGC); Palm Beach Co., Lake Worth, Geneva Lakes Court, October 28, 2004, V. Golia, Mercury Vapor Light (1♀, VGC); same, October 27, 2004 (1V, VGC); same, May 24, 2003, Black Light (1♂, VGC); Broward Co., Ft. Lauderdale, 4 June 1974, Rotary Net, N. L. Woodiel (1♂, USNM); Broward Co., Hwy 27, Sawgrass Rec Area, 23 mi NW Ft.

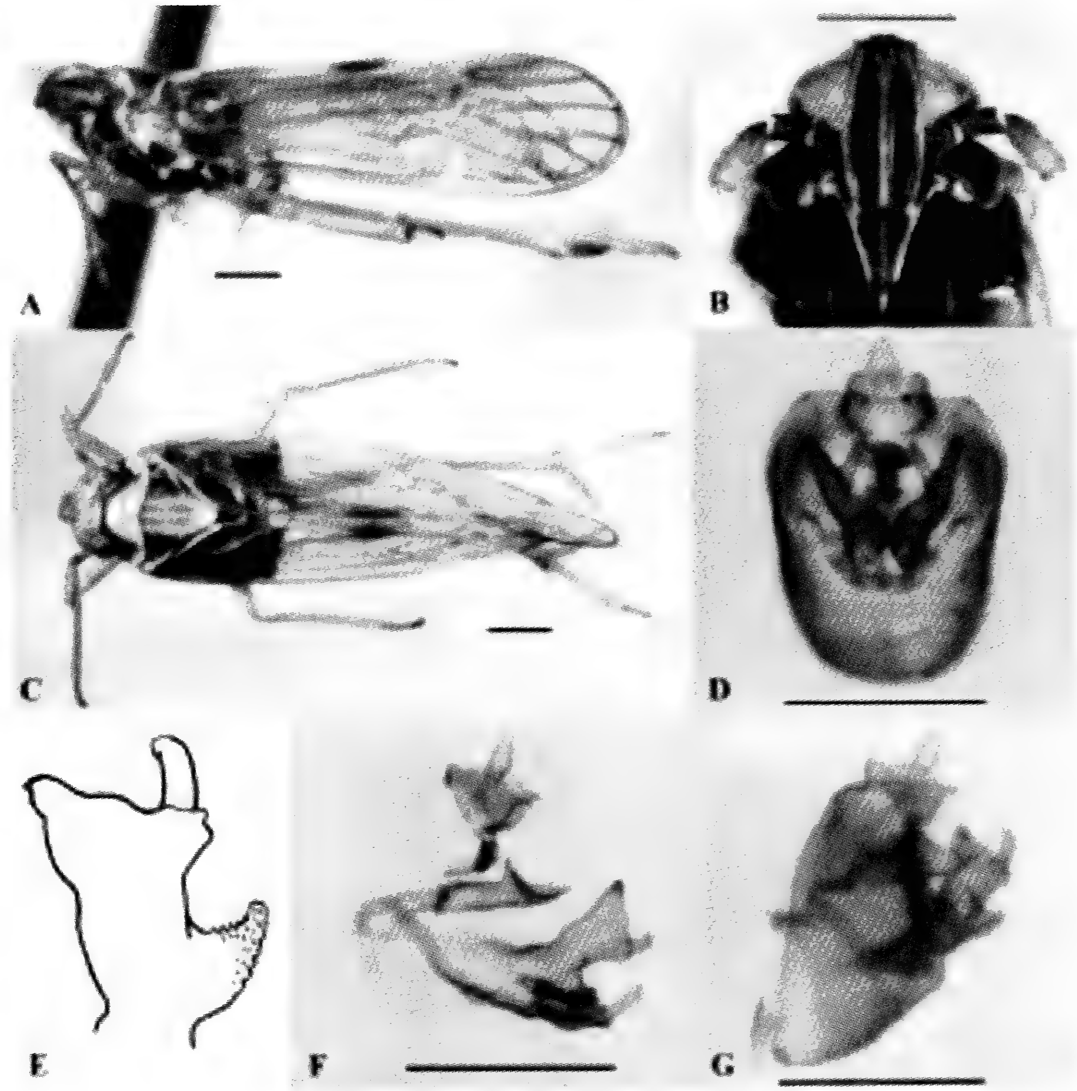

Figure 6. *Nilaparvata wolcotti* macropter: A. lateral view, B. frons, C. dorsal view, D. pygofer, caudal view, E. left paramere, widest view, F. aedeagal complex with parameres and post genital segments, and G. pygofer, lateral view.

Lauderdale, 21-V-1976, UV Trap, C. W. O'Brien & G. B. Marshall (1♂, 2♀, LOBC); Collier Co., Collier-Seminole S.P., 22-VI-1965, C. W. O'Brien, Blacklight trap (1♂, LOBC); Palm Beach Co., Lake Worth Geneva Lakes Court, 8-VIII-2003, V. Golia, Mercury Vapor Light (1♂, VGC). ARIZONA: Sabino Canyon, July 9, 1952 [R. H. Beamer] (1♂, SEMC); Chiric. Mts. 9-11-35, E. D. Ball (1♂, USNM). CALIFORNIA: San Joaquin Co., 24 Aug 1974, lt Trap, M. Croce, 75-6719 (1♂, USNM); Sacramento, VIII-14-1934 (1♂, USNM); Sacramento, VIII-12-1933, H. H. Keifer (1♂, CSCA); Palm Canon, Palm Springs, 17 Dec[19]'17, J. Ch. Bradley (2♂ Brachypter, USNM); Siskiyou Co., 5 mi N of Gazelle, (7-3)-(8-10), 1981, Light Trap, John Hunter Orchard, F. D. Horn (1♂, CSCA); Santa Barbara Co., Santa Cruz Is., 17-VIII-1939, L. M. Martin (1♂, 1♀, CSCA). GULF OF MEXICO, 29°35'N, 93°20'W, 12-VIII-1984, M. L. Isreal, blacklight trap (1♂, USNM). MEXICO: Salvatierra, 7 mi. W., Guanajuato, VII-28-1954, E. I. Schlinger (1♂, EMEC). PUERTO RICO: Bayamon, Anderson & Lesene, San Juan No. 2983, on grass (1♀, 1 broken, USNM, tentatively included).

Undetermined *Nilaparvata* females

USA: WISCONSIN: Kenosha Co., August 2[6?], 1953, D. H. Habeck (1♀, NCSU). NEW YORK: Westchester County, Greenburgh, Route 9A, July 10, 1994, V. Golia, Black light (1♀, VGC); Rochester, USGC, 5 July 1968 (1♀, NYSM). CONNECTICUT: Prospect, VII-22-2001, C. W. O'Brien, at night (1♀, LOBC). MARYLAND, Allegany Co., Little Orleans, 13-VII-2000, S. T. Dash, sweeping meadow (1♀, UDCC). FLORIDA: Collier County, Fakahachee Strand St. Res. K-12, 18-V-1998, C. W. O'Brien (1♀, LOBC); Green Cove Springs, Aug. 1942, R C Barnes, at light trap (2♀, USNM); Palm Beach Co., Delray Beach, Country Lake, March 19, 1994, V. Golia, Mercury Vapor Light (1♀, VGC); same except October 25, 1994 (1♀, VGC). CALIFORNIA: Contra Costa Co., Antioch Natl. Wildlife Ref. (SF), X-10-1991, blacklight, J. Powell (1♀, EMEC). BELIZE (as British Honduras): Punta Gorda, May 1930, J. J. White (10♀, NCSU); Rio Grande, June 1932, J. J. White (3♀, NCSU); Rio Temas, July 19[27?], A. J. White (1♀, NCSU); (as Belize) Belize district, Western Highway nr Belize Zoo, 7-Jan.-2003, C. R. Bartlett, Pine Grassland (1♀, UDCC); Cayo District nr Teakettle Bank, nr Pook's Hill, 8-Jan.-2003, C. R. Bartlett, Sweep at river (1♀, UDCC). COSTA RICA: Heredia, Estac. Biol. La Selva, 50-100m, I-8/17-1993, blacklight in secondary forest, J. Powell (1♀, EMEC). GUATEMALA: Morales, Oct 1930, J. J. White (1♀, NCSU); Guatemala City, 3/29/1953, D. M. Delong (1♀, UKYC). PANAMA: Chiriqui Prov., Vagala, 10 km NW of David, (8-15)-Jan.-1981, A. C. Brown, Malaise Trap nr. Rice and River (1♀, NCSU). PARAGUAY: Cordillera, Inst. Agro. Nac. Caacupe, Jan. 17-20, 1983. E. G. Riley (1♀, LSUC). CUBA: XI-26-1935, Baltimore no 3903 (1♀, USNM).

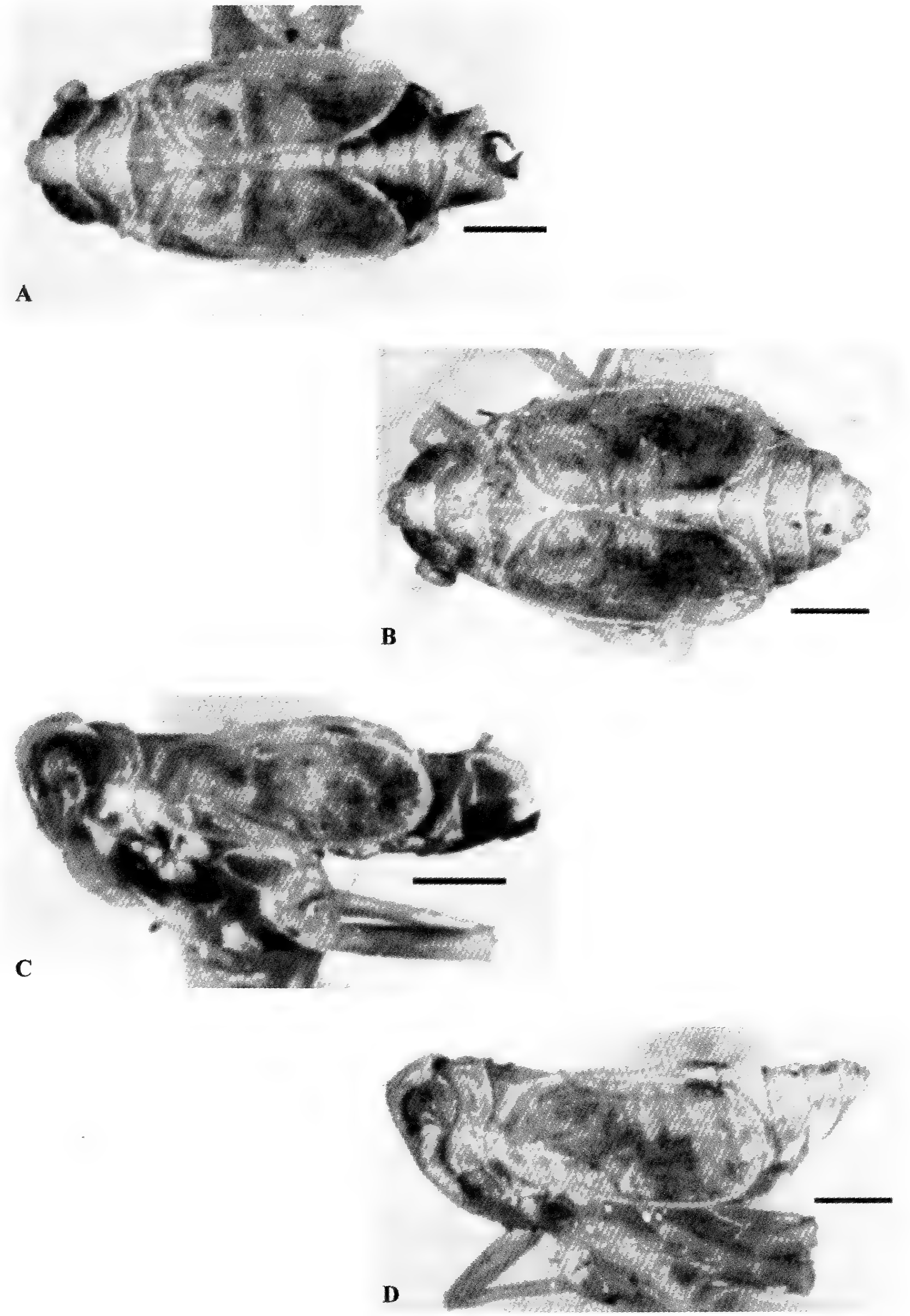

Figure 7. *Nilaparvata wolcotti* brachypters (Utah): A. dorsal view, male. B. dorsal view, female; C. lateral view, male; D. lateral view, female.

DISCUSSION

Nilaparvata serrata, N. caldwelli, and *N. wolcotti* were found to occur well outside of their previously reported range. It is puzzling that the genus has gone largely unrecognized outside of Puerto Rico since it is relatively easy to recognize. It might be possible that the Puerto Rican species were introduced to the continental fauna, but the high dispersal ability known in this genus makes endemicity or adventive dispersal more plausible hypotheses. Most observed specimens were macropterous (191 of 216 specimens), with brachypters only found for *N. wolcotti.* Nearly all specimens with collecting methods recorded were collected at lights, except one specimen from Panama collected at a malaise trap, and two specimens collected by sweeping. Unfortunately, light collecting provides little information concerning hosts or habitat, although two specimens (one *N. serrata* from Florida and one undetermined female from Panama) indicated that they were collected near rice, a habitat consistent with the rice and *Leersia* hosts known for Old World *Nilaparvata* species. *Nilaparvata wolcotti,* however, was found well outside the range of either of its reported hosts. The widespread occurrence of these species and the record of a *Nilaparvata* in the Gulf of Mexico may suggest that the New World *Nilaparvata* species are migratory in a similar manner to *Nilaparvata lugens* (e.g., Taylor 1985, Kisimoto 1991, Watanabe 1995), although perhaps less dramatically. It is anticipated that all of these *Nilaparvata* species will be found to be even more widely distributed than is reported here.

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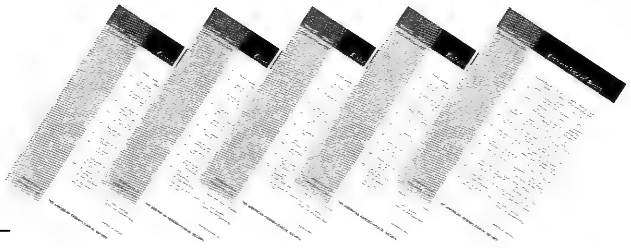

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A NEW SPECIES OF *METAPHYCUS* MERCET (HYMENOPTERA: ENCYRTIDAE) FROM CHINA, PARASITOID OF *PARASAISSETIA NIGRA* (NIETNER) (HOMOPTERA: COCCOIDEA)[1]

Yan-Zhou Zhang,[2] Da-Wei Huang,[2,3] Yue-Guan Fu,[4] and Zheng-Qiang Peng[4]

ABSTRACT: *Metaphycus parasaissetiae* sp. n., belonging to *M. zebratus* species group, is described from China. Photomicrographs are provided to illustrate morphological characters of the species. *Metaphycus parasaissetiae* is an important parasitoid of the Nigra Scale, *Parasaissetia nigra* (Nietner).

KEY WORDS: Hymenoptera, Encyrtidae, *Metaphycus parasaissetiae* sp. n., *Parasaissetia nigra,* Homoptera, Coccoidea, China

The Nigra Scale, *Parasaissetia nigra* (Nietner) is a well-known plant sap-sucking scale insect in family Coccidae (Homoptera: Coccoidea) (Ben-Dov, 1978; OEPP/EPPO, 2002). It is now a serious insect pest of *Hevea brasiliensis* (Brazilian rubber tree, Euphorbiaceae), an economically important plant in southern China, Yunnan Province (Duan et al., 2005; Guan et al., 2005). For example, in Xishuangbanna, about 40666.7 hectares of *H. brasiliensis* plantations are severely damaged following heavy infestation by *P. nigra* (Duan et al., 2005). A recent investigation of the natural enemies of this pest revealed an undescribed species belonging to genus *Metaphycus* Mercet (1921) (Hymenoptera: Encyrtidae) played an important role in regulating numbers of *P. nigra* in this area (Guan et al., 2005). The *Metaphycus* species is described here in order to provide the taxonomic basis for further research into its potential role as biological control agents of *P. nigra.*

The description of the new species is based on specimens reared from *P. nigra* collected in the Experiment Farm of Yunnan Institute of Tropical Crops, Jinghong City, Xishaunbanna, Yunnan Province, China. Morphological terminology generally follows that of Guerrieri and Noyes (2000), and Noyes (2004). Absolute measurements are used for body length. Relative measurements are used for other dimensions. All specimens examined, unless otherwise specified, are deposited in the Institute of Zoology, Chinese Academy of Sciences, Beijing (IZCAS).

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Mailed on April 27, 2007

Metaphycus parasaissetiae Zhang and Huang sp. n.

Figs. 1-8

Description. Female: Body length 1–1.65 mm; Head with frontovertex orange, genae and face yellowish white except lower part of genae and mouth margin dark brown; occiput nearly entirely black; pronotum anteriorly dark brown, posteriorly yellow to yellowish white and with a dark brown spot on each side; mesoscutum, axillae and scutellum orange, sometimes with a brownish hue; tegula yellow, apically brownish; metanotum and propodeum dorsally black; sides and venter of thorax yellowish white; antennal scape in outer aspect dark brown except dorsal margin, apex and base whitish (Fig. 1a); inner aspect of scape nearly entirely dark brown except dorsal margin, extreme apex and base yellowish white (Fig. 1b); basal half or so of pedicel dark brown; F1-F4 dark brown, F3 or F4 often internally yellowish white, F5-F6 yellowish white; clava black except extreme apex yellowish; wings hyaline; legs yellowish white, each tibia with two almost complete dark brown rings and with apices brownish; gaster dorsally dark brown and ventrally yellowish.

Head. Head about 4.6x as wide as frontovertex; frontovertex about 2.3x as long as wide; ocelli forming an angle of about 45°; posterior ocellus separated from inner eye margin by about half its diameter and 2x its diameter from occipital margin; antenna (Fig. 1) with scape distinctly expanded and flattened, about 2.3x as long as broad; funicle with F1-F4 distinctly smaller than F5-F6, F5-F6 bearing linear sensilla; clava 3-segmented, apically more or less transversely truncated; maxillary palpi 4-segmented; labial palpi 3-segmented (Fig. 2).

Thorax. Mesoscutum with notaular lines incomplete and reaching about half way across mesoscutum; forewing about 2.5x as long as broad, venation as in Fig. 5.

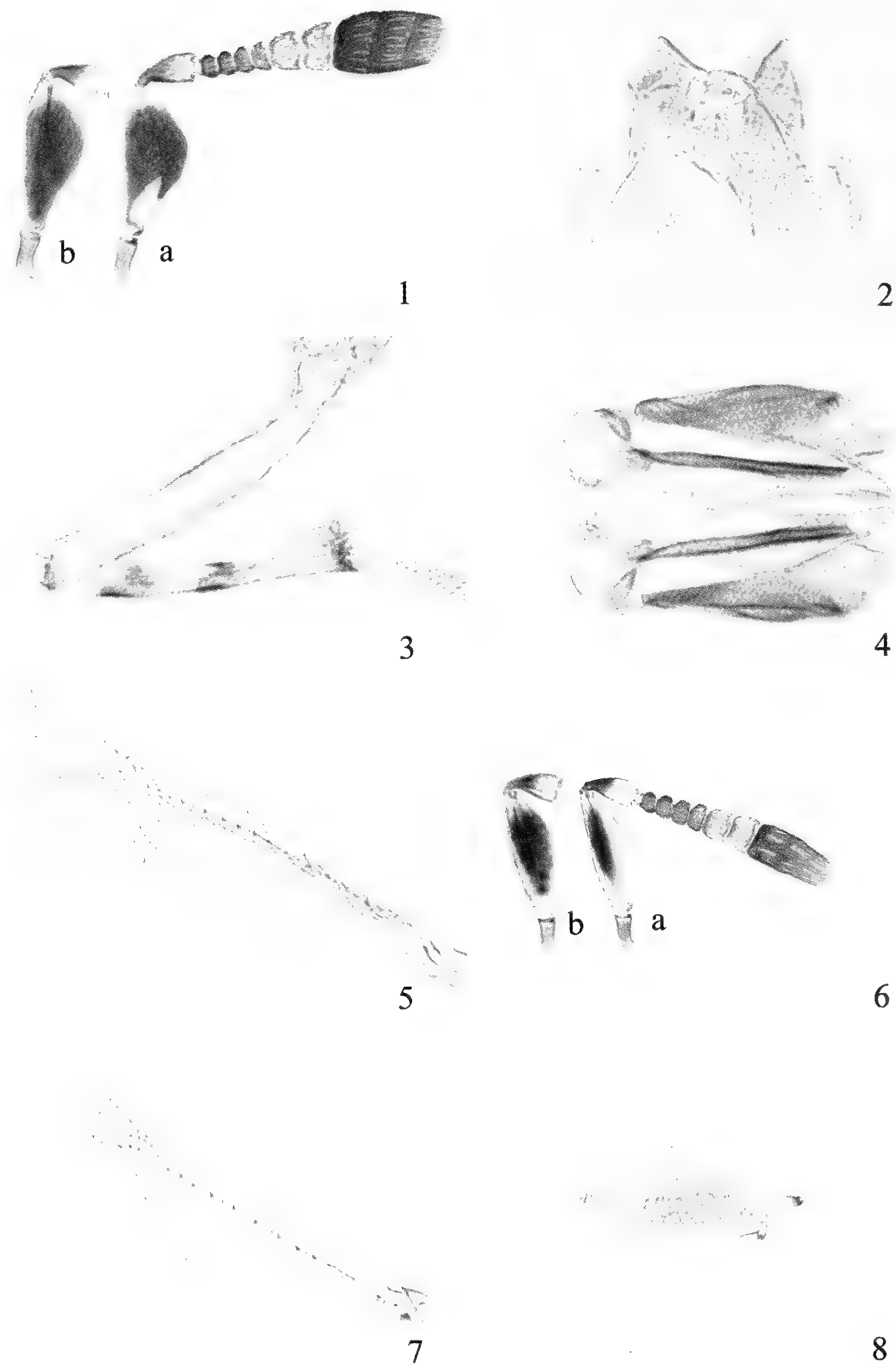
Gaster. Ovipositor (Fig. 4) not exserted or hardly so, about as long as mid-tibia (Fig. 3).

Relative measurements. Head width 65, Frontovertex width 14, POL 6, OOL < 2, AOL 6, Scape length 30, Scape width 13, Forewing length 150, Fore wing width 60, Mid-tibia length 54, Ovipositor length 55, Gonostylus length 8.

Male. Body length 1–1.2 mm, otherwise similar to female but for the antenna (Fig. 6), forewing (Fig. 7), and genitalia (Fig. 8), antennal scape in outer aspect whitish except a longitudinal dark brown band along dorsal margin (Fig. 1a); inner aspect of scape nearly entirely dark brown except dorsal margin, extreme apex and base yellowish white (Fig. 1b); antennal scape about 3x as long as broad.

Biology. A gregarious parasitoid of *Parasaissetia nigra* (Nietner). One to eight individuals have been observed to emerge from a single host.

Type Material: Holotype. female, CHINA: Yunnan: Xishuangbanna (Jinghong City, Junnan Institute of Tropical Crops), 28.vii.2004, ex. *Parasaissetia nigra* (Nietner) on *Hevea brasiliensis* coll. FP Zhang and ZQ Peng (IZCAS). Paratypes. 19 females, 5 males, same data as holotype (IZCAS).



Figs. 1-8. *Metaphycus parasaissetiae,* sp. n., 1-5, female: 1. antenna outer aspect (a), scape inner aspect (b); 2. maxillary palpi and labial palpi; 3. mid leg; 4. ovipositor; 5. forewing; 6-8. male: 6. antenna outer aspect (a), scape inner aspect (b); 7. forewing; 8. genitalia.

Other material studied. Many females and males, reared from *Parasaissetia nigra* (Nietner) collected on *Hevea brasiliensis* in Yunnan, Xishuangbanna.

Table 1. Some diagnostic characters of *Metaphycus anneckei, M. hageni,* and *M. parasaissetiae*[1]

	M. anneckei	*M. hageni*	*M. parasaissetiae*
Lower part of genae (♀)	Without dark brown band	Without dark brown band	With dark brown band
Ovipositor/Mid tibia (♀)	0.82 x (78/95)	1.2 x (41/34)	1 x (55/54)
Ovipositor/Gonostylus (♀)	4 x (78/20)	6 x (41/7)	7 x (55/8)
Toruli of male	Without associate pores	With associate pores	Without associate pores

[1] Characters of *Metaphycus anneckei* and *M. hageni* from Guerrieri and Noyes (2000)

Comments. Several keys to species of *Metaphcus* are used in identification of this *Metaphycus parasaissetiae.* Among them are Annecke and Mynhardt (1971), Viggiani and Guerrieri (1988), Trjapitzin (1989), Zeya and Hayat (1993), Guerrieri and Noyes (2000), and Noyes (2004). By using the most recent ones (Guerrieri and Noyes, 2000), *Metaphycus parasaissetiae* runs to key couplet 56, whithin the *zebratus*-group (maxillary palpi 4-segmented), that includes *Metaphycus hageni* Daane and Caltagirone (1999) and *Metaphycus anneckei* Guerrieri and Noyes (2000). *Metaphycus parasaissetiae* can be separated from both of them by characters listed in Table 1.

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PTINUS SEXPUNCTATUS PANZER (COLEOPTERA: ANOBIIDAE, PTININAE) NEWLY RECORDED IN NORTH AMERICA[1]

Christopher G. Majka,[2] T. Keith Philips,[3] and Cory Sheffield[4]

ABSTRACT: The Palearctic spider beetle, *Ptinus sexpunctatus* Panzer (Anobiidae: Ptininae), is newly recorded in North America from collections in Nova Scotia, Canada, and Pennsylvania and Utah in the United States. It is also newly recorded in association with the native blue orchard mason bee, *Osmia lignaria* Say (Hymenoptera: Megachilidae). Its presence on the continent is briefly discussed in the context of mechanisms of introduction of invertebrates to North America.

KEY WORDS: *Ptinus,* Anobiidae, Megachilidae, introduced species, new records

Ptinus sexpunctatus Panzer is a Palearctic spider beetle (Anobiidae: Ptininae) found from southern Europe north to England and southern Fennoscandia and Karelia; it is also known from the Caucasus (Burakowski et al., 1986) and east to Siberia (Borowski 1996). Within its native range it is an associate of cavity-nesting solitary bees in the genera *Osmia* and *Megachile* and also with *Hoplitus adunca* (Panzer) and *Chelostoma nigricorne* (Nylander) (Linsley 1942). It is also found in oak (*Quercus*) forests, particularly in galleries of *Cerambyx cerdo* Linnaeus (Cerambycidae) (Burakowski et al., 1986).

Thirty-eight native and non-native species in the genus *Ptinus* Linnaeus (spider beetles) (Philips 2002) and three additional adventive species not yet reported in the literature (Philips, unpublished data) are found in North America. A large number of introduced species in the genera *Gibbium* Scopoli, *Mezium* Curtis, *Niptus* Boildieu, *Pseudeurostus* Heyden, *Sphaericus* Wollaston, *Tipnus* Thompson, and *Trigonogenius* Solier have also been recorded from North America (Philips 2002). Many feed on a variety of dried stored products and are found in houses, warehouses, flour mills, grain elevators, museums and other places where such materials are kept. Others are associated with bird, mammal, and wasp nests (Hicks 1959, Bousquet 1990), and nests of several cavity nesting megachilid bees (Fabre 1914, Linsley and MacSwain 1942, Linsley 1958, Krombein 1979, Bosch and Kemp, 2001). Our study provides the first North American records of *P. sexpunctatus* and indicates that it has become established in association with a native species of mason bee.

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METHODS

The abbreviations of collections referred to in this study are, as follows: **ACNS,** Agriculture and Agri-food Canada, Kentville, Nova Scotia, Canada; **NSMC,** Nova Scotia Museum, Halifax, Nova Scotia, Canada; **TKPC,** T. K. Philips Collection, Bowling Green, Kentucky, U.S.A.

RESULTS

In June 2003 a larval *Ptinus* specimen was collected from a nest of the blue orchard mason bee, *Osmia lignaria* Say (Hymenoptera: Megachilidae), in Upper Canard, Kings County, Nova Scotia, Canada, by C. Sheffield. It was reared to maturity and the adult proved to be *Ptinus sexpunctatus* Panzer (NSMC). Photographs of the specimen are available from Majka (2004). Subsequently, three specimens of *P. sexpunctatus* were discovered 28 April 2004 in Kentville, Kings County, Nova Scotia in nesting tubes of *O. lignaria* imported from Logan, Utah, U.S.A. (ACNS). Specimens of *Tricrania stansburyi* Haldeman (Coleoptera: Meloidae), a known parasite of bees (Linsley and MacSwain 1951), were also found in these nesting tubes. *Tricrania stansburyi* is a western species, found in Canada only in the Northwest Territories and British Columbia (Campbell 1991).

A much earlier North American collection of *P. sexpunctatus* was from Philadelphia, Pennsylvania, USA, a specimen taken on 26 January 1915 and "bred from an english walnut" (TKPC). The specimens from Nova Scotia, Pennsylvania, and Utah represent the first North American records of this Palearctic species.

DISCUSSION

Many pathways have and continue to spread ptinines and other adventive beetles to North America. Lindroth (1957) discussed dry ballast-mediated introductions and Spence and Spence (1988) highlighted introductions associated with plant nursery stock. Dried product pests, many of which have become cosmopolitan, have been introduced with imported stored goods. The Philadelphia record likely is based on a larva inside a walnut imported from Europe, the adult later emerging in the New World.

The introduction of *P. sexpunctatus* with stocks of bees represents another mode of entry. Two species of the genus *Osmia* (subgenus *Osmia s. str.*) have been introduced into the United States for research and evaluation as pollinators of tree fruits; *Osmia cornuta* (Latreille) from Spain and *O. cornifrons* (Radoszkowski) from Japan (Cane 2003). *Ptinus sexpunctatus* might have accompanied such introductions. Once in North America it likely colonized nests of the native *O. lignaria,* a closely related species. *Osmia cornuta* has also been imported to and evaluated in the western United States, including California and Utah. *Osmia lignaria* has been subsequently imported from Utah into Nova Scotia (2000-

2005) for evaluation as an apple pollinator (Sheffield et al., 2003). These records indicate that *P. sexpunctatus* is now established in Utah in association with *O. lignaria* and also suggest its establishment in Nova Scotia. The detailed bionomics of this species in bee nests and its potential impact in bee colonies has been little investigated. Tscharntke et al. (1998) listed it as a predator in the nests of *O. rufa* Linnaeus and *O. caerulescens* (Linnaeus) in Germany. Ingolf Steffan-Dewenter (pers. com.) has observed that *P. sexpunctatus* can be very destructive in *Osmia* nests in Germany and feels that the beetles might prey on larvae and pupae in addition to feeding on dead individuals.

Although there is no evidence that the meloid, *Tricrania stansburyi,* has become established in Nova Scotia, the collection of this western North American species in the province is another example of bee associates being introduced with the international trade and transport of bee stocks.

Even though dry ballast is no longer dumped on shorelines, and quarantine regulations now regulate the introduction of nursery stock, additional species of beetles continue to arrive on the continent. Some species may have little discernable effect on native species and ecosystems, while others may have a considerable economic impact on agriculture, horticulture, silviculture, or forestry. Large quantities of stored products are destroyed or contaminated annually by various arthropods, mainly beetles (Hinton 1945). Worldwide more than 600 species are associated with such products (Bousquet 1990). Although knowledge of the bionomics of *P. sexpunctatus* is meager, its destructive habits in *Osmia* nests in Germany suggest the potential for similar effects in North America.

The availability of baseline data on bionomics and distribution will be critical for detecting additional immigrant insects and assessing their potential impact on native species and ecosystems.

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HUMAN PARASITISM BY THE CAPYBARA TICK, *AMBLYOMMA DUBITATUM* (ACARI: IXODIDAE)[1]

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ABSTRACT: During two field trips in the state of São Paulo, two of us became infested by two adults, three nymphs, and one larva of the capybara tick, *Amblyomma dubitatum* Neumann, 1899 (= *Amblyomma cooperi* Nuttall and Warbuton, 1908). Previously, there has been only a single report of an *A. dubitatum* adult tick from humans. Our observations on human infestation by all parasitic stages of *A. dubitatum* suggest that this behavior may be more frequent than previously thought, especially in the case of immatures, which are herein reported from humans for the first time.

KEY WORDS: human parasitism, capybara, *Hydrochaeris hydrochaeris,* capybara tick, *Amblyomma dubitatum,* Acari, Ixodidae

Amblyomma dubitatum Neumann, 1899 (= *Amblyomma cooperi* Nuttall and Warbuton, 1908) is known as the capybara tick, since most collection records have been from the capybara, *Hydrochaeris hydrochaeris* (Linnaeus, 1766) (Rodentia: Hydrochaeridae) (Aragão, 1936; Evans et al., 2000; Guimarães et al, 2001). Although the range of this large, semiaquatic rodent encompasses all countries of South America (except Chile) and Panama (Emmons and Feer, 1997), *A. dubitatum* is restricted to areas of southern South America, specifically Uruguay, Argentina, Paraguay, Bolivia, and the west-central, southeastern, and southern portions of Brazil (Guglielmone et al., 2003; Vieira et al., 2004). Besides *A. dubitatum,* capybaras in Brazil are frequently infested by the cayenne tick *Amblyomma cajennense,* which is the principal vector of Brazilian spotted fever, a highly lethal zoonosis caused by the bacterium *Rickettsia rickettsii* (Guedes et al., 2005). In fact, capybaras are one of the few host species capable of successfully sustaining *A. cajennense* populations in Brazil (Vieira et al., 2005).

The natural habitats of capybaras are open grasslands and scrub vegetation near water bodies such as lakes, rivers and flooded areas (Emmons and Feer, 1997). In recent years, this habitat type has been significantly altered in southeastern Brazil by the expansion of agriculture (mainly sugar cane and corn), with crops maintained up to the water's edge. Consequently, the remaining natural areas are now inhabited by large numbers of capybara, sustained by surrounding croplands and an absence of natural predators (e.g., jaguars, alligators) (Ferraz et al., 2003). Not surprisingly, high tick densities (*A. dubitatum* and *A. cajennense*) have emerged in these capybara "refugia." The chief impact of this altered ecol-

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ogy has been the emergence of Brazilian spotted fever in areas with high capybara populations (Lemos et al., 1996; Labruna et al., 2004a; Vieira et al., 2004; Guedes et al., 2005).

While *A. cajennense* is the main vector of *R. rickettsii* in Brazil, *A. dubitatum* has been associated with another *Rickettsia* species, closely related to *R. parkeri* and *R. africae,* which is potentially pathogenic to humans (Labruna et al., 2004a; Horta et al., 2004a). Thus, cases of human parasitism by *A. dubitatum* in Brazil entail a potential risk of acquiring infection by this newly recognized *Rickettsia.* To date, however, there has been only a single report of human parasitism by *A. dubitatum*, consisting of an adult specimen from Pedreira, state of São Paulo (Famadas et al., 1997).

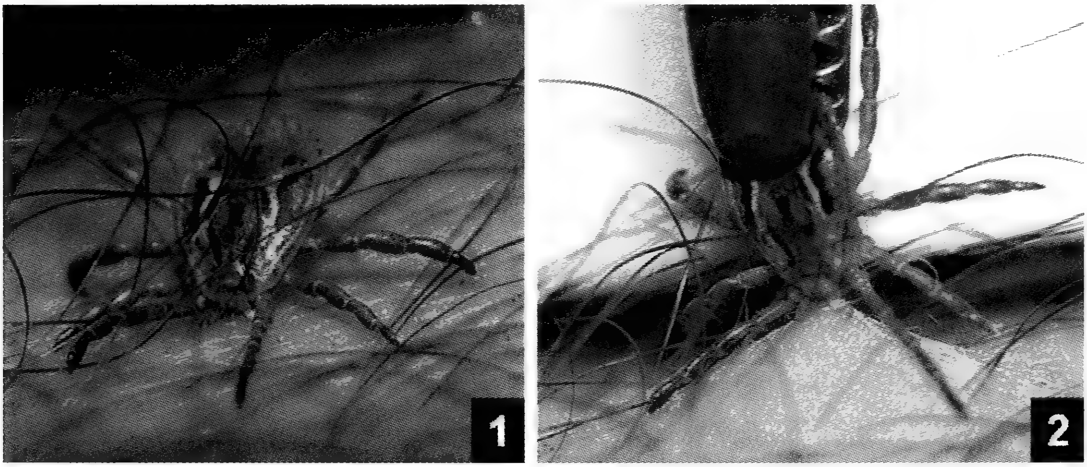
During 2005-2006, while conducting several surveys of Brazilian spotted fever in the state of São Paulo, we actively collected free-living ticks using dry ice traps, as previously described (Oliveira et al., 2000). Traps were set in areas inhabited by capybara and that usually contained large populations of both *A. cajennense* and *A. dubitatum.* On several occasions, we became infested by ticks while entering capybara habitat to place or recover dry ice traps. Most infestations consisted of numerous larvae and nymphs of *Amblyomma* sp. (ticks were not determined to species) and, to a lesser extent, adults of *A. cajennense.*

On 15 September 2005, during one of our field trips to capybara habitat in Ribeirão Grande Municipality (24°16'S, 48°25'W), one of us (M.B.L.) noticed an adult male of *A. dubitatum* attached to his belly. Although the tick was left attached to the skin, it was not found the following morning. It is not known if the tick actively detached or if it was groomed off by the author while sleeping. Regardless, the tick remained attached to the skin for at least 6 hours. During this trip, 43 adults of *A. dubitatum*, together with hundreds of larvae and 23 nymphs of *Amblyomma* spp., were collected from 20 dry ice traps, reflecting the high level of tick activity in the area.

On 26 January 2006, during a field trip to capybara habitat in Itu Municipality (23°15'22.7"S, 47°22'20.9"W), one of us (R.C.P.) noticed an adult male of *A. dubitatum* attached to the skin of his leg (Fig. 1). This tick was shown to be firmly attached by pulling upward on its body with forceps (Fig. 2). About 8 hours after being detected, the tick was manually removed from the skin and taken to the laboratory, where it was identified. On this same field trip, we were infested by dozens of larvae and nymphs of *Amblyomma* spp. Three of these nymphs and one larva were left to engorge on one of us (M.B.L.). After 4 to 5 days of feeding, the engorged ticks were manually removed from the skin and taken to the laboratory for molting in an incubator. Approximately three weeks later, the three nymphs molted to the adult stage, yielding 1 male and 1 female of *A. dubitatum*, and a female of *A. cajennense.* The engorged larva molted to a nymph, which was allowed to feed on a rabbit and, three weeks later, molted to an adult male of *A. dubitatum.* Also on this trip, 44 adults of *A. dubitatum* and 21 adults of *A. cajennense*, together with thousands of larvae and ≈1,200 nymphs of

Amblyomma spp., were collected from 20 dry ice traps, reflecting a very high level of local tick activity.

While it is well known that all active stages of *A. cajennense* aggressively attack humans (Aragão, 1936; Guimarães et al., 2001; Vieira et al., 2004), there has been but a single report of *A. dubitatum* from man (Famadas et al., 1997). Our observations on human infestation by all parasitic stages of *A. dubitatum* suggest that this behavior may be more frequent than previously thought, especially in the case of immatures, which are here reported from humans for the first time. Recent studies have demonstrated a broader host range for the immature stages of *A. dubitatum*, including turia (*Myocastor coypus*), deer (*Mazama gouazoubira*), monkey (*Alouatta caraya*), opossum (*Didelphis* spp.) and bird (*Rhea americana*) (Labruna et al., 2004b; Horta et al., 2004b). However, determination of immature *Amblyomma* involved in cases of human infestation in Brazil is often impossible either because these stages have not yet been described or because, as in *A. dubitatum* and *A. cajennense*, they lack distinguishing morphological characters.



Figures 1-2. An *Amblyomma dubitatum* adult male attached to a human. 1, close-up of the attached tick; 2, the same tick being pulled by forceps, demonstrating that its mouthparts were embedded in the host skin.

The results of the present study suggest that *A. dubitatum* may be a competent vector of rickettsiae to humans, since this tick has been found infected by spotted fever group (SFG) rickettsiae (Lemos et al., 1996; Labruna et al., 2004a). Interestingly, evidence of infection by this *A. dubitatum*-borne SFG rickettsia has been reported in dogs (Horta et al., 2004a). Finally, it should be noted that the human infestations by *A. dubitatum* reported here occurred while we were working with dry ice traps in the field. It is possible that the sublimation of dry ice into CO_2 gas had an excitatory effect on the ticks, resulting in greater aggressiveness toward humans. Further studies should be conducted to test the effects of such extrinsic stimuli on tick host specificity.

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A NEW SPECIES OF *TALLAPERLA* (PLECOPTERA: PELTOPERLIDAE) FROM NORTH CAROLINA, U.S.A.[1]

Boris C. Kondratieff,[2] R. F. Kirchner,[3] Robert E. Zuellig,[4] and David R. Lenat[5]

ABSTRACT: A new species of *Tallaperla, T. maiyae,* is described from Wilkes County, North Carolina, U.S.A. from two males. The new species is similar to *T. maria* and *T. anna,* but can be distinguished by the combination of a prominent spine-like epiproct and brown coloration.

KEY WORDS: Plecoptera, stonefly, *Tallaperla,* new species, North Carolina, U.S.A.

Stark (1983, 2000) reviewed the eastern Nearctic roachfly genus *Tallaperla,* recognizing six species distributed mainly along the Appalachian Mountains. Recent collecting in North Carolina revealed an additional distinctive species related to *T. maria* (Needham and Smith) and *T. anna* (Needham and Smith). The description follows the style of Stark (2000).

Tallaperla maiyae, new species Kondratieff, Kirchner, and Zuellig
(Figs. 1-2)

Adult. Male. Macropterous. Forewing length 13-14 mm. General color brown. Epiproct sclerite extending laterally around membranous cowl; mesal part of sclerite an erect prominent spine (Fig. 1). Knob 2.0X wide as long (Fig. 2), margined with black hairs. Paraprocts acute (Fig 2).

Female. Unknown.

Type Data: Holotype ♂: U.S.A., North Carolina, Wilkes County, Middle Fork Reddies River, Old NC 16, east of Wilbur, N 36.2189 W 81.30073, 2 May 2005, B. C. Kondratieff, R. F. Kirchner, R. E. Zuellig, and D. R. Lenat (USNM). Paratype ♂, same data as holotype. The holotype will be deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D.C. (USNM), paratype male in the Colorado State University C. P. Gillette Museum of Arthropod Diversity, Fort Collins, Colorado (CSUC).

Etymology. The patronym continues the use of female names for this genus, and honors the senior author's daughter, Maiya L. Kondratieff.

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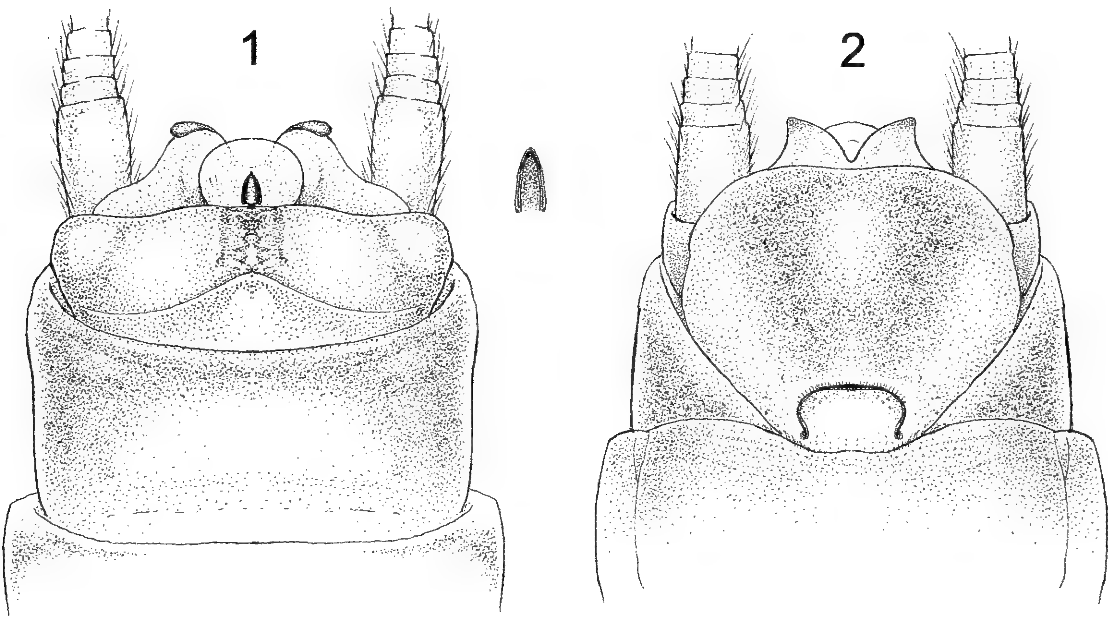

Figures 1-2. *Tallaperla maiyae* male genitalia. 1. Dorsal aspect, inset epiproct. 2. Ventral aspect.

Diagnosis. Males of *T. maiyae* are most similar to *T. maria,* but can be distinguished by the prominent, erect, central spine-like epiproct sclerite. In *T. maria,* the epiproct sclerite is variable, usually slender mesally and poorly developed laterally (Stark 2000, see Fig. 4.18). The upright central spine-like epiproct sclerite is similar only to *T. anna* (Needham and Smith), but the yellow-brown body color of *T. anna* easily separates it from the brown body color of *T. maiyae.*

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We thank Bill P. Stark, Mississippi College, for confirming the status of this new species and providing comments. Dave Carlson, Windsor, Colorado rendered the illustrations.

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SPECIES OF *SYNECHES* FROM GUANGXI, CHINA (DIPTERA: HYBOTIDAE)[1]

Ding Yang[2, 3]

ABSTRACT: The genus *Syneches* Walker is recorded from Guangxi for the first time. Two new species, *S. guangxiensis* and *S. maoershanensis,* are described.

KEY WORDS: Diptera, Hybotidae, *Syneches*, new species, Guangxi, China

The genus *Syneches* Walker is characterized by Rs very long, anal cell nearly as long as basal cells, hind femur weakly to distinctly thickened with distinct ventral bristles, male genitalia symmetrical (Chvála, 1983). It is distributed worldwide with over 120 known species. There were 40 known species from the Oriental Region (Smith, 1975) and 12 known species from the Palaearctic Region (Chvála and Kovalev, 1989). The Chinese species of *Syneches* were revised recently by Yang and Yang (2004) and 18 species were recorded. Herein, *Syneches* is recorded from Guangxi for the first time with two new species, supplementing Yang and Yang (2004). The types are deposited in the Entomological Museum of China Agricultural University (CAU), Beijing. The following abbreviations are used for bristles: ad-anterodorsal, av-anteroventral, h-humeral, oc-ocellar, npl-notopleural, pd-posterodorsal, psa-postalar, pv-posteroventral. Basic terminology follows McAlpine (1981).

Syneches guangxiensis NEW SPECIES

(Figs. 1-2)

Diagnosis. Antenna brown with brownish yellow pedicel. Palpus brownish yellow. Fore and mid femora black with yellow tips, hind femur yellow.

Description. Male. Body length 5.6-5.7 mm, wing length 5.0-5.4 mm. Head black with gray pollen. Eyes holoptic, dark brown with enlarged upper facets dark yellow. Hairs and bristles on head black; ocellar tubercle distinct, with 2 oc and 4 posterior hairs, oc distinctly longer than hairs. Antenna brown with brownish yellow pedicel; scape without hairs; pedicel with circlet of subapical hairs; first flagellomere nearly quadrate with 2 dorsal hairs; arista brown, indistinctly pubescent except tip thin and bare. Proboscis brownish yellow; palpus brownish yellow with 2-3 long ventral hairs.

Thorax black with gray pollen. Hairs and bristles on thorax black; h absent, 2 npl, mesonotum with short hairs except mid-posterior area with several slightly

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long hairs and with one transverse row of 3 long prescutellar bristles, 1 long psa; scutellum with long marginal hairs (of which 6 hairs are bristle-like). Legs yellow; coxae and trochanters black; fore and mid femora black with yellow tips, hind femur yellow; tarsomere 5 black. Hairs and bristles on legs black. Fore femur 1.2 times as wide as mid femur; hind femur 1.2 times as wide as mid femur, with row of 4-5 long av (which are distinctly longer than thickness of hind femur). Fore tibia with 5 thin ad, apically with 1 long av and 1 very long brownish yellow pv. Mid tibia with 3-4 ad and several long posterior hairs, apically with 4 brownish yellow bristles. Hind tibia with 1 long ad, apically with 4 brownish yellow bristles. Wing grayish; stigma dark brown; veins dark brown, R_{4+5} and M_1 convergent apically. Squama brownish with brown hairs. Halter dark brown.

Abdomen curved downward, black with gray pollen. Hairs on abdomen black. Male genitalia (Figs 1-2): Epandrial lobe rather narrow apically in lateral view, with apical portion strongly curved inwards and apical margin weakly incised; hypandrium deeply incised apically, with acute apico-lateral portion slightly curved outwards; aedeagus rounded apically, with short curved subapical lateral process.

Female. Body length 4.4-6.0 mm, wing length 5.0-5.4 mm. Similar to male, but abdomen nearly straight, halter dark yellow, hairs on abdomen partly brownish.

Type Data. Holotype male, Guangxi: Maoershan (1100-1600 m), 2003. VI. 29, Shuwen An (CAU). Paratypes 1 male 2 females, same as holotype (CAU); 1 male, Guangxi: Maoershan, Jiuniutang (1100 m), 2003. VI. 29, with light trap, Xingyue Liu (CAU).

Etymology. The species is named after the type locality Guangxi.

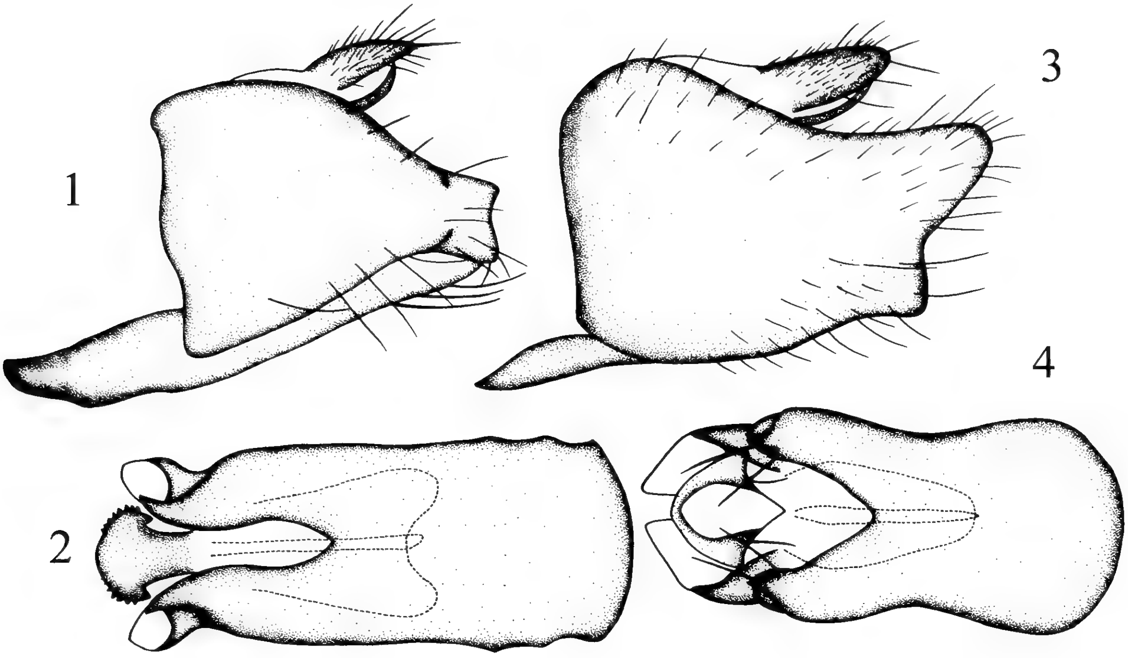
Discussion. The new species is somewhat similar to *Syneches acutatus* Saigusa et Yang from Henan, but it can be separated from the latter by the fore and mid femora black with yellow tips and hind femur entirely yellow, and the hypandrium deeply incised apically. In *S. acutatus,* the femora are yellow with the wide basal portion of the fore femur and narrow basal portion of the mid and hind femora brown, the hypandrium is shallowly incised apically (Saigusa and Yang, 2002; Yang and Yang, 2004).

Syneches maoershanensis NEW SPECIES

(Figs. 3-4)

Diagnosis. Antenna dark brown with pedicel brown. Palpus brownish. Femora black with yellow tips.

Description. Male. Body length 4.0 mm, wing length 4.3 mm. Head black with gray pollen. Eyes holoptic, brown with enlarged upper facets dark yellow. Hairs and bristles on head black; ocellar tubercle distinct, with 2 oc and 6 hairs, oc longer than hairs. Antenna dark brown with brown pedicel; scape without hairs; pedicel with circlet of subapical hairs; first flagellomere nearly quadrate



Figures 1-4. 1-2. *Syneches* guangxiensis new species, 3-4. *Syneches* maoershanensis new species. 1, 3. Male genitalia, lateral view; 2, 4 hypandrium and aedeagus, ventral view.

with 2 dorsal hairs; arista brown, indistinctly pubescent except tip thin and bare. Proboscis brownish; palpus brownish with 2 long ventral hairs.

Thorax black with gray pollen. Hairs and bristles on thorax black; h absent, 2 npl (anterior npl short), mesonotum with short hairs except mid-posterior area with long hairs and with one transverse row of 3 bristle-like prescutellar bristles, 1 long psa; scutellum with long marginal hairs mostly bristle-like. Legs black; femora with yellow tips; knees blackish; tibiae and tarsi yellow except hind tibia brown with yellow tip and tarsomere 5 dark brown. Hairs and bristles on legs black. Fore femur 1.2 times as wide as mid femur; hind femur 1.3 times as wide as mid femur, with row of 6-7 long av (which are slightly longer than thickness of hind femur). Fore tibia with long posterior hairs, apically with 1 long weak pv. Mid tibia with 2 long ad and 1 long pd on basal half and several long posterior hairs, apically with 4-5 bristles (of which 2 av and 1 pv are long and brownish yellow). Hind tibia with 1 ad near base, apically with 4-5 bristles (of which 2 av and 1 long pd are brownish yellow). Wing hyaline, weakly tinged with gray; stigma brown; veins dark brown, R_{4+5} and M_1 distinctly convergent apically. Squama brown with brownish yellow hairs. Halter dark brown.

Abdomen curved downward, black with gray pollen. Hairs on abdomen mostly pale. Male genitalia (Figs. 3-4): Epandrial lobe slightly narrowed apically in lateral view, outer apical margin oblique and weakly incised; hypandrium deeply incised apically, apico-lateral portion with 2 short acute spines; aedeagus rounded apically, with weak subapical lateral process.

Female. Unknown.

Type Data. Holotype male, Guangxi: Maoershan, Hongjunting (1600 m), 2003. VI. 28, with light trap, Xingyue Liu (CAU).

Etymology. The species is named after the type locality Maoershan.

Discussion. The new species is similar to *Syneches guangxiensis* sp. nov., but may be separated from the latter by the hind femur black with the yellow tip. In *S. guangxiensis,* the hind femur is yellow.

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SCIENTIFIC NOTE

SEX DISCRIMINATION OF ADULT *CURCULIO NUCUM* L. (COLEOPTERA: CURCULIONIDAE), A PEST OF HAZELNUTS IN TURKEY[1]

Izzet Akça,[2] Celal Tuncer,[3] and Islam Saruhan[4]

The hazelnut weevil, *Curculio nucum* L., is the key pest of hazelnut (*Corylus avellana* L., Betulaceae) in many countries. Recently, increasing attention on the pest status of *C. nucum* in commercial orchards has accelerated the number of studies on its biology, behavior, and ecology (Ural, 1957; Tabamaishvili, 1988; Paparatti, 1990; Pucci, 1992; AliNiazee, 1997; 1998; Milenkovic and Mitrovic, 2001; Tuncer and Ecevit, 1997; Tuncer et al., 2001; Akça and Tuncer, 2005). At times, biological, behavioral, and ecological studies require researchers to determine the sex of adults without dissecting the genitalia and killing the organisms. Many earlier studies used the length of the rostrum in *C. nucum* as a criterion to distinguish their sex (Ural, 1957; Tabamaishvili, 1988; Sezen et al., 1999; Akça and Tuncer, 2005). In addition to this character, our previous study described several differences in average body size and elytral size between males and females in *C. nucum*. However, owing to large variation, sex discrimination using these characters, except rostral length, is not reliable.

Rostral length is a good character to sex adult *C. nucum* [averaging 5.56 (4.92-6.65) and 3.96 (3.35-4.56) mm for female and male, respectively, differing significantly between sexes, $t_{0.05}$ (2), 49 = 30.2]; Akça and Tuncer, 2005). However, using rostral length is not convenient because it requires a device for measurement, and it appears to be affected by environmental factors. Also, the differences in rostral length can be as little as 0.5 mm, making it time-consuming and cumbersome to use, particularly for field applications (Akça and Tuncer, 2005). Duan et al. (1999) suggested the use of a suture dividing the last two abdominal tergites of males, instead of snout length, for sexing adult *Anthonomus pomorum* (Coleoptera: Curculionidae). Lykewise, Sappington and Spurgeon (2000) demonstrated that the tergal-notch in the eighth tergite of male *Anthonomus grandis* (Coleoptera: Curculionidae) is more accurate than snout characteristics for sexing the adults. This study describes a new, nondestructive character associated with abdominal tergites to discriminate male and female *C. nucum* adults.

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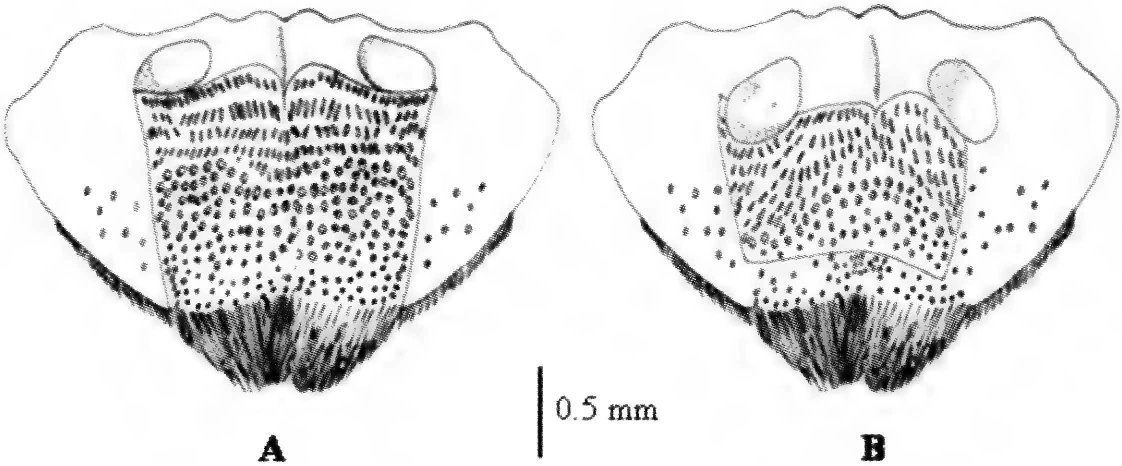

Fig. 1. Dorsal view of the last abdominal tergites (AVII and AVIII) of female (A) and male (B) *C. nucum* after the elytra are separated by gently pressing them downwards.

Adult *C. nucum* were collected by shaking branches of hazelnut trees from randomly selected orchards in Samsun, Turkey, during May 2002. Fifty male and 50 female weevils were examined with a stereomicroscope (6-10 x magnification, Leica S6D) for exploring differences in abdominal tergites.

We found that male and female *C. nucum* can be conclusively distinguished by differences on their last two visible abdominal tergites, AVII and AVIII (Fig. 1). In females, the last two abdominal tergites are clearly covered with dense setae in a square shape area that extends to the posterior end of each segment. However, this cover is not as developed in males and it does not extend to end of the abdomen. In males, this rectangular velvety area is only about two-thirds the size of that in females. The differences in the last abdominal tergites of both sexes mentioned here are very clear if adult weevils are inspected in prone position by separating elytra. Because the adult *C. nucum* is relatively small (circa 7 mm), at least 6x magnification is recommended to see these differences clearly. The differences in the last abdominal tergites are the most distinct and practical character to rapidly and accurately discriminate the sexes of adult *C. nucum.*

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AN ANNOTATED LIST OF THE GREEN LACEWINGS (NEUROPTERA: CHRYSOPIDAE) OF NORTHWESTERN TURKEY, WITH NEW RECORDS, THEIR SPATIO-TEMPORAL DISTRIBUTION, AND HARBORING PLANTS[1]

Bahattin Kovanci[2] and Orkun Baris Kovanci[2]

ABSTRACT. The occurrence and distribution of green lacewing species (Neuroptera: Chrysopidae) were studied in northwestern Turkey in 1992-2005. A total of 3529 green lacewing adults were collected from 154 localities, representing 23 species. Among these, 21 species belonged to the subfamily Chrysopinae, while only two species were members of the subfamily Nothochrysinae. Four species were new records for northwestern Turkey. The most frequently caught species were *Chrysoperla carnea sensu lato* and *Dichochrysa prasina* with percent dominance values of 26.10 and 18.22%, respectively. The cumulative number of chrysopid species was highest during July with a total of 18 species per month. There were 13, 20, 19 and one chrysopid species occurring at altitudes between 1-500, 501-1000, 1001-1500 and >1500 m species, respectively. *Rexa raddai* was recorded at altitudes higher than 500 m, namely 925 m, for the first time. In addition, plant species harboring chrysopids are provided for each species and their association with the chrysopid fauna is discussed.

KEY WORDS: Neuroptera, Chrysopids, altitude, northwestern Turkey, harboring plants, phenology

Among the families of the order Neuroptera, the green lacewing family, Chrysopidae, have probably received the most attention in the world owing to larval predatory activity on many insect species including aphids, mealybugs, leafhoppers, thrips, scales, and mites. Studies on the Chrysopidae fauna of Turkey were first initiated by Brauer (1876) in the late 1800s and followed by the works of other European entomologists (Esben-Petersen, 1932; Holzel, 1967a, b; Aspock and Aspock, 1969; Gepp, 1974; Popov, 1977; Aspock et al., 1980; Holzel and Ohm, 1986; Monserrat and Holzel, 1987). However, these studies were either limited to the biological expeditions within a restricted time period or to the specimens collected from Turkey, which were later sent to worldwide taxonomists for identification.

The first comprehensive study on the chrysopid fauna of Turkey was conducted by Sengonca (1979, 1980) who reported the presence of 32 chrysopid species in Turkey. Later studies focused on the species diversity at the local level (Duzgunes et al., 1981; Ari and Kiyak, 2000; Canbulat and Kiyak, 2000; Bahadiroglu and Daymaz, 2001; Gaziyiz-Onar and Aktac, 2002). Local research efforts have led to the discovery of new species both for the Turkish (Canbulat and Kiyak, 2002, 2004) and world fauna (Canbulat and Kiyak, 2003, 2005). With these new additions, the total number of chrysopid species reported from Turkey reached to 48 species.

There has been no detailed study on the chrysopid fauna at the local level in Bursa province of northwestern Turkey although the chrysopid map of Turkey drawn by Aspock et al. (1980) showed the occurrence of 13 chrysopid species in this region. Sengonca (1981) found another chrysopid species during a national survey, so the number of species totaled 14 in Bursa. However, these figures are believed to underestimate the actual number of chrysopid species in Bursa province

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as far as the diversity of natural and agricultural ecosystems from sea level to Mount Uludag (2543 m) are concerned.

Temperature can affect the development of chrysopid species as well as their geographic and seasonal distribution (Canard and Principi, 1984). For example, *Chrysoperla carnea* (Stephens, 1836) *sensu lato* (= *s.l.*) has the broadest environmental tolerance compared with other chrysopid species and can be found anywhere from lowlands to high Mountains. However, the occurrence of individual chrysopid species in a geographical region is determined not only by climatic conditions, but also by the character of habitat and vegetation. The number of chrysopid species decreases in response to a decline of vegetation richness with increasing altitude and latitude (Zeleny, 1984a). Yet, there is little information available about the spatial distribution of chrysopid species and their species richness in Bursa province.

The objectives of this study were to determine the species composition, adult phenology and spatio-temporal distribution of green lacewing species in natural and man-altered habitats in Bursa.

METHODS

A survey of green lacewing adults was carried out from January 2004 to December 2005 in Bursa province located between 39-41° N and 28-30° E in northwestern Turkey. Moreover, green lacewing species collected within the framework of other studies during 1992-2003 were also included. Specimens were collected from 154 localities in 17 counties of Bursa province. Localities were chosen depending on the ecosystem diversity and altitudinal variation. Altitudes, route tracks and directions were measured with Magellan Sportrak Pro GPS (Thales Navigation, CA, U.S.A.).

Each green lacewing specimens was collected from its harboring plant. Living specimens were identified immediately after capturing or they were brought back to laboratory alive and killed with ethyl acetate (Neuenschwander, 1984). All the chrysopid specimens were pinned with their wings spread, then dried and preserved in Plant Protection Department collection of Faculty of Agriculture at Uludag University. Species were identified according to the descriptions of Holzel (1965), Aspock et al. (1980), Sengonca (1980) and Canard et al. (1998). Feminity rate of each species was calculated using the following formula: Feminity rate = number of females/total number of (males + females).

RESULTS

The species composition, feminity rate and percent dominance values of adult green lacewings collected from 17 counties of Bursa province in 1992-2005 are given in Table 1. A total of 3529 chrysopid adults, representing 23 species were caught. Among these, 21 species belonged to the subfamily Chrysopinae, while only two species were members of the subfamily Nothochrysinae. Four chrysopid species were recorded from northwestern Turkey for the first time (Table 1).

Adult phenology of green lacewing species for 15-day periods from January to December is presented in Table 2. Only *Ch. carnea s.l.* adults were constantly present in all months of the year. Adults of a few species emerged in April while most species appeared in May. Adult flight activity increased during the summer months. The cumulative number of chrysopid species was highest during July with a total of 18 species per month. While many species tend to have a fairly prolonged flight period up to September and October, a few were restricted to specific seasons. For example, *Rexa raddai* (Holzel, 1966) adults were collected mainly in the spring whereas *Italochrysa italica* (Rossi, 1790) adults occurred only in the summer.

The altitudinal distribution and harboring plants of green lacewing species are summarized in Table 3. There were 13, 20, 19 and 1 green lacewing species occurring at altitudes between 1-500, 501-1000, 1001-1500 and >1500 m, respectively. Of these, eight were found below 100 m altitude. Among all chrysopid species, *Ch. carnea s.l.* showed the greatest environmental tolerance in terms of the altitudinal distribution and host plant preference. *Ch. carnea s.l.* adults were caught at shrub, herbaceous and foliage-crown levels on all kinds of vegetation. Both *Ch. carnea s.l.* and *Dichochrysa prasina* (Burmeister, 1839) were ubiquitous species that occurred in mixed stands of deciduous tree species and coniferous trees. However, some species like Chrysopa viridana Schneider, 1845 were thermophilous, and preferred only oak and coniferous forest stands.

Information on the number and sex of specimens from each species, localities where rare specimens were collected, extreme dates of adult flights, and interesting facts about green lacewing species observed in the field was summarized below.

Table 1. Species composition, feminity rate and percent dominance values of green lacewings collected in 1992-2005 in Bursa province, northwestern Turkey

Species	**Female**	**Male**	**Total**	**Feminity Rate (%)****	**Dominance Value (%)**
Chrysopa dorsalis	91	80	171	53.20	4.85
C. formosa	63	74	137	45.90	3.88
C. hungarica	-	1	1	?	0.03
C. pallens	46	64	110	41.80	3.12
C. perla	60	66	126	47.60	3.57
C. viridana	214	224	438	48.80	12.41
Chrysoperla carnea s.l.	515	406	921	55.90	26.10
Cunctochrysa albolineata	37	33	70	52.80	1.98
Cu. baetica	1	1	2	50.00	0.06
Dichochrysa clathrata	8	7	15	53.30	0.43
D. flavifrons	80	124	204	39.20	5.78
D. inornata	5	2	7	71.40	0.20
D. prasina	354	289	643	55.00	18.22
D. zelleri	131	78	209	62.60	5.92
Hypochrysa elegans	12	27	39	30.70	1.11
Italochrysa italica	94	80	174	54.00	4.93
Nineta carinthiaca	-	1	1	?	0.03

*N. flava**	5	4	9	55.50	0.26
*N. pallida**	6	7	13	46.10	0.37
*N. principiae**	76	60	136	55.90	3.85
*Nothochrysa fulviceps**	9	2	11	81.80	0.31
Peyerimhoffina gracilis	3	7	10	30.00	0.28
Rexa raddai	34	48	82	41.40	2.32
Total no. individuals	1844	1685	3529		

* New records for northwestern Turkey

** Feminity rate= number of females/total number of (males + females)

Annotated List
Subfamily: Chrysopinae

***Chrysopa dorsalis* Burmeister, 1839**

The first adult catch was recorded from *Pinus* spp. on 28 May at Orhaneli County (Erenler, 6 km NE, 425 m) and (Mahaller, 3 km SE, 990 m), and the last adult catch occurred on 23 October at Nilufer County (Kayapa inlet, 180 m). This species was collected in 29 of the 154 localities studied. A total of 171 adults composed of 91 females and 80 males were captured.

***Chrysopa formosa* Brauer, 1850**

Chrysopa formosa adults were generally found on low vegetation, shrubs, fruit orchards and forest edges near urban areas. Adults were first caught in sweep nets on 3 May at Mudanya County (Zeytinbagi, 3 km SW, 170 m) and no adults were caught after 21 September. This species was widely distributed in 27 localities. Overall, the number of adult catches during the study period totaled 137 (63 females, 74 males).

***Chrysopa hungarica* Klapalek, 1839**

2004: 20.V, 1♂ (Inegol County, Sehitler, 2 km S, 370 m).

***Chrysopa pallens* (Rambur, 1838)**

This species occurred commonly and collected from 39 of the 154 localities visited. Of 110 adults caught, 46 were females and 64 were males. Adults were first and last detected on 8 May and 24 October at Kestel County (Derekizik, 2 km N, 300 m) and Nilufer County (Kayapa inlet 180 m), respectively. Specimens were found in orchards, tree and shrub associations, oak and pine forests and low vegetation (Table 3).

***Chrysopa perla* Linnaeus, 1758**

Sweep net catches showed a north-south trend in distribution of *C. perla* adults. Of the 23 localities where this species was collected, 10 were located in the northern slopes of Mount Uludag and 9 were in the southern slopes. This species was also found in 3 more localities to the north of Mount Uludag. There was only one exception to the west. Based on sweep net catches, adults emerged on 8 May at Kestel County (Derekizik, 2 km N, 300 m) and adult flight ended on 14 August in the same County (Alacam, 1 km N, 775 m). A total of 126 adults, 60 females and 66 males, were captured on all kinds of vegetation.

***Chrysopa viridana* Schneider, 1845**

Chrysopa viridana was the four most widespread species. Adults of this species were caught in 47 localities composed mainly of oak forests and oak-pine associations. Of the

Table 2. Adult phenology of green lacewing species for 15-day periods from January to December in Bursa province, northwestern Turkey.

Species	Months																							
	I		II		III		IV		V		VI		VII		VIII		IX		X		XI		XII	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Chrysopa dorsalis	–	–	–	–	–	–	–	–	–	+	+	+	+	+	+	+	–	+	–	+	–	–	–	–
C. formosa	–	–	–	–	–	–	–	–	+	+	+	+	+	+	+	+	+	+	–	–	–	–	–	–
C. hungarica	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–
C. pallens	–	–	–	–	–	–	–	–	+	+	+	+	+	+	+	+	+	–	–	+	–	–	–	–
C. perla	–	–	–	–	–	–	–	–	+	+	+	+	+	+	+	–	–	–	–	–	–	–	–	–
C. viridana	–	–	–	–	–	–	–	–	–	+	+	+	+	+	+	+	+	–	–	–	–	–	–	–
Chrysoperla carnea s.l.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Cunctochrysa albolineata	–	–	–	–	–	–	–	–	–	+	+	+	+	+	+	+	+	–	–	–	–	–	–	–
Cu. baetica	–	–	–	–	–	–	–	–	–	–	–	–	+	–	+	–	–	–	–	–	–	–	–	–
Dichochrysa clathrata	–	–	–	–	–	–	–	–	–	+	+	+	+	+	–	+	–	–	–	–	–	–	–	–
D. flavifrons	–	–	–	–	–	–	–	–	+	+	+	+	+	+	+	+	+	+	+	+	–	–	–	–
D. inornata	–	–	–	–	–	–	–	–	–	–	–	–	+	+	–	–	–	–	–	–	–	–	–	–
D. prasina	–	–	–	–	–	–	–	+	+	+	+	+	+	+	+	+	+	+	+	+	–	–	–	–
D. zelleri	–	–	–	–	–	–	–	+	+	+	+	+	+	+	+	+	+	+	–	–	–	–	–	–
Hypochrysa elegans	–	–	–	–	–	–	–	–	+	+	–	+	–	–	–	–	–	–	–	–	–	–	–	–
Italochrysa italica	–	–	–	–	–	–	–	–	–	–	–	–	+	+	+	+	+	–	–	–	–	–	–	–
Nineta carinthiaca	–	–	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–
N. flava	–	–	–	–	–	–	–	–	–	–	+	+	+	+	–	+	+	–	–	–	–	–	–	–
N. pallida	–	–	–	–	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–
N. principiae	–	–	–	–	–	–	–	–	–	+	+	+	+	+	+	+	+	+	–	–	–	–	–	–
N. fulviceps	–	–	–	–	–	–	–	–	–	–	–	+	+	+	+	+	–	–	–	–	–	–	–	–
Peyerimhoffina gracilis	–	–	–	–	–	–	–	–	–	–	–	–	+	+	+	–	+	–	–	–	–	–	–	–
Rexa raddai	–	–	–	–	–	–	+	+	+	+	+	–	–	–	–	–	–	–	–	–	–	–	–	–

Table 3. Altitudinal distribution and harboring plants of green lacewing species in Bursa province, northwestern Turkey.

Species	Altitude (m)	Harboring plants
Chrysopa dorsalis	180 - 1430	*Pinus brutia* Ten., *Pinus nigra* Arnold, *Pinus sylvestris* L. (all Pinaceae)
C. formosa	55 - 945	*Acer* spp. (Aceraceae), *Ficus carica* L. (Moraceae), *Olea europea* L. (Oleaceae), *Phillyrea latifolia* L. (Oleaceae), *Pinus brutia* Ten. (Pinaceae), *Pinus nigra* Arnold (Pineceae), *Quercus* spp. (Fagaceae), *Vitis vinifera* L. (Vitaceae), weeds
C. hungarica	370	*Triticum aestivum* L. (Poaceae)
C. pallens	15 - 1300	*Corylus avellana* L. (Betulaceae), *Ficus carica* L. (Moraceae), *Fragaria vesca* L. (Rosaceae), *Juglans regia* L. (Juglandaceae), *Olea europea* L. (Oleaceae), *Phillyrea latifolia* L. (Oleaceae), *Pinus brutia* Ten. (Pinaceae), *Pinus nigra* Arnold (Pinaceae), *Prunus avium* (L.) L. (Rosaceae), *Prunus domestica* L. (Rosaceae), *Pyrus communis* L. (Rosaceae), *Quercus* spp. (Fagaceae), *Vitis vinifera* L. (Vitaceae)
C. perla	300 - 1500	*Corylus avellana* L. (Betulaceae), *Fragaria vesca* L. (Rosaceae), *Malus domestica* Borkh. (Rosaceae), *Pinus brutia* (Pinaceae), *Pinus nigra* (Pinaceae), *Prunus avium* (L.) L. (Rosaceae), *Prunus cerasifera* Ehrh. (Rosaceae), *Quercus* spp. (Fagaceae), *Triticum aestivum* L. (Poaceae), Weeds
C. viridana	125 - 1300	*Juglans regia* L. (Juglandaceae), *Pinus brutia* Ten. (Pinaceae), *Pinus nigra* Arnold (Pinaceae), *Quercus* spp. (Fagaceae), *Ulmus* spp. (Ulmaceae)
Chrysoperla carnea s.l.	10 - 2000	various fruit trees, forest trees, ornamental plants, shrubs
Cunctochrysa albolineata	515 - 1430	*Corylus avellana* L. (Betulaceae), *Fragaria vesca* L. (Rosaceae), *Pinus brutia* Ten., *Pinus nigra* Arnold, *Pinus sylvestris* L. (all Pinaceae), *Prunus cerasifera* Ehrh. (Rosaceae), *Quercus* spp. (Fagaceae)
Cu. baetica	625 - 725	*Pinus sylvestris* L. (Pinaceae), *Quercus* spp. (Fagaceae)
Dichochrysa clathrata	300 - 1200	*Cornus mas* L. (Cornaceae), *Juniperus oxycedrus* L. (Cupressaceae), *Phillyrea latifolia* L. (Oleaceae), *Prunus cerasifera* Ehrh. (Rosaceae), *Quercus* spp. (Fagaceae)
D. flavirons	55 - 1430	*Juglans regia* L. (Juglandaceae), *Juniperus oxycedrus* L. (Cupressaceae), *Malus domestic*a Borkh. (Rosaceae), *Olea europea* L. (Oleaceae), *Phillyrea latifolia* L. (Oleaceae), *Pinus brutia* Ten. (Pinaceae), *Pinus nigra* Arnold (Pinaceae), *Prunus avium* (L.) L. (Rosaceae), *Pyrus communis* L. (Rosaceae), *Quercus* spp. (Fagaceae), *Tilia* spp. (Tiliaceae), *Ulmus* spp. (Ulmaceae)
D. inornata	525 - 1030	*Malus domestica* Borkh. (Rosaceae), *Quercus* spp. (Fagaceae)

(Table 3 continued)

D. prasina	35 - 1430	*Abies bornmuelleriana* Mattf. (Pinaceae), *Corylus avellana* L. (Betulaceae), *Ficus carica* L. (Moraceae), *Fragaria vesca* L. (Rosaceae), *Juglans regia* L. (Juglandaceae), *Malus domestica* Borkh. (Rosaceae), *Olea europea* L. (Oleaceae), *Phillyrea latifolia* L. (Oleaceae), *Pinus brutia* Ten. (Pinaceae), *Pinus nigra* Arnold (Pinaceae), *Populus* spp. (Salicaceae), *Prunus cerasifera* Ehrh. (Rosaceae), *Prunus domestica* L. (Rosaceae), *Prunus persica* (L.) Batsch., *Pyrus* spp. (Rosaceae), *Quercus* spp. (Fagaceae), *Salix* spp. (Salicaceae), *Tilia* spp. (Tiliaceae), *Triticum aestivum* L. (Poaceae), Weeds
D. zelleri	10 - 1300	*Abies bornmuelleriana* Mattf. (Pinaceae), *Juglans regia* L. (Juglandaceae), *Juniperus oxycedrus* L. (Cupressaceae), *Phillyrea latifolia* L. (Oleaceae), *Pinus brutia* Ten. (Pinaceae), *Prunus cerasifera* Ehrh. (Rosaceae), *Pyrus communis* L. (Rosaceae), *Quercus* spp. (Fagaceae)
Italochrysa italica	15 - 1060	*Pinus nigra* Arnold (Pinaceae), *Pinus sylvestris* L. (Pinaceae), *Quercus* spp. (Fagaceae)
Nineta carinthiaca	1215	*Quercus* spp. (Fagaceae)
N. flava	715 - 1300	*Quercus* spp. (Fagaceae)
N. pallida	1030 - 1110	*Abies bornmuelleriana* Mattf. (Pinaceae), *Pinus nigra* Arnold (Pinaceae)
N. principiae	715 - 1300	*Quercus* spp. (Fagaceae)
Nothochrysa fulviceps	830 - 1030	*Fagus orientalis* Lipsky. (Fagaceae), *Quercus* spp. (Fagaceae)
Peyerimhoffina gracilis	725 - 1430	*Abies bornmuelleriana* Mattf. (Pinaceae), *Pinus nigra* Arnold (Pinaceae), *Pinus sylvestris* L. (Pinaceae)
Rexa raddai	10 - 925	*Olea europea* L. (Oleaceae), *Phillyrea latifolia* L. (Oleaceae)

* Predominantly *Quercus cerris* L. (Fagaceae)

438 adults captured, females and males constituted 49% and 51% of the captures, respectively. First adults were found on 21 May at Orhaneli County (Erenler, 6 km NE, 425 m), and last adults were seen on 2 September at Osmangazi County (Sogukpinar, 1 km NW, 1060 m).

Chrysoperla carnea **(Stephens, 1836) sensu lato (= s.l.)**

Chrysoperla carnea s.l. was the most widespread and common green lacewing species. This species was caught in 121 of the 154 localities. Of the 921 collected specimens, 515 were females and 406 were males. *Ch. carnea s.l.* adults were found throughout the year and remained in low numbers as overwintering adults in reproductive diapause on olive leaves, oleaceous shrubs, and dry but unfallen fig and oak leaves during the winter.

Cunctochrysa albolineata **(Killington, 1935)**

Adults were observed at 17 localities in the eastern, southern, northern slopes of Mount Uludag. The first adult was caught on 26 May at Kestel County (Sevketiye, 1 km N, 570 m) and the last on 12 September in the same County (Alacam, 100 m S, 1030 m). A total of 70 specimens were captured (37 females and 33 males) mainly in pine forests and pine-oak associations.

Cunctochrysa baetica **(Holzel, 1972)**

2004: 07.VIII, 1♀ (Iznik County, Sansarak upper canyon, 2 km S, 725 m). 2005: 02.VII, 1♂ (Iznik County, Hisardere, 2 km SE, 625 m).

Dichochrysa clathrata **(Schneider, 1845)**

2004: 02.VI, 1♀ (Orhaneli County, Goktepe, 4 km NE, 620 m); 10.VI, 1♂ (Orhaneli County, Sadagi canyon, 1 km NE, 450 m); 12.VI, 1♂, 2♀ (Kestel County, Derekizik, 2 km N, 300 m); 09.VII, 1♂ (Orhaneli County, Sadagi canyon, 1 km NE, 450 m); 24.VII, 1♀ (Kestel County, Derekizik, 2 km N, 300 m); 20.VIII, 1♂ (Orhaneli County, Sadagi canyon, 1 km NE, 450 m); 21.VIII, 1♀ (Kestel County, Derekizik, 2 km N, 300 m). 2005: 27.V, 1♂ (Nilufer County, Maksempinar, 2 km E, 390 m); 16.VI, 1♂ (Mustafakemalpasa County, Korekem, 2 km E, 475 m); 25.VI, 1♀ (Osmangazi County, Kirazli, 875 m); 1♀ (Osmangazi County, Bagli picnic area, 1200 m); 12.VII, 1♀ (Kestel County, Osmaniye picnic area, 515 m); 23.VIII, 1♂ (Orhaneli County, Kadikoy, 500 m SW, 880 m).

Dichochrysa flavifrons **(Brauer, 1851)**

Dichochrysa flavifrons was the thirdmost widespread green lacewing species. Sweep net collections of this species from 56 localities totaled 204 adults, 80 females and 124 males. First adult emergence began on 5 May at Nilufer County (Uludag University forest, 125 m) and last adults occurred on 23 October in the same county (Kayapa inlet 180 m).

Dichochrysa inornata **(Navas, 1901)**

2004: 03.VII, 1♂, 2♀ (Kestel County, Osmaniye picnic area, 515 m); 10.VII, 2♀ (Kestel County, Sevketiye, 1 km N, 570 m); 24.VII, 1♂ (Kestel County, Alacam, 100 m S, 1030 m). 2005: 30.VII, 1♀ (Kestel County, Alacam, 100 m S, 1030 m).

Dichochrysa prasina **(Burmeister, 1839)**

Dichochrysa prasina was the secondmost common species and mainly found on oak and pine forests, oak-pine associations, shrubs and low vegetation. This species was collected from 85 of the 154 localities. Of the 643 individuals caught, there were 354 females and 289 males. First adult catch occurred on 20 April at Nilufer County (Uludag University fruit orchard, 55 m) and last catch was recorded on 23 October in the same county (Kayapa inlet, 180 m).

Dichochrysa zelleri **(Schneider, 1851)**

This species was widely distributed throughout the oak forests and oak-shrub associations. A total of 209 adult specimens, 131 females and 78 males, were collected from 46 localities. The first adults were captured on 16 April at Gemlik County (Narli, 4 km W, 10 m) and the last on 18 September at Osmangazi County (Sogukpinar, 1 km NW, 1060 m).

Italochrysa italica **(Rossi, 1790)**

Italochrysa italica adults were recorded only from 21 of the 154 localities. The total number of captured adults was 174, which was comprised of 94 females and 80 males. The first capture of adults occurred on 8 July at Nilufer County (Kayapa inlet, 180 m) and adult catches continued until 2 September. This species was distributed over oak forests and oak-pine associations.

Nineta carinthiaca **(Holzel, 1965)**

2004: 17.VI, 1♂ (Osmangazi County, Kocayayla, 1215 m).

Nineta flava **(Scopoli, 1763)**

2004: 12.VI, 1♂ (Kestel County, Alacam, 100 m S, 1030 m); 24.VII, 1♂ (Kestel County, Alacam, 100 m S, 1030 m); 26.VIII, 1♂ (Osmangazi County, Huseyinalan, 1005 m); 02.IX, 1♀ (Osmangazi County, Sogukpinar, 2 km NE, 1300 m). 2005: 18.VI, 1♂ (Gursu County, Ericek, 500 m NE, 715 m); 21.VI, 2♀ (Kestel County, Alacam, 1 km N, 775 m); 25.VI, 1♀ (Osmangazi County, Bagli picnic area, 1200 m); 12.VII, 1♀ (Kestel County, Alacam, 100 m S, 1030 m).

Nineta pallida **(Schneider, 1845)**

2005: 30.VII, 2♂, 4♀ (Kestel County, Alacam, 100 m S, 1030 m); 5♂, 2♀ (Kestel County, Alacam, 1 km S, 1110 m).

Nineta principiae **Monserrat, 1980**

Oak forests in 19 localities were found to harbor *N. principiae.* During the study period, sweep net captures of this species reached a total of 136 adults made up of 76 females and 60 males. Adults were first seen on 18 June at Gursu County (Ericek, 500 m NE, 715 m) and disappeared after the last catch on 18 September at Osmangazi County (Sogukpinar, 2 km NE, 1300m).

Peyerimhoffina gracilis **(Schneider, 1851)**

2004: 29.VII, 1♂; 07.VIII, 1♂; 25.IX, 4♂, 1♀ (Iznik County, Sansarak upper canyon, 725 m). 2005: 06.VIII, 1♂ (Osmangazi County, Sogukpinar-Ketenlik, 1430 m); 11.VIII, 1♀ (Iznik County, Sansarak upper canyon, 725 m); 30.VIII, 1♀ (Kestel County, Alacam, 100 m S, 1030 m).

Rexa raddai **(Holzel, 1966)**

Adults of this species were neither too common nor too rare. Of the 82 adults captured in 13 localities, 34 were females and 48 were males. *R. raddai* was one of the earliest emerging green lacewing species in spring in the region. First adult emergence was observed on 12 April at Nilufer County (Kayapa inlet, 180 m) and last adult was recorded on 4 June within the same County (Uludag University forest, 125 m).

Subfamily: Nothochrysinae

Hypochrysa elegans **(Burmeister, 1839)**

1999: 09.V, 1♀ (Osmangazi County, Bagli, 1 km NE, 1100 m); 19.V, 1♂ (Kestel County, Sevketiye, 1 km S, 800 m), 1♂ (Kestel County, Sayfiye, 1 km W, 830 m). 2004:

22.V, 10♂, 3♀ (Osmangazi County, Huseyinalan, 1005 m). 2005: 07.V, 3♀ (Orhaneli County, Goktepe, 4 km NE, 620 m); 14.V, 14♂, 3♀ (Kestel County, Alacam, 1 km N, 775 m); 21.V, 1♀ (Orhaneli County, Erenler, 6 km NE, 425 m); 27.V, 1♂ (Nilufer County, Maksempinar, 2 km E, 390 m); 18.VI, 1♀ (Gemlik County, Findicak, 480 m).

***Nothochrysa fulviceps* (Stephens, 1836)**

2004: 14.VIII, 1♂, 2♀; 21.VIII, 1♀ (Kestel County, Sayfiye, 1 km W, 830 m). 2005: 27.VI, 1♂, 1♀ (Inegol County, Ciftlikkoy, 100 m SW, 875 m); 12.VII, 1♀ (Inegol County, Ciftlikkoy, 100 m SW, 875 m), 1♀ (Kestel County, Alacam, 100 m S, 1030 m); 30.VII, 3♀ (Kestel County, Sayfiye, 1 km W, 830 m).

DISCUSSION

During the course of the study, a total of 23 green lacewing species were captured of which four were new records for northwestern Turkey (Table 1). The four new records were *N. flava, N. pallida, N. principiae* and *No. fulviceps.* In addition to these newly recorded species, five other species, *C. formosa, C. perla, D. inornata, I. italica* and *N. carinthiaca,* were found in Bursa province for the first time. Our findings also confirmed the presence of 13 other species previously recorded by Aspock et al. (1980) in this region and one species reported by Sengonca (1981).

Among *Chrysopa, C. viridana* was the most predominant species followed by *C. dorsalis,* and *C. formosa.* Aspock et al. (1980) noted widespread distribution of all three species in Turkey, but the researchers did not find *C. formosa* in Bursa province. Several studies have shown that *C. viridana* and *C. formosa* were common in other parts of Turkey (Duzgunes et al., 1981; Ari and Kiyak, 2000; Canbulat and Kiyak 2000; Bahadiroglu and Daymaz, 2001; Canbulat, 2002). On the other hand, *C. dorsalis* was only recorded from Ankara province (Duzgunes et al., 1981). *Chrysopa. perla* was previously found in the Black Sea region and Istanbul (Aspock et al., 1980) but it was new to Bursa and collected from various habitats in Mount Uludag. The habitats of *Chrysopa* species determined in this study are in agreement with those of Aspock et al. (1980) and Zeleny (1984a). However, our study revealed new records for harboring plants (Table 3).

Chrysoperla carnea s.l., an eurytopic and cosmopolitan species, was widespread in all counties of Bursa province varying in altitude from 10 m to up to 2000 m (Table 3). Widespread distribution and high abundance of this species can be attributed to the ability to live in harsh conditions from dry lowland to humid high Mountain areas as well as nonpreference for harboring plants. *Chrysoperla carnea s.l.* was almost the only species commonly occurring in vegetable-growing areas and fruit orchards that were treated heavily with pesticides. It appears to have some natural tolerance to pesticides (Pree et al., 1989), which shows the incredible adaptation capacity of this species. Owing to these characteristics, *Ch. carnea s.l.* occurs in high numbers throughout Turkey (Sengonca 1980).

Cunctochrysa albolineata was confined to particular locations although Aspock et al. (1980) reported common presence of this species in Bursa and throughout Turkey. Another *Cunctochrysa* species, *Cu. baetica,* was found very rarely in Bursa province. This finding is consistent with those of Holzel (1972) and Aspock et al. (1980) who reported only few specimens of *Cu. baetica* from Turkey. It is important to note that both *Cunctochrysa* species were found in oak-pine forests.

The most common and widespread *Dichochrysa* species in Bursa province was *D. prasina.* Other common species include *D. flavifrons* and *D. zelleri.* These species were recorded in various regions of Turkey (Aspock et al., 1980; Duzgunes et al., 1981; Sengonca, 1980; Ari and Kiyak, 2000; Canbulat and Kiyak, 2000; Canbulat, 2002). Yet, *D. inornata* and *D. clathrata* were rare. Aspock et al. (1980) showed the presence of the latter species in Bursa province, but *D. inornata* was the first record in this province, and only the second record for Turkish fauna as it was previously reported in Edirne province of Thrace region (Gaziyiz-Onar and Aktac, 2002).

Aspock et al. (1980) reported *N. guadarramensis s.l.* (Pictet, 1865) from 5 provinces of Turkey. However, Canard et al. (1998) later described the subspecies *principiae* of *N. guadarramensis* as a new species. In our study, all the specimens that were previously identified as *N. guadarramensis* turned out to be *N. principiae* based on the updated key of Canard et al. (1998). These results cast doubt on the presence of *N. guadarramensis sensu stricto* in Turkey. In our opinion, the presence of this endemic Atlanto-Mediterranean species in Turkey is not very probable, unless it was introduced. Therefore, old *N. guadarramensis s.l.* specimens from Turkey should be reexamined using the updated taxonomic key of Canard et al. (1998) for *Nineta* species.

Sweep net catches indicated that the adult flight period of many green lacewing species occurred primarily between May and September in northwestern Turkey (Table 2). A similar trend in adult flight activity has been observed in central and southern Europe (Neuenschwander and Michelakis, 1980; Honek and Kraus, 1981; Campos, 1989). Nevertheless, adult flight period lasted longer in some species. *D. prasina* adults exhibited extended flight period from April to October. An extreme example was the constant presence of *Ch. carnea s.l.* adults during the year. This polyvoltine species continued to reproduce in autumn and overwintered in the adult stage.

Adult green lacewing populations increased during the hot and dry summer months and usually reached a peak in July. A significant increase in adult green lacewings in summer was also documented in Czech Republic and Romania (Zeleny, 1984b; Paulian, 1996). However, there were differences between Turkish and central European populations of some chrysopid species in terms of life histories. For example, *C. perla* is univoltine in central Europe with adult flight activity in May and June (Holusa and Vidlieka, 2002), but bivoltine in northwestern Turkey with a summer brood, the adults of which were found in the field up to mid-August. The differences between Turkish and central European populations of *C. perla* can be attributed to lower latitudes and warmer climatic conditions in northwestern Turkey. The fact that some *C. perla* populations in southwestern France also exhibit this multivoltine reproductive strategy supports this assumption (Canard, 1973).

Species composition of chrysopids can be characterized by vegetation of the given habitats. Some chrysopid species are eurytopic while others are habitat specialists. According to our results, *N. pallida* and *P. gracilis* preferred coniferous forest stands, mainly *Pinus* and *Abies,* which is in accordance with the findings of Szentkiralyi and Kristin (2002). The researchers recorded coniferous *Picea abies* as a host plant of *N. pallida* and both *Picea* and *Abies* species for *P. gracilis* in central Europe. It is important to note that habitat preferences may vary among congener species. Unlike *N. pallida,* other *Nineta* species recorded in this study were found in deciduous *Quercus* trees. Evidently, *N. carinthiaca, N. flava,* and *N. principiae* showed a strong affinity to a single habitat that fulfills all of their needs. Another habitat specialist was *C. dorsalis,* a thermophilous species that was found only in pine stands (Table 3).

Increasing altitude and latitude may also have limiting effects on distribution of chrysopid species. When the habitat altitude of 17 species living in northwestern Turkey were compared with those from central Europe (Zeleny, 1984a), the habitats of 14 species had higher maximum altitude values than did the same species in central Europe while 12 species had lower minimum altitude values. Clearly, many species living in northwestern Turkey extended their vertical distribution ranges but there were exceptions like *C. hungarica.* This species was caught in a xerothermic forest-steppe located at a similar altitude to central Europe. Apparently, the occurrence of *C. hungarica* is delimited by habitat rather than altitude.

There were also differences in upper limits of habitats between chrysopid species living in northwestern Turkey and southern Europe (Aspock et al., 1980). For example, maximum altitude values for habitats in northwestern Turkey were higher than those in southern Europe for species such as *C. dorsalis, C. pallens, C. viridana, Cu. albolineata,* and *N. flava.* However, maximum altitudes of habitats were found to be similar for *C. formosa* but lower for *Cu. baetica, D. inornata, H. elegans* and *P. gracilis* populations. In addition, the upper limits of habitats in northwestern Turkey were lower for *C. dorsalis, C. formosa, C. pallens, C. viridana, Cu. albolineata, D. prasina,* and *H. elegans* than those of same species in near East and Anatolia based on the findings of Aspock et al. (1980).

In terms of the upper limits of habitats, *R. raddai* was known to occur at altitudes below 500 m (Aspock et al., 1980). However, this species was recorded at an altitude of 925 m for the first time in this study. A couple of *R. raddai* adults were observed at Karaislah (1 km N, Osmangazi) and one adult was captured on an oleaceous shrub *Phillyrea latifolia* L. The harboring plant was infested with nymphs of *Euphyllura phillyreae* Foerster on which *R. raddai* larvae prey. This finding suggests that the presence of *R. raddai* was not directly related to altitude but to the availability of their prey and harboring plants. Our observations support the work of Canard and Labrique (1989) who determined a similar relationship between *Rexa lordina* Navas and jumping plantlouse *Euphyllura olivina* (Costa) on oleaceous bush *Phillyrea angustifolia* (L.).

Up-to-date studies on Turkish chrysopidae fauna at the local level have reported 5, 6, 6, 9, 11 and 13 species in Kayseri (mid-Anatolia), Canakkale (Marmara), Adana (Mediterranean), Kahramanmaras (southern-Anatolia), Edirne (Thrace) and Ankara (mid-Anatolia) provinces, respectively. When Bursa's green lacewing fauna compared with that of other Turkish provinces, the presence of 23 species in this region may be considered as a fairly good indicator of rich biodiversity. The distribution of each green lacewing species is considered to be a function of bioclimatic factors, vegetation, prey density and, to a lesser extent, altitude. It is very likely that the number of species will increase if discrete localities and unreachable areas by road can be searched in more detail. In addition, further research is needed to determine the sibling species of *Ch. carnea s.l.* complex.

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SCIENTIFIC NOTE

TWO OVERLOOKED FAMILY-GROUP NAMES FOR FOSSIL TERMITES (ISOPTERA: MASTOTERMITIDAE)[1]

Michael S. Engel[2] and Kumar Krishna[3]

During the final phases of completing a new, annotated world catalog of the termites (Isoptera) two family-group names for termites were discovered that had been overlooked during prior accounts of such names (Engel and Krishna, 2004a, 2004b). The subfamily Pliotermitinae was proposed by Sándor Pongrácz (1917) for his new genus, *Pliotermes,* itself established for a fossil termite from the Early Miocene of Hungary. Subsequently, Emerson (1965) demonstrated that *Pliotermes hungaricus* Pongrácz was conspecific with *Mastotermes croaticus* Rosen, also from the Miocene of southeastern Europe, and thereby relegated the former, along with its monotypic genus and subfamily, to synonymy.

Similarly, the subfamily Miotermitinae was created by Alexander Pongrácz (1926) for the genus *Miotermes* Rosen, 1913. Though appearing only in a chart, the name Miotermitinae is nonetheless available, as prior to 1931 any given family-group name need only be based on an available generic name and need not be accompanied by a formal description (ICZN, 1999: Art. 12.2.4). Despite the inclusion of *Miotermes,* a valid genus, in the family Mastotermitidae Desneux for many decades, the name Miotermitinae has been overlooked since 1926 by all authors (e.g., Snyder, 1949; Emerson, 1965). Therefore, we herein formally place Miotermitinae into synonymy with Mastotermitidae (**new synonymy**). In our earlier list of family-group names for termites (Engel and Krishna, 2004: 2–4), Pliotermitinae should be incorporated between the names Stylotermitinae and Arrhinotermitinae, and Miotermitinae between Acanthotermitinae and Macrotermitinae. The entries would read as follows:

19a. Pliotermitinae Pongrácz, 1917: 28. Type genus: *Pliotermes* Pongrácz, 1917. Combining stem: Pliotermit–.

21a. Miotermitinae Pongrácz, 1926: 29 [chart]. Type genus: *Miotermes* Rosen, 1913. Combining stem: Miotermit–.

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In the table summarizing the hierarchical classification of Isoptera (Engel and Krishna, 2004a), Pliotermitinae and Miotermitinae would be listed as synonyms of Mastotermitidae. Neither name affects the priority or status of any other family-group names in use.

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OBITUARY

HERMAN LENT (1911-2004)

The main specialist in vectors (Hemiptera, Reduviidae) of Chagasì disease in Brazil was, without any doubt, Herman Lent. He was born in Rio de Janeiro – former Federal District – on 3 February 1911 and died in the same city on 7 June 2004, at the age of 93 years.

Lent was graduated as bachelor (surveyor) of Sciences and Letters by the Military School of Rio de Janeiro in 1928. In 1934, he finished the courses of medicine in the Faculty of Medicine of Rio de Janeiro. Two years prior to his medicine graduation, he finished the Application Course of the Instituto Oswaldo Cruz, with Professor Lauro Travassos (1890-1970), a well-known helminthologist, as his mentor. The institution admitted him as a researcher in 1933 and later on he became a faculty member and Head of Entomology Section and the Zoology Division (1962-1964).

His first scientific paper, published in 1934 with his colleague J. F. Teixeira de Freitas (1912-1970), refers to helminths of birds. He penned other papers on parasites for several years. In 1935, he published a paper on Hemipter, as collaborator of César Pinto (1896-1986). Thereafter, he published many papers on reduviids. With Peter Wygodzinsky (1916-1987) he finished his major paper on the subject: Revision of the Triatominae (Hemiptera, Reduviidae) and their significance as vector of Chagasì disease [Bulletin of the American Museum of Natural History, 163 (1):123-510]. Lent and other scientists (R. Carcavallo, I. G. Girón, and J. Jurberg) published the bilingual book *Atlas dos Vetores da Doença de Chagas nas Américas* – Atlas of Chagasì Disease Vectors in the Americas (3 volumes, Editora FioCruz, Rio de Janeiro, 1997).

He served as the editor of the *Revista Brasileira de Biologia* (1941-1981, changed to *Brazilian Journal of Biology* in 2000) and *Anais da Academia Brasileira de Ciências* (1968-1981. He did not accept the change in the name of the *Revista* because the journal, which had been well known all over the World for 60 years, began to be published in English. In 2 April 1970, Lent and nine other colleagues from the Instituto Oswaldo Cruz (Rio de Janeiro, Brazil) were dismissed and forbidden to work for any Brazilian government unit (Institutional Act n. 5). This episode was explained in his book *Massacre de Manguinhos* (Avenir Editora, Rio de Janeiro, 69 pp., 1978). Due to his qualities as a researcher, Lent was soon invited to work as a Full Professor at the renown Universidad de Los Andes (Merida, Venezuela) were he served from 1972 to 1974. In 1975, he was a Research Associate at the American Museum of Natural History, New York. When he returned to Brazil in 1976, he was invited to work for the Universidade Santa Úrsula (Rio de Janeiro), as a Full Professor of Helminthology, were he stayed until 2004. In this last year of life, he received a scholarship from the National Research Council of Brazil, continuing his work in that University as researcher A-1.

He was a member of the Sociedade Brasileira de Zoologia, Sociedade Brasileira de Microbiologia, Sociedade Brasileira para o Progresso da Ciência, Academia Brasileira de Ciências, Sociedad Americana de Parasitologistas, Sociedad Chilena de Historia Natural, Association of Tropical Biology, etc. In 1972 he was awarded the Costa Lima Prize for his work on medical entomology.

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RECENTLY PUBLISHED BOOKS[1]

Aglow in the dark. The revolutionary science of biofluorescence 2005 by Vincent Pieribone and David Gruber. The Belknap Press of Harvard University Press. Cambridge, Massachusetts, U.S.A. 263 pp.

Atlas der Pflanzen und Tiere im Baltischen Berstein 1998 by W. Weitschat and W. Wichard. Verlag Dr. Friedrich Pfeil. München, Germany. 256 pp.

Bee 2006 by Claire Preston. Reaktion Books Ltd. London, England, U.K. 206 pp.

Biogeography 2006 by M. V. Lomolino, B. R. Riddle, and J. H. Brown. Sinauer Associates, Inc. Sunderland, Massachusetts, U.S.A. 845 pp.

Bioinformatics and molecular evolution 2004 by P. G. Higgs and T. K. Attwoord. Blackwell Publishing. Malden, Massachusetts, U.S.A. 365 pp.

Chaos and life. Complexity and order in evolution and thought 2003 by Richard J. Bird. Columbia University Press. New York, NY, U.S.A. 322 pp.

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Fauna de Tenebrionidae de la Península Ibérica y Baleares. Volumen 1. Lagriinae y Pimeliinae 2005 by A. Viñolas and M. C. Cartagena. Argania Editio. Bercelona, España. 428 pp.

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Statistics explained. An introductory guide for life scientists 2005 by Steve McKillup. Cambridge University Press. Cambridge, U.K. 267 pp.

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What makes biology unique? Considerations on the autonomy of a scientific discipline 2004 by Ernst Mayr. Harvard University Press. Cambridge, Massachusetts, U.S.A. 232 pp.

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THE AMERICAN ENTOMOLOGICAL SOCIETY

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DESCRIPTION AND CONSERVATION STATUS OF A NEW SUBSPECIES OF *CICINDELA TRANQUEBARICA* (COLEOPTERA: CICINDELIDAE), FROM THE SAN JOAQUIN VALLEY OF CALIFORNIA, U.S.A.[1]

C. Barry Knisley[2] and R. Dennis Haines[3]

ABSTRACT: This paper describes a new subspecies of oblique-lined tiger beetle, *Cicindela tranquebarica joaquinensis,* from the San Joaquin Valley of California. This new subspecies is most closely related to *C. t. vibex* with which it intergrades along the margins of the San Joaquin Valley. The maculation pattern of *C. t. joaquinensis,* like that of *C. t. arida* is characterized by being reduced to only the apical lunules. However, *C. t. arida* is significantly smaller in body size, has microserrations on the elytra, is restricted to the Death Valley area and thus well separated from *C. t. joaquinensis* by both distance and the Sierra Nevada Mountains. A study of collection records indicated *C. t. joaquinensis* was historically present throughout much of the San Joaquin Valley in alkali sink or flat habitats. A search of the historic and many additional sites with these habitats produced only three extant populations of *C. t. joaquinensis,* all in patches of habitat that were less than three hectares in size. The extirpation of most populations of this beetle was caused by habitat loss from intense agricultural development in the San Joaquin Valley, especially cultivation for crops, cattle grazing, and water diversions and modifications related to irrigation. Increased vegetation is also reducing the open areas in the habitats needed by this species. Because of the very few and small extant populations and the elimination of nearly all of the alkali sink habitat, *C. t. joaquinensis* should be considered for endangered status by the U.S. Fish and Wildlife Service.

KEY WORDS: tiger beetle, *Cicindela tranquebarica,* Cicindelidae, Coleoptera, insect conservation, rare insects, San Joaquin Valley, California, U.S.A.

Tiger beetles (family Cicindelidae) have become increasingly important as a focus group in insect conservation, particularly as indicators of biodiversity and habitat degradation (Knisley and Hill 1992, Pearson and Cassola 1992, Pearson et al., 2006). At present, four species of tiger beetles are listed as endangered or threatened and two others are candidates for listing. An additional 25 or more species and subspecies of tiger beetles may be sufficiently rare to be included on the list of threatened or endangered species (Knisley and Schultz 1997, Pearson et al. 2006). Although both species and subspecies may be listed under the Endangered Species Act, determining the taxonomic status is necessary because it affects listing priority and action. For example, taxonomic studies were a critical part of the status surveys and listing considerations for all of the currently listed or candidate tiger beetles (*C. dorsalis dorsalis, C. puritana, C. ohlone, C. albissima, C. nevadica lincolniana,* and *C. highlandensis*).

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The oblique-lined tiger beetle, *Cicindela tranquebarica,* is one of the most widespread and diverse of the U.S. tiger beetles. Over 27 names have been applied to it, and the 12 subspecies recognized by most workers are more than any other North American species. Eleven of the subspecies occur west of the Great Plains, including 10 in the southwest, and 6 of these in California (Pearson et al., 2006). The most distinctive character of this species is the extended anterior maculation (humeral lunule), which is long and angles gradually inward from the outer edge of the elytron, and the absence of a marginal white line (Pearson et al., 2006). However, several populations have the maculations reduced to only a small apical lunule at the posterior tip of the elytra. Dorsal coloration varies from black, brown, red, and green to bluish-green. Of the five subspecies that are restricted to or range into southern California, *C. t. vibex* is the most widely distributed. It ranges from British Columbia south through California and west of the Sierra Nevada to San Luis Obispo and Ventura Counties. Most of the specimens in collections from the San Joaquin Valley have been identified as *C. t. vibex. C. t. sierra* is a widespread montane form (occurring above 200 m) and ranging from far eastern Tulare County north to Lassen County in northern California. *C. t. inyo* is restricted to the Owens Valley of eastern California and adjacent Nevada, while *C. t. viridissima* is in Orange, Los Angeles, Riverside, and San Bernardino Counties.

The most recent taxonomic study of *C. tranquebarica* by Kritsky and Horner (1998) recognized eight subspecies and elevated *C. t. arida* to full species status. These workers considered *C. t. moapana* and *C. t. inyo* to be synonyms of *C. t. parallelonota,* and *C. t. borealis* a synonym of *C. t. vibex.* Most cicindelid workers, especially those familiar with the diversity of forms in southern California, including some populations not examined by Kritsky and Horner (1998), believe their study was not thorough enough to justify the taxonomic revisions they present, and that much additional work on this species is needed, possibly including mtDNA or other new approaches. Consequently, we follow the most widely accepted treatment of this species as given in Boyd et al. (1982), Freitag (1998) and Pearson et al. (2006). Adding to the problem is that many California populations have apparently been extirpated in the past several decades, most likely due to the widespread conversion of natural habitats to agricultural or urban uses. Regardless of whether or not the revisions of Kritsky and Horner (1998) become widely accepted, the new subspecies we describe was apparently unknown by those authors and a distinct subspecies of *C. tranquebarica.* Our study was prompted by the extreme rarity of this new form and the need to protect it from extirpation.

METHODS

The initial part of this study included a compilation of information on the distribution of the southern California populations of *C. tranquebarica* by reviewing the literature and examining collection records and specimens from various museum, university, and private collections that had specimens of this species from southern California.

Specimens we examined were from the following collections:AMNH – American Museum of Natural History, New York, NY; CASC – California Academy of Sciences, San Francisco, CA; CBKC – C. Barry Knisley Collection, Ashland, Virginia; CSCA – California State Collection of Arthropods, Sacramento, CA; DBC – David Brzoska Collection, Naples, Florida; LACM – Los Angeles County Museum, Los Angeles, CA, California; RDHC – R. Dennis Haines Collection, Tulare, California; TCAC – Tulare County Agricultural Commissioner/Sealer's Office, Tulare, CA; UCRC – University of California, Riverside, Riverside, CA; UID – University of Idaho, Moscow, ID.

Taxonomic Studies: Our taxonomic study was based primarily on population differences in maculation pattern and color because these are the characters most commonly used by other workers to distinguish subspecies of *C. tranquebarica*. To evaluate differences in maculation pattern among populations we graded specimens (usually 10-20 per population, if available) according to the range of maculation patterns of *C. tranquebarica*, from the most fully maculated (Fig. 1A) to the least maculated (Fig. 1H). Other variations of the maculation pattern included in the analysis were width at the base of the middle band, connection of the humeral dot with the humeral lunule, and connection of the apical dot with the apical lunule (Fig. 1). Dorsal ground coloration was also a variable character and included in the analysis. Mean total body length differences were not statistically significant for all populations examined except for *C. t. arida*, which was significantly smaller than all other populations. Setal patterns and several other characters of potential importance were examined but were similar in all populations and thus not useful for separating populations.

Field Surveys: The diversity of habitat types utilized by *C. tranquebarica* presented a challenge for obtaining an accurate determination of its preferred habitat and distribution within our survey area. Some of the historic label data was too general to identify specific localities and habitat type, but fortunately one of us (RDH) obtained firsthand information from several of the early collectors about their collecting sites in the San Joaquin Valley. With this information and visits to many *C. tranquebarica* sites in southern California, we concluded this species occurred almost exclusively in two types of habitats, both having moisture at or near the surface. Most records were from sandy floodplains along rivers or streams, but others were from alkali sinks, flats, and playas, so we concentrated our field surveys on these two habitat types. We conducted fieldwork on >30 dates from summer of 2002 through spring 2006, primarily from March through May and September through November. This is the bimodal period of adult *C. tranquebarica* activity indicated by collection records. In our visits to these sites, we searched the open areas of potential habitat for adults, made spot checks of the ground surface for larval burrows (Knisley and Schultz 1997) and recorded habitat features that were probable indicators of habitat for *C. tranquebarica*. Most sites with potential habitat were visited 2-4 times. At the sites where we found *C. tranquebarica,* we recorded dominant plant species and other habitat characteristics and conducted visual searches and counted the numbers of adults and larvae present. Representative specimens were collected for the description, but because of its rarity, only limited numbers were taken and most of these later in the year after they had time to mate and oviposit.

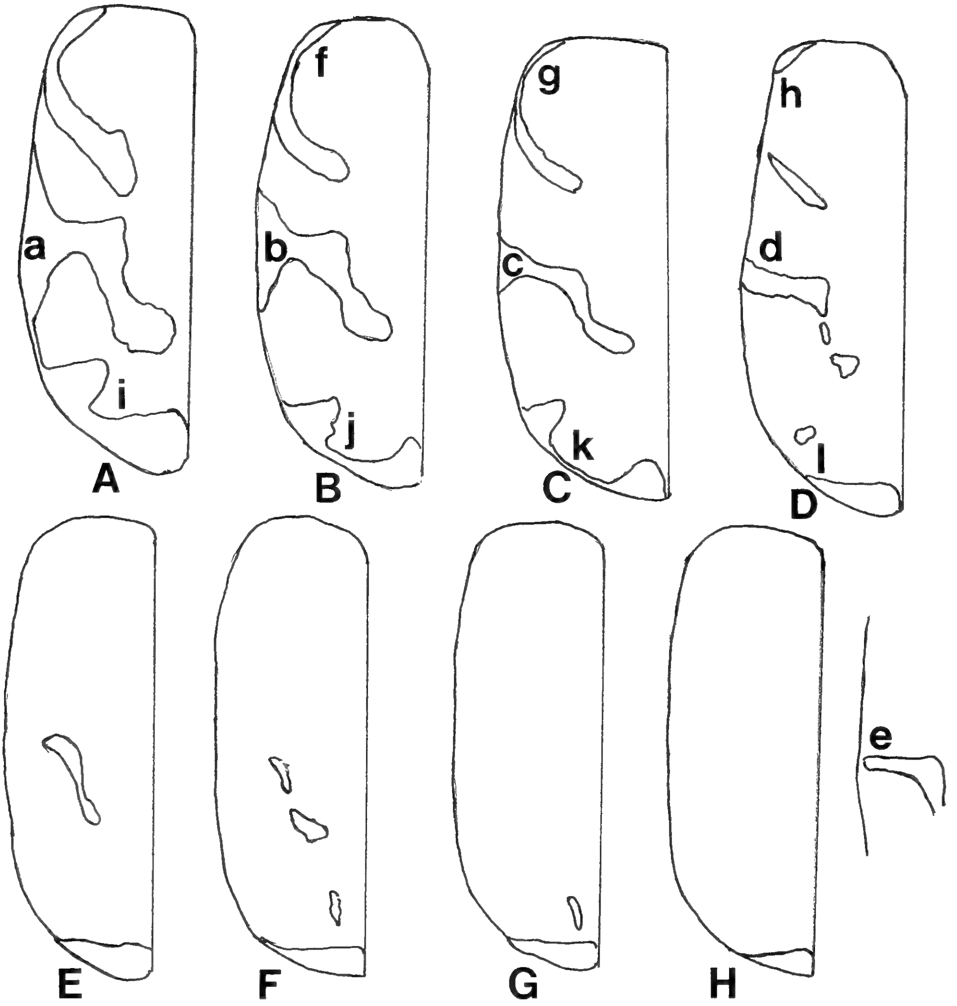

Figure 1. Illustrations of the variations of maculation patterns for *C. tranquebarica* throughout its range. Capital letters indicate middle band and overall maculation pattern, arranged from most (A) to least developed maculations (H). Small letters (a to e) indicate variations in the width at the base of the middle band; f, g, h are variations in attachment of humeral lunule; i, j, k, l are variations in apical lunule. See Table 1 and text.

RESULTS AND DISCUSSION

Cicindela tranquebarica joaquinensis Knisley and Haines, new subspecies

(Fig. 2)

Description: Holotype male. Length 12.8 mm, robust. Color green dorsally; ventrally head and thorax shiny metallic green, abdomen metallic blue; vertex, frons and clypeus shiny, metallic green. Elytral maculation reduced to only a small apical lunule. HEAD: Labrum ivory with black margin, three labral teeth of equal size, with 6-7 marginal setae. Mandibles with basal and apical portion black, middle portion green, with 3 teeth. Frons rugose with abundant (>50) erect setae; vertex rugose, and with dense, erect setae; gena rugose especially near eye, with 1-2 indistinct setae on anterio-ventral margin. Antennal segments one to four metallic green; segment one with 19-25 setae, segment two with 1 apical setae; segments three and four each with rows of long setae along the lateral margin and apex; segments 5-11 are testaceous and dull brown. THORAX: Pronotum rectangular, widest anteriorly; disc covered with shallow wavy rugae; median line shallow, anterior and posterior transverse grooves deep; long, thin, erect setae along marginal third of disc. Prosternum glabrous; proepisternum with abundant long, thin setae; mesepisternum and mesepimeron with many long, erect setae. Metasternum and metepisternum with long, erect setae. ELYTRA parallel sided, surface finely granulate, covered with raised gold bumps; deep setae bearing fovea. Apices without microserrations, but with a short spine. ABDOMEN: Terminal three sternites shiny metallic green with scattered long erect setae, most along posterior margin. LEGS: Pro- and mesocoxa with long, erect setae; metacoxa with long, erect setae along dorsal anterior margin; pro- and mesotrochanter with long, erect setae on posterior margin; metatrochanter glabrous.

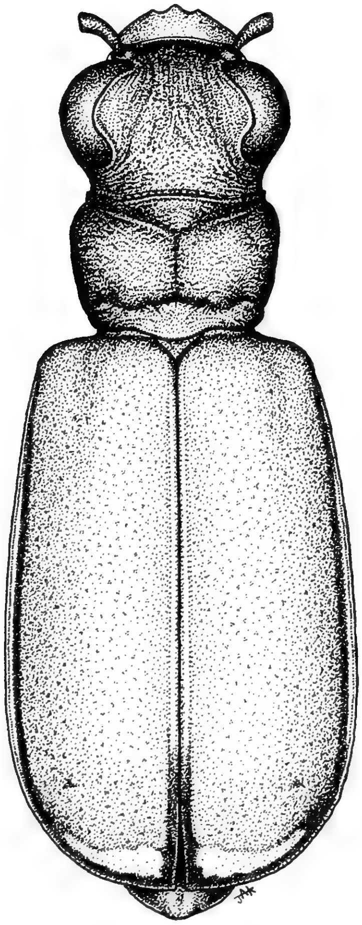

Figure 2. Habitus of male holotype of *Cicindela tranquebarica joaquinensis* Knisley and Haines.

Type Material: Holotype (male), CA, Kings Co., near Guernsey, 27-III-2005. Paratypes: 10 from CA, Tulare Co., west of Earlimart, 17-XI-2005; 12 from CA, Kings Co., near Guernsey, 27-III-2005. Holotype and 5 paratypes to be deposited in California Academy of Sciences; 6 paratypes to USNM, 3 to AMNH, 8 to the authors (4 each to RDH and CBK).

Variation of type series: Males: Mean length, 11.8 mm, range of 11.1 to 12.2 mm. Females: Mean length, 12.6 mm, range of 11.8 to 13.2 mm. A small percent of specimens have a dot-like or faintly developed partial middle band or a detached part of the apical lunule. Setae on first antennal segment range from 12 to 28, most individuals with 18-24. Number of setae on anterio-ventral edge of gena ranges from 0-4. Sixth abdominal sternite in females lacking fine pubescence and long, erect satae.

Comparison with other populations. Although the maculation pattern of *C. t. joaquinensis* is most similar to that of *Cicindela t. arida* (Table 1), our study indicates this new subspecies is most closely related taxonomically to *C. t. vibex* but differs in maculation (see below). Despite the nearly identical maculation patterns of *C. t. joaquinensis* and *C. t. arida* and green coloration, most of the *C. t. arida* we examined also had a reddish cast or sheen over the green. More importantly, *Cicindela t. arida* has microserrations on the elytral apices and is significantly smaller ($p < 0.001$, ANOVA) than *C. t. joaqinensis* in both elytral length (mean of 7.34 mm, s.d.= 0.19, versus 8.37 mm, s.d. = 0.44, in females and 6.58 mm, s.d.= 0.35 versus 7.65 mm, s.d.= 0.27, in males) and elytral width (4.69 mm, s.d = 0.26 versus 5.29 mm, s.d. = 0.29, in females and 4.28 mm, s.d. = 0.28 versus 4.88 mm, s.d. = 0.18, in males). Populations of all other western subspecies that we measured were not significantly different in elytral length or width from *C. t. joaquinensis*. Previous studies of tiger beetle subspecies have established a precedent for body size as an appropriate taxonomic character. For instance, body size was used to separate the subspecies of *C. dorsalis* (Boyd and Rust 1984). These differences may also function as a reproductive isolating mechanism. In laboratory mating studies of *C. d. dorsalis* and *C. d. media*, the size difference between these two subspecies reduced pairing success and mating times (Fielding and Knisley, unpublished studies). That study also found that the size mismatch of the flagellum of the male aedeagus and the spermathecal duct of the female (into which the flagellum inserts during sperm transfer) might reduce the chances for successful sperm transfer in intersubspecific matings. The size difference between *C. t. arida* and other western subspecies is comparable to that of *C. d. dorsalis* and *C. d. media*, and may similarly function as a reproductive isolating mechanism. The structures of the male genitalic components of *C. t. arida* were similar to other *C. tranquebarica* but their smaller size and was a key factor in the separate species status (Kritsky, pers. comm.). Further evidence that *C. t. joaquinensis* is less related to *C. t. arida* than to *C. t. vibex* is the great distance (over 220 km) and the presence of the Sierra Nevada Mountains that would act as a significant barrier to gene exchange between populations in the San Joaquin Valley and Death Valley. The similarity of the elytral maculation pattern in these two subspecies may thus be a result of convergent evolution rather than taxonomic similarity. Also, the differently colored and maculated subspecies of *C. t. inyo* from the Owens Valley occurs west of Death Valley and between the ranges of *C. t. arida* and *C. t. joaquinensis*.

Of the 88 specimens from the seven populations within the San Joaquin Valley examined, 59 had only apical maculations (Fig. 1, grades G or I) and 15 others had, in addition, a very reduced or incomplete middle band, usually represented by one or two dots or short lines (grades D, E, F). Only 14 specimens had a complete middle band (grades B, C) with a wider base (grades c, d). Most of these were from Coalinga at the western edge of the San Joaquin Valley or from the Dinuba-Reedley populations at the eastern edges of the San Joaquin Valley, and probably intergrades of *C. t. vibex* and *C. t. joaquinensis*. A range of maculation patterns was present among specimens from Kern County, but most of these had a well developed middle band (B) and humeral maculations (f, g) and were similar to populations further south (Soda Lake in San Luis Obispo County) or to the east (Lake Isabella in eastern Kern County) (Table 1). Most workers have identified these populations as *C. t. vibex*, but additional studies are needed, probably using mtDNA analysis, to confirm this and to determine their relationship to other southern California populations. In addition to *C. t. viridissima* and *C. t. sierra*, there are brown, well maculated populations from the Cuyama Valley of western Ventura County, similar brown populations along the Mojave River in western San Bernardino County, and well-maculated green to blue green populations along the Santa Clara River in eastern Ventura County. The identity of these forms is uncertain, and they apparently were not included in Kritsky and Horner's (1998) study of *C. tranquebarica*. One additional character that distinguishes *C. t. joaquinensis* from all other *C. tranquebarica* subspecies we examined, including those in Table 1, is the lack of microserrations on the elytral apices.

Historic and recent records: Our examination of San Joaquin Valley *C. tranquebarica* specimens in collections produced a total of 46 site records within the range of *C. t. joaquinensis*, including 3 records for Madera County, 19 for Tulare County, 2 for Kings County, 21 for Fresno County, and 1 from Stanislaus (Table 2, Fig. 3). Most of these records were from the 1920s to 1940 (many collected by F. T. Scott and R. Hopping). The most common collection sites were Coalinga (8 records), Visalia (7 records), and Kerman (6 records). Coalinga is along the western edge of the San Joaquin Valley. Specimens from there are more maculated, and probably intergrade with *C. t. vibex* (see above). The most recent records for *C. t. joaquinensis* were from March 1984 and April 2000. The 2000 record was for a small population found in scattered patches of alkali sink habitat in southern Madera County (Christopher Rogers, pers. comm.). The 1984 record was for several specimens found along a sandy road through an alkali meadow in the Kaweah Oaks Preserve, near Farmersville (Tulare County), by the second author. The only other recent records for *C. tranquebarica* within the San Joaquin Valley are two specimens taken along the Kings River near Reedley (October 2003) and one from Dinuba (1988). All three of these specimens have more complete maculations suggesting they are intergrades with *C. t. vibex*.

Table 1. Maculation and color variations for *C. tranquebarica* populations used in this study. Letters in table are illustrated in Fig. 1.

TABLE 1 - part 1		**Maculation Pattern**								**Middle Band Width at Base**					
	Subspecies	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**a**	**b**	**c**	**d**	**e**	**f**
S. J. Valley Populations															
Madera	*joaquinensis*								6						
Guernsey*	*joaquinensis*						3	6	16						
Earlimart*	*joaquinensis*							2	11						
Kerman/Helm	*joaquinensis*		1	1			2	5	3		1				
Vis-Ext-Prt-Frm	*joaquinensis*		2	2	3		4	1	8				13		
Reedley-Dinuba	*vibex x joaquinensis?*		1	1	1								2	1	
Coalinga	*vibex x joaquinensis?*		12	4	1			4		2	7	6	2	1	1
Bakersfield	*vibex?*		8	5	1					1	9	4			
Other Populations															
Santa Clara River	uncertain	20	3							2	11	8			
Riverside Co.	*viridissima*		1	22	2						1	2	10	10	2
Lk Isabel	*sierra?*		6	13	2							15	3		3
San Luis Obispo Co.	*vibex?*		4	1						1		2	2		
Cuyama Valley	uncertain	7	5							6	6				
Calaveras Co.	*sierra*			10	3	1	1					5	8		
Death Valley	*arida*								25						
Owens Valley	*inyo*	22	1								5	10	8		
Modoc Co., No. CA	*vibex*	12	12								4	12	5	2	

TABLE 1 - part 2

		Connection of Humeral Lunule and Dot			Connection of Apical Lunule and Dot				Dorsal Coloration			
Subspecies		**f**	**g**	**h**	**i**	**j**	**k**	**l**	**Green to Blue-Green**	**Dark Green**	**Brown**	**Dark Brown**
S. J. Valley Populations												
Madera	*joaquinensis*								3			
Guernsey	*joaquinensis*								25			
Earlimart	*joaquinensis*								13			
Kerman/Helm	*joaquinensis*		1				1		12			
Vis-Ext-Prt-Frm	*joaquinensis*		2			2			12			
Reedley-Dinuba	*vibex x joaquinensis?*		1	2			3		3			
Coalinga	*vibex x joaquinensis?*		6	1		2	5		4^2			1
Bakersfield	*vibex?*		11	3		6	8		12		2	
Other Populations												
Santa Clara River	uncertain	19	4		4	15	4		23			
Riverside Co.	*viridissima*		5	20		2	23		25			
Lk Isabel	*sierra?*		2	19		2	5	15	21			
San Luis Obispo Co.	*vibex?*		4	1		2	3		5			
Cuyama Valley	uncertain		12		2	4	6			2	4	6
Calaveras Co.	*sierra*			12			2	14				
Death Valley	*arida*								25^1			
Owens Valley	*inyo*	2	20	2	4	17	3		21	3		24
Modoc Co., No. CA	*vibex*		17	7		2	22					

Table. 2. Collection records for *C. tranquebarica* within the San Joaquin Valley. Locations of current *C. t. joaquinensis* populations are not included.

County	Locality	No.	Date	Collector	Collection
Madera	Chowchilla	1	7-III-39	R. P. Allen	AMNH
Madera	Granite Cr.	1	6-V-34		AMNH
Madera	20 km W of Borden	6	10-IV-2000	C. Rogers	DBC
Fresno	Fresno	1		E. A. Schwartz	USNM
Fresno	Farmerville		30-III-1984	D. Haines	RDHC
Fresno	Kerman		19-III-1933		TCAC
Fresno	Kerman		30-X-1927		TCAC
Fresno	Kerman		15-X-1927		TCAC
Fresno	Kerman		15-X-1927		TCAC
Fresno	Kerman	1	30-X-27	M. A. Cazier	AMNH
Fresno	Kerman		19-III-1933		TCAC
Fresno	9 mi W. Kerman	1	25-III-53	Snelling	CDFA
Fresno	Helm		16-III-1924		TCAC
Fresno	20 mi. SW Fresno	1	4-III-38		LACM
Fresno	Parlier, Kearney Agr. Center, Fresno	5	9-X-89	N. J. Smith	CDFA
Fresno	Coalinga		V-5		TCAC
Fresno	Coalinga		15-III-1927		TCAC
Fresno	Coalinga				TCAC
Fresno	Coalinga		V-5		TCAC
Fresno	Coalinga		20-III-62		CALAC
Fresno	Coalinga	2	27-X-83		N Smith
Fresno	Coalinga	3	30-III-40		NLRC
Fresno	Coalingua, Los Gatos Ck.	4	7-IV-73		UCR
Fresno	Parkfield Grade, 10 mi SW Coalingua	2	27-X-83		CDFA
Tulare	San Joaquin Mill	1	5-IV-05		AMNH
Tulare	San Joaquin Mill	2	5-V-10		AMNH
Tulare	San Joaquin Mill	1		H F Wickham	LACM
Tulare	San Joaquin Mill	3		Hopping	UCR
Tulare	Kaweah Oaks Preserve	3	I-84	D. Haines	RDHC
Tulare	Visalia			F. Scott	TCAC
Tulare	Visalia		IV-34	F. Scott	TCAC
Tulare	Visalia		IV/1926?	F. Scott	TCAC
Tulare	Visalia		IV-34		TCAC
Tulare	Visalia		IV-30	F. Scott	TCAC
Tulare	Visalia	2	V-34	F. T. Scott	LACM
Tulare	Visalia	2	33?	F. T. Scott	CDFA
Tulare	Exeter	1	28-III-34	A. Nicolay Colln.	USNM
Tulare		1	V-30	F. T. Scott	LACM
Tulare	Exeter	5	28-II-34	M. A. Cazier	AMNH
Tulare		2	III-30	F.Scott	TCAC
Tulare	Exeter	1	3/21/1934?		TCAC
Tulare	Skaggs Bridge	1	10/13/1929		TCAC
Tulare	Porterville	2	1/V/1957	WM.R.Clark	TCAC
Kings?	"North Kamm"	3	25-III-32	A. T. McClay	USNM
Kings	2 mi S. Hub		7-VI-78	?	
Kern	Cottonwood Cr.	2	6-IV-39	W. F. Barr	USNM
Kern	?	1		H. Morrison	USNM
Kern	Cottonwood Cr.	2	22-III-40	W. F. Barr	LACM
Kern	Cottonwood Cr.	1	6-IV-39	W. F. Barr	LACM
Kern	Cottonwood Cr.	5	22-III-40	W. F. Barr	NLRC
Kern	Cottonwood Cr.	1	6-IV-39	L. L. Jensen	MCZ
Kern	Bakersfield	4	27-II-1892	F. C. Bowditch	LACM
Kern	Poso Cr., 3 mi. E. Hwy 65	14	17-IV-71		LACM
Kern	Poso Cr., 3 mi. E. Hwy 65	12	10-V-71	C. E. Langston	LACM
Kern	Poso Cr., 3 mi. E. Hwy 65	40	17-IV,22-III		UCR
Kern	Poso Cr., Snyders Swamp	2	29-III-70	Rumpp	NLRC
Kern	Poso Cr., Snyders Swamp	1	19-IV-75	Rumpp	NLRC
Kern	Kern R.	1	15-IV-05	Hopping	LACM
Kern	Kern R.	1	16-IV-05	Hopping	LACM
Kern	Kern R.	1	IV-28		LACM
Kern	Oil City	3	IV-16		LACM
Kern	Oil City	1	IV-28	R. Hopping	LACM
Kern	Adobe Station		19-IV-05		UCR
Kern	Kern R.	1	IV-28		LACM
Kern	Cuyama Rch, Cuyama Cyn.	26	6-III-37	M. Cazier	AMNH
Kern	Bakersfield	4	12-III-34		AMNH
Kern	4mi W Bakersfield	10	28-X-75		UCR
Stanislaus	Turlock	6	?		UCR

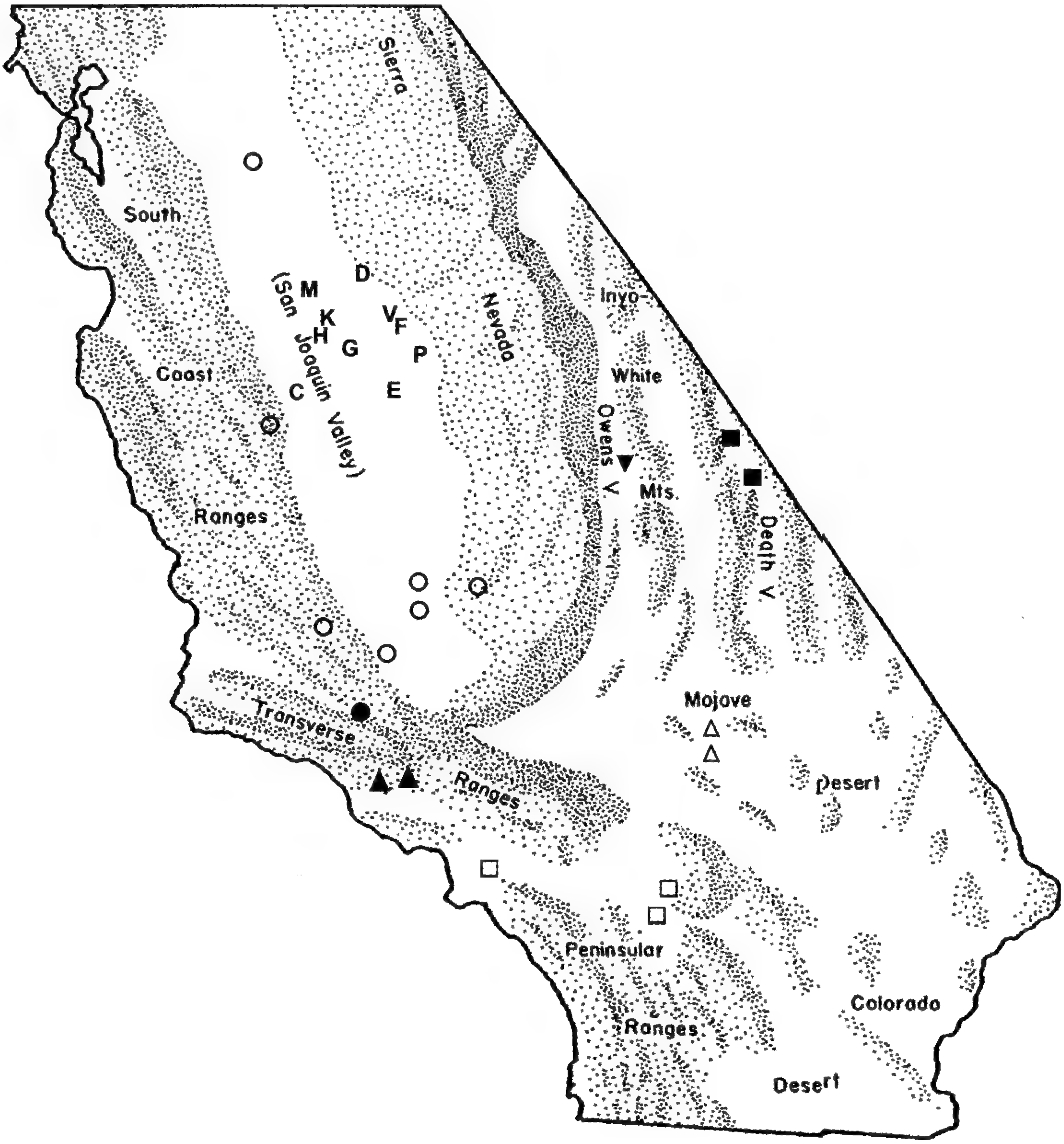

Figure. 3. Map of southern California showing sites for *C. tranquebarica* populations and named subspecies. Letters indicate *C. t. joaquinensis* sites: C = Coalinga, D = Dinuba, E = Earlimart, F = Farmersville, G = Guernsey, H = Helm, K = Kerman, M = Madera, P = Portersville, V= Visalia. Open circles indicate probable intergrade populations of *C. t. joaquinensis* x *C. t. vibex*; solid circle is Cuyama River population; solid triangles are Santa Clara River populations; open squares are *C. t. viridissima*; open triangles are Mojave River populations; solid inverted triangle is *C. t. inyo*; solid squares are *C. t. arida.*

Field surveys and habitats: Using these historical site records, we focused our initial search of extant populations on historic riparian and alkali sink sites within the four-county area, and on additional sites in adjacent counties where these habitats were represented. Over 80 sites were visited (Table 3). Those located along rivers and creeks were the most common among the records and

Table 3. Locations and habitat notes for all sites surveyed for *C. t. joaquinensis*.

County	Site Location	Date	Habitat	Site Characteristics, Comments
Madera	Avenue 12, S. side, near Rd. 19	10/04, 3/26/05	alkali sink	heavy use, wide sandy edge, N. side deposits, resurvey
Madera	Hwy 145 x Cottonwood Ck.	2/11/2004	creek edge	channelized, sandy levee, vegetated, no water
Fresno	Rt. 180, 6 mi W. Rt. 145, N side	3/13/04, 4/2/05	alkali sink	
Fresno	Rt. 180, 9 mi W. Rt. 145, S side	3/13/04, 4/2/05	alkali sink	native undisturbed
Fresno	Mendota Wildlife Area, public access, off 180	3/13/04, 3/27, 4/2/05	alkali sink	roads and opens areas, S side of road
Fresno	Jameson, James Rd & Hwy 180	3/13/2004	alkali sink/grassland	3 other sites east of Mendota WMA
Fresno	Rt. 145 x Cottonwood Ck.	2/13/2004	Floodplain	Channelized sandy levee, vegetated, no water
Fresno	Rt. 145 x San Joaquin River, Skaggs Bridge	2/11,3/14/04,3/26/05	Floodplain	heavy use, wide sandy edge, N. side deposits, resurvey
Fresno	E of Hub, Kings R. x Excelsior Ave.	2/12/04, 3/13/2004	Riverbed	Extensive sandy, dry, heavy use, ORVs
Fresno	E of Hub, Kings R. x Maple St.	2/12/04, 3/13/2004	Riverbed	sandy, dry riverbed
Fresno	Laton x Kings R.	3/14/2004	Riverbed	extensive sandy, dry, heavy use, recheck
Fresno	Kingsburg, Rt. 201 x Kings R., Elmonte Way (J-40)	3/14/2004	Riverbed	
Fresno	SW Kerman, N and S of American Ave.	4/2/2005	alkali playa	series of historic habitat patches, now all agriculture
Fresno	Helm	3/13/2004	alkali playa	historic site, no habitat seen
Fresno	Helm, E of 145, N of Kamm	4/2/2005	alkali playa	disced and planted to grain
Fresno	Helm, North of Kamm, section 17	4/2/2005	alkali playa	disced and planted to grain
Fresno	Coalinga,SE of, Parkfield Grade	4/25/2004	dry sandy wash	heavy disturbance from cattle, had flowing water in 1983
Fresno	Coalinga,SE of, Rt. 198, Wartham Creek	4/25/2004		
Fresno	Coalinga, S of, Jacillitos Creek at Lost Hills Rd.	2/12/2005	sandy wash	needs further survey
Fresno	Coalinga, NE of, Los Gatos Ck near Salt Canyon	4/2/2005	alkali playa	disced and planted to grain
Fresno	Coalinga, NE of, Los Gatos Ck near Gale Ave	4/2/2005	alkali playa	disced and planted to grain
Fresno	Coalinga, N of, Palmer Ave.	4/2/2005	alkali playa	disced and planted to grain
Fresno	Coalinga, E of, Calaveras Ave.	4/2/2005	alkali playa	disced and planted to grain
Fresno	E of Coalinga, Arroyo Pasajero, Phelps Ave.	3/26/2005	large sandy wash	
Fresno	Coalinga, E of, Jayne Ave x Chino Ck..	3/26/2005	sandy wash	dry creek bed
Fresno	Coalinga, E. of, Los Gatos Ck. at Phelps	4/1/2005	sandy wash	channelized
Fresno	Coalinga, Warthan Crk & Jayne Ave	3/26/2005	sandy wash	channelized
Fresno	Coalinga, Oil City, Los Gatos Creek	4/25/2004	sandy wash	
Fresno	Coalinga, Los Gatos Creek Park	4/25/2004	stream	channelized
Fresno	Little Panoche Valley, L. Panoche Ck at J-1	5/29/2005	streambed/saltgrass	
Fresno	Little Panoche Valley, L. Panoche Wildlife Area	5/29/2005	streambed/saltgrass	C. haemorhagica
Fresno	Little Panoche Valley, S. Fork L. Pan Ck. at J-1	5/29/2005	streambed/saltgrass	C. haemorhagica
Kings	SW Lemoore, E side Hwy 41, N and S of Jackson	3/30/2005		
Kings	SW Lemoore, Murphy Ranch Rd., S of Hwy 198	3/30/2005		
Kings	Clarks Fork (S) Kings River at Rt. 41	3/31/2005	river edge	
Kings	North Fork Kings River at Rt. 41	3/31/2005	river edge	
Kings	Kings R. x Maple St., W of Laton	3/28/2005	river edge	heavy grading, ORV activity, sandy

Kings	Kings R. at Laton, Kingston Regional Park	3/28/2005	river edge	river bank to bank, no habitat
Kings	Kings R. x Rd. to Stratford, Rt. 41	3/28/2005	river edge	river bank to bank, no habitat
Kings	Kings R., w side of Rt. 41	3/28/2005	river edge	soft saline lake edge Salicornia
Kings	Kings, E side, Rt. 41	3/28/2005	river edge	soft saline with Salicornia
Kings	W of 137, west end of Avenue 224			
Kings	E side of Corcoran Irrig. District Reservoir	3/29/2005	vernal pool	too wet
Kings	S end Rd. 32 along Lakeland Canal			
Kings	S of Ave. 144, along Lakeland Canal			
Kings	S of Kent Ave btwn 12th & 14th	6/1/2005	alkali sink	disced
Kings	S of Lemoore, SW cor Hwy 41 & Jackson	6/1/2005	alkali sink	old dairy site
Kings	S of Lemoore, SE cor Hwy 41 & Jackson	2004, 2005	alkali sink	off-road course
Kings	S of Lemoore, NE cor Hwy 41 & Jackson	2004, 2005	alkali sink	eucalyptus grove
Tulare	N. of Farmersville, Kaweah Oaks Preserve	Jan-84	Sandy road, floodplain	Sandy road near Kaweah River and riverbed
Tulare	N. of Farmersville, Kaweah Oaks Preserve	3/31/03; 3/13, 4/20/04	saltgrass mdw	same habitat, nothing
Tulare	S of Woodlake at Kaweah R. x Rt. 245	3/13/2004		adult seen along sandy edge
Tulare	Exeter, E of at Yokohl Dr., Yokohl Crk.	3/13/2004	sandy streambed	heavy cattle use
Tulare	Lort Drive, between Rds 182 and 196, N of Exeter	03/2005, 05/2005	saltgrass mdw	
Tulare	Porterville, Hwy 190 x Tule River			
Tulare	Terra Bella at Deer Ck.	Mar-06	sandy streambed	heavy cattle use
Tulare	E of Angiola, proposed PNWR	4/26/2005	alkali playas	disced, but not planted
Tulare	Lindsay, SE of, Lewis Creek	3/05	saltgrass mdw	overgrown with invasive species, future landfill,resurvey
Tulare	SE of Tulare, J15 x Ave 192	4/29/2005	alkali grassland	overgrown with invasive species, future landfill,resurvey
Tulare	E of Tulare, J15, N of Ave 208	4/29/2005	alkali grassland	overgrown with invasive species, future landfill,resurvey
Tulare	El Monte Way x Kings R.	3/14/04		
Tulare	Rt. 201 x Kings R.	3/14/04		
Tulare	Dinuba		parking lot	well maculated adult
Tulare	Earlimart, W of, SE end Pixley NWR, S Deer Ck	5/7/2005	alkali playas	burrows, summer cattle grazing
Tulare	Earlimart, Pixley NWR, Deer Crk Unit	4/30/05, 5/04/05	alkali playas	winter cattle use
Tulare	N of Pixley NWR, Horse Pasture Unit, 2 sites	4/30/05, 5/04/05	alkali playas	heavy cattle use
Tulare	Earlimart, E of, Church St x Deer Ck. Ave	4/30/2005	alkali playas	disced, but not planted
Tulare	Earlimart, E of, Rd. 144	4/30/2005	alkali playas	disced, but not planted
Tulare	SE of Corcoran, PNWR, Los Feliz Unit	5/1/2005	grassland	winter cattle use
Tulare	W of Earlimart, SE cor Ave 56 & Rd 112	4/30/2005	alkali playas	summer cattle use, needs further survey
Tulare	E of Pixley, E of Rd 144 & S of Ave 112	4/30/2005	alkali playas	heavy cattle use
Tulare	E of Pixley, E of Rd 144 & S of Ave 112	4/30/2005	alkali playas	disced and overgrown
Tulare	White River, E of Ducor	05/13-14/05	sandy streambed	heavy cattle use
Kern	Kern River Park, NE of Bakersfield, Kern River..	3/31/2005		Limited sandy edge, river slow moving
Kern	E of Famoso, Poso Creek, E of old Hwy 65	3/31/2005	sandy floodplain	channelized, upland areas grazed
Kern	Hwy 65 x Poso Creek	4/24/2004	sandy floodplain	dry creekbed, coarse sand, little edge
Kern	Lureline Wells, Poso Creek		alkali sink	disced, but not planted, needs further survey
Kern	W of Delano, Hwy 155		alkali sink	scattered patches of historic native, disced

easiest to find. We checked over 25 floodplain or water edge sites including most historic sites, but no *C. tranquebarica* or other tiger beetles were found. Nearly all of these sites seemed unlikely to support tiger beetle populations because of habitat loss or degradation from agricultural activity, reduced water flow, cattle and human trampling, and/or other land use changes.

We checked over 50 sites with alkali sink or similar saline habitats, including all known historic sites. We focused on the sites near Visalia, Kerman and Helm where many of the earlier collections were made, but most of these and other sites no longer had suitable habitat because of their conversion to agricultural usage, primarily tillage and cattle grazing. We did find several sites in the Kerman area, near the Mendota Wildlife Refuge, with remaining patches of seemingly suitable habitat, but no tiger beetles were found. We and several other collectors also visited the Madera County site between 2003 and 2005 but, because the site was a private ranch, only the peripheral areas were checked and not the interior areas where the beetles were previously found. We found this site to be very densely vegetated with planted grasses, suggesting it may no longer be suitable habitat. Our surveys found *C. t. joaquinensis* at only four sites, three within a 10 sq. km area in Kings County and one in Tulare County. Specific locations of these sites are not given here because of the extreme rarity of this tiger beetle and possible threats from over-collecting.

Kings County sites: The three Kings County sites (designated here as A, B, C), found in late March and April 2005, were scattered fragments of remaining alkali sink habitat near the northeastern edge of the historic Tulare Lake basin, all with similar vegetation and physical characteristics. Vegetation was relatively high (0.5-0.8 m in spring 2005), due to abundant early spring rains, with scattered open bare patches ("mini-playas") of variable size, but usually <100 sq. m) where adults and most larvae were primarily concentrated. The habitat type at site A had common elements of the Valley Grassland, while sites B and C had a greater number of herbaceous perennials. The vegetation included a mix of low, salt tolerant shrubs (*Suaeda moquinii, Frankenia salina, Allenrolfea occidentale,* and *Isocoma acradenia*) and *Distichlis spicata* (saltgrass). Common annual grasses were *Bromus* spp., *Vulpia* spp., and *Hordeum* spp. Common forbs were *Atriplex* spp., *Hemizonia pungens, Lasthenia* spp., *Lepidium* spp., and *Spergularia* spp. At Kings A we counted a peak number of 35 adults in late March 2005. At Kings B we found only a few adults in March and April 2005 and made a high count of 30-35 in late March 2006. The third site (Kings C) had small numbers of larvae that were probably those of *C. tranquebarica*, but unfortunately the site was plowed and the habitat found to be destroyed when we checked it in spring 2006.

Tulare County site: A review of aerial photographs of the San Joaquin Valley revealed a potential area for *C. t. joaquinensis* along the eastern edge of the historic Tulare Lake margin. We surveyed the location near Earlimart (Tulare County) in June of 2005 and here we noted apparent *C. tranquebarica* larval burrows associated with the grassland and scattered mini-playas. The vegetation at this site is dominated by Valley Grassland species with very little of the perennial herbaceous cover seen at Kings B. The vegetation included a mix of low, salt tolerant shrubs (*Isocoma acradenia* and *Suaeda moquinii*), *Distichlis spicata* (saltgrass), common annual grasses (*Bromus* spp., *Hordeum* spp., and *Vulpia* spp.), and common forbs (*Atriplex* spp., *Gilia tricolor, Hemizonia* spp., *Lasthenia* spp., *Lepidium* spp., and *Spergularia* spp.). Further surveys in the fall of 2005 confirmed the presence of adult *C. t. joaquinensis*, with a peak count of 22 individuals.

Field notes, behavior, and seasonality: Observations at both Kings and Tulare County sites indicated adults were restricted to the open or edges of the bare alkali patches ("mini-playas") of varying size (20 to 200 sq. m) with usually 1-3 adults per patch. Some patches had standing water or were moist from recent rain, but others had dry surface soil. Most larval burrows (often in small clusters of 2-5) were located at the edges of these bare patches near vegetation. Our field observations and collection records suggest that *C. t. joaquinensis* has a modified spring-fall seasonal pattern similar to that of the other southern California forms. Adults can be found from late January to mid-February through April, and again in September to November when the new cohort emerges. Most collection records are for March and October (Table 2). The spring activity period is longer than many other spring-fall species but is limited to days when temperatures are near or above 60° F and sunny, and probably when there is some surface moisture. There will thus be frequent extended periods of a week or more during spring when conditions are unfavorable for adult activity. A new adult cohort emerges in late September through October, but the fall emergence may not occur until spring if there is little or no fall rainfall. Our latest observation of adult activity was on November 19, 2005. On that date we dug some adults from apparent larval burrows and observed others going into these burrows. This behavior suggested the adults had emerged earlier and were possibly retreating into these preexisting burrows during periods of unfavorable weather or to spend the cold periods from November to February.

We found large numbers of larval burrows (>150) at both Kings A and B in April 2005, and over 100 at the Tulare site in June 2005. Most were second and third instars and usually present as clusters of 2-8 burrows along the edges of vegetation surrounding the bare patches. A small group of larval burrows were tagged and monitored in 2005. These larvae remained active throughout the summer, but they began plugging their burrows in early September until early October, presumably in preparation for pupation and fall emergence.

Habitat loss, limiting factors, and causes of rarity: Most of the suitable habitat for tiger beetles in the San Joaquin Valley has been lost, primarily due to the intense agricultural activity and the coincidental disruption of water flow in the rivers and streams. The primary limiting factor for the existing areas of potential alkali sink habitats seemed to be whether or not past land usage had included tillage. None of the sites we surveyed that had experienced significant tillage of the soil had evidence of *C. t. joaquinensis* or any suitable habitat. This was not surprising when considering the immobile nature of larvae and the limited opportunity for reinvasion by adults from the increasingly isolated populations. Some disturbances, however, may only eliminate or reduce habitat quality temporarily. For instance, at one of the sites with beetles, a section had been previously trenched, apparently to alter the drainage pattern.

Tiger beetle habitat in the San Joaquin Valley has also been lost through excessive use of the land for cattle grazing. The main effect of this activity in not the reduction in vegetation but rather the disturbance caused by too many hooves on fragile soil types. Alkaline soils tend to "liquify" during periods of winter and spring rains, and the weight of heavy animals drives their hooves deep into the substrate causing compaction and crushing burrows and/or larvae. Placement of salt licks near alkali playas can also cause animals to congregate near these fragile systems, destroying larval burrows and adult foraging areas. Cattle will also seek out playa areas for water in late spring. These negative perturbations are, however, offset by the benefits of cattle grazing which reduces the vegetation height and density of non-native species to create the open areas needed by *C. t. joaquinensis*.

Another limiting factor for tiger beetles in this area is the loss of open patches due to the growth of annuals plants, some of which are invasive species. The primary invasive species at the current sites are Mediterranean grasses (*Bromus diandrus, B. madritensis rubens, B. hordeaceus,* and *Hordeum murinum leporinum*), along with several annual forbs (*Bassia hyssopifolia, Erodium spp., Malva parvifolia*, and *Melilotus indica*). In cases where land was not grazed to reduce cover, openings at the margins and between playas were often not present. This choking out of habitat by excessive plant growth was a common problem, and we hypothesize that this is the cause for the extirpation of a *C. t. joaquinensis* population at the Kaweah Oaks Preserve. Before this site was acquired as a preserve the alkali meadow habitat had several small playa areas kept open by cattle grazing, but one of the early management decisions was to remove grazing cattle in an effort to protect seedling Valley Oaks (*Quercus lobata*). This allowed the meadow to become overgrown with both native and invasive species. We surveyed this site 5-6 times from 2003-2006 but found no tiger beetles and little or no apparent suitable habitat present. An historic population of *Cicindela terricola lunalonga* had also been found at this site, but has been extirpated from this and other San Joaquin Valley sites (Kippenhan, pers. comm.). Increased vegetation cover has been previously documented as a significant cause of decline and habitat loss for other tiger beetles, including C. *abdominalis* (Knisley and Hill, 1994), *C. ohlone* (Knisley, unpulished studies), and *C. debilis* (Knisley and Shultz 1997).

Historic notes and current status of *C. t. joaquinensis*: Since the late Pleistocene, Tulare Lake has been a dominant feature of the southern San Joaquin Valley. Fed by the Kings, Kaweah, Tule, White, and Kern Rivers, it covered approximately 1970 square kilometers and was the largest freshwater lake west of the Great Lakes. It was a shallow body of water (no more than 2 m deep in most areas) and regularly subject to summer evaporation and extreme shoreline fluctuation. At some point during the late Pleistocene or early Holocene, *C. tranquebarica* probably colonized the saline areas associated with Tulare Lake and nearby foothills. Over time those populations along the lakeshore began to specialize in occupying the summer-dry alkali playas, while those more typical of *C. t. vibex* continued to occupy alluvial and riparian sites along and into the foothills. These alkali playa tiger beetle populations arose along the eastern margins of Tulare Lake (Guernsey, Earlimart) and the alkali wetlands to the north (Helm, Kerman). With time they became increasingly immaculate and bright green, possibly for camouflage among the tufted spring vegetation (*Suaeda moquinii* and *Lepidium dictyotum*) at the playa margins. These populations would have had genetic contact with the green-bronze, well-maculated populations of *C. t. vibex* along the foothills of the Sierra Nevada and from the Inner Coastal Range (Carrizo Plain, Warthan Canyon). This intergradation of the two subspecies along the riparian corridors that fed Tulare Lake resulted in populations with bright green coloration and more expanded maculations (Coalinga, Dinuba, Bakersfield), and thus considerable variation in maculation pattern in many of the populations.

In today's landscape the immaculate *C. t. joaquinensis* is isolated from surrounding populations by the dramatic changes that have occurred in the past 125 years. The draining of the Tulare Lake and construction of irrigation systems in the 1890s made vast tracts of land available for cultivation. The initial focus of this conversion to agricultural use was land without the high alkalinity associated with the old lakebed. These conversions eliminated most of the saltgrass meadow habitat adjacent to the old riparian corridors. As indicated by collection records, most of the more maculated populations existed in these floodplains associated with prime farmland or along the perimeter of the San Joaquin Valley. As new technologies became available for conversion of the alkaline soils, and greater pressure for new land was exerted, even marginal soils were plowed for agriculture. This has greatly limited the available habitat for the remaining immaculate populations. Little appropriate habitat remains, thus putting the few surviving *C. t. joaquinensis* populations at a high risk for extinction.

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THE FIRST RECORD OF *PAROCHLUS KIEFFERI* (GARRETT, 1925) (DIPTERA, CHIRONOMIDAE, PODONOMINAE) FROM ITALY[1]

Valeria Lencioni,[2] Laura Marziali,[2] and Bruno Rossaro[3]

ABSTRACT: *Parochlus kiefferi* (Garrett, 1925) Brundin (Diptera, Chironomidae) was found in two high-altitude glacial ponds (2455 m a.s.l.) in the Italian Alps (Trentino). This represents the first record of the tribe Podonomini and the second record of the subfamily Podonominae from Italy. New information on the geographical distribution and the ecological traits of the species is given.

KEY WORDS: Podonominae, *Parochlus kiefferi,* cold stenothermic, biogeography, Italian Alps

The subfamily Podonominae was established for a few northern hemisphere species by Thienemann (1937) while its presence and high diversity in the southern continents was discovered by Brundin (1966). It comprises two tribes, Podonomini and Boreochlini, both including six genera. Within Podonomini, the large genus *Parochlus* Enderlein, 1912, comprising 45 species, possesses a wider distribution than any other genus of the subfamily (Brundin, 1966). The present main centre of *Parochlus* is temperate South America, followed by New Zealand, Tasmania and South-East Australia. Worldwide, *Parochlus* has been recorded in Andean South America and the Archipelago of South Chile (from Peru to Tierra del Fuego and Navarino Islands), Juan Fernandez Islands, South Georgia, South Shetland Islands, Tasmania, New South Wales, New Zealand, Campbell Island, North America, Greenland, Austria, Finland, Faroe Islands, Germany, Great Britain, Finland, Ireland, Iceland, Norway, Poland, and Sweden (Brundin, 1966; Sæther and Spies, 2004).

However, this is mainly due to the exceptional distribution of *Parochlus kiefferi* (Garrett, 1925) Brundin, widely distributed in the Holarctic region (Sæther, 1969; Sæther and Spies, 2004).

Within the monophyletic group *araucanus,* considered the most interesting group from evolutionary as well as biogeographical points of view within the genus *Parochlus* (Brundin, 1966), *P. kiefferi* is the sole species occurring in the northern hemisphere (Brundin, 1966; Cranston, 1995). All the other 15 species included in this group are distributed over the southern land masses (New Zealand, Australia, South America). Several New Zealand-South America vicariance events and one Australia-South America vicariance event occurring after the initial event involving Australia-South America-New Zealand are apparent within the araucanus group. Such sequences fit with the known earth history

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concerning late Cretaceous Gondwanan fragmentation (Cranston, 1995) (Fig. 1).

In the present paper, new information on the geographical distribution and the ecological traits of *P. kiefferi* is given.

Figure 1. World distribution of the species belonging to *Parochlus araucanus* group.

METHODS

Study material was collected in two glacial ponds in the flood plain of the Noce Bianco stream, at 2455 m a.s.l. (Val de la Mare, Trentino, Stelvio National Park, NE Italy, 46° 24′ N, 10° 40′ E). These ponds are free from snow and ice from late June to October, shallow (depth of 40 ± 15 cm), transparent (17 ± 5 mg l^{-1} of suspended sediments), dominated by sand and silt in the substrate, with a current velocity < 0.1 m s^{-1} and water temperature ranging from 4.4 to 15.2°C in summer and from 0.2 to 2.0°C in winter. In summer, total phosphorus ranges from 2 to 4 µg l^{-1}, nitrate nitrogen from 90 to 140 µg l^{-1}, conductivity from 105 to 160 µS cm^{-1}, and pH from 6.1 and 6.5. The ponds are rich in mosses on the shoreline and shallow (mean depth of 30 cm).

Chironomid larvae, pupae and pupal exuviae were collected using a pond net and a drift net, both with a mesh size of 100 µm. Adults were collected with emergence and light traps. Samples were collected twice a month from May to November, 2001 to 2004. Only one female pupal exuvia of *P. kiefferi* was found in one drift sample collected on 17.IX.2003. This specimen was mounted on a permanent slide with Canada Balsam according to Wiederholm (1983) and deposited at the Museum of Natural Science of Trento (Italy). Pictures were taken using a Nikon Eclipse E600 microscope by means of the Leica DC 300 camera. The general morphological terminology follows Sæther (1980) and Langton (1991). Measurements are given in microns.

RESULTS AND DISCUSSION

Morphology of the pupa

From evolutionary, as well as biogeographical points of view, the *araucanus* group forms the most interesting group within the genus *Parochlus*. Among the austral Chironomidae the *araucanus* group takes a unique position because its 16 species, though practically inseparable in the imaginal stage, do show distinctive specific pupal characters (Brundin, 1966).

The closest relatives of *P. kiefferi* are *P. araucanus* Brundin, from the South Andes, *P. bassianus* Brundin, from Tasmania and *P. maorii* Brundin, from New Zealand, which constitute the *araucanus* subgroup. Within the subgroup, *P. kiefferi* is the species with the most apomorphic pupa (Brundin, 1966). The pupa of *P. kiefferi* can be separated on the basis of the morphology of the anal lobes and thoracic horn. Each anal spur has only one seta, which is much shorter than the spur and inserts terminally (Fig. 2) (the presence of setae on the anal spur is the characteristic feature of the *Parochlus* pupa; Wiederholm, 1986). Close to the seta there is a small seta-like spine which is possibly homologous with the second seta of the other species of the subgroup (Brundin, 1966).

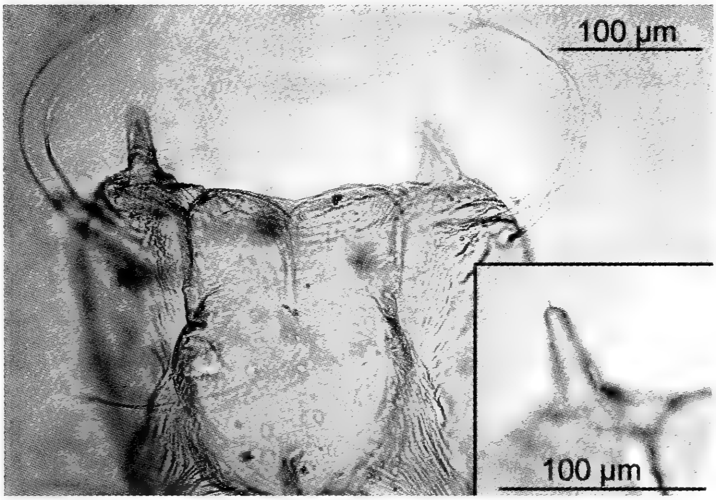

Figure 2. Pupal anal spur: detail of the terminal seta (*P. kiefferi*, PeF, NE Italy).

The thoracic horn differs from those of related species in having a larger porous plate and a more strongly widened distal part (Fig. 3). Furthermore, it is longer than the stalk, and the broad felt chamber which tapers strongly basally is distinctive.

Our measurements of *P. kiefferi* are in agreement with those of Langton (1991) except for the length of the pupal exuvia and of the thoracic horn, which are longer in the Italian specimen (Table 1).

Figure 3. Pupal thoracic horn (*P. kiefferi*, PeF, NE Italy).

Table 1. *Parochlus kiefferi*: lengths and proportions of pupal abdomen, thoracic horn and anal lobes of the female pupa (n= 1). PeL = length of pupal exuvia; AbdL = length of abdomen; ThL = length of thoracic horn; ThR = thoracic horn ratio (length / breadth); Pp L L Th = plastron plate length / length of thoracic horn; ALR = anal lobe ratio (length / breadth of one side only).

PeL mm	AbdL mm	ThL µm	ThR	Pp L L Th	ALR
4.46	3.01	440	1.69	0.64	2.5

Geographical Distribution

The present paper documents the first record of *P. kiefferi* from Italy. It represents the second record of the subfamily Podonominae from the country. The first record was published by Ferrarese (2005), who collected two larvae of *Paraboreochlus minutissimus* (Strobl, 1894) in a tapped spring in Alto Adige (1550 m a.s.l., NE Italy).

Parochlus has close and very similar relatives in the southern temperate zone (e.g. *Zelandochlus* Brundin, 1966, *Podonomus* Philippi, 1865 and *Microzetia* Séguy, 1965) but stands rather isolated in the Holarctic fauna. Numerous *Parochlus* species occur in the southern temperate zone, but only *P. kiefferi* has been found to occur in the Holarctic region (Wiederholm, 1986). Described from

British Columbia in 1925, it was later recorded from North America: Quebec, Ontario, British Columbia, Maine, New York, Colorado, Washington, California, Greenland, and Europe: Iceland, Faroe Islands, Finland, Sweden (including Gotland Island), Norway, Ireland, Britain (including Shetlands, Orkneys, Hebrides and Man Islands), Poland, Germany, Austria (Sæther, 1969; Sæther and Spies 2004) (Fig. 4).

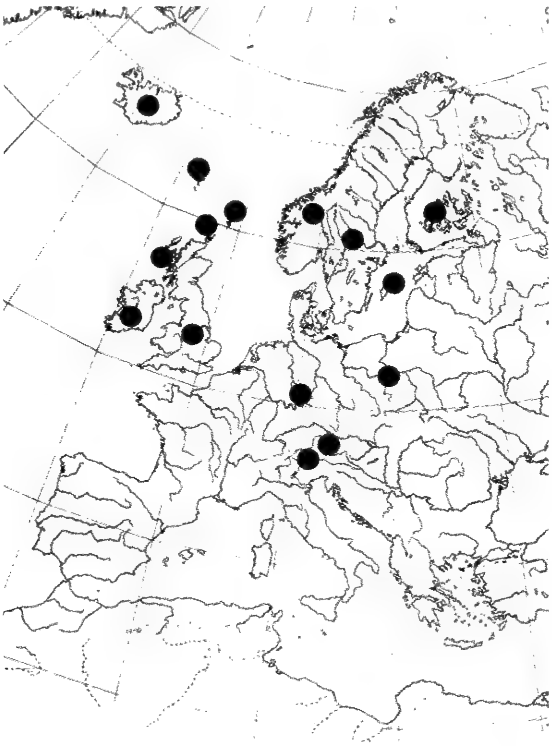

Figure 4: Distribution of *Parochlus kiefferi* in the Palaearctic region.

Three possible explanations of the biogeographic isolation of *P. kiefferi* were given (Cranston, 1995): 1) faulty analyses of phylogenetic relationships; 2) dispersal from a cold stenothermic southern hemisphere location to its present North American localities; 3) the clade predates the early Cretaceous Gondwana, having originated in geologically earlier time in megacontinental Pangea, in which North and South America were contiguous.

The generally accepted Gondwanan fragmentation of cool temperate species (leaving vicariant daughter taxa in Magellanic South America, New Zealand, southern Australia and, sporadically, upland southern Africa) is a repeated and well-established pattern amongst predominantly cool stenothermic taxa (Cranston, 1995). The finding of adult males of a species of the *P. araucanus* clade at high elevations in Costa Rica (Central America) (Watson and Heyn, 1993) might indicate northward diffusion from South America rather than a more archaic pattern, if the unknown pupa were to be identical or sister-group to *P. kiefferi* (Cranston, 1995). The invasion of Europe probably occurred via Greenland and Iceland (Lindeberg, 1979; Cranston and Oliver, 1987).

Ecological Remarks

According to Brundin (1966), *Parochlus* stands out as a "successful" genus, being adapted to a wide range of habitats. The immature stages live in running waters of various types, mainly mountain streams of glacial origin (e.g., *P. glacialis* Brundin, 1966, *P. maorii,* and *P. ohakunensis* (Freeman, 1959) were found emerging at a water temperature of 0.5°C close to the glacial snout of the Fox Glacier, New Zealand; Brundin, 1966). However, *Parochlus* does not show the strict confinement to running waters apparently characteristic of some genera of the subfamily. For example, *P. steinenii* (Gerke, 1889), one of the few endemic dipteran species in Antarctica (Convey and Block, 1996), was collected among mosses in cold shallow tarns and other standing waters (Brundin, 1966). Larvae of *P. kiefferi* are known to be grazers and gathering collectors (detritus feeders) and live in eukrenal, hypokrenal and epirhithral habitats (Moog, 1995). Pupae are free-living and have open-ended thoracic horns (this represents the most primitive condition, Langton, 1995) which are applied to the water/air interface to replenish the oxygen supply directly from the air.

Thienemann (1937) reported *P. kiefferi* from springs and euhypokrenal biotopes in Swedish Lapland with a temperature ranging from 0.4 to 8.8°C. In its isolated occurrence at the top of Schneeberg, Black Forest, *kiefferi* showed the same preference (Wülker, 1958). In North America it was collected also in large fast running non-glacial streams. In the Italian Alps, the first author collected *P. kiefferi* among mosses in a pond fed by icemelt waters (limnokrenal), while it was absent in brooks and streams in the same floodplain. The pond is frozen from November to June, with a median summer temperature of 5.1 ± 2.3°C. This species might be considered as cold stenothermic, according to the habitat features in which it was found.

In the same sample three other chironomid species were found: *Pseudodiamesa branickii* (Nowickii, 1837), typical of cold springs (Lencioni and Rossaro, 2005), *Chaetocladius laminatus* Brundin, 1947, which colonizes northern and montane seepages and pools (Langton, 1991) and, as dominant taxon, *Micropsectra radialis* Goetghebuer, 1939, colonizer of northern and alpine lakes (Nocentini, 1985).

Parochlus kiefferi is rare in the investigated area. Only one pupal exuviae was found amongst hundreds of specimens collected in standing and lotic habitats within the Noce Bianco catchment along a wide altitudinal range (1300-2800 m a.s.l.) (Lencioni et al., 2007).

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A GYNANDROMORPH OF *EUREMA HECABE* (LEPIDOPTERA: PIERIDAE) FROM JAPAN[1]

S. Narita,[2] M. Nomura,[2] and D. Kageyama[3]

ABSTRACT: A gynandromorph of a pierid butterfly, *Eurema hecabe*, caught at Mt. Tsukuba in Central Japan is described here. Wings were apparently bilaterally asymmetric, while the external and internal genitalia clearly showed the morphology and genotype of the female. The fact that this individual showed a female genotype excluded the possibility of incomplete feminization due to *Wolbachia* infection. Presence of a spermatophore in the bursa copulatrix and the difference in number of matured eggs between the right and left ovaries indicated that this gynandromorphic individual had copulated and oviposited in the field.

KEY WORDS: *Eurema hecabe*, gynandromorph, Lepidoptera, Pieridae, Mt. Tsukuba, Japan, *Wolbachia*

In wild-caught or laboratory-reared insects, individuals showing a mosaic of morphology of both sexes are found very rarely. They are usually referred to as "gynandromorphs." The common yellow butterfly, *Eurema hecabe* (L.) (Lepidoptera: Pieridae), is distributed almost all over the Oriental, Australian as well as Afrotropical biogeographic regions, and extends into the cool-temperate zone of the Eastern Palaearctic Region (e.g. the northern part of Honshu, Japan, up to 40°N, Yata, 1995). It was recently recognized that *E. hecabe* consists of two sibling species, tentatively called yellow type and brown type, which are distinctive in various biological and genetic traits.

We captured an abnormal adult of *E. hecabe* (yellow type) with wings of both male (left) and female (right) at Mt. Tsukuba located in the central part of mainland Japan. This individual was examined for morphology and karyotype of the internal and external genitalia. In addition, infection status with endosymbiotic bacteria *Wolbachia* was examined. *Wolbachia* is known to manipulate the reproduction of its host insect in various ways such as feminization, male killing, induction of parthenogenesis or induction of cytoplasmic incompatibility (Bourtzis and Miller, 2003). In Okinawa, a southwestern island of Japan, a part of *E. hecabe* females (ca. 10%) produce progeny with a sex ratio strongly biased in favor of females. These females are infected with two different strains of *Wolbachia* (*w*Hec1 and *w*Hec2), while those producing progeny with a normal sex ratio are infected with wHec1 only. The result of antibiotic treatment (individuals eclosed were all males) as well as of cytogenetic sexing suggested that these females were genetically male but feminized by *Wolbachia* (Hiroki et al., 2002, 2004). Almost all populations of *E. hecabe* in Japanese mainland except-

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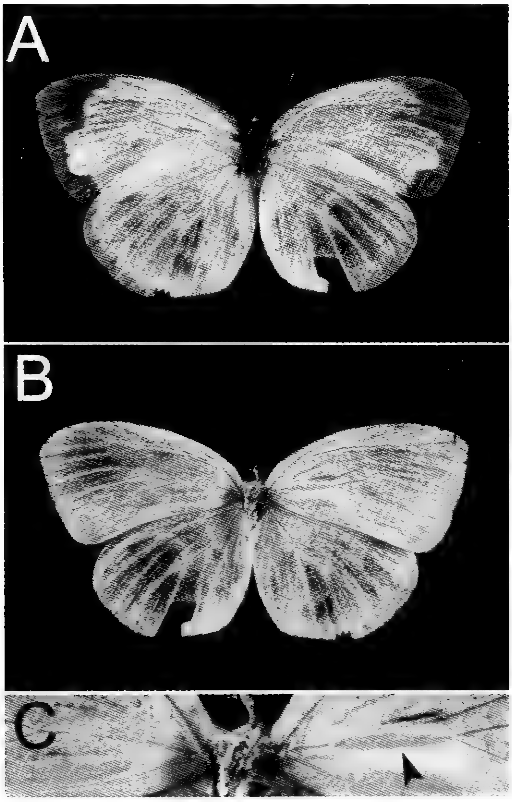
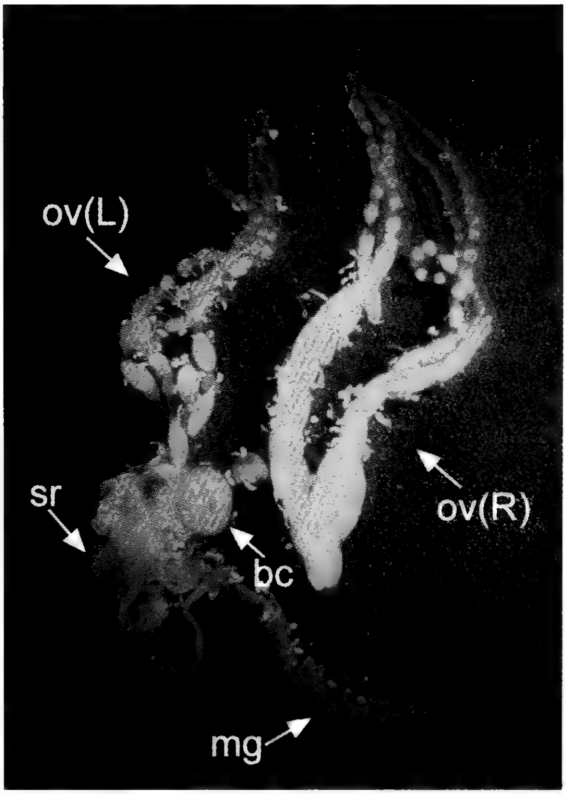
ing for the northern area, are infected with only one *Wolbachia* strain, wHec1 (Narita et al., 2006), where the female-biased sex ratio has never been reported.

Sample: A gynandromorph of *E. hecabe* was caught at Mt. Tsukuba, Ibaraki Prefecture, Japan in June 23, 2006.

Sexual phenotype of wings: Ground color of the left wings was bright yellow (Fig. 1a). On the left forewing underside, the sex-brand which normally appears only in male (Yata, 1995) was present (Figure 1B, 1C). On the contrary, ground color of the right wings was pure white/pale yellow, and the sex-brand was absent in the right forewing (Figure 1). Thus the left wings of this individual were exactly those of the male, while the right wings were exactly those of the female.

Sexual phenotype of the internal organs and external genitalia: The internal organs were dissected. They were exactly of the normal female: the bursa copulatrix, seminal receptacle and ovaries (female organs) were present and the testes (male organ) were absent (Table 1; Figure 2). A spermatophore was present in the bursa copulatrix, indicating that this individual had copulated with a male. Matured eggs were significantly fewer in the left ovary than in the right (Figure 2). The external genitalia were macerated in a 10% KOH (potassium hydroxide) for two hours and their scales removed. They were also exactly of the female (data not shown).





Figures 1-2. 1. A gynandromorph of *Eurema* sp. collected at Mt. Tsukuba. A: dorsal view. B: ventral view. C: magnified image of B. Arrowhead indicates sex-brand. 2. Internal organs of the gynandromorph of *Eurema* sp. ov (L): ovary (left side), ov (R): ovary (right side), bc: bursa copulatrix, sr: seminal receptacle, mg: midgut.

Table 1. Sex-related traits of the gynandromorph of *Eurema hecabe* (yellow type) examined in this study.

Sex-related traits		Female	Gynandromorph	Male
Forewing	ground color[1] (left/right)	w/w	s/w	s/s
	sex bland (left/right)	-/-	+/-[2]	+/+
Internal genitalia	ovary	+	+[3]	-
	testis	-	-	+
	seminal receptacle	+	+[3]	-
External genitalia	valva	-	-	+
	phallus	-	-	+
	ovipositor	+	+	-
	bursa copulatrix	+	+[3]	-
Karyotype	Malpighian tubule	ZW	ZW	ZZ
	bursa copulatrix	ZW	ZW	ZZ

[1]w, weak yellow; s, strong yellow, [2]See Figure 1, [3]See Figure 2.

Cytogenetic Sexing: In many species of Lepidoptera including *E. hecabe*, the sex chromosome constitution is female-heterogametic (ZZ in males/ZW in females), and the W chromosome is conspicuous as a condensed sex-chromatin body in interphase nucleus (Traut and Marec, 1996). In this study, the Malpighian tubules and bursa copulatrix were removed and fixed in methanol : acetic acid (3:1) for ca. 1 min, transferred to slides, stained and mounted in lactic acetic orcein and examined under a light microscopy as described in Kageyama and Traut (2004). Sex chromatin bodies were present in every nucleus of Malpighian tubule and bursa copulatrix cells, indicating that at least a part of the body was genetically female (Table 1).

Detection and Identification of *Wolbachia*: *Wolbachia*-specific PCR amplifying wsp gene (ca. 600 bp) gave a positive result. The primers used were wsp81F 5' TGGTCCAATAAGTGATGAAGAAAC -3' (forward) and wsp691R 5'- AAAAATTAAACGCTACTCCA -3' (reverse) (Zhou et al., 1998). To characterize the *Wolbachia* strains detected, the PCR product of wsp gene were cloned and subjected to DNA sequencing. The sequences of 27 clones examined were all identical to those of cytoplasmic-incompatibility-inducing *Wolbachia* seen in *E. hecabe* from the mainland of Japan (*w*Hec1, accession number AB210826).

DISCUSSION

Abnormal individuals that are comprised of morphologically male and female tissues are usually referred to as "gynandromorphs." Strictly speaking, however, "gynandromorph" is defined as chimeric individual of genetically both male and female. Gynadromorphs usually result from either loss of a sex chromosome during early embryogenesis, or from fertilization of a bi-nucleated egg (Laugé, 1985). In Lepidoptera, sex chromosome constitution is heterogametic (ZW) in females and homogametic (ZZ) in males. The most frequent origin of a gynandromorph in the silk moth, *Bombyx mori* (L.), is double-fertilization of a bi-nucleated egg (Z+W), resulting in an individual with ZZ and ZW cell karyotypes (Goldschmidt and Katsuki, 1927). In *Drosophila,* gynandromorphs are typically produced by the loss of an X chromosome during the first cleavages of an XX zygote (Morgan, 1914). In the honeybee, *Apis mellifera* L., where males are haploid and females are diploid, the male tissues of gynandromorphs are of maternal origin and the female tissues are of biparental origin (Rotenbuhler et al., 1952).

Similarly, intersexes are individuals that are comprised of phenotypically male tissues and female tissues. But they are essentially different from gynandromorphs in that an intersex is genetically either purely male or purely female. In *Drosophila,* various mutants that produce intersexes have been isolated and contributed to the understanding of the sex-determining mechanism (e.g. Morgan et al., 1943; Sturtevant, 1945; Watanabe, 1975; Hildreth, 1965). In the gypsy moth, *Lymantria dispar,* a crossing between geographic strains resulted in production of intersexes having purely male karyotype (Goldschmidt, 1934). In some of the strains of the adzuki bean borer, *Ostrinia scapulalis* (Lepidoptera: Crambidae) and *E. hecabe* are infected with endosymbiotic bacteria *Wolbachia* that have an ability to feminize their genetically male hosts (Kageyama and Traut, 2004; Hiroki et al., 2002). In *O. scapulalis,* incomplete elimination of *Wolbachia* resulted in production of intersexes which were genetically purely male (Kageyama et al., 2003; Kageyama and Traut, 2004).

The individual of *E. hecabe* examined here was morphologically female except for the left wings. Cytogenetic observation of this individual revealed that the internal organs and external genitalia were genetically female. Unfortunately, however, we could not examine the sexual genotype of wings, the only tissue showing the male phenotype. Thus we could not determine whether this individual was an intersex or not. Although *Wolbachia* was detected, the fact that the bursa copulatrix and Malpighian tubules were genetically female indicated that this was not the case of feminization of genetic males caused by *Wolbachia.*

It is very likely that this individual had copulated with a male and laid eggs in the field, since one spermatophore was present in the bursa copulatrix and matured eggs in the left ovary were apparently fewer than in the right one (Figure 2).

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NESTS AND PREY OF *ISODONTIA ELEGANS* (F. SMITH) (HYMENOPTERA: SPHECIDAE) IN MONTANA, U.S.A.[1]

Kevin M. O'Neill[2] and Ruth P. O'Neill[3]

ABSTRACT: A description is provided of the cavity-nests of *Isodontia elegans* (Smith), one of three North American members of the subgenus *Murrayella.* As is typical of its close relatives and of other populations of the same species, females constructed multi-cellular nests in tunnels (trap-nests in this case) and separated cells with 2-20 cm thick partitions consisting of finely cut, dried plant fragments. Cells, up to five per nest, were stocked solely with tree crickets (*Oecanthus quadripunctatus*), 97% of which were adults, primarily females. From 3 to 11 prey were placed in individual brood cells, with female offspring receiving, on average, 40% more prey than males.

KEY WORDS: Hymenoptera, Sphecidae, *Isodontia,* trap-nest, nesting behavior, Gryllidae, *Occanthus,* Montana, U.S.A.

The genus *Isodontia* (Sphecidae: Sphecinae) contains more than 60 described species, including 6 in America north of Mexico (Pulawski 2007). Among solitary cavity-nesting wasps, only *Isodontia* of the subgenus *Murrayella* use dried plant materials (grass blades and stems, bark fibers) as the sole constituents of nest partitions and plugs. Nests and prey of three North American *Isodontia* (*Murrayella*) species have been studied: *Isodontia auripes* (Fernald), *Isodontia elegans* (Smith), and *Isodontia mexicana* (Saussure) (Pulawski 2007). Of the three, *I. mexicana* is the best-studied and most geographically widespread (Medler, 1965; Lin, 1966; Krombein 1967, O'Neill and O'Neill 2003, O'Neill et al., in press; O'Neill and O'Neill, submitted); it has, in fact, recently spread to the Midway Atoll in the mid-Pacific (Nishida and Beardsley, 2002) and Europe (Pagliano et al., 2001). *Isodontia elegans* is the least-studied. In our trap-nesting studies in southwestern Montana, we encountered 148 nests of *I. mexicana* at five sites (O'Neill and O'Neill 2003, but only 12 of *I. elegans,* all at one site. Krombein (1967) also found 12 nests of this species (only 7 of which had final closures), all from southeast Arizona; he also reviewed earlier, less-detailed accounts of the behavior of this species, none of which appeared later than 1924. Other, more recent studies provide distributional data on this species (see Pulawski 2007), along with a brief account of ovary structure by Ohl and Linde (2003). Thus, it seems of value to provide further biological data here.

METHODS

We found *I. elegans* nesting in the Horseshoe Hills, 15 km NE of Logan, Gallatin Co., Montana, in a narrow, dry gully containing a stand of junipers (*Juni-*

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perus sp.). At this site, *I. elegans* occupied trap nests consisting of pine boards with 15 cm long holes into which we had inserted cardboard tubes with internal diameters of 7.5, 8.0, and 9.0 mm. In June of 2001, 2003, 2005, we placed trap-nests, with holes facing southeast, at heights of ~1.5 m at the edges of individual junipers. In late October of each year, we transferred all nests to an 8°C, 85% relative humidity storage facility at Montana State University where they remained until April of the following year; rearing was then completed at 24-29°C and 20-36% relative humidity. We dissected all nests immediately after removal from cold storage, so that all cell contents could be recorded and diagramed. The lengths of cells, partitions, and final plugs were measured along central longitudinal axis of the tunnel; length of the final plug was measured to the end of the nest tube. We examined prey parts, particularly head capsules, mandibles, antennal bases, wing fragments, and terminalia, to estimate the number and sexes of prey in each cell. At this time, *I. mexicana* cocoons and fly puparia were removed for individual rearing in glass culture tubes. Head widths of emerging adult wasps were measured to the nearest 0.1 mm using a micrometer with 0.02 mm increments. Head width is a commonly used measure of overall body size in the Hymenoptera (O'Neill 2001).

RESULTS AND DISCUSSION

Of the 12 tubes occupied by *I. elegans* in Montana, three were in 7.5 mm diameter holes, three in 8.0 mm holes, and six in 9 mm holes. All 12 nests had final closures, a broom of dried grass stems that protruded from nest entrances by as much as 5 mm; in most cases, however, the broom was flush, or nearly so, with the nest entrance. All nests studied by Krombein (1967) in Arizona were within 12.7 mm diameter tunnels, perhaps because the next smallest tunnels he made available had diameters of 6.4 mm, which were too small for this species. Nest partitions between cells and final plugs in our nests were constructed of dried plant fragments of the type previously described for *Isodontia* (Medler 1966, Krombein 1967, O'Neill and O'Neill 2003). The number of cells per nest, and the dimensions of cells, partitions, and final plugs were similar to those reported by Krombein (Table 1); however, in Arizona, nest cells and partitions were somewhat longer, whereas final plugs tended to be shorter. Eleven of twelve innermost cells in the Montana nests began at the inner end of the boring, but one nest began with a 2 mm thick inner plug of fine plant fragments.

We found only three intact prey in cells, but other prey were identifiable from fragments remaining following larval feeding. Of the 189 prey counted, 5 were late instar nymphs and 184 were adults of tree crickets of the genus *Oecanthus* (Gryllidae: Oecanthinae). All 73 prey that could be identified to species were *Oecanthus quadripunctatus* Beutenmüller, which was also the most common prey of *I. mexicana* at nearby sites (O'Neill and O'Neill 2003). In Arizona, *I. elegans* provisioned not only with *O. quadripunctatus*, but with *Oecanthus californicus* Saussure and two species of Tettigoniidae (Krombein 1967). The use of both tree crickets and katydids is common for *I. mexicana* as well (Medler 1966, Krombein 1967, O'Neill and O'Neill 2003). Adult prey that could be sexed in Montana nests included 60% females (N = 120), a significant sex bias ($\chi^2 = 34.2$, $P < 0.001$), but one that was somewhat less extreme than we found among *I. mexicana* tree cricket prey in both Montana (77% females among *O. quadripunctatus*; O'Neill and O'Neill 2003) and New York (92% females among *Oecanthus niveus* De Geer; K. M. O'Neill and J. F. O'Neill, submitted).

Table 1. Comparison of characteristics of nests of *Isodontia elegans* in Montana (present study) and Arizona (Krombein 1967).

	Montana			Arizona		
	Mean	Range	N	Mean	Range	N
Number of cells per nest	2.9	1-5	12	-	2-4	7
Cell length (mm)	27.9	18-51	33	38	18-90	24
Partition length (mm)	5.5	2-11	23	8	2-20	12
Final plug (mm)	45.0	5-82	11	25	14-45	7

Twenty-one of 35 nest cells produced adults, including 12 females from 3.8-4.2 mm head width (mean ± SE = 4.08 ± 0.03) and 9 males from 3.4 -3.8 mm (mean = 3.64 ± 0.04; Mann-Whitney test, $P < 0.001$). Among these cells, the number of prey provided was a significant predictor of the head width of the emerging adult (linear regression: head width = 0.067 x (prey number) + 3.431; $r^2 = 0.35$, F-test, $F_{1,\,19} = 10.08$, $P = 0.005$). As in *I. mexicana* (O'Neill and O'Neill 2003) and other solitary wasps (reviewed in O'Neill 2001), females allocated more prey to cells in which they had laid female eggs. Twelve female cells were stocked with a mean of 8.2 ± 0.5 prey (range: 5-11), whereas nine male cells had 5.2 ± 0.5 prey (range: 3-7) (F-test, $F_{1,\,19} = 4.07$, $P < 0.001$). Offspring sex ratios tended to be female-biased in inner cells, but male-biased in outer cells: cell 1, the innermost cell (1 male: 6 females), cell 2 (2:5), cell 3 (5:1), and cell 4 (1:0). The only male in present in the innermost cell position came from a nest with just one cell, and no males emerged from cells basal to a cell housing a female in the same nest.

Among the cells that did not successfully produce adults, one was completely empty, two contained prey only (one or two), and two had cocoons containing prepupae that had been destroyed by infestations of *Melittobia* sp. (Hymenoptera: Eulophidae) that probably originated in the lab during rearing. The remaining cells contained normal cocoons from which adults failed to emerge.

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A NEW SPECIES OF *RHAMPHOMYIA* (*SENSU STRICTO*) MEIGEN (DIPTERA, EMPIDIDAE) FROM SOUTHERN ANATOLIA, TURKEY[1]

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ABSTRACT: A new species of *Rhamphomyia* (s. str.) from southern Anatolia (Karaman province) is described and illustrated and compared with related species.

KEY WORDS: *Rhamphomyia,* Diptera, Empidiidae, new species, southern Anatolia, Turkey

Rhamphomyia Meigen is one of the largest genera of the family Empididae. Recently, Chvála and Wagner (1989) listed 315 species in the Palaearctic Region. Although 30 species have been described since then (Barták, 1985, 1997, 1998, 1999, 2000, 2001, 2004, 2006; Barták and Syrovátka, 1983), there is no *Rhamphomyia* record from Turkey with the exception of recently described *R. cimrmani* Barták, 2006. Due to the geographical position and habitat diversity of Turkey, a high number of species from *Rhamphomyia* is expected. The Holarctic subgenus *Rhamphomyia* s.str. was delimited by Barták (1982), it contains species with setulose proepisternal depression, complete anal vein (A1) and acute axillary angle.

METHODS

McAlpine (1981) morphological nomenclature was followed, with a few modifications. The genitalia were macerated in 10% KOH (24 hours, at room temperature). Abbreviations used are as follows: T 1, 2, 3 / Mt 1, 2, 3 = length of fore, mid, hind tibia: length of fore, mid, hind basal tarsomere, respectively; Mt 1, 2, 3 / Mt 1, 2, 3 = length of fore, mid, hind basal tarsomere: width of this tarsomere, respectively; M2 / D = length of vein M2: greatest length of discal medial cell; M3 / Db = length of apical of M3: preapical sections of vein CuA1; lw / ww = greatest length of wing: greatest width of wing.

Rhamphomyia (s. str.) *karamanensis* sp. n.

Figs. 1-4

Male

Eyes holoptic, facets in lower half of eyes much smaller than upper ones. Frons black, grey pruinose, without hairs. Ocellar setae black and fine, approximately one third as long as frons, accompanied by 1-2 pairs of slightly shorter setulae. Face black, light grey pruinose, lower part 0.21 mm broad and as long as its width, without hairs. Occiput black, light grey pruinose, fine black setose, postocular row incomplete. Antenna black, ratio of antennal segments = 12: 9: 50: 7, longest setulae on

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basal two segments about 0.15 mm long. Labrum shinning brownish-black, shorter than height of head. Palpus brown, short, covered with several dark setulae. Gena narrow and pruinose, clypeus polished partially.

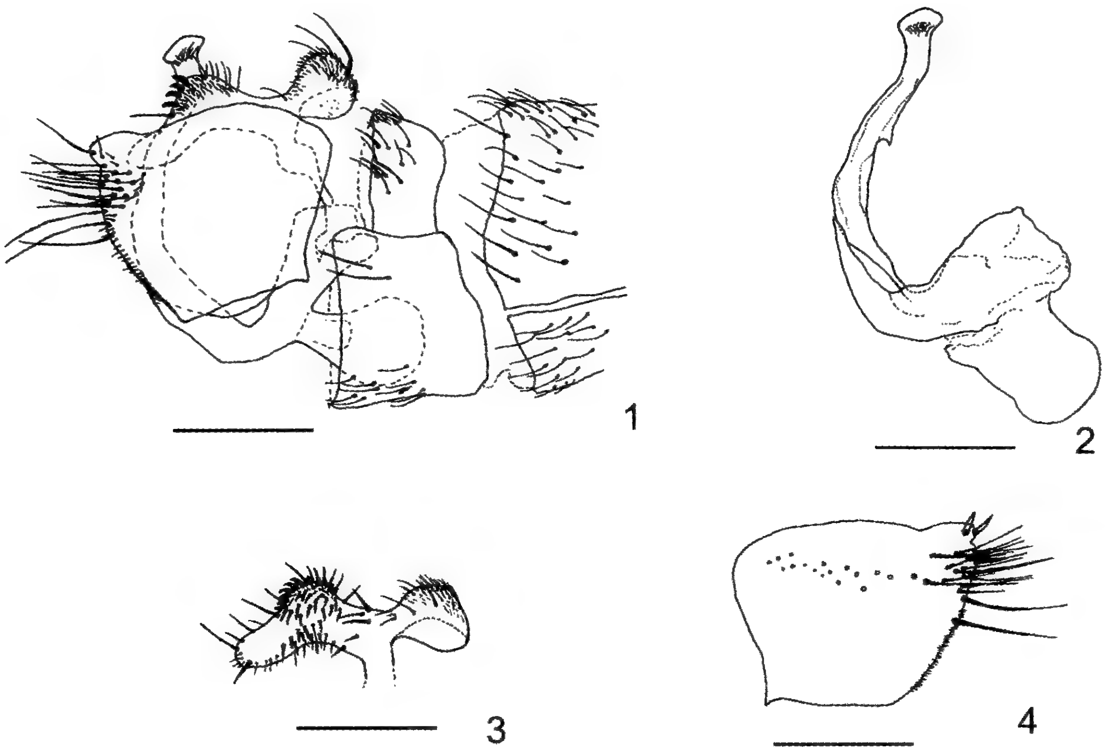
Thorax black, light grey pruinose, with two brown stripes along rows of dorsocentral setae. All setae and setulae are black. Chaetotaxy: about 15 setulae on proepisternum; 3-4 setulae on proepisternal depressions; prosternum bare; 16 biserial, fairly fine acrostichals; 25-28 irregularly biserial dorsocentrals about 0.20 mm long, ending with 3 stronger prescutellars; 4-5 setulae on intrahumeral areas; 1 strong posthumerals and 0-2 additional setulae; 1 strong humeral accompanied with about 10 much smaller and finer setulae; 3 strong notopleurals and 2-3 short setulae on anterior part of notopleuron; 1 strong supraalar (plus 1-2 additional setulae) and about 4-5 setulae in prealar areas; 1 long and 1 small postalars; 2 scutellars; laterotergite (metapleura) with black setae.

Pleura and coxae same appearance, coxae with black setose. Legs brownish-black, pruinose (pruinosity consists of rather long microchaetae), black setose. A long seta present in comb at tip of hind tibia. Fore femur with sparse row of fine anteroventral setulae shorter than width of femur, posterior surface rather densely covered with equally fine setulae about as long as width of femur. Fore tibia with 4-5 pairs of anterodorsal and posterodorsal setae twice as long as width of tibia, fine setulae between them also relatively long, posteroventral ciliation about as long as width of tibia. Mid femur with fine anteroventral setulae half as long as width of femur, anterodorsal and posteroventral setae somewhat longer, up to as long as width of femur. Mid tibia with 3 long, strong anterodorsals on apical half of tibia, 3 times as long as width of tibia; posterodorsal setae absent except single short subbasal and preapical setae, 2-3 anteroventral and equal number of posteroventral setae twice as long as width of tibia. Hind femur with only very fine and short ventral setulae (approximately half as long as width of femur), also other ciliation short and fine except several fine posterior setulae on basal part of femur about as long as width of femur. Hind tibia very slightly swollen and flattened, with 3-4 anterodorsal and 5-6 posterodorsal setae, about 1.5 times as long as width of tibia ventral; setulae are shorter. Basal tarsomeres of all legs thin and short setose, with short ventral spines, T1 / Mt1 = 2.1-2.2, Mt1 / Mt1 = 6.5, T2 / Mt2 = 2.9-3.0, Mt2 / Mt2 = 5.6-5.7, T3 / Mt3 = 2.1, Mt3 / Mt3 = 7.1.

Wing clear, stigma brown, veins brown, anal vein (A1) complete. Costal seta absent, axillary angle deeply incised. M2 / D = 1.5-1.6, M3 / Db = 2.7-2.8, lw / ww = 2.7-2.8. Halteres yellow, calypters yellow with dark fringes.

Abdomen black, light grey pruinose, dorsal genital lamella partly polished. All setae and setulae dark. Hind marginal setae on sides of tergites 2-3 are as long as their segments, on remaining segments setae slightly shorter than sclerites, discal setulae shorter than marginals. Dorsum of tergites with short setulae. Sternite 1 with 2 setulae on sides. Terminalia simple (Figs 1-4). Cercus with submedian dorsal process and long preapical seta; epandrium broadly ovate, with long setae only at tip; phallus slightly broadened at tip and also laterally about middle and with a small dorsal hook; hypandrium ovate and free at tip.

Length of body 5.5 mm, wing 5.7 mm.



Figures 1-4: *Rhamphomyia karamanensis* sp. n.: 1. Terminalia in lateral view, 2. phallus (lateral view), 3. cercus (lateral view), 4. epandrium (lateral view), scales 0.3 mm.

Female

Eyes broadly dichoptic, all facets same size. Frons, face and occiput black, densely grey pruinose. Frons almost parallel-sided, upper part only slightly broadened. Frontal setulae black and quite short. Face broader than frons and broadened towards lower part. Upper half of occiput covered with black, long and strong setae, lower part of occiput with longer and finer yellowish-brown hairs. Antenna black, first antennal segment 1.5 times as long as 2nd antennal segment. 3rd antennal segment nearly 3 times as long as first antennal segment, style short, as long as 2nd antennal segment. Labrum slightly longer than height of head, shinning black.

Thorax black, grey pruinose, with four brown stripes, two stripes along lines of dorsocentral setae and two stripes along sides of mesoscutum; outer pair of stripes less distinct and thinner. All setae and setulae black, shorter than setae and setulae of male. Chaetotaxy: pronotum with row of short setulae; prosternum bare, about 10-15 setulae on proepisternum; acrostichals and dorsocentrals equally long and biserial, dorsocentrals ending with 3 pairs of long prescutellars; 1 strong postpronotal accompanied with small setulae; 1 posthumeral with several setulae nearby; 3 strong notopleurals; on anterior part of notopleuron with additional 3-4 short setulae; 1 supra-alar and about 2-3 setulae in prealar areas; 1 strong and 1 quite short and fine postalars; 2 scutellars; laterotergite with black setae.

Pleura and coxae same appearance, coxae black setose except fore coxae with yellowish-brown long hairs and additional black setae (3-4 in row). Legs black, slightly grey pruinose. All femora with short black setulae. Fore tibia covered with short black setulae, denser on ventral part, posterodorsally with strong setae as long as width of tibia, anterodorsally with strong seta on middle part, preapical setae longer than width of tibia. Mid tibia covered with short black setae, posterodorsally with 2-3 strong setae, as long as width of tibia, preapical setae shorter than preapicals on fore tibia. Hind tibia covered with short black setae anterodorsally and posterodorsally with row of strong setae becoming longer than width of tibia towards tip; preapical pair of setae much longer than width of tibia. All tarsal segments with preapical setae, hind basitarsus dorsally with 2 long setae (longer than width of basitarsus), posteroventrally and anteroventrally with 3-4 strong setae, as long as width of basitarsus.

Wing slightly brown tinged, veins dark brown, anal vein complete. Costal seta absent. Halter yellow with darker stem, calypter yellow with dark fringes.

Abdomen black, grey pruinose and covered with black setulae. Anterior four segments laterally with very long setae (as long as their segments), following segments with shorter setae.

Length of body 5.5 – 5.8 mm, wing 5.7 – 6.0 mm.

Differential Diagnosis: *Rhamphomyia* (s.str.) *karamanensis* sp. n. belongs to the *R.* (s.str.) *ignobilis* complex. It is most closely related to several species of this complex on the basis of the relatively long and narrow cercus, however its peculiar shape (Fig. 3) clearly distinguishes this new species from other species of this complex. In a sense, this new species represents a connecting line between Frey´s subgenera *Eorhamphomyia* (no strong ventral setae on hind femora in both sexes) and *Collinaria* (costal seta absent). The most closely related species is probably *R. biroi* Bezzi, however the authors have not seen any male specimen of this species and the original description is quite unsatisfactory. Females are similar to *R. biroi,* however this species has much shorter setose abdomen (hind marginal setae on segments 4-5 are at most 1/3 as long as their segments), whereas the setae in females of *R. karamanensis* are at least as long as particular segments.

Variability: One male from the Karamanbey mountain pass has five stripes on the mesoscutum, main two stripes on dorsocentral setae brown and distinct, outer pairs brown but thin and not very distinct, middle stripe on acrostichal setae slightly distinct (only view from above), black and ending in the middle of mesoscutum. Halteres yellow with stem nearly black. Other all characters are identical.

Holotype Male: Turkey centr., 100 km NE Konya, Karaman env., pasture, 30.iv.1996, leg. B. Mocek, deposited in Museum Hradec Králové.

Additional Materials: Turkey centr., 100 km NE Konya, Karaman env., pasture, 30.iv.1996, 1 female, leg. B. Mocek, deposited in Museum Hradec Králové; Turkey, Içel, Mersin, between Çatak and Findikpinari, 20.v.2005, 1 male, 1 female, leg. A. Hasbenli, deposited in Zoological Museum of Gazi University (ZMGU); Turkey, Içel, Silifke, between Kıcaköy and Çömelek, 21.v.2005, 1 male, leg. A. Hasbenli, deposited in Zoological Museum of Gazi University (ZMGU); Turkey, Karaman, between Ermenek and Karaman, Karamanbey mountain pass, 22.v.2005, 2 males, 1 female, leg. M. Çiftçi, deposited in Zoological Museum of Gazi University (ZMGU).

Distribution: Turkey.

Dates of Occurrence: April-May.

Derivatio Nominis: The species is named after the province of the type locality.

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BOOK REVIEW

An introduction to biological evolution. Second Edition. Kenneth V. Kardong. 2008 The McGraw-Hill Companies, Inc. New York, New York, U.S.A. 352 pp. ISBN 978-0-07-305077-5. Soft cover.

Although Kardong's *An Introduction to Biological Evolution* (2nd ed.) is considered a textbook, it reads more like a story, acknowledging the humanity behind the people and ideas of evolution, while retaining a scholarly tone. The writing builds on biology basics, relating them to the specifics of Darwin and Wallace's theory. For more ambitious readers, all seventeen chapters list "Selected References" for further reading. Numerous, monochrome, three-dimensional illustrations complement the text.

The idea of evolution is ancient. "Evolution of Evolution" (chapter 1), discusses the different data that provided the clues Darwin needed for *The Origin of Species*. However, Darwin had two unanswered questions. First, how were traits passed onto offspring? Second, how could evolution occur given the estimated (at that time) age of the Earth? Kardong answers these questions in chapters 2 and 3 with a discussion of fossils and heredity.

Then Kardong moves onto the progression of life. Starting from inorganic matter to current eukaryotic mammals (and everything in between), Kardong briefly discusses each of the "major evolutionary transitions" (chapters 4 and 5). Next, is perhaps the strongest part of this book, the "evidence of evolution" (chapter 6). Kardong discusses the fossil record, corresponding anatomy, comparative embryology, and the distribution of organisms. He also discusses what can be deduced from each piece of evidence. The evidence does more than prove Darwin's argument; it also has implications for human anatomy, which Kardong also discusses.

With the fundamentals of evolution established, Kardong treats each aspect of evolution in depth. First is selection. He discusses both artificial and natural selection, including stabilizing, directional, and disruptive selection. He finishes off with sexual selection (chapter 7). What allows evolution to occur in the first place? Variation – the "the raw material of evolution." Chapter 8 discusses the different ways variation is generated.

What precise factors lead to the formation of a new species? "Speciation" (chapter 9) answers this question. Starting with a general four-step model, Kardong explains various reproductive isolating mechanisms that act to prevent interbreeding among species. He also discusses geographical patterns of speciation. Chapter 10 addresses co-evolution: "the joint evolution of two or more species as a consequence of their ecological interaction." Because speciation has a genetic basis, there are phylogenetic relationships among organisms. This chapter discusses how these relationships can be advantageous or disadvantageous.

The success of an organism depends on its ability to survive in its environment. Chapter 11 discusses how the full life of an organism can be broken down into many different adaptations. If one of those adaptations fail, the organism may not be able to reproduce. Kardong also discusses the abiotic and biotic factors that organisms must contend with. One adaptation of many groups is living in a group. "Life in Groups" (chapter 12) addresses this phenomenon. Chapter 13 discusses extinction: types, plausible causes (particularly of the dinosaurs), and some of the classified extinctions.

Chapters 14 and 15 address human evolution, including common misunderstandings. For instance, one famous error is the common picture depicting the stages of human evolution, beginning with prokaryotes on upward and concluding with *Homo sapiens.* Such a paradigm is "mistaken," says Kardong. All living organisms, including humans, are "equal survivors" in their given environments.

The last two chapters (16 and 17) consider some of the evolutionary issues we face today. One is genetic engineering and its many variants, such as gene therapy, replacement therapy, genetic screening, and other technologies that allow us to manipulate our genes to ensure better fitness. The relationship between humans and pathogens is also discussed. Concluding the book, Kardong addresses the question of "intelligent design." Many people wonder how nature could create such complex adaptations. Kardong answers them succinctly, with the rest of his book as proof: "one step at a time."

EDITOR'S NOTE: The author of this book review is a biology student interested in becoming a researcher. The student has requested anonymity.

Mailed on June 18, 2007

NEW DATA ON *ASYNDETUS* (DIPTERA: DOLICHOPODIDAE) FROM CHINA, WITH DESCRIPTION OF A NEW SPECIES[1]

Mengqing Wang,[2,3] Ding Yang,[2,*] and Kazihiro Masunaga[4]

ABSTRACT: A new species, *Asyndetus ventralis* sp. n., is described from Yunnan and a species, *Asyndetus thaicus* Grootaert and Meuffels, is recorded from China for the first time. A key is given to separate the Chinese species.

KEY WORDS: Dolichopodidae, *Asyndetus*, new species, China, new species

The genus *Asyndetus* Loew is distributed worldwide with 99 known species (Yang, Zhu, Wang and Zhang, 2006). It is characterized by the wing with vein costa ending at R_{4+5} just before wing apex, vein M usually with bend or weakening in distal third of wing, male sternum 8 usually with four strong curved bristles (Negrobov, 1973; Bickel, 1996). The species of *Asyndetus* mostly occur within shores of freshwater, playa lakes and marine coastal habitats (Bickel, 1996). Ten species were known from China (Zhang and Yang, 2003; Wang and Yang, 2005). Here a new species and a newly recorded species are added to Chinese fauna. The types are kept in the Entomological Museum of China Agricultural University (CAU), Beijing.

The following abbreviations are used: acr - acrostichal, ad - anterodorsal, av - anteroventral, dc - dorsocentral, LI - fore leg, LII - mid leg, LIII - hind leg, oc - ocellar, pd - posterodorsal, pv - posteroventral, v - ventral.

Updated key to species of *Asyndetus* from China (males)

1. Crossvein m-cu present 2
– Crossvein m-cu absent; first flagellomere longer than wide. Neimeng; Hungary, Mongolia ....*longicornis* Negrobov

2. Abdominal sternum 5 without long bristles; cercus without long apical bristles 3
– Abdominal sternum 5 with many long bristles (wave-like curved apically); cercus with 2 long curved apical bristles. Xinjiang.. ....*wusuensis* Wang and Yang

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3. All legs entirely black 4
– Fore and mid tibiae yellow or brownish yellow 7

4. Hind femur without row of ad or pd; lateral lobe on epandrium not trapezoidal 5
– Hind femur with row of ad and pd; lateral lobe on epandrium trapezoidal, with long apical bristle on finger-like process and short subapical bristle. Guangxi.. *guangxiensis* Zhang and Yang

5. Fore tarsus not shortened, without rowed pv; lateral lobe on epandrium nearly as long as surstylus; cercus not bilobate..6
– Fore tarsomeres 2 and 3 shortened, fore tarsomeres 1 and 2 with row of pv; lateral lobe on epandrium shorter than half of surstylus; cercus bilobate. Beijing..*beijingensis* Zhang and Yang

6. Upper postocular bristles black, lower postocular bristles (including ventral hairs) yellow; lateral lobe on epandrium elongate, with 1 short bristle near tip. Yunnan; Thailand..................................*thaicus* Grootaert and Meuffels
– All postocular bristles white; lateral lobe on epandrium large with wide base and acute apex, apically with 3 bristles. Henan, Taiwan; Palaearctic and Oriental Regions ....*latifrons* (Loew)

7. Hind tibia partly or mostly yellow; lateral lobe on epandrium not subtriangular...8
– Hind tibia entirely black; lateral lobe on epandrium subtriangular. Yunnan.. ....*ventralis* sp. n.

8. Hind tibia chiefly yellow with brown apex..9
– Hind tibia brown to black with basal half reddish brown; hind femur just with sparse v. Taiwan ....*calcaratus* Becker

9. First flagellomere about as long as wide 10
– First flagellomere 1.7 times longer than wide. Xinjiang ....*xinjiangensis* Wang and Yang

10. First flagellomere with round apex; lateral lobe on epandrium indistinct, with thin finger-like process bearing bristle apically. Beijing, Fujian, Shanghai ....*perpulvillatus* Parent
– First flagellomere with acute apex; lateral lobe on epandrium long and broad with wide apex, bearing 2 bristles apically. Xinjiang.................................... ....*lii* Wang and Yang

Asyndetus thaicus Grootaert and Meuffels

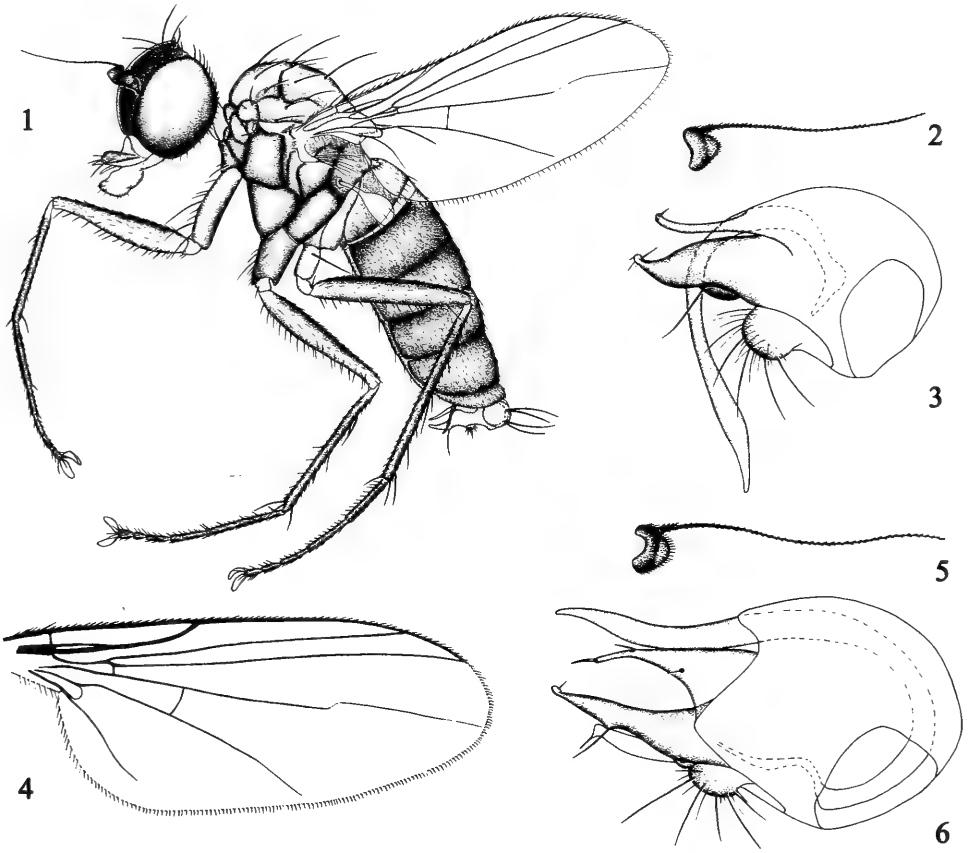
(Figs. 1-3)

Asyndetus thaicus Grootaert and Meuffels (2002): 42. Type locality: Thailand.

Diagnosis: First flagellomere 1.3 times wider than long; legs entirely black; lateral lobe on epandrium elongate, nearly as long as surstylus, with 1 short bristle near tip.

Specimens Examined: 57 males 12 females, Yunnan: Xishuangbanna, Jinghong (300m), 2002. IV. 12, Wenquan Zhen (with yellow pan traps).

Distribution: China (Yunnan); Thailand.



Figures 1-3. *Asyndetus thaicus* Grootaert and Meuffels, male; 4-6. *Asyndetus ventralis* sp. n., male. 1. Habitus. 2, 5. Antenna (excluding scape and pedicel). 3, 6. Genitalia, lateral view. 4. Wing.

Asyndetus ventralis, NEW SPECIES

(Figs. 4-6)

Diagnosis: First flagellomere 1.4 times wider than long; fore and mid tibiae brownish, hind tibia entirely black; hind femur with 2 rows of long ventral bristles.

Description: Male. Body length 3.1-3.3 mm, wing length 2.3-2.6 mm. Head metallic green with pale gray pollen. Hairs and bristles black; ocellar tubercle distinct with 2 strong oc and 2 posterior hairs; lower postocular bristles (including postero-ventral hairs) pale. Antenna black (Fig. 5); first flagellomere 1.4 times wider than long; arista dorsal, blackish, short pubescent, with basal segment rather short. Proboscis dark brown with brown hairs; palpus black with black hairs and 3 black apical bristles (2 short and 1 long).

Thorax dark metallic green with pale gray pollen. Hairs and bristles on thorax black; 4 uniformly strong dc, 6-7 paired acr short and hair-like; scutellum with 2 pairs of bristles (apical pair thick and long, basal pair rather short and hair-like). Propleuron with 1 black bristle on upper portion and 1 long and 1 short bristles on lower portion. Legs chiefly black except fore femur with yellow brownish apex, fore and mid tibiae brown, fore and mid tarsi brown or blackish. Hairs and bristles on legs black; fore coxa with 4 anterior and apical bristles; mid coxa with 2 anterior outer bristles; hind coxa with 1 outer bristle near base. Fore femur with row of av on basal half and pv on entire length; mid femur with 2 rows of v on apical 1/4; hind femur with 2 rows of long v (longer than femur width). Fore tibia with 1 ad near base and 1 pd at middle, apically with 4 bristles; mid tibia with 2 ad and 4 short v, apically with 4 bristles; hind tibia with 4 ad, 5 pd, and with 2 rows of v on basal half, apically with 4 bristles. All tarsomere 1 with row of short v, hind tarsomeres 2-3 each with row of short v. Legs without claws; elongate pulvilli of fore leg longer than tarsomere 5. Relative lengths of tibia and 5 tarsomeres LI 3.5: 2.0 : 0.75 : 0.5 : 0.3 : 0.3; LII 4.0 : 2.25 : 1.05 : 0.7 : 0.4 : 0.3; LIII 5.25 : 1.6 : 1.4 : 0.8 : 0.4: 0.3. Wing hyaline (Fig. 4); veins brown, R_{4+5} and M divergent apically. CuAx ratio 0.2. Squama pale yellow with pale hairs. Haltere pale yellow.

Abdomen dark metallic green with pale gray pollen. Hairs and bristles on abdomen black. Terga 1-5 with row of posterior bristles; sternum 8 with 4 strong bristles. Male genitalia (Fig. 6): Lateral lobe on epandrium large, subtriangular, nearly as long as surstylus, with broad base and long acute apex, and with 1 long apical bristle and 1 short subapical bristle; surstylus thick and acute apically, with 1 short bristle near tip and 1 long bristle at middle, basally with 1 short and thick process; cercus nearly semicircular with moderately long bristles; aedeagus slender.

Female: Body length 2.7-3.2 mm, wing length 2.1-2.7 mm. Similar to male, but claws present and pulvilli not elongate.

Holotype: male, Yunnan: Xishuangbannan, Jinghong, 2002. IV. 12, W. Zhen (with yellow pan traps). **Paratypes:** 25 males 18 females, same data as holotype.

Etymology: The specific name refers to the hind femur with 2 rows of long v.

Remarks: The new species is somewhat similar to *Asyndetus calcaratus* Becker, but may be separated from the latter by the hind femur with long v and the entirely black hind tibia. In *A. calcaratus*, the hind femur has sparse v, and the hind tibia is brown to black with the basal half reddish brown (Becker, 1922).

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THE *POLANA* (*POLANANA*) *SANA* SPECIES GROUP (HEMIPTERA: CICADELLIDAE: GYPONINAE), WITH DESCRIPTIONS OF SIX NEW SPECIES[1] FROM SOUTH AMERICA

Paul H. Freytag[2]

ABSTRACT: The *Polana (Polanana) sana* species group consists of eight species. Included are: *P. (P.) sana* DeLong (=*P. (P.) santana* DeLong and Foster, new synonym), *P. (P.) tropica* DeLong and Triplehorn, and six new species, *P. (P.) ordinaria, P. (P.) brevis, P. (P.) declivata, P. (P.) diplota, P. (P.) minima,* and *P. (P.) ancistra. Polana (P.) sana* is now known from Bolivia, Brazil, Colombia and Peru, *P. (P.) tropica* and *P. (P.) brevis* are known from Colombia and Peru, and the other five species are only known from Colombia.

KEY WORDS: Leafhoppers, Hemiptera, Cicadellidae, Gyponinae, *Polana,* South America

The genus *Polana* DeLong is a group of leafhoppers belonging to the subfamily Gyponinae (Scarinae) that contains some 130 species (DeLong and Freytag, 1972, DeLong, 1979, DeLong and Triplehorn, 1979 and DeLong and Foster, 1982). Most species are from 5 to 10 mm in length, are robust and oval in body shape, and have few color markings. The crown is short, broad, and rounded to the face, with the ocelli near the anterior margin, and with transverse striae between the compound eyes. All species are found in the New World.

The *sana* species group belongs in the subgenus *Polanana* DeLong and Freytag (1972) that contains nineteen species from South America. This subgenus is characterized by having the male genitalia without paraphysis or even the aedeagus without basal processes, and the pygofer without processes.

All species in the *sana* species group look much alike, being either dark brown or black, and nearly the same length from 7 to 8.5 mm. They can only be separated at this time by the differences in the male genitalia. Most species have the median area of the style bulging and sticking out of the genital capsule, which can often be used to spot specimens of this group.

Acronyms used in this paper are the following: IHVL = Instituto von Humboldt, Villa de Leyva, Colombia; and UKYL = University of Kentucky Collection, Lexington, Kentucky, USA.

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***Polana (Polanana) sana* DeLong**
(Figures 1-4)

Polana (Polanana) sana DeLong 1979, p. 299.
Polana (Polanana) santana DeLong and Foster 1982, p. 118. New synonym.

Length of males 8-8.5 mm, females unknown. This species was described by DeLong (1979) and again by DeLong and Foster (1982). Both types are the same and represent the same species.

The male genitalia are illustrated again (Figs. 1-4) for comparative purposes. In the original descriptions the aedeagus was illustrated without hair-like processes. These could have been broken off, but they are also very difficult to see.

This species is now known to occur in Bolivia, Brazil, Colombia and Peru.

***Polana (Polanana) minima* Freytag, new species**
(Figures 5-6)

Description: Length of males 7.2-7.4 mm, females unknown. Similar to *sana,* but smaller and with different male genitalia. Male genitalia: Pygofer and genital plates similar to *sana.* Style (Fig. 5) similar to *sana,* except notch on apical margin represented by short spine. Aedeagus (Fig.6) similar to *sana,* except shorter, thicker in ventral view, with shorter apical hair-like processes.

Type Data: Holotype male: Colombia: Putumayo, PNN La Paya, Cabaña Viviano Cocha, 0°7' S 74°56' W, 320 m., Malaise, II-1-10-2003, R. Cobete, M 3156 (IHVL). Paratype male: Same data as holotype (IHVL).

Additional Specimens: Ten males, same locality as holotype, various dates from 2001 to 2003 (IHVL and UKYL).

Differential Diagonosis: This species is very similar to *sana,* but is smaller and has a short spine at the base of the apical margin of the male style, and a shorter, stouter aedeagus.

***Polana (Polanana) declivata* Freytag, new species**
(Figures 7-8)

Description: Length of males 7.8-8.2 mm, females unknown. Similar to *sana,* but slightly smaller, with different male genitalia. Male genitalia: Pygofer and genital plates similar to *sana.* Style (Fig. 7) with large medially pointed spine near apex. Aedeagus (Fig. 8) similar to *minima,* with slight narrowing of shaft on apical half, very short hair-like processes at apex.

Type Data: Holotype male: Colombia: Meta, PNN Macarena, Borde Rio Guejar, 3°20' N 73°56' W, 460 m., Malaise, XII-24-28-2001, D. Campos, M 2609 (IHVL). Paratype males: One, Meta, PNN Tingua, Vda. Bajo Raudal, 2°16’ N

73°48' W, 460 m., Malaise, II-2-16-2002, M 2329 (IHVL); two, same data, except I-19-II-2-2002, M 2331, (IHVL and UKYL); one, Meta, PNN Tingua, Caño Nevera, 2°11' N 73°48' W, 390 m, Malaise, II-7-16-2002, C. Sanchez, M 2334 (IHVL) and one, Meta, PNN Sierra de La Macarena, Caño Curia Parcela, 3°21' N 73°5' W, 460 m., Malaise, II-9-III-24-2003, W.Villelba, M 3531 (IHVL).

Additional male specimen: Colombia, Cundinamarca, PNN Sumapaz, Jardin Botánico, 3°48' N 73°56' W, 730 m., Malaise, I-4-24-2002, H. Vargas, M 3109 (IHVL).

Differential Diagnosis: This species is close to *sana,* but differs by the very different male style which appears to be closer to *tropica.*

Polana (Polanana) tropica DeLong and Triplehorn
(Figures 9-10)

Polana (Polanana) tropica DeLong and Triplehorn, 1979, p. 180.

Length of males 7.5-8 mm, females unknown. This species was described from Peru. It has a very characteristic male style (Fig. 9), with a long, bent spine near middle of apical margin. The aedeagus (Fig. 10) appears to lack the apical hair-like processes.

Specimens Seen: Besides the type, nine males from Colombia: Amazonas and Vaupès, collected in December and January, from 60 to 380 m, Malaise (IHVL and UKYL).

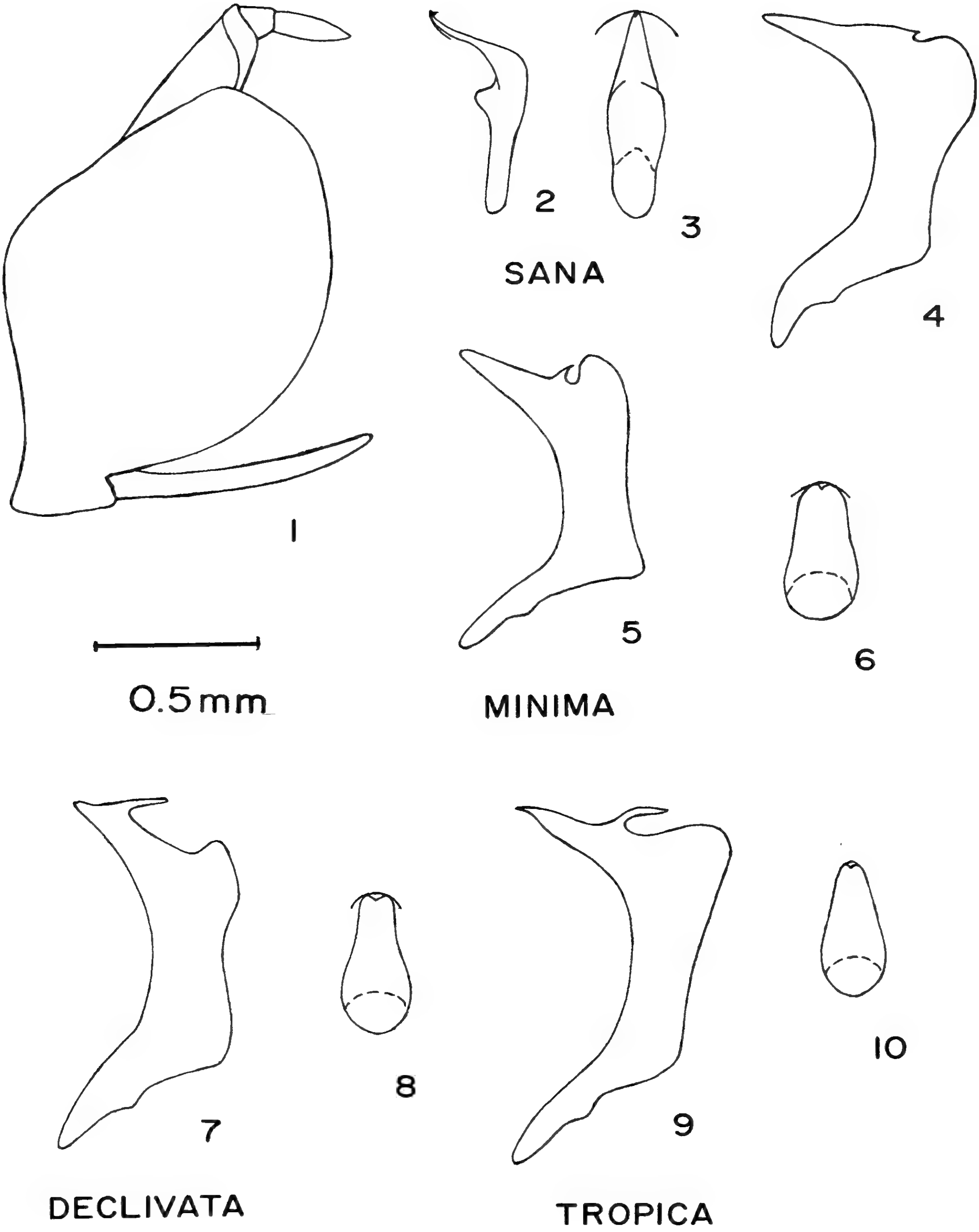
Polana (Polanana) diplota Freytag, new species
(Figures 11-12)

Description: Length of males 7.5-8 mm, females unknown. Similar to *tropica,* but with a different type of spine on male style. Male genitalia: Pygofer and genital plates similar to *sana.* Style (Fig. 11) with spine near middle of apical margin which parallels apex, shorter than apex. Aedeagus (Fig. 12) similar to *tropica.*

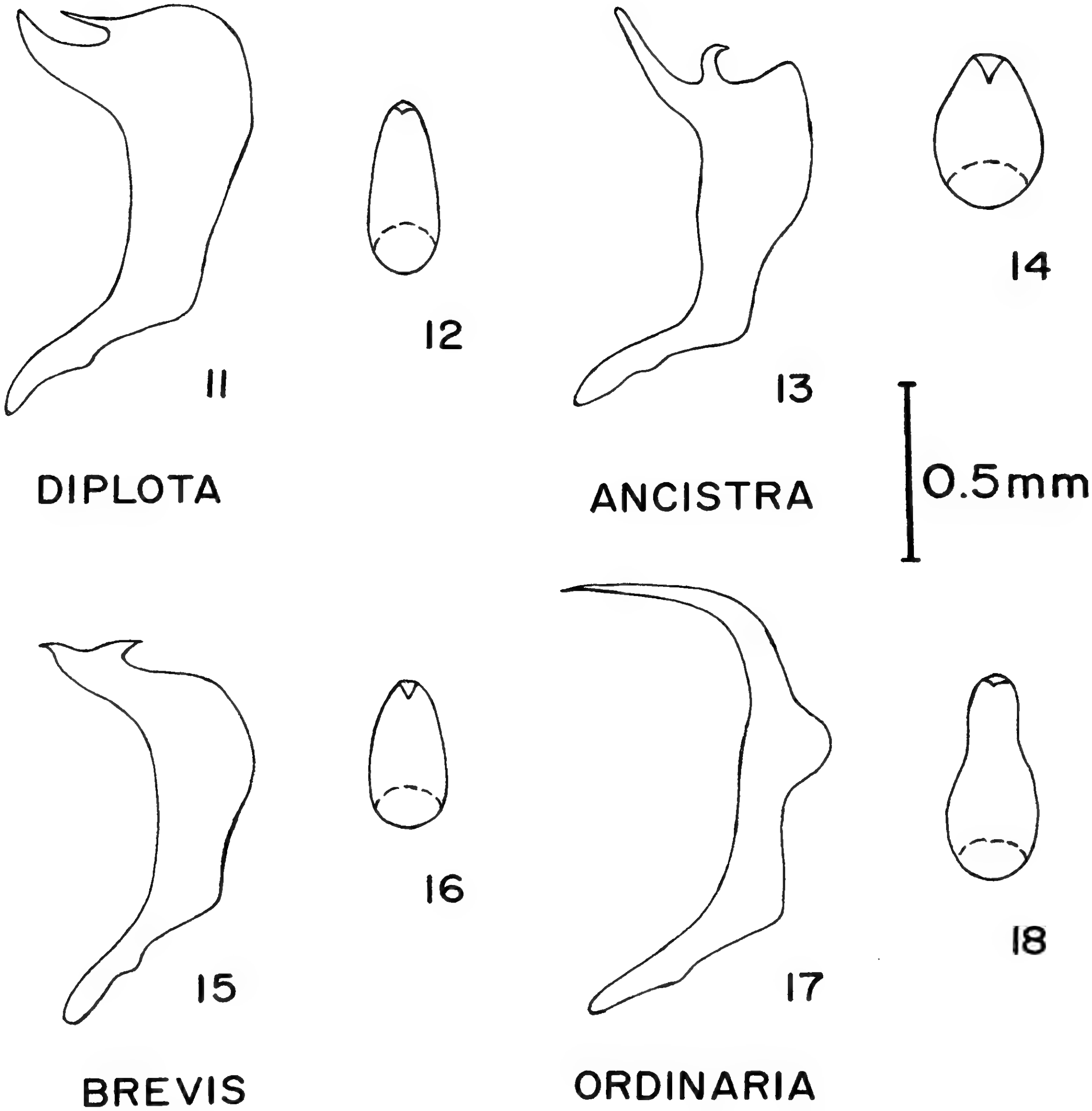
Type Data: Holotype male: Colombia: Putumayo, PNN La Paya, Resquardo Cecillo Cocha, 0°11' S 74°55' W, 190 m, Malaise, I-20-24-2003, C. Sarmiento, M 3419 (IHVL). Paratype males: Four, same data as holotype (IHVL and UKYL).

Additional Specimens: Six males, same data as holotype, except various dates from 2001 to 2003, and various altitudes up to 320 m, (IHVL and UKYL); and one male, Amazonas, PNN Amacayacu, Matamata, 3°23' S 70°6' W, 150 m., Malaise, XI-19-XII-3-2001, D. Chota, M 2768 (IHVL).

Differential Diagnosis: This species is close to *tropica,* but has a different style with the spine pointing towards the apex, whereas in *tropica* it bends towards the median margin.



Figures 1-4. *Polana (Polanana) sana* DeLong. Fig. 1. Male genital capsule, lateral view. Fig. 2. Aedeagus, lateral view. Fig. 3. Aedeagus, caudal view. Fig. 4. Style, lateral view. Figures 5-6. *P. (P.) minima* Freytag, n. sp. Fig. 5. Style, lateral view. Fig. 6. Aedeagus, caudal view. Figures 7-8. *P. (P.) declivata* Freytag, n. sp. Fig. 7. Style, lateral view. Fig. 8. Aedeagus, caudal view. Figures 9-10. *P. (P.) tropica* DeLong and Triplehorn. Fig. 9. Style, lateral view. Fig. 10. Aedeagus, caudal view. All drawn to the same scale.



Figures 11-12. *Polana (Polana) diplota* Freytag, n. sp. Fig. 11. Style, lateral view. Fig. 12. Aedeagus, caudal view. Figures 13-14. *P. (P.) ancistra* Freytag, n. sp. Fig. 13. Style, lateral view. Fig. 14. Aedeagus, caudal view. Figures 15-16. *P. (P.) brevis* Freytag, n. sp. Fig. 15. Style, lateral view. Fig. 16. Aedeagus, caudal view. Figures 17-18. *P. (P.) ordinaria* Freytag, n. sp. Fig. 17. Style, lateral view. Fig. 18. Aedeagus, caudal view. All drawn to the same scale.

Polana (Polanana) ancistra Freytag, new species
(Figures 13-14)

Description: Length of males 7.5-8 mm, females unknown. Similar to *tropica,* but with a different male style and aedeagus. Male genitalia: Pygofer and genital plates as in *sana.* Style (Fig. 13) with long thin apex, spine in median apical margin hook-like. Aedeagus (Fig. 14) similar to *tropica,* but shorter, stouter.

Type Data: Holotype male: Colombia: Amazonas, PNN Amacaracu, San Martin, 3°23' S 70°6' W, 150 m., Malaise, II-23-III-3-2001, B. Amado, M 2040 (IHVL). Paratype males: One, same data as holotype, except V-16-23-2000, M 691 (IHVL); one, same data as holotype, except VII-17-30-2000, M 701 (IHVL) and two, same data as holotype, except X-10-18-2000, M 835 (IHVL and UKYL).

Additional Specimens: Twenty males, same locality as holotype, various dates from 2000 to 2004 (IHVL and UKYL); one male, Vaupès, RN Mosiro Itajura (Caparú), Centro Ambiental, 1°4' S 69°31' W, 60 m., Malaise, I-20-21-2003, M. Sharkey and D. Arias, M 3386 (IHVL) and three males, same data as last, except Igapo, IX-7-22-2003, L. Benarides, M 3393 (IHVL and UKYL).

Differential Diagnosis: This species is close to *tropica,* but the style has a longer bulge on the medial side, and a thinner apex, with a shorter hook-like spine.

Polana (Polanana) brevis Freytag, new species
(Figures 15-16)

Description: Length of male 7.5 mm, female unknown. Similar to *tropica,* but with a different male style and longer aedeagus. Male genitalia: Pygofer and genital plates similar to *sana.* Style (Fig. 15) with short, thick spine near apex. Aedeagus (Fig. 16) short, stout.

Type Data: Holotype male: Colombia: Putumayo, PNN La Paya, La Nueva Paya, 0°2' S 75°12' W, 210 m., Malaise, I-31-II-5-2003, C. Sarmiento, M 3423 (IHVL).

Additional Specimen: One male, Peru: Madre de Dios, near Puerto Maldanado, Posadas Amazonas Lodge, at Rio Tambopata, 186 m., 12°48'115" S 69°18'019" W, IX-30-X-3-2004, C. R. Bartlett (UKYL).

Differential Diagnosis: This species is close to *tropica,* but the spine on the male style is shorter and closer to the apex, which makes the apex look almost bifurcate.

Polana (Polanana) ordinaria Freytag, new species
(Figures 17-18)

Description: Length of male 7.5 mm, female unknown. Similar to *tropica,* but with a very different male style. Male genitalia: Pygofer and genital plates similar to *sana.* Style (Fig. 17) long, with small bulge near middle, than narrowing, curving dorsad to pointed apex. Aedeagus (Fig. 18) similar to *declivata,* but without hair-like processes at apex.

Type Data: Holotype male: Colombia: Amazonas, Cgto. La Pedrera, Comunidad Camaritagua, 1°20' S 69°35' W, 380 m., Malaise, XII-24-2003-I-13-2004, J. López, M 4168 (IHVL).

Differential Diagnosis: This species is similar to *tropica,* but with a very distinct male style, with only a small bulge and a very narrow and long apex.

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Thanks are extended to Michael J. Sharkey, Department of Entomology, University of Kentucky, who made it possible to study the specimens from Colombia through his National Science Foundation Grant no. DEB 0205982. Also thanks to Charles R. Bartlett, Department of Entomology, University of Delaware for the specimens he collected and made available.

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FUNCTIONAL MORPHOLOGY OF THE VENOM APPARATUS OF THE FUNNEL SPIDER, *AGELENA GRACILENS* (ARANEAE: AGELENIDAE) FROM TURKEY[1]

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ABSTRACT: The funnel-web spider, *Agelena gracilens* Koch C. L., 1841 is widely distributed throughout Middle Europe, Mediterranean countries, and Middle Asia. The aim of this study is to describe the functional morphology of the venom apparatus in *A. gracilens* using scanning electron microscopy. The organization of the venom apparatus of *A. gracilens* follows the general structure of the venom apparatus of other spiders. The venom apparatus is situated anteriorly in the prosoma and it is composed of a pair of chelicerae and venom glands. Each chelicera consists of a stout basal and a movable apical (fang) segments. The fang rests in a furrow on the basal segment and it narrows apically. There are parallel fine grooves on the surface of the fang. To eject the venom, a venom pore is located on the subterminal part of the fang. The venom glands of *A. gracilens* are of equal size and tubular. Each gland is surrounded by a bulky muscular layer. Also, neurons innervate the surface of the venom gland by SEM.

KEY WORDS: *Agelena gracilens*, spider, venom apparatus, morphology, scanning electron microscope

Spiders are an ancient and successful group of invertebrates widely distributed throughout the world (Levi and Levi, 1990). Spiders are the largest group of venomous animals, represented by about 40,000 extant species. Approximately 200 species are actually dangerous to humans. In recent years, there has been a noticeable increase in studies on spider venoms (Herzig et al., 2004; Kalapothakis et al., 2003; Rash and Hodgson, 2002; King, 2004).

In principle, all spiders with any kind of venom apparatus are considered venomous, but this does not mean that all of them are dangerous to humans. Their venom is toxic to insects, their usual prey. The most dangerous known spiders belong in the genera *Latrodectus* (black widow spiders), *Loxosceles* (violin spiders), *Atrax* (funnel spiders), and *Phoneutria* (banana spiders). *Segesteria, Agelena, Cheiracanthium, Steatoda,* and *Lycosa* are known as secondarily dangerous spiders. The bites of spiders cause local and systemic disorders. Envenomation produced by a spider bite is known as arachnidism, araneism, or araneidism. Areneism has recently been considered a serious public health problem.

Like the venoms of other animals, such as snakes and scorpions, venoms of spiders are made up of complex mixtures of biologically active and inactive substances. The major constituents of spider venoms are proteins, polypeptides and polyamine neurotoxins, enzymes, nucleic acids, free amino acids, monoamines

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and inorganic salts (Ori and Ikeda, 1998; Rash and Hodgson, 2002). As the primary purpose of spider venom is to kill or paralyze prey, spiders produce a variety of toxins, which affect the nervous system (Escoubas et al., 2000). Spider's neurotoxins affect prey and non-prey alike. The toxins isolated from spider venom have been invaluable in understanding the role and diversity of neuronal ion channels and the process of exocytosis (Pescatori and Grasso, 1994). A toxin, named agelenin, is found in the venom of spiders in the Agelenidae. This toxin is a calcium blocker and halts the neuronal transmission at the neuromuscular synapses presynaptically (Nakajima, 2006). In addition, the toxins of spider's venom have enormous pest control potentials for the use of insect specific toxins in agriculture (King et al., 2002; Tedford et al., 2004).

Previous investigators have described the venom apparatus of several venomous animals including snakes, wasps and centipedes (Mebs et al., 1994; Young et al., 2001; Schoeters et al., 1997; Menez et al., 1990). The venom apparatus of spiders consists of a pair of chelicerae and venom glands. The shape and position of the venom gland is different in various species. For instance, in large tarantulas, the venom glands are quite small and lie inside the chelicerae.

While there are many studies on venoms of various spiders, there is little knowledge on the functional morphology of venom apparatus that produce venom in spiders. The objective of this study is to describe functional morphology of the venom apparatus of *Agelena gracilens* Koch C. L., 1841, a widely distributed spider throughout the Middle Europe, Mediterranean countries, and Middle Asia.

METHODS

Adults of both sexes of *A. gracilens* were collected in Yahsihan-Kirikkale (33°: 31' E, 39°: 50' N, Turkey) on September 2005. The spiders were identified, reared in special cages, and fed insects at the Zoological Research Laboratory. Prior to dissection, spiders were narcotized with ether. The carapace was gently removed and the venom apparatus taken for electron microscopy studies under a stereo microscope (Nikon SMZ800).

Chelicerae and venom glands were fixed in 3% glutaraldehyde buffered with 0.1 M sodium phosphate buffer (pH 7.2) for two hours at 4°C and then rinsed for 12 hours in sodium phosphate buffer, and postfixed in 1% osmium tetroxide in the same buffer for 2 hours. They were dehydrated in a graded ethanol series. To clean the surfaces, chelicerae and fangs were washed for 10 minutes in a gentle stream of 100% ethanol. The last stages of dehydration were performed with propylene oxide and acetone. Then, the venom apparati were dried in an incubator at 30°C overnight. These specimens were coated with a thin layer of gold by Polaron SC 500 sputter coater. The materials were examined at an accelerating voltage of 12 kV with a JEOL JSM 5600 scanning electron microscope, and electronmicrographs were recorded. All materials that investigated are deposited at The Zoological Research Laboratory of Kirikkale University.

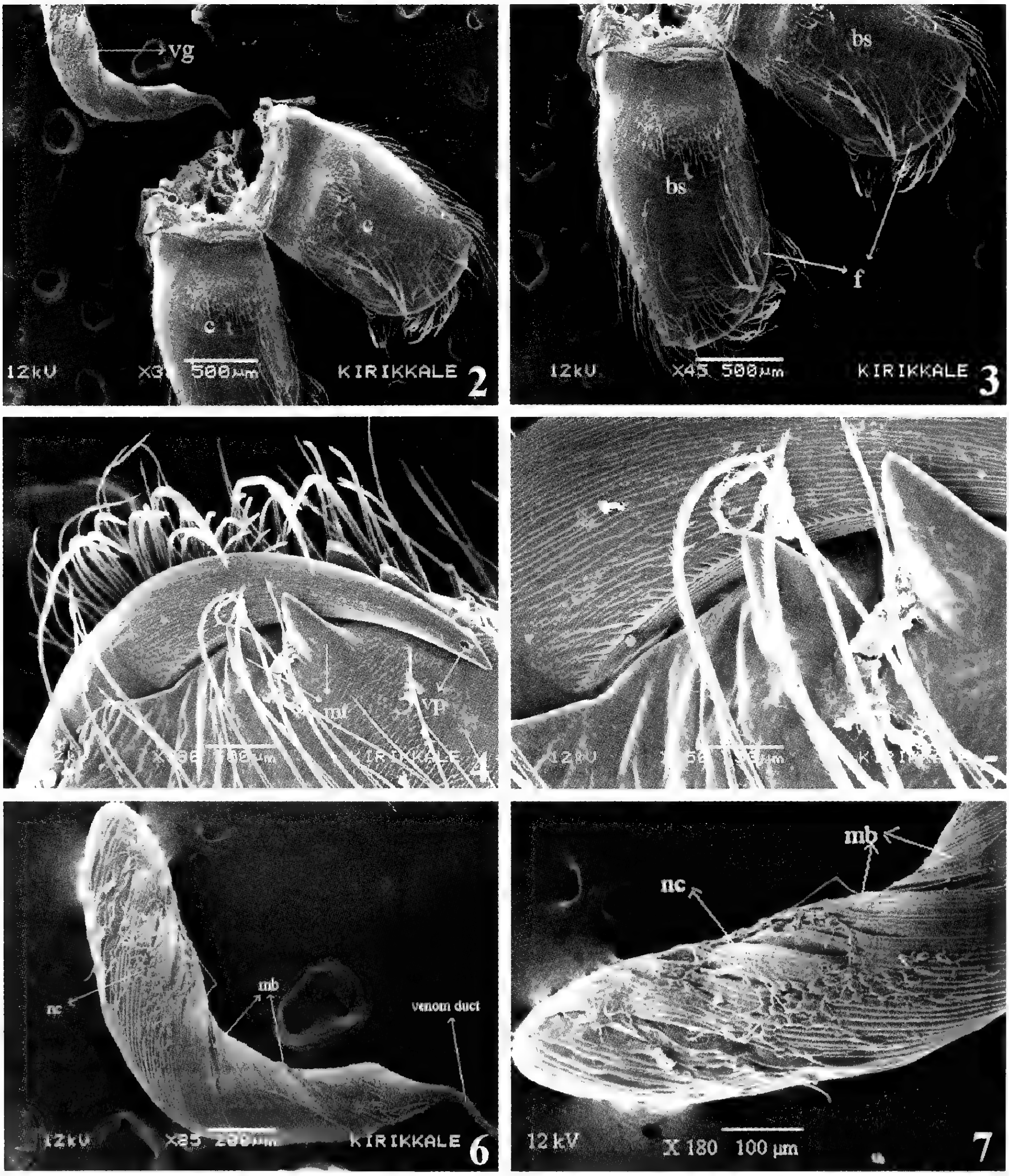
RESULTS

The organization of the venom apparatus of *A. gracilens* (Fig. 1) follows general architecture of venom apparatus of other spiders. The venom apparatus of *A. gracilens* is situated in the anterior part of the prosoma. It is composed of a pair of venom glands that produce the venom, the ducts that carry the venom from its source to the point of delivery, and cheliceral fangs that envenomate the prey by pricking it (Fig. 2).

Fig. 1. Overall dorsal view of a female *Agelena gracilens* (taken with a dissecting stereo microscope). This specimen is approximately 10 mm long (excluding the legs).

Each chelicera consists of two parts: a stout basal segment and a movable articulated fang. The basal segments of chelicerae are very stout and strong, and covered by hairs (Fig. 3). The fang rests in a furrow of the basal segment. Both margins of the cheliceral furrow are armed with two marginal teeth. These teeth are used for holding and crushing the prey. The fang narrows towards the apical part, and there are parallel fine grooves on the fang surface. The fangs possess a ridge, and on the lateral side there is a blade-like structure. To eject the venom, a venom pore is situated on the subterminal part of the fang (Fig. 4). Also, where the fangs connect to the basal segment, there are cuticular structures that look like a saw laterally (Fig. 5). .

The venom glands of *A. gracilens* are equal size and are tubular (Fig. 6). Each gland is surrounded by a bulky muscular layer. This gross muscle bundle spirally covering the venom gland can be easily observed (Fig. 7). The venom is produced in the venom glands, it is carried by venom ducts passing through the chelicerae, and exiting from the venom pore during the muscular contractions. Also, the nerve cells that control the contraction of the bulky muscular layer can be observed on the surface on the venom gland. The nerve cells are abounded on the distal portion of the venom gland surface (Fig. 7).



Figures 2-7. 2. Venom apparatus of *Agelena gracelins*. The dorsolateral view of a pair of chelicerae, c: Chelicera, vg: Venom gland. 3. The view of the chelicerae. The chelicera consists of two parts, a basal segment (bs) and a movable fang (f). The fangs (f) rest in a groove of the basal segment. 4. The venom pore (vp) and fine grooves on the surface of the fangs, marginal teeth (mt). 5. Fine grooves on the surface of the fang and cuticular structures look like a saw on the lateral side at higher magnification. 6. Morphological description of the venom gland of *A. gracilens*. The venom gland is tubular and is covered with muscle bundles (mb) that completely encapsulate it, nc, nerve cells. 7. The higher magnification of Figure 5 clearly shows distinctive muscle bundles (mb) and the nerve cells (nc).

DISCUSSION

The position of the fangs in spiders allows them to be divided into two suborders: Mygalomorphae and Areaneomorphae. It has been noted that mygalomorph and araneomorph spiders move their chelicerae in different manners. Mygalomorph chelicerae move parallel to one another in the vertical plane. Araneomorph spiders have chelicerae that move in opposition to each other in pinching motion in the horizontal plane (Ubick et al., 2005). Some venomous species such as *Poecilotheria* spp., *Pterinochilus* spp. (Theraphosidae) and *Atrax robustus* (Hexathelidae) are mygalomorph. In these spiders, the venom glands are in chelicera and quite small. However, *Latrodectus*, *Loxosceles*, *Phoneutria*, *Segesteria*, *Cheiracanthium, Steatoda, Lycosa*, and *Agelena* are araneomorph spiders. The morphology of the venom apparatus of *A. gracilens* is basically similar to those of the other araneomorph spiders (Moon and Tillinghast, 1996; Yigit et al., 2004).

Spiders use their chelicerae for defense, seizing prey, carrying egg cocoons, making noise, and digging. In many spider species, one or both margins of the cheliceral furrows are often armed with cuticular teeth. There are also similar but very small structures on the ventral side of the fang. These act as a buttress for the movable fang. Spiders whose chelicerae are equipped with such teeth mash their prey into an unrecognizable mass. Spiders without such teeth can only suck out their victims through the small bite holes. There are two retromarginal teeth on cheliceral furrow on *A. gracilens*. The number and size of the retromarginal teeth are important diagnostic characteristics for taxonomists (Ubick et. al, 2005).

The tip of the fang is pointed and sharp. It is hollow and has a needle-like structure. It is used for injecting venom as well as for piercing and holding prey. The cutting ridge on both lateral sides allows deeper fang penetration of the prey. *Agelena gracilens* fang possesses a ridge on the lateral side with a blade-like structure. We found grooves on the surface of the fang. These grooves possibly suck up the body fluids of the prey by capillary action.

The venom glands of *A. gracilens* are paired structures located in the prosoma that communicate with the outside through two ducts that lead into the fangs. Most araneomorph spiders, including *A. gracilens*, have relatively large venom glands that extend out of the chelicerae and reach the middle of the prosoma. Kovoor and Munoz-Cuevas (2000) described the structure and histochemistry of the poison glands in *Lycosa tarentula* (Lycosidae), four species of *Peucetia*, and *Oxyopes lineatus* (Oxyopidae). All these species show two voluminous gland sacs situated dorsally in the prosoma, over the nervous system. The shape of the venom glands is different in various species of spiders: bulbous in *Loxosceles intermedia* (Santos et al., 2000), carrot-like in *Plesiophirctus collinus* (Theraphosidae), and sac-like or cylindrical and consisting of two lobes in *Hetropoda venatoria* (Heteropodidae) and *Lycosa indagastrix* (Lycosidae) (Ridling and Phanuel, 1989), whereas the venom glands of *A. gracilens* are long and tubular.

Some of these structures, such as retromarginal teeth, shape of venom gland will probably prove to be of diagnostic value for spiders.

In *L. intermedia,* the external muscular bundles are web-like (Santos et al., 2000). However, in *A. gracilens*, the blocks of prominent muscle bundles spirally, encapsulating the glands.

The venom gland of *A. gracilens* is surrounded by a thick layer of striated muscle that encircles the gland. The contraction of the bulky muscular layer is controlled by the nervous system. The neurons can be easily observed on the surface on the venom gland. The neurons are abundant on the distal portion of the venom gland's surface.

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LAMINATOPINA ORIENTALIS GEN. ET SP. NOV. (HEMIPTERA: FULGOROIDEA: DELPHACIDAE) FROM CHINA[1]

Dao-zheng Qin[2] and Ya-lin Zhang[2]

ABSTRACT: A new genus and species, *Laminatopina orientalis*, gen. et sp. n. from China is described and illustrated, and assigned to the tribe Delphacini within the subfamily Delphacinae (Delphacidae). The new genus resembles *Neometopina* Yang, 1989, but can best be distinguished from the latter by features of the male genitalia.

KEY WORDS: Hemiptera, Auchenorrhyncha, Fulgoromorpha, Delphacini, *Laminatopina* gen. n., China.

According to Asche (1985, 1990), the subfamily Delphacinae is divided into three tribes: Tropidocephalini, Saccharosydnini and Delphacini. The Delphacini represents the largest tribe within the subfamily, and also the largest group of Delphacidae worldwide. Although the Chinese Delphacini has been studied extensively, and includes 129 genera (see Ding, 2006), there are probably many more new taxa awaiting to be found. In the present paper one new genus and one new species of Delphacini from China are described. The type specimens of the new species for this study are deposited in the Entomological Museum, Northwest A & F University, Yangling, Shaanxi, China (NWAFU). The methods and terminology in this paper follow those of Ding (2006).

Laminatopina NEW GENUS

Type species. *Laminatopina orientalis* n.sp.

Diagnosis. Head: Longer and narrower than pronotum. Vertex longer medially than broad at base, acuately rounding into frons, Y-shaped carina with stem weak. Median carina of frons forked at base. Antennal segment II longer than I. Thorax: Lateral carinae of pronotum not attaining hind margin. Legs with tibia normal, calcar of hind leg tectiform with many black-tipped teeth on posterior margin. Abdomen: Male anal segment ring-like, caudoventral margin produced medially into a large spinose process. Pygofer with a distinct plate-like process at each side of dorsal margin of diaphragm, twisted, without medioventral process. Phallus tubular, strongly decurved medially, one strong process arising basally. Diaphragm broad, dorsomedially with a projection. Suspensorium with dorsal part Y-shaped, ventral part ring-like. Genital styles extremely long, strongly diverging from base.

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Remarks. Of the Chinese genera of Delphacini, the plate-like structures of the diaphragm are highly unusual and only found in *Neometopina* and the new genus. The new genus is also related to *Neometopina* in many parallel features: head narrower than pronotum; vertex longer medially than broad at base; fastigium acuately rounded; frons with median carina forked at base; antennal segment II longer than I; spinal formula of hind leg 5-7-4; pronotum with lateral carinae not attaining hind margin; calcar of hind leg with many teeth; forewing acutely rounded at apex; male anal segment ring-like and caudoventral margin produced medially into a large spinose process; pygofer without medioventral process; diaphragm broad and dorsal margin produced; suspensorium with ventral part ring-like; genital styles long and narrowed subapically. But can be distinguished from the latter by: vertex with basal compartment wider at base than greatest length; the stem of Y-shaped carina weak; rostrum reaching to metacoxae; especially by the features of the male genitalia: male anal segment with median process not produced in ventral margins; diaphragm distinctly projected dorsomedially; suspensorium with the dorsal portion Y-shaped; phallus tubular, decurved, and with one strong process arising basally; genital styles strongly diverging.

Etymology. The name is derived from the Latin word "laminatus" (plate), and with combination of the feminine suffix "-a", which refers that the pygofer with a distinct plate-like process at each side of dorsal margin of the diaphragm. The gender is feminine.

Laminatopina orientalis, NEW SPECIES

(Figures 1-15)

Type Locality. CHINA, Hainan, Bawangling.

Description. Color. Body entirely pale yellowish orange.Vertex with outer area to submedian carinae black, frons sublaterally with narrow stripe, blackish brown, genae yellowish orange. Median carina of pro- and mesonotum whitish yellow, inner lateral carinae with light yellowish brown stripe. Ocelli dark. Eyes dark brown to black. Dorsum of abdomen yellowish orange.

Structure: Body length ♂ 4.54 mm, ♀ 4.67-4.73 mm. Head including eyes narrower than pronotum (0.84:1), longer medially than broad at base about 1.3:1, lateral margins of vertex in dorsal view subparallel, except where expanded laterally behind eyes, submedian carinae originating from near middle of lateral carinae, not uniting at apex, basal compartment wider at base than greatest length. Fastigium acuately rounded. Vertex length ♂ 0.26-0.27 mm, ♀ 0.32-0.35 mm, width ♂ 0.24 mm, ♀ 0.25-0.29 mm. Frons about 2.4 times as high as its maximum width, widest at apex, lateral carinae slightly sinuate, frons width ♂ 0.24 mm, ♀ 0.26-0.27 mm, length ♂ 0.62 mm, ♀ 0.68-0.69 mm. Antennae terete, surpassing frontoclypeal suture, length of segment (♂) I 0.15-0.19 mm, II 0.30-0.32 mm, (♀) 0.16-0.19 mm, II 0.31-0.32 mm. Rostrum reaching to metacoxae. Postclypeus large, as wide as frons at apex. Lateral carinae of pronotum posterolaterally directed, slightly curved, pronotum width ♂ 0.74-0.78 mm, ♀ 0.81-0.86 mm, length ♂ 0.22-0.24 mm, ♀ 0.24-0.27 mm. Mesonotal carina obscure at apical third, lateral carinae diverging, reaching to posterior margin or not, mesonotum length ♂ 0.65-0.70 mm, ♀ 0.74-0.82 mm. Forewing long and narrow, roundly acute at apex, length ♂ 3.86 mm, ♀ 3.93-4.02 mm. Metabasitarsus slightly longer than tarsomere 2+3 combined, spinulation of metabasitarsus 7 (2+5), 2nd 4, calcar length ♂ 0.38 mm, ♀ 0.39-0.45 mm, tectiform, concave ventrally, more than half length of basitarsus, with 20-22 black-tipped teeth.

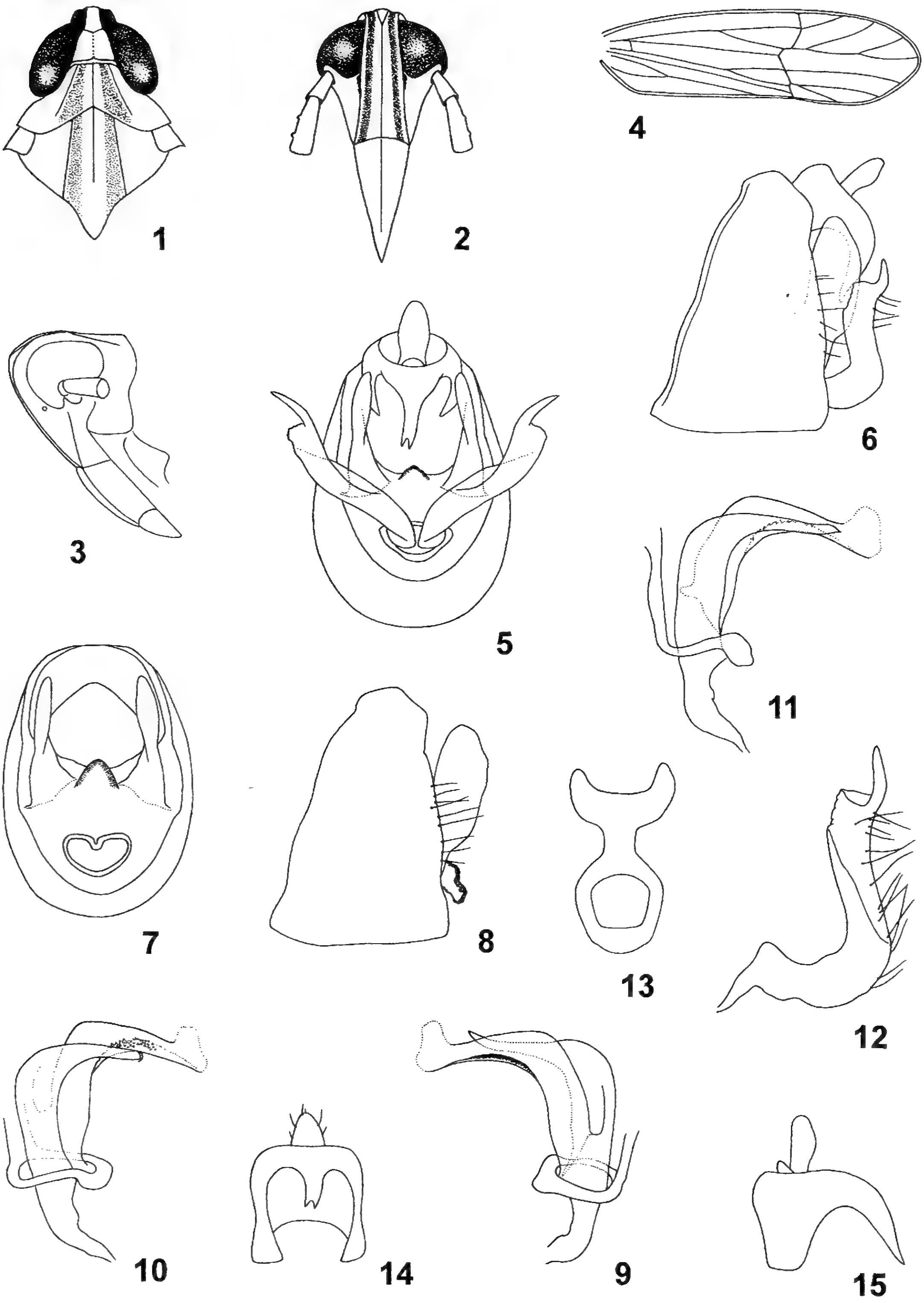
Male genitalia: Anal segment large, median spinose process nearly straight, apex bifurcated. Pygofer in profile subtriangular, distinctly wider ventrally than dorsally, in posterior view with opening longer than wide. Phallus tubular and with many small ventral teeth, apex enlarged, membranous, basal process shorter than phallus, broad at basal half, then gradually tapering to acute apex. Suspensorium well-developed and sclerotized. Diaphragm broad, dorsomedially with a cone-shaped projection, pigmented and sclerotized. Opening for genital styles large, dorsal margin nearly straight, produced into a small lobe medially, ventral margin evenly curved. Genital styles extremely long and strongly diverging from base, surpassing level of lateral margins of pygofer, sinuate, slightly widened subapically and greatly narrowed subapically to acute apex.

Brachypterous. Unknown.

Recorded Hosts. None.

Material Examined. Holotype. Macropterous ♂. China: Hainan Province, Bawangling, 28-V-1983, coll. Yalin Zhang. Paratypes: 1♂, 3♀, same data as holotype.

Etymology. The name is derived from Latin word "orientalis" which refers to the type locality which is in Oriental Region.



Figures 1-15. *Laminatopina orientalis*, sp. n. male. Fig. 1. Head and thorax, dorsal view. Fig. 2. Face. Fig. 3. Head and pronotum, lateral view. Fig. 4. Forewing. Fig. 5. Male terminalia, posterior view. Fig. 6. Same, left lateral view. Fig. 7. Pygofer, posterior view, anal segment and genital styles removed. Fig. 8. Same, left lateral view. Fig. 9. Phallus, dorsolateral view, right aspect. Fig. 10. Same, dorsolateral view, left aspect. Fig. 11. Same, left lateral view. Fig. 12. Genital styles, left side. Fig. 13. Suspensorium. Fig. 14. Anal segment, ventral view. Fig. 15. Same, left lateral view.

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NEW GENUS AND SPECIES OF ACANTHOCORINI (HEMIPTERA: HETEROPTERA: COREIDAE: COREINAE) FROM AUSTRALIA[1]

Harry Brailovsky[2]

ABSTRACT: A new genus, *Postleniatus* and species, *P. glycosmisus,* collected in Australia, are described. The relationship with *Pomponatius* Distant and *Turrana* Distant is discussed. An illustration of the new species and figures of the hemelytra, male genital capsule, and female genital plates are provided. A key to the Australian Acanthocorini is provided.

KEY WORDS: Heteroptera, Coreidae, Acanthocorini, Australia, new genus, new species

Prior to this paper, two genera and three species of Acanthocorini have been recorded from Australia (Brailovsky and Monteith 1996, Cassis and Gross 2002). The genus *Pomponatius* Distant, 1904, contains two species, *P. luridus* Brailovsky and Monteith, 1996, and *P. typicus* Distant, 1904; *Turrana* Distant, 1911, includes one species *T. abnormis* Distant, 1911. This paper adds one new genus and species and provides eight morphological features to distinguish them from other Australian Acanthocorini: head and pronotum longer than wide, femora unarmed, abdomen in both sexes narrowed and expanded posteriorly, antennal segment II longer than III, eyes small, semiglobose, longitudinal groove of mesosternum deep, reaching posterior third, and abdominal segments VIII and IX of female short. A key to the known genera and species of Acanthocorini of Australia is given.

Postleniatus, NEW GENUS

Type Species. *Postleniatus glycosmisus* Brailovsky sp. nov.

Description. *Male. General habitus* (Fig. 9). *Head* longer than wide across eyes, subquadrate, not produced beyond antenniferous tubercles, granulate, and dorsally flat; tylus medially upturned to form a small horn, and apically rounded; juga unarmed, thick, globose, shorter than tylus; inner margins of antenniferous tubercles with large lobe apically rounded and widely separated; antennal segment I robust, thickest, longer than head; segment II cylindrical, regularly incrassate; segment III cylindrical, slender, IV fusiform; antennal segment IV shortest, segment I longest, II longer than III; frons with deep median longitudinal sulcus; ocelli almost sessile; preocellar pit small, deep; eyes moderately large, semiglobose; postocular tubercle absent; bucculae unarmed, short, rounded, not extending beyond anterior margin of eyes; rostrum reaching posterior margin of mesosternum; rostral segment III shortest, segment IV longest, II longer than I. *Thorax:* pronotum rectangular, longer than wide, flat, weakly declivent; collar not clearly marked; frontal angles produced forward as small conical projection; anterior margin concave; anterolateral margins straight, slightly reflected; humeral angles obtuse, apex subacute; posterolateral margins straight, smooth; posterior margin concave, smooth; anterior lobes of pronotal disk granulate, with few punctures, posterior

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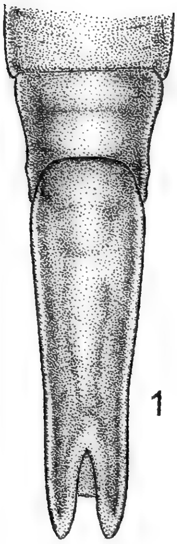
lobes densely punctate, each puncture medium-sized and scarcely deep; calli flat, separated along midline by longitudinal furrow; anterior lobe of metathoracic peritreme elevated, reniform, posterior lobe sharp, small; mesosternum with median longitudinal groove, reaching posterior third; pro-, meso-, and metathoraces granulate with few scattered punctures. *Legs:* short; hind femur not extending beyond posterior border of abdominal sternite IV; femora unarmed, gradually clavate, densely granulate; tibiae terete, conspicuously sulcate. *Scutellum:* triangular, longer than wide, flat, finely striate; apex subacute. *Hemelytra:* macropterous, reaching anterior margin of abdominal segment VII; costal margin emarginate; apical margin weakly sinuate; apical angle obtuse; clavus and corium strong and deeply punctate (Fig. 8). *Abdomen:* narrow, slightly expanded posteriorly; abdominal segment VII exposed aterally with posterior margin trilobate, median lobe fairly rounded, lateral expansions subtriangular (Fig. 9); connexivum raised above terga; posterior angle of each connexival segment entire, not expanded into spine; abdominal sterna without medial furrow. *Male genitalia.* Genital capsule: posteroventral edge elongate, projected as broad large-sized triangular lobe, apically subtruncated (Figs. 5-6). *Female genitalia:* abdomen narrow, expanded posteriorly; abdominal sternite VII with plica and fissura; plica rectangular, short, reaching anterior third of sternite VII. Genital plate: gonocoxa I square, shorter than paratergite IX, in caudal view closed, in lateral view convex; paratergite VIII triangular, elongate, with spiracle visible; paratergite IX triangular, elongate, larger than paratergite VIII and apically acute.

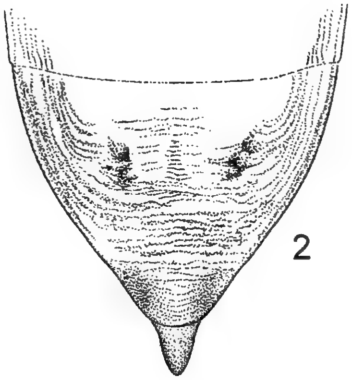
Discussion. The new genus is closely allied to *Turrana* Distant (1911) in having the head and pronotum longer than wide, postocular tubercle absent, posterior margin of pronotal disk concave, legs short with hind femur reaching anterior or middle third of abdominal sternite IV, ocelli not raised, femora unarmed, and clavus and corium strong and deeply punctate.

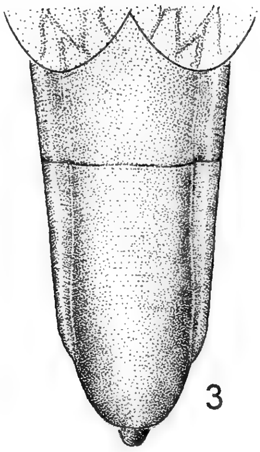
In *Postleniatus,* the abdomen in both sexes is narrowed and slightly expanded posteriorly (Fig. 9), antennal segment II longer than III, eyes moderately large, rostrum reaching posterior margin of mesosternum, longitudinal groove of mesosternum deep, reaching posterior third, and abdominal segments VIII and IX of female short. In *Turrana* the abdomen in both sexes are gradually narrowing beyond middle (Figs. 1, 3), antennal segment III longer than II, eyes small, compressed, rostrum shorter reaching posterior margin of prosternum, longitudinal groove of mesosternum not reaching posterior third, and abdominal segments VIII and IX of female elongate, tubular-type (Fig. 1).

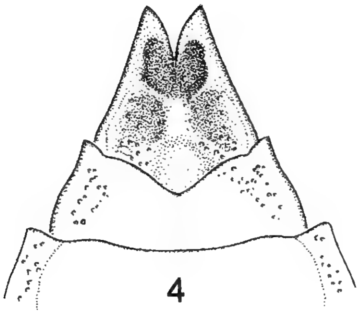
In *Pomponatius* Distant (1904), the other australian genus included in Acanthocorini, the head and pronotum are wider than long, femora ventrally armed, postocular tubercle present, clavus and corium dense and finely punctate, each puncture small, never deeply excavated, hemelytral membrane shorter (Fig. 7), hind femur reaching anterior or middle third of abdominal sternite V, male abdominal segment VII with posterior margin not trilobate (Fig. 2), and female genitalia elongate (Fig. 4).

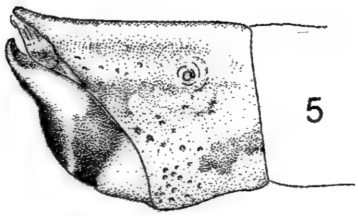
Etymology. Named after Anthony Postle, distinguished Australian entomologist. Gender masculine.

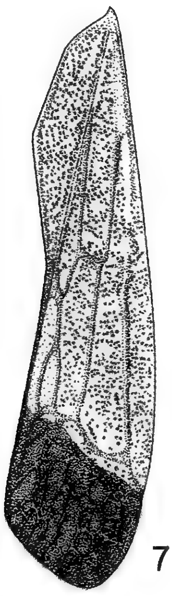












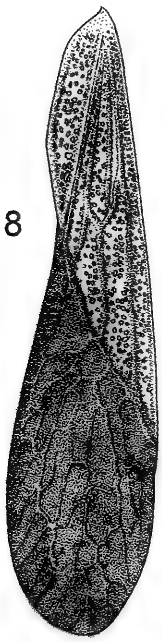


Fig. 1. *Turrana abnormis* Distant. Dorsal view of female abdominal segments VII to IX. Figs. 2-3. Dorsal view of male abdominal segment VII, and apex of genital capsule. Fig. 2. *Pomponatius typicus* Distant. Fig. 3. *Turrana abnormis* Distant. Fig. 4. *Pomponatius typicus* Distant. Dorsal view of female abdominal segments VII to IX. Figs. 5-6. Male genital capsule of *Pomponatius glycosmisus* NEW SPECIES. Fig. 5. Lateral view. Fig. 6. Caudal view. Figs. 7-8. Hemelytra. Fig. 7. *Pomponatius typicus* Distant. Fig. 8. *Postleniatus glycosmisus* NEW SPECIES.

Postleniatus glycosmisus, NEW SPECIES

(Figs. 5, 6, 8, 9)

Types. Holotype: male: Western Australia. Glycosmis Bay, 9 March 2004, A. Postle; deposited: Queensland Museum, Brisbane (QMBA). *Paratype:* female: Western Australia. Glycosmis Bay, 9 March 2004, A. Postle; deposited: Queensland Museum, Brisbane (QMBA).

Description. Dorsal color: yellowish dark, suffused with pink and dark irregular marks. *Head:* yellowish dark with outer face of antenniferous tubercles, widened longitudinal stripe running between inner face of antenniferous tubercles until vertex, and postocular space dark brown; antennal segment I pale reddish brown suffused with yellowish dark marks; antennal segment II reddish brown with inner face at basal third pale yellow; segment III pale yellow with apical third reddish brown, and IV with basal half pale orange and apical half reddish brown. *Pronotum:* yellowish dark, suffused with pink irregular marks, and punctures dark brown; humeral angles almost black. *Scutellum* yellow with lateral margins pale brown. Hemelytra: clavus and corium yellowish dark, suffused with pink irregular marks, and punctures dark brown; hemelytral membrane pale brown with veins darker. *Abdomen:* connexival segments III to VII black with anterior third pale yellow; abdominal terga II to VI shiny orange yellow, and VII yellow with two dark brown longitudinal stripes running laterally to midline. Ventral color: pale yellow suffused with pink irregular marks on head and thorax, and with following areas black: longitudinal stripe on meso- and metasterna, upper margin of metaacetabulae, the area adjacent to metathoracic peritreme, posterior third of pleural margins of abdominal sterna, rim of abdominal spiracle, irregular spots on abdominal sterna, and much of genital capsule; upper margin of abdomen almost entirely dark yellow. *Legs:* coxae reddish brown with ventral surface castaneus to shiny orange; trochanters reddish brown to dark brown; femora with dorsal surface reddish brown to dark brown suffused with yellowish dark marks, ventral surface pale yellowish with dark brown spots and irregular stripes dark brown to black; tibiae dark yellow with basal joint dark brown; tarsi dark yellow with orange marks.

Measurements. Male: head length 1.44 mm; width across eyes 1.38 mm; interocular space 0.86 mm; interocellar distance 0.42 mm; antennal segment length I, 2.64, II, 2.30, III, 2.24, IV, 1.18 mm; pronotum length 2.54 mm; width across humeral angles 2.26 mm; scutellar length 1.04 mm; width 0.76 mm; total body length 13.68 mm.

Female. Similar to male holotype except antennal segment II reddish brown with basal third dark yellow, fore tibiae yellow suffused with pale brown marks, middle and hind tibiae pale yellow with basal joint dark brown; connexival segment VII black with anterior third, wide obliquely stripe at middle third, and posterior border yellow, connexival segments VIII and IX black with dorsal third yellow, and genital plates yellow.

Measurements. Female: head length 1.60 mm; width across eyes 1.56 mm; interocular distance 0.98 mm; interocellar distance 0.46 mm; antennal segment length I, 3.06, II, 2.64, III, 2.52, IV, 1.26 mm; pronotum length 3.12 mm; width across humeral angles 2.80 mm; scutellar length 1.36 mm; width 1.08 mm; total body length 17.62 mm.

Etymology. Named for Glycosmis Bay, the type locality.

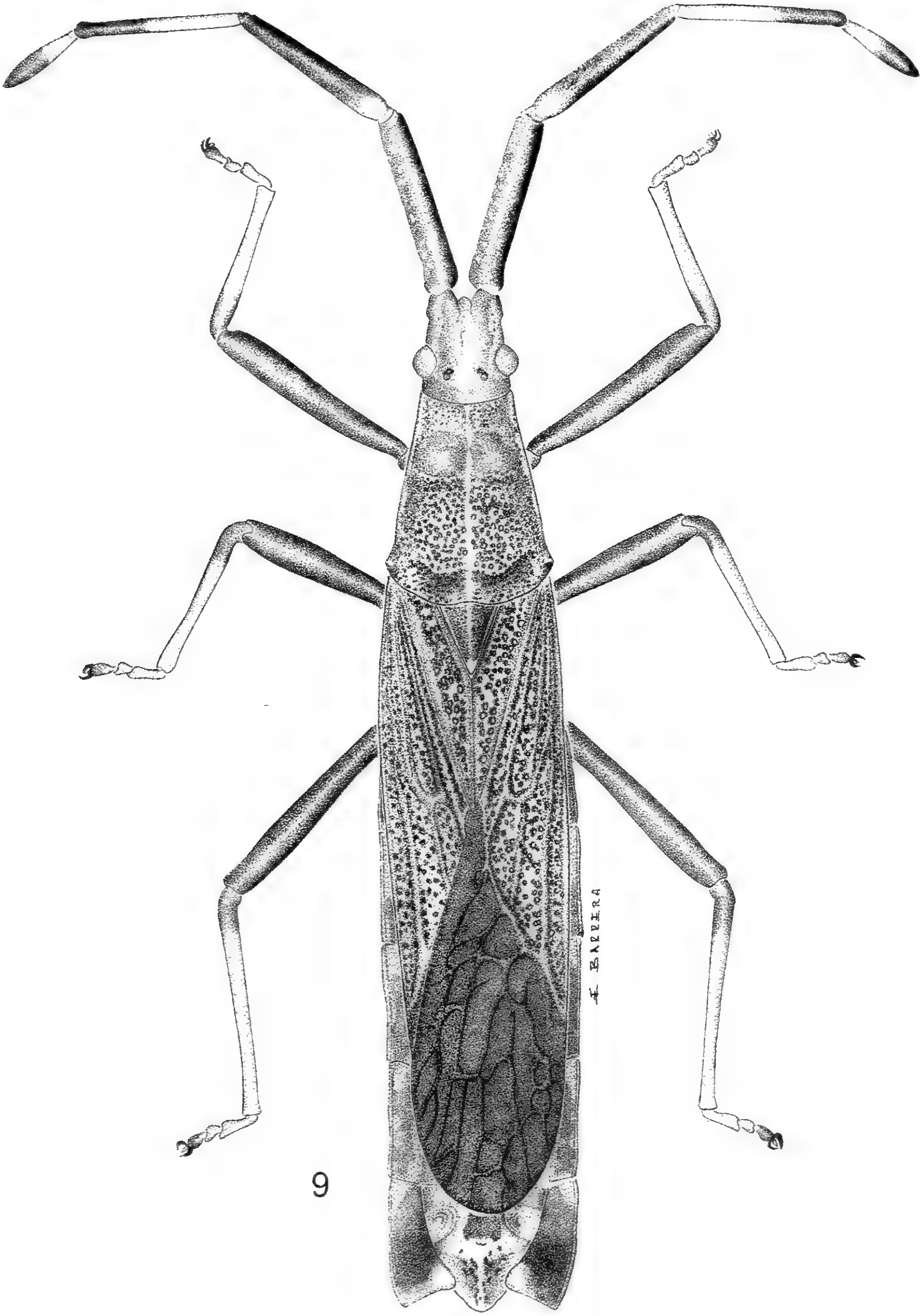

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Fig. 9. Dorsal view of *Postleniatus glycosmisus* NEW SPECIES (male).

Key to the known Australian Acanthocorini

1. Head and pronotum longer than wide; legs short; hind femora reaching middle third of abdominal sternite IV; clavus and corium strong and deeply punctate, each puncture deeply excavated, and large (Fig. 8); femora unarmed; postocular tubercle absent.....3

   Head and pronotum wider than long; legs longer; hind femora reaching anterior or middle third of abdominal sternite V; clavus and corium dense and finely punctate, each puncture small and never deeply excavated (Fig. 7); femora ventrally armed; postocular tubercle present..2

2. Antennal segment III not noticeably more swollen than II, bicoloured, with apical half paler than basal half; hemelytral membrane elongate, longer than 3.20 mm, with several longitudinal veins, with basal margin strongly sinuate; dark longitudinal stripes on prosternum about same width as rostrum.. ....*Pomponatius luridus* Brailovsky and Monteith

   Antennal segment III noticeably more swollen than II not bicoloured; hemelytral membrane short, less than 3.20 mm, with reticulate venation, basal margin uniformly curved; dark longitudinal stripes on prosternum at least twice width of rostrum ....*Pomponatius typicus* Distant

3. Abdomen in both sexes gradually narrowing beyond middle (Fig. 3); antennal segment III longer than II; eyes small, compressed; rostrum short, reaching posterior border of prosternum; longitudinal groove of mesosternum short, not reaching the posterior third; abdominal segments VIII and IX of female elongate, tubular-type (Fig. 1)......... ....*Turrana abnormis* Distant

   Abdomen in both sexes narrowed, slightly expanded posteriorly (Fig. 9); antennal segment II longer than III; eyes moderately large; rostrum reaching posterior margin of mesosternum; longitudinal groove of mesosternum deep, reaching posterior third; abdominal segments VIII and IX of female short ....*Postleniatus glycosmisus* NEW GENUS, NEW SPECIES

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A NEW SPECIES AND SOME NEW RECORDS OF THE GENUS OXYCERA (DIPTERA: STRATIOMYIDAE) FROM TURKEY[1]

Turgay Üstüner[2] and Abdullah Hasbenli[3]

ABSTRACT: A new species, *Oxycera quadrilineata* sp. n., is described from Turkey and diagnostic characters are illustrated and compared with four related species. *Oxycera galeata* (Lindner, 1975), *Oxycera grata* Loew, 1869 and *Oxycera pardalina* Meigen, 1822 are recorded for the fauna of Turkey for the first time.

KEY WORDS: Stratiomyidae, *Oxycera*, *Oxycera quadrilineata*, new species, Turkey

Only seven species of *Oxycera* (Stratiomyidae) have been recorded from Turkey (Üstüner et al. 2002, Üstüner and Hasbenli 2004, Woodley 2001). These species are *Oxycera insolata* Kühbandner, 1984, *Oxycera limbata* Loew, 1862, *Oxycera meigenii* Staeger, 1844, *Oxycera nigricornis* Olivier, 1811, *Oxycera pygmaea* (Fallén, 1817), *Oxycera trilineata* (Linnaeus, 1767) and *Oxycera turcica* Üstüner and Hasbenli, 2004. During our investigations of Turkish Stratiomyidae in the Tahtalı Mountains of Turkey, we discovered four species which represent interesting additions to the *Oxycera* fauna of Turkey. One of these species is a new species distinctly differing from the related species *Oxycera pardalina* Meigen, 1822, *Oxycera limbata* Loew, 1862, *Oxycera insolata* Kühbandner, 1984 and *Oxycera trilineata* (Linnaeus, 1767). Three of these species are recorded for the first time in Turkey.

Oxycera quadrilineata NEW SPECIES

(Figs. 1-8)

Holotype: Female, Turkey: Sivas, Gürün-Kindiralik Village, elev. 1819 m., July 16, 2002, coll. Üstüner and Hasbenli, deposited in the collection of the Zoological Museum of the Gazi University (ZMGU), Ankara in Turkey.

Paratypes: 3 females, Turkey: Sivas, Gürün-Kindiralik Village, elev. 1819 m., 16 July 2002 coll.Üstüner and Hasbenli. The paratype specimens are deposited in the collection of the Zoological Museum of the Gazi University (ZMGU), Ankara (coll. Hasbenli) and Selçuk University Department of Biology in Konya (coll. Üstüner) in Turkey. All specimens were collected in a grassy area surrounding a moist spring.

Diagnosis: Frons black with 2 yellow spots and a pair of long yellow stripes on sides. Antenna entirely black. There are 4 yellow longitudinal stripes on the mesonotum.

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Mailed on June 18, 2007

Female: Eyes have quite short sparse hairs. Frons (Fig. 1) shining black, about 1/3 as broad as head. On the frons there are two yellow medial spots below the ocelli that do not reach the eye-margin. Broad lateral yellow areas present along eye margins extending from middle of frons below onto the face. Genae black. Postocular region (Fig. 2) broadly yellow, extending from upper angle of the eye to the postgena, interrupted at about upper one-third. Antenna entirely black. Scape and pedicel shining black. Antennal apical style is longer than rest of flagellum. Postocciput, vertex (cerebrale behind of ocellar triangle) shining black. Labella yellow. Frons and postocular area with sparse, short, yellow hairs. Some long sparse hairs present on lower part of face and genae.

Thorax (Figs. 3 and 4) black, covered with sparse, short, yellow hairs. Four yellow longitudinal stripes present on mesonotum. Humeral callus and postalar callus are yellow. Yellow subnotopleural stripes widened posteriorly and extend to base of halteres. Scutellum and scutellar spines are yellow. Wings (Fig. 5) are transparent, cell r1 is golden yellow, R4 present, wing with stronger veins are golden yellow. Legs are mainly yellow. All femur are yellow, with the middle of exterior face of fore and mid tibia with a black stripe-like spot, hind tibia yellow with indistinct spot near middle. Fore tarsi entirely black. Tarsal segments 3 and 4 of mid and hind tarsi segments black. Halteres are light yellow with darkened stalk.

Abdomen (Fig. 6) shining black covered with sparse, short, yellow hairs. Lateral margin yellow beginning at anterior corner of tergum 2, enlarged into lateral markings on terga 2-4 that are rather broad on tergites 3 and 4, and somewhat more extended medially on tergite 4. There is a yellow apical spot on tergite 5. Venter is entirely black. Female terminalia (Figs. 7 and 8): Cerci are relatively long and one-segmented. Genital furca is slender, long and triangular. Anterior portion of genital furca slender. There is a small, posteromedial emargination on the furca. Posterolateral projections are long and broad on genital furca.

Length of body 6 mm., wing 5.5 mm.

Discussion: The four yellow stripes on the black mesonotum are very characteristic for this species. Although *Oxycera quadrilineata* sp.n. females resemble females of *Oxycera pardalina* Meigen,1822, *Oxycera limbata* Loew, 1862, *Oxycera* insolata Kühbandner, 1984 and *Oxycera trilineata* (Linnaeus, 1767), it is different from them (Kühbandner 1984, Lindner 1936-1938, Rozkošný 1983).

Oxycera quadrilineata sp.n. has been carefully compared with the other species. The female of *O. limbata* has the antenna light brown with style black; 4 yellow spots at eye margin on the frons; and two narrow longitudinal stripes on the mesonotum. The female of *O. quadrilineata* sp. n., has the antenna entirely black, 2 yellow spots at eye margin on the frons, and four longitudinal stripes on mesonotum. The coloration of the abdomen of the new species is entirely different from the abdomen of *O. limbata*.

This species also differs from *Oxycera insolata* Kühbandner, 1984 and *Oxycera trilineata* (Linnaeus, 1767). There are no spots at eye-margin on the frons in *O. insolata* and O. *trilineata*. The notopleural stripe of O. *trilineata* is broader than in the new species and it is connected to the subnotopleural suture on mesonotum. And there are four yellow or green longitudinal stripes and three black longitudinal ground stripes on the mesonotum in the female of O. *trilineata*. This new species appears to be related to *Oxycera pardalina* Meigen,1822, but *O. pardalina* Meigen, 1822 has only two yellow longitudinal stripes on mesonotum in the female.

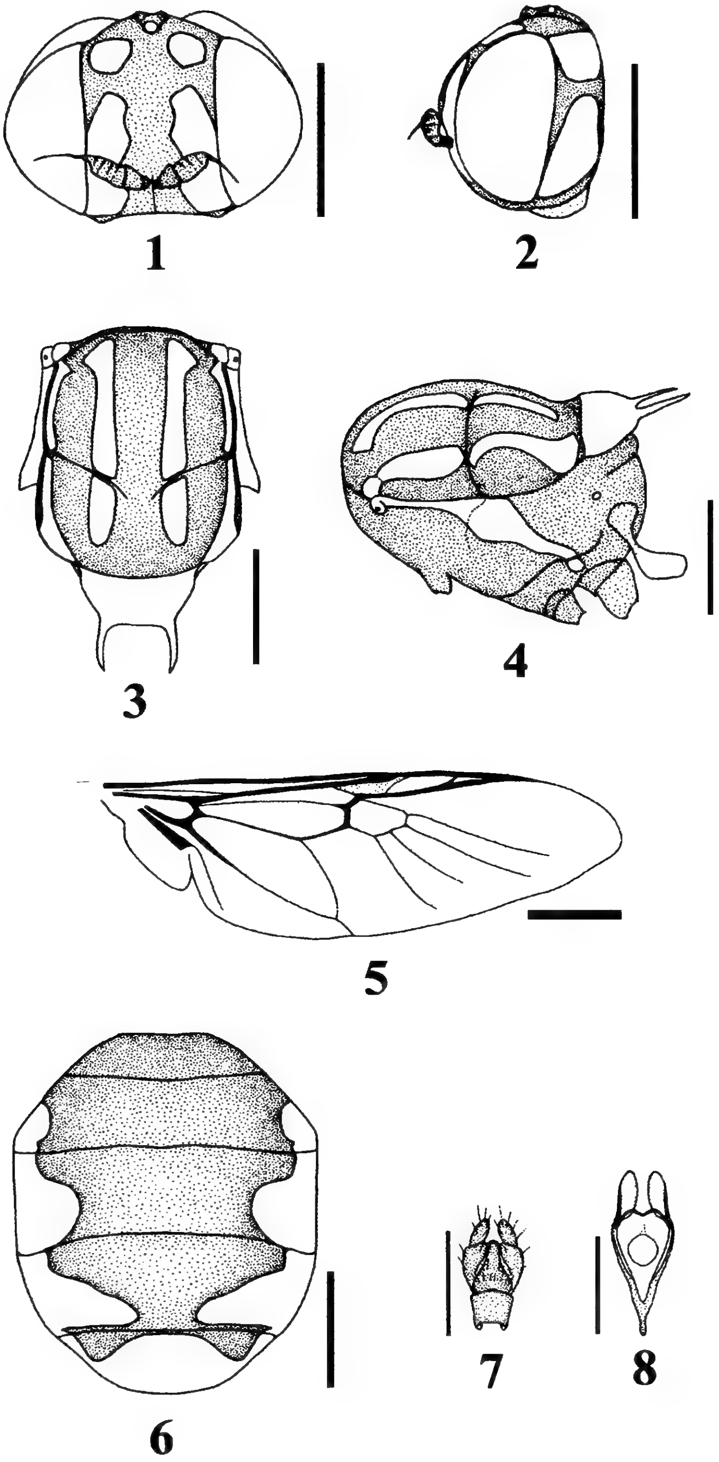

Fig. 1-8 *Oxycera quadrilineata* sp.n. female: 1. Head in frontal view, 2. Head in lateral view, 3. Thorax in dorsal view, 4. Thorax in lateral view, 5. Wing, 6. Abdomen in dorsal view. Scale bar: 1 mm.; female genitalia: 7. female terminalia in dorsal view, 8. genital furca. Scale bar: 0.25 mm.

A list of species of *Oxycera* newly recorded from Turkey

Oxycera galeata (Lindner, 1975)

Oxycera galeata was described by Lindner from Israel in 1975 as *Heraclina galeata*. *Oxycera galeata* (Lindner, 1975) is recorded for the fauna of Turkey for the first time.

Material Examined: 1 male: Turkey: Adana, Feke, Degirmenusagi Village, elev. 727 m, June 24, 2002, coll. Üstüner and Hasbenli. 1 female: Turkey: Adana, Feke, Degirmenusagi Village, elev. 727 m, June 24, 2002, coll. Üstüner and Hasbenli. 1 female: Turkey: Kayseri, Yahyali, Burhaniye Village, elev. 1414 m, July 13, 2002, coll. Üstüner and Hasbenli. 1 female: Turkey: Kayseri, Yahyali, Sogulca Plateau, elev. 1665 m, July 14, 2002, coll. Üstüner and Hasbenli. 1 female: Turkey: Kayseri, Sariz, Karapinar Village, elev. 1723 m, July 16, 2002, coll. Üstüner and Hasbenli. 2 male: Turkey: Adana, Saimbeyli, Avcipinari Village, elev. 1430 m, July 27, 2003, coll. Üstüner and Hasbenli.

Distribution: Palaearctic: Israel (Lindner, 1975; Lindner and Freidberg, 1978; Woodley, 2001).

Oxycera grata Loew, 1869

This species has been previously known only from Greece. The female we collected represents the first record for Turkey.

Material Examined: 1 female: Turkey: Sivas, Sarkisla, between Sarkisla and Pinarbasi, Basören Village, elev. 1810 m, June 23, 2003, coll. T. Üstüner and A. Hasbenli.

Distribution: Palaearctic: Greece (Kertész, 1908; Pleske, 1925a; Rozkošný, 1983; Woodley, 2001).

Oxycera pardalina Meigen, 1822

A Palaearctic species that ranges from Europe to west Europe and Caucasia. This species is recorded for the fauna of Turkey for the first time.

Material Examined: 1 female: Turkey: Kayseri, Tasci (Bakirdagi), Deresimli Village, elev. 1490 m, July 15, 2002, coll. Üstüner and Hasbenli. 1 female: Turkey: Kayseri, Tasci (Bakirdagi), Deresimli Village, elev. 1400 m, August 29, 2003, coll. Üstüner and Hasbenli.

Distribution: Palaearctic: Albania, Armenia, Austria, Belgium, Czech Republic, England, France, Georgia, Germany, Hungary, Ireland, Italy, Netherlands, Poland, Roumania, Russia, Slovakia, Spain, Sweden, Switzerland, Yugoslavia (Kertész, 1908; Pleske, 1925b; Séguy, 1926; Lindner, 1936-1938; Rozkošný, 1973; Dušek and Rozkošný, 1974; Rozkošný, 1983; Narchuk, 1988; Rozkošný and Nartshuk, 1988; Woodley, 2001).

Key to Species of *Oxycera* Meigen, 1803 of Turkey

1. Eyes contiguous, male. Mesonotum shining black, humeral cali and postalar cali with yellow spots, subnotopleural stripes yellow. Scutellum and scutellar spines yellow. Abdomen black, with yellow margin beginning at tergum 2 and yellow spots on terga 3-4 .... *Oxycera galeata* (Lindner, 1975)
– Eyes broadly separated, females 2

2. Mesonotum with yellow longitudinal stripes 3
– Mesonotum with yellow rectangular spot .... *Oxycera galeata* (Lindner, 1975)

3. Mesonotum with 4 yellow longitudinal stripes. Frons black with 2 yellow spots and a pair of long yellow stripes on sides .... *Oxycera quadrilineata* n.sp.
– Mesonotum with 2 yellow longitudinal stripes 4

4. Pteropleura with yellow spots, subnotopleura with wide yellow stripes. Abdominal side-markings on tergum 4 extend to the middle part of the tergum ... . *Oxycera* grata Loew, 1869
– Pteropleura without yellow spots, subnotopleura with relatively narrow yellow stripes Abdominal side-markings on tergum 4 not extend to the middle part of the tergum .... *Oxycera pardalina* Meigen, 1822

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Our thanks are due to Prof. R. Rozkošný (Brno, Czech Republic) for his opinion on this new species and due to Dr. N. E. Woodley for critically reviewing the manuscript. The work was carried out with financial support from the Selcuk University Scientific Research Council (BAP) (grant 2001/122).

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RECTIMARGINALIS, NEW GENUS, WITH KEY TO GENERA OF HOLOCHLORINI (ORTHOPTERA: TETTIGONIIDAE: PHANEROPTERINAE) FROM CHINA[1]

Chun-Xiang Liu[2] and Le Kang[2]

ABSTRACT: A new genus, *Rectimarginalis* is erected for *Holochlora fuscospinosa*, *H. traba*, *H. ensis* comb. nov. and *Rectimarginalis profunda* sp. nov., based on the distinguished male stridulatory apparatus and male epiproct with possession of a stick-shaped projection. The new genus belongs to the tribe Holochlorini. A key to the eleven Chinese genera of Holochlorini is provided. A new species, *R. profunda*, is described from southwestern China. Two more new combinations, *R. ensis* (De Haan), and *R. traba* (Ingrisch), are proposed. A key to all four species of *Rectimarginalis* is given, together with illustrations of important taxonomic characters.

KEY WORDS: new genus, new species, Holochlorini, key, stridulatory area, China, Orthoptera, Phaneropterinae

Due to special functions of sound in mating behavior of Orthopteroid insects, Characters of the male stridulatory organ play an important role in separation for species and genera (Liu et al, 2004). When examining the tettigoniids from several museum collections, we established a new genus *Rectimarginalis*, for 3 known species, *Holochlora fuscospinosa* Brunner von Wattenwyl, *Holochlora ensis* (De Haan), *Holochlora traba* Ingrisch and Shishodia, and one new species *R. profunda*, based on specialized male stridulatory area and epiproct.

The genus *Holochlora* Stål is an important group of the subfamily Phaneropterinae, and is mainly distributed in the Oriental region. Fifty-eight species were recorded in the genus *Holochlora* Stål (Eades et al, 2006), among which some of the species are not monophyletic. The genus *Sinochlora* was established by Tinkham (1945) for the type species *Sinochlora kwangtungensis*, which was a synonym of *Sinochlora longifissa* (Matsumura and Shiraki, 1908), based on the recent studies (Kang, 1987; Liu and Jin, 1999). In fact the genus *Sinochlora* has covered 13 species, among which one species *Sinochlora voluptaria* (Carl) was also removed out of *Holochlora* (Liu and Kang, 2007). Our current investigation proposed to transfer 3 known species, *Holochlora fuscospinosa* Brunner von Wattenwyl, *Holochlora ensis* (De Haan), *Holochlora traba* Ingrisch and Shishodia, from the genus *Holochlora*, and to establish the new genus *Rectimarginalis*.

The new genus is related to *Sinochlora, Pseudopsyra,* and *Holochlora*, but maybe it is more remotely related to *Holochlora* than *Sinochlora* and *Pseudopsyra.* It is distinctly distinguished from *Holochlora* and other related genera including *Sinochlora* Tinkham, and *Pseudopsyra* Hebard by the following synapomorphies: field around stridulatory file is not swollen (Figs. 6, 8), and, posterior portion of anal margin of right stridulatory area is straight (Figs. 7, 9).

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Whereas, the species of the genera *Holochlora*, *Sinochlora,* and *Pseudopsyra* possess similar characteristics about male stridulatory area with the field around stridulatory file being strongly swollen (Figs. 10, 12, 14), and base of the posterior portion of anal margin of right stridulatory area being concave into a triangular region with other veinlets (Figs. 11, 13, 15). Furthermore, apical projection of male epiproct of the new genus is stick-shaped (Figs. 22-25), as male phallus described by Ingrisch and Shishodia (1998; 2000).

The new genus belongs to the tribe Holochlorini. Holochlorini is erected by Bei-Bienko (1954), who provided descriptions restricted to some genera reaching countries adjacent to U.S.S.R, and did not include all genera of Holochlorini. Eades et al (2006) included nine genera in Holochlorini, and we proposed that the genera *Parapsyra* Carl, *Pseudopsyra* Hebard, *Sinochlora* Tinkham, and *Stictophaula* Hebard are ascribed to the tribe. Here we just provided a key to the eleven genera of Holochlorini in China in order to compare the new genus with other relatives.

Materials come from the following two depositories: Insect Collection of Institute of Zoology, Chinese Academy of Sciences, Beijing, China (IZAS); and Institute of Entomology, Chinese Academy of Sciences, Shanghai, China (MSIE).

Key to Chinese genera of the tribe Holochlorini

1. Genicular lobe of hind femur with 1-2 spines 2
   Genicular lobe of hind femur rounded, without spines 10
2. Male subgenital plate without styli. Female ovipositor with lateral surface smooth 3
   Male subgenital plate with styli. Female ovipositor with lateral surface more or less granulated 5
3. Tegmina with Rs not bifurcated. Male tenth abdominal tergum with median process prolonged .... *Phaulula* Bolívar, 1906
   Tegmina with Rs bifurcated. Male tenth abdominal tergum without median process 4
4. Posterior margin of pronotum with a small median notch. Leg pilose. Male subgenital plate emarginated .... *Arnobia* Stål, 1876
   Posterior margin of pronotum without median notch. Leg not pilose. Male subgenital plate with apical margin deeply notched ....
   .... *Stictophaula* Hebard, 1922
5. Tegmen usually with delicate texture, more or less sub-transparent. Female ovipositor thickset, somewhat coarse; dorsal margin obliquely truncated or with a slight truncation at apex 6
   Tegmen usually with slightly coarse texture. Female ovipositor fine, compressed, gradually curved 8
6. Left stridulatory vein not swollen on dorsal side of tegmen (Figs. 6, 8); stridulatory file on underside of left tegmen fine (Figs. 1-2). Male epiproct

with the possession of a stick-shaped projection (Figs. 22-25) .... *Rectimarginalis* NEW GENUS

Left stridulatory vein strongly swollen on dorsal side of tegmen (Figs. 10, 12); stridulatory file on underside of left tegmen rather thick (Figs. 3-4). Male epiproct not same as above 7

7. Costal vein black and white at base of tegmen. Femoral spines strongly black. Male tenth abdominal tergum with a pair of forcipate processes and a median process, which varied through different species. Female ovipositor with the dorsal valvulae strongly truncate at apex .... *Sinochlora* Tinkham, 1945

Costal vein always conclorous with rest of tegmen. Femoral spines not black except in *Holochlora venusta* Carl. Male tenth abdominal tergum with a pair of knob-like processes. Female ovipositor with the dorsal valvulae slightly obliquely truncated at apex .... *Holochlora* Stål, 1873

8. Tegmina with costal vein indistinct .... *Parapsyra* Carl, 1914

Tegmina with costal vein disctinct 9

9. Male tenth abdominal tergum not produced into a strongly deflexed plate; male subgenital plate with styli much shorter than half of its length .... *Psyrana* Uvarov, 1940

Male tenth abdominal tergum produced into a strongly deflexed large plate; male subgenital plate with styli much longer than its length... *Pseudopsyra* Hebard, 1922

10. Pronotal disc with lateral margins parallel. Occiput and pronotum punctured. Male subgenital plate with styli longer than its length. Female ovipositor with lateral surface smooth .... *Tapiena* Bolívar, 1906

Pronotal disc with lateral margins spreading outwards; occiput and pronotum not punctured. Male subgenital plate with styli much shorter than third of its length. Female ovipositor with distal part of lateral surface granulated .... *Ruidocollaris* Liu, 1993

Rectimarginalis NEW GENUS

Type species: *Holochlora fuscospinosa* Brunner von Wattenwyl, 1891

Diagnosis: Size medium or large. Parapterous, usually green, rarely colourful. Male left stridulatory vein swelling on dorsal surface of tegmen (Figs. 6, 8). Stridulatory file on underside of left tegmen fine. Mirror of right tegmen indistinct, occupied by several veinlets (Figs. 7, 9). Male tenth abdominal tergum devided into two lateral lobes (Figs. 16-17, 19-20). Epiproct with a stick-shaped projection (Figs. 22-25). Male subgenital plate with short styli (Figs. 18, 21). Female ovipositor robust, with dorsal margin of distal part only slightly truncate (Fig. 26).

Description: Occiput slightly convex. Fastigium verticis circa right-angularly inserted with fastigium frontis, dorsally and distally sulcate, narrower than first segment of the antennae. Compound eyes wide, oval, brown. Antennae long, thin.

Pronotal disc smooth, with longitudinal carina subtle in prozona and distinct in metazona, without lateral carina; main sulcus V-shaped; anterior margin slightly concave, posterior margin convex. Paranota distinctly higher than long; anterior margin substraight to slightly concave, ventral margin oblique, posterior margin S-shaped; humeral notch distinct. Tegmina and wings fully developed. Tegmen gradually widened toward the middle, and then gradually narrowed toward the apex; greatest width of tegmen longer than the length of pronotum, tegminal apex narrowly rounded; costal vein distinct straight and short; Rs generally bifurcate; cross-veins of tegmina numerous, many of which straight and transverse.

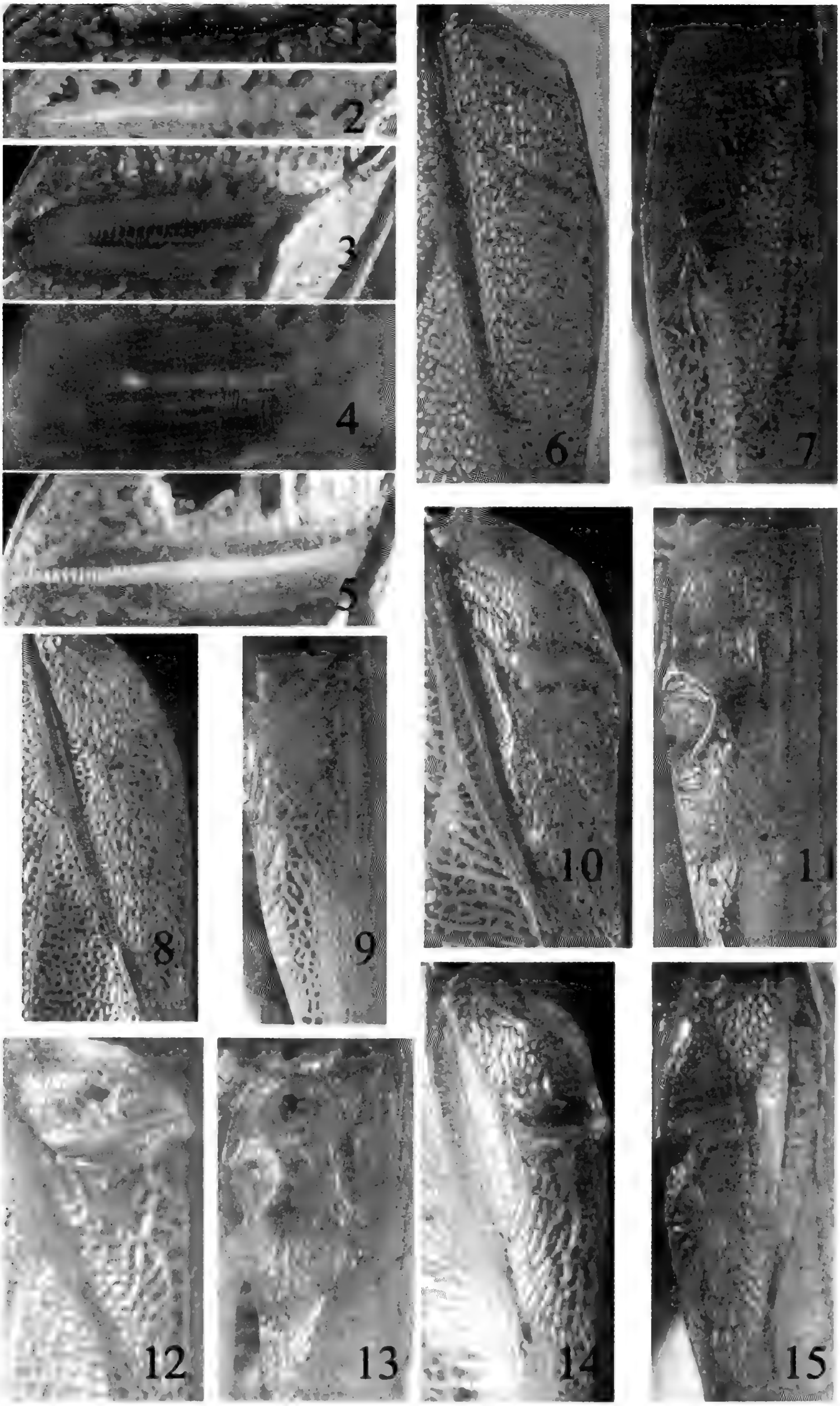
Anterior coxae armed. Anterior tibiae dorsally sulcate, widened at and suddenly constricted below tympana; auditory foramina internally conchate, externally apert. The occurrence and number of small spinules on femora and tibiae is not constant, it may even vary between both sides of the same individual. The following pattern occurs most commonly: anterior femora with spinules on ventro-internal, median femora on ventro-external, and posterior femora on both ventral margins. Anterior tibiae with spinules on dorso-external, median tibiae on dorso-internal, and posterior tibiae on both dorsal margins. Genicular lobe with two spines on each femur.

Male: Epiproct stick-shaped, covered with clinging hairs. Subgenital plate elongate, split at apex, with short styli.

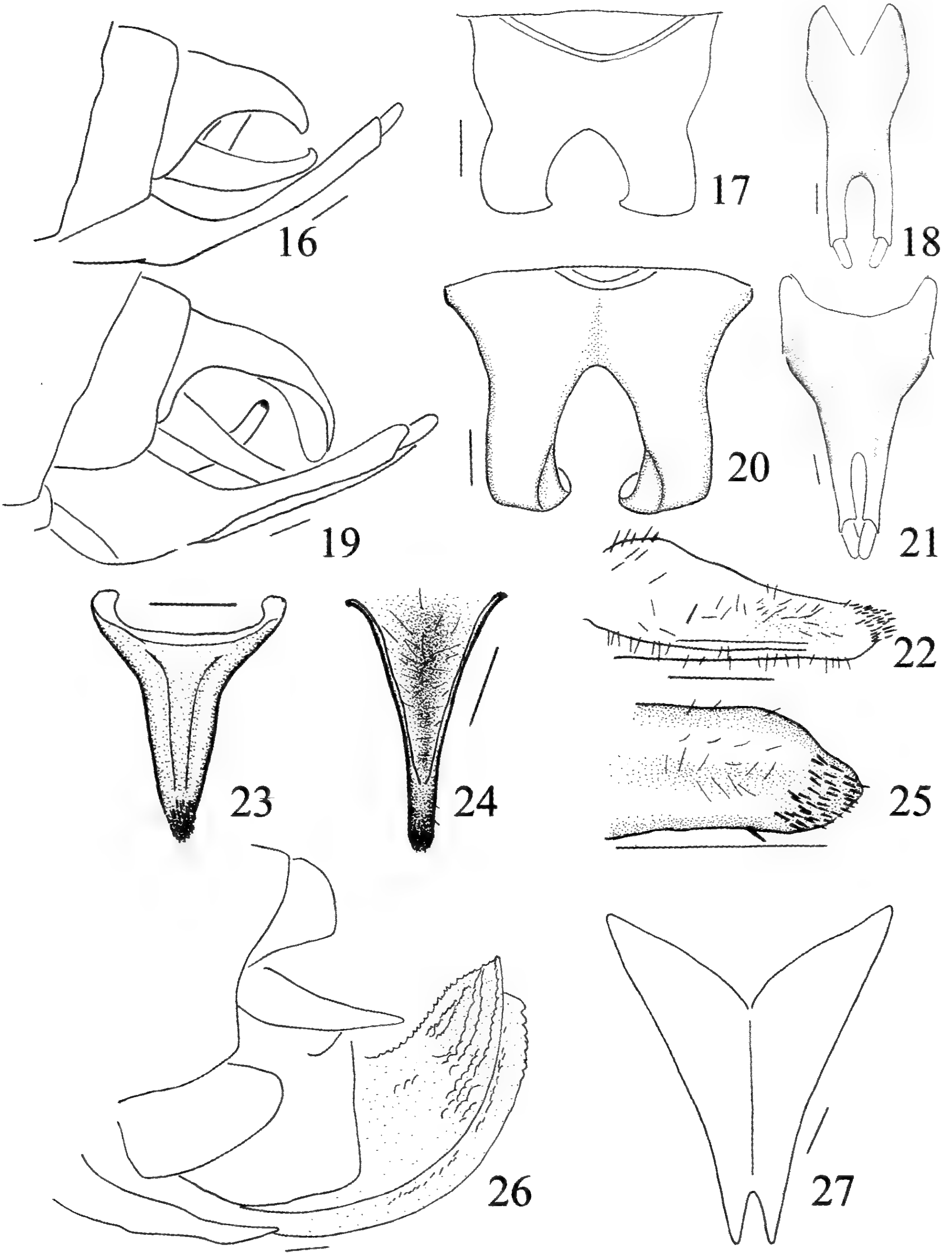
Female: Similar to *Holochlora* Stål. Size distinctly larger than male. Tenth abdominal tergum with apical margin emarginated. Cerci rather short, conical. Ovipositor robust with distinct transverse ridgy pleat, lateral surface coarse with rows of irregular spines in the distal half, dorsal margin serrate with distal part obliquely truncated, ventral margin with distal sixth denticulate (Fig. 26).

Discussion: The new genus belongs to Holochlorini, for characters as fastigium frontis, fastigium verticis, occiput, pronotum, tegmen, anterior tibial tympana, spination of legs. The differences from other Chinese genera in Holochlorini are listed in the above key.

Etymology: The name *Rectimarginalis* is composed of the prefix *Recti-,* meaning straight, and the word *marginal.* The name refers to the distinctively straight posterior margin of the male right stridulatory area which differs from the situation in other genera of Holochlorini. The name is regarded as feminine in gender.



Figs. 1-15. Male stridulatory area 1, 6-7. *Rectimarginalis fuscospinosa*; 2, 8-9. *R. profunda*; 3, 10-11. *Holochlora* sp.; 4, 12-13. *Sinochlora* sp.; 5, 14-15. *Pseudopsyra* sp. 1-5. Male stridulatory file underside of the left tegmen; 6, 8, 10, 12, 14. Male stridulatory area of left tegmen; 7, 9, 11, 13, 15. Male stridulatory area of right tegmen.



Figs. 16-27. Species of *Rectimarginalis*. Figs. 16-18, 22-27. *R. fuscospinosa*; Figs. 19-21. *R. profunda*. 16, 19. Male abdominal apex, lateral view; 17, 20. Male tenth abdominal tergum, dorsal view; 18, 21. Male subgenital plate, ventral view; 23. Male epiproct, dorsal view; 24. Male epiproct, ventral view; 21. Male epiproct, lateral view; 25. Male epiproct, lateral-apical view 26. Female abdominal apex, lateral view; 27. Female subgenital plate, ventral view.

Key to species of *Rectimarginalis* NEW GENUS

1. Each lateral margin of occiput with a short brown line behind compound eye, extending along pronotal lateral margin 2
   Occiput and pronotum with unicolorous dorsal surface................................3

2. Tegmen with cells in radial and medial areas with aggregation of brown dots. Male tenth abdominal tergum split in distal half; lateral lobes short, strongly narrowed at apex (Figs. 16-17)..
   ...*Rectimarginalis fuscospinosa* (Brunner von Wattenwyl, 1891) comb. nov.
   Tegmen unicolorous. Male tenth abdominal tergum split in basal third; lateral lobe long, gradually narrowed distad (Figs. 19-21) ....
   ....*Rectimarginalis profunda* NEW SPECIES

3. Male subgenital plate split in distal quarter into two compressed lobes (Ingrisch and Shishodia 1998: 372, Fig. 27) ....
   ....*Rectimarginalis traba* (Ingrisch and Shishodia, 1998) comb. nov.
   Male subgenital plate split in distal third into two cylindrical lobes (Karny 1926: 121, Fig. 138).......*Rectimarginalis ensis* (De Haan, 1842) comb. nov.

Rectimarginalis fuscospinosa (Brunner von Wattenwyl, 1891) comb. nov.

(Figs. 1, 2, 6-9, 16-18, 22-27)

Holochlora fuscospinosa Brunner von Wattenwyl, 1891: 91, 92; Hebard, 1922: 158.

Examined material: 1 male, P.R. China: Yunnan Prov.: Xishuangbanna, Mengla, 620-650m, 1958.XI.15, Coll. Zhang Yiran (IZAS). Paratype: 1 male, P.R. China: Hainan Island, Jianfengling, 1983.VIII.4, Coll. Liu Yuanrun (IZAS); 1 male, Tonkin, Hoa-Binh, leg. A. de Cooman (IZAS); 1 female, P.R. China: Yunnan Prov., Mengyang, Sanchahe, 1995.VII.31-VIII.3, Coll. Liu Xianwei, Zhang Weinian and Jin Xingbao (MSIE).

Description: Male. Medium-sized. Hind wings longer than tegmina. Tegmina distinctly surpassing beyond the genicular lobe of hind femur; Tegmen with costal vein edged by a brown line, Rs branching slightly before middle of tegmen; radial stem with 3 more lateral branches.

Male: Stridulatory file on underside of left tegmen in basal part with about 9 indistinct small teeth, middle part with about 23 widely arranged large teeth, and distal part with 8 obsolescent teeth (Fig. 1). Tenth abdominal tergum dorsally with an obtuse furrow in the basal third. Lateral lobes strongly deviating outwards; notch "U"-shaped (Figs. 16-17). Epiproct beam-shaped, upheaved lengthwise in center, shaped a median groove in the ventral surface, with numerous brown bristles at apex (Figs. 22-25). Cerci rather long, extending little beyond three quarters of subgenital plate, coniform, evenly incurved, apex with an incurved hook. Subgenital plate widest at base, evenly constricted in basal third, split in apical third into two lobes; styli short, cylindrical; ventral surface of subgenital plate with two lateral and one median carina (Fig. 18).

Female: Subgenital plate narrowly triangular, longer than wide, lateral margin slightly concave, apex with acute triangular notch (Fig. 27).

Coloration: Green brownish (discolored probably green when alive). Both lateral margins of pronotal disc with dark brown longitudinal stripes. Each lateral lobe of pronotm with two brown spots. Area between radial and cubital veins of tegmen with large brown spots. Hook of cercus dark brown.

Measurements (mm): length of body: male 26.0, female 36.0; length of pronotum: male 7.5, female 8.5; length of tegmen: male 51.0, female 62.5; greatest width of tegmen: male12.5, female 18.0; length of hind wing: male 57.0, female 67.5; length of hind femur: male 28.5, female 33.5; length of ovipositor 8.0.

Rectimarginalis profunda NEW SPECIES

(Figs. 2, 8-9, 19-21)

Type Material: Holotype. 1 male, P.R. China: Yunnan Prov.: Xishuanbanna, Mengnuo, 850m, 1957.VI.27, Coll. Li Xiaofu (IZAS).

Description: Male (holotype). Large-sized. Tegmen with costa bordered by a brown line; Rs branching before middle of the tegmen; radial stem with also three more lateral branches.

Male: Stridulatory file on underside of left tegmen in basal 2/3 with about 25 widely arranged large teeth, and distal part with about 7 obsolescent teeth (Fig. 2). Tenth abdominal tergum long, arculately deflexed in distal half, with lateral margin concave; split in basal third into two lobes with internal semilunar groove in distal part (Figs. 19-20). Cerci rather long, extending as far as two thirds of subgenital plate, coniform, evenly incurved, apex with an incurved hook. Subgenital plate widest at base, gradually tapering and more strongly tapering behind basal third, split in apical third into two thin sheet lobes; styli short, cylindrical (Fig. 21).

Female: Unknown.

Coloration: Green. Lateral margins of pronotal disc with symmetrical light brown longitudinal stripes.

Measurements of male (mm): length of body 26.0, length of pronotum 6.0, length of tegmen 45.0, largest width of tegmen 11.5, length of hind wing 50.0, length of hind femur 22.5.

Discussion: The new species resembles *R. fuscospinosa* (Brunner von Watteneyl) in coloration, stripes of pronotal disc, but differs from the latter by shape of tegminal spots and arrangement of veinlets of male stridulatory area, and structure of tenth abdominal tergum. *R. profunda* differs from *R. ensis* (De Haan) by the brown lateral stripes on pronotum and the male subgenital plate being not deeply split.

Etymology: The name derives from the Latin word "profund," which indicated that the male ten abdominal tergum is deeply split into two lobes.

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BIOLOGY OF *PHERBELLIA INFLEXA* (DIPTERA: SCIOMYZIDAE), A PREDATOR OF LAND SNAILS BELONGING TO THE GENUS *ZONITOIDES* (GASTROPODA: ZONITIDAE)[1]

B. A. Foote[2]

ABSTRACT: Information is presented on the distribution, life cycle, and larval feeding habits of *Pherbellia inflexa* Fisher, whose larvae attack the small land snail *Zonitoides arboreus* (Zonitidae).

KEY WORDS: Diptera, Sciomyzidae, *Pherbellia inflexa,* predation, *Zonitoides arboreus,* Gastropoda, Zonitidae, land snails

Larvae of Sciomyzidae (Diptera), frequently called snail-killing flies, have been intensively studied since the early 1950s when C. O. Berg (1953) reported that the larvae of several species attack a variety of aquatic and terrestrial snails. Although most of the 200 North American species are associated with aquatic and semi-aquatic snails (Knutson and Berg 1978, Knutson and Vala in press), a handful of species are known to attack semi-terrestrial Succineidae, land snails, and slugs (Table 1).

The genus *Pherbellia* Robineau-Desvoidy is the largest genus of Sciomyzidae in North America, containing 43 species. All of the 29 reared species of the genus worldwide have larvae that either prey on stranded aquatic snails (13 spp.) or attack non-operculate land snails or Succineidae (see references in table 1).

Pherbellia inflexa has a broad distribution in the western United States and Canada, being recorded in mountainous areas from southern British Columbia south to northern Arizona, east to central Colorado, and west to eastern California (Fig. 1). Collection records indicate that this species occurs in coniferous forests containing fallen, rotting logs.

RESULTS

Rearings were initiated from a puparium found in a shell of the small land snail *Zonitoides arboreus* (Say) (Zonitidae) collected VII-12-1965 under the bark of a decaying log of Douglas Fir (*Pseudotsuga menziesii* (Mirb.) Franco) in a lowland coniferous forest just north of the parking lot at the University of Montana Biological Station in Flathead County, MT (47° 52' N x 114° 01' W). There was no septum in front of the puparium, and the puparium was close to the aperture of the body whorl of the snail. It was curved to fit within the body whorl. On VII-13-1965, 29 additional shells of the host snail were collected in the same habitat. Of these, 13 were alive and uninfested by fly larvae, 5 were dead but contained no puparia, another 5 were dead but each contained a puparium, and 1

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snail was alive and contained a third-instar larva that projected its posterior end into the body whorl of the snail. In total, 38% of the collected shells had been infested by *P. inflexa*.

Figure 1. Geographical distribution of *Pherbellia inflexa*.

The infested snail died on VII-14, but the larva was still in place and apparently feeding on the decaying tissues of the host. It formed a puparium in the body whorl on VII-18, and a pupa within the puparium was noted on VII-22. This gave a prepupal period of 4 days. An adult male emerged on VIII-17, giving a pupal period of 26 days. The reared male died on IX-18, having lived for some 31 days.

None of the 5 puparia collected on VII-13 had produced adults by IX-25 when they were placed in a refrigerator and stored at 7°C. The puparia were returned to room temperature III-01-1966, having been exposed to low temperatures for 156 days. Undetermined wasps of the family Ichneumonidae emerged from 3 of these puparia, but no adult flies were obtained.

Table 1. Utilization of terrestrial gastropods by larvae of Sciomyzidae in North America.

Species	Host Snail	Habitat	Relationship To Host	References
Sciomyzini				
Oidematops ferrugineus Cresson	*Stenotrema*	Deciduous forests	Parasitoid	Foote, 1977
Pherbellia albocostata (Fallén)	*Discus*	Mixed forests	Parasitoid /predator	Bratt et al., 1969
Pherbellia albovaria (Coquillett)	*Anguispira,* *Discus,* *Triodopsis,* *Zonitoides*	Deciduous forests	Parasitoid /predator	Bratt et al., 1969
Pherbellia inflexa Orth	*Zonitoides*	Coniferous forests	Parasitoid?	This paper
Pherbellia schoenherri maculata (Cresson)	*Catinella,* *Oxyloma*	Marshes	Parasitoid	Bratt et al., 1969
Pteromicra anopla Steyskal	*Oxyloma*	Prairie	Parasitoid?	Steyskal, 1954
Pteromicra perissa Steyskal Steyskal	*Pupilla*	Mixed forests	Parasitoid?	Steyskal, 1958
Pteromicra steyskali Foote	*Discus*	Shrubby marshes	Parasitoid	Foote, 1959b
Sciomyza aristalis (Coquillett)	*Succinea*	Marshes	Parasitoid	Foote, 1959a
Sciomyzia dryomyzina Zetterstedt	*Succinea*	Marshes	Parasitoid	Knutson, 1988
Tetanocerini				
Antichaeta borealis Foote	*Catinella,* *Oxyloma*	Marshes	Egg predator	Robinson and Foote, 1978
Antichaeta testacea Melander	*Oxyloma*	Marshes	Egg predator	Fisher and Orth, 1964
Euthycera arcuata (Loew)	*Mesodon,* *Stenotrema,* *Ventridens*	Deciduous forests	Parasitoid /predator	Foote and Keiper, 2004
Hoplodictya spinicornis (Loew)	*Catinella,* *Oxyloma*	Marshes	Parasitoid /predator	Neff and Berg, 1962
Limnia boscii (Robineau-Desvoidy)	*Succinea*	Vernal ponds	Parasitoid /predator	Steyskal, et al., 1978
Tetanocera clara Loew	*Pallifera,* *Philomycus*	Marshes	Parasitoid /predator	Trelka and Foote, 1970

Tetanocera kerteszi (Hendel)	*Vallonia*	Mixed forests	Unknown	Knutson, pers. comm.
Tetanocera melanostigma Steyskal	*Succinea*	Marshes	Parasitoid /predator	Foote, 1996
Tetanocera oxia Steyskal	*Catinella*	Marshes	Parasitoid /predator	Foote, 1996
Tetanocera phyllophora Melander	*Discus,* *Zonitoides*	Mixed forests	Parasitoid /predator	Personal observations
Tetanocera plebeja Loew	*Deroceras*	Marshes	Parasitoid /predator	Trelka and Foote, 1970
Tetanocera rotundicornis Loew	*Oxyloma*	Marshes	Parasitoid /predator	Berg, 1953; Foote, 1996
Tetanocera spirifera Melander	*Oxyloma*	Marshes	Parasitoid /predator	Foote, 1996
Tetanocera valida Loew	*Deroceras*	Deciduous forests marshes	Parasitoid /predator	Trelka and Foote, 1970
Trypetoptera canadensis (Macquart)	*Vallonia*	Deciduous forests marshes	Parasitoid /predator	Personal observations

DISCUSSION

Although the rearings were incomplete, it is evident that larvae of *P. inflexa* infest land snails belonging to the genus *Zonitoides.* The few data available suggest that it is an univoltine species and is either a parasitoid or a parasitoid/predator.

Knutson and Vala (2002) have recently elucidated feeding behavior within the Sciomyzidae, recognizing 15 behavioral groups. According to their scheme, *P. inflexa* probably belongs to their group 6, "Parasitoids intimately associated with terrestrial non-operculate snails," although it is not known whether the larvae complete all three instars within one individual of *Z. arboreus.* Therefore, it is possible that the larvae are better classified as being parasitoid/predators of terrestrial snails.

Compared with the numerous species of Sciomyzidae that attack aquatic snails, the number utilizing land gastropods is comparatively small. Only 27 of the 200 North American species of the family (13.5%) have been recorded as attacking terrestrial snails or slugs (Table 1). These species are nearly equally divided between the two tribes, with 11 belonging to the Sciomyzini, and 16 to the Tetanocerini.

As suggested by Berg et al. (1959), the more terrestrial species show distinct tendencies to become increasingly parasitoid in their relationship to snail prey.

Most of the species are more or less host specific, remain with their prey for an extended period of time, and kill relatively few individual snails. Most of the species are quite host specific during the first instar but become somewhat more generalized in their choice of prey in the later instars (parasitoid/predator). However, two species illustrate the trend towards a more intimate association with their prey (parasitoid). *Oidematops ferrugineus* Cresson and *Sciomyza aristalis* (Coquillett) are highly host specific, attacking only one genus of snails, remaining with their prey for several days, and usually killing only one individual snail. Both species form their puparia within the shell of the host snail. *Sciomyza aristalis* probably represents the epitome of the parasitoid trend among the more terrestrial Sciomyzidae in that it also deposits its egg directly onto the shell of the host snail (Foote, 1959). A similar story was reported by Barnes (1990) for *S. varia* (Coquillett), a species that attacks stranded or aestivating individuals of the aquatic snail *Stagnicola elodes* (Say).

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SCIENTIFIC NOTE

A GLOMERIDESMID MILLIPED IN CANADA (DIPLOPODA: GLOMERIDESMIDA)[1]

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Introduced millipeds abound in urban environments of the continental United States (US) and Canada but are uncommon in areas removed from direct human influence. Most belong to the orders Julida and Polydesmida and are of European or Asian origins, although Neotropical representatives of the orders Polyzoniida, Spirobolida, and Polydesmida have been widely introduced into Florida and the Gulf Coastal states of the southeastern US (Hoffman 1999; Shelley 2000, 2001, 2004; Shelley & Golovatch 2000; Shelley & Edwards 2001, 2002; Shelley et al. 2006). Kevan (1983) and Shelley (1988, 1990, 2002) cited 20 non-native diplopods in Canada, and with an overall fauna of 64 species/subspecies, including two native ones recently described from Vancouver Island, British Columbia (BC) (Shear 2004), introduced species comprise nearly a third, 31.3%, of the country's milliped fauna.

On 13 August 2004, a research crew from the BC Ministry of Forests studying ecosystem recovery on the north coast collected an unusual, live milliped in the upper 10 cm of soil on the eastern side of Pitt Island, BC, approximately 100 m from the shoreline at 12 m elevation; site coordinates are 53° 53' 23.8" N and 130° 8' 57.3" W. The methodology involved cutting out forest floor samples measuring 15 x 15 x 10 cm and placing them in plastic bags for hand sorting the same day; arthropods were immediately preserved in alcohol. The milliped was sent to RAC for deposit in the Royal British Columbia Museum and then to RMS for identification; though soft, depigmented, and in poor condition, it was clearly a female of the genus *Glomeridesmus* Gervais, 1844 (Glomeridesmida: Glomeridesmidae). One of the least diverse diplopod orders, the Glomeridesmida comprises only one family with two subfamilies, each with a single genus. According to Hoffman (1980, 1999), *Glomeridesmus* comprises some 23 species that inhabit both the New and Old Worlds; occurrence in the former extends from southern Mexico (Tabasco & Chiapas) and the Greater Antilles (Hispaniola [Haiti] & Puerto Rico) to Ecuador, and that in the latter includes southern India & Sri Lanka, Indonesia, and Papua New Guinea (New Ireland). The Glo-

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meridesmida belongs to the Infraclass Pentazonia of the Subclass Chilognatha (Shelley 2003) that includes two other orders, Glomerida and Sphaerotheriida, and is characterized by separate segmental sclerites, modification of the last two pairs of legs in males into "telopods," a small 2nd tergite and pygidium, and the inability to volvate (Hoffman 1982).

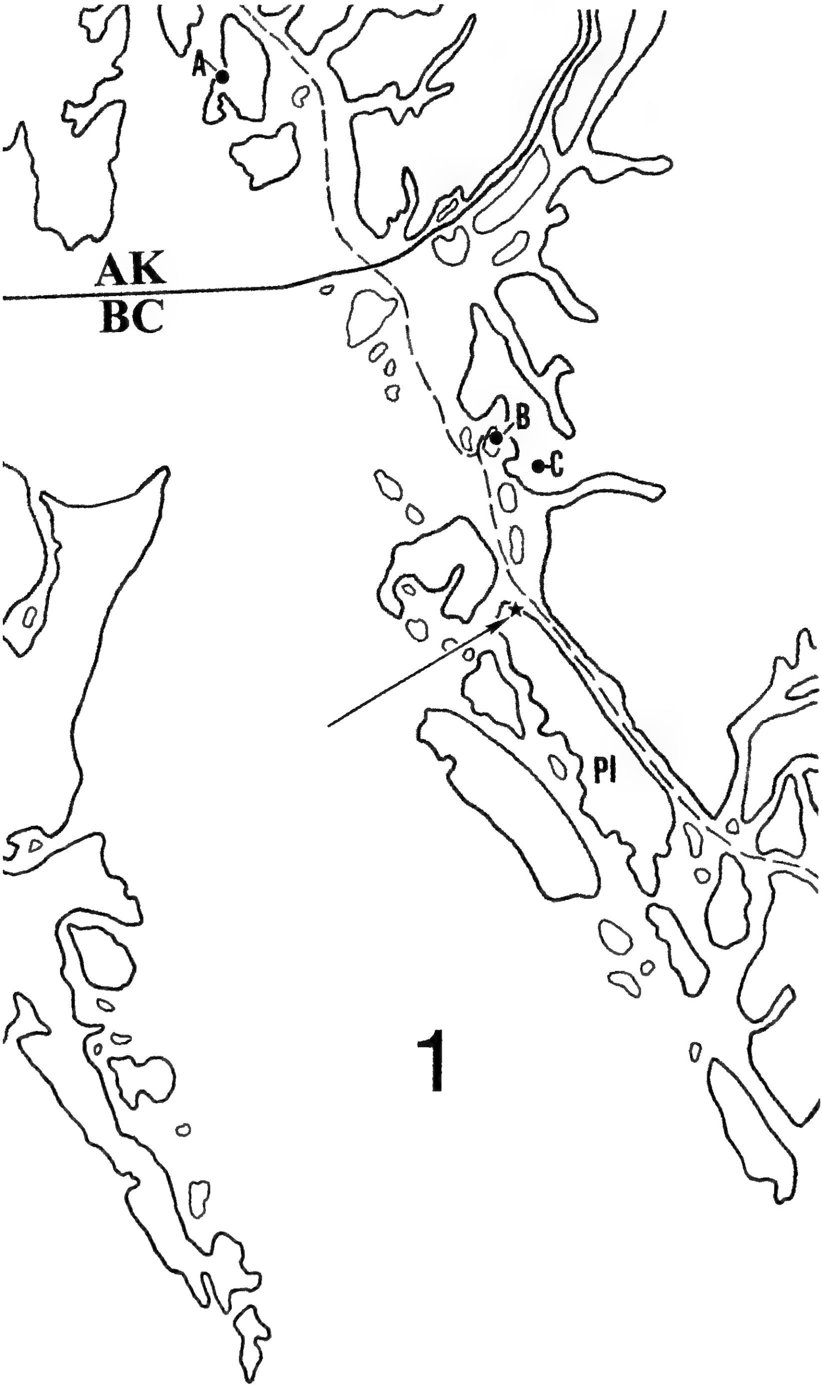

Fig. 1. Northern coastal British Columbia (BC) and Alaska (AK). The glomeridesmid collection site on Pitt Island (PI) is shown by the star (indicated by the arrow), and the dashed line marks the Inside Passage. Municipalities, denoted by dots, are as follows: A, Metlakatla, AK; B, Prince Rupert, BC; C, Port Edward, BC.

Pitt Island, located some 47 km (29.4 mi) SSW Prince Rupert along the western side of the "Inside Passage" where BC and Alaska Marine Highway ferries pass, is some 90 km (56.3 mi) long and 22 km (13.8 mi) wide; the total area is 1,361 sq. km (525 sq. mi). It is uninhabited, and the collection area has not experienced regular human activity since it was logged in 1940-1941. At that time, the loggers were stationed on an offshore float camp, and while False Stewart Anchorage on the northeastern end of Pitt Island is occasionally used as a temporary harbor by sport fishermen, it is unlikely that they would go ashore. The climate is mild with little snow, being foggy and rainy throughout the year, and the collection site is located in the wet Hypermaritime Subzone of the Coastal Western Hemlock Zone (Banner et al. 1993). The dense second growth forest canopy at this site is dominated by Sitka spruce (*Picea sitchensis*) and Western hemlock (*Tsuga heterophylla*). The moist Orthic Ferrohumic Podzol soil supports diverse but poorly developed shrub and herb layers comprised mainly of Alaskan blueberry (*Vaccinium alaskaense*), red huckleberry (*V. parvifolium*), false azalea (*Menziesia ferruginea*), spiny wood fern (*Dryopteris expansa*), deer fern (*Blechnum spicant*), and false lily-of-the-valley (*Maianthemum dilatatum*). The moss layer is well-developed (15-20 cm deep) and is dominated by lanky moss (*Rhytidiadelphus loreus*), step moss (*Hylocomium splendens*), Oregon beaked-moss (*Eurhynchium oreganum*), and common green sphagnum (*Sphagnum girgensohnii*). This environment, while moist, is significantly cooler (mean annual temperature approximately 7°C) and possesses considerably different vegetation from those in the aforementioned tropical areas where glomeridesmids occur. Fifteen sites were investigated on Pitt Island over two years but only this one glomeridesmid was found, so there is no evidence of an established population.

In groping for an explanation for this extreme geographical anomaly we have considered a variety of scenarios for both native occurrence and introduction by human agency, and all appear equally implausible; consequently, we cannot offer a hypothesis at this time. It is difficult to grasp how a relictual population of a tropical milliped order, foreign even to the southern US, could be indigenous to an island in so different a climatic zone as northern coastal BC, some 5,760 km (3,600 mi) northwest of the closest locality in Mexico. However, as Pitt Island has never been inhabited by modern man, human impact has been minimal other than when it was logged over 60 years ago, so occurrence as a human introduction seems unlikely. We therefore only publicize the discovery for the benefit of future workers and note that if the occurrence results from human agency, it will constitute the 21st exogenous Canadian milliped and the first introduction anywhere of a glomeridesmidan. To our knowledge it will also be only the second of the infraclass Pentazonia, the other being the Indian/Sri Lankan sphaerotheriidan, *Arthrosphaera* cf. *brandti* (Humbert, 1865) in Tanzania (Enghoff 1977).

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SCIENTIFIC NOTE

SEASONAL STATUS AND SURVIVAL OF *CALOSOMA SAYI* (COLEOPTERA: CARABIDAE) IN SOUTH GEORGIA, U.S.A.[1]

Orrey P. Young[2]

During 1980-1983, considerable research in south Georgia, U.S.A. was conducted on *Calosoma sayi* DeJean (Coleoptera: Carabidae), investigating the potential of the species for use in an augmentative and conservation biocontrol program against insect pests of row crops (e.g., Young 1985, Young and Hamm 1986). Among the issues not addressed in those reports was the possibility that the species could produce more than one generation in a year and could live as an adult for more than one year, factors that certainly would increase its biocontrol potential. The possibility of multiple generations had been suggested by Price and Shepard in South Carolina (1978), who reported *C. sayi* adult populations, composed of young and old individuals, occurring in crops to mid-October. Burgess and Collins (1917) studied in the lab six species that occur in Georgia, including *C. sayi*. All had egg, larval, and pupal stages in early-mid summer, with adult emergence in July and August and subsequent hibernation in August and September. Some individual beetles, under their laboratory conditions, were able as adults to live more than one year, though not *C. sayi*. They did not demonstrate for any of the six species a second generation of adults produced in late summer from adults eclosed in early summer. It should be noted, however, that most of their studies were conducted in outdoor insectaries in northeastern Massachusetts, which may have affected late season activity of southern species.

In the entire state of Georgia, *Calosoma sayi* adults have been captured from March to November (Fattig 1949). At the south Georgia light trap where the *C. sayi* adults used in this and the previously cited experiments were captured, over a three-year period initial captures of the season occurred the first week of May and the final captures of the season occurred the first week of October. Those beetles captured in the period of early May-late June were dull colored and somewhat worn on the leading edges of the clypeus and fore-tibia. Beetles obtained in July and August were a mix of shiny and unworn, and dull and greatly worn individuals. By late September, virtually all individuals were either unworn or slightly worn. The 'shiny and unworn' individuals represent the presumptive recently eclosed adults, and were either teneral (= soft exoskeleton) or at least in 'prime' condition, e.g., body surfaces fresh and anterior edges of the clypeus and fore-tibia sharp and well-defined. The 'slightly worn' and 'dull and

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greatly worn' represent presumptive older individuals. This pattern of body condition suggests that the group of beetles obtained in the spring was composed of those individuals that had become adults the previous mid to late summer and then hibernated. As those beetles became active in the spring and aged, they exhibited more wear and eventually died before late September. Freshly eclosed individuals, either teneral or unworn, only occurred in July and August, and were the only beetles alive and showing slight wear in October just prior to their hibernation.

The above sequence of aged individuals in a light trap suggests only one generation of *C. sayi* is produced each year and that adults live only one season. Conceptually, there are three life history patterns that may occur in the sampled south Georgia populations, based on the demonstration by Burgess and Collins (1917) that not one of the 38 *Calosoma* species studied was observed to overwinter in any stage other than as an adult: (1) adults produced in July-August overwinter, reproduce the following spring, feed throughout the summer, overwinter, and reproduce again the following spring, with the same beetle possibly continuing into subsequent years, (2) adults produced in July-August overwinter, reproduce in spring, and die before winter, (3) adults that have overwintered reproduce in early spring and either die or overwinter, their progeny become adults in mid-summer and overwinter, with their progeny becoming adults before fall and overwinter. Patterns no. 1 and no. 2 were demonstrated for many species by Burgess and Collins (1917), but not pattern no. 3. One reason for the absence of two generation of adults produced in the same year is probably due to the developmental time requirements of the earlier life stages. As an example, *Calosoma calidum* (Fab.), which occurs in Georgia and is about the same size as *C. sayi,* required on average 45 days to pass through the egg, larva, prepupa, and pupa stages, with adults feeding for a month or so before hibernation (Burgess and Collins 1917, Gidaspow 1959). If adults emerged from hibernation as early as 1 May, it would be about 1 July before their progeny would be present for reproduction and sometime after 1 September before the second generation of adults would emerge. That second generation of adults would have much difficulty obtaining sufficient food to acquire fat reserves, while surviving the lowering fall temperatures, prior to entering a hibernation period that would be successful.

To consider in the laboratory the life history pattern of *C. sayi,* a technique was employed that examined life span differences between presumptively different generation populations. If life history pattern no. 2 is characteristic of *C. sayi,* adult populations in mid June should be overwintered individuals that are reproductively active and which will become senescent and die before hibernation in the fall can occur. Adult populations in late August should include recently eclosed individuals preparing for hibernation and perhaps some senescent individuals remaining from the spring population. One way to document differences between the June and August populations, besides the physical condition of individuals, is to determine the survival periods of each population. If members of each group are offered food ad libitum, any differences in survival between the groups could be related to their likelihood of surviving under normal circumstances to the following spring-summer reproductive period.

Adult individuals of *C. sayi* were obtained on 19 June and 28 August from a walk-in black-light trap surrounded by row crops located 6 km NW of Tifton, Tift Co., Georgia. Beetles were brought into the laboratory and maintained in individual containers under conditions as previously described (Young 1985, Young and Hamm 1986). For each group (19 Jun and 28 Aug collections), 8 beetles were maintained without food and 16 beetles were offered food, for a total of 24 containers per group. Beetles were examined on Monday, Wednesday, and Friday of each week. On each occasion the condition of the beetle and its food was noted, water mist was added, and food if required was placed in the container. The offered food consisted of three live larvae (5th-6th instar, 25-30 mm) of the fall armyworm (FAW), *Spodoptera frugiperda* (J. E. Smith) (Lepidoptera: Noctuidae). For statistical purposes, when a beetle was determined to be dead at one of the feeding occasions, it was considered to have died that day. Comparison of the means of the two groups was accomplished by use of the Student's t-test.

In the 19 June group without food, beetles survived on average 29 days (range 15-44) with the mean end day of 7 July. Members of the 28 August group without food survived on average 31 days (R = 19-47) with the mean end day of 28 September. In the 19 July group with food, beetles survived on average 78 days (R = 13-94) with the mean end day of 4 September. Members of the 28 August group with food survived on average 118 days (R = 76-133) with the mean end day of 25 December. Within each date group (Table 1), the mean no. of days surviving of the two feeding sets (food vs. no food) were both significantly different (Student's t-test, $P < 0.05$), and confirms that the food offered and consumed did extend the life of the beetles as compared to the absence of food. The values for the mean no. of days surviving with food for each date group were also significantly different (Student's t-test, $P < 0.05$).

Table 1 – Comparison of the survival of two groups of adult *Calosoma sayi* either offered or deprived of food.

Date	Treatment	No. beetles	Range (days)	Mean no. days	Mean end day
19 June	No Food	8	15-44	29	7 Jul
19 June	FAW Larvae	16	13-94	76	4 Sep
28 August	No Food	8	19-47	31	28 Sep
28 August	FAW Larvae	16	76-133	118	25 Dec

This experiment demonstrated that the 19 Jun group was a previously overwintered population that most likely could not have survived to overwinter again. The 25 August group, with its much longer survival period, would most likely have overwintered if it had been allowed to burrow into soil and been faced with a decreasing food supply and declining temperatures, conditions that the experiment did not provide. Although Burgess and Collins (1917) note than in general, newly eclosed (teneral) adult *Calosoma* spp. had shorter starvation periods than those newly emerged from hibernation, the close similarity in starvation survival between the two date groups does not agree with that observation. The entire 19 June group was probably not recently emerged from hibernation, some individuals possibly appearing up to 6 weeks previously. The 28 Aug group probably contained some adults that had emerged recently and some that may have emerged up to 8 weeks previously. Research with other carabid species has also demonstrated similar survival times of individual adults captured at different times of the year (Kabacik-Wasylik and Stejgwillo-Laudanska 1971). The sum of this laboratory experiment and the associated field observations provide no evidence that adult *C. sayi* can live more than one year, and no evidence that two generations can be produced in a single season.

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SCIENTIFIC NOTE

NEW OBSERVATIONS OF HOST PLANT USAGE BY *CLEMATODES LARREAE* (ORTHOPTERA: ACRIDIDAE: COPIOCERINAE), INCLUDING A NEW HOST PLANT IN TEXAS, U.S.A.[1]

Thomas Stidham[2] and John Stidham[3]

Clematodes larreae Scudder is a small flightless gray grasshopper that occurs in the western part of Texas, southern New Mexico, and adjacent Mexico (Rehn and Eades 1961). The type material was collected on *Larrea* (creosote bush), and the grasshopper's specific epithet is in reference to that host plant (Scudder 1900). *Clematodes larreae* is predominantly found on *Larrea* (Rehn and Eades 1961, Tinkham 1948), but it also has been recorded on low grasses (Poaceae), *Koeberlinia spinosa* (Koeberliniaceae, crucifixion thorn), *Fallugia paradoxa* (apache plume, Rosaceae), *Macrorhamnus (Colubrina) ericoides* (Rhamnaceae, snakewood), and *Acacia* spp. (Fabaceae) (Rehn and Eades 1961).

On 25 June 1983 and 30 June 2005, we collected specimens and observed other *C. larreae* on *Prosopsis glandulosa* (Fabaceae, honey mesquite) in Trans-Pecos Texas. These specimens will be placed in the Texas A & M University Insect Collection (Department of Entomology, Texas A&M University). The occurrence of *C. larreae* on mesquite previously has not been reported. We collected one male and three female specimens in 1983 approximately 40 miles east of El Paso on Interstate 10, El Paso County, Texas, and three males and three females in 2005 west of Fort Hancock on Interstate 10, Hudspeth County. At both locations, the soil is light-colored sand, and the vegetation is composed of a mixture mostly of mesquite and creosote. At the Ft. Hancock locality, individuals were observed on both mesquite and creosote. During the time we were at the Ft. Hancock locality in the mid-afternoon, it was extremely hot (over 43°C) and we observed that insects died within seconds if they came into contact with the sandy surface of the ground. The *Clematodes* individuals that occurred on mesquite were easily located. They appeared to occupy the highest, visually exposed positions on the center tallest branches of individual mesquite trees (sometimes over two meters tall) in a cluster of three or more mesquite trees. We believe that this position was taken in order to keep away from the extremely hot ground surface. In 1983, we only encountered *Clematodes* by beating low vegetated branches of mesquite where the specimens were always well hidden. The temperature was not as extreme at that time.

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The occurrence of *Clematodes* on *Larrea* at the Ft. Hancock locality appears to have paralleled that of the creosote grasshopper [*Bootettix argentatus* (Bruner)]. Every creosote bush or cluster of bushes that was occupied by creosote grasshoppers (over 37 observations) also contained at least one individual of *Clematodes*. There was perfect correspondence between their co-occurrence on seven bushes. We examined over thirty other creosote bushes with neither grasshopper species. These are limited data, but we believe that it adds to the discussion about the use of individual bushes of *Larrea* by *Clematodes* and *Bootettix*, since both species may be selecting individual plants using the same or similar criteria.

A variety of hypotheses have been erected to explain the distribution of *Bootettix argentatus* on creosote (Otte and Joern 1975), but those hypotheses do not appear to explain all distribution data (Garcia 1996). The co-occurrence of these two species of grasshopper on particular creosote bushes may be a reflection of a common choice by both species for some currently unknown factor such as leaf chemical abundance or composition (Chapman 1988). Additional observations are necessary before that hypothesis can be tested.

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SCIENTIFIC NOTE

NEW ADDITIONS TO THE CADDISFLY FAUNA (TRICHOPTERA) OF TENNESSEE AND VIRGINIA, U.S.A.[1]

John K. Moulton[2]

Ultraviolet light trap collections by the author in eastern Tennessee and portions of western Virginia during the summer and autumn of 2005 and 2006 yielded adults of two caddisflies, *Polycentropus carlsoni* Morse and *Lepidostoma sackeni* (Banks), not previously reported from Tennessee and two species, *Lepidostoma serratum* Flint and Wiggins and *L. sommermanae* Ross, not previously reported from Virginia. The caddisfly fauna of Tennessee, with approximately 400 known species, is among the most intensely studied in the United States (Etnier and Schuster 1979; Etnier et al., 1998). Parker and Voshell (1981) provided a preliminary checklist of the Trichoptera of Virginia that included a total of 239 species and 101 new state records.

Polycentropus carlsoni was collected on June 18, 2005 (1 male, 1 female), and October 9, 2005 (1 male), from Fowler Spring Branch, a small, coldwater, cobble-bottomed, first-order tributary to Beaver Creek in northern Knox County, Tennessee (Bell Campground Rd., 0.3 km N of jct. with W. Brushy Valley Dr., 36° 02.958 N, 84° 04.146 W). Fowler Spring Branch is the type locality of another caddisfly species with a rather restricted range, *Neophylax etnieri* Vineyard and Wiggins. *Polycentropus carlsoni* was previously known only from small springs along the western slope of the Appalachian Mountains from North Carolina (Etnier et al., 1998), South Carolina (Morse 1971, Hoffman and Morse 1990), and Alabama (Harris et al., 1991). Therefore, the Tennessee record reported herein is the first for *P. carlsoni* from a locality west of the Appalachian backbone. Based upon prior reports, adults of this species can be taken from April or May through October. Most specimens have been taken in Malaise traps, and collections generally are comprised of fewer than five individuals.

Several adults of *Lepidostoma sackeni,* one of the most easily recognized species in this speciose genus (at least the adult male), were taken on September 5, 2005, from a bog habitat alongside Newfound Gap Road (US 441) in the Great Smoky Mountains National Park, Tennessee (1.5 km S of parking lot for Alum Cave Bluff Trail, 35° 37.300 N, 83°26.318 W). This record brings the total number of *Lepidostoma* species known or thought to inhabit Tennessee to 21 (Flint and Wiggins 1961; Etnier et al., 1998; Weaver 1988). The previous most southerly record for *L. sackeni* was central West Virginia (Tarter and Hill 1979). I predict *L. sackeni* will eventually be found in the intervening regions of North Carolina and Virginia once suitable bog habitats are identified and sampled during the appropriate time, late summer to early fall.

Three males and an undetermined number of females of *Lepidostoma serratum* were collected from a small rivulet on a heavily wooded and sloped tract of privately held land in southcentral Grayson County, Virginia (36° 37.095 N, 81 02.448 W), on September 15, 2005. Several adults of three additional species in the genus, *L. sommermanae, L. tibiale,* and *L. togatum,* were also present in the sample. This is the first

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published report of *L. serratum* from Virginia, although C. R. Parker (personal communication) has a single record of it from Patrick County. The discovery of this rare, but widely distributed species is not unexpected for Virginia. Previously, it has been reported from Connecticut (Nelson 1987, Weaver 1988) and PA (Masteller and Flint 1992) to the north and LA (Weaver 1988), NC (Flint and Wiggins 1961, Weaver 1988, Morse et al., 1989), and SC (Morse et al., 1989) to the south. *Lepidostoma sommermanae* was also not included in the Virginia checklist by Parker and Voshell (1981), although C. R. Parker has subsequently collected it along the Blue Ridge Mountains of Virginia (C. R. Parker, personal communication). *Lepidostoma sommermanae* is known from eastern Canada and the northeastern United States and down the Appalachians into western North Carolina (Weaver 1988).

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SCIENTIFIC NOTE

RANGE EXTENSION OF THE ARMY ANT *ECITON MEXICANUM* ROGER (FORMICIDAE: ECITONINI) IN THE PANTANAL SURROUND PLATEAU, BRAZIL[1]

Fernando J. Zara[2] and Harold G. Fowler[3]

The army ant *Eciton mexicanum* is represented by six subspecies identifiable through male or queen morphology (for review see Borgmeier, 1955; Rettenmeyer, 1963). In Brazil, *E. mexicanum* has been reported as far south as Goiania, Goias state (referred as Campinas by Schwarzmaier in 1935, an old name of Goiania city), Ribeirão Preto, São Paulo and Pirapóra, Minas Gerais (Borgmeier, 1955) (Fig 1). Additional occurrences, without locality and subspecies register, are recorded from the states of Rondônia, Amazônas, Pará, Pernambuco and Bahia (Borgmeier, 1955; Kempf, 1972, Watkins, 1976).

Figure 1. Distribution map depicts the new (star) and previous (black target) registers for *E. mexicanum* in Brazil.

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On April 23, 2005, one colony of *E. mexicanum* was found in a house in the center of Aquidauana, Mato Grosso do Sul, situated at the border of the Pantanal floodplain (20°28'16"S, 55°47'14"W). Raiding columns emerged from a residential basement attacking subterranean ant nests, similar to records of Rettenmeyer (1963). The occurrence of any species of *Eciton* foraging in an urban center has never been reported and this may be related to *E. mexicanum*'s primarily hypogaetic habits (Borgmeier 1995, Rettenmeyer 1963, Gotwald 1995), immediately parallel to the Aquidauana River. Rettenmeyer (1963) classified *E. mexicanum* as the most subterranean and nocturnal of the five *Eciton* species in his study at Barro Colorado Island, where he observed only one diurnal raid on a rainy day, contrasting to our observation.

The present record extends the known Brazilian range of *E. mexicanum* 810km southwest from Goiania, 835km northwest from Ribeirão Preto and 1200km west from Pirapora and suggests that this species may be present in the Bolivian Pantanal. Worker voucher specimens are deposited in collections of H. G. Fowler and the myrmecological collection of the Biology Departments of UNESP-Rio Claro and São Vicente.

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SCIENTIFIC NOTE

OCCURRENCES OF THE MILLIPED, *CHONDROMORPHA XANTHOTRICHA* (ATTEMS, 1898), IN THE NEW WORLD: FIRST RECORDS FROM MEXICO, COSTA RICA, PANAMA, THE CAYMAN ISLANDS, SAINT VINCENT AND THE GRENADINES, AND TOBAGO; FIRST LOCALITIES IN CUBA (POLYDESMIDA: PARADOXOSOMATIDAE)[1]

Rowland M. Shelley[2] and Fabio G. Cupul-Magaña[3]

In the Western Hemisphere, a diverse indigenous fauna of the milliped family Paradoxosomatidae occupies South America and ranges northward to Costa Rica and Dominica (Pocock 1888, 1894; Hoffman 1960, 1977, 1980a, 1999; Loomis 1968). However, the only paradoxosomatids in North America, the lone populated continent without native taxa, are four introduced species from Asia and one from Australia: *Oxidus gracilis* (C. L. Koch, 1847), which is widespread in urban environments in both the United States and Canada and frequently undergoes population explosions; *Asiomorpha coarctata* (Saussure, 1860), in Florida, Louisiana, and Texas; *Akamptogonus novarae* (Humbert and Saussure, 1869), the lone Australian paradoxosomatid, in California; *Chondromorpha xanthotricha* (Attems, 1898), in Texas; and *Helicorthomorpha holstii* (Pocock, 1895), in Florida (Causey 1943; Weems and Loomis 1974; Hoffman 1980b; Kevan 1983; Shelley 1988, 1990, 2000, 2001, 2002a, b; Shelley and Edwards 2002; Shelley et al., 1998). The first two species and *C. xanthotricha* occur in Central America and on Caribbean Islands, and are sympatric with the indigenous fauna from Costa Rica and Dominica southward. New World occurrences of *O. gracilis* and *A. coarctata* are supported by numerous samples and published records, but comparatively few of either exist for *C. xanthotricha,* a more recent importation. The earliest reported collection, 1938 from Paramaribo, Surinam (Jeekel 1963), is supplanted by the 1931 sample from Trinidad (detailed below); consequently, the original importation appears to have been in the late 1920-1930s in the area of Trinidad and the northern South American coast. The milliped has been introduced as far north as southern Texas, USA (Shelley 2000), as far south as Ecuador, the first South American record outside of Surinam (see below), and is known from all islands in the Greater Antilles.

Chondromorpha xanthotricha is readily distinguished from other exogenous paradoxosomatids by the granular, papilose, and setose dorsum and the configuration of the gonopods; anatomical diagnoses and illustrations are available in Attems (1898: 139, pl. 5, fig. 115 as *Prionopeltis xanthotrichus*; and 1937:110-112, figs. 145-148 as

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C. granosa and *C. xanthotricha*), Loomis (1948:187-188, figs. 3-6 as *Xaymacia granulata*), and Shelley and Lehtinen (1998:88, figs. 10-12). The first report of *C. xanthotricha* in the Western Hemisphere was by Chamberlin (1941), who cited it as *Dasomus bicolor* Chamberlin, 1941, from Jamaica in general based on eight specimens that were intercepted in quarantine in Washington, DC, USA. Seven years later, Loomis (1948) reported it from five localities in Jamaica under another synonym, *Xaymacia granulata* Loomis, 1948. Subsequently, the milliped has been recorded from Surinam (Jeekel 1963), two additional sites in Jamaica as *C. kelaarti* (Humbert, 1865) (Loomis 1975), Guadeloupe and Marie-Galante (Mauriès 1980), Puerto Rico (Santiago-Blay and Velez 1985), Cuba in general (Gonzalez Oliver and Golovatch 1990), and Haiti and Trinidad Shelley (2000).

We list below records from six new countries and three new Caribbean islands, along with the first localities in Cuba, unreported Jamaican sites, and details of the general records from Haiti and Trinidad. Repository acronyms are BMNH, The Natural History Museum, London, United Kingdom (UK); CAS, California Academy of Sciences, San Francisco, USA; CZUG, Colección Entomológica del Centro de Estudios en Zoología de la Universidad de Guadalajara, Zapopan, Jalisco, Mexico; FSCA, Florida State Collection of Arthropods, Gainesville, USA; NCSM, North Carolina State Museum of Natural Sciences, Raleigh, USA; and ROM, Royal Ontario Museum, Toronto, Canada.

Occurrences

Mexico: *Jalisco,* Puerto Vallarta, 20°39'28.5" N, 105°13'6.5" W, 48 m elev., 11 March 2006, F. G. Cupul-Magaña (CZUG). **New Country Record.**

Costa Rica: *Puntarenas Prov.,* Julieta, Finca La Ligea, 28 November 1964, K. A. Arnold (FSCA); and Coto District, 25 July 1981, G. B. Edwards (FSCA). **New Country Record.**

Panama: *Colon Prov.,* Colon, Cia. Agricola Amsterdam, 19 April 1975, G. H. Gwin (FSCA). *Herrera Prov.,* Divisa, 14 October 1957, Lancaster (FSCA). **New Country Record.**

Ecuador: Guayaquil, 20 March 1966, R. O. Albert (FSCA). **New Country Record.**

Cuba: *Ciudad de la Habana,* Marianao, Country Club, 19 March 1949, M. L. Jaume (FSCA); and Littoral de W Gariano, 29 July 1951, M. L. Jaume (FSCA). *Guantánamo Prov.*, Loma en el km 6 de la Carretera de Hoya Colorado, Ciudad Baracoa, Haboma, 26 September 1951, M. L. Jaume (FSCA). *Pinar del Rio Prov.,* San Vicente, 13 August 1959, R. E. Woodruff (FSCA); 2 km del Puebla de Artemisa, 27 May 1950, M. L. Jaume (FSCA); and Cayajabos, 2 October 1951, M. L. Jaume (FSCA). **First Specific Localities.**

Haiti: Martissant, 1 August 1958, S. Lazell (FSCA, NCSM).

Puerto Rico: Mayaguez, 26 May 1981, D. Richman (FSCA).

Jamaica: *Portland Parish,* Nonsuch Cave, November 1973, R. Norton (FSCA). *St. Andrew Parish,* locality unknown, 31 August 1952, W. J. Baerg (FSCA); Buff Bay, 26 December 1970, D. Bennett (FSCA); and nr. Kingston, Costa Mente Hotel, 30 December 1970, D. Bennett (FSCA). *St. Ann Parish,* Ocho Rios, 27 December 1970, D. Bennett (FSCA); and Runaway Cave, 27 March 1973, R. Norton, R. Zimmerman (FSCA). *St. Catharine Parish,* St. Claire Cove, 27 December 1972, S. and J. Peck

(FSCA). *St. Elizabeth Parish,* municipality unknown, Bamboo Ave., 5 August, year unknown, E. S. Ross (CAS). *St. Thomas Parish,* Morant Bay, 59.2 km (37 mi) E Kingston, 1 May 1971, W. Baker (ROM).

Cayman Islands (UK): *Grand Cayman,* 3.2 km (2 mi.) NE George Town, 6 March and 29 April 1970, D. W. Buden (FSCA); and Old Man Bay, 26 February 1970 (FSCA). **New Territory and Island Record.**

St. Vincent and the Grenadines: *Mustique,* 6 August 2005, M. de Silva (digital photo sent to RMS). **New Country and Island Record.**

Trinidad and Tobago: *Tobago,* Bloody Bay, 7 July 1999, R. M. Shelley, M. Judson (NCSM); L'Anse Fourmi and Speyside, 8-9 July 1999, R. M. Shelley (NCSM) **New Island Record.** *Trinidad,* St. Augustine, 5 November 1931, D. Vesey-Fitzgerald (BMNH); and St. Georges County, Arima Valley, Simla, 27 June - 3 July 1978, C. B. and H. V. Weems (FSCA).

In the Grenadines, *C. xanthotricha* occurs under stones and leaf litter throughout Mustique, where it is the most common small milliped; however, it has not been found to the south on Mayreau, the only other island examined to date. Mustique receives substantial imports like plants from St. Vincent and Barbados and construction sand from Guyana, so a sizeable population of an introduced milliped is not surprising (M. de Silva, pers. comm. to RMS). In Puerto Vallarta, Mexico, *C. xanthotricha* is common outdoors in the rainy season (June-October) but is found only under stones in the dry months (November-May). Mating was observed in March.

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DETECTION AND IDENTIFICATION OF *LEISHMANIA* kDNA IN *LUTZOMYIA OLMECA OLMECA* AND *LUTZOMYIA CRUCIATA* (DIPTERA: PSYCHODIDAE) BY POLYMERASE CHAIN REACTION IN SOUTHERN MEXICO[1]

Silvia B. Canto-Lara,[2] María D. Bote-Sánchez,[2] Eduardo A. Rebollar-Téllez,[2] and Fernando J. Andrade-Narváez[2]

ABSTRACT: Localized cutaneous leishmaniasis caused by *Leishmania (Leishmania) mexicana* is endemic in the Yucatán peninsula, Mexico. *Lutzomyia olmeca olmeca* and *Lutzomyia cruciata* have been found infected by flagellates. This represents the first report on the detection and identification of *Leishmania* to the genus and subgenus levels in both sand fly species using the polymerase chain reaction.

KEY WORDS: *Leishmania (Leishmania) mexicana, Lutzomyia olmeca olmeca, Lutzomyia cruciata,* identification, PCR

Localized cutaneous leishmaniasis (LCL) was first described in southern Mexico by Seidelin (1912). Since then, the sylvatic area of the Yucatán peninsula has been recognized as an endemic focus of LCL. *Leishmania (Leishmania) mexicana* (Biagi 1953, emended Garham 1962) has been identified as the predominant causative agent in humans and wild rodents (Perez-Mutúl et al., 1994; Chablé-Santos et al., 1995; Canto-Lara et al, 1998; Canto-Lara et al., 1999). The sand fly *Lutzomya olmeca olmeca* (Vargas and Diaz Nájera 1953) has been incriminated as a *Leishmania* vector (Biagi et al., 1965), but the species of *Leishmania* present in this region are unknown. However, recent evidence suggested that *L. cruciata* (Coquillet) may play an important role in *Leishmania* transmission in the adjacent state of Campeche (Rebollar-Téllez et al., 1996a). Female *L. cruciata* are highly anthropophilic and are by far the most abundant man-biting species caught in the states of Campeche (Rebollar-Téllez et al., 1996 b and c), Quintana Roo (Cruz-Ruiz et al., 1994) and Yucatán (Rebollar-Téllez and Manrique-Saide 2001). This is the first report regarding the detection and identification to the genus and subgenus levels of *Leishmania* in both *L. o. olmeca* and *L. cruciata* collected in the Yucatán Peninsula of Mexico using a polymerase chain reaction (PCR) method to amplify the parasite's kDNA.

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METHODS

Study Sites: Site selection was based on epidemiological studies carried out between 1988 and 2000 in collaboration with health authorities from these three states of the Yucatán peninsula. Collections were performed at the following sites: La Libertad, Escarcega, Campeche (N 18° 31.60', O 90° 27.89'); La Guadalupe, Calakmul, Campeche (N 17° 20.25', O 89° 28.49'); Dos Naciones, Calakmul, Campeche (N 17° 58.40', O 89° 20.74'); La Virgencita, Calakmul, Campeche (N 18° 14.53' O 89° 19.65'); Santa Isabel, Carrillo Puerto, Quintana Roo (N19° 28.20', O 88° 06.87'); Becanchen, Tekax, Yucatán (N 19° 52.31', O 89° 12.618'). Collections were carried out during the transmission season (Andrade-Narváez et al., 2003), from November to March 2001-2002 and November to February 2002-2003 using Shannon and Disney traps between 18.00-22.00 h and 18.00-07.00 h, respectively.

Once identified using a sand fly key (Biagi 1966), the insects were stored in 80% ethanol in groups of 15-20 specimens per vial (2001-2002 collections), or groups of 5-10 specimens per vial (2002-2003 collections). DNA was extracted as described by Aransay et al. (2000). Briefly, sand fly bodies were homogenized and DNA was extracted using 100μl of extraction buffer, and samples were incubated at 65°C for 30 min. Following the addition of 14.0 μl 8 M potassium acetate (pH 7.2) the homogenates were incubated on ice for 30 min and then centrifuged at 13000 rpm for 10 min. Supernatants were recovered and DNA was precipitated with the addition of 200 μml of 100% ethanol. DNA pellets were resuspended in 20 ml of Tris-EDTA buffer.

Primers specific for *Leishmania* genus, namely 13 A (GTGGGGGAGGGGCGTTCT) and 13 B (ATTTTACACCAACCCCCAGTT), B-4 (TCGTACTCCCCGACATGCCTC) for the subgenus *Viannia,* and M1.1 (CCAGTTTCGACCGCCGGAGC) for the subgenus *Leishmania* were designed within the conserved region of the kDNA minicircle by Dr. Peter C. Melby, Health Sciences Center, The University of Texas, San Antonio, Texas USA (Invitrogen).

The PCR was standardized using *L. (L.) mexicana* (MHET/MX97/Hd18) identified by monoclonal antibodies (Canto Lara et al., 1999) and *L. (V.) braziliensis* WHO reference strain (MHOM/BR/LTB300).

RESULTS AND DISCUSSION

In the states of Campeche and Quintana Roo, 290 and 295 *L. O. olmeca* specimens were captured during the first and second study seasons, respectively. However, in the state of Yucatán, just 25 and 30 *Lu. cruciata* were trapped each season (Tables 1 and 2), highlighting the differences in sand fly abundance between each microfocus.

Only two species of *Leishmania* have been reported in the Yucatán peninsula: *L. (L.) mexicana* has been predominantly identified in humans and wild rodents, whereas *L. (V) braziliensis* was present in only a few cases of LCL (Pérez-Mutúl et al., 1994; Canto-Lara et al., 1999). Therefore, the use of primers for each subgenus *(Leishmania,* M1.1 and *Viannia,* B-4) permitted indirect species identification.

Table 1. Detection of the subgenus Leishmania by PCR in wild-caught sand flies during the transmission season 2001-2002 in the Yucatán Peninsula.

Study site	**State**	**No. *Lutzomyia* No. vials**	***Lutzomyia*/ spp.**	**Pools positive %**
La Libertad	Campeche	80/4	*olmeca*	4 (100 %)
La Guadalupe	Campeche	96/5	*olmeca*	4 (80 %)
Dos Naciones	Campeche	86/5	*olmeca*	3 (75 %)
Santa. Isabel	Quintana Roo	23/2	*olmeca*	2 (100 %)
Becanchen	Yucatán	25/2	*cruciata*	1 (50 %)

Table 2. Detection of the subgenus *Leishmania* detected by PCR in wild-caught sand flies during the transmission season 2002-2003 in the Yucatán peninsula.

Study site	**State**	**No. *Lutzomyia* No. vials**	***Lutzomyia*/ spp.**	**Pools positive %**
La Libertad	Campeche	15/2	*olmeca*	0 (0 %)
La Guadalupe	Campeche	100/11	*olmeca*	3 (27 %)
Las Virgencitas	Campeche	140/14	*olmeca*	7 (50 %)
Santa. Isabel	Quintana Roo	40/4	*olmeca*	1 (25 %)
Becanchen	Yucatán	30/3	*cruciata*	0 (0 %)

In a two-year study on vectors of cutaneous leishmaniasis in the state of Campeche previously reported, five *Lutzomyia* species were found infected with flagellates believed to be *Leishmania* spp. (Rebollar-Téllez et al., 1996a). The highest prevalence of infection was observed in *L. O. olmeca* (7.1%) followed by *L. cruciata* (4.5%).

Two classical methods exist for the estimation of infection rates in vectors, microscopic analysis and isolation of parasites in culture which requires absence of bacterial and/or fungal contamination. Both are laborious and inaccurate for identification of the parasite in sand flies. The second one has been tried unsuccessfully due to contamination. The most successful method for detection and identification of *Leishmania* in naturally infected sand flies has been PCR directed to amplify kDNA (Rodriguez et al., 1999; Aransay et al., 2000; Santamaría et al., 2005).

Most studies done recently have been based on Aransay et al. (2000) method (Santamaría et al., 2005, Gomez-Saladín et al., 2005, Jorquera et al., 2005). It must be expected that there could be some differences regarding endemic area, *Leish-*

mania spp. involved, as so *Lutzomyia* studied. In all of them pools from sand flies as suggested by the methodology have been examined. In the present study pool samples varied from 15-20 (first collection) and 5-10 (second collection). This was based on a previous standardization of specificity of the PCR assay using a template genomic DNA equivalent to 10, 100 and 1000 promastigotes of *L. (L) mexicana*. The sensitivity was high enough to detect 10 *Leishmania* promastigotes.

In the present study we confirmed *L. O. olmeca* as vector of L. (L.) mexicana through detection and identification of subgenus *Leishmania* kDNA by PCR (Figure 1). For the first time the subgenus *Leishmania* was detected and identified in a pool of *L. cruciata* from the state of Yucatán. However, it should be highlighted that Becanchen, Tekax, in Yucatán has never been documented as a hyperendemic area of LCL (Albertos-Alpuche et al., 1996).

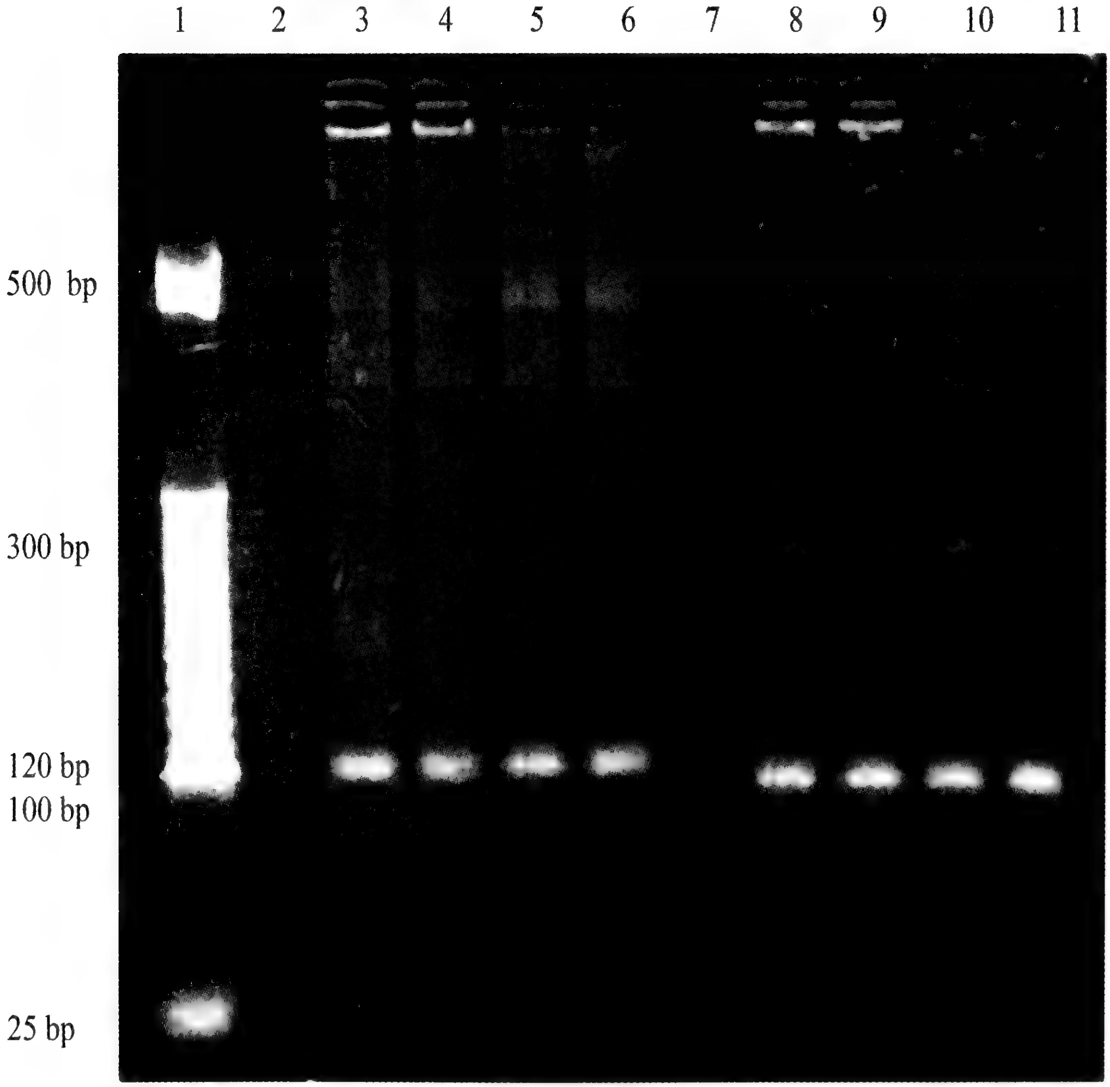

Figure 1. Detection and identification of kDNA specific for the genus and subgenus *Leishmania* in *Lu. o. olmeca* by PCR. Lanes, as follows: 1. Marker (bp), 2. Control (-), 3. Control (+) genus *Leishmania,* 4. *Lu. o. olmeca,* 5. *Lu. o. olmeca,* 6. *Lu. o. olmeca,* 7. Control (-), 8. Control (+) subgenus *Leishmania,* 9. *Lu. o. olmeca,* 10. *Lu. o. olmeca,* 11. *Lu. o. olmeca.*

The potential of *L. cruciata* as vector of *L. (L.) mexicana* should be confirmed by performing studies in the state of Campeche where *L. cruciata* population dynamics and biting rhythm of the anthropophilic sand fly *Lutzomyia cruciata* (Diptera: Psychodidae) has been documented (Rebollar-Téllez et al., 1996b). Moreover, the incidence-prevalence of LCL caused by *L. (L.) mexicana* is well established (Andrade-Narváez et al., 1990).

In summary, PCR technique employed must be improved to detect kDNA in one sand fly in order to become a very useful tool not only for monitoring the *Leishmania* infection rate in sand fly populations, but also for the rapid identification of both prevalent *Leishmania* and sand fly species in endemic areas as it has been proposed by Kato et al. (2005).

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TWO NEW SPECIES OF *PALINGONALIA* (HEMIPTERA: CICADELLIDAE: CICADELLINAE) FROM COLOMBIA[1]

Paul H. Freytag[2] and Juan M. Vargas[3]

ABSTRACT: Two new species are added to the genus *Palingonalia* Young, 1977 (Hemiptera: Cicadellidae: Cicadellinae) from Colombia, *P. subta* and *P. hypera.*

KEY WORDS: *Palingonalia,* Hemiptera, Cicadellidae, Colombia

The genus *Palingonalia* was described by Young (1977) for the single species *P. bigutta* (Signoret, 1854) from French Guiana and Brazil. This species has only been known from this Northeastern part of South America. In this paper two new species are added from Colombia. The new species have many features which are similar to *P. bigutta,* but the color patterns of both are quite different from each other and from *P. bigutta.* These two species are pictured on http://www.ciencias.unal.edu.co/galeria/detalle_dep.php?id=7&coleccionfiltered=49

The acronyms used in this paper are: IHVL = Instituto von Humboldt, Villa de Leyva, Colombia; UKYL = University of Kentucky, Department of Entomology, Insect Collection, Lexington, Kentucky, USA.

Palingonalia subta Freytag and Vargas, NEW SPECIES

(Figures 1, 3, and 5)

Description: Length of males 7.0-7.2 mm., females 7.1-7.5 mm. Similar to *bigutta,* but with a different color pattern. Generally brownish black with orange markings. Head (Fig. 1) with crown orange with pair of large black spots on anterior margin and median black rectangular area from between ocelli back to posterior margin. Face uniformly yellowish orange. Pronotum brownish black with three bands of orange, one longitudinal band on each side near lateral margin and one between these which is U-shaped.

Scutellum entirely brownish black. Forewing brownish black with three longitudinal orange bands. One short band along anterior of commisure, one from base of clavus to apex of clavus, and one from near base of corium to base of second apical cell. Ventral side of thorax and abdomen mostly yellowish orange with legs mostly orange. Female with apex of seventh sternum black. Male genitalia: Pygofer (Fig. 5) broadly rounded. Subgenital plates (Fig. 5) short, with a triangular dorsal extension on medial side. Aedeagus (Fig. 5) large, similar to *bigutta.* Connective and second phallobase as in *bigutta.* Style short, sharply hooked at apex. Female seventh sternum (Fig. 3) long, narrowing to bifurcate apex.

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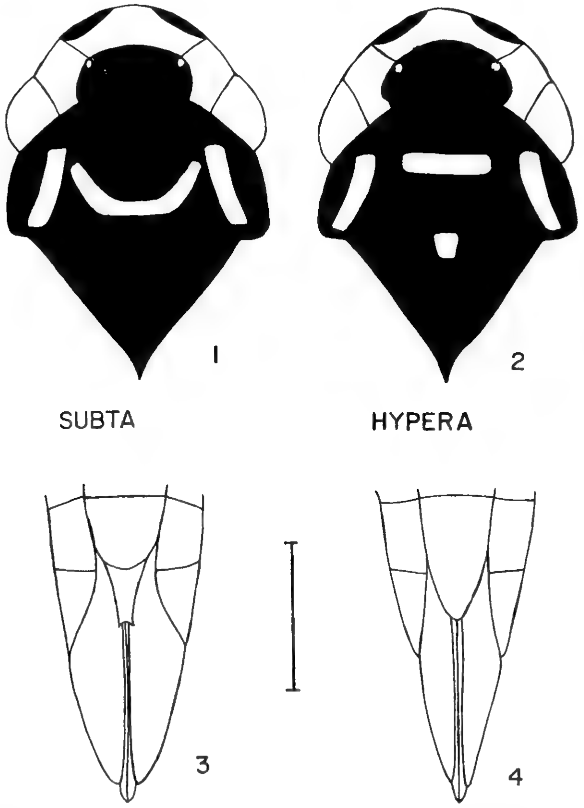
Type Data: Holotype male: Colombia: Vaupés, RN Mosiro-Itajura (Caparú) Centro Ambiental, 1°4'S 69°31'W, 60 m., Malaise, 20-I-1-II-2003, M. Sharkey and D. Arias, M 3386 (IHVL). Paratypes: two males, two females, same data as holotype (IHVL and UKYL)

Additional Specimens: Colombia: One male, Amazonas, PNN Amacayacu, Cabaña Lorenal, 3°0'S 69°59'W, 210 m., 27-VIII-2001, Red, D. Campos, M 2234 (IHVL); one female, same data, except Malaise, M 2238; one female, same data, except San Martin, 3°23'S 70°6'W, 150 m., Malaise, 2-7-VII-2000, B. Amado, M 699 (IHVL); one female, same data, except Matamata, Tierra Firme, 8-12-III-2000, Malaise, M. Sharkey; one female, same data as holotype, except FIT, M 3388 (IHVL); one male, same data as holotype, except Antigua Cabaña, 1°4'N 69°3'W, 60 m., Malaise, 27-III-3-IV-2003, J. Pinzón, M 3634 (IHVL); one male, same data, except 9-25-II-2003, M 3629: one male, same data, except 10-III-17-IV-2003, M 3613 (IHVL); one female, same data, except Igapo, 1°4'S 69°31'W, 60 m., 4-11-III-2003, M 3623; one male, same data, except 7-22-X-2002, L. Benavides, M 3395 (IHVL); one female, Caquetá, PNN Chiribiquete, Cuñare-Amu, 1°12'N 72°24'W, 300 m., Malaise, 14-17-II-2001, M. Ospina and E. González, M 1388 (IHVL).

Notes: This species is named for the more posterior median U-shaped orange marking on the pronotum.



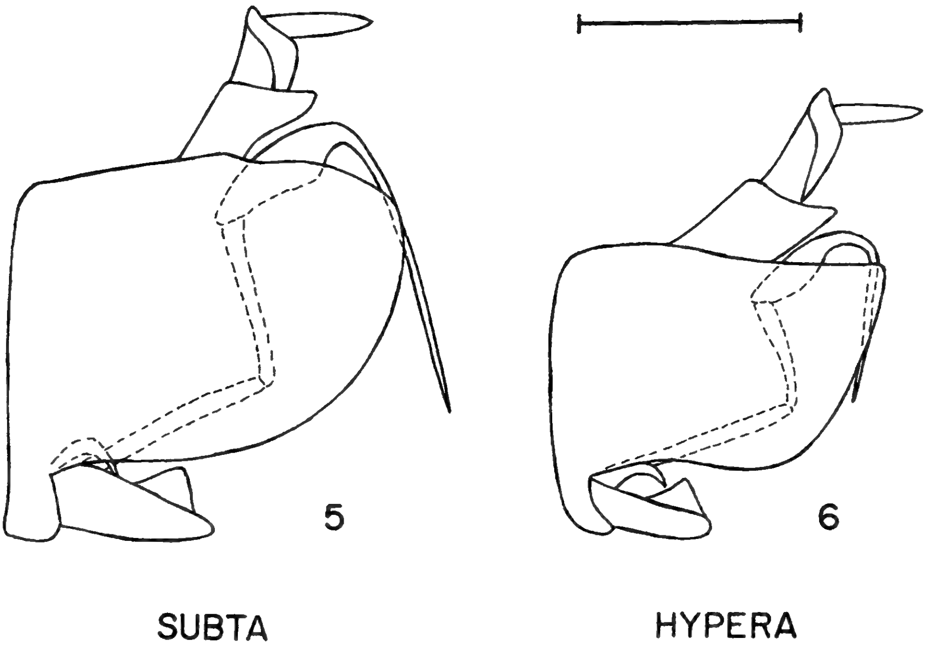
Figures 1, 3. *Palingonalia subta* n. sp. Figures 2, 4. *P. hypera* n. sp. Fig. 1-2. Dorsal view of head, pronotum and scutellum. Fig. 3-4. Female abdominal terminal segments, ventral view (setae not shown). All drawn to the same scale, which equals 1 mm.

Palingonalia hypera Freytag and Vargas, NEW SPECIES

(Figures 2, 4, and 6)

Description: Length of males 7.0-7.5 mm., females 7.3-7.5 mm. Similar to subta, but with different color pattern and genitalia. Generally brownish black with orange markings. Head (Fig. 2) with orange crown with pair of large black spots on anterior margin and large rectangular black area from between ocelli back to posterior margin. Face uniformly yellowish orange. Pronotum brownish black with three orange bands. One longitudinal band on each side near lateral margin and one horizontal band between them along median anterior margin. Scutellum brownish black with small orange median spot near posterior pronotal margin. Forewing brownish black with two longitudinal orange bands, one from base of clavus to apex of clavus, and one from near base of corium to base of second apical cell, sometimes with a third small orange band along commisure, as in *subta.* Female seventh sternum black at apex. Male genitalia: Pygofer (Fig. 6) smaller than *subta,* more truncate at apex. Subgenital plate (Fig. 6) small, with dorsal triangular median process. Aedeagus (Fig. 6) similar to *subta,* but half the size. Connective and second phallobase similar to *subta.* Style similar to *subta.* Female seventh sternum (Fig. 4) long, narrowing to somewhat pointed apex.

Type Data: Holotype male: Colombia: Caquetá, PNN Chiribiquete, Rio Cuñare, 0°30'N 72°37'W, 300 m., Malaise, 1-5-XI-2000, E. González and M. Ospina, M 960 (IHVL). Paratypes: Five males, six females, same data as holotype (IHVL and UKYL).



Figures 5-6. Male genital capsule, lateral view, showing internal genitalia (setae not shown). Fig. 5. *Palingonalia subta* n. sp. Fig. 6. *P. hypera* n. sp. Both drawn to the same scale, which equals 1 mm.

Additional Specimens: Colombia: Seven males, same data as holotype, except 0°31'N 72°38'W, 10-14-XI-2000, M 959 (IHVL and UKYL); one male, same data, except Rio Mesay, 0°14'N 72°56'W, 300 m., Malaise, 26-28-I-2000, F. Quevedo, M 222 (IHVL): one male, one female, same data, except Cuñare-Amu, 0°12'N 72°24'W, 300 m., Malaise, 14-17-II-2001, M 1388 (IHVL); one female, Amazonas, PNN Amacayacu, Matamata, 3°23'S 70°6'W, 150 m., Malaise, 29-V-6-VI-2000, A. Parente, M 680 (IHVL); one female, same data as last, except 15-29-I-2001, A. Alvarado, M 1320 (IHVL); one male, same data as last, except, Cabaña Lorenal, 3°0'S 69°59'W, 210 m., Pantrap, 31-VIII-2001, D. Campos, M 2204 (IHVL); and one female, same data, except San Martín, 3°23'S 70°6'W, 150 m., Malaise, D. Chota, M 2774 (IHVL).

Remarks: This species is named for the median anterior orange band on the pronotum.

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MORPHOLOGY AND CHEMICAL ANALYSIS OF THE METATHORACIC SCENT GLANDS OF *COREUS MARGINATUS* (LINNAEUS, 1758) (HETEROPTERA: COREIDAE) FROM TURKEY[1]

Dilek Durak[2] and Yusuf Kalender[3]

ABSTRACT: The morphology of the metathoracic scent glands of *Coreus marginatus* (Linnaeus, 1758) (Heteroptera: Coreidae) was studied by scanning electron microscopy. The metathoracic scent glands are composed of a reservoir and a pair of lateral glands that connect to the reservoir through a duct. The metathoracic scent glands open to the surface through paired ostioles located between the 2nd and 3rd coxae in evaporation areas with a mushroom-like structure. Extracts of the volatile fraction from male and female metathoracic gland secretions were analyzed by capillary gas chromatography-mass spectrometry (GC-MS). Thirteen and sixteen compounds were detected in males and females, respectively. Most of the chemical compounds are qualitatively similar on each male and female but they differ in their quantity. In the analyses of metathoracic scent glands of females of *C. marginatus,* n-hexenoic acid (22.46%) was determined at the most and 14-Beta-H-Pregna (0.12%) was determined at the least in all samples. In males, octadecanoic acid (57.78%) was determined at the most and n-hexyl acetate (0.06%) was determined at the least in all samples.

KEY WORDS: *Coreus marginatus,* Heteroptera, Coreidae, scent glands, electron microscopy, gas chromatography-mass spectrometry, Turkey

Many heteropterans are characterized by the production of large quantities of strong-smelling and irritating defensive chemicals that are released when these insects are disturbed (Aldrich, 1988). Odorous compounds are produced by both adults and immatures (Staddon, 1979, Pavis et al., 1994, Ho and Millar, 2001) and several reports attest to their efficacy as effective defenses against predation (Krall et al., 1999; Ho and Millar, 2001). These chemicals may also have a role as alarm pheromones (Gunawardena and Bandumathie, 1993; Leal et al., 1994). The source of these defensive/alarm compounds could be a single or a pair of median or ventral scent glands usually located in the metathoracic region of Heteroptera (Carayon, 1971).

Coreus marginatus is a cosmopolitan species and that feeds on many flowers both in the garden and open grassy areas, especially plants belonging to the Polygonaceae, such as Rumex (Hoberlandt, 1955). These bugs are ideal for this study because they can be captured in nature simultaneously at various stages of development of leaf surfaces of their host plant. This insect is common in central Turkey reaching a length of 12-15 mm and can be collected from early spring to early autumn, being prone to fly away when disturbed or hide between the spines and the brown fibres of the leaves. Large quantities of volaties are released by *C. marginatus* in response to disturbance (Aldrich, 1988).

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In this work, the morphology of the metathoracic scent gland (MTG) of this species was described by scanning electron microscopy and volatiles released from extracts of these glands were analyzed by GC-MS.

METHODS

Insects

Adult *C. marginatus* were collected (15 females and males) on various Polygonaceae in Ayaş, Ankara, Turkey, from June to September 2005. Insects were reared in the laboratory and maintained in plastic jars at 22-24°C and 70% relative humidity with a 12:12 light-dark photoperiodic regime. Bugs were maintained on fresh host-plants until dissection. Insects were dissected under insect's saline (0.7% NaCl + 0.3% KCl, Santos-Mallet and De Souza, 1990).

Morphology of the metathoracic scent glands

To study the morphology of the metathoracic scent glands of *C. marginatus* a scanning electron microscopy (SEM) was used. To prevent the insect discharge of gland contents, bugs were anesthetized with CO_2 and then killed by freezing. The thoracic region was dissected in a Petri dish, the tergites were removed, and the metathoracic scent glands (reservoir and glands) were fixed for 3 hrs on 3% glutaraldehyde (0.1 M sodium phosphate buffer, pH 7.2). After washing in fresh buffer, the metathoracic scent glands were post fixed with 1% osmium tetroxide (0.1 M sodium phosphate buffer), dehydrated in a graded ethanol series, dried using 1,1,1,3,3,3-hexamethyldisilazane (HMDS), mounted in stubs, and sputter-coated with gold. The observations were made in a JEOL JSM 5600 scanning electron microscope.

Chemical Analyses

Analyses of the metathoracic scent glands of *C. marginatus* were done on each male and female. The metathoracic scent glands were removed and immersed in ~100 µL analytical grade hexane distilled from calcium hydride (CaH2) and stored at -20°C for posterior analyses. Extracts were analyzed (~2 µL of the extract) by splitless coupled gas chromatography-mass spectrometry (GC-MS, Agilent 6890 series) fitted with a HP-5 MS column (30m x 0,25 mm I.D. x 0,25 µm film) and interfaced to a mass selective detector (Agilent 5973, electron impact ionization, 106 eV). The GC temperature program for the column oven was 50°C/2 min and then 5°C/min to 250°C, with injector and transfer line temperatures of 250 and 280°C, respectively. Helium was used as carrier gas. Compounds were preliminary identified by GC-MS.

RESULTS

The morphology of the metathoracic scent glands of *C. marginatus*

The metathoracic scent glands of *C. marginatus* have a well-developed bag-like reservoir and paired glands located in the upper-lateral areas of the reservoir (Fig. 1A). There are irregular projections and intrusions on the reservoir's surface. Reservoir connects to the glands by a canal in the apical surface (Fig. 1A).

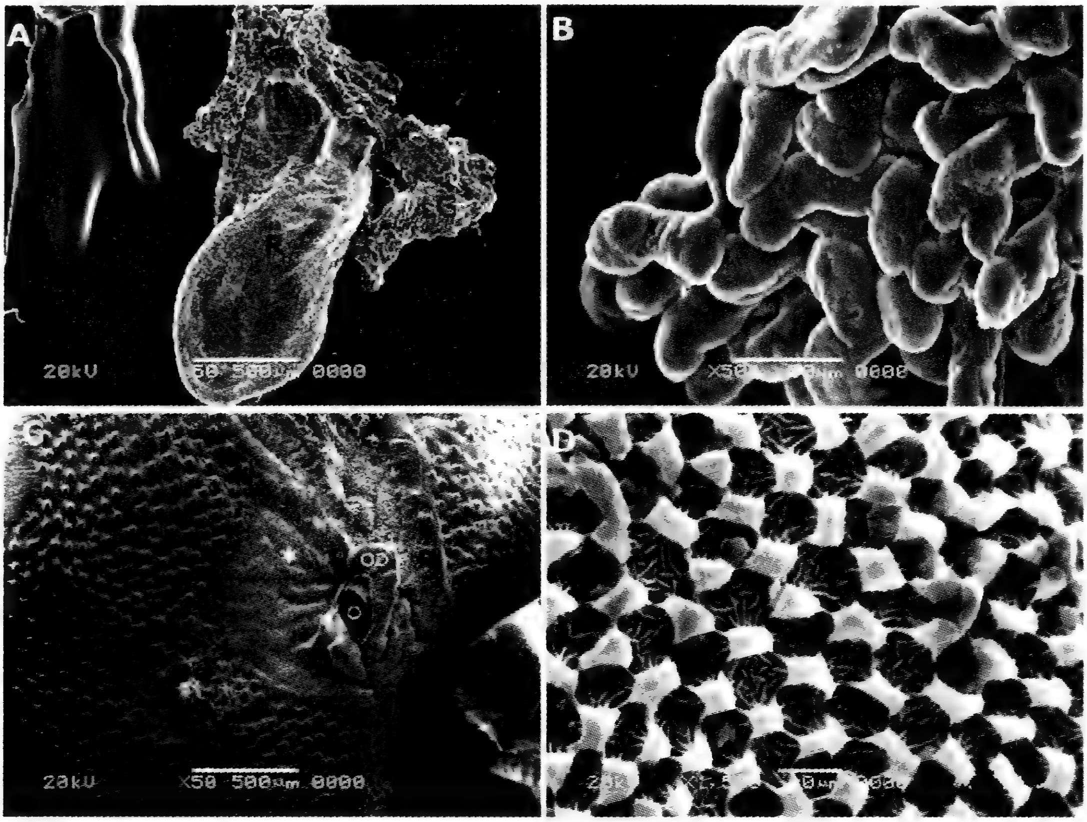

Fig. 1A. Scanning electron micrograph of the metathoracic scent glands of *C. marginatus*. B. Multitubular lateral glands of metathoracic scent glands. *C. Ostiole* (O) and evaporation area (✶). D. Evaporation area, LG: Lateral gland, R: Reservoir, OD: Ostiolar duct.

Lateral glands connect to the reservoir via a duct and have many tubular structures (Fig. 1B). The metathoracic glands open onto the surface of the coreid through paired oval ostioles located between the 2nd and 3rd coxae (Fig. 1C). A long, wide and groove-like structure extends downwards from ostioles (ostiolar duct, OD on Fig. 1C). The ostiole, ostiolar groove and their surroundings are collectively called evaporation area. The metathoracic scent gland secretions exit from the ostiole and it spreads out this region through the ostiolar groove and into the rest of the evaporation area which is endowed with mushroom-like structures (Fig. 1D). The polygonal mushroom-like structures, which are slightly convex in the center, have irregular projections. The mushroom-like structures linked to each other through cuticular ridges and numerous trabecules found under the ridges (Fig. 1D). No sexual differences in the fine structure of the metathoracic scent glands of *C. marginatus* were found.

Odors from the metathoracic scent glands of *C. marginatus*

Analyses of the metathoracic scent glands of *C. marginatus* were done on each male and female (15 males and females). While sixteen different compounds were detected for females, thirteen different compounds were detected for males (Table 1). Quantitative and qualitative compositions of these compounds differ in both sexes. In *C. marginatus* females, five alkanes (cyclooctane, octadecane, tetracosane, octacosane, tricosane), two esters [n-hexyl ester, S-(2-aminoethyl) ester], two aldehydes [n-hexenal, (E)-2-octenal], three acids (n-hexanoic acid, n-hexadecanoic acid, octadecanoic acid), one steroid (14-Beta-H-Pregna), one ether (vinyl cetyl ether), and two alcohols (4-methyl-5-decanol, 1-octadecanethiol) were found. In *C. marginatus* female's metathoracic scent glands, n-Hexenoic acid (22.46%) was the most abundant compound detected and 14-Beta-H-Pregna (0.12%) was the least (Fig. 2). In the male, three alkanes (cyclooctane, tetracosane, docosane), three esters [n-hexyl ester, ethyl ester, methyl ester], two aldehydes [n-hexenal, (E)-2-octenal], four acids (n-Hexadecanoic acid, n-hexanoic acid, 2-methyl, 2-butenoic acid, octadecanoic acid), and one steroid (14-Beta-H-Pregna) were found. Octadecanoic acid (57.78%) was the most abundant compound detected in the male and n-hexyl acetate (0.06%) was the least (Fig. 3).

DISCUSSION

Three different categories of scent glands are described in insects: metathoracic scent glands, Brindley's glands, and ventral glands. The metathoracic scent glands and Brindley's glands are situated in the insect's metathoracic region (Schofield and Upton, 1978). Metathoracic scent glands are present in most of heteroptera and are usually found in the third thorax region of *C. marginatus*. Kàlin and Barret (1975) described the Brindley's glands of the haematophagous bug *Rhodnius prolixus*. These paired glands are dorsally located extending into the second abdominal segment and are found only in reduviids (Santos-Mallet and De Souza, 1990). Shape, size and aspect of Brindley's glands vary according to the feeding status

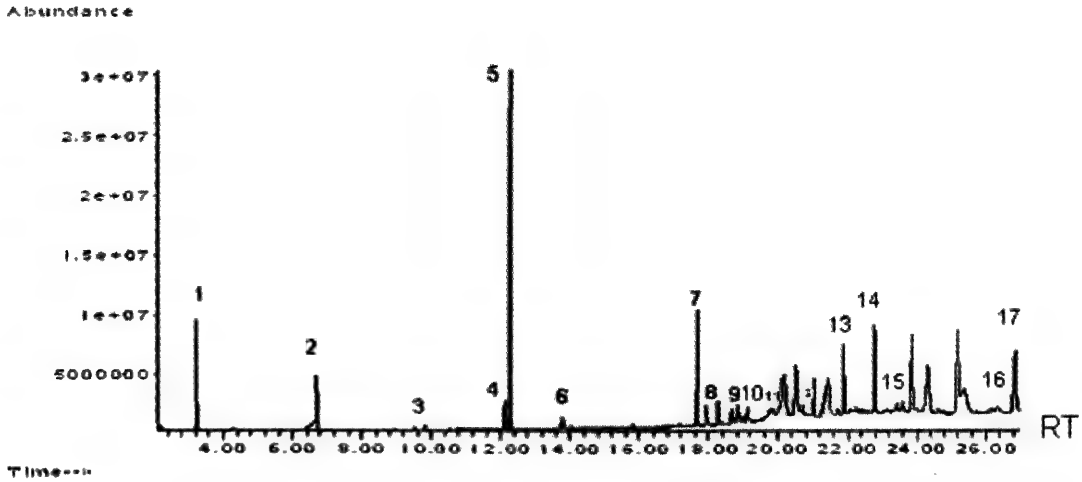

Fig. 2. Gas chromatogram of the compounds present in the female's metathoracic scent glands of *C. marginatus*. 1-n-Hexanal, 2-n-Hexyl ester, 3- Cyclooctane, 4-(E)-2-Octenal, 5-n-Hexanoic acid, 6-Octacosane, 7-4-Methyl-5-decanol, 8-Hexadecanoic acid, 9-Vinyl cetyl ether, 10-14-Beta-H-Pregna, 11-Octadecane, 12-S-(2-aminoethyl) ester, 13-Octadecanoic acid, 14-Octacosane, 15-1-Octadecanethiol, 16-Tricosane, 17-Tetracosane, RT: Retention time in minutes.

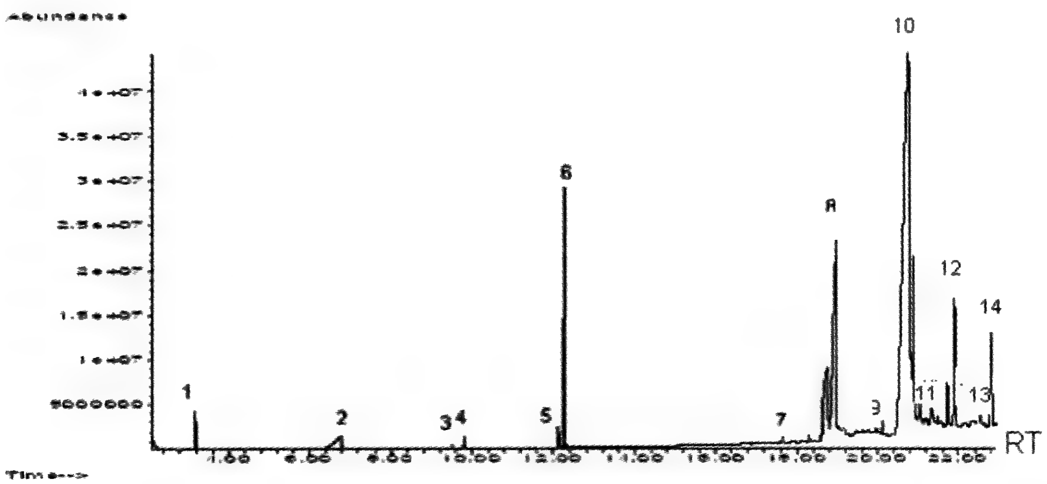

Fig. 3. Gas chromatogram of the compounds present in the male's metathoracic scent glands of *C. marginatus*. 1-n-Hexanal, 2-n-Hexanoic acid, 3-n-Hexyl ester, 4-Cyclooctane, 5-(E)-2-Octenal, 6-n-Hexanoic acid, 7-2-methyl, 2-butenoic acid, 8-n-Hexadecanoic acid, 9-Ethyl ester, 10-Octadecanoic acid, 11-14-Beta-H-Pregna, 12-Docosane, 13-Methyl ester, 14-Tetracosane, RT: Retention time in minutes.

(Santos-Mallet and De Souza, 1990). However, Kalin and Barret (1975) did not observe any difference between insects unfed for 30-40 days and those fed 1 or 2 days before examination. In well-fed *C. marginatus* bugs (15 males and 15 females), the metathoracic scent glands extend into the abdominal cavity up to the second segment, whereas in starved bugs the aspect was milky and shriveled and they were located just in the thorax. However, size differences were observed in the reservoir, whether it was full or empty.

There are two types of metathoracic scent glands in heteroptera: the diastomien type and the omphalien type. In the distomien type, scent glands always open to the outside through more than one ostiole, whereas omphalien scent glands open through one ostiole. We found that *C. marginatus* has diastomien metathoracic scent glands. There is one scent gland between the second and third coxa in *C. marginatus*.

Table 1. Percentages of compounds detected in metathoracic scent secretion of female and male of *C.marginatus,* n.d.= not detected

Group	Chemical Compounds	*C. marginatus sex*	
		Female %	Male %
ALKANES	Cyclooctane	0.25	0.22
	Octadecane	0.32	n.d
	Tetracosane	8.77	2.82
	Octacosane	20.45	n.d
	Tricosane	0.19	n.d
	Docosane	n.d	2.22
ALDEHYDES	(E)-2-Octenal	1.24	0.40
	n-Hexanal	5.09	0.63
ESTERS	Methyl ester	n.d	0.09
	Ethyl ester	n.d	1.38
	n-Hexyl ester	6.22	0.06
	S-(2-aminoethyl) ester	1.50	n.d
ACIDS	n-Hexanoic acid	22.46	8.17
	n-Hexadecanoic acid	3.26	19.61
	Octadecanoic acid	7.50	57.78
	2-methyl, 2-butenoic acid	n.d	0.12
ALCOHOLS	4-Methyl-5-decanol	15..43	n.d
	1-Octadecanethiol	0.42	n.d
ETHER	Vinyl cetyl ether	0.32	n.d
STEROID	14-Beta-H-Pregna	0.12	1.38

Ostiole structure of metathoracic scent glands is often used in systematic keys and diagnosis (Kamaluddin and Ahmad, 1988). In *C. marginatus,* the metathoracic scent gland ostiole has an elongate peritreme (ostiolar duct) with mushroom-like surfaces of evaporation, features that can be used as systematic keys and diagnosis for *C. marginatus.* The evaporation area, i.e., the mushroom-like structure, may show differences between species of the same genus or family (Davidova-Vilimova, 2000). As suggested by Carayon (1971), mushroom-like structures and ostiolar grooves are different in evaporation areas of species belong to *Xylocoris.* Moreover, we found that the ostiolar grooves are short and the ostioles structures are folded. In addition, the mushroom-like structures of the evaporation area are polygonal and are connected to each other through numerous trabecules. It is thought that many of the ridges found in the evaporation area contribute to the long residency of volatiles (Carayon, 1971).

Our results on the comparative study of the chemical analysis of the metathoracic scent glands of male and female of the *C. marginatus* revealed a lot of compounds identified on individual specimens. Octadecane, octacosane, tricosane, S-(2-aminoethyl) ester, 4-methyl-5-decanol, 1-octadecanethiol, vinyl cetyl ether are specific to only females but docosane, methyl ester, ethyl ester and 2-methyl, 2-butenoic acid are specific to males. Some of these compounds may be sex pheromone (Durak and Kalender, 2007).

According to the chemical analyses performed, compounds of metathoracic scent gland can be divided into eleven chemical groups: aldehydes, saturated hydrocarbons, acetates, alcohols, terpenes, lactones, ketones, esters, alcenes, acids and miscellaneous compounds (Farine et al., 1993). In our study, seven different chemical groups were detected in the chemical analyses of MTG of *C. marginatus:* alkanes, aldehydes, acetates, steroid, acids, alcohols and ether. A kind of steroid, 14-Beta-H-Pregna, was detected only in females. This compound may lead not only defensive chemicals but also would function as a sex pheromone. Chemical and behavioral analyses showed that aldehydes and hydrocarbons found in the scent glands of a number of Heteroptera species have a dual function. In addition, these compounds may have different effects according to their level of viscosity (Farine et al., 1992). Here two aldehydes and five hydrocarbons were identified in the female and two aldehydes and three hydrocarbons were identified in *C. marginatus* male. These compounds may have a dual function in this sex.

As suggested by Waterhouse (1964), the various paraffins compounds like hexacosane, tricosane, octacosane have been shown to aid in the penetration of the cuticle of insect enemies and, by delaying evaporation, acting as 'odor fixatives' for the more volatile constituents. There are not these components in the metathoracic scent glands of every species. These compounds were identified in *C. marginatus,* and we can speculate that they may quickly block the evaporation of scent compounds after the release of them. That is, paraffins compounds may also be an odor fixative for *C. marginatus*. Besides, it would be interesting to know the relative efficiencies of scents with and without paraffins in deterring natural enemies.

MTG contents are primarily for defense and have a role as sex pheromones. In addition to these hypothetical defensive and pheromonal activities, other functions could be attributed to the secretion of the MTG of *C. marginatus* by comparing them with other close bug species. The composition and structure of the MTG has been identified and quantified in many Heteroptera, the biological function of each compound in the scent secretion still needs further study.

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POSTEMBRYONIC DEVELOPMENT OF *DROSOPHILA MELANOGASTER* MEIGEN, 1830 UNDER THE INFLUENCE OF QUERCETIN[1]

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Damjan Franjević,[3] and Herwig O. Gutzeit[5]

ABSTRACT: Quercetin is one of the best studied and most abundant flavonoid molecules in plants. Flavonoids are a large group of natural polyphenols that are almost ubiquitously present in the plants. The consumption of fruit and vegetables containing quercetin has been associated with several health benefits. In this study, we examined the impact of dietary quercetin (0, 0.005, 0.05, 0.5 and 1.75% quercetin by weight) on *Drosophila melanogaster* Meigen, 1830 postembryonic development and histological changes in larvae and females. A possible hormonmimetic (ecdysonergic) activity of quecetin was also studied on polytene chromosomes present in the larval salivary glands. We noticed a decrease in the duration of the larval period of flies raised on 1.75% quercetin diet. Quercetin-fed larvae entered metamorphosis sooner than the control ones. The most dramatic change was observed in larval fat body. Dark round structures were observed in fat body cells from larvae treated with quercetin.

KEY WORDS: *Drosophila melanogaster,* Diptera, Drosophilidae, quercetin, postembryonic development, fat body, polytene chromosomes

Quercetin is one of the best-studied and most-abundant flavonoid molecules in plants. The quercetin is naturally present in plant foods and particularly abundant in apples (Rosaceae), broccoli (Brassicaceae), and onions (Alliaceae). The consumption of fruit and vegetables containing quercetin has been associated with several health benefits, including reduced risk of cardiovascular disease and some forms of cancer (Graf et al., 2006).

Flavonoids comprise a large group of natural polyphenols that are almost ubiquitously present in the plant kingdom and exhibit a wide range of biological activities arising mainly from their ability to chelate bivalent metals, modulate activity of various enzymes or nuclear receptors and consequently alter gene expression (Rusak et al., 2002). The effect of flavonoids on insect development is investigated mainly in the light of insect nutritional ecology, with less emphasis on the mechanism of action. (Anti)estrogenic effects of flavonoids may arise due to the interaction of the flavonoid with the estradiol receptor (Kuiper et al., 1998).

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Quercetin is able to inhibit ecdysone receptor (EcR)-dependent reporter-gene expression when given in conjunction with ecdysteroid. Increase in ecdysone titer induces changes in gene expression through the activation of transcription of small set of so-called “early” genes. In giant polytene chromosomes, transcribed genes are represented as puffs making it possible to visualize the effect of steroid hormone, or his analogue, on gene expression (Ashburner 1990).

The aim of this study was to investigate the effect of quercetin on *D. melanogaster* Meigen, 1830, postembryonic development. Therefore, we have examined the influence of dietary quercetin on the duration of *D. melanogaster* larval period and the histological changes in larvae and adult females. A possible hormonmimetic (ecdysonergic) activity of quercetin was also studied on polytene chromosomes present in larval salivary glands.

METHODS

Wild-type *D. melanogaster* provided by Bloomington Drosophila Stock Center at Indiana University was raised on cooked food composed of cornmeal, sugar, baker’s yeast, agar and propionic acid (to retard mold growth). After boiling and mixing, food was cooled, poured into glass tubes (20 x 2 cm diameter), and allowed to harden during the night. Each tube contained 10 ml of culture medium and was plugged with foam rubber.

Adult flies were allowed to lay eggs for 20 h. After 24 h of egg incubation, a freshly hatched first instar larvae were gently transferred to tubes (20 larvae/tube) containing 10 ml of culture medium, supplemented with 0, 0.005, 0.05, 0.5 or 1.75% quercetin by weight. Quercetin (Sigma-Aldrich, Switzerland) was mixed into the diet when the food had cooled under ~ 50°C (just prior to solidification and pouring). For each quercetin concentration, plus control, 6 replicates were prepared. From the onset of pupariation (identified by the eversion of anterior spiracles), the newly formed prepupae were counted once a day. Each prepupa was marked with ink on the tube wall as counted. The larvae that pupariated on the medium were also counted. When adults began to emerge from the pupal case, they were counted separately, males and females. The mean developmental time from hatching to pupariation (and from hatching to eclosion, for each sex separately) was calculated for each concentration used. One-way ANOVA (Statistica 6, Neural Networks) was used to determine significant differences ($P < 0.05$) between the experimental groups. A post-hoc Newman-Keuls test was used to determine which groups differed significantly in their distribution.

Histological analyses were performed on the third instar larvae and on females (1,5 and 22,5 h after eclosion), raised on a 1.75% quercetin diet or regular food. Females spent an indicated period following eclosion together with untreated males. The specimens were then fixed in Bouin´s solution for 24 hours, dehydrated through a graded series of alcohol, embedded in paraffin and sectioned with microtome at 7 µm. Sections were stained with 0.1% toluidin blue and examined with a light microscope (Opton III Zeiss).

Salivary glands from the late third instar larvae had to be dissected prior to ecdysone release, meaning during the puffing stage one (PS 1) approximately 12-18 h from pupariation (Farkaš and Slama 1999). In order to stage the animals correctly, they were grown on food supplemented with 0.05% bromphenolblue. Actively crawling larvae with blue content in the gut were selected. Larvae with completely cleared guts were thought to be 3 h from pupariation (Karim and Thummel 1991). To determine more accurately larvae of the salivary PS1, puff analysis of one salivary gland lobe from each animal had to be done, since two sister lobes have an identical puffing pattern. Following dissection in Ringer solution and under the stereomicroscope, the two salivary gland lobes were separated: one lobe was cultured, and the second one immediately fixed in 40% acetic acid, stained with lacto-orcein, squashed, and its puffing pattern was examined under the light microscope. Puff analysis was determined (Ashburner 1989) using cytology maps (Lindley and Zimm 1992). The sister lobe was cultured in 50 µl of Grace's media (Grace 1962) diluted in ratio 5:1 in distilled water (Ashburner 1989). Incubation of lobes took place at 20-22°C in humified chambers for 1, 2 or 3 h with or without quercetin. At the end of the incubation period, puffing pattern of treated glands was examined. Only glands that were initially in PS 1 were used for interpreting results. Quercetin was stored in required stock solution of DMSO, and added to Grace's medium to yield a final concentration of 10 µM or 100 µM quercetin and 0.1% of DMSO. Solvent controls were also run. For each exposure level, at each incubation time, 4-6 glands were squashed. Minimally two nuclei from each gland were examined.

RESULTS AND DISCUSSION

Quercetin-fed larvae entered metamorphosis sooner than the control larvae. Stamp et al. (1994) has conducted experiments showing that rutin (quercetin glycoside) reduces growth, prolongs development, and increases survival of various insects. Mean larval developmental time of flies reared on 1.75% quercetin diet was decreased for an average of 7 h in comparison to other experimental groups, including the control. On the fourth day after egg-laying, 34.7% flies from 1.75% quercetin fed group had pupariated, while in the control group only 11.7% flies had done so. This effect was statistically significant ($P < 0.0001$). While larvae fed with 1.75% quercetin preferentially selected medium as pupariation place, larvae from all other experimental groups mostly pupariated on the tube wall (Fig. 1).

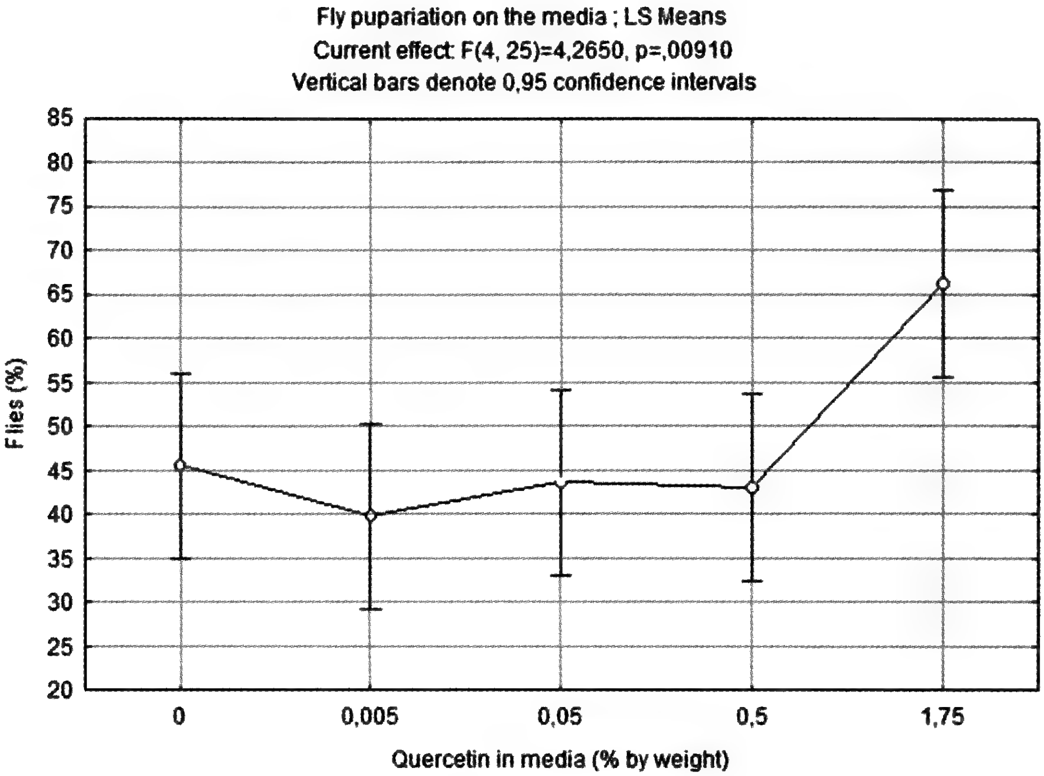

Figure 1. Effect of quercetin on pupariation. Summary of F-statistic from one-way ANOVA. Each point represents the mean value of all results from each group (there were six tubes per exposure level of quercetin, each tube recieved 20 newly hached larvae). Difference between control vs. 1,75% quercetin-treated group was significant at p = 0.008687 level as indicted by a post-hoc Neuman-Keuls analysis.

Besides direct binding to ecdysone receptor, querectin can interfere with steroid hormone system by modulating the activity of ecdysone 20-mono-oxygenase, an enzyme belonging to cytochrome P450 family (Mitchell et al., 1993). This may also account for the shorter development of quercetin-fed larvae.

Fly survival and duration of metamorphosis were not affected by the treatment. The examined structure of ovarioles did not differ between control and treated groups.

The most dramatic change was observed in larval fat body. Dark round structures were observed in fat body cells from larvae treated with quercetin (Fig. 2). Fat body is insect analogue of liver in vertebrates. It is a major site of xenobiotic metabolism. The dark round structures were found in fat body from larvae fed quercetin. There is a possibility that this could be some quercetin metabolite, but this needs further investigation.

Salivary glands which were initially in PS1 were incubated with quercetin in order to investigate quercetin activity as ecdysone analogue. PS1 lobe was identified by puffs at 3C, 68C, 25B loci. Then, after 1, 2, or 3 h incubation, puffing pattern of sister lobe was determined. We were most concerned in examining the puffs at 2B5, 74EF and 75B loci, but we did not detect induction of puffs at these

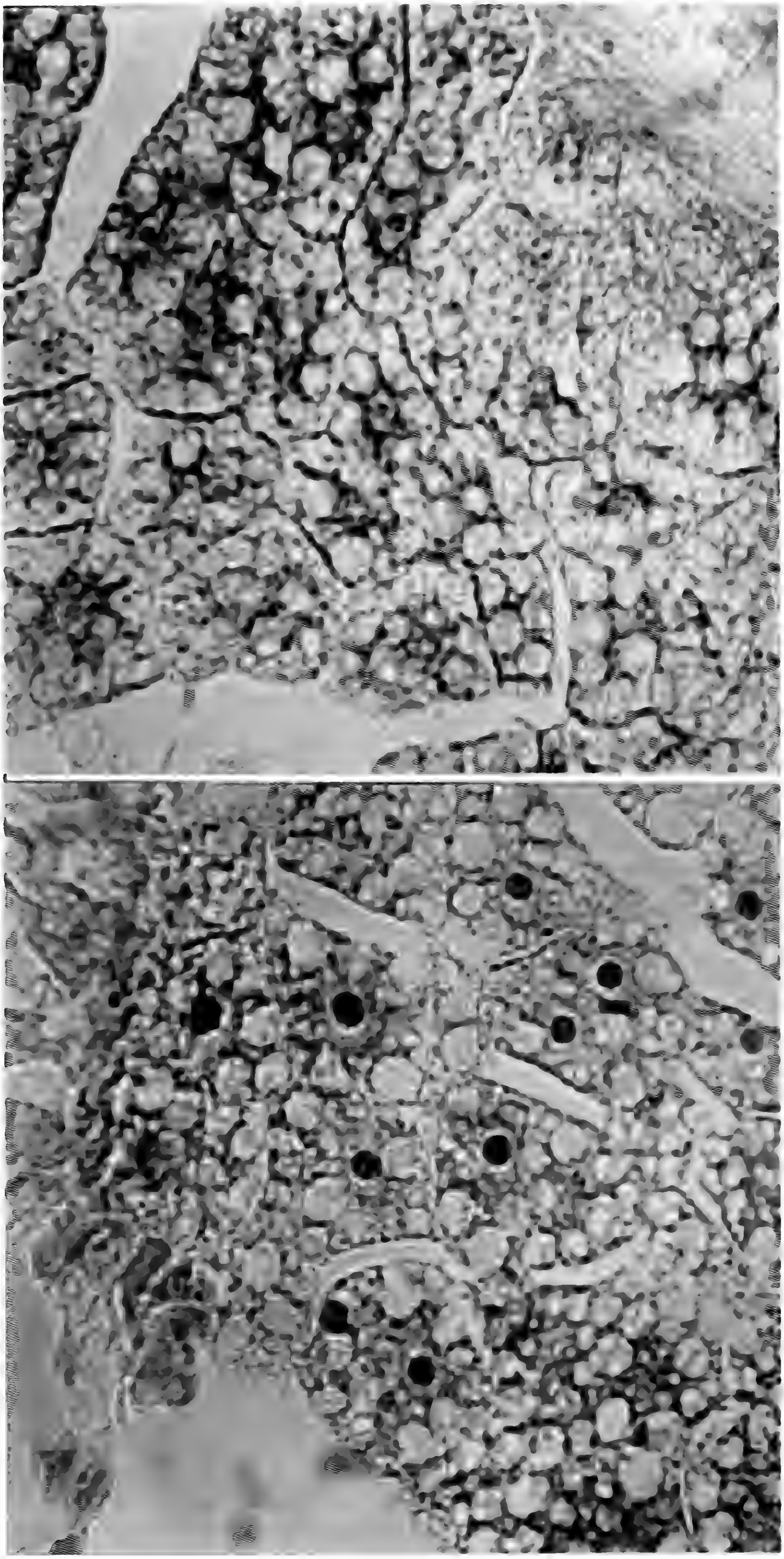

Figure 2. Top Panel. Control larvae without round structures in fat body cells. Bottom Panel. Round structures in fat body cells of third instar larvae raised on a 1.75% quercetin diet. Stained with 0.1% toluidin blue. Magnification 40 x 6.3.

loci after incubation with 10 or 100 μM of quercetin. Using this system of cultured salivary glands we wanted to test our hypothesis that quercetin acted as ecdysone analogue when shortening larval period in our feeding experiments. This system has already been used when investigating ecdysone-agonist properties of compounds that stimulate precocious development in immature stages of various insects (Farkaš and Slama 1999). Quercetin activation of ecdysone-inducible puffs was not confirmed. The main reason for such results probably lies in limited understanding of the absorption, metabolism and mechanisms of action of quercetin in metabolism. It has been shown that quercetin is rapidly metabolized in living organism (Williamson et al., 2000). That confirms the fact that different tissues may respond differently, therefore it may be possible that in our experiment quercetin didn't accelerate development of all organs equally.

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ROBBER FLIES (DIPTERA: ASILIDAE) OF ARKANSAS, U.S.A.: NOTES AND A CHECKLIST[1]

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ABSTRACT: A checklist of 131 species of robber flies from Arkansas is presented. It includes 101 species studied by the authors, of which 66 species are here recorded for the first time from the state. Seven more species have been recorded in the literature, and 23 species that might occur in the state have never been recorded. The Arkansas robber fly fauna has close affinities with the fauna of the eastern United States. Distributional notes are given for several species, and biological notes are presented for *Orthogonis stygia. Ceraturgus fasciatus* is resurrected from synonymy with *C. cruciatus.*

KEY WORDS: Robber flies, Asilidae, Arkansas, *Ceraturgus fasciatus, Orthogonis, Zabrops*

Robber flies comprise one of the most taxonomically diverse, speciose, and conspicuous families of Diptera. More than seven thousand species have been described worldwide, and about one thousand are known to occur in the Nearctic Region (Geller-Grimm 2005, Poole 1996). Most species have restricted ecological requirements and are rather locally distributed. Within their broader ranges, individuals tend to be found in isolated, local colonies (Martin 1965).

Most North American robber flies are associated with dry, open habitats, and the family has a predominantly southern and western distribution. Asilids have been collected from short, mixed, and tallgrass prairies, glades, savannas, and open woodlands. Adult robber flies are opportunistic, aerial predators of many kinds of insects. Upon seizing its prey, the fly kills it with paralyzing saliva injected through its hypopharynx. The liquefied contents of the victim are then sucked up through the proboscis. Certain robber fly species seem to prefer bumblebees, wasps, dragonflies, grasshoppers, or beetles. The larval stage is spent in the soil, among plant roots, or in decaying stumps and logs, usually within the galleries of wood-boring insects. Asilid larvae are predators or ectoparasites that feed on eggs, larvae, or pupae of other insects. Larvae of most species that have been reared feed on white grubs (Coleoptera: Scarabaeidae), but some have been known to prey on larvae of other beetle families, Hymenoptera, Diptera, or Orthoptera eggs (Knutson 1972, Lavigne et al. 1978, Wood 1981, Foote 1991).

Their specialized habitats and other species-specific specializations, together with their ecological roles as primary predators among the insects, make robber flies significant elements of the ecosystem. Along with butterflies (Lepidoptera), tiger beetles (Coleoptera: Carabidae), and dragonflies (Odonata), robber flies are increasingly viewed as a focal group of conservation concern.

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Due to the dependence of some species on much-reduced habitat types, such as prairies, there is concern that several species may have experienced population declines. In general, grasslands support a highly diverse robber fly fauna, and perhaps the most serious historic anthropogenic stress on robber fly populations has been the destruction of grasslands by farming, overgrazing, fire suppression, vehicular traffic, and introduction of weeds. Forest species may be adversely affected by logging operations, especially those that remove woody debris used as breeding sites by asilid larvae. Of the 101 species of Asilidae recorded from Canada's Montane Cordillera Ecozone, 8 are considered endangered, threatened, or vulnerable. Most of these species are associated with vanishing grasslands (Cannings 1998). In Finland, some robber flies have declined due to changes in forestry and agricultural practices (Väisänen 1982).

To date, there has been no systematic inventory of robber flies in Arkansas. Before 2005, only 42 species from Arkansas had been recorded in the published literature. *Ceraturgus cruciatus* (Say) was the first species recorded from the state. Say (1823) described it as *Dasypogon cruciatus* from "Arkansa." Up to 1964, only 4 more species were recorded (Back 1909, Wilcox 1936b, 1960, Martin 1957). That year, Whitcomb and Bell (1964) identified 21 species (excluding one misidentification) of Asilidae from Arkansas cotton fields, all new records for the state. The specimens they collected form the core of the University of Arkansas Arthropod Museum (UAAM) robber fly collection. Their *Nerax rufibarbis* (Macquart) is a junior synonym of *Efferia pogonias* (Wiedemann), and their *Proctacanthella leucopogon* (Williston) is apparently misidentified *Philonicus rufipennis* Hine. The following year, Martin (1965), unaware of the 1964 report, was able to tally only 12 species from Arkansas, and he also found other states bordering the Mississippi River to have a dearth of species. Scarbrough (1972) recorded 22 species found in the northeastern part of the state. Twelve of those were new state records. Scarbrough's Arkansas specimens are now at the National Museum of Natural History and the University of Arkansas Arthropod Museum. Accomplished robber fly taxonomist Joe Wilcox recorded *Ceraturgus cornutus* (Wiedemann) from Arkansas in an unpublished generic revision dated 1975. Adisoemarto and Wood (1975) recorded one more species, Bullington (1986) recorded two, and Warriner (2004) recorded one. Several more records appear in the unpublished draft *Catalog of the Robber Flies (Diptera: Asilidae) of the Nearctic Region* by Eric M. Fisher and Joe Wilcox dated 1997. Recent collecting and analysis have revealed that Arkansas has a fauna of more than one hundred recorded robber fly species, plus another 20% of that number that potentially occur here but have not yet been found.

Artigas and Papavero (1997) subdivided the genus *Efferia.* They placed some species in old genera, including *Nerax,* which had been treated as a synonym. They also described five new genera – *Albibarbefferia, Aridefferia, Carinefferia, Pogoniefferia,* and *Tuberculefferia* – to receive other species. The latest catalog of robber fly genera recognizes all of these genera (Geller-Grimm 2003).

However, we feel that the subdivision of *Efferia* was based on insufficient evidence and continue to use *Efferia sensu lato.*

METHODS

Specimens were keyed to genus using Wood's (1981) key, and they were keyed to species using the references cited therein or more recent works. The unpublished draft catalog of Nearctic robber flies was indispensable for determining which species probably occur in Arkansas. Specimens from the following collections were studied: California Academy of Sciences, Department of Entomology, San Francisco (CASE); Hot Springs National Park Collections, Hot Springs, Arkansas (HSNP); Louisiana State Arthropod Museum, Department of Entomology, Louisiana State University, Baton Rouge (LSAM); Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts (MCZH); National Museum of Natural History, Smithsonian Institution, Washington, D.C. (NMNH); K.C. Emerson Museum, Oklahoma State University, Stillwater (OSEC); Snow Entomological Collections, University of Kansas Natural History Museum, Lawrence (SEMC); and the University of Arkansas Arthropod Museum, Department of Entomology, Fayetteville (UAAM).

DISTRIBUTIONAL, TAXONOMIC, AND BIOLOGICAL NOTES

Notes are here provided on several species for which our records significantly extend the known ranges, provide new biological or taxonomic information, or correct inaccurate published data. These notes are arranged alphabetically by species name.

Atomosia punctifera Hermann

This taxon was described by Hermann (1912) as a Mexican variety of *Atomosia rufipes* Macquart. Fisher and Wilcox raised it to species rank in their unpublished catalog and recorded it from Kansas to Texas and Mississippi as well as Mexico. Beckemeyer (2001), under the influence of the Fisher and Wilcox catalog, published this new status without annotation or comment.

Atomosia punctifera has not been recorded from Arkansas, although it occurs in at least two neighboring states.

Ceraturgus cornutus (Wiedemann)

Arkansas: Benton County, 7 June 1933, 1 female, S. A. Summerland, UAAM.

In his unpublished revision of *Ceraturgus,* Joe Wilcox recorded the following specimens from Arkansas: Washington County: 5 June 1960, 12 June 1939 and 17 June 1941, one with a second label, *Oenothera,* 3 females, UAAM (examined by JW, now apparently lost).

Ceraturgus fasciatus Walker

Unpublished revisionary work on the genus *Ceraturgus* by the senior author has resulted in *Ceraturgus fasciatus* being resurrected from synonymy with *C. cruciatus* (Say). The Midwestern species *Ceraturgus cruciatus* has not been recorded from Arkansas since Say (1823) described it from the state. *Ceraturgus fasciatus* has not been recorded from Arkansas, although it is known from nearby localities in Mississippi. From there its range extends to the Northeast. The ranges of the two species apparently do not overlap.

Cyrtopogon lutatius (Walker)

Arkansas: Logan County, Mt. Magazine State Park, N 35°10.550' W 93°37.063', oak-hickory forest, 4-18 May 2004, 1 female, J. K. Barnes, UAAM; Pulaski County, Little Rock, flight intercept trap, 10 April 1998, 1 female, B. Baldwin, UAAM.

Cyrtopogon lutatius was previously known from Michigan to Nova Scotia, south to Pennsylvania (Martin and Wilcox 1965). These Arkansas records significantly extend the southwestern corner of the known range.

Diogmites angustipennis Loew

Some Arkansas *Diogmites* specimens could be identified as *D. symmachus* Loew using existing keys (Bromley 1936b, Artigas 1966). We are considering these to be light colored variants of *D. angustipennis*. Loew (1866) described *D. angustipennis* in 1866 from two relatively robust and dark colored females collected in Kansas. A few years later, he described *D. symmachus* Loew from two smaller, light colored specimens collected in Texas, both a male and a female (Loew 1872). In females from both type series, abdominal tergites 1-5 and the corresponding sternites are dull and pollinose, whereas tergites 6-8 and the corresponding sternites are glabrous except for the lightly pollinose extreme lateral edges of tergite 6. *D. angustipennis* is common and widespread in Arkansas. In a similar, but as yet undescribed, species, females have abdominal tergites 1-6 pollinose and dull dorsally, tergites 7-8 glabrous dorsally and dull laterally, and all abdominal sternites pollinose and dull. This new species is apparently rare in Arkansas, occurring only in the southwest portion of the state, but it is widespread from Colorado and Kansas south to the United States border from California to Louisiana. More will be said about synonymy, and the new species will be described, in a future publication.

Diogmites discolor Loew

Arkansas: Garland County, Hot Springs, 13 August 1962, 1 female, E. Cochrane, OSEC; Montgomery County, Mt. Ida, 23 July 1963, 1 male, M. E. Cochrane, UAAM.

Most recorded specimens of *D. discolor* have been collected from Ohio and Kentucky east to Massachusetts and Virginia, but the species has also been recorded from Alabama (Artigas 1966, Martin and Wilcox 1965). These records extend the southwestern border of the known range.

Echthodopa formosa **Loew**

Arkansas: Craighead County, Craighead Forest Park, woodland trail, 22 April 2004, 1 male, N. Lavers, UAAM; Greene County, Crowley's Ridge State Park, woodland path, 10 May 2004, 1 male, N. Lavers, UAAM; Poinsett County, Lake Hogue, open woodland, understory in sun, 15 April 2004, 2 males, N. Lavers, UAAM.

Echthodopa formosa was previously known to range from Massachusetts to Mississippi (Adisoemarto and Wood 1975).

Echthodopa pubera **Loew**

Arkansas: Boone County, Baker Prairie Natural Area, 30 May 2003, 1 male, M. D. Warriner, UAAM.

This is the most southeastern record for this species (Adisoemarto and Wood 1975).

Efferia kansensis **(Hine)**

Arkansas: Crawford County, 19 June 1964, 2 males, 1 female, UAAM; ex *Desmodium,* 6 July 1970, 1 male, P. Tugwell, UAAM; 6 August 1970, 1 male, P. Tugwell, UAAM.

Efferia kansensis was previously known only from Kansas, Oklahoma, and Texas (Wilcox 1966).

Efferia prairiensis **(Bromley)**

Arkansas: Greene County, Scatter Creek Wildlife Management Area, path in grassland, 16 June 2004, 1 female, N. Lavers, UAAM; Poinsett County, Lake Hogue, 26 July 2003, 1 male, N. Lavers, UAAM.

Efferia prairiensis was previously known only from Kansas, Oklahoma, and Texas (Wilcox 1966).

Efferia texana **(Banks)**

Arkansas: Calhoun County, 2 July 1964, 1 female, UAAM; Garland County, Hot Springs National Park, 18 June 1961, 1 female, HSNP; Montgomery County, Richardson Bottoms, 5 September 2003, 1 female, T. D. Marsico, UAAM; Pulaski County, 22 May 1965, 1 female, H. R. Dodge, UAAM; 12 June 1965, 1 male, H. R. Dodge, UAAM.

Efferia texana was previously known from Oklahoma, Texas, and Arizona (Wilcox 1966).

***Heteropogon macerinus* (Walker)**

Arkansas: Cross County, Village Creek State Park, 9 September 2003, 1 female, N. Lavers, UAAM; 25 August 2005, 1 female, N. Lavers, UAAM; Craighead County, Bono Bog, 26 August 2005, 1 female, N. Lavers, UAAM.

Heteropogon macerinus was previously recorded from New York to Kentucky (Martin and Wilcox 1965).

***Laphria affinis* Macquart**

Arkansas: Pulaski County, Little Rock, Malaise trap, 4 October 1999, 1 male, B. Baldwin, UAAM.

Most species of *Laphria* fly in late spring or early summer. *Laphria affinis,* however, flies in late summer and fall. It was previously recorded from Massachusetts to to Georgia and Louisiana (Bromley 1934b, Martin and Wilcox 1965). McAtee and Banks (1920) found this species to be plentiful in Washington, D.C., in autumn, and they identified two prey species, one a staphylinid beetle and the other a chrysomelid beetle. Bromley (1934b) found this species to be quite common at Chadbourne, Columbus County, North Carolina, in September and October 1925. One individual fed on a lampyrid beetle.

***Laphria divisor* (Banks)**

Arkansas: Stone County, Sylamore Creek, trail, open woodland, understory in sun, 5 May 2004, 1 male, N. Lavers, UAAM.

Laphria divisor was previously known from Ontario, Maine to Wisconsin, and south to North Carolina and Illinois (Martin and Wilcox 1965, Skevington 1999).

***Laphria vorax* (Bromley)**

Arkansas: Boone County, Baker Prairie Natural Area, Jenkins Road, east section, 11 July 2002, 2 males, M. D. Warriner, UAAM; Baker Prairie Natural Area, 2 July 2003, 1 male, M. D. Warriner, UAAM; Franklin County, Cherokee Prairie Natural Area, 19 May 2003, 1 female, M. D. Warriner, UAAM; H. E. Flanagan Prairie Natural Area, 3 June 2003, 2 males, M. D. Warriner, UAAM.

Laphria vorax was previously known from the prairie states Nebraska, Iowa, Kansas, and Oklahoma (Bromley 1934b). The Arkansas records are all from prairie remnant habitats.

***Leptogaster atridorsalis* Back**

Arkansas: Carroll County, Urbanette, N 36°25.064' W 93°28.574', 2-9 July 2004, 1 male, J. K. Barnes, UAAM; Craighead County, 21 June 2005, 1 male, N. Lavers, UAAM; Hempstead County, Rick Evans Grandview Prairie, N 33°48.076', W 93°48.082', 25 May-2 June 2004, 1 male, J. K. Barnes, UAAM.

Leptogaster atridorsalis was previously thought to be confined to a rather small area from southern Pennsylvania to North Carolina and westward as far as Indiana (Martin 1957).

***Machimus virginicus* (Banks)**

Arkansas: Clay County, Chalk Bluff, 30 June 2005, 1 male, N. Lavers, UAAM; Cleburne County, Cherokee Wildlife Management Area, logging road, near pasture, 15 June 2004, 1 male, H. Raney, UAAM; Craighead County, Bono Bog, 22 May 2003, 1 male, 1 female, N. Lavers, UAAM; Craighead Forest Park, 10 May 2003, 1 male, N. Lavers, UAAM; 23 May 2004, 2 males, 1 female, N. Lavers, UAAM; Jonesboro, 28 May 2005, 1 male, 1 female, N. Lavers, UAAM; 1 June 2005, 1 male, N. Lavers, UAAM; Cross County, Village Creek State Park, woodland, 11 June 2004, 1 male, 1 female, N. Lavers, UAAM; Greene County, Crowley's Ridge State Park, 26 May 2003, 1 male, N. Lavers, UAAM; 17 June 1971, 2 males, 2 females, A. G. Scarbrough, UAAM; Scatter Creek, woodland edge, 14 May 2005, 1 female, N. Lavers, UAAM; Scatter Creek Wildlife Management Area, 27 May 2005, 1 male, 1 female, N. Lavers, UAAM; Newton County, woodland trail near Pruitt, 5 June 2004, 2 males, 1 female, N. Lavers, UAAM; Buffalo National River, Cecil Cove Trail, 3 km NW Erbie, 24-28 June 1994, 1 female, C. E. Carlton, UAAM; Perry County, 2 mi. NE Lake Sylvia, 16 June 1993, 1 male, C. E. Carlton, UAAM; Pope County, Piney Creeks Wildlife Management Area, 18 June 2005, 1 male, N. Lavers, UAAM; Scott County, Mill Creek, 5 mi. E of Y City, 21 May 1978, 1 male, G. W. Byers & C. W. Young, SEMC.

Scarbrough (1972) reported *M. notatus* (Wiedemann) from Arkansas, but his specimens are more likely referable to *M. virginicus.* McAtee and Banks (1920) found *M. notatus* and *M. virginicus* to be similar species, distinguishable by characters of the male genitalia. Inspection of the male genitalia of Scarbrough's specimens, and all other male specimens collected in Arkansas, reveals that each half of the epandrium (= superior forceps) has the apex projecting straight backwards as in *M. virginicus,* not downturned as in *M. notatus.*

***Megaphorus clausicellus* (Macquart)**

Whitcomb and Bell (1964) recorded this species from Arkansas cotton fields. We have not been able to confirm its presence in the state. At UAAM, there is a single specimen of *Megaphorus acrus* (Curran) misidentified as *M. clausicellus.* It was collected in Conway County, 29 July 1959.

***Microstylum morosum* Loew**

Arkansas: Howard County, 1994, 1 female, S. Reeder, UAAM.

Until recently, these giant asilids, up to 50 mm long, were known from only Texas, Oklahoma, Kansas, Colorado, New Mexico, and Arizona (Beckemeyer and Charlton 2000). Warriner (2004) recorded the species from Terre Noire

Natural Area, a blackland prairie remnant near Arkadelphia, Clark County, Arkansas. The specimen recorded here was found in the student collection of Southern Arkansas University, Magnolia, and was presented to UAAM as a gift by Dr. Randall Adams.

***Neoitamus orphne* (Walker)**

Arkansas: Polk County, 21-24 April 1998, 1 female, V. L. Moseley, LSAM.

Neoitamus orphne was previously recorded from Colorado to Wisconsin and Maine, south to North Carolina (Martin and Wilcox 1965).

***Neomochtherus auricomus* (Hine)**

Arkansas: Carroll County, Urbanette, N 36°25.064', W 93°28.574', 24 August-1 September 2004, 1 male, J. K. Barnes, UAAM; Logan County, Mt. Magazine State Park, N 35°10.550', W 93°37.063', oak-hickory forest, 16 August-1 September 2004, 1 male, J. K. Barnes, UAAM; Montgomery County, Crystal Mountain Scenic Area, 22 September 1993, 2 males, C. E. Carlton, UAAM; off Hwy 270 at Co. 527, 23-30 September 1999, 4 males, C. Lewis, UAAM; Pulaski County, Little Rock, in house, 20 September 1996, 1 female, B. Baldwin, UAAM; Little Rock, Malaise trap, 17 September 1998, 2 males, B. Baldwin, UAAM; Little Rock, 21 October 2003, 1 female, B. Baldwin, UAAM; Washington County, near West Fork, 14634 Hwy 170, 22 September 2004, 1 female, J. J. Riggins, UAAM; woods, 25 September 1984, 1 male, B. White, UAAM.

Oklahoma: Grady County, Tuttle, 17 September 2005, 3 females, B. Baldwin, UAAM; 18 September 2005, 2 males, B. Baldwin, UAAM; 2 October 2005, 2 males, 2 females, B. Baldwin, UAAM.

These records represent a significant range extension from the previously known range, which includes Ontario, Illinois, Ohio, Pennsylvania, New Jersey, and Connecticut (Martin and Wilcox 1965, Skevington 1999).

This species was previously placed in the genus *Asilus.* In their unpublished catalog, Fisher and Wilcox moved it to the predominantly Palaearctic genus *Neomochtherus.* Skevington (1999) published this combination without comment, apparently under the influence of the Fisher and Wilcox catalog.

***Nicocles pictus* (Loew)**

Arkansas: Cross County, Village Creek State Park, woodland trail, 5 March 2005, 1 female, N. Lavers, UAAM; Washington County, 1959, 1 female, J. Lindsey, UAAM.

Nicocles pictus was previously recorded from New Jersey; Washington, D.C.; Georgia; Florida; and Alabama (Martin and Wilcox 1965). It flies early in the season, and it has been known to prey on ants of the genus *Lasius* and the dung beetle *Aphodius femoralis* Say (McAtee and Banks 1920).

Orthogonis stygia (Bromley)

Arkansas: Clay County, Chalk Bluff, fallen oak log, 8 July 2004, 1 male, N. Lavers, UAAM; poison ivy, 14 July 2004, 1 female, N. Lavers, UAAM; Cross County, Village Creek State Park, oak log in deep woods canyonside, 23 July 2004, 1 male, N. Lavers, UAAM; Phillips County, Saint Francis National Forest, 20 July 2005, 1 male, N. Lavers, UAAM; Washington County, Fayetteville vicinity, 25 June 1962, 1 female, L. J. Paulissen, UAAM.

This exceptionally rare robber fly is large, about 2.5 cm long. With its black and metallic blue coloration, it resembles a spider wasp, family Pompilidae. Bromley (1931a) originally described this species in the genus *Laphria.* Hull (1962) placed it in *Smeryngolaphria,* but Martin and Wilcox (1965) placed it in *Orthogonis,* and Eric Fisher (personal communication) finds that it is "definitely congeneric with typical *Orthogonis.*" The holotype female was collected in Stovall, Granville County, North Carolina, 26 June 1919, and the paratype females were collected in Ovett, Jones County, Mississippi, 20 June 1914. All type specimens were from the Hine Collection, Ohio State University. Bromley (1950) later recorded the species from Gainesville, Alachua County, Florida. Taber and Fleenor (2003) recorded two female specimens in the Texas A&M University Insect Collection collected by Bromley in 1934 in Liberty, Texas, and they reported on a single female that they collected in June in the Ottine Swamps of Gonzales County, south central Texas, but they failed to report the day or year of collection and the specimen depository. The specimen was found on a trail in a swamp characterized by green ash, *Fraxinus pennsylvanica* Marshall, and dwarf palmetto, *Sabal minor* (Jacquin) Persoon. Our specimens include the first recorded males.

On 9 July 2004, at Chalk Bluff, Clay County, Arkansas, NL tried to net a male specimen on a rotting oak log. It escaped, but flew only to the other end of the log, where NL succeeded in capturing it. Two days later, on 11 July, examination of about 20 other logs did not turn up any new specimens, but a second male was found upon returning to the original log. This log was in closed-canopy woods consisting of hardwoods, mostly oaks, with dappled shade. The understory was mostly bare, with only dried leaf litter and the occasional seedling or sapling tree. The log attractive to *O. stygia* was well rotted, about 0.5 m in diameter and 12 m long, and lying on an eastward-facing slope of about 30 degrees. The log was oriented up and down the slope, rather than across it. The soil was highly erodible loess, and there was a stream at the bottom of the slope.

When first spotted, the second male was flying along the ground about 2 m from the log carrying a 6-7 mm ichneumonid or braconid wasp. When pursued, the robber fly made frequent, brief flights, but over a period of two hours or more it always landed on or close to the rotting log, as if it was defending its territory. A male *Laphria grossa* (Fabricius) shared the environs of the log, but it was far less active than the *Orthogonis* male.

NL returned to the same area about 10:00 AM on 14 July and found a male *Orthogonis stygia* active on top of, and in the immediate vicinity of, the rotting log, never flying more than about a meter above the ground. It flew beyond the log about 3 m, then it quickly returned carrying an ichneumonid wasp 8 mm long. NL then walked to the ridge top above the log, about 60-70 m from the log, and there in closed-canopy woods with a dense ground cover of poison ivy and other low, woody plants was a female *O. stygia*. This habitat was much richer in potential prey than the areas being guarded by the males. The female escaped NL's first attempt to net it, but like the males, when pursued, she only flew 2-3 m away and then landed on low vegetation. It was eventually netted. NL returned to the log on 17 July and again found a male *O. stygia* seemingly guarding it. It flew beyond the log and returned with an ichneumonid wasp, 6 mm long.

On 23 July, NL visited Village Creek State Park in Cross County, still on Crowley's Ridge, but some 150 km south of the previous site, where he found similar habitat: closed canopy, oak/beech forest on loess soil in a steep sided ravine. When he approached a large, rotting log, 16-17 m long and 0.5 m in diameter, positioned up and down a 35 degree, east-facing slope, a male *O. stygia* appeared. It performed what appeared to be a wasp-like warning display, buzzing loudly about 0.3 m from his face. This same behavior had been noted in the males observed at Chalk Bluff. When pursued with an insect net, the fly scrambled away two or three times but refused to leave the log. It was finally caught. Further observation on 27 July revealed no more specimens of *O. stygia* at this site.

The following specimen was examined by Eric Fisher (personal communication) at the California Academy of Sciences, San Francisco: Arkansas: Washington County, Cave Creek Valley, 1000 ft., "1955-56," 1 female, M. Hite, CASE. The following three specimens were examined by JKB at the National Museum of Natural History, Smithsonian Institution, Washington, D.C.: Alabama: 1 female [no other data], NMNH; Oklahoma: Muskogee County, Fort Gibson, 21 July 1937, 1 female, Standish-Kaiser, NMNH; and Mississippi: Oktibbeha County, Agricultural College, July 1894, 1 female, H. E. Weed, NMNH.

Proctacanthella leucopogon (Williston)

Whitcomb and Bell (1964) reported finding *Proctacanthella leucopogon* in Arkansas, but this record is probably an error. Many specimens of *Philonicus rufipennis* Hine were found at UAAM misidentified as this species.

Stichopogon colei Bromley

Arkansas: Little River County, weeds, 4 July 1961, 2 females, UAAM; Perry County, Toad Suck, 7 September 2003, 1 female, H. Raney, UAAM; Toad Suck Park, along sandy Arkansas River beach, 5 September 2004, 1 female, H. Raney, UAAM.

This species was previously recorded only from Texas (Martin and Wilcox 1965). The three species of *Stichopogon* that are known to occur in the central United States are distinguished from other North American species by the lack of marginal hairs or bristles on the scutellum. *Stichopogon trifasciatus* (Say) is readily distinguished by entirely black tibiae and the silvery pollinose abdominal segments 1, 4, and 8 contrasting sharply with the otherwise velvety black abdomen. *Stichopogon colei* Bromley has the tibiae reddish basally, and it has distinctive black or dark brown triangles on tergites 1-7 (Bromley 1934c, Wilcox 1936a). In the specimens that we have seen the frons and vertex are covered with golden brown pollen. *Stichopogon pritchardi* Bromley has the tibiae yellowish basally and the abdomen is fairly uniformly yellowish red (Bromley 1951). The frons is white pollinose, and the vertex usually has at least a transverse line of golden brown pollen at about the level of the ocellar triangle. It is sometimes very difficult to distinguish between *S. colei* and *S. pritchardi.* Further study might prove them to be synonymous.

Zabrops flavipilis **(Jones)**

Arkansas: Pope County, Holla Bend National Wildlife Refuge, NW side, in shaded woods, perching on leaf tops, 5 July 2005, 1 female, H. D. Raney (UAAM).

The habitat was bottomland hardwood, oak, hickory, and cottonwood in full shade with an open understory of ferns, sapling oaks, and poison ivy. It was several hundred yards from the Arkansas River channel, out of the floodplain except for extraordinary flood years. The soil was covered with rich leaf litter and probably a deeper sandy base. The soils are generally moist, with some puddle and pool areas, but they were mostly dried at the time this specimen was collected. Also found perching on leaf tops in the vicinity were *Diogmites neoternatus* (Bromley) and *Machimus antimachus* (Walker).

This species was described from a female holotype specimen collected in Meadow [county unknown], Nebraska (Jones 1907). Published records also exist for Riley County, Kansas (1 male) and Scioto County, Ohio (1 male) (Fisher 1977). E. Fisher (personal communication) provided the following unpublished records: Iowa: Pottawattamie County, Council Bluffs, 19 July 1940, 2 females, F. S. Stancliffe (Larry Bezark Collection); Missouri: Linn County, Pershing State Park, malaise trap, 16 July 2004, 1 female, D. A. Woller (D. A. Woller Collection).

CHECKLIST

The recorded robber fly fauna of Arkansas comprises 108 species. We have collected, or studied museum specimens of, 101 species, of which 35 were previously recorded from the state, and 66 are here recorded for the first time (names in boldface type). In most cases specimens are deposited in the UAAM. Another 7 species have been reported in the literature, but we have not yet confirmed their presence in the state (names followed by a dagger, †, followed by the relevant reference), for a total of 108 recorded species. We consider another 23 species to be potential residents of the state, based on known distributions in nearby states (names followed by an asterisk, *), for a state faunal list consisting of 131 species. We have adopted the subfamily classification found in Geller-Grimm's (2003) world catalog of robber fly genera.

Subfamily Apocleinae

Efferia aestuans (Linnaeus)
Efferia albibarbis (Macquart)
Efferia apicalis (Wiedemann)*
Efferia bicolor (Bellardi)*
***Efferia kansensis* (Hine)**
Efferia nemoralis (Hine)
***Efferia plena* (Hine)**
Efferia pogonias (Wiedemann)
***Efferia prairiensis* (Bromley)**
***Efferia texana* (Banks)**
Mallophora orcina (Wiedemann)
Megaphorus acrus (Curran)
Megaphorus clausicellus (Macquart)† (Whitcomb and Bell 1964)
Megaphorus guildiana (Williston)*
***Proctacanthella cacopiloga* (Hine)**
Proctacanthus brevipennis (Wiedemann)† (Whitcomb and Bell 1964)
Proctacanthus duryi Hine
Proctacanthus hinei Bromley
Proctacanthus longus (Wiedemann)*
Proctacanthus milbertii Macquart
Proctacanthus rufus Williston
Promachus bastardii (Macquart)
Promachus fitchii Osten Sacken
Promachus hinei Bromley
Promachus oklahomensis Pritchard*
Promachus rufipes (Fabricius)† (Scarbrough 1972)
***Promachus vertebratus* (Say)**
Triorla interrupta (Macquart)

Subfamily Asilinae

***Asilus sericeus* Say**
Dicropaltum rubicundus (Hine)
***Machimus antimachus* (Walker)**
***Machimus erythocnemius* (Hine)**
Machimus notatus (Wiedemann)† (Scarbrough 1972)
***Machimus paropus* (Walker)**

***Machimus prairiensis* (Tucker)**
***Machimus sadyates* (Walker)**
***Machimus snowii* (Hine)**
***Machimus virginicus* (Banks)**
***Neoitamus flavofemoratus* (Hine)**
***Neoitamus orphne* (Walker)**
***Neomochtherus auricomus* (Hine)**
Philonicus rufipennis Hine

Subfamily Dasypogoninae
Diogmites angustipennis Loew
***Diogmites basalis* (Walker)**
***Diogmites discolor* Loew**
Diogmites misellus Loew
Diogmites missouriensis Bromley
Diogmites neoternatus (Bromley)
Diogmites platypterus Loew
Diogmites properans Bromley*
Diogmites salutans Bromley*
***Diogmites texanus* Bromley**
***Nicocles pictus* (Loew)**
***Taracticus octopunctatus* (Say)**

Subfamily Dioctriinae
***Echthodopa formosa* Loew**
***Echthodopa pubera* Loew**
Eudioctria tibialis (Banks)

Subfamily Laphriinae
***Andrenosoma fulvicauda* (Say)**
***Atomosia glabrata* (Say)**
***Atomosia melanopogon* Hermann**
Atomosia puella (Wiedemann)
Atomosia punctifera Hermann*
Atomosia pusilla Macquart*
Atomosia rufipes Macquart
Atomosia sayii Johnson
***Cerotainia albipilosa* Curran**
***Cerotainia macrocera* (Say)**
***Lampria bicolor* (Weidemann)**
***Lampria rubriventris* (Macquart)**
***Laphria affinis* Macquart**
Laphria aktis McAtee† (Bullington 1986)

***Laphria apila* (Bromley)**
***Laphria cinerea* (Back)**
***Laphria divisor* (Banks)**
***Laphria flavicollis* Say**
***Laphria grossa* (Fabricius)**
Laphria index McAtee
***Laphria ithypyga* McAtee**
***Laphria lata* Macquart**
***Laphria macquarti* (Banks)**
***Laphria saffrana* Fabricius**
Laphria sericea Say*
***Laphria sicula* McAtee**
***Laphria thoracica* Fabricius**
***Laphria vorax* (Bromley)**
***Orthogonis stygia* (Bromley)**
***Pogonosoma dorsatum* (Say)**
Pogonosoma ridingsi Cresson*

Subfamily Laphystiinae
Laphystia bromleyi Wilcox
Laphystia notata (Bigot)*
Laphystia ochreifrons Curran*
***Laphystia sexfasciata* (Say)**
Psilocurus birdi birdi Curran
Psilocurus nudiusculus Loew
***Zabrops flavipilis* (Jones)**

Subfamily Leptogastrinae
***Apachekolos tenuipes* (Loew)**
Beameromyia disfascia Martin*
***Beameromyia vulgaris* Martin**
***Leptogaster aegra* Martin**
***Leptogaster atridorsalis* Back**
***Leptogaster brevicornis* Loew**
Leptogaster flavipes Loew*
Leptogaster incisuralis Loew*
Leptogaster murina Loew
***Leptogaster virgata* Coquillett**
Psilonyx annulatus (Say)
***Tipulogaster glabrata* (Wiedemann)**

Subfamily Ommatiinae
Ommatius gemma Brimley

Ommatius oklahomensis Bullington and Lavigne*
***Ommatius ouachitensis* Bullington and Lavigne**
Ommatius tibialis Say† (Scarbrough 1972)
Ommatius wilcoxi Bullington and Lavigne*

Subfamily Stenopogoninae
Ceraturgus cruciatus (Say)† (Say 1823)
***Ceraturgus cornutus* (Wiedemann)**
***Ceraturgus elizabethae* Brimley**
Ceraturgus fasciatus Walker*
Ceraturgus mitchelli Brimley*
***Cyrtopogon lutatius* (Walker)**
***Heteropogon macerinus* (Walker)**
Holopogon guttulus (Wiedemann)*
***Holopogon phaeonotus* Loew**
Microstylum morosum Loew
Prolepsis tristis (Walker)
***Scleropogon subulatus* (Wiedemann)**

Subfamily Stichopogoninae
***Stichopogon colei* Bromley**
***Stichopogon pritchardi* Bromley**
Stichopogon trifasciatus (Say)
Townsendia nigra Back*

Subfamily Trigonomiminae
Holcocephala abdominalis (Say)*
***Holcocephala calva* (Loew)**
***Holcocephala fusca* Bromley**

DISCUSSION

The checklist of Arkansas robber flies now comprises 131 species. It includes 101 species studied by the authors, of which 66 species are recorded for the first time from the state. Seven more species have been recorded in the literature, and 23 species that might occur in the state have never been recorded. Preliminary evidence seems to indicate that Arkansas robber fly biodiversity is greatest in areas with friable soils, such as the loess of Crowley's Ridge and the sands of the riparian habitat at Toad Suck on the Arkansas River.

The Arkansas robber fly fauna shares many species with the fauna of the eastern United States, sharing nearly 60% of its species with Kansas (Beckemeyer 2001), which has a fauna consisting of 122 recorded species and another 14 that might occur there, over half of its species with Michigan, which has a fauna consisting of 72 recorded species and another 7 that might occur there (Baker and Fischer 1975), and over half of its species with Ohio, which has a fauna consisting of 90 recorded species and another 9 that might occur there (Bromley 1931b, 1933, 1934a, 1936a, 1947). In contrast, less than 10 percent of Arkansas' species are shared with Utah, which has a fauna consisting of some 158 recorded species (Nelson 1987). The species shared with Utah tend to be those that occur over all or most of the United States, such as *Stichopogon trifasciatus* (Say), *Triorla interrupta* (Macquart), *Efferia aestuans* (Linnaeus), *E. albibarbis* (Macquart), *Machimus paropus* (Walker), and *Proctacanthus milbertii* Macquart.

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XANTHOGALERUCA SUBCOERULESCENS (WEISE, 1884) (COLEOPTERA: CHRYSOMELIDAE), A LITTLE-KNOWN GALERUCINE FROM TURKEY, WITH A DESCRIPTION OF THE FEMALE, ADDITIONS TO THE DESCRIPTION OF THE MALE, AND ECOLOGICAL REMARKS[1]

Ali Gök,[2] Ebru Gül Aslan,[2] and Baran Aslan[3]

ABSTRACT: *Xanthogaleruca subcoerulescens* (Weise, 1884), has been rediscovered recently in southern Turkey. Beetles were found feeding on the leaves of *Celtis glabrata* Steven ex Planchon (Ulmaceae), leaving behind small, round holes. Redescriptions of the male and female are presented. The spermatheca is illustrated for the first time.

KEY WORDS: Chrysomelidae, Galerucinae, *Xanthogaleruca subcoerulescens,* host plant, Turkey

The genus *Xanthogaleruca* Laboissière, 1934 is characterized by the following combination of characters: body oblong, parallel-sided, upperside pubescent; third antennomere equal to fourth or a little shorter, following segments about twice as long as wide; aedeagus with a remarkable long internal comb-shaped sclerite (Silfverberg, 1974; Beenen, 2003; Warchalowski, 2003).

Xanthogaleruca is represented by two species throughout the western Palearctic region: *X. luteola* (Müller, 1766) and *X. subcoerulescens* (see Silfverberg, 1974; Beenen, 2003). *Xanthogaleruca luteola* is a well-known species with a large distribution area in the western Palearctic region, including Turkey (Silfverberg, 1974; Warchalowski, 2003). However, *X. subcoerulescens* is known only from Turkey (Weise, 1884; Silfverberg, 1974; Beenen, 2003; Warchalowski, 2003).

Xanthogaleruca subcoerulescens was first described based on a single male specimen collected from Amasya (Turkey) by Weise (1884). This was a very brief description lacking illustrations. Then, the species went unrecorded for about a century. During faunistic trips in the southern provinces of Turkey between 1988 and 1993, a few specimens of *X. subcoerulescens* were collected outside the type locality. Beenen (2003) dealt with these specimens in his recent paper which included illustrations of male genitalia and a key for western Palearctic species of the genus *Xanthogaleruca.* Neither the original description nor Beenen's paper contain a description of the female or data on host plant and habitat. In 2005, during a field research in southwest Turkey, specimens of *X. subcoerulescens* were found feeding on leaves of *Celtis glabrata* Steven ex Planchon (Ulmaceae).

The goals of this paper are to supplement the original description of *X. subcoerulescens* with a description of the female, to add to the description of the male with illustrations of the aedeagus, and to provide information on habitat and host plant.

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METHODS

This study was based on *X. subcoerulescens* specimens collected in Antalya (Turkey) by the authors. Samples were taken from the host plant using an aspirator and sweep net. Genitalia were photographed with a Camedia C-5060 digital camera attached to an Olympus SZX12 stereomicroscope. Ten specimens (5 males and 5 females), including the largest and smallest ones of each sex were used for measurements. Voucher specimens are deposited at the Department of Biology, Faculty of Arts and Sciences, Süleyman Demirel University, Turkey. The ecological notes are summarized from personal observations.

SYSTEMIC ENTOMOLOGY

***Xanthogaleruca subcoerulescens* (Weise, 1884)**

Description of the female. Body parallel, 5.58 - 5.73 mm long, covered entirely with long white hairs. Macropterous. Head, pronotum, legs and the ventral part of antennomeres 1-7 pale yellow; elytra dark brown with usually bluish sheen, or dark reddish in some specimens. Venter: underside yellowish in the greatest part; metasternites moderately black; all abdominal sternites pale yellow with a black spot at both side of each sternite. Legs entirely pale yellow. The last abdominal sternite very slightly emarginate.

Head: maximum width of head 1.27-1.31 mm, distance across the eyes 0.72-0.75 mm. Vertex with deep and dense punctures, and a fine and regular median longitudinal impression. Frontal tubercles distinct; raised; impunctate and glabrous. Antennae pubescent; segments 1-7 black dorsally, yellow ventrally; the remaining segments completely black. Frontal keel evident; lateral margins with hairs. Labrum with eight regular, large bristles. Mandibles small, black apically; palps yellow.

Pronotum: maximum width about 2.02 mm; maximum length 1.01 mm. Front margin of pronotum slightly arched. Margin of lateral borders small; lateral margins faintly rounded from front to base. Upper surface of pronotum rather punctate; punctures mostly large. Pronatal disc with 1-3 black spots in the middle; a large hollow at each side of the disc.

Scutellum: broad and moderately rounded; punctation sparser than on pronotum and elytra.

Elytra: almost parallel; maximum width about 2.93 mm; maximum length 4.53 mm. Lateral margins quite visible from above; flat and broad; gradually narrowing from base to apex, disappearing at apex. Humeral calli well-developed; elytral margin becoming slightly narrow just behind the humerus, extending again to the apex. Elytra coarsely and densely punctate; covered completely with white hairs. Elytral epipleura distinct; wide at base, narrowing gradually towards apex.

Spermatheca: nodulus of spermatheca moderately long with transverse wrinkles, roundish at the base; cornu long, thin, hook-shaped; ductus short, attached to dorsal side of nodulus (Figure 1A).

Sexual dimorphism: Males resemble females except for the following traits: body length 5.13-5.47 mm (5.58 - 5.73 in females); antennomeres 1-8 black dorsally, yellow ventrally; antennomere 9 black dorsally, partly brownish-black ventrally (antennomeres 1-7 black dorsally, yellow ventrally; the remaining antennomere completely black on females); the last two antennomeres completely black;

the last abdominal sternite distinctly and deeply emarginated (very slightly emarginate in the female). *Aedeagus:* about 2.02 mm in length; quite typical, slender with a strongly elongate apex; apex slightly curved dorsally in lateral view (Figure 1B); characterized by the presence of a long internal comb-shaped sclerite which is also treated as an important distinctive feature of the genus *Xanthogaleruca* (Figure 1C).

Habitat and host plant: Beetles were collected during July, August, and September from a mountain slope in Dibek Nature Reserve (Antalya) at an elevation of 1362 m above sea level. The scrubland consists mainly of *Quercus* spp. (Fagaceae), *Juniperus* spp. (Cupressaceae) and *Crataegus* spp. (Rosaceae) interspersed with *Cedrus* spp. (Pinaceae) at the higher elevations. Adult *X. subcoerulescens* were found feeding on the leaves of a shrub or small tree with shiny, glabrous twigs, *Celtis glabrata* Steven ex Planchon (Ulmaceae), leaving behind tiny, round (approximately 4 mm) holes.

Fully grown leaves of *C. glabrata* are 2.5-8.0 x 2.0-5.0 cm; yellowish green; broadly ovate to narrowly ovate, sometimes serrate in shape. The fruit, a drupe, is globose, yellow to orange. *Celtis glabrata* mainly occurs in open rocky slopes

Figure 1. *Xanthogaleruca subcoerulescens* (Weise), genitalia. (A) spermatheca; (B) aedeagus lateral view; (C) aedeagus dorsal view Scale bar = 0.5 mm.

between the altitudes of 650-1370(-1800) m and it is widely distributed in Turkey, the Balkans, Crimea, Caucasia, Iran and northern Iraq (Davis, 1982).

Material Examined: SW Turkey, Antalya, Kumluca, Dibek Nature Reserve (36° 38' 76" N, 30° 16' 78" E), 1362 m, 16.07.2005, 9 males, 7 females; 06.08.2005, 8 males, 6 females; 10.09.2005, 10 males, 7 females.

DISCUSSION

Although the classification of *Xanthogaleruca* is not settled (Beenen, 2003), it is widely recognized as a genus with two western Palearctic species. *Xanthogaleruca luteola* has been known from central and south Europe, Caucasus, Central Asia, Turkey, Iran, North Africa, and North America, where it was introduced (Silfverberg, 1974; Gruev and Tomov, 1998; Beenen, 2003; Warchalowski, 2003). *Xanthogaleruca subcoerulescens* is a less studied species, recorded only from Turkey up to now (Silfverberg, 1974; Beenen, 2003; Warchalowski, 2003). Its type locality was Amasya, located in northern Turkey. Additionally, it has been recorded from Adana, Antalya, and Içel situated in southern Turkey (Beenen, 2003). This distributional disjunction can now be explained by the parallel distribution of the host plant. *Celtis glabrata* has a scattered distribution in central, northern, eastern and southern Turkey (Davis, 1982). We predict that *X. subcoerulescens* should be present in all except western Turkey where the host plant, *C. glabrata,* does not occur. *Xanthogaleruca luteola* feeds on *Ulmus* sp. (Ulmaceae) (Gruev and Tomov, 1998; Warchalowski, 2003), suggesting that species of *Xanthogaleruca* are associated with ulmaceans. Additionally, other factors may also affect the distribution of *X. subcoerulescens.*

There is variability in antennomere and coloration as well as beetle length. For instance, in the key to western Palearctic species of *Xanthogaleruca* (Beenen, 2003), the legs and antennae are reported as black. However, in our samples legs are entirely pale yellow and antennomeres 1-8 (in female 1-7) are black dorsally, yellow ventrally. According to Warchalowski (2003), the length of *X. subcoerulescens* is about 4.5 mm, the specimens which Beenen (2003) examined were 7-8 mm; whereas our specimens are 5-6 mm long.

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HETEROCERAN FAUNA OF GÖKÇEADA AND BOZCAADA (NORTH AEGEAN ISLANDS, TURKEY), WITH A NEW RECORD OF NOCTUIDAE (LEPIDOPTERA), AND BIOGEOGRAPHICAL ANALYSES[1]

Zuhal Okyar[2] and Nihat Aktac[2]

ABSTRACT: During 1988-1989, 72 species of heterocerans (Lepidoptera) were collected and identified in Gökçeada and Bozcaada islands. One species collected on Gökçeada *Caradrina ingrata* (Staudinger, 1897), is the first record for Turkey and the North Aegean Islands. All identified species are first records for Gökçeada and Bozcaada, whereas 32 of them are first records of heterocerans for the North Aegean Islands.

KEY WORDS: North Aegean Islands, Gökçeada, Bozcaada, Heterocera, Lepidoptera, fauna, new record

Islands are areas somewhat independent from continents that tend to have peculiar ecological conditions and Islands biogeographic characteristics. Compared to the continent, species diversity can be different in islands that are completely isolated.

The study of the heteroceran Lepidoptera of the Greek islands of Thasos, Limnos, and Samothraki began with Staudinger (1870) followed by Beier (1936), Reiser (1946), Rebel (1935, 1938), and Koutsaftikis (1970, 1973). In total, 250 species of Heterocera have been identified. Many of these species were the first records for the Balkans, Greece, and the Aegean Sea island fauna (Koutsaftikis, 1973). However, up to the present study, no heteroceran lepidopteran has been recorded for the islands of Gökçeada and Bozcaada. There is only one study on Gökçeada's lepidopterans (Kılıç, 1987) that included 32 diurnal species.

METHODS

The current study was performed expecting that the heteroceran Lepidoptera fauna of islands possessing typical features of Mediterranean region climate and vegetation, such as Gökçeada and Bozcaada, should be represented by more species than the number of species collected from this region previously. Adult specimens were collected from various habitats such as woodlands, orchards and cultivated areas, areas around water channels and areas where small sized annual plants (*Inula* sp. and *Carthamus* sp., Asteraceae) present of Gökçeada and Bozcaada in 1998 and 1999. Collections were made only during their peak active months (between April and October), thus excluding the species which would possibly be found during the winter period and nonadult stages of all species. Materials were also collected with a light trap and a sweeping net during the day.

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Specimens were prepared and identified and prepared following the methods used by previous researchers (Pierce, 1967; Kornoşor, 1982; Fernandez, 1986). Expert identified specimens, deposited both at Trakya University (Science and Art Faculty, Biology Department) and at Cukurova University (Agriculture Faculty Plant Protection Department), were utilized to identify the species. Faunistic studies done for neighboring countries (Hacker, 1989, 1990; Dufay, 1975; Kloet and Hincks, 1972) and systematic studies were also used (Staudinger, 1878, 1881; Pierce, 1967, 1978; Forster and Wohlfahrt, 1971; Wolfsberger, 1965, 1971; Scheuringer, 1972; Bustillo and Varela, 1981; Arnsheid, 1981; Calle, 1982; Rezbanyai-Reser, 1983, 1986; Vardikyan, 1985; Skou, 1986; Freina and Witt, 1987; Kornoşor, 1987; Hacker, 1990; Fibiger, 1993; Rezbanyai-Reser et al., 1997; Hausmann, 2001; Hacker et al., 2002; Mironov, 2003; Hacker, 2004; http://www.faunaeur.org/index.php). The study islands and the collecting localities are shown in Figure 1.

RESULTS

Fifty-two genera and 72 species belonging to 8 families were identified in the islands. Of these, 1 genus and 1 species belong to the Hepialidae, 1 genus and 1 species to the Pyralidae, 15 genera and 27 species to the Geometridae, 5 genera and 5 species to the Sphingidae, 2 genera and 2 species to the Notodontidae, 2 genera and 2 species to the Lymantridae, 2 genera and 2 species to the Arctidae and 25 genera and 32 species to the Noctuidae. All identified species are first records for Gökçeada and Bozcaada. Thirty-two of these species (*H. sylvina, T. smaragdaria, T. fimbrialis, C. pendularia, T. comea, S. flaccidaria, I. dilutaria, I. dimidiata, I. subsericeata, I. filicata, I. politaria, I. rusticata, I. determinata, E. centaurata, C. aestimaria, C. pennaria, E. regina, L. populi, M. quercus, T. pityocampa, E. chrysorrhoea, P. palpina, E. crypta, N. orbona, M. albipuncta, P. effusa, T. matura, C. ingrata, C. clavipalpis, A. melanura, A. triplasia, P. plumigeralis*) are also first records for the North Aegean Islands (Table 1). *Caradrina ingrata* Staudinger, 1897 caught in Gökçeada is the first record for Turkey and North Aegean Islands' Noctuidae fauna.

Noctuidae

Caradrina ingrata Staudinger, 1897, Dt.Ent.Z.Iris 10:175

Material Examined: Çanakkale-Gökçeada-Agricultural Management Office, 22.09.1998, 1 ♂ (Fig. 1).

Geographical Distribution: Middle Italy (Wolfsberger, 1965, 1971; Scheuringer, 1972); The Alps (Arnscheid, 1981); North Half of Spain (Calle, 1982); Syria, Libya, Israel, Iraq, Arab Peninsula, Egypt (Hacker, 1990); Greece-Crete (Hacker, 2004).

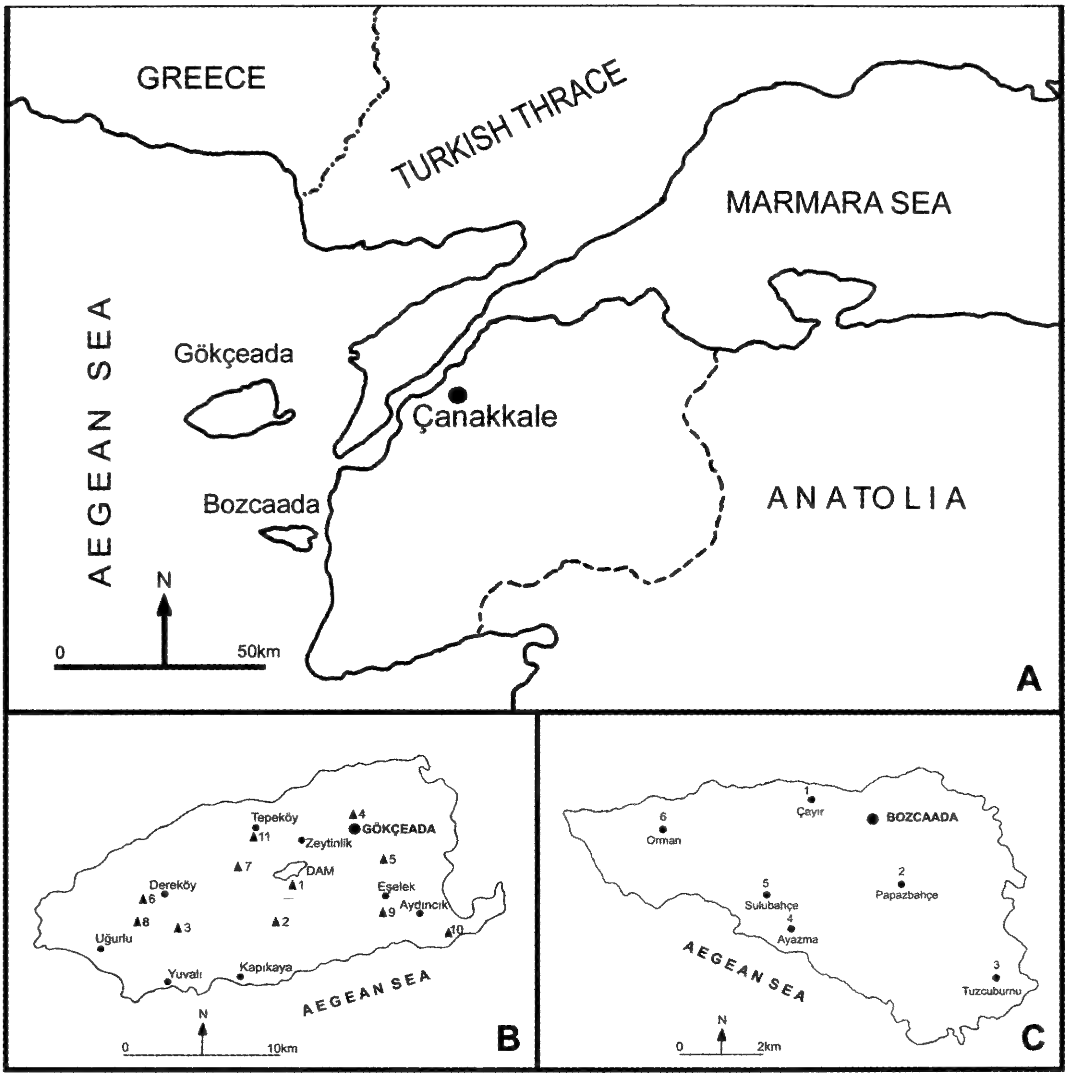


Figure 1. A. The Location of the Islands of Gökçeada and Bozcaada in the Aegean Sea. ----: Çanakkale city border; B. Collecting sites in Gökçeada, (▲ 4. Collecting site of *C. ingrata:* Agricultural Management Office); C. Collecting sites in Bozcaada.

Table 1. Distribution of the species that identified in Gökçeada and Bozcaada in neighboring countries. Asterisk,*, means first record for Turkey and North Aegean Islands' noctuid fauna.

SPECIES / **NEIGHBORING COUNTRIES**	Gökçeada	Bozcaada	Aegean Islands	Greece	Bulgaria	Turkey
HEPIALIDAE						
1. *Hepialus sylvina* (Linnaeus, 1761)	+	+		+	+	+
PYRALIDAE						
2. *Pyrausta aurata* (Scopoli, 1763)	+		+	+	+	+
GEOMETRIDAE						
3. *Thetidia smaragdaria* Fabricius, 1787	+			+	+	+
4. *Thalera fimbrialis* (Scopoli, 1763)	+	+		+	+	+
5. *Cyclophora pendularia* (Clerck, 1759)	+				+	+
6. *Timandra comea* Schmidt, 1931	+			+	+	+
7. *Scopula marginepunctata* (Goeze, 1781)	+		+	+	+	+
8. *Scopula imitaria* (Hübner, 1799)	+		+	+	+	+
9. *Scopula flaccidaria* (Zeller, 1852)	+			+	+	+
10. *Idaea ochrata* (Scopoli, 1763)	+	+	+	+	+	+
11. *Idaea dilutaria* (Hübner, 1799)	+			+	+	+
12. *Idaea seriata* (Schrank, 1802)	+		+	+	+	+
13. *Idaea dimidiata* (Hufnagel, 1767)	+			+	+	+
14. *Idaea subsericeata* (Haworth, 1809)	+			+	+	+
15. *Idaea filicata* (Hübner, 1799)	+			+	+	+
16. *Idaea politaria* (Hübner, 1799)	+			+	+	+
17. *Idaea rusticata* (Denis-Schiffermüller, 1775)	+			+	+	+
18. *Idaea palaestinensis* (Sterneck, 1933)	+		+	+		+
19. *Idaea determinata* (Staudinger, 1876)	+			+	+	+
20. *Rhodometra sacraria* (Linnaeus, 1767)	+	+	+	+	+	+
21. *Xanthorhoe fluctuata* (Linnaeus, 1758)	+		+	+	+	+
22. *Camptogramma bilineata* (Linnaeus, 1758)	+		+	+	+	+
23. *Eupithecia breviculata* (Donzel, 1837)	+		+	+	+	+
24. *Eupithecia centaurata* (Denis-Schiffermüller, 1775)	+	+		+	+	+
25. *Isturgia arenacearia* (Denis-Schiffermüller, 1775)	+		+	+	+	+

SPECIES / NEIGHBORING COUNTRIES	Gökçeada	Bozcaada	Aegean Islands	Greece	Bulgaria	Turkey
26. *Chiasmia aestimaria* Hübner, 1809	+			+	+	+
27. *Colotois pennaria* (Linnaeus, 1761)	+			+	+	+
28. *Eumera regina* Staudinger, 1892		+		+	+	+
29. *Aspilates ochrearia* (Rossi, 1794)	+		+	+	+	+
SPHINGIDAE						
30. *Laothoe populi* (Linnaeus, 1758)	+	+		+	+	+
31. *Marumba quercus* (Denis-Schiffermüller, 1775)	+			+	+	+
32. *Agrius convolvuli* (Linnaeus, 1758)		+	+	+	+	+
33. *Macroglossum stellatarum* (Linnaeus, 1758	+	+	+	+	+	+
34. *Hyles livornica* (Esper, 1780)	+		+	+	+	+
NOTODONTIDAE						
35. *Traumetopoea pityocampa* (Denis-Schiffermüller, 1775)	+			+	+	+
36. *Pterostoma palpinum* (Clerck, 1759)						
LYMANTRIIDAE						
37. *Lymantria dispar* (Linnaeus, 1758)	+	+	+	+	+	+
38. *Euproctis chrysorrhoea* (Linnaeus, 1758)	+			+	+	+
ARCTIIDAE						
39. *Pragmatobia fuliginosa* (Linnaeus, 1758)	+		+	+		+
40. *Arctia villica* (Linnaeus, 1758)	+		+	+	+	+
NOCTUIDAE						
41. *Euxoa crypta* (Dadd, 1927)		+		+		+
42. *Agrotis ipsilon* (Hufnagel, 1766)	+		+	+	+	+
43. *Noctua orbona* (Hufnagel, 1766)	+			+	+	+
44. *Noctua comes* Hübner, 1813	+		+	+	+	+
45. *Peridroma saucia* (Hübner, 1808)	+		+	+	+	+
46. *Hadula trifolii* (Hufnagel, 1766)	+		+	+	+	+
47. *Hecatera dysodea* (Denis-Schiffermüller, 1775)	+		+	+	+	+
48. *Mythimna albipuncta* (Denis-Schiffermüller, 1775)	+			+	+	+
49. *Mythimna unipuncta* (Haworth, 1809)	+		+	+	+	+
50. *Acronicta rumicis* (Linnaeus, 1758)	+		+	+	+	+

SPECIES NEIGHBORING COUNTRIES	Gökçeada	Bozcaada	Aegean Islands	Greece	Bulgaria	Turkey
51. *Pyrois effusa* (Boisduval, 1828)	+			+	+	+
52. *Thalpophila matura* (Hufnagel, 1766)	+			+	+	+
53. *Caradrina ingrata* Staudinger, 1897 *	+					
54. *Caradrina clavipalpis* (Scopoli, 1763)	+			+	+	+
55. *Spodoptera exigua* (Hübner, 1808)	+		+	+	+	+
56. *Heliothis peltigera* (Denis-Schiffermüller, 1775)	+	+	+	+	+	+
57. *Protoschinia scutosa* (Denis-Schiffermüller, 1775)	+		+	+	+	+
58. *Emmelia trabealis* (Scopoli, 1763)	+		+	+	+	+
59. *Acontia melanura* (Tauscher, 1809)	+			+	+	+
60. *Acontia lucida* (Hufnagel, 1766)	+		+	+	+	+
61. *Abrostola triplasia* (Linnaeus, 1758)	+			+	+	+
62. *Autographa gamma* (Linnaeus, 1758)	+		+	+	+	+
63. *Trichoplusia ni* (Hübner, 1803)	+		+	+	+	+
64. *Catocala elocata* (Esper, 1787)		+	+	+	+	+
65. *Catocala conjuncta* (Esper, 1787)	+		+	+	+	+
66. *Catocala conversa* (Esper, 1783)	+		+	+	+	+
67. *Catocala nymphagoga* (Esper, 1787)	+		+	+	+	+
68. *Dysgonia algira* (Linnaeus, 1767)	+		+	+	+	+
69. *Grammodes stolida* (Fabricius, 1775)	+		+	+	+	+
70. *Euclidia glyphica* (Linnaeus, 1758)	+		+	+	+	+
71. *Tyta luctuosa* (Denis-Schiffermüller, 1775)	+	+	+	+	+	+
72. *Polypogon plumigeralis* (Hübner, 1825)	+			+	+	+
Totals	**68**	**14**	**40**	**70**	**69**	**71**

Caradrina ingrata (Staudinger, 1897) is a first record for Turkey and North Aegean Islands. *Caradrina ingrata* (Staudinger, 1897) collected in Gökçeada is a suprameditterranian-asiatic member according to Bustillo and Vaela (1981). Thus far, it has been reported from middle Italy, the Alps (Wolfsberger, 1965, 1971; Scheuringer, 1972; Arnscheid, 1981), northern half of Spain (Calle, 1982, Draudt, 1934), south France, and Switzerland (Rezbanyai-Reser, 1983). Outside Europe, *C. ingrata* has also been found in Syria, Palestine (Warren, 1914; Draudt, 1934), Libya, Israel, the Arabic Peninsula, Egypt (Hacker, 1990), and Greece-Crete (Hacker, 2004). Rezbanyai-Reser (1983) has questioned whether *C. ingrata* is a newly discovered native species in Middle Europe or a migrant.

He reported that more investigations must be done to clarify the situation. Because *C. ingrata* resembles *C. clavipalpis* in terms of external morphology, Rezbanyai-Reser (1983) emphasized that specimens identified as *C. clavipalpis* should be reidentified using external genital organ investigations (Figure 2). By doing so, the existence of *C. ingrata* in previous years in Europe perhaps will be clarified.

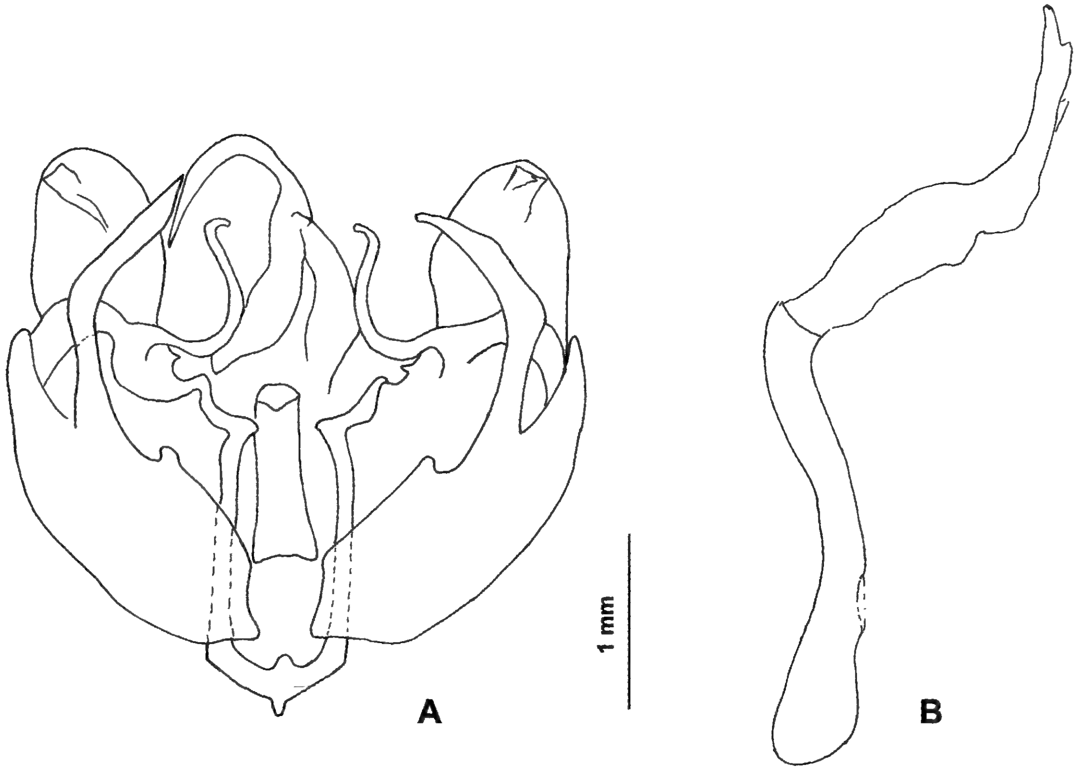


Figure 2. *Caradrina ingrata* Staudinger, 1897. Male external genital organs. A. Valve, B. Aedeagus.

BIOGEOGRAPHICAL ANALYSES

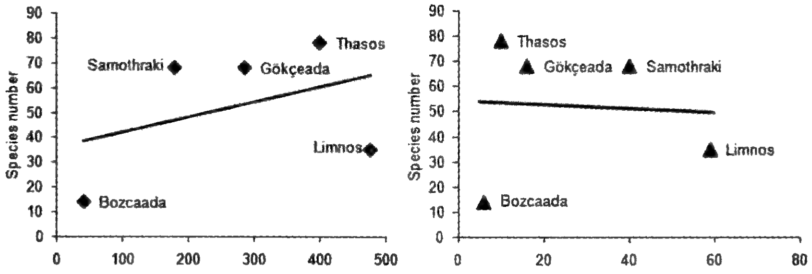
Seventy-one species identified in Gökçeada and Bozcaada show similarities with the Heterocera fauna of Turkey. Similarly, 69, 70 and 40 species show similarity with Heterocera fauna of Bulgaria, Greece and Aegean islands (Table 1). The data given above show that the heteroceran fauna of Gökçeada and Bozcaada have great similarity with that of the mainland.

Seventy-eight species from Thasos, the North Aegean Island, 68 species from Samothraki and 35 species from Limnos were identified (Koutsaftikis 1973). When the nearness of the islands to the continent, their surface areas and the vegetation types present here are taken into consideration, it is reasonable to say that 68 species identified in Gökçeada and 14 species identified in Bozcaada make the number of species in these islands to be in expected values. During the study, 68 of 72 species were identified in Gökçeada, but only 14 species were found in Bozcaada. This relatively low number in Bozcaada is somewhat surprising. Perhaps the predominant xerophyllous and herbaceous vegetation and the continuous wind limit species diversity in Bozcaada.

The theory of island biogeography holds that the number of species found on an island is directly related by island size and inversely related to the distance from the mainland. These would affect the rates of extinction and immigration on the islands. For instance, islands closer to the mainland are more likely to receive immigrants than those far from the mainland. The chance of extinction on smaller islands is greater than on larger ones. Thus, larger islands can hold more species than smaller ones (Mac Arthur and Wilson, 1967). Larger islands closer to the mainland are predicted to hold more species than tiny islands located far from the mainland.

Table 2. Surface areas, the distances to mainland and the number of species kept of five islands in the northern Aegean Sea. Data from Erinç and Yücel (1988), http://www.holiday-european-island.eu/Greece.php, http://thasos.netfirms.com/ index.htm, http://www.wikipedia.org/wiki/Samothrace, http://tr.wikipedia.org/wiki/Bozcaada.

Island Name	**Area (km2)**	**Distance (km) from nearest mainland**	**Number of species olf Heterocera**
Bozcaada	40	6	14
Gökçeada	285	16	68
Limnos	476	59	35
Thasos	399	10	78
Samothraki	178	40	68



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Figures 3-4. Relationship between area and numbers of species on five islands in the northern Aegean Sea. Relationship between distances to the mainland and numbers of species of five islands in the northern Aegean Sea.

When Bozcaada, Gökçeada, Limnos, Thasos, Samothraki are compared according to their surface areas, the distance from the mainland, and the number of species they possess (Table 2), it appears that there is a weak correlation between the number of species and surface area (Fig. 3, $r = 0.392$; in semi-log scale $\log r = 0.633$, $p > 0.05$). There is also a weak negative correlation between the number of species and the distance from mainland (Fig. 4, $r = -0.063$; in semi-log scale, $\log r = 0.16$, $p > 0.05$). Although Samothraki Island seems not to fit island biogeography theory (Table 2), this situation can be explained by the fact that it is probably exposed to continuing migrations from the mainland, both Turkish Thrace and Greece, never reaching equilibrium. Also, Samothraki was studied by Koutsaftikis (1973). He also collected his specimens using light traps and only during active period, not during the winter, as we did. We do not know whether he collected nonadult stages. Both the continuing dispersal of lepidopterans from the mainland to Gökçeada and Bozcaada and shipping activities providing a continuous link between these land masses diminish the likelihood of isolation.

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LONG-RANGE DISPERSAL POSSIBILITIES VIA SEA TURTLE - A CASE FOR *CLUNIO* AND *PONTOMYIA* (DIPTERA: CHIRONOMIDAE) IN PUERTO RICO[1]

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ABSTRACT: Larvae of the marine midges *Clunio* and *Pontomyia* are reported as epibionts on the carapace of sea turtles. Turtle transportation may be an important factor in the dispersal of flightless marine midges.

KEY WORDS: long range dispersal, *Clunio, Pontomyia,* Diptera, Chironomidae, turtles, Puerto Rico

Pontomyia Edwards (Diptera: Chironomidae) is considered the only truly marine midge (Pinder 1995), occurring at depths down to 30 meters in Belize (Bretschko 1982) as well as in shallow coastal waters (Hashimoto 1976; Epler 2001). Larval *Pontomyia* and *Clunio* Haliday have been found associated with algae and are commonly collected in benthic samples and plankton tows (Tokunaga 1932; Hashimoto 1959). Most reports of *Pontomyia* species are from Indo-Pacific locations (Soong et al., 1999), but a single report exists from the Caribbean (Bretschko 1982), and Hudson et al. (1990) and Epler (1992, 1995, 2001) have reported the genus from Florida. *Clunio* has a worldwide distribution along temperate and tropical sea coasts. This note describes the presence of *Pontomyia* sp. and *Clunio* sp. as Hawksbill sea turtle [*Eretmochelys imbricata* (L.)] epibiota in Puerto Rico.

Previous studies of marine turtle epibiota have reported diverse assemblages of marine organisms (Caine 1986; Frick et al., 1998; Schärer 2003). Special reports have been generated for epibiotic groups such as barnacles (Bugoni et al., 2001; Gramentz 1988; Matsuura and Nakamura 1993; Monroe and Limpus 1979), mollusks (Frazier et al., 1985), crabs (Davenport 1994; Dellinger et al., 1997; Frick et al., 2000), tunicates (Frazier et al., 1991), Bryozoa (Frazier et al., 1992), and algae (Senties et al., 1999). Although midge larvae have been reported as commensals or parasites on a wide variety of invertebrates and vertebrates (Tokeshi 1993, 1995; Epler 2001), chironomids have not previously been reported as epibionts on marine turtles. This research theme may provide knowledge about the dispersal of epibionts as well as insight into habitat use and migrations by their hosts. Marine turtles inhabit coastal areas where intertidal organisms are present, and surfacing through the water column increases the likelihood for acquiring planktonic and benthic larval organisms. Results of epibiotic community studies on *E. imbricata* have identified groups previously unrecorded, such as the only known submarine Chironomidae.

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Mona Island and satellite Monito Island are located in the Mona Passage, between Puerto Rico and the Dominican Republic, approximately 75 km west of Puerto Rico, between 18° 00' N and 18° 13' N and between 67° 01' W and 67° 48' W. The islands' coasts are surrounded by limestone vertical walls, seagrass lagoons, reefs, and sandy beaches, which are nesting habitat for marine turtles. The water temperatures around Mona fluctuated between 25.5° and 30.5°C throughout the year. The islands' coasts provide foraging habitat for endangered species of sea turtles [*E. imbricata* and *Chelonia mydas* (L.)].

The epibiota were identified from 105 turtles collected in July and August of 1999. *Pontomyia* and *Clunio* larvae were present on 19 turtles (18%) which were also covered with patches of filamentous turf algae. This turtle-chironomid association was more frequent in coral reef (17 of 39) vs. cliff wall areas (2 of 66). Percent occurrence of chironomids was ten times higher on turtles of coral reef habitat (35.8%) than in cliff walls (3.0%); the difference is significant at $p < 0.001$ in Chi^2, 2x2 contingency tables ($X^2 = 22.7$).

Individual *Pontomyia* and *Clunio* larvae were observed in the samples collected, swimming and crawling within algae and unconsolidated substrate composed of calcareous sediment, with foraminiferan tests, small shells, and other unidentified fragments. Chironomids were also observed within tubes of sand particles probably constructed by the larvae. The turtle project was not designed as a midge study; thus the numbers of larvae on each turtle were not recorded, only their frequency of occurrence was noted. The more frequent occurrence of larvae on turtles from coral reef habitat compared to those from cliff wall habitat may be related to the accumulation of sand and turf algae on the carapace of coral reef turtles; in cliff wall habitats this accumulation was less common.

Because only larvae were collected from the turtles, it was not possible to identify specimens of either genus to species. Only one species of *Clunio*, *C. marshalli* Stone and Wirth, has been described from the northwestern Atlantic, with a northernmost record from North Carolina (Epler 2001). The identity of the south Florida/Caribbean species of *Pontomyia* is unknown, because adult males, necessary for species identification, have not been collected. Bretschko (1982) suggested the most likely species would be *P. natans* Edwards, but the insects collected in the Caribbean and Florida could represent an undescribed species. Because Bretschko collected only larvae, pupae and females, he postulated that the Belize population may be parthenogenetic.

According to Soong et al., (1999), *P. oceana* Tokunaga larvae hatch and molt through 4 instars in a generation time of 30 days. Larvae lived up to 45 days under laboratory conditions; adult life stages lasted one to two hours. Soong et al. (1999) stated that the presence of males appears to be necessary for eclosion of females, but offered no explanation. In another marine midge, *Clunio marinus* Haliday, males must strip the pupal exuviae from females before mating (several papers summarized by Armitage 1995). Cheng and Collins (1980) hypothesized that such behavior may occur in *Pontomyia*, but it has never, to our knowledge, been observed.

In some parthenogenetic chironomid taxa, such as *Paratanytarsus grimmii* (Schneider), at least some eggs may be deposited within the pupal exuviae before eclosion (Langton et al., 1988) or all eggs may be laid within the pupal exuviae by uneclosed females (P. S. Cranston, pers. comm.). Thus eclosion, whether aided by males or not, may not be necessary for successful reproduction. Bretschko (1982) did not report any eggs within pupal exuviae.

Clunio males are fully winged and have been collected in light traps in the Florida Keys (Hribar and Epler 2007), but females of *Clunio* and *Pontomyia* are wingless (and essentially legless). *Pontomyia* males possess shortened wings, useless for flight, which are used as oars as the midges skate across the water's surface. Males of *Clunio* may be able to disperse by flight over great distances, but *Clunio* females and both sexes of *Pontomyia* would be unable to do so. Thus, sea turtles may provide a significant means for long range dispersal for members of these two genera. It could also be hypothesized that *Thalassomya,* another coastal marine genus that can occur with *Clunio* (Epler 2001), may eventually be found on the carapace of sea turtles. However, in *Thalassomya bureni* Wirth, along with the other known coastal marine species in the Gulf of Mexico, *Telmatogeton japonicus* Tokunaga, both sexes are fully winged.

Much has been written about the life history of marine midges and the influence of tidal, lunar and diel effects (see Armitage 1995 for summary), but little has been observed or hypothesized concerning the dispersal abilities of marine flightless midges. Cheng and Hashimoto (1978) offered two hypotheses: males dragging their mates *in copula* would be attracted to fishing vessels, with some egg masses adhering to the algae growing on the sides of the vessels; or eggs could be embedded in floating algal mats which are then dispersed by currents, etc. There appear to be no fossil records of flightless marine midges and we do not know the extent of distribution of these taxa before humans began plying the seas. The fishing vessel hypothesis may partially explain "modern" distribution and dispersal, but it cannot be tested without a fossil record.

Growth of the epibiotic community on a turtle may be enhanced by increased water flow over the carapace, increased exposure to light (when the turtle is surfacing to breathe), and protection from predation or escape from unfavorable conditions. The distribution of marine chironomids and *E. imbricata* overlap in Pacific and Caribbean tropical regions. Trans-Caribbean migrations of adult sea turtles (Van Dam and Diez, unpublished data) may provide for distribution of chironomid species with limited dispersal capabilities, such as *Clunio* and *Pontomyia.* With the recent report (Green and Sánchez 2006) of live midge larvae being transported in the feces of Black-tailed Godwits [Aves: Charadriiformes: Scolopacidae: *Limosa limosa* (L.)], biogeographical hypotheses for marine invertebrates with limited dispersion capabilities should also be reviewed in light of this new observation of turtle transportation. Or, in other words, testudine transportation of tiny tenacious "tendipedids" may partially account for their distribution.

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A LIGHT-TRAPPED ANT, *DOLICHODERUS BISPINOSUS* (FORMICIDAE) WITH EVIDENCE OF STYLOPIZATION BY MALE *CAENOCHOLAX FENYESI WALOFFI* (STREPSIPTERA: MYRMECOLACIDAE) FROM MEXICO[1]

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Jaime Gómez,[5] and Juan F. Barrera[3]

Most Strepsiptera (Insecta) are collected as free-living adult males from light or Malaise traps. The family Myrmecolacidae is exclusively night flying, and light-trapped Strepsiptera are typically adult male members of this family (Kathirithamby, unpublished). Of the 113 species of Myrmecolacidae described thus far (Kathirithamby 2006), only 6 have been found and definitely associated with their ant hosts (Kathirithamby and Johnston 2004; Kathirithamby, unpublished). The sexes in Myrmecolacidae have different hosts: males parasitize ants and females orthopterans (Ogloblin 1939; Kathirithamby and Hamilton 1972).

Only two stylopised ants had been discovered so far outside their nests (Westwood 1861; Ogloblin 1939). Ogloblin (1939) indicated that the behavior of ants is altered when stylopized stating that they: "change their nocturnal habits, acquiring positive phototropism, but evidently lose their social instincts, abandoning their nests and rambling singly, often climbing high on grass and bushes." Westwood (1861) notes "…a species of ant, which had ascended a tuft of grass on an extensive pattena (sic), or meadow, the parasite making its exit back to back from the ant." It was therefore assumed that stylopized ants abandoned the nest, thus explaining why they are rarely found: "The myrmecologists used, almost without exception, a special method of only collecting the ants in their nests, in order to get all forms of polymorphic colonies, mostly progeny of a single or of a few females. This method gave the students of ants little chance to meet stylopized specimens which evidently abandon the nest soon after the male parasites extert their puparium" (Ogloblin 1939). However, if this was what was happening, stylopized ants would be more frequently encountered because ants

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are one of the most abundant macroinvertebrates in terrestrial ecosystems (Kathirithamby and Hamilton 1972). More recently, Kathirithamby and Hamilton (1972) and Kathirithamby (2005) have speculated that, unlike stylopized wasps and bees, stylopized ants remain in the nest until the male strepsipteran is ready to emerge. This has been confirmed by the collection and dissections of several nests which contained ants parasitized by late pupal stages of male myrmecolacids (Kathirithamby 1991; Kathirithamby and Johnston 1992, 2004; Kathirithamby and Hughes 2002; Hughes et al., 2003). Until now, stylopized ants have not been found in traps. One such specimen was encountered during field collections in southeastern Mexico, and is reported here.

METHODS

A black light trap was set up and checked daily at Estación de Biología Tropical "Los Tuxtlas" Instituto de Biología (Universidad Nacional Autónoma de México), Km 30 Carretera Catemaco-Montepío, San Andrés Tuxtla, Veracruz, Mexico (18° 35'N 95° W). The trap, designated as ECOIAPAR-L, consists of an empty transparent plastic drinks bottle (2.0 l) with an opening (11 x 20 cm) on its side. The black light (20 watt fluorescent lamp black light blue) was suspended inside of the top of the bottle, and the insects trapped in soapy water at the bottom. The insects were sorted under a dissecting microscope, and preserved in ethanol.

RESULTS AND DISCUSSION

An empty strepsipteran puparium was noted in a male *Dolichoderus bispinosus* Olivier (Formicidae: Dolichoderinae). The puparial cap (cephalotheca) of *Caenocholax fenyesi waloffi* Kathirithamby and Johnston was hinged to the side of the puparium (Fig. 1). In Myrmecolacidae the male cephalotheca does not break all the way round as in other strepsipterans, but instead it "closes back" on the puparium after the emergence of the male (Kathirithamby 1991).

Description of the cephalotheca: An illustration of a cephalotheca of a myrmecolacid was given by Kinzelbach (1971), but the species name was not given. This is the first description of the cephalotheca of *C. f. waloffi* and of any named Myrmecolacidae. Length: 0.75mm. Width: 0.52mm. Complex eyes (e): Rudiments of ommatidia are presented as 22 small thickenings of the sclerite on either side of the cephalotheca. Antennal rudiments (ant) occur as a patch of pigments which represent the scapus and pedicellus, and a slight bulge enclosed within the pedicellus which represents the vestige of a flabellum. Mandibles (mdb): These appear during the last larval instar before extrusion and participate in the extrusion of the male larva through the host cuticle prior to pupation. These occur on either side below the eyes with an outward pointing tooth. Clypeus (cly): is a raised region in the center of the cephalotheca. Mouth opening (mth): below the clypeus. Labrum (lbr): lies just below the eyes. Hinge (h): was attached to the host and puparium within the host when the rest of the cephalotheca was broken by the emerging adult male *C. f. waloffi*. Vertex (vtx) and occipital suture (ocs) are found on the dorsal region of the cap.

Dolichoderus bispinosus has been recorded to be parasitized by *C. f. waloffi* (Kathirithamby and Johnston 2004), and although many workers and sexuals have been found to be stylopized in the nests, none have so far been found in the traps. This is the first record of an ant with an empty male strepsipteran pupa in a trap.

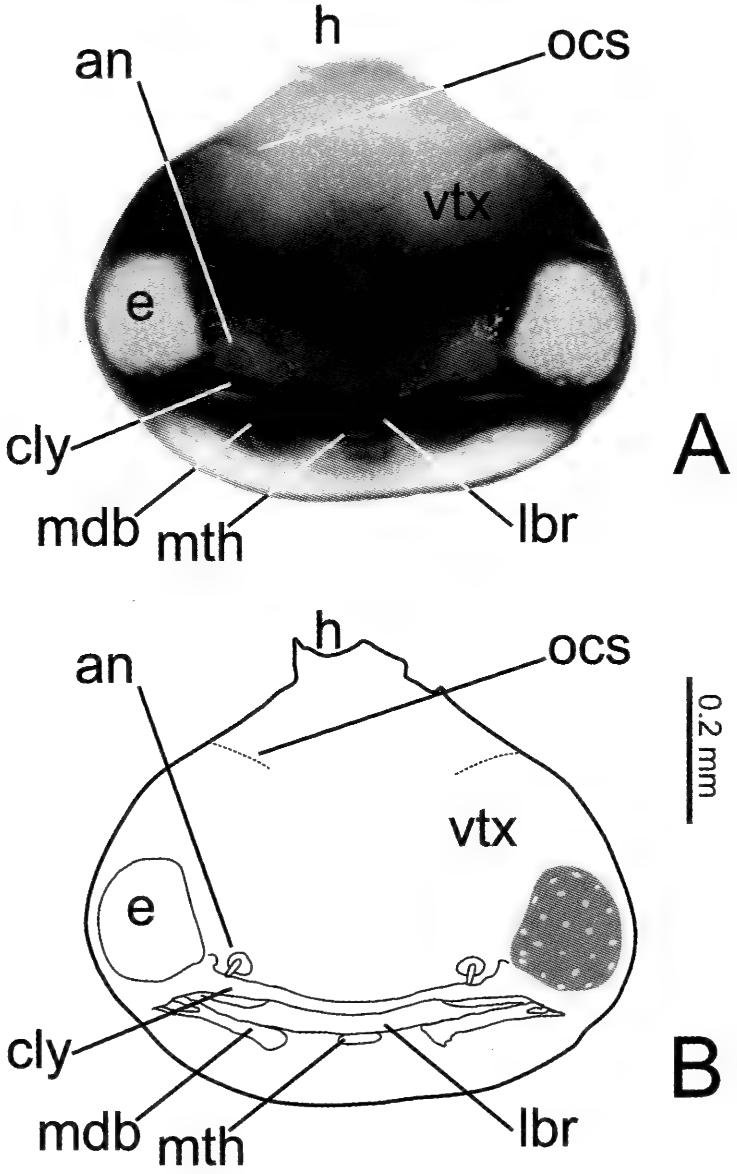

Fig. 1 Dorsal view of the male puparial cap (cephalotheca) of *Caenocholax fenyesi waloffi* Kathirithamby and Johnston (Strepsiptera: Myrmecolacidae) which was attached to a male *Dolichoderus bispinosus* Olivier (Formicidae: Dolichoderinae) A. Light microscope photograph. B. Line drawing, with position of eye facets indicated by shading. Abberviations: ant - antenna and antennal sclerite; cly - clypeus; e - compound eye; h - hinge of puparial cap; lbr - labrum; mdb - mandible; mth - mouth; ocs - occipital suture; vtx - vertex.

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MICRODON FALCATUS WILLISTON (DIPTERA: SYRPHIDAE): A REDESCRIPTION, WITH LECTOTYPE DESIGNATION AND NEW SYNONYMS[1]

F. Christian Thompson[2]

ABSTRACT: *Microdon falcatus* Williston 1887 (Diptera: Syrphidae) is redescribed. A lectotype is designated for the name and three new synonyms are proposed (*Microdon aquilinus* Giglio-Tos 1892, *Microdon hondanaria* Hull 1940, and *Microdon mellogutta* Hull 1943).

KEY WORDS: *Microdon falcatus,* Diptera, Syrphidae, redescrition, lectotype, synonyms, Neotropics

More than a century ago Williston (1887) described a small microdontine fly from the Isthmus of Tehuantepec (Mexico) and named the fly *Microdon falcatus,* due to the distinctive shape of the basoflagellomere. The basoflagellomere is elongate and curved, with its base swollen, and the arista is short and thick (Fig. 1-4). Giglio-Tos (1892) recognized the species and described a related one, *aquilinus,* but since then no one has recognized either name. Hull, however, did redescribe the species twice (Hull 1940, 1943), and upon the second time declared his "new" species was related to no known species. This situation represents a common problem in the study of the Neotropical flower fly fauna, lots of new species descriptions, but little synthetic, monograph work. As previously noted (Thompson et al., 1976: 1), the Neotropical fauna is undoubtedly the richest, most diverse one in the World and hundreds of new species await description, but first, two centuries of names must be resolved, so new synonymies are now more important than new species descriptions. The challenges are to understand the species, their characters, variation and distribution, then re-examine types of old names where available or original descriptions where types are lost. So, this paper makes one small step toward that goal of resolving the Neotropical flower fly fauna, so we can begin to fully and accurately enumerate it.

METHODS

This paper presents a revision of a species, with a complete synonymy, distributional and biological data for the species, as well as a lectotype designation and notes on the type specimens of each name. Adult terminology follows Thompson (1999), the abbreviations found in the synonymies follow Thompson (2006), the use of the asterisk in the distribution statement refers to verified records found in the material examined section, ellipses ("...") are used in the material examined section to replace data that is the same as the immediately preceding record. In the literature cited section, an attempt has been made to provide precise publication dates for all critical works (those with nomenclatural

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acts). These are in the numerical format of Year: Month: Day, with question marks used for unknown values. Color images of the species and more extensive information is provided at the Diptera WWW site under Flies and Syrphidae (see www.diptera.org/syrphid/syrphid.htm).

SYSTEMATIC ENTOMOLOGY

Microdon falcatus Williston

Microdon falcatus Williston 1887: 9. Mexico, Isthmus of Tehuantepec. LT ♂ USNM here designated. Williston 1891: 3 (key ref., Mexico [Guerrero), notes]; Giglio-Tos 1892: 36 (description, Mexico); Aldrich 1905: 345 (catalog citation); Kertész 1910: 355 (catalog citation); Fluke 1957: 26 (catalog citation); Thompson et al., 1976: 64 (catalog citation).

Microdon aquilinus Giglio-Tos 1892: 2. Mexico, Veracruz, Tuxpango. HT ♀ MRSN. Giglio-Tos 1893: 133 (description, Mexico); Aldrich 1905: 345 (catalog citation); Kertész 1910: 352 (catalog citation); Fluke 1957: 21 (catalog citation); Thompson et al., 1976: 63 (catalog citation). **NEW SYNONYM.**

Microdon hondurania Hull 1940: 247. Honduras, Salada River, 15 miles inland from Ceiba. HT ♂ CNC. Fluke 1957: 28 (catalog citation); Cooper and Cumming 1993: 65 (HT in CNC). **NEW SYNONYM.**

Microdon honduranius. Thompson et al., 1976: 247 (catalog citation).

Microdon mellogutta Hull 1943: 104. Brazil, Amazon. HT ♀ BMNH. Fluke 1957: 30 (catalog citation); Thompson et al., 1976: 66 (catalog citation). **NEW SYNONYM.**

Lectotype (Fig. 2) **Male. Head** (Fig. 3): Face yellowish orange, shiny, black pilose; facial stipe very narrow ventrally, expanded dorsally, brownish-white pollinose; lunule black; frons yellowish orange except for small black punctum just dorsad to antenna, shiny, black pilose; vertex yellowish orange except ocellar triangle black, black pilose; occiput narrow on ventral 3/4, expanded dorsally, black and grayish-white pollinose on ventral 3/4, yellowish orange dorsally, black pilose; antenna black, black pilose; basoflagellomere elongate and curved, with distinct round basolateral sensory pit; arista thick, about 3/4 as long as basoflagellomere, with very fine, short pile, with pile about ? as long as aristal diameter; antennal ratio 5:1:12.

Thorax: Postpronotum reddish orange, black pilose; scutum (Fig. 6) reddish orange except large medial and submedial black vittae which merge together along most of their length which is about medial 3/4 of scutum, black pilose; scutellum (Fig. 8) reddish yellow, black pilose, with small black microtrichose apical tubercle; pleuron yellow except pectus black, black pilose; anepisternum uniformly pilose dorsally; katepisternum pilose dorsally; anepimeron pilose; metasternum greatly reduced, bare; plumula short, pale; calypter brownish black; halter yellow with brown capitulum. **Legs.** black, black pilose. **Wing.** hyaline except veins diffusely brownish bordered; completely microtrichose; crossvein sc-r present; vein R4+5 with distinct spur; vein M1 (apical crossvein) straight, perpendicular to vein R4+5.

Abdomen (Fig. 7): Reddish orange, black pilose; 1st sternum narrow, pilose; male genitalia (Fig. 10) as figured, typical *Microdon* structure with apically furcate aedeagus; cercus simple; 9th tergum with short dense pile dorsally; surstyle triangular in lateral view with posteroventral process; aedeagus with short apical processes.

Length. 7 mm (LT), 5-10 mm; wing: 5 mm (LT), 5-6 mm.

Variation: As is usual with many syrphid species, color develops and darkens after the adult emerges. Freshly emerged adults (young specimens) appear paler (Fig. 6), whereas older ones are much darker (Fig. 5). Examination of specimens of *falcatus* indicates that the extent of pale (yellow to reddish orange) coloration on the scutum and abdomen is a factor of age, individual and geographic variation. Also, there is the normal sexual dimorphism related to the eyes and the female basoflagellomere is not so swolllen basally (Fig. 4).

The lectotype as described above is rather typical of the specimens from Mexico. The darkest individual specimen examined (Costa Rica, INBIO ... 459599, male) differs in having the frons completely brownish black, scutum and scutellum entirely brownish black and the abdomen almost entirely brownish black with only narrow pale areas along apical margin of 2nd tergum and basal and apicolateral margins of 4th tergum. The lightest individuals are the specimens from Brazil and Bolivia. In these the thorax and legs are entirely pale, yellow to orange, and pale pilose; the abdomen may have large brownish fasciate maculae on 3rd and 4th terga, but the abdomens are entirely pale pilose. Intermediate specimens have different combinations of partially pale legs (coxae, trochanters and basal 1/2 to 3/4 of femora pale), partially pale pilose scutella and scuta, dark frons, etc. So, there is a male specimen with black pilose scutellum, partially pale legs and dark frons (Costa Rica, INBIO ... 2426262) collected with a female specimen with pale pilose scutellum, partially pale legs and pale frons (Costa Rica, INBIO ... 2426255) ["with" means labeled as being of the same lot, same place, time and collector]. While comparison of typical specimens from Mexico with those from Brazil suggests differences that in many cases warrant species recognition, the various intermediate forms found in Costa Rica and Panama strongly suggest instead individual and geographic variation which will be confirmed when additional material from Colombia and Ecuador are studied. Hence, only one species is here recognized.

Types. *Microdon falcatus* Williston was described from 4 "female" specimens in the C. V. Riley collection from Tehuantepec. All these syntypes are still present in USNM collection, but are males! All have identical locality labels, but one is also labeled with a USNM type label and what appears to be a Williston determination label. This specimen is here designated lectotype to fix and ensure consistent interpretation of the name. This lectotype is labeled as follows (Fig. 9):

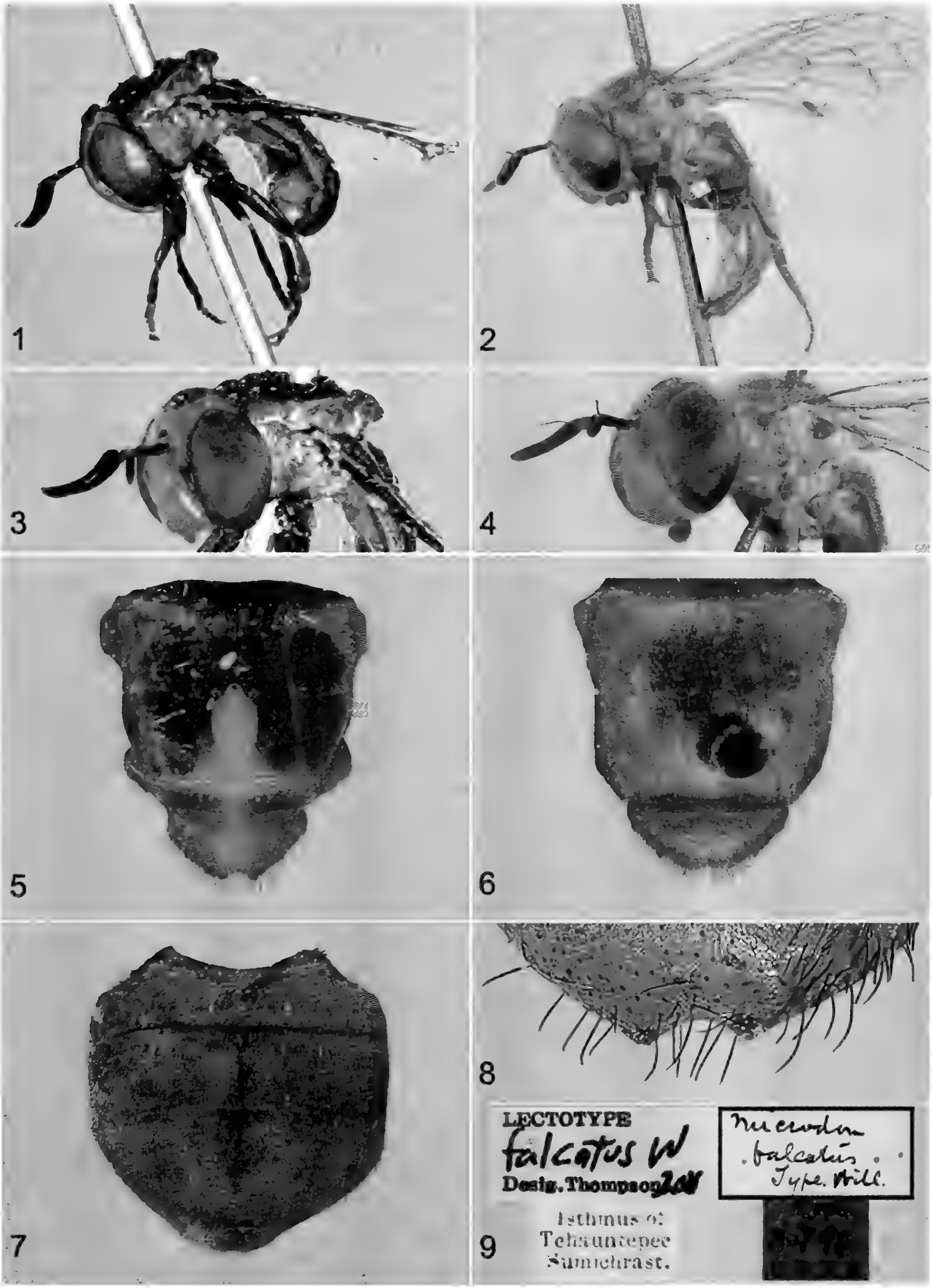
"Isthmus of, Tehauntepec, Sumchrast;" "Type, No. 796, U.S.N.M. [red];" "Microdon, falcatus, Type Will" [black bordered, apparently in Williston's hand]. I have added a yellow lectotype label. The lectotype is in fair condition, the left wing is missing and the base of the abdomen has been damaged by dermestid beetle larvae.

Microdon aquilinus Giglio-Tos was described from a single female from Tuxpango collected by Sumichrast. In the Bellardi Mexican collection (MRSN), the holotype is labeled with "288," and "Microdon aquilinus, [upside down male sex symbol] Giglio-Tos" [in Giglio-Tos' hand] and is above the green Bellardi collection label of "Microdon, 2 [upside down female sex symbol], Tuxpango (Sumichr.) 288."

Microdon honduriana Hull was described from a specimen he collected "on small, low herbage along the Salada River ... " The holotype is now in the CNC and is labeled: 'Salado R., 20 mi inland, Hond., 8.30.38;' F. M. Hull collector;" "HOLOTYPE hondurania Hull;" and "HOLOTYPE, Microdon, hondurania Hull, CNC No. 20440." The right wing is missing from the holotype. In describing *honduriana,* Hull provided no comparative information.

Microdon mellogutta Hull was described from a single female collected from the "Amazon" by Henry W. Bates. This specimen is in good condition in the Natural History Museum, London, and is labeled: "Holo-, type" [red circular BMNH type label], "Amazon, 66: 53", and "Holotype, Microdon, mellogutta Hull" [red, in Hull's hand]. In describing *mellogutta* Hull wrote "Not related to known species." Hull apparently did not know many *Microdon* species and even some of his own species!

Distribution. Mexico (Tamaulipas*), El Salvador,* Honduras,* Costa Rica,* Panama,* Brazil,* Bolivia.*



Figs. 1-9. *Microdon falcatus* (Williston). 1. Adult male, lectotype, lateral view; 2. Adult, female, lateral view; 3. head, lectotype, frontoblique view; 4. head, frontoblique view; 5-6. thorax, dorsal view; 7. abdomen, dorsal view; 8. scutellum, dorsal view; 9. labels on lectotype.

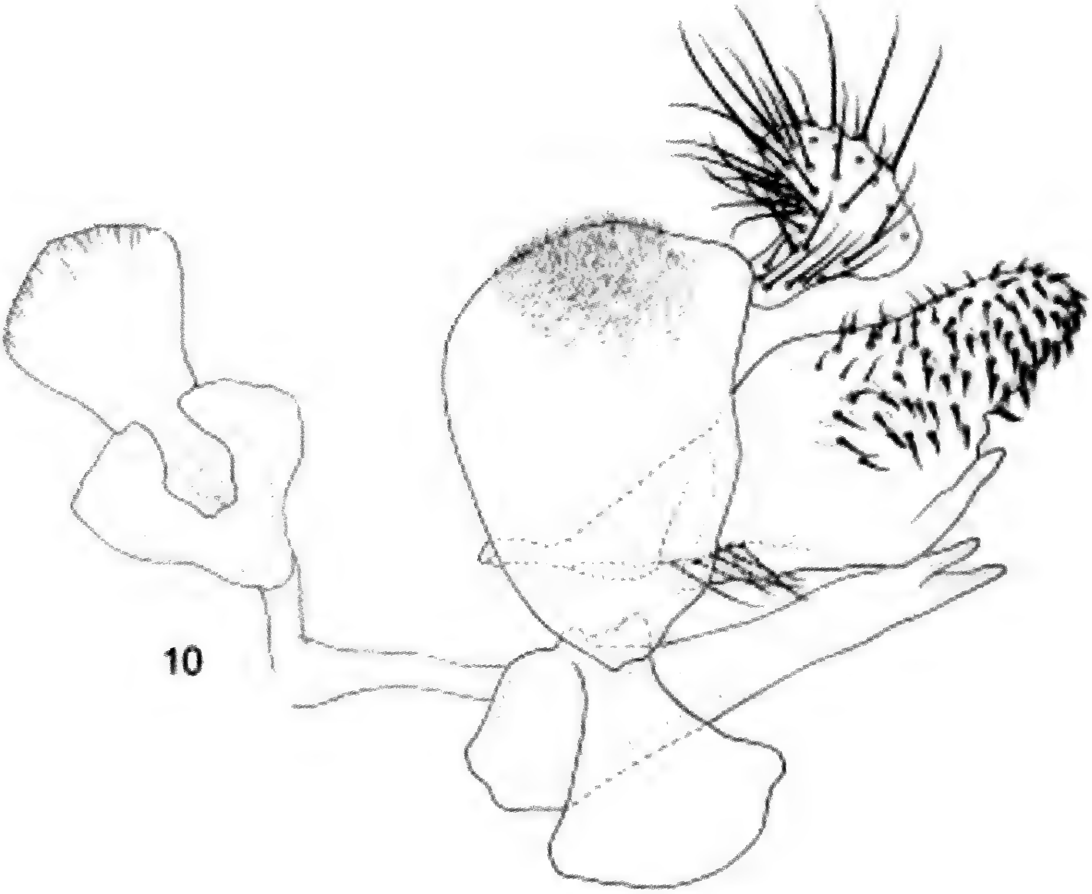


Fig. 10. *Microdon falcatus* (Williston). Male genitalia, lateral view.

Material Examined (42). **BRAZIL.** [? State] "Amazon," (HT ♀ of *mellogutta*). Para: Belem, 48. 29 W 1. 27 S 1967 Apr 12, Y. Sedman, (♀ USNM ENT00038259 USNM). **BOLIVIA.** Cochabamba Prov., Villa Tunari, 16 54' 55" S 65 22' 06" W, March 2001, Malaise Trap, H. Haider (♀, G. Stahls FMNH DNA voucher Y 128, FMNH). **COSTA RICA.** Cartago: Ref. Nac. Fauna Silv. Tapanti, Quebrada Segunda, 1200 m, LN 194000_560000, 1992 Apr, R. Vargas (♂ INBIOCRI000459599 USNM). Limon: Res. Biol. Hitoy Cerere, Rio Cerere, Est. Hitoy-Cerere, LN 184200_643300, 200 m, 1991 Apr, G. Carballo (♂ INBIOCRI000601465 USNM); ..., LN 643400_184600, 100 m, 1993 Jan, G. Carballo ("5-6cc-93"), #1775 (♂ INBIOCRI001742876 USNM); Bribri, 4 km NE, 1989 Sept-Nov, P. Hanson, (1 ♀ 3 ♂♂ USNM ENT00038254-7 USNM). Guanacaste: Sector Las Pailas, 4.5 km SW del Volcan Rincon de la Vieja, LN 306300_388600, 800 m, 1995 Jun 24-Jul 10, K. Taylor, #6198 (♂ INBIOCRI002426262, ♀ INBIOCRI002426255 USNM); A. C. Guanacaste, P. N. Guanacaste, Sector Las Pailas, 800 m, 1994 Jun 6-26, K Taylor, #3063 (♂ INBIOCRI001908659 USNM); Estacion Expt Enrique Jimenez Nunez, 20 km SW Canad, 1991 Nov 5-17, A S Menke, (♂ USNM ENT00038250 USNM).

Puntarenas: R. F. Golfo Dulce, 24 km w Piedras Blancas, 200 m, 1990 Nov, P. Hanson (♂ USNM ENT00038258 USNM). **EL SALVADOR.** Cuscatlan: Rosario, 88. 55 W 13. 46 N 1957 June 15 (♂ USNM ENT00038243 USNM); Quezaitepeque, 3 miles W, 1961 Aug 24, M. E. Irwin (3 ♂♂ USNM ENT00038266-8 USNM); ..., 1961 July 19, M. E. Irwin (♀ USNM ENT00038269 UCDavis); San Salvador, 1958 June 22, O. L. Cartwright (♀ USNM ENT00038252 USNM); ..., 1958 May 24, O. L. Cartwright (♀ USNM ENT00038253 USNM). **GUATEMALA.** Coyotenango "Such", Finca San Rafael Olimpo, 1700 ft, 1965 May 1, J. M. Campbell (♀ USNM ENT00038272 CNC); Siquinala, (♀ USNM ENT00038248 USNM). **HONDURAS.** La Lima, 1958-1959, J. G. Mattysse (♂ USNM ENT00038270 Cornell); Salado River, 20 miles inland from Ceiba, 30 Aug 1938, F. M. Hull (HT of *honduriana*, ♂ CNC). **MEXICO.** Chiapas: Huixtla, 20 miles N, 3000 ft, 1969 June 5, Malaise Trap (♂ ♀ USNM ENT00038277-8 CNC); ..., Huixtla, 20-25 miles NE, 3000 ft, 1969 June 1, H. J. Teskey (2 ♀ USNM ENT00038273-4 CNC); ..., Tapachula, Crawford, (♂♀ USNM ENT00038244-5 USNM); Colima: Colima, 103 41 W 19 14 N. L. Conradt, (♂♀ USNM ENT00038246-7 USNM); Oaxaca: Palomares, 1961 Sep 5-21, R. and K. Dreisbach (2 ♂♂ USNM ENT00038260-1 USNM); Sinaloa: Concordia, 20 miles east, 3000 ft, 1964 Aug 8, W. R. M. Mason (♂ USNM ENT00038279 CNC); ..., Mazatlan, 1964 Aug 16, J. F. McAlpine, Malaise Trap (♂ USNM ENT00038275 CNC); Tamaulipas: Gomez Farias, and vicinity, 1965 July 20-24, Cornell Mexican Field Party, Malaise Trap, (♂ USNM ENT00038271 Cornell); Veracruz, Tuxpango, 18E49'N 97E01W (holotype of *aquilinus,* MRSN); [state?], Tehauntepec, Isthmus of, [95 0' 0" W 16 30' 0" N], Sumichrast, C. V. Riley Collection, (LT ♀, 3 ♂♂ PLT of *furcatus,* USNM ENT00038262-4 USNM); Veracruz: Lake Catemaco, 1969 June 17, B. V. Peterson, (♂ USNM ENT00038276 CNC). **PANAMA.** Canal Zone: Ancon, [80. 0. 0W 9. 0. 0N] 1918 Aug 9, R. P. Dietz (♀ USNM ENT00038251 USNM); ..., Summit, [79. 7 W 9. 1 N] 1946 Dec, N. L. H. Kraus (♂ USNM ENT00038249 USNM).

Remarks. Curran (1925, 1936, 1940, 1941), the last worker to attempt to publish comprehensive treatments of the genus *Microdon,* did not recognize these names (*falcatus* Williston, *aquilinus* Giglio-Tos) as he only worked from specimens previously identified in the collection of his museum (see Curran 1936: 1). He simply ignored the descriptions of other species by earlier authors. In the last published key to the Neotropical species of *Microdon* (Curran 1941), *falcatus* runs to couplet #21, where typical specimens do not match either alternative well (thorax black or dull orange) as the thorax is both black and pale yellow / orange. In those specimens, where the thorax is entirely yellow, *falcatus* is readily distinguished from *Aristosyrphus currani* Goot [replacement name for *clavicornis* Curran] by antennal shape, wing venation and coloration.

Among the New World microdontine flies, *Microdon falcatus* is easily recognized by its distinctive antennal shape as noted above. Other diagnostic characters are: 1) a greatly reduced and bare metasternum; 2) unarmed (without apical calcar) scutellum or one with small apical microtrichose tubercles; 3) oval abdomen; 4) vein R4+5 with distinct spur; and 4) vein M1 (apical crossvein) straight and joining vein R4+5 perpendicularly.

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This study resulted from an investigation of the flower fly fauna of Costa Rica and is the 18th in a series dedicated to the documentation of the Costa Rican flower fly fauna, started in 1991 with the encouragement of Daniel H. Janzen. Beyond the support of my organization, additional funding has been provided by the S. W. Williston Diptera Research Fund of the Smithsonian Institution and the Global Environmental Facility Trust Fund of the World Bank (project # CR-GE-39876).

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CAVE CRICKETS (ORTHOPTERA: RHAPHIDOPHORIDAE) AS VECTORS OF DICTYOSTELIDS (PROTISTA: DICTYOSTELIIDA)[1]

Steven L. Stephenson,[2] Michael E. Slay,[3] Christy A. Slay,[2] and Alicia E. Tuggle[2]

ABSTRACT Our study was done to determine if cave crickets (*Ceuthophilus gracilipes gracilipes*) are able to transport dictyostelid cellular slime molds into and within caves. Large cave crickets were captured from Pigeon Roost Cave in northwestern Arkansas. Crickets were individually washed to remove dictyostelid spores, and fecal pellets collected aseptically from the washed crickets. Five species of dictyostelids, assigned to two genera (*Dictyostelium* and *Polysphondylium*), were recovered from the surface of six crickets, and a single species (*D. sphaerocephalum*) from one sample of fecal pellets. Since cave crickets forage outside the cave, they can introduce dictylostelids to caves from outside sources, and can serve as vectors for transporting dictyotelids within caves. The present study is the first to demonstrate that cave-dwelling invertebrates are capable of transporting these organisms.

KEY WORDS: Rhapidophoridae, *Ceuthophilus,* dictyostelids, cave, Arkansas, U.S.A.

Dictyostelid cellular slime molds (Dictyosteliida: Dictyosteliidae) are single-celled, eukaryotic, phagotrophic bacterivores usually present and often abundant in terrestrial ecosystems. These organisms represent a normal component of the microflora in soils and apparently play a role in maintaining the natural balance that exists between bacteria and other microorganisms in the soil environment. Dictyostelids are most abundant in the surface humus layer of forest soils, but they also occur in the soil-like material found in caves. In a recent study, 17 dictyostelid species were recovered from over 100 caves in eastern North America (Landolt et al., 2006). Five species of dictyostelids were recovered in more than 25 different caves, and three additional species were present in more than 20 different caves. In general, based on available data, the distribution of dictyostelids in caves appears to be rather patchy, but in the microhabitats where they do occur, these organisms can exhibit surprisingly high levels of abundance and diversity.

Unlike many microorganisms, dictyostelids produce spores that appear to have a rather limited potential for dispersal. In the dictyostelid life cycle, the unicellular amoeboid cells that represent the vegetative stage aggregate to form a structure called a pseudo-plasmodium, which then gives rise to one or more fruiting bodies (sorocarps), each bearing one to several masses of spores (sori). Because the spores are embedded in a mucilaginous matrix that dries and hardens, they stand little chance of being dispersed by wind (Cavender, 1973; Olive, 1975). Various animals, ranging from invertebrates to amphibians, small mammals, and birds are capable of dispersing the spores of dictyostelids by means of ingestion-defecation (Suthers, 1985; Huss, 1989; Stephenson and Landolt, 1992). Dictyostelids may be introduced to caves by bats (Stephenson and Landolt (1992). However, are there other organisms that could serve as vectors for

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dictyostelid spores, either for short range dispersal within a cave or introduction to the cave from outside?

Cave and camel crickets (Orthoptera: Rhaphidophoridae) represent an important component of the animal communities associated with caves in North America, and several species are considered critical members of these communities (Benoit et al., 2004; Taylor et al., 2005). Cave and camel crickets forage on the surface at night and then return to caves to roost during the day. In doing so, organic material in the form of cricket fecal material, cricket eggs, and cadavers of crickets are introduced to the cave, which supplies nutrients to a number of invertebrate species. In addition to transferring organic material, 14 genera of fungi were recovered from external body surfaces and internal contents of the raphidophorid *Hadenoecus cumberlandicus* inhabiting two Kentucky caves (Benoit et al., 2004). Most of these fungi were common soil saprophytes typically found in caves, but two plant pathogen species, which were isolated only internally, were believed to have been acquired during foraging outside the cave. The presence of fungi externally and internally on cave crickets plus their surface foraging and subsurface roosting behavior suggests that these organisms also might be capable of vectoring slime molds. Our primary objective of the study reported herein was to investigate the potential role that these crickets may play in the dispersal of dictyostelids into and within caves.

METHODS

Ceuthophilus gracilipes gracilipes (Haldeman) is a species of rhaphidophorid cricket commonly found inhabiting caves and forest floors across central and eastern United States (Hubbell, 1936). It has been reported from a number of caves in Arkansas (Graening et al., 2004). Pigeon Roost Cave in Benton County, Arkansas, was selected for this study because the site contained *C. gracilipes gracilipes* and because human access to the cave is restricted due to the seasonal presence of federally endangered gray bats (*Myotis grisescens*). Pigeon Roost Cave is developed in Mississippian aged limestones, specifically the Boone and underlying St. Joe formations. The cave is located in an oak-hickory forest typical of the type found throughout much of northern Arkansas (Spetich, 2004).

Twelve crickets were captured alive inside the cave. While in the cave, each cricket was placed into separate 50 mL centrifuge tubes containing 7.5 mL of sterile deionized water and 0.25 mL of a wetting agent (Tween 20). The surfactant was used as a wetting agent to elute any substances carried by the crickets. The tube was shaken gently for a few seconds, after which the cricket was removed and placed in a single holding container lined with sterile paper. Crickets were removed from the cave and held in the holding container without food for 5 days at 20°C to collect fecal pellets.

Fecal pellets (frass) deposited by the crickets on the bottom of the holding container were combined into two samples. Each sample was transferred to a sterile 50 mL centrifuge tube containing 7.5 mL of sterile distilled water. The pellets in each tube were broken up with the use of a sterile glass rod and vigorous shaking of the sealed tubes.

Isolation procedures used for dictyostelids were those described by Cavender and Raper (1965). Aliquots (each 0.5 mL) of the "cricket wash" from each of the

12 tubes were added to each of two 100 x 15 mm culture plates prepared with hay infusion agar (Raper, 1984). The same procedure was followed for the two tubes containing the suspended material from the fecal pellets except that three plates were prepared from each tube. Approximately 0.4 ml of a heavy suspension of E. coli was added to each culture plate, and plates were incubated under diffuse light at 20–25°C. Each plate was examined at least once a day for several days following appearance of initial aggregations, and the location of each aggregate clone marked. When necessary, isolates were subcultured to facilitate identification. Nomenclature used herein follows Raper (1984).

RESULTS AND DISCUSSION

Five different species of dictyostelids appeared in one or both of the plates prepared with "cricket wash" from six of the twelve crickets we examined (Table 1), and three of these were recovered from a single cricket. Because Pigeon Roost Cave was one of the caves investigated for the presence of dictyostelids in a larger study of the distribution and occurrence of these organisms (Landolt et al., 2006), data are available on the species present. *Dictyostelium purpureum,* recovered from crickets, was not isolated from samples of cave soil. Two other species (*D. rosarium* Raper and Cavender and *Polysphondylium pallidum* Olive), recorded from cave soil, were not recovered from the crickets. One of the six plates prepared with suspended material from the fecal pellets yielded a single colony of *D. sphaerocephalum.*

Table 1. Occurrence of dictyostelids in the two sets of samples. Plus (+) indicates presence, minus (-) indicates absence.

Dictyostelid Species	**Cricket Wash**	**Cricket Frass**
Dictyostelium giganteum Singh	+	-
Dictyostelilum mucoroides Brefeld	+	-
Dictyostelium purpureum Olive	+	-
Dictyostelium sphaerocephalum (Oudem) Sacc and Marchal	+	+
Polysphondylium violaceum Brefeld	+	-

Because several surface-dwelling invertebrates have been reported as vectors of dictyostelid spores (Huss, 1989), the results obtained in the present study are not unexpected. However, the fact that we were able to recover dictyostelids from half of the crickets examined suggests that these organisms potentially play a role in spore dispersal. A still unanswered question is whether cave crickets can introduce dictyostelids to caves. As noted above, cave crickets forage in the litter layer on the forest floor outside the cave. Although the primary microhabitat for dictyostelids in forests is represented by the soil/humus layer that occurs at the interface of soil and the decomposing organic material (mostly leaf litter) located above the soil, dictyostelids also occur in the leaf litter itself (Stephenson and Landolt, 1996). As such, crickets would have the opportunity to come into contact with dictyostelid spores during their foraging activities in leaf litter. It seems likely that some of these spores could be introduced to caves.

In summary, our data indicate that cave crickets can serve as vectors for dictyostelid spores within caves. Since the crickets forage outside the cave, it is possible that they also introduce spores to caves from outside sources. The present study is the first to demonstrate that cave-dwelling invertebrates are capable of transporting dictyostelid spores.

ACKNOWLEDGMENTS

The research reported herein was supported in part by a grant (DEB-0316284) from the National Science Foundation and in part by The Nature Conservancy. Appreciation is extended to S. Taylor for suggesting the project. We thank G. Graening and S. Taylor for reviewing an early draft of the manuscript.

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THE GENUS *ZOGRAPHETUS* WATSON (LEPIDOPTERA: HESPERIIDAE) IN CHINA, WITH THE DESCRIPTION OF TWO NEW SPECIES[1]

Xiao-ling Fan,[2] Min Wang,[2] Liu-sheng Chen,[2] and Ling Zeng[2]

ABSTRACT: Two new species, *Zographetus pangi* Fan and Wang sp. nov. from Nanling National Nature Reserve, Guangdong, and *Z. hainanensis* Fan and Wang sp. nov. from Yinggeling, Hainan, China, are described and illustrated. *Z. pangi* is allied to *Z. rama*, but can be easily separated from the latter by forewing lack of swollen vein in the male, and hindwing underside having dark brown spots, as well as the valva of male genitalia without pointed protruding in the upper margin of the harpal process. *Z. hainanensis* is closely related to *Z. pangi*, differing from the latter in having the small white spot in space M_2 on forewing upperside and that on underside more distinct, the spot in upper cell rather smaller; valva with the harpal process nearly rectangular, the upper margin nearly straight. Female genitalia of *Z. satwa* de Nicéville is described for the first time.

KEY WORDS: Lepidoptera, Hesperiidae, *Zographetus*, new species, China

The genus *Zographetus* was described by Watson in 1893 with *Isoteinon satwa* de Nicéville, 1884 as its type. The striking features of the genus are smaller size; palpi with the third segment short; forewing vein M_2 down-curved at its base, with ground color on upperside dark brown, and small white hyaline spots; hindwing underside with ground color ferruginous, and black spots in cell and postdiscal area. Based on forewing venation and secondary sexual characters, the genus includes two remarkable groups, e.g., the *Z. satwa* group and *Z. ogygia* group. The former comprises *Z. satwa*, *Z. rama*, *Z. abima* and *Z. pallens* with forewing vein Cu_2 arising much closer to the wing base than to vein Cu_1, and the basal portion of vein Cu_2 and the cubitus are swollen in the male (de Jong, 1993); the latter is composed of the remaining species, with forewing vein Cu_2 arising slightly closer to vein Cu_1 than to the wing base, male without swollen vein (Eliot, 1992; de Jong, 1993).

The knowledge of the genus *Zographetus* from China has been summarized by Chou (1994), in which three species are included. Later, four species of the genus were reported from Hainan (Gu and Chen, 1998). Unfortunately, most of the species they recognized are misidentified.

Prior to the present study, only nine species are known in the genus (Bridge, 1994), ranging from northeastern India through southern China and the Malay Peninsula to the Philippines, Sulawesi and the Lesser Sunda Islands, of which one species, *Zographetus satwa* (de Nicéville, 1884) has been recorded in China. Recently, we conducted a systematic research of the genus from China based on our collection, and two species were confirmed as new to science.

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METHODS

The terminology used in descriptions of morphology follows Evans (1949) and Shirôzu (1960). Photographs were taken with a Nikon Coolpix 995 digital camera, along with a Leica MZ125 for genitalic photos. Digital images were imported into Adobe Photoshop 6.0 for labeling and plate composition. Measurements are given in millimeters.

Zographetus satwa (de Nicéville, 1884)

Isoteinon satwa de Nicéville, 1884: 86. (Type locality: Assam, India)

Zographetus satwa: Watson, 1893: 85; Seitz, 1927: 1067; Evans, 1949: 299; Pinratana, 1985: 71; Chou, 1994: 740; Gu and Chen, 1998: 329; Huang (Ed.), 2001, 4: 147.

Widespread species; hindwing underside with basal half yellow, distal half brown making it different from other congenerics. Herein, we describe and illustrate the female genitalia for the first time.

Female genitalia (Fig. 1): Papilla analis completely sclerotized; lamella antevaginalis broad, with upper-lateral processes; lamella postvaginalis long and narrow rectangular, protruded medianly; ductus bursa short and sclerotized; copulatrix bursa long globular; signum absent.

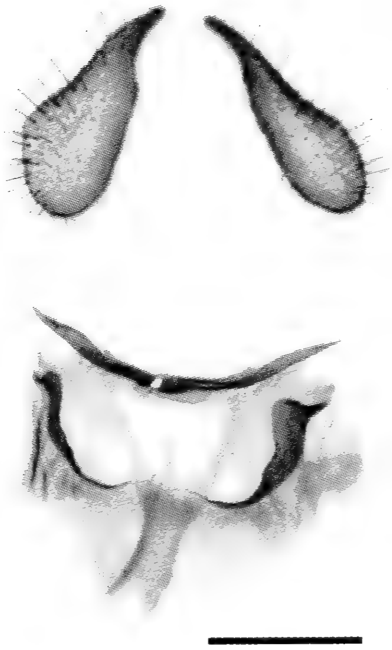


Fig. 1. Female genitalia of *Zographetus satwa* (de Nicéville, 1884), scale = 1 mm.

Examined Specimens: 1 male, China: Hainan, Jianfengling, 1983. III. 26, leg. M. B. Gu; 1 female, China: Yunnan, Mengla County, 1994. IV. 17, leg. X. L. Fan and M. Wang.

Distribution: Yunnan, Hainan, Hong Kong; Sikkim, India, Burma, Thailand, W. Malaysia, Sumatra, Java.

Zographetus pangi Fan and Wang, NEW SPECIES

(Figs. 2-3)

Diagnosis: Externally the new species is closely allied to *Z. rama* (refer to Eliot, 1992; Evans, 1949 for photos of adults and male geinitalia), but can be distingished from the latter by forewing with the spots in cell connected; hindwing underside with dark brown spots in spaces M_3, Cu_1, Cu_2, and M_1; the valva of male genitalia without pointed protruding in the upper margin of the harpal process.

Description of the male: Forewing length 16 mm, antenna length 11 mm (Fig. 2).

Head. Antennae longer than 1/2 of forewing costa, dark brown with club pale yellow inwardly before the apiculus, which is pointed and hooked; palpi second segment porrect, densely covered with long yellow scales ventrally, third segment short and small.

Wing. Wings upperside with ground color dark brown. Forewing with orange hair tuft at the basal dorsum, and five white spots in spaces R_5, M_3, Cu_1 and cell, of which the double spots in cell connected and the one in space R_5 and upper cell rather small; hindwing unmarked. Forewing underside with ground color and white spots the same as of the upperside, covered with yellow brown scales along costa and at apex, small black spots in spaces M_1 and M_2; hindwing underside yellow, costa and termen dark brown, with small dark brown spots in the spaces M_3, Cu_1, Cu_2, and M_1, the one in space M_1 blurred, distal cell spot dark brown with yellow centrally.

Male genitalia (Fig. 3). Uncus long and thin with distinct fenestrula; socius and gnathos absent; saccus broad and long; valva nearly rectangular, the harpal process broad with upper margin wavy and armed with small spines basally, end blunt, the ampullar process thin and digit-shaped, shorter than the harpal process; aedeagus with subzonal sheath slim basally, suprazonal sheath stout; juxta U-shaped with a common base.

Female: Unknown.

Type Data: Holotype, male, China: Guangdong, Ruyuan, Nanling National Nature Reserve, 2003. VI. 12, leg. Min Wang and Guo-Hua Huang. Paratype, 1 male, same data as holotype. Deposited in Department of Entomology, South China Agricultural University, Guangzhou, Guangdong, China.

Host Plant: Unknown.

Distribution: Known only from the type locality.

Etymology of specific epithet: Named in honor of the late Prof. Xongfei Pang for his contributions to entomology in China.

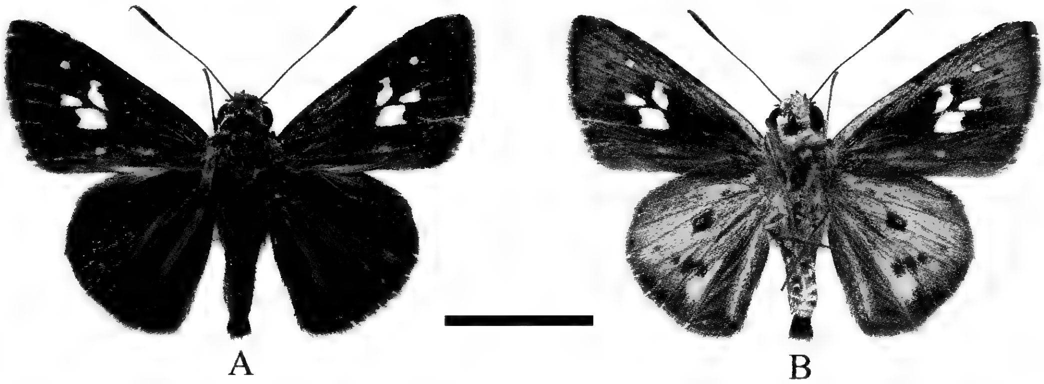
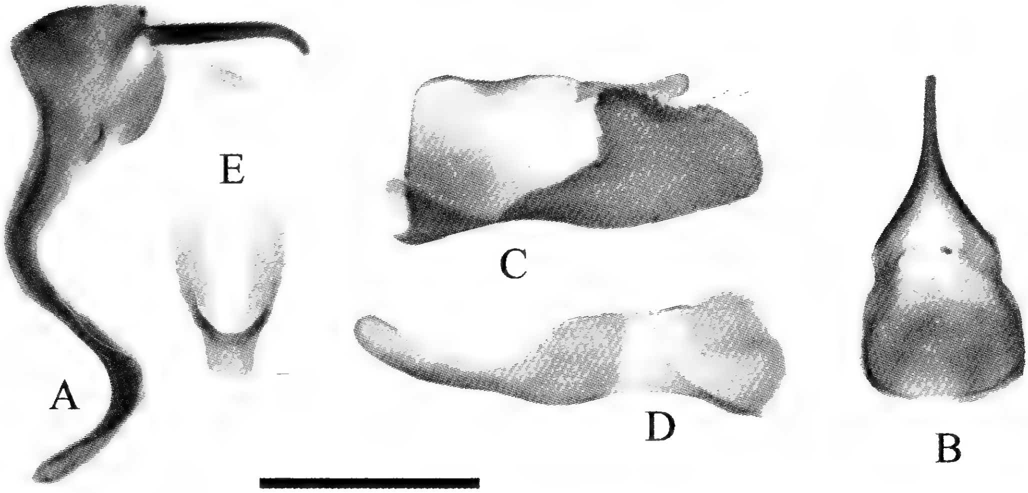


Fig. 2. *Zographetus pangi* sp. nov. (scale = 10 mm) A. Dorsal view. B. Ventral view.



Figs. 3. Male genitalia of *Zographetus pangi* sp. nov. A. ring, lateral view. B. tegumen, dorsal view. C. valva, inner view. D. aedeagus. E. juxta. Scale = 1 mm.

Zographetus hainanensis Fan and Wang, NEW SPECIES
(Figs. 4-5)

Diagnosis: The new species is similar to *Z. rama* in appearance, differing from the latter in the small white spot in space M_2 on forewing upperside, and that on underside more distinct, the spot in upper cell rather small; hindwing with dark brown spots in spaces M_3, Cu1 and Cu_2; the valva of male genitalia without pointed protruding in the upper margin of the harpal process.

Description of the male: Forewing length 14 mm, antenna length 9 mm (Fig. 4).

Head. Antennae longer than 1/2 of forewing costa, dark brown with club pale yellow inwardly before the apiculus, which is pointed and hooked; palpi second segment porrect, densely covered with long gray scales ventrally, third segment short and small.

Wing. Wings upperside with ground color dark brown. Forewing with orange hair tuft at the basal dorsum, and white spots in spaces R_5, M_3, M_2, Cu_1 and cell, of which the spots in space M_2 and upper cell very small; hindwing unmarked. Forewing underside with ground color and white spots the same as of the upperside, covered with yellow brown scales along costa and at apex; hindwing underside yellow brown, costa and termen dark brown, with small dark brown spots in the spaces M_3, Cu_1, Cu_2, distal cell spot dark brown and comma-shaped.

Male genitalia (Fig. 5). Uncus long and thin with distinct fenestrula; socius and gnahos absent; saccus broad and long; valva broad and long, the harpal process nearly rectangular with upper margin straight and covered with small spines, the ampullar process thin and digit-shaped, shorter than the harpal process; aedeagus with subzonal sheath thinner than suprazonal sheath; juxta U-shaped with a common base, lateral arms broader.

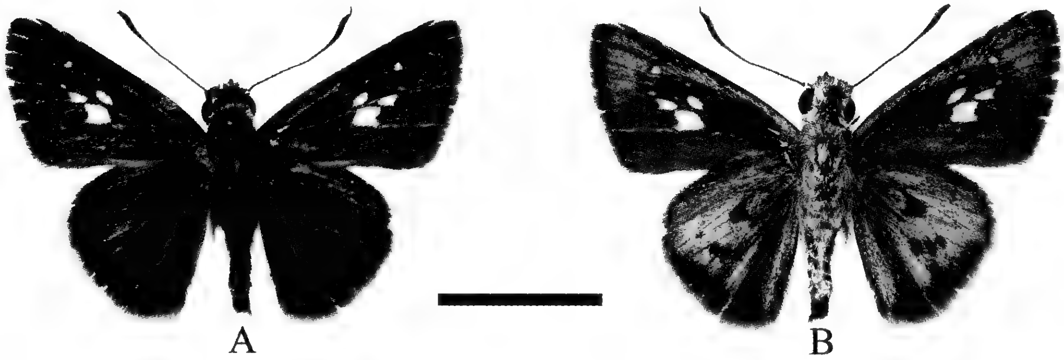


Fig. 4. *Zographetus hainanensis* sp. nov. (scale = 10 mm) A. Dorsal view. B. Ventral view.

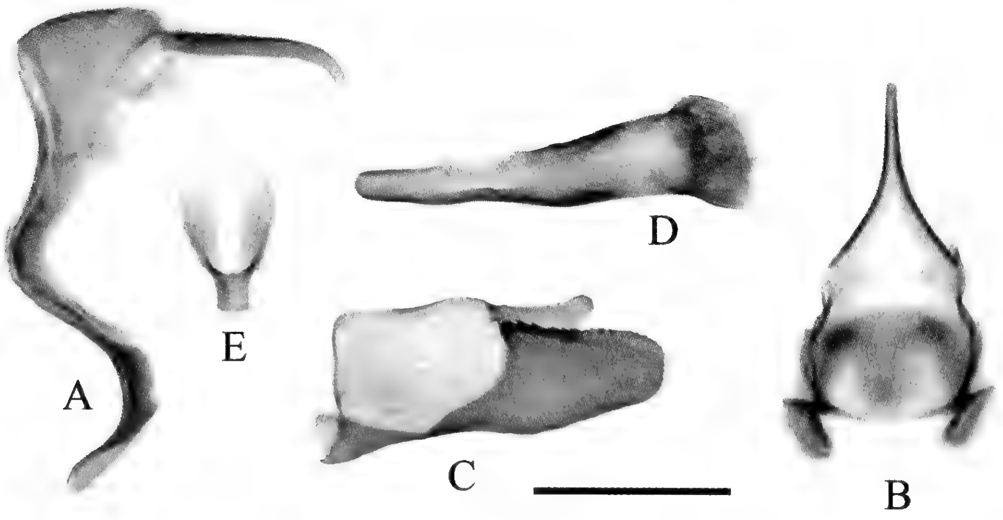


Fig. 5. Male genitalia of *Zographetus hainanensis* sp. nov. A. ring, lateral view. B. tegumen, dorsal view. C. valva, inner view. D. aedeagus. E. juxta. Scale = 1mm.

Female: Unknown.

Type Data: Holotype, male, China: Hainan, Yinggeling, 2005. V. 12, leg. Min Wang and Liu-Sheng Chen. Paratype, 1 male, same data as holotype. Deposited in Department of Entomology, South China Agricultural University, Guangzhou, Guangdong, China.

Host Plant: Unknown.

Distribution: Known only from the type locality.

Etymology of specific epithet: Referring to the type locality.

DISCUSSION

The genus *Zographetus* comprises a rather heterogeneous group of species, with differences in forewing venation and secondary sexual characters (Eliot, 1992). The two new species, *Z. pangi* and *Z. hainanensis*, share the following characters: forewing upper side with an orange hair tuft at the basal dorsum, vein Cu_2 arises slightly closer to the wing base than to vein Cu_1, no veins are swollen in the male; hindwing underside with dark brown spots.

However, the latter differs from the former in forewing having the spot in upper cell rather smaller, while it is larger and distinct in *Z. pangi*; the spot in space M_2 is white on both sides in *Z. hainanensis*, while it is unmarked on upperside and black on underside in *Z. pangi*; aedeagus with subzonal sheath is straight in *Z. hainanensis*, but it is bent in *Z. pangi*; valva with the dented upper margin of harpal process sinuated in *Z. pangi*, but it is straighter in *Z. hainanensis*.

Zographetus pangi and *Z. hainanensis* differ from the species in the *Z. ogygia* group by having the forewing upper side with an orange hair tuft, from the *Z. satwa* group by the forewing lack of a swollen vein in the male. The forewing upper side has a hair tuft, which is also present in *Z. rama*, but *Z. pangi* and *Z. hainanensis* are easily separated from the latter by forewing lack of swollen vein in the male, and hindwing underside having dark brown spots, as well as the valva of male genitalia without pointed protruding in the upper margin of the harpal process. Obviously, the two species are very different from all other species of the genus. Further studies are required to infer monophyletic lineage and the species group of the genus *Zographetus*.

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CONTRIBUTIONS TO THE KNOWLEDGE OF THE LACEWING FAUNA OF TURKEY (NEUROPTERA: CONIOPTERYGIDAE, MYRMELEONTIDAE), WITH SOME ECOLOGICAL REMARKS

Savaş Canbulat

ABSTRACT: I report on three lacewings, a dusty wing, *Parasemidalis fuscipennis,* and two rare myrmeleontids, *Myrmecaelurus spectabilis* and *Distoleon kabulensis,* coming from Turkish lacewing fauna. Faunistic data and habitats are provided. Photographs of wings of two ant lions, drawings on male and female external and internal genitalia structure of *Myrmecaelurus spectabilis* and female genitalia of *Distoleon kabulensis* are illustrated with 9 figures. The distribution map with new recording sites is also given.

KEY WORDS: Neuroptera, Coniopterygidae, Myrmeleontidae, new records, Turkey

Until the 1960s neuropterologists did not pay attention to the rich Turkish lacewing fauna. In the past four decades, however, all families of Neuroptera (Osmylidae, Coniopterygidae, Hemerobiidae, Chrysopidae, Dilaridae Mantispidae, Berothidae, Nemopteridae, Myrmeleontidae, Ascalaphidae) living in Turkey have been intensively researched. Turkish and foreign neuropterologists have collected and identified many lacewings from various localities of Turkey (Aspöck and Aspöck 1969; Aspöck and Hölzel 1996; Aspöck et al., 1980, 2001; Canbulat 2002; Canbulat and Kıyak 2002a, 2005a; Gepp 1974; Hölzel 1972, 1987; Kacirek 1998; Meinander 1990; Monserrat and Hölzel 1987; Popov 1986; Şengonca 1979). Nevertheless, the lacewing fauna of Turkey is believed to be richer.

Previous studies have mostly focused on the local fauna of Neuroptera, and only a few pieces of information are available on the distribution of Neuroptera at national level due to the lack of provincial and countrywide surveys. Aspöck et al. (2001) catalogued 170 species and 1 subspecies from 10 lacewing families, but subsequent studies revealed the presence of 11 other species for the Turkish fauna (Canbulat and Kıyak 2002b, 2003a, b, 2004, 2005b; Kacirek 1998; Onar and Aktaç 2002) yielding 181 lacewing species and 1 subspecies.

The aim of this study was to investigate the lacewing fauna of Turkey at the provincial level looking for new records which will be added to the forthcoming checklist of Neuroptera of Turkey.

METHODS

In 2004 and 2005, neuropterans were collected from Kayseri and Bolu provinces of Turkey by sweep net. Specimens were killed in ethyl acetate and cyanide jars, prepared and labeled according to the standard procedures for

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museum material. Specimens were identified based on the taxonomic keys of Aspöck et al. (1980), Hölzel (1972), Krivokhatsky (1998) and Meinander (1972). The drawings of gonarcus-parameres complexes and apex of abdomen of *M. spectabilis* and drawings of spermatheca and apex of abdomen of *D. kabulensis* were made by using an Olympus BX41 microscope with a drawing attachment. The drawings of genitalic structures of both ant-lion females give adequate information from taxonomical and morphological point of view to identify the specimens. Specimens of the newly recorded species are deposited in the insect collection of Sakarya University, Science, as well as in the Art Faculty in the Department of Biology, Sakarya, Turkey.

SYSTEMATIC ENTOMOLOGY

Parasemidalis fuscipennis (Reuter, 1894)

Material Examined: Turkey, Kayseri province (Hisarik town; 5. km from Hisarik to Develi, Erciyes Mountain), 38°20'N/35°49'E, 1520 m, one female, 28.V.2004. This species was collected by a net in a coniferous forest (*Abies cilicica* subsp. *cilicica*) (Leg. S. Canbulat). Drawings of the genitalia segments and identification keys to species of Coniopterygidae can be found in Aspöck et al. (1980) and Meinander (1972).

Sziráki (1992) reported collecting of *P. fuscipennis* on oak trees in a gallery forest in Hungary. Popov (1986) found this species in *Juniperus* spp. (asl. 700 m) in Bulgaria. Greve (1997) showed an association between *P. fuscipennis* and coniferous trees, especially *Pinus sylvestris* and *Juniperus communis* by using light traps. However, Monserrat and Diaz-Aranda (1987) caught this species in *Crataegus monogyna.* In Norway the seasonal flight activity of imago was found from June to early July (Greve 1997).

Aspöck et al. (1980) encountered small populations of this species in Europe. The species spread in Holarctic distribution, and were mainly recorded from Europe: Austria, Bulgaria, Switzerland, Czech Republic, Slovakia, Germany, Denmark, Spain, France, Great Britain, Greece, Hungary, Croatia, Italy, Latvia, Norway, Poland, Romania, Russia, Sweden, Finland, Slovenia, Serbia and Montenegro. Asia: Mongolia. North America: USA (Michigan, Arizona, California), Mexico (Durango) (Aspöck et al., 2001).

Myrmecaelurus spectabilis Navas, 1912

Figure 1-6

Material Examined: Turkey, Bolu province (Ankara-Gerede road, 13 km to Gerede), 1300 m, one male, two females, 17.VI.2005. This species was collected by a net on steppe vegetation (Leg. S. Canbulat).

The original description of the species was short but later a partial description (without female figures) of wings, male genitalia and end of abdomen was given by Krivokhatsky (1998: 45 Figure 11), based on the specimens collected in Armenia (Arax River) and presently deposited in the Zoological Institute of the Russian Academy of Sciences. However, even this study did not provide any information on the female genitalia.

This species has been collected in Armenia and Russia, but the actual range of the species remains unknown (Aspöck et al., 2001). Krivokhatsky (http://www.zin.ru/projects/zinsecta/eng/ZInsecta.asp) reported some specimens of *M. spectabilis* from Russia (Duske) (2 males, 5 females) (missing) (FZM), Armenia (Artik) of 1937 Armenia (Artik) (1 female) (ZIN) and 14 km southeast of Sarıkamış in Turkey (18.VII.1999, 4 males) (ZIN).

As it is the second time for *M. spectabilis* to be detected in Turkey, the author gives the male and female genitalia drawings and a photograph of wings of *M. spectabilis* in Figs. 1-6 to ease species recognition.

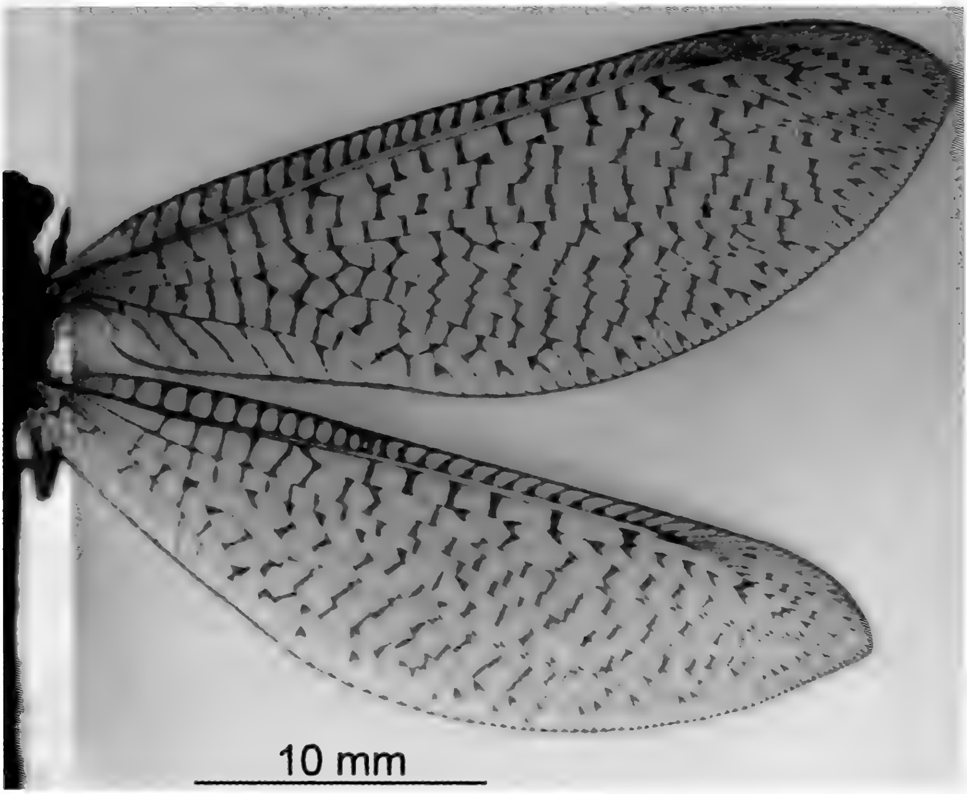
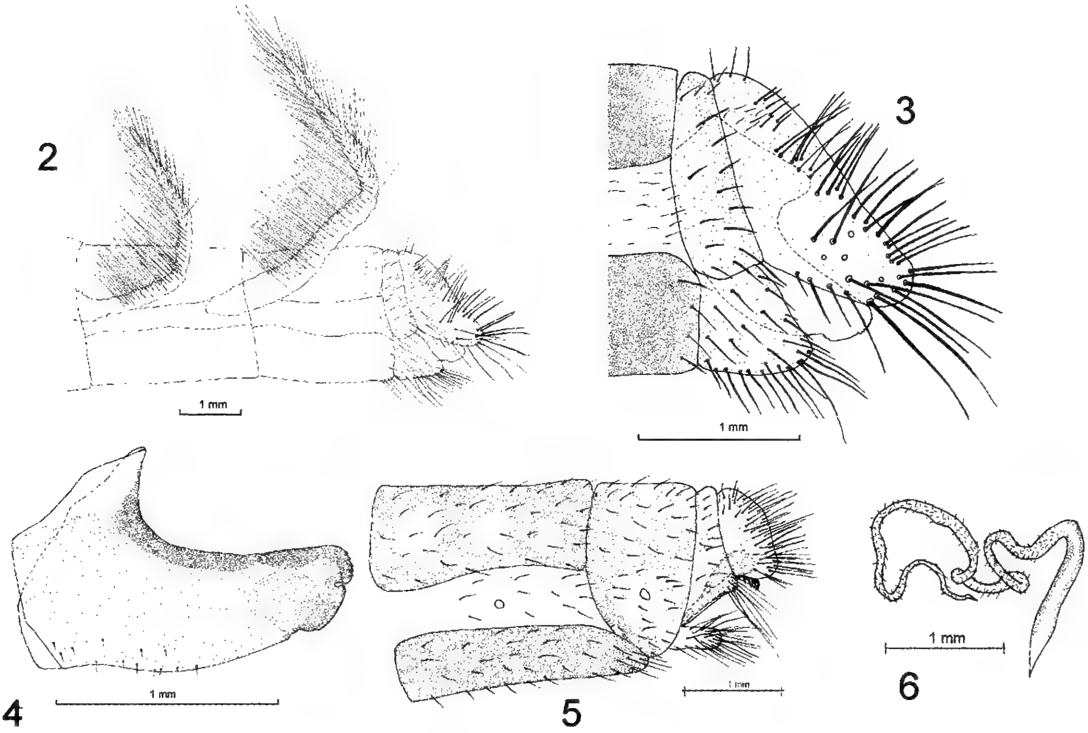


Figure 1. *Myrmecaelurus spectabilis:* 1. Right wings.



Figures 2-6. *Myrmecaelurus spectabilis:* 2. Pleuritosquamae and apex of male abdomen, lateral view. 3. Genital structure of male, lateral view. 4. Gonarcus and parameres complex, lateral view. 5. Apex of female abdomen, lateral view. 6. Spermatheca, lateral view.

***Distoleon kabulensis* Hölzel, 1972**

Figure 7-9

Material Examined: Turkey, Kayseri province (Pınarbaşı town, around Cinliören Village), 38°50'N/36°15'E, one female, 1350 m, 14.VII.2004. The specimen was found in habitat with dense vegetation consisting of various species of Poaceae (Leg. S. Canbulat).

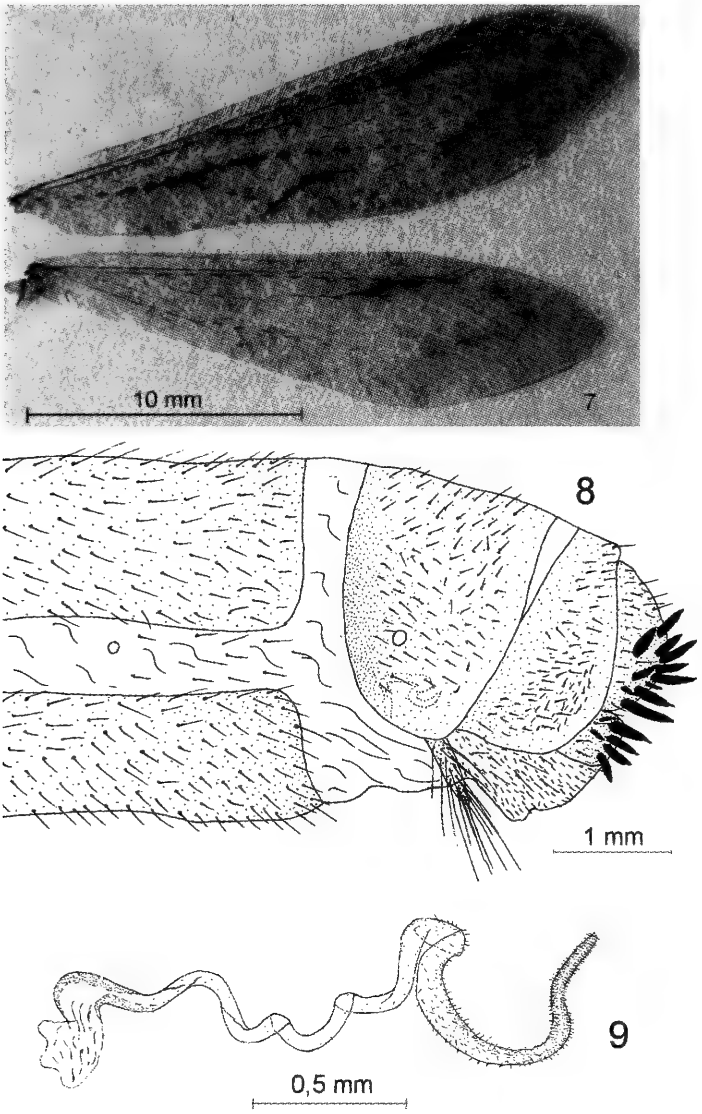
Distoleon kabulensis was originally described from Afghanistan, Iran, and Anatolia (Turkey), and seems to be widespread, but rarely collected in the southwest Palaearctic region. There is no available information on its ecological tolerance (Hölzel 1972). *Distoleon kabulensis* is thought to be an Iranoeremial faunal element (Aspöck et al., 2001).

The description of *D. kabulensis* by Hölzel (1972) was not complete and lacked genitalia drawings. Because of this a description of the female of the species follows.

Description of female *D. kabulensis*

Body 23 mm, forewings 23 mm, hind wings 21 mm. Body color brown.

Head brown, clypeus and frons yellow, terminal segment of labial palps thickened with brown and brown hairs. Vertex curved, with medial line and two rows across with dark brown spots. Eyes convex. Antennae clavate, length 6 mm, flagellum segment with brown, distally becoming progressively brighter.



Figures 7-9. *Distoleon kabulensis:* 7. Right wings. 8. Apex of female abdomen, lateral view. 9. Spermatheca, lateral view.

Pronotum brief, not longer than broad, yellowish strips before the side edge, white bristle lateral. Meso and metanotum dark; small yellow marks only at the mesocutellum. Wings yellow with interrupted brown lines, interrupted with brown at intersections of crossveins, membranes shaded with brown (Fig. 7). Forewing shading, longitudinal veins pale, interrupted with brown at intersections of crossveins, Sc, and last part of R, Cua fork, Cua_1 completely dark brown, in forewing 6 crossveins before last part of Rs and crossveins between with dark brown. Hinterwing Rs fork last part brown. Pterostigma distinct. Legs; coxae and femora yellow, tibia yellow distal part brown. Tibia of all legs white bristle and dark long thorn. Fifth segment of tarsi as long as 1-4 tarsi. Spurs basal pale yellow distal brown, slightly curved, as long as tarsi 1-4.

Abdomen of female shorter than wings, with clear brown with short white hair. Apex of female abdomen as in (Fig. 8). Ectoprocts with digging setae on ventral surface; two pairs of gonapophyses present: with short cylindrical gonapophyses anterior and spherically round gonapophyses posterior, forming a globose structure with digging setae. Spermatheca twist, slightly enlarged distally (Fig. 9).

Drawings of female genitalia, spermatheca, and photograph of wings (Figs. 7-9) are published here for the first time.

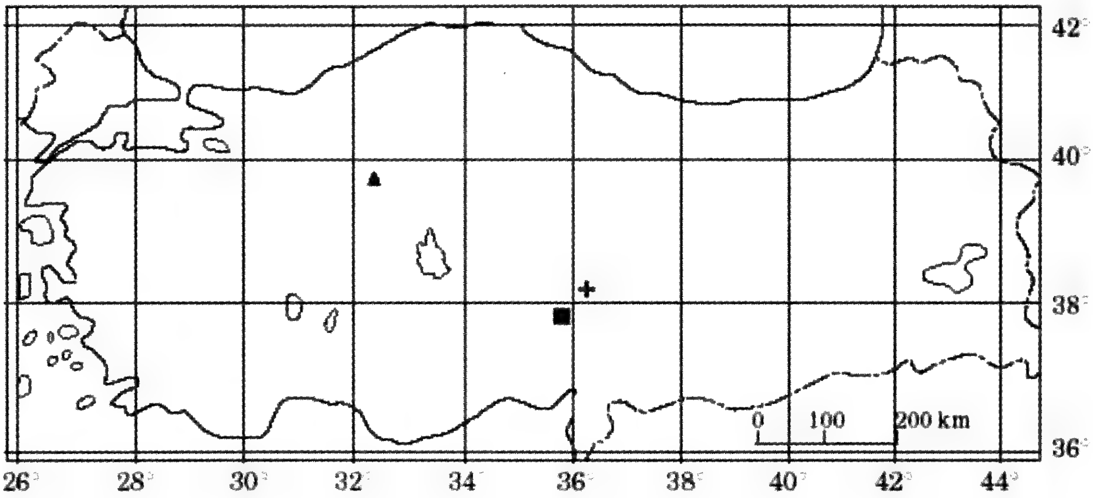


Figure 10. Distribution of (■) *Parasemidalis fuscipennis,* (▲) *Myrmecaelurus spectabilis* and (✚) *Distoleon kabulensis* in Turkey.

DISCUSSION

Five species of *Parasemidalis* are known from Europe, Mongolia, U.S.A., and Mexico (Meinander 1990). This is the first report for the genus and species (*P. fuscipennis*) for the Turkish lacewing fauna, southwest part of Palaearctic region. Due to their very small size, many dusty wing species may still remain undetected in Turkey.

The dry climate, loose soil, and scarce vegetation are favorable to ant-lions and, not surprisingly, the Turkish ant-lion fauna is extremely rich in species as compared with the European counterpart. Due to the intensive fieldwork made by Turkish neuropterologists, the number of Turkish ant-lion species has continuously increased in the last twenty years, useful in faunistical and zoogeographical evaluations.

The second male and the first female of *M. spectabilis,* the very rare species were recorded from Turkey. Until now only a male specimen has been known in Sarıkamış (Kars, Turkey) (Krivokhatsky [http://www.zin.ru)]. It should be noted that *M. spectabilis* is formally new to the country. Furthermore, the female of this species is recorded for the first time in Turkey. In West Anatolia, where *M. spec-*

tabilis was collected, the transition among the Mediterranean, Euro-Siberian, and Irano-Turanian regions is occupied by scrub or even parklike forest often dominated by junipers and deciduous forests.

Species of *Distoleon* are one of the least known groups of Myrmeleontidae in Turkey. In this genus, three species have been recorded in Turkey (Aspöck et al., 2001). *Distoleon kabulensis* was also found for the second time in Turkey. This species was recorded in the part of type series from Anatolia (Turkey) in Elazığ province (Ergani-Maden town) (Hölzel 1972). On the other hand, Aspöck et al. (2001) did not cite the data of the paratype female in the catalogue of west Palearctic fauna. The new localities for *Distoleon kabulensis* are in the Irano-Turanian zoogeographical region extending from Central to East Anatolia in Turkey.

Further studies at the provincial level are likely to reveal more new species for both the Turkish and the world fauna.

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SCIENTIFIC NOTE

ORTHOGRAPHY AND DISTRIBUTION OF *PARALEPTOPHLEBIA PACKII* (EPHEMEROPTERA: LEPTOPHLEBIIDAE) IN WESTERN NORTH AMERICA[1]

W. P. McCafferty[2]

Leptophlebia packii Needham was originally described from the North Fork of the Ogden River, Weber County, Utah, by Needham (1927). This species is one of the tusked burrowing leptophlebiids of western North America (e.g. Edmunds and McCafferty 1996), and was referred to as Pack's Tusker by Needham and Christenson (1927). Traver (1935) correctly referred to it as the recombined *Paraleptophlebia packii* (Needham). Beginning with its citation in a checklist by Edmunds and Allen (1957), it has been incorrectly referred to as *Paraleptophlebia packi.* As per the recent correction of the name *Drunella doddsii* (Needham) by Jacobus and McCafferty (2004), even if the subsequent emendation of orthography was deliberate, the use of the first spelling ending in "-ii" is mandated by Section 4 of Article 33 of the current International Code of Zoological Nomenclature (1999), and the original orthography is here restored. This species has been known from Grand and Jackson Counties in Colorado (McCafferty et al., 1993), Weber County in Utah (Needham 1927), and Teton County in Wyoming (Kroger 1974).

New records of *P. packii* based on materials residing in the Purdue Entomological Research Collection, West Lafayette, Indiana, or on data provided by the late George Edmunds, include the following:

UTAH: Summit County, Weber River, at Peoa, 14-X-1970, M. M. Boreman (larvae); Wasatch County, Provo River, at Midway, 11-XI-1947, G. F. Edmunds (larvae and adults); Weber County, South Fork Weber River, at Huntsville, 20-XI-1968, G. Z. Jacobi (larvae).

WYOMING: Natrona County, North Platte River, at By-The-Way Ranch, ca. 24 miles southwest of Casper, off State Road 220, 8-X-2001, W. P. and N. McCafferty (larvae).

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SCIENTIFIC NOTE

FIRST RECORD OF ITHYTRICHIA (TRICHOPTERA: HYDROPTILIDAE) IN MICHIGAN, U.S.A.[1]

Jaquelyn M. Craig[2] and Margret A. Chriscinske[2]

The microcaddisfly genus *Ithytrichia* Eaton (Trichoptera: Hydroptilidae) has been previously reported from many Great Lakes states (Illinois: Ross 1944, Ohio: Huryn and Foote 1983, Wisconsin: Hilsenhoff 1995, Pennsylvania: Moulton et al., 1999, Minnesota: Houghton et al., 2001, New York: Bode et al., 2002) and Canada (Barton and Hynes 1978), but had not previously been documented from Michigan. *Ithytrichia* larvae are strongly compressed laterally and have distinct lobate projections. They produce a purse-like case made of silk secretions and live on rocks and moss in lotic habitats where their ability to keep the flat side of their case against the substrate is advantageous (Wiggins 1996).

Ithytrichia specimens were identified as part of a benthic macroinvertebrate community survey for the Crystal River within Sleeping Bear Dunes National Lakeshore, conducted in July and September 2004 and June 2005. The park is located along the eastern shore of Lake Michigan in Leelanau County, Michigan. Our observations in conjunction with those of White (1987) describe the river as follows: it originates in Glen Lake, passes through Fisher Lake, and empties into Lake Michigan. Total stream length is <10 km, half of which is within the park. Although the river receives ground-water input, discharge is primarily surface water from the lakes, resulting in warm, rich, hard water. Beds of submerged aquatic vegetation over a sandy substrate are extensive in certain reaches of the river, while other areas are characterized by pool-riffle-run over sand and gravel, and some segments of the stream are runs of bare sand. The low-head dam and culverts at County Road 675 provide areas of tailrace whitewater flow over cobble and gravel. Although depths range from less than 3 cm over some gravel bars to about 1.5 m in a deep run, the overall average depth of the river is about 0.3-0.6 m. Typically, the shoreline is littered with woody debris and detritus.

Benthic macroinvertebrate samples were collected by D-frame dip-net. All samples were preserved in 10% buffered formalin and transported to the Great Lakes Science Center in Ann Arbor, MI, where they were sorted and identified. Trichoptera identification was based on Wiggins (1996), and representative specimens were donated to the University of Michigan Museum of Zoology, Insect Division, Trichoptera Collection.

All 14 *Ithytrichia* specimens we encountered were larvae and were collected from a variety of substrate types and flow regimes. Whereas the literature indi-

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cates that *Ithytrichia* larvae inhabit rocks and moss in running water (Wiggins 1996), the Crystal River specimens were found primarily on sand substrates, occasionally with gravel and/or aquatic vegetation. Numerous empty cases were found in most of the samples, indicating that occurrence of *Ithytrichia* in the Crystal River may be common. Although there is no larval key to species, our specimens are likely *Ithytrichia clavata*, based on known ranges of the three North American species. Future studies of *Ithytrichia* in Michigan should include adult light-traps and larval rearing to confirm species identification.

ACKNOWLEDGMENTS

This study was funded by the U.S. Geological Survey and the National Park Service through the National Resources Preservation Program. Field collections were performed by USGS-GLSC personnel: Greg Kennedy, Glen Black, Jeff Allen, and Jerrine Nichols. This is contribution #1428 of the United States Geological Survey, Great Lakes Science Center, Ann Arbor, Michigan, U.S.A.

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SCIENTIFIC NOTE

OCCURRENCE OF THE CENTIPEDE, *PARACRYPTOPS INEXPECTUS* CHAMBERLIN, 1914, IN BARBADOS (SCOLOPENDROMORPHA: CRYPTOPIDAE: CRYPTOPINAE)[1]

Rowland M. Shelley[2]

The cryptopine centipede genus, *Paracryptops* Pocock, 1891, comprises four small-bodied species in southern/southeastern Asia and one in the West Indies (Lesser Antilles) and northeastern South America, which is based on a specimen discovered during a quarantine inspection in Washington, DC, USA. Chamberlin (1914) proposed *P. inexpectus* for this centipede, and the nominal species is known from Guyana and Dominica (Chamberlin 1914; Attems 1930; Bücherl 1939, 1941, 1974; Chagas and Shelley 2004). As few anatomical differences exist between it and the type species, *P. weberi* Pocock, 1891, occurring in India, Vietnam, and Singapore, the last authors suggested that the names may be synonymous and that *P. inexpectus* may be the one applied to New World specimens of *P. weberi*. Species of *Paracryptops* are intimately associated with man, as they are cryptic, have twice been intercepted in quarantines, and 5 (29.4%) of the now 17 samples were encountered in urban environments where introduced species are common. Chagas and Shelley (2004) therefore suggested that *Paracryptops* may consist of only one or two species that have been unknowingly carried by man to other locations and then discovered and redescribed as new species. A definitive conclusion as to the origin of *Paracryptops* in the New World can only come from a full generic revision, in which all specimens are examined and compared, and all available names are evaulated.

While visiting the Zoological Museum of the Danish Museum of Natural History, Copenhagen (ZMUC), in August 2005, I discovered a sample with two individuals of *P. inexpectus* from Cole's Cave, Barbados, Lesser Antilles. This is a somewhat inaccessible cave with a resident bat colony that tourists can visit with a guide, and it is located near the village of Proutes in the center of the island, about an hour's drive northeast of Bridgetown. The sample thus represents both the third country and locality for *P. inexpectus* and *Paracryptops* in the Western Hemisphere and the second generic record from a cave, the other being the type of *P. indicus* Silvestri, 1924, from Siju Cave, Meghalaya State, India (Jangi and Dass 1978, Khanna 2001, Chagas and Shelley 2004). The centipedes were encountered "in guano" well inside Cole's Cave, the same locality and habitat where the same collector found the widespread Caribbean milliped,

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Orthoporus antillanus (Pocock, 1894) (Spirostreptida: Spirostreptidae), two years later (Krabbe and Enghoff 1985). Sample data are as follows:

Barbados: ca. 24 km (15 mi) NE Bridgetown, Cole's Cave near Proutes, 400-500 m (1,312-1,640 ft.) from entrance, in guano, 2 specimens, 7 March 1976, T. Wolff (ZMUC). **New Country and Island Record.**

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SCIENTIFIC NOTE

NEW RECORDS OF *RHAMMATOCERUS VIATORIUS* (ORTHOPTERA: ACRIDIDAE: GOMPHOCERINAE) FROM TEXAS, U.S.A.[1]

Thomas Stidham[2] and John Stidham[3]

The grasshopper *Rhammatocerus viatorius* (Saussure) occurs from South America northward to the southwestern United States (Otte 1981). In the United States, it occurs in south central Arizona, and there are two specimens collected in 1930 and 1931 from the Chinati Mountains in Presidio County (Figure 1) in Trans-Pecos Texas (Tinkham 1948). These are the only records of this species known from Texas. On 1 July 2005, the authors collected an adult male and an adult female *Rhammatocerus viatorius* on a rocky hillside with tall grass (60-80 cm in height) on route 118 northwest of the McDonald Observatory, north of Ft. Davis in the Davis Mountains, Jeff Davis County, Texas (Figure 1). The locality is approximately 2000 m (6500 ft) in elevation. Other grasshoppers observed at the locality with *Rhammatocerus* were *Melanoplus lakinus, Melanoplus aridus, Opeia obscura, Dactylotum bicolor variegatum, Mermeria texana,* and *Eritettix tricarinatus.* These are the first records of *R. viatorius* in over 70 years from Texas and are a northeastern range extension of that species' occurrence in Texas by approximately 100 km (65 miles). The Chinati and Davis Mountains are not connected mountain ranges and have intervening desert. Thus, these individuals may be from an isolated population separate from those in the Chinati Mountains or they may be recent dispersers to Jeff Davis County. These new specimens will be placed in Texas A&M University Insect Collection (Department of Entomology, Texas A&M University).

The occurrence of adults in the Davis Mountains in early July differs from reports of adults in the late spring in Arizona and the Chinati Mountains (Otte 1981). However, the morphology of the specimens is consistent with previously described specimens, having red hind tibiae, six to eight large black spots on the tegmen, and angular bands on the outer face of the hind femora. In addition, the sulci on the pronotum match those illustrated by Otte (1981), and the male specimen's phallus and epiphallus do not differ from those illustrated for specimens from Mexico (de Assis-Pujol 1998). Additional collections are necessary to determine if these individuals are late survivors from the previous spring or if the Davis Mountains individuals occur at a different time of year.

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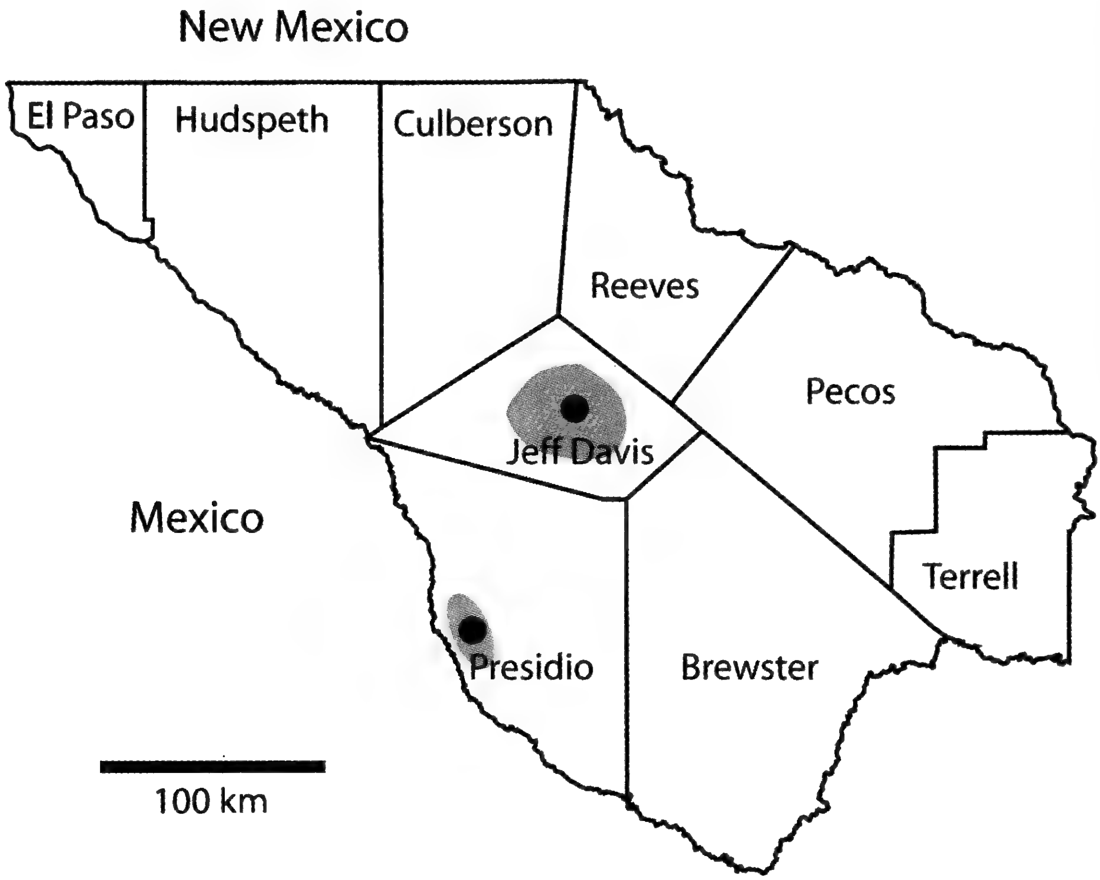

Figure 1. Map of the counties of Trans-Pecos Texas. Dots indicate the localities where *Rhammatocerus viatorius* have been collected. The shaded areas are the extent of the Davis and Chinati Mountains.

ACKNOWLEDGMENTS

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SCIENTIFIC NOTE

OCCURRENCE OF THE MILLIPED GENUS *SCYTONOTUS* C. L. KOCH, 1847 (POLYDESMIDA: POLYDESMIDAE) IN ALBERTA, CANADA[1]

Rowland M. Shelley[2]

The milliped genus *Scytonotus* C. L. Koch, 1847, occupies four areas of North America, one east of the Central Plains and three west of the Continental Divide (one coastal and two in the interior) (Shelley 1993, Hoffman 1999, Shelley et al., 2005). The western coastal area extends along the Pacific from Yakutat Bay, Alaska, to Marin and San Joaquin counties, California, including all intervening offshore islands except the Queen Charlottes, British Columbia (BC). One interior area encompasses the Wasatch and Teton mountains, and associated ranges, in western Wyoming, eastern Idaho, and northern Utah, and the other centers on the Columbia River Valley and the Rocky and Selkirk Mountains from Revelstoke and Yoho National Parks, BC, to southeastern Washington, northern Idaho, and western Montana (Kevan 1983; Shelley 1990, 1993, 2002). Three species inhabit the last area, but only *S. columbianus* Chamberlin, 1920, occurs in BC, where it extends northward to the vicinity of Takkakaw Falls in Yoho. While recently perusing samples in the Virginia Museum of Natural History (VMNH), Martinsville, I discovered one with three unidentifiable females of *Scytonotus* from "Sta. 2," 4,000', Jasper National Park, Alberta, the first record of the genus from this Canadian province. The specimens were collected on 2-4 October 1964 by the late D. R. Whitehead, an experienced arthropod field collector, so there is no reason to suspect a labeling error; Jasper is also where he routinely collected beetles in the course of doctoral program at the University of Alberta. The precise location of "Sta. 2" is unknown, but Dr. Whitehead sampled extensively in the vicinity of Mt. Edith Cavell, some 144 km (90 mi) NNW of the site in Yoho. "Sta. 2" may not have been here, but the southern boundary of Jasper Park is ca. 88 km (55 mi) NNW of the Yoho locality, and the northward generic range extension is probably between these distances because the part of the Park north of Jasper village and highway 16 is largely roadless and inaccessible. Males are necessary for a specific determination, but considering the magnitude of this extension and the fact that the locality lies east of the Divide, a formidable distribution barrier that runs along the border between BC & Alberta, the species seems more likely to be undescribed than *S. columbianus.* Canadian biologists should be aware of the possibility of an undescribed milliped species in Jasper, and if true, it will be the second that is known only from the Park, the other being *Austrotyla borealis* Shear, 1971 (Chordeumatida: Conotylidae), whose holotype and only known specimen was collected by Dr. Whitehead in 1967 at "Sta. 5," precise location also unknown (Shear 1971; Shelley 1990, 2002; Hoffman 1999).

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The distribution of *Scytonotus* in southeastern BC and Alberta is shown in Fig. 1.

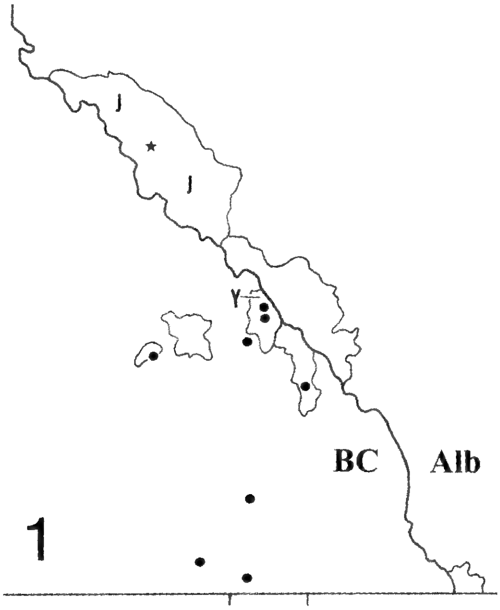

Fig. 1. Occurrences of *Scytonotus* in Alberta (Alb) and southeastern British Columbia (BC). Dots, *S. columbianus;* star, *Scytonotus* sp. J, Jasper National Park; Y, Yoho National Park. Areas directly under BC represent the parts of the states of Washington, Idaho, and Montana (U.S.A.).

ACKNOWLEDGMENTS

I thank R. L. Hoffman, for access to the Alberta sample in the VMNH milliped collection, and G. E. Ball, for a prepublication review.

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SCIENTIFIC NOTE

AN UNUSUAL PREY RECORD FOR *TACHYTES CHRYSOPYGA OBSCURUS* CRESSON (HYMENOPTERA: SPHECIDAE: LARRINAE) FROM IOWA, U.S.A.[1]

G. K. Lechner[2]

The genus *Tachytes* Panzer is a large group of solitary fossorial wasps with over 300 species worldwide and 35 species in America north of Mexico (Bohart 1994). *Tachytes* has been classified into subgenera (Banks 1942) or into species groups (Bohart and Menke 1976; Kurczewski and Spofford 1986; Bohart 1994). *Tachytes* are described as hunters of Orthoptera (although two separate workers had noted the aberrant behavior of *T. bidens* and *T. ambidens* preying on lepidopterous larvae of the family Geometridae in certain states of the former USSR), and prey specificity is reported to be fairly constant at the family level (Bohart and Menke 1976). Kurczewski and Spofford (1986) delineate the prey of *Tachytes* by species groups as follows: species in the *aurulentus* group hunt Tettigoniidae (katydids); the *pepticus* and *distinctus* groups hunt Acrididae (true grasshoppers and locusts); the *mergus* group preys on Tridactylidae (pygmy mole crickets); and in the group exhibiting the most diverse behavior, *abdominalis,* prey records include Tetrigidae (pygmy grasshoppers), Tridactylidae and Acrididae (for common names of orthopterans, see Capinera, et.al., 2004).

Tachytes chrysopyga is a member of the *abdominalis* group and is reported to store Acrididae (Kurczewski and Spofford 1986). This species ranges from southern Mexico to southern Brazil; however, the subspecies *obscurus* inhabits the United States and northern Mexico (Bohart and Menke 1976).

I had a chance meeting with a female *T. chrysopyga obscurus* on 26 July 2006 as she was transporting prey to the nest. This incident was my first, and so far only, encounter with this species. At approximately 1415 hrs, the wasp in question flew in and landed at my feet in the lawn of a residential lot in Sioux City, Iowa, very close to the base of a retaining wall constructed of small slabs of broken concrete. She immediately began walking toward an interstice in the wall; but before she could enter, I was able to collect her prey, a snowy tree cricket (*Oecanthus fultoni* Walker, T.) She ignored my intrusion and walked straightaway into a gap between two concrete slabs. I set a clear plastic jar against the wall; and when the wasp emerged, she was trapped. This *T. chrysopyga obscurus* was in good condition (only minor fraying on the wings); and, at approximately 13 mm in length, was of a normal size for a female of this species (length range: 13-14 mm; W. J. Pulawski, pers. comm.).

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My review of the literature indicates that the use of an *Oecanthus fultoni* (Orthoptera: Gryllidae: Oecanthinae) as prey by *Tachytes chrysopyga obscurus* may represent a new prey record for this species of wasp (Evans and Kurczewski 1966, Kurczewski 1976, Kurczewski and Ginsberg 1971, Kurczewski and Kurczewski 1971, Kurczewski and Spofford 1986, Lin 1967, Parker 1921, Pulawski 1999, Rau 1923, 1946).

The wasp has been retained in my personal collection; the snowy tree cricket has been donated to the ensiferan Orthoptera collection of the Florida State Collection of Arthropods.

ACKNOWLEDGEMENTS

I am indebted to Terry P. Nuhn, USDA Systematic Entomology Laboratory, Washington, D.C., and A. S. Menke, Bisbee, Arizona, for suggestions on locating an expert to verify the species of the wasp involved. In this regard, my thanks go to W. J. Pulawski, California Academy of Sciences, San Francisco, California, for identifying the *Tachytes* and for providing clarification on nomenclature and size ranges. Likewise, I am grateful to T. J. Walker, University of Florida, Gainesville, Florida, who kindly identified the snowy tree cricket.

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SCIENTIFIC NOTE

A FOURTH BAHAMIAN RECORD OF THE MILLIPED, *AMPHELICTOGON SUBTERRANEUS BAHAMIENSIS* CHAMBERLIN, 1918 (POLYDESMIDA: CHELODESMIDAE)[1]

Rowland M. Shelley[2]

The milliped, *Amphelictogon subterraneus bahamiensis* Chamberlin, 1918, a senior synonym of *A. bidens* Loomis, 1934, is common in Cayo Coco, in the Archipiélago de Camagüey, Cuba, and is known from three islands in the Bahamas: Andros, Cat, and Eleuthera (Chamberlin 1918, Perez-Asso 1996, Shelley 2003). It is the only Bahamian representative of the Chelodesmidae and the polydesmidan suborder Leptodesmidea, and these occurrences are the only New World representations of the family north of the Tropic of Cancer. Shelley (2003) hypothesized that the Bahamian populations arose during the Pleistocene via rafting between the existing Cuban and "Great Bahama Bank" land masses, whereupon the milliped dispersed through the latter. The present populations therefore represent fragments of the Pleistocene population that became isolated on today's islands as sea levels rose in the post-Pleistocene era. If true and if modern populations survive, *A. s. bahamiensis* would be expected on other islands that were formerly united in the "Great Bahama Bank" land mass – Long Island, the Exumas, New Providence, the Guana Cays, and possibly Bimini (see Shelley 2003, fig. 4).

While recently perusing milliped samples at the Florida State Collection of Arthropods (FSCA), Gainesville, I discovered one of *A. s. bahamiensis* from New Providence Island, which supports this hypothesis. It is the fourth island and the fourth Bahamian locality for the species, genus, family, and suborder, and it supplants Eleuthera as the northernmost record of the species, genus, and family in the New World. Sample data are as follows:

BAHAMAS: *New Providence I.*, east end, "beach," ♂, ♀, 12 July 1964, E. M. & W. Loomis.

The Andros, Cat, and Eleuthera samples were collected from 74 to 116 years ago. This one was taken only 42 years ago but still far enough in the past that it does not constitute evidence of present occurrence. Investigations are still needed to determine if Bahamian populations survive today, and with three records from the former "eastern arm" of the Pleistocene island, the exception being that from Andros, other components of this "arm" – Long Island, the Exumas, and the Guana Cays – are promising places to search.

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The meaning of the notation, "beach," and whether the millipeds were actually found on the sand itself, probably in association with wood or debris, is unknown. They seemingly could have come from surrounding forest and washed onto the beach along with litter during a storm, as I have seen an example of this situation from a beach in Oregon.

ACKNOWLEDGEMENTS

I thank G. B. Edwards, curator at the Florida State Collection of Arthropods, for access to the milliped collection and for loaning the New Providence sample. R. L. Hoffman provided a pre-submission review.

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A DETAILED DESCRIPTION OF A NEW SPECIES OF THE *HOPLOPLEURA AITKENI* GROUP (PHTHIRAPTERA: ANOPLURA: HOPLOPLURIDAE) PARASITIC ON SOUTH AMERICAN RODENTS (MAMMALIA: RODENTIA) IN ARGENTINA[1]

Dolores del C. Castro,[2] Alda González,[3] Mariano Lattari,[2]
Natalia Martino,[2] and Mariano D. Romero[4]

ABSTRACT: *Hoplopleura paranaensis* sp. nov. is described from specimens collected from *Deltamys kempi* Thomas, 1917, on the Delta del Paraná, Buenos Aires Province, Argentina. Detailed descriptions of sexes, the three nymphal instars, external architecture of eggs (by scanning electron microscopy), and sites of oviposition are provided. Differences from *Hoplopleura aitkeni* Johnson, 1972 are included. A key and discussion of the distribution of the ten species of the *aitkeni*-group on their hosts, and their respective geographical ranges in Argentina is also given.

KEY WORDS: Phthiraptera, Anoplura, Holploplurìdae, parasitism, eggs, nymphs, adults, new species, Argentina, South America, mammalian, Rodentia, new species, key

We describe herein a new species of anopluran lice, *Hoplopleura paranaensis,* based on specimens collected from *Deltamys kempi* Thomas, 1917 from Campana, Paraná de Las Palmas River, Buenos Aires Province, Argentina. This new species resembles *Hoplopleura aitkeni* Johnson, 1972 and is included in the *"aitkeni"* species-group, which contains nine species known from Argentina (Castro 1984, 1988, 1997, Castro et al., 1998, Castro and González, 2003).

METHODS

Studied specimens were obtained directly from museum host skins. Lice were cleared and mounted on conventional microscope slides following the procedure described by Castro and Cicchino (1978). Procedures for scanning electronic microscopic study included hydration with decreasing ethanol, cleaned in physiological solution by means of an ultrasonic vibrator, rinsed in distilled water, fixed in 70% ethanol solution, dehydrated with increasing ethanol solutions. They were then mounted in stubs, coated with gold/palladium, and observed and photographed at different magnifications in a Jeol/RO 1.1 scanning electron microscope at the Electronic Microscopy Service of Museo de La Plata, Buenos Aires

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Province. Nomenclature of the different structures of the egg follows Castro et al. (1991). Body measurements, given in millimeters, were taken directly from mounted specimens using a calibrated eyepiece and are identified in the text by the following abbreviations: HL, head length; HW, maximum head width; THL, thorax length; THW, maximum thorax width; AL, abdomen length; AW, maximum abdomen width; TL, total body length. Scale: the figures are represented in millimeters. Measurements include the range of the available specimens. Magnifications for SEM pictures were obtained directly from the automatic scale. Figure scales are represented in micrometers.

Cephalic chaetotaxy follows Kim and Ludwig (1978). Illustrations were drawn with the aid of a camera lucida. Holotype, allotype and most of the paratypes are deposited in Museo de La Plata collections, Buenos Aires province, Argentina (MLP).

SYSTEMATIC ENTOMOLOGY

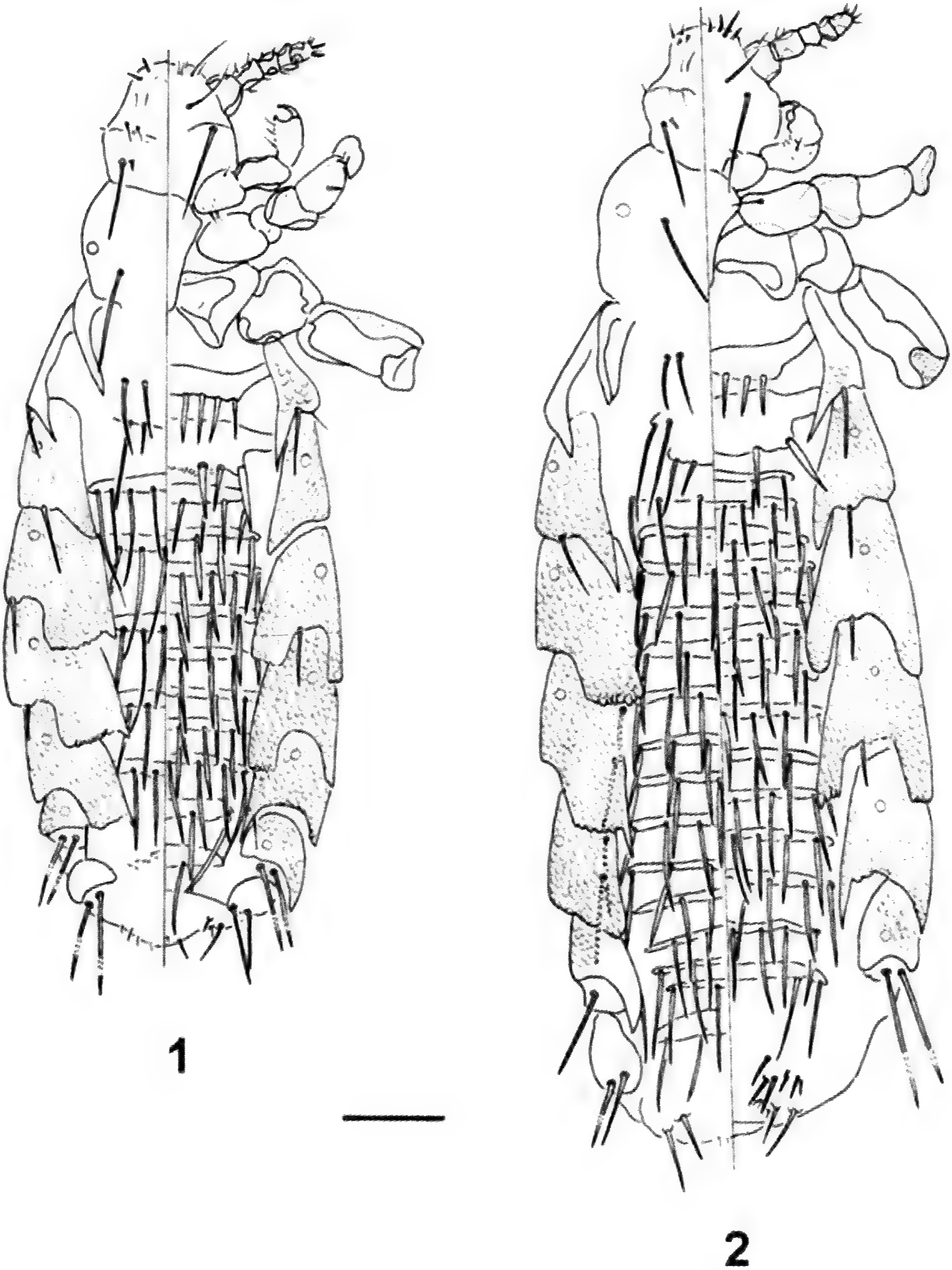
Hoplopleura paranaensis sp. nov.

(Figs. 1-10, 11j, 12-15)

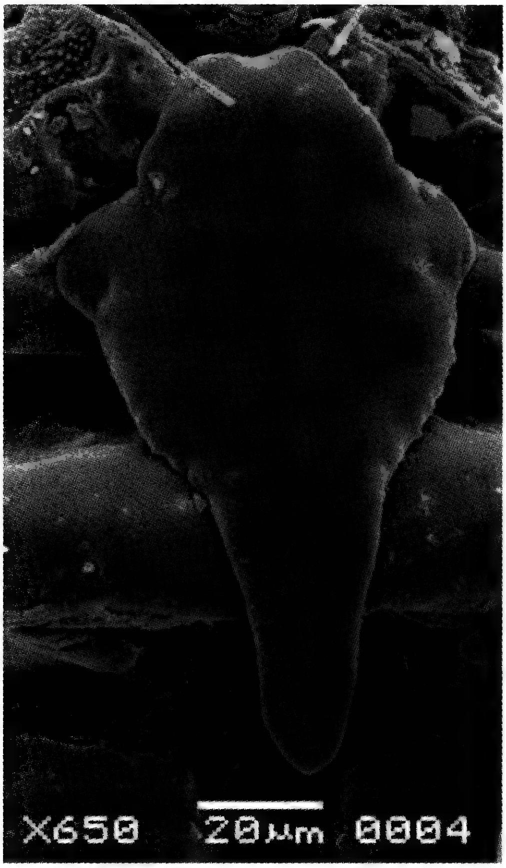
Male Holotype: Fig. 1. Head slightly longer than broad, with anterior border rectilineous and lateral borders convex; postantennal angles rounded. Cephalic chaetotaxy: dorsal principal head seta long and robust; accessory small and robust; sutural 2 thin; preantennal 2 thin; anterior marginal 1 thin; apical 1-2 thin; ventral principal head seta long and robust; preantennal long and thin; anterior marginal 3-4 small and thin, 1 long. Thorax slightly broader than long, seta medial to mesothoracic spiracle long and robust, sternal plate twice longer than broad, with its posterior margin rounded in contact with coxa III (Fig. 3). Abdomen with sternal plates well developed and with remarkably uniform setae on each. Tergal plates well developed starting with tergite IV. Number of setae on tergite I: 4 thin and of same length; tergite II: 4 external ones much longer than central ones; tergite III: 8-10 thin and of same length; tergites IV-V: 6-7 thin and of same length; tergites VI-VII: 4 thin and of same length. Paratergal plates with the following characteristics: II: with 2 unequal acute lobes, ventral much longer and thinner than dorsal, and with 2 different sized setae, with scaly appearance in medial third; III: with 2 rounded subequal lobes, with 2 much longer setae of the same length, with markedly scaly appearance in all its length; IV-V: with 2 lobes, ventral one narrow, with 2 setae, one of them tiny, and markedly scaly appearance in all its length; VI: with 2 lobes, ventral much thinner than dorsal, with 2 setae, one of them tiny and markedly scaly appearance in all its length; VII: with 2 lobes, ventral short and rounded and dorsal longer and thin, with 2 macrochaetae; VIII: without lobes, with 2 macrochaetae (Figs. 7, 11j). Abdominal terminalia as in Figure 5.

Genitalia: well developed, long and narrow basal plate, parameres moderately developed and rounded apically; pseudopenis well developed and serrate in medial third, narrowed to acute apex (Fig. 4).

Female Allotype: Similar to male, differing in measurements, abdominal terminalia, and greater number of tergites and sternites. Gonapophysis: with longer and robust setae (Figs. 2, 6).



Figs. 1-2. *Hoplopleura paranaensis* sp. nov. 1. Male, dorsal and ventral view. 2. Female, dorsal and ventral view. Scale 0.1mm.



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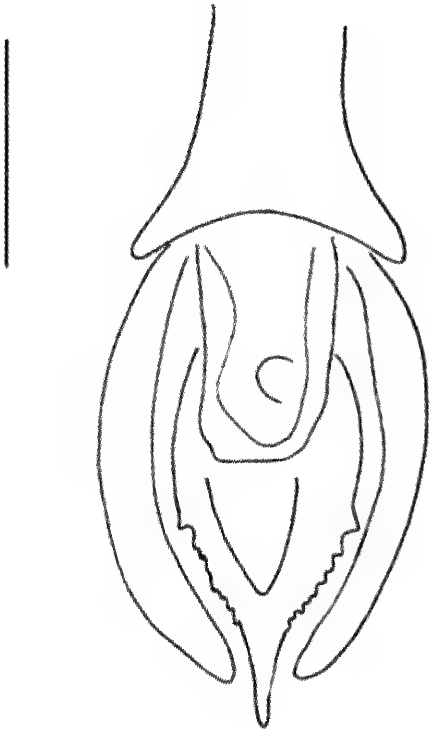

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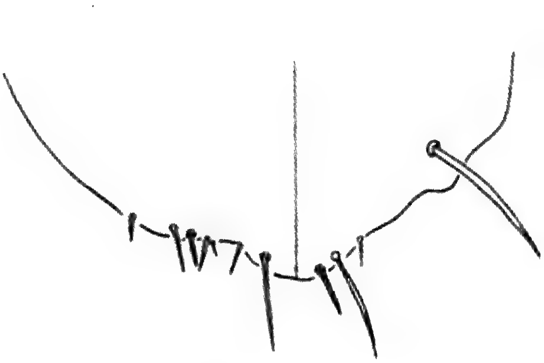

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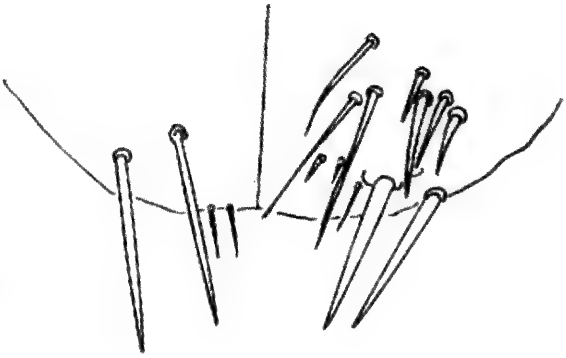

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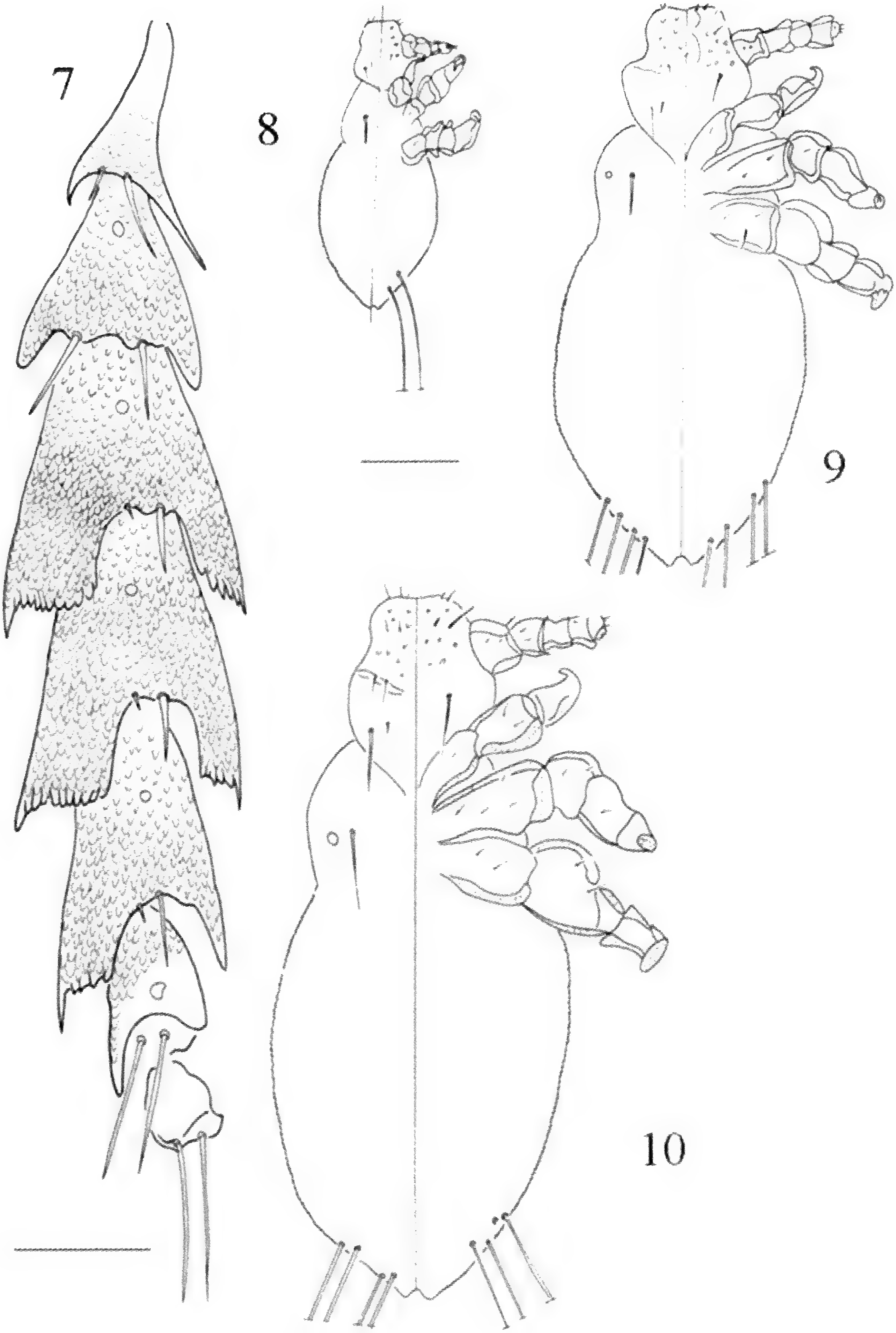
Figs. 3-6. *Hoplopleura paranaensis* sp.nov. 3. Scanning electron micrograph of thoracic sternal plate, x650, scale 20 µm. 4. Male genitalia. 5. Male terminalia. 6. Female terminalia, scale 0.05mm.



Figs.7-10. *Hoplopleura paranaensis* sp.nov. 7. Female paratergal plates, scale 0.1mm. 8. Nymph I, scale 0.1mm. 9. Nymph II, scale 0.1mm. 10. Nymph III, scale 0.1mm.

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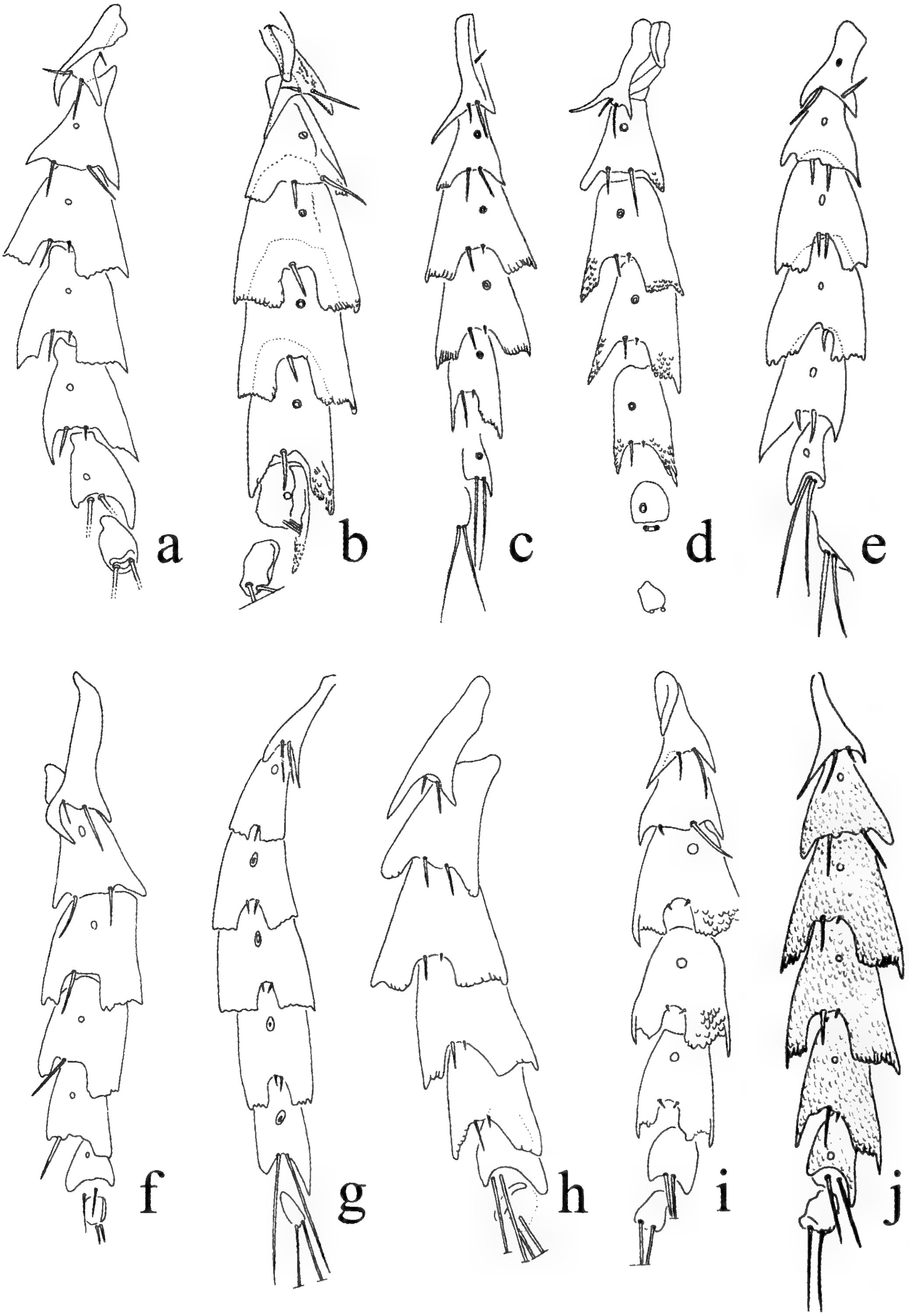


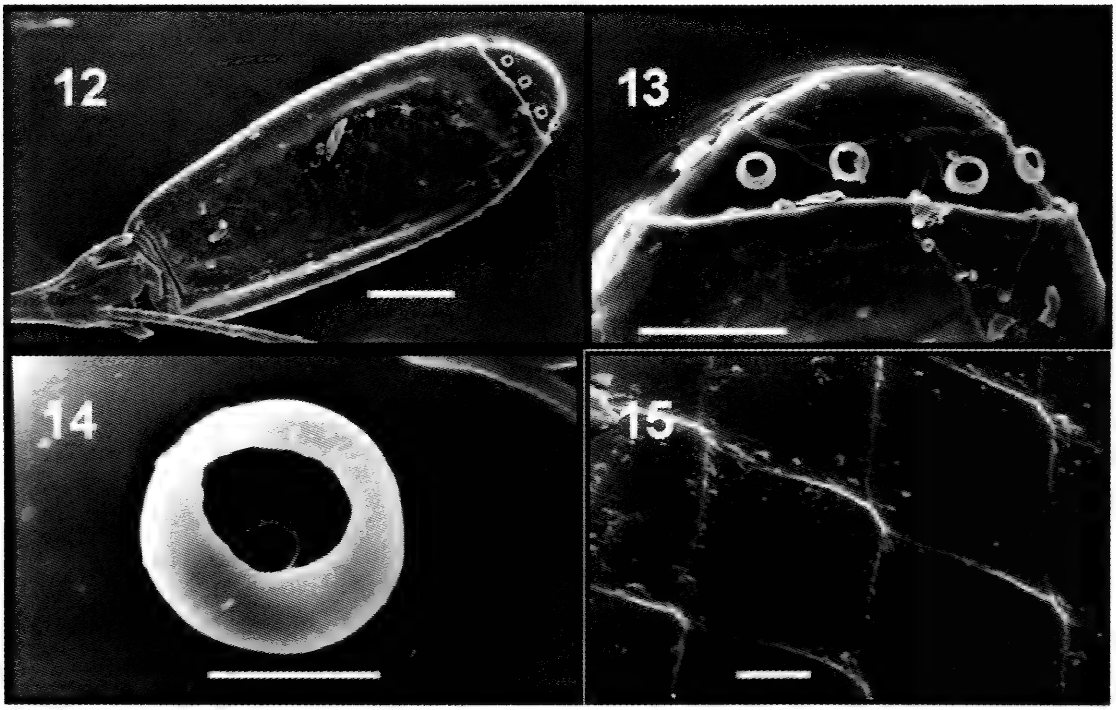
Fig. 11. Paratergal plates of the species of the *"aitkeni"* group: a. *H. aitkeni*; b. *H. imparata*; c. *H. mendozana*; d. *H. nicolai*; e. *H. serrulata*; f. *H. varia*; g. *H. riojensis*, h. *H. misionalis*; i. *H. massoiai*; j. *H. paranaensis* sp. nov. All figures were taken from original descriptions.

First nymphal instar: Dorsal principal head seta well developed and short; accessory poorly developed and thin; ventral principal seta long and thin; abdomen with marked and forked anal lobe, with 2 macrochaetae on each side (Fig. 8).

Second nymphal instar: Dorsal principal head seta well developed, long and thin; accessory well developed and thin; sutural 2 poorly developed; ventral principal seta long and thin; preantennal long and thin; abdomen with marked and forked anal lobe, with 4 macrochaetae on each side (Fig. 9).

Third nymphal instar: Dorsal principal head seta well developed, long and robust; accessory long and thin; sutural 2 well developed, of equal size and thin; preantennal 2 short and thin; ventral principal seta long and robust; central anterior 1 short and thin; preantennal long and thin; abdomen with marked and forked anal lobe, with 4 macrochaetae on each side (Fig. 10).

Measurements. Males (n = 5) HL= 0.15-0.16; HW= 0.13- 0.14; THL= 0.13-0.14; THW= 0.17-0.18; AL= 0.67-0.4; AW= 0.34-0.37; TL= 0.93- 1.05. Females (n= 7) HL=0.16-0.17; HW= 0.14; THL= 0.13-0.15; THW= 0.17-0.17; AL= 0.77-0.87; AW= 0.34-0.38; TL= 1.05-1.15. Nymphs I (n= 4) HL= 0.11-0.12; HW= 0.10-0.11; THL= 0.05-0.07; THW= 0.12-0.15; AL= 0.16-0.27; AW= 0.11-0.27; TL= 0.29-0.44. Nymphs II (n= 3) HL= 0.12-0.13; HW= 0.120-0.21; THL= 0.06-0.06; THW= 0.16-0.17; AL= 0.33); AW= 0.27-0.28; TL= 0.49-0.60. Nymphs III (n= 3) HL= 0.13-0.14; HW= 0.12; THL= 0.09-0.11; THW= 0.17-0.20; AL= 0.40-0.54; AW= 0.30-0.38; TL= 0.65-0.77.



Figs.12-15. Scanning electron microphotograph of the egg of Hoplopleura paranaensis sp.nov.: 12. General view x 200 (Scale 100 µm); 13. Operculum, showing air chambers and adjacent region of amphora x 750 (Scale 50 µm); 14. Detail of air chamber showingthe location of the micropyle x 5000 (Scale 10 µm); 15. Detail of ornamentation of amphora x 1500 (Scale 10 µm).

Egg: Silhouette ellipsoidal (Fig.12), type of ornamentation of amphora: pavimentose, strongly impressed (Fig.15), kind of aerial chamber: ampullacea normal (Figs. 13, 14), relationship among aerial chambers: isolated; number of air chambers: 9-10 (Fig. 13).

Total length: 596µm.

Taxonomic Summary

Type Host: Deltamys kempi Thomas, 1917 (Rodentia, Muridae, Sigmodontinae) MBR. Nº 15612 and 15613: Buenos Aires, Delta, Paraná de las Palmas. 23-IV-1964; 28-VII-1964, Coll. Massoia; Museo Bernardino Rivadavia (MBR); Nº 18668: Buenos Aires, Delta INTA. 03-V-1988; 04-V-1988 Coll. Piantanida. (MBR).

Type locality: Estación Experimental INTA, Campana (34º 12'S; 58º 56'W), Delta, Paraná de las Palmas River, Buenos Aires Province, Argentina.

Type specimens: Male holotype, female allotype; 4 male; 6 female and 7 nymph I; 3nymph II; 3 nymph III paratypes, 9-V-1998, Castro Coll. in MLP.

Ethymology: Paranaensis is named after the region in which the host was collected: Paraná de Las Palmas River.

Sites of oviposition on the host: We examined eight host individuals; six of them were parasitized, although in low density, by *H. paranaensis* sp. nov. Each had a similar infestation pattern, always on the flanks of the thorax and cephalic posterior dorsal region. All the eggs were fixed with a little spumaline only at the base of the hair.

Host: Deltamys kempi Thomas, 1917. Type locality: "Isla Ella, in the delta of the Rio Paraná at the top of the La Plata Estuary." The Delta del Paraná is a large area of islands, marshes, and small rivers and creeks of the Paraná River estuary, between the provinces of Buenos Aires and Entre Rios (about 34ºS and 59ºW, Argentina) (González and Pardiñas, 2002). *Deltamys kempi* has 2 subspecies (González and Massoia, 1995): *D. k. kempi* and *D. k. langguthi.* In Argentina *D. k. kempi* is known from the Delta del Paraná area and from several localities bordering the Rio de La Plata estuary (from islands of the Ibicuy in Entre Ríos province and La Balandra in the Buenos Aires province) (González and Pardiñas, 2002). Sauthier et al. (2005) extend the rank of their distribution 40 Km South of La Balandra.

Remarks

Hoplopleura paranaensis sp. nov. is morphologically similar to *H. aitkeni,* differing in the shape and dimensions of the thoracic plate, structure of the paratergal plates, male external genitalia, body shape and measurements.

DISCUSSION

In Argentina, *Hoplopleura* Enderlein, 1904 includes 27 species (including *H. paranaensis* sp. nov.), all are parasites of rodents from Sciuridae and Muridae families, excluding the four species assigned to *Ferrisella* Ewing, 1929 by

Castro and Verzi (2002). Distribution of the 10 members species of *"aitkeni"* group in South America includes Venezuela, Brasil and Argentina.

Of those 10 species, one (*H. aitkeni*) of them has been described from Venezuela and recorded from Argentina, (*H. imparata* Linardi, Teixeira and Botehlo, 1984) from Brazil, and the remaining eight from Argentina (*H. mendozana* Castro, 1984; *H. varia* Castro, 1988; *H. misionales* Castro, 1988; *H. riojensis* Castro, 1997; *H. serrulata* Castro, 1997; *H. nicolai* Castro et al., 1998; *H. massoiai* Castro and González, 2003 and *H. paranaensis* sp. nov.). In Argentina the "aitkeni" species-group distribution includes the northwestern provinces of Catamarca, La Rioja and Jujuy, the northeastern provinces of Chaco and Misiones, the central western provinces of Mendoza and San Luis, the central eastern province of Buenos Aires and the southwestern province of Neuquen.

The known species of the *"aikteni"* group parasitize Muroidea rodents, from Muridae family, Sigmodontinae subfamily. Most of *"aitkeni"* group are parasites of Akodontini rodents.

Key to the *Hoplopleura aitkeni* species-group

1. Paratergal plate II with two lobes of similar length 2
1' Paratergal plate II with two lobes of different length.....................................3

2. Paratergal plate VII narrow, with ventral lobe longer than the dorsal one. Plates IV-V with dorsal lobe narrower than the ventral one ....
....*H. serrullata* Castro (Fig. 11e)
2' Paratergal plate VII wide, with dorsal lobe longer than the ventral one. Plates IV-V with dorsal lobe wider than the ventral one ....
....*H. aitkeni* Johnson (Fig. 11a)

3. Paratergal plate II with long dorsal lobe and short ventral lobe......................
....*H. riojensis* Castro (Fig. 11g)
3' Paratergal plate II with short dorsal lobe and long ventral lobe.....................4

4. Paratergal plate VII without lobes................*H. nicolai* Castro et al. (Fig. 11d)
4' Paratergal plate VII with one or two lobes 5

5. Paratergal plate VII with one lobe..6
5' Paratergal plate VII with two lobes..7

6. Paratergal plate VII wide, with long and thin dorsal lobe ....
....*H. imparata* Linardi et al. (Fig. 11b)
6' Paratergal plate VII narrow, with short dorsal lobe ....
....*H. mendozana* Castro (Fig. 11c)

7. Paratergal plate VII with dorsal and ventral lobes subequal in length...........8
7' Paratergal plates VII with dorsal and ventral lobes very different in length..9

8. Paratergal plate VII with ventral lobe slightly longer than the dorsal one. Paratergal plates IV-VI with one much longer setae ....*H. varia* Castro (Fig. 11f)
8' Paratergal plate VII with dorsal lobe slightly longer than the ventral one. Paratergal plates IV-VI with evident lateral denticle and 2 short and similar setae ....*H. massoiai* Castro and González (Fig. 11i)

9. Paratergal plate VII wide, with rounded dorsal lobe. Paratergal plates IV-VI with reduced lateral denticulation...................*H. misionalis* Castro (Fig. 11h)
9' Paratergal plate VII narrow, with thin dorsal lobe. Paratergal plates IV-VI with noticeable lateral denticulation...........*H. paranaensis* sp. nov. (Fig. 11j)

ACKNOWLEDGMENT

The authors thank Olga Vaccaro for the information of the host.

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ERRATUM

A NOTE ON THE PRIMARY TYPE DEPOSITORY OF *TETRACNEMOIDEA COIMBRENSIS* (HYMENOPTERA: CHALCIDOIDEA: ENCYRTIDAE) AND A COMMENT ON THE CORRECT SPELLING OF THE SPECIES NAME[1]

G. Japoshvili[2]

In a recent paper, Japoshvili and Abrantes (2006) published the descriptions of several new species of Encyrtidae from Portugal, including *Tetracnemoidea coimbrensis.* Unfortunately, when listing the type depository for this species we inadvertently included the type depository for another species described in the same paper, namely that of *Pseudaphycus portugalensis.* Technically, under the current International Code of Zoological Nomenclature this renders the name *Tetracnemoidea coimbrensis* unavailable for use because the type depository of the primary type of this species is not given (see International Code of Zoological Nomenclature, 1999: Article 16.4.2). To ensure that there is no ambiguity in the availability of this species name we hereby state that the holotype of *Tetracnemoidea coimbrensis* is deposited in the collections of the Institute of Zoology, Tbilisi, Georgia. We also note that *Tetracnemoidea coimbrensis* is misspelled as *Tetrachnemoidea* in the title of description on the page 429 and *conimbrigensis* in the caption for Figures 4-5 on same page. The correct spelling of the species name is *Tetracnemoidea coimbrensis* Japoshvili.

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Japoshvili, G. and I. Abrantes. 2006. New records of encyrtids (Chalcidoidea: Encyrtidae) from Portugal, including description of two new species. Entomological News, Vol. 117(4):423-431.

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NEW RECORDS OF PENTATOMOIDEA (HETEROPTERA) FOR THE FAUNA OF EUROPE, TURKEY, AND THE TURKISH THRACE[1]

Meral Fent[2] and Nihat Aktaç[2]

ABSTRACT: This study was carried out in various localities in five provinces of the Turkish Thrace, between the years 1992 and 2003. A total of 101 species from six heteropteran families (Pentatomidae, Scutelleridae, Thyreocoridae, Cydnidae, Acanthosomatidae and Plataspidae) were determined, 22 of the species are new records of the Pentatomoidea for the Turkish Thrace. Of these, three species (*Thyreocoris fulvipennis, Neottiglossa lineolata, Podops inuncta*) are first records for Turkey. It seems that *Podops* is a new genus record for Turkey. *Picromerus brachypterus,* which has previously been recorded from Anatolia (Turkey), is considered a new record for Europe.

KEY WORDS: Europe, Turkey, Turkish Thrace, Pentatomoidea, new records

Early biological studies of the Turkish Thrace heteropterans date back to the early 1900s (Horvath, 1906, 1917, 1918, 1919). The report of Zwölfer (1930) discussed a number of localities from Anatolia, and also included records from Edirne and Istanbul of the Turkish Thrace. Gadeau de Kerville (1939) and Hoberlandt (1955), who studied different parts of Anatolia, prepared a detailed species list that included some species from Edirne, in the Turkish Thrace. Also, Reuter (1900) has species records from the region but he gave no precise locality. Fahringer (1922) gives some records from Istanbul, particularly from the Belgrad Forest. In addition, there are species records of Schmitschek (1944) and Linnavuori (1965) for different places in Istanbul. Wagner (1966) identified a few species only from Tekirdağ. Josifov (1986) included some information about the Turkish Thrace in the Heteroptera checklist of the Balkan Peninsula. In addition, some species have been recorded from different localities in the region, including papers by Lodos et al. (1978), Lodos and Önder (1978, 1979, 1980, 1982, 1983), Önder et al. (1984), Abbas and Önder (1990), Ahmad and Önder (1990, 1990a), Kıvan (1998, 2004), and Fent and Aktaç (1999, 2002). When all these studies summarized, it appears that 98 species have been recorded from the Turkish Thrace, with three of them being new records (Ahmad and Önder 1990, 1990a).

In this study we aim to contribute to the knowledge of the Pentatomoidae fauna of the Turkish Thrace which has a wide variety of vegetation and is also a bridge between the Balkans, Europe, and Asia.

METHODS

The study material was collected from different habitat types in the Turkish Thrace during the active period of the Pentatomoidea (May - September) for three years from 2000 to 2003. Additionally, some data belonging to our previous field samplings, some as early as 1992, were also evaluated for the present work.

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Different regions, each with particular vegetation and climatic characters in the study area (e.g. dry and humid forests in the Istranca Mountains, Ergene River basin, an anthropogenic steppe, and coastal plain which has Mediterranean type vegetation), were chosen as sampling sites. These sites were surveyed regularly every year in order to search the whole area horizontally and vertically.

The identification of the species was made following Tamanini (1959), Stichel (1960, 1961, 1962), Wagner (1965), Awel (1977), Lodos and Önder (1979); Seidenstücker (1963, 1971) Štys and Davidová (1980), Göllner-Scheiding (1986, 1990) and Abbas and Önder (1990), as well as Ahmad and Önder (1990, 1990a). Also, during the identification process, several species were compared with the materials in the Niyazi Lodos Museum at the Plant Protection Department of the Faculty of Agriculture at Ege University (Izmir, Turkey). The altitude, type of habitats and sampling dates in the study sites are summarized in Table 1. The localities are shown in Figure 1. The study materials have been preserved in the Entomology Museum at the Biology Department of the Faculty of Arts and Science at Trakya University.

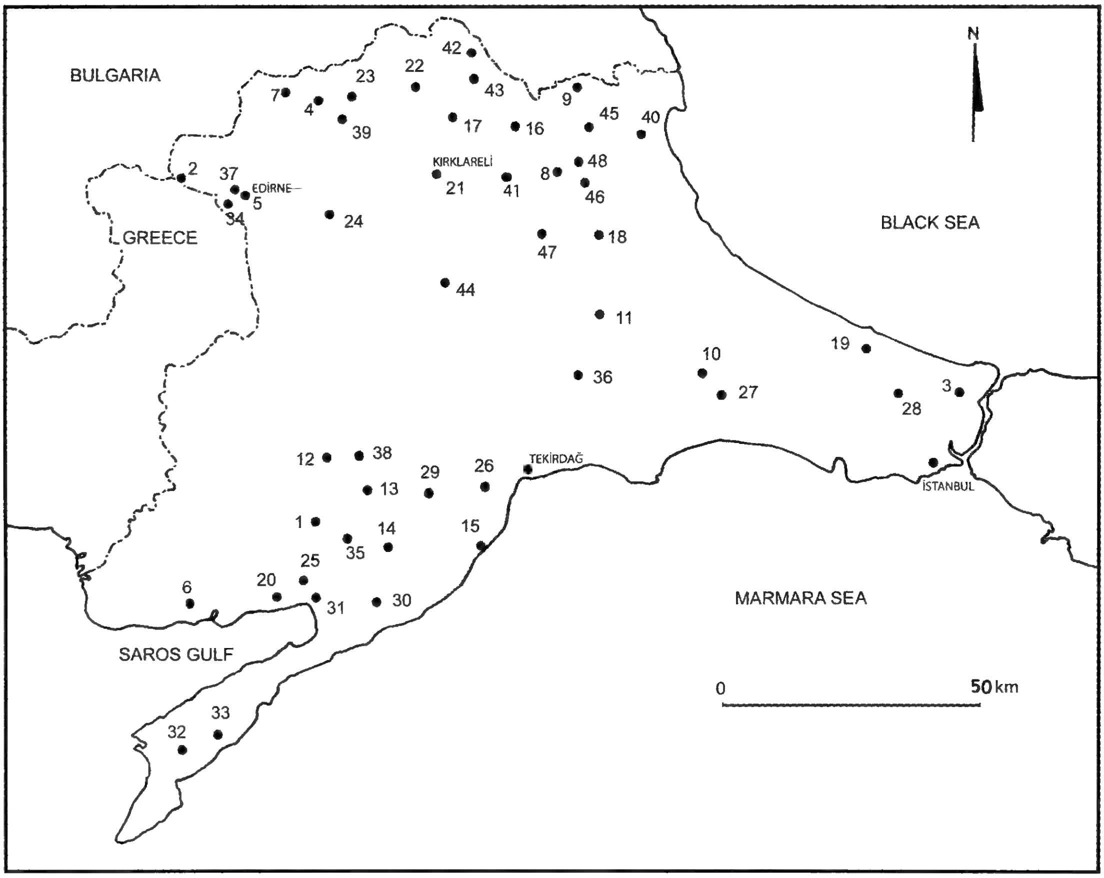

Figure 1. Collecting localities for this study.

Table 1. The localities, altitudes, habitats, and dates where Pentatomoidea species were recorded in Turkish Thrace.

Loc. no	Province	Locality	Coordinates	Altitude (m)	Habitat	Collection Dates
1	Tekirdağ	Malkara (Izgar Köyü)	40° 52' 0N 26° 46' 0	200	Alfalfa field *Medicago sativa* (Fabaceae) meadow	26.09.1992 18.09.1994 28.07.1998 05.05.2001
2	Edirne	Kapıkule	41° 40' 28N 26° 33' 39E	41	*Populus alba* (Salicaceae), meadow	23.06.1993 21.07.1993
3	Istanbul	Bahçeköy (Bilezikçi Çiftliği)	41°10' 47N 28° 59' 29E	25	Mixed forest *Quercus* spp., *Fagus orientalis,* (Fagaceae) *Populus* spp. (Salicaceae)	24.06.1993 14.06.2001
4	Edirne	Lalapaşa (Hacı danişment)	41° 54' 33N 26° 49' 24E	400	Pasture	21.07.1993
5	Edirne	Centre Centre Güllapoğlu Yerleşkesi	41° 40' 28N 26° 33' 39E	41	Fruit trees *Prunus domestica, Malus sylvestris,* (Rosaceae) flowering plants	02.12.1995 13.01.2001 28.05.2002 06.06.2002 12.06.2003 18.06.2003
6	Edirne	Keşan (Yayla)	40° 37' 60N 26° 23' 60E	Sea level	Roadside	17.05.1997
7	Edirne	Lalapaşa (Doğanköy)	41° 55' 60N 26° 41' 60E	350	Mixed fores*t Ulmus* sp. (Ulmacea) *Acer* sp. (Aceraceae) *Quercus* spp. (Fagaceae) *Alnus* sp. (Betulaceae)	05.07.1997 01.09.2001
8	Kırklareli	Pınarhisar (Yenice)	41° 43' 58N 27° 38' 7E	450	Oak forest: *Quercus* spp. (Fagaceae)	06.07.1997
9	Kırklareli	Demirköy (Yiğitbaşı)	41° 55' 60N 27° 38' 60E	292	Oak forest: *Quercus* spp. (Fagaceae)	06.07.1997
10	Istanbul	Silivri (Beyciler)	41° 13' 59N 28° 7' 3E	163	Streamside, *Populus alba* (Salicaceae)	15.08.1997
11	Tekirdağ	Saray (Sinanlı)	41° 23' 30N 27° 46' 20E	125	Streamside, *Populus tremula,* (Salicaceae)	11.09.1997
12	Tekirdağ	Malkara (Şahin)	41° 1' 18N 26° 50' 33E	242	Pasture	29.07.1998
13	Tekirdağ	Malkara (Karaidemir)	40° 57' 0N 27° 1' 60E	120	Pasture	29.07.1998
14	Tekirdağ	Şarköy (Emirali)	40° 46' 60N 27° 1' 60E	110	Alfalfa field *Medicago sativa,* (Fabaceae)	30.07.1998
15	Tekirdağ	Uçmakdere	40° 47' 49N 27° 21' 55E	33	Oak forest: *Quercus* spp. (Fagaceae)	06.08.1998
16	Kırklareli	Çukurpınar	41° 50' 7N 27° 28' 15E	533	Oak forest: *Quercus* spp. (Fagaceae)	25.08.1998

Loc. no	Province	Locality	Coordinates	Altitude (m)	Habitat	Collection Dates
17	Kırklareli	Kuzucu	41° 52' 0N 27° 15' 0E	423	Oak forest: *Quercus* spp. (Fagaceae)	25.08.1998
18	Kırklareli	Vize	41° 34' 21N 27° 45' 57E	186	Oak forest: *Quercus* spp. (Fagaceae)	27.08.1998
19	Istanbul	Çatalca (Durusu)	41° 18' 19N 28° 40' 36E	40	Mixed forest: *Quercus* spp. (Fagaceae), *Pinus* ssp. (Pinaceae), maquis: *Juniperus oxycedrus* (Cupressaceae), *Cistus* sp. (Cictaceae)	29.08.1998
20	Edirne	Keşan (Sazlıdere)	40° 39' 50N 26° 37' 53E	10	Pine Forest: *Pinus brutia, Pinus nigra* (Pinaceae)	31.05.1999
21	Kırklareli	Centre	41° 43' 54N 27° 13' 29E	200	Hayfield, fruit garden *Amygdalus communis* (Rosaceae)	17.07.2000
22	Kırklareli	Kofçaz	41° 55' 42N 27° 9' 40E	500	Streamside	02.08.2000 29.06.2002
23	Edirne	Lalapaşa (Ömeroba)	41° 55' 0N 26° 55' 60E	310	Oak forest: *Quercus* spp. (Fagaceae)	02.08.2000
24	Edirne	Havsa (Hasköy)	41° 38' 28N 26° 51' 31E	95	Fruit garden: *Malus silvestris, Amygdalus communis, Pirus communis* (Rosaceae)	11.05.2001
25	Edirne	Keşan (Korudağı)	40° 46' 0N 26° 38' 60E	300	Mixed forest: *Quercus* spp. (Fagaceae), *Pinus* spp. (Pinaceae)	07.06.2001
26	Tekirdağ	Nusratfakı	40° 57' 0N 27° 19' 0E	189	Mixed forest: *Ulmus* sp. (Ulmaceae), *Cornus mas* (Cornaceae)	09.06.2001
27	Istanbul	Silivri (Büyükkılıçlı)	41° 9' 25N 28° 10' 14E	56	Streamside	15.06.2001
28	Istanbul	Gaziosmanpaş (Boğazköy)	41° 10' 59N 28° 46' 20E	116	Mixed forest: (*Corylus avellena* Corylaceae *Quercus* sp. (Fagaceae), *Ulmus* sp. (Ulmaceae), *Pinus* spp. (Pinaceae)	15.06.2001
29	Tekirdağ	Malkara (Mahramlı)	40° 55' 60N 27° 10' 60E	123	Mixed forest: *Quercus* sp. (Fagaceae), *Ulmus* sp. (Ulmaceae), *Picea abies* (Pinaceae)	07.08.2001
30	Tekirdağ	Şarköy (Yeniköy)	40° 38' 60N 26° 58' 60E	160	Mixed forest: *Thuja* sp., *Cupressus* sp. (Cupressaceaea) *Pinus nigra* (Pinaceae)	10.08.2001
31	Çanakkale	Gelibolu (Kocaçeşme)	40° 39' 47N 26° 48' 1E	350	Pine forest: *Pinus brutia, Pinus nigra* (Pinaceae)	10.08.2001 20.05.2003

Loc. no	Province	Locality	Coordinates	Altitude (m)	Habitat	Collection Dates
32	Çanakkale	Gelibolu Ilgardere	40° 17' 60N 26° 28' 60E	160	Pine forest: *Pinus brutia* (Pinaceae)	11.08.2001
33	Çanakkale	Eceabat (Kemalyeri)	39° 45' 29N 26° 14' 8E	170	Mixed forest: *Pinus brutia, Cedrus* sp. (Pinaceae) *Cupressus* sp. (Cupressaceae)	12.08.2001
34	Edirne	Karaağaç	41° 39' 28N 26° 31' 25E	23	*Populus nigra* (Salicaceae) *Medicago sativa* (Fabaceaea)	12.09.2001 21.05.2003
35	Tekirdağ	Malkara (Karacahalil)	40° 49' 0N 26° 55' 60E	210	Streamside	14.09.2001
36	Tekirdağ	Çorlu (Ulaš)	41° 14' 6N 27° 42' 39E	120	Mixed forest: *Pinus* sp. (Pinaceaea), *Ulmus* sp. (Ulmacaeae)	17.05.2002
37	Edirne	Sarayiçi (Tavuk Ormanı)	41° 40' 28N 26° 33' 39E	41	Mixed forest: *Ulmus* sp. (Ulmaceaea), *Populus alba, Salix alba* (Salicaceae)	12.05.2002 21.05.2002
38	Tekirdağ	Malkara (Kozyörük)	41° 1' 5N 26° 56' 39E	250	Mixed forest: *Quercus* sp. (Fagaceae)	19.05.2002
39	Edirne	Süleoğlu (Baraj)	41° 46' 2N 26° 54' 43E	156	Dam side	24.05.2002 25.06.2002
40	Kırklareli	Demirköy (Iğneada Pedina Gölü)	41° 46' 57N 27° 51' 59E	Sea level	Mixed forest: *Populus* spp. (Salicaceae) *Quercus* spp. (Fagaceae) *Alnus* sp. (Betulaceae) *Ulmus* sp. (Ulmaceae)	26.05.2002
41	Kırklareli	Üsküp (Hacıfaklı)	41° 43' 60N 27° 26' 60E	297	Roadside	27.06.2002
42	Kırklareli	Çağlayık	42° 1' 60N 27° 19' 0E	347	Mixed forest: *Quercus* spp. (Fagaceae), *Alnus* sp. (Betulaceaea), *Ulmus* sp. (Ulmaceae) *Corylus avellen* (Corylaceae)	28.06.2002
43	Kırklareli	Dereköy	42° 1' 60N 27° 20' 0E	430	Oak forest: *Quercus* spp. (Fageceae)	28.06.2002
44	Kırklareli	Lüleburgaz (Kırık)	41° 28' 0N 27° 14' 58E	136	Pasture	28.08.2002
45	Kırklareli	Demirköy (Balaban)	41° 50' 8N 27° 40' 34E	700	Mixed forest: *Populus alba* (Salicaceae) *Ulmus* sp. (Ulmaceae) *Quercus* sp. (Fagaceae)	29.08.2002
46	Kırklareli	Vize (Sergen)	41° 42' 19N 27° 42' 30E	425	Meadow	29.08.2002

Loc. no	Province	Locality	Coordinates	Altitude (m)	Habitat	Collection Dates
47	Kırklareli	Pınarhisar (Tozaklı)	41° 34' 60N 27° 34' 0E	248	Mixed forest: *Quercus* spp. (Fagaceae) *Ulmus* sp. (Ulmaceae) *Alnus* sp. (Betulaceae)	29.08.2002
48	Kırklareli	Pınarhisar (Mahya Tepesi)	41° 43' 55N 27° 38' 7E	800	Mixed forest: *Fagus orientalis* (Fagaceae) *Carpinus betulus* (Oleaceae)	07.06.2003
			41° 45' 46N 27° 38' 7E	880	Anthropogenic steppe	07.06.2003

SYSTEMATIC ENTOMOLOGY

Acanthosomatidae Stål, 1865

Cyphostethus tristriatus (Fabricius, 1787)

Material Examined: loc. **30**, 2 ♂♂.

Distribution: Widely distributed in the Balkan Peninsula and found in many localities in Anatolia. First record for the Turkish Thrace.

Thyreocoridae Amyot and Serville, 1843

Thyreocoris fulvipennis (Dallas, 1851)

Material Examined: loc. **5**, 3 ♀♀.

Distribution: Recorded from Austria, Bulgaria, Corsica, Czechoslovakia, South of France, Italy, Macedonia, Spain, Slovakia, Portugal, Yugoslavia, Hungary, Romania, and from Algeria and Morocco (Stichel, 1961; Štys and Davidová, 1980). This species is the first record for Turkish fauna. The study area can be considered the eastern border of the distribution range of the species.

Diagnosis and Comments: The most important characters of *Thyrecoris fulvipennis* used to differentiate it from other *Thyrecoris* species is the ratio of the lengths of the 2nd and 3rd antennal segments and the corium coloration. When our specimens were compared with the description of Štys and Davidová (1980), it appears that the length of the 2nd antennal segment is 1/3 of the 3rd. On the other hand, the 2nd antennal segment of *T. scarabaeoides* has a length of more than half of the 3rd. *T. ohridanus* can be placed between these two species in terms of the same length character. The 2nd antennal segment of this species is shorter compared to that of *T. scarabaeoides* and the 3rd is shorter compared to that of *T. fulvipennis* (Štys and Davidová, 1980). Corium of *T. fulvipennis* is brown with reddish yellow shades while it is black with metallic reflections in *T. scarabaeoides*.

Our specimens of *T. fulvipennis* are also in accordance with descriptions of Stichel (1961) and Josifov (1981). The contact among the populations that are distributed mostly in Europe is continued.

Cydnidae Billberg, 1820

Microporus nigrita (Fabricius, 1794)

Material Examined: loc. **39**, 1 ♂.

Distribution: Distributed in a broad area, particularly in Europe. Known to occur in a few localities of Anatolia. New record for the Turkish Thrace.

Plataspidae Dallas, 1851

Coptosoma mucronatum Seidenstücker, 1963

Material Examined: loc. **23**, 1 ♂; loc. **26**, 1 ♀, 5 ♂♂; loc. **48**, 1 ♂.

Distribution: Distributed in several eastern European countries, as well as in Russia, and Kazakhstan. Found in Anatolia, particularly in the midland. New record for the Turkish Thrace.

Scutelleridae Leach, 1815

Odontoscelis minuta Jakovlev, 1881

Material Examined: loc. **39**, 8 ♀♀, 17 ♂♂; loc. **40**, 4 ♀♀, 7 ♂♂.

Distribution: Widely distributed in Balkan Peninsula and Anatolia. Recorded for the first time from Turkish Thrace during the present study.

Comments: The male genitalia morphology obtained by genital preparations of males, as well as other morphological characters are in accordance with those of Seidenstücker (1971) and Göllner-Scheiding (1986).

Psacasta tuberculata (Fabricius, 1781)

Material Examined: loc. **2**, 1 ♀.

Distribution: Widespread in Europe, Mediterranean countries, and in the south of Russia. Occurs in many parts of Anatolia and it is particularly common in the Mediterranean region of Turkey. Recorded for the first time for the Turkish Thrace.

Psacasta neglecta (Herrich-Schaeffer, 1837)

Material Examined: loc. **4**, 1 ♀.

Distribution: Common in the Balkan Peninsula, but known to occur in only two localities in Anatolia. First record for the Turkish Thrace.

Odontotarsus freyi Puton, 1882

Material Examined: loc. **1**, 1 ♀, 2 ♂♂; loc. **15**, 2 ♀♀; loc. **20**, 1 ♀; loc. **25**, 1 ♀, 1 ♂; loc. **31**, 5 ♀♀, 2 ♂♂.

Distribution: Found in the north African countries, Spain, and Greece, as well as in Aegean and Mediterranean regions of Turkey (Lodos, et al., 1978, 1998; Önder et al., 1995). First record for the Turkish Thrace.

Odontotarsus plicatulus Horvath, 1906

Material Examined: loc. **15**, 1 ♀, 6 ♂♂; loc. **35**, 1 ♂, **41**, 1 ♀, 1 ♂.

Distribution: Although this species is known to occur from Macedonia to Anatolia and northern Syria (Göllner-Scheiding, 1990), it has been recorded for the first time in the Turkish Thrace during the present study.

Odontotarsus rufescens Fieber, 1861

Material Examined: loc. 7, 1 ♂; loc. **8**, 1 ♂; loc. **9**, 1 ♂; loc. **12**, 1 ♂; loc. **13**, 1 ♀; loc. **14**, 1 ♂; loc. **16**, 1 ♂; loc. **17**, 1 ♀, 2 ♂♂; loc. **18**, 1 ♂; loc. **22**, 1 ♀, 1 ♂; loc. **23**, 1 ♀; loc. **28**, 2 ♀♀; loc. **33**, 1 ♀; loc. **37**, 1 ♂; loc. **38**, 1 ♀; loc. **42**, 1 ♂; loc. **44**, 2 ♂♂; loc. **48**, 1 ♀, 2 ♂♂.

Distribution: This species has a distribution range including Greece, Bulgaria, Crete, Cyprus, Syria, Egypt, Iraq and Anatolia. It is a new record for the Turkish Thrace fauna.

Comments and Diagnosis: The morphological characters of *Odontotarsus freyi*, *O. plicatulus,* and *O. rufescens* in this present study are in accordance with those reported by Stichel (1961) and Göllner-Scheiding (1990). Moreover, genital preparations of male specimens of these three species confirmed the data of Göllner-Scheiding (1990).

Pentatomidae Leach, 1815

Picromerus brachypterus Ahmad and Önder, 1990

Material Examined: loc. 7, 3 ♀♀.

Distribution: This species is known to occur only in Turkey and its type locality is the Bayburt-Kaçkar Mountains. Since it was recorded for the first time from the Turkish Thrace during the present study, it is also the first record for the Balkan Fauna and Europe.

Diagnosis and Comments: Membrane of hemelytra in *P. brachypterus* is short and does not entirely cover the distal part. Second antennal segment is at least 1½ x or about 1⅓ x length of third, and usually is distinctly longer than the fourth. The fourth and fifth segments are almost equal; paraclypeus are as long as clypeus. The close species to this species are *P. bidens* and *P. pseudobidens*. According to Ahmad and Önder (1990), hemelytra in *P. bidens* reaches till the distal part of abdomen entirely, second antennal segment is longer than the third but less than 1¼ x length of third, and equal to the fourth, the fourth and fifth segments are equal. Paraclypeus are equal to clypeus or shorter. In the other species *P. pseudobidens,* the hemelytra distinctly reaches beyond abdomen; the second antennal segment is equal or slightly longer than the third, and is longer than the fifth; paraclypeus is equal or slightly longer than the clypeus. Our *P. barchypterus* material conforms to the study of Ahmad and Önder (1990).

Jalla dumosa (Linnaeus, 1758)

Material Examined: loc. 48, 1 ♀.

Distribution: This species has a wide geographic range and is commonly found throughout Europe. It is also known to occur in many localities in Anatolia, but the present study represents the first record for the Turkish Thrace.

Sciocoris (Aposciocoris) homalonotus Fieber, 1852

Material Examined: loc. **36**, 4 ♀♀, 1 ♂; loc. **37**, 1 ♀.

Distribution: Exhibits a wide distribution in Europe, but is found in a few localities in Anatolia, also is the first record for the Turkish Thrace.

Aelia albovittata Fieber, 1868

Material Examined: loc. **6**, 1 ♀; loc. **31**, 2 ♀♀, 2 ♂♂.

Distribution: This species has been reported from Greece and Bulgaria which are contiguous countries to the study area. It is known to occur in Syria and many localities in Anatolia but is the first record for the Turkish Thrace.

Neottiglossa leporina (Herrich-Schäffer, 1830)

Material Examined: loc. **17**, 1 ♀.

Distribution: Common in Europe and also found in the south of Russia and Siberia. This species has been reported from several localities in Anatolia. It was recorded from only one locality in our study area and it is the first record for the Turkish Thrace.

Neottiglossa lineolata (Mulsant and Rey, 1852)

Material Examined: loc. **27**, 2 ♀♀; loc. **37**, 2 ♀♀.

Distribution: This species has been found in European countries which are on the Mediterranean coast, in the Balkan Peninsula and in the south of Russia. It was found in only two localities in Turkish Thrace and is the new record for the Turkish Fauna.

Comments and Diagnosis: The taxonomic status of this species is highly complicated and, therefore, it has been included in different taxa by several authors. This species is very close to *N. pusilla* but, as Wagner (1954) stated, due to several head and genital parts it is definitely different from that species. According to Stichel (1961), the medial part of the venter forms a dark triangle-shaped spot distally, laterally with a dark black stripe consisting of black punctures, the area between these stripes and the middle part of the abdomen is pale yellow and has scarce brown punctures. The venter described above is the same in our specimens. Stichel (1961) regards these features as distinctive between *N. lineolata* and *N. pusilla.* Wagner (1954) and Josifov (1981) have given these features of the venter for *N. pusilla.* Josifov (1981) separated the two species according to the coloration on the connexivum. According to Josifov (1981), there are triangle-shaped spots on the connexivum of each paratergites in *N. lineolata.* Stichel (1961) states that the dark punctures are distributed homogeneously on connexivum or that they are found densely on each of proximal and distal margins. The shape of punctures on connexivum in our study conforms to description of Josifov (1981).

Acrosternum heegeri Fieber, 1861

Material Examined: loc. **34**, 1 ♀.

Distribution: Widely distributed throughout Palaearctic, particularly common in southern Europe. Although this species has previously been reported from several localities in Anatolia, it is the first record for the Turkish Thrace.

Holcostethus albipes (Fabricius, 1781)

Material Examined: loc **1**, 2 ♀♀; loc. **21**, 1 ♀.

Distribution: Distributed particularly in Mediteranean countries and in Europe, but is reported from a few localities in Anatolia. First record for the Turkish Thrace.

Holcostethus sphacelatus Fabricius, 1794

Material Examined: loc. **48**, 1 ♀.

Distribution: Distributed in Europe, Mediterranean countries, southern Russia, and in a few localities in Anatolia. First record for the Turkish Thrace.

Carpocoris melanocerus (Mulsant and Rey, 1852)

Material Examined: loc. **7**, 1 ♂; loc. **11**, 1 ♀; loc. **16**, 1 ♀; loc. **19**, 1 ♀; loc. **25**, 1 ♀; loc. **29**, 1 ♀; loc. **32**, 1 ♀; loc. **46**, 1 ♂.

Distribution: Distributed in Europe, Caucasia, and found in many localities in Anatolia. First record for the Turkish Thrace.

Stagonomus bipunctatus (Linnaeus, 1758)

Material Examined: loc. **3**, 2 ♂♂; loc. 7, 1 ♂; loc. **10**, 2 ♀♀, 1 ♂; loc. **43**, 2 ♂♂; loc. **45**, 1 ♂; loc. **47**, 1 ♂.

Distribution: This species is widely distributed in Europe, North Africa, Caucasia, the Middle East, and several localities in Anatolia. First record for the Turkish Thrace.

Podops (Podops) inuncta (Fabricius, 1775)

Material Examined: loc. **3**, 1 ♀.

Distribution: This species has a wide distribution in Europe, particularly in the Balkan Peninsula. It is the first record for Turkish fauna at genus level.

The genus *Podops* is represented by 10 species belonging to 3 subgenera in the Palaearctic (Josifov, 1981; Derzhansky, 2000). The presence of the genus in Turkey is shown for the first time during the present study in which we recorded *Podops inuncta.* The subgenera of *Podops* are *Petalodera, Podops,* and *Opocrates.* The genus *Podops* is characterized by the peculiar shape of the distal corner of the pronotal projections, such as axe, tongue, pen, or spine (Stichel, 1961).

Diagnosis: According to the description of Stichel (1961) regarding *Podops inuncta,* the circular brown spot on the distal portion of the femur is single, tibia is yellow without a longitudinal line, tarsi are entirely yellow. Moreover, the number of tubercles is three or may be five. In the study material, the femur has circular brown spots, brown pretarsi, and the ventral side of the tibia with brown longitudinal stripe. The number of tubercles on the proximal side of scutellum is three.

DISCUSSION

As a result of this study, 22 new records belonging to 6 families (Pentatomidae, Scutelleridae, Thyreocoridae, Cydnidae, Acanthosomatidae and Plataspidae) for Turkish Thrace were determined. Three of these species (*Thyreocoris fulvipennis, Neottiglossa lineolata, Podops inuncta*) are new records for Pentatomidae fauna of Turkey. The genus *Podops* is also new for Turkey. *Picromerus brachypterus* is the first record for Europe and for the Balkan Peninsula.

In the previous studies dealing with the geographical distribution, no species belonging to genus *Podops* had been reported for the Turkish Thrace and Anatolia. However, this genus is represented by the species *P. inuncta,* and *P. rectidens*, in Bulgaria, as well as *P. curvidens* and *P. rectidens* in Greece (Josifov, 1981, 1986). *Podops inuncta,* which was found only in Istanbul-Belgrad Forests for the first time during the study, may be considered a European species in terms of its geographic distribution.

Three species of the genus *Thyreocoris* have been known from the Palaearctic. These are *T. scarabaeoides, T. fulvipennis,* and *T. ohridanus* (Josifov, 1981, 1986). Only *T. scarabaeoides* has been known from Turkey up to now. In the early studies, *T. scarabaeoides* was recorded from Ankara (Escherich, 1897; Hoberlandt, 1955) and Istanbul-Belgrad Forests (Fahringer, 1922). In later studies, it was reported from Antalya, Nevşehir and Izmir (Lodos and Önder, 1980; Lodos et al., 1998). *Thyreocoris scrabaeoides* has been known to occur in Bulgaria and Greece which are the neighbor countries to the study area (Josifov, 1986). *Thyreocoris fulvipennis* is known to occur in a few European countries including Bulgaria (Stichel, 1962; Josifov, 1981), which also was contributed to Turkish fauna by the present study. The third species, *T. ohridanus,* was reported from southwestern Bulgaria, though it was not found in the Turkish Thrace during this study. However, this species may possibly be found in the area if its distribution is regarded. Josifov (1981) pointed out that *T. fulvipennis* is a mountainous species particularly for high altitudes, since it is found at mountains (Rhodope, Vitosha and Lozen) above 800 m in Bulgaria. However, our findings do not support Josifov's (1981) suggestions because it was found at 41 m altitude in Edirne. In central Europe *T. fulvipennis* occurs only in lowlands (Štys and Davidová, 1980).

Neottiglossa lineolata, which was the first record in the study area, has been reported to occur in only Europe and in the Balkans regarding its geographic distribution. This species was found in two localities (Edirne-Sarayiçi and Silivri-Büyükkılıçly) which are located at a long distance from each other. It is possible that this species may have a broader distribution. The study area may be considered as the eastern boundary of its distribution, because this species has never been reported from Anatolia.

The species *Cyphostethus tristriatus, Microporus nigrita, Coptosoma mucronatum, Odontoscelis minuta, Odontotarsus freyi, O. rufescens, O. plicatulus, Psacasta tuberculata, P. neglecta, Jalla dumosa, Sciocoris homalonatus, A. albovittata, Nettiglossa leporina, Acrosternum heegeri, Holcostethus albipes, H. sphacelatus, Carpocoris melanocerus* and *Stagonomus bipunctatus,* which appeared as new records for the Turkish Thrace, are widespread in Anatolia, the Balkans, and particularly in Greece and Bulgaria. Although *Picromerus brachypterus* has already been reported from Anatolia, it was recorded for the first time in the Turkish Thrace during the course of the present study.

As a result, the species number of Turkish Pentatomoidea fauna increased from 244 to 247 with the introduction of three new species recorded during the present extensive survey in the Turkish Thrace. The species number of Pentatomoidea in the Turkish Thrace was 98 before the present study, and the addition of 22 new records from the Turkish Thrace, 3 of which are also new for Turkey, increased this number to 120. In conclusion, the present data revealed that the Turkish Thrace exhibits a rich species diversity of Pentatomoidea, as this relatively small area houses almost half of the species of Turkish Pentatomoidea.

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A PROPOSAL OF GENERIC AND SUBGENERIC ABBREVIATIONS FOR PHLEBOTOMINE SANDFLIES (DIPTERA: PSYCHODIDAE: PHLEBOTOMINAE) OF THE WORLD[1]

Carlos Brisola Marcondes[2]

ABSTRACT: The systematics of Phlebotomine sandflies has been studied and discussed since the beginning of the 20th century, and many systems have been proposed. Complex and well-based systems, dividing Phlebotominae in many genera and subgenera, proposed for Old and New World species, have been progressively understood and accepted by the workers in the subfamily. Due to its complex nature, a system of abbreviations, similar to that utilized for Culicidae, is proposed here for these groups of Phlebotominae. It uses two letters for genera and three for subgenera.

KEY WORDS: Psychodidae, Phlebotominae, nomenclature, systematics, abbreviation, genus, subgenus

Many systems of classification of the species of Phlebotomine sandflies have been proposed since Newstead (1911). Galati (1995, 2003) revised the existing proposals for New World sandflies, and created a new system, based on a careful phyllogenetic study. It includes a complete review and reorganization of the species of the subfamily Phlebotominae into two tribes (Hertigiini and Phlebotomini). The first was divided in the subtribes Hertigiina and Idiophlebotomina, and the second in Phlebotomina, Australophlebotomina, Brumptomyiina, Sergentomyiina, Lutzomyiina and Psychodopygina.

Galati (1995, 2003) did not analyze the infrageneric systematics of the genus *Phlebotomus*; moreover, Rispail and Léger (1998) proposed a new classification of genera and subgenera for Old World Phlebotominae sandflies, based in a morphological study, which is utilized here. Older classifications are discussed by Galati (1995, 2003) and Rispail and Léger (1998), in their analyses and new proposals.

Several of the many genera and subgenera of Phlebotominae have the same initial letter, preventing the use of abbreviations in publications. If the authors choose to abbreviate in publications, some confusion may occur. A system of abbreviations for these categories is proposed. It is similar to the system proposed by Reinert (1975, 1982, 1992, 2001) for the genera of Culicidae, which has been very useful.

METHODS

The abbreviations of genera utilize the first two letters of the genus and those of subgenera the first three of the subgenus. When necessary to avoid confusion, another combination of letters is proposed. Since some publications include references to Culicidae and Phlebotominae, the abbreviations for the last group were usually conciliated to those of Reinert (2001).

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Since series and groups are provisory, and these categories are not recognized by the Code of Zoological Nomenclature, no abbreviations are proposed for them.

PROPOSALS

The abbreviations for 31 genera and 35 subgenera proposed by Galati (2003) and Rispail et al. (1998) are shown below. Adequate utilization of abbreviations is recommended by the International Code of Zoological Nomenclature (ICZN, Chapter 7, Article 25, Recommendation 25A, 1999), to prevent confusion between genera and subgenera with the same initial. Periods must be used with the generic and subgeneric abbreviations (ICZN, Appendix B11, 1999).

Proposed abbreviations for genera of Phlebotominae

Genus	Abbreviation
Australophlebotomus Theodor	*Au.*
Bichromomyia Artemiev	*Bi.*
Brumptomyia França and Parrot	*Br.*
Chinius Leng	*Ch.*
Dampfomyia Addis	*Da.*
Deanemyia Galati	*De.*
Evandromyia Mangabeira	*Ev.*
Expapillata Galati	*Ex.*
Hertigia Fairchild	*He.*
Idiophlebotomus Quate and Fairchild	*Id.*
Lutzomyia França	*Lu.*
Martinsmyia Galati	*Mt.*
Micropygomyia Barretto	*Mi.*
Migonemyia Galati	*Mg.*
Nyssomyia Barretto	*Ny.*
Oligodontomyia Galati	*Ol.*
+*Phlebotomiella* Hennig	*Pe.*
+*Phlebotomites* Meunier	*Pt.*
Phlebotomus Rondani and Berté	*Ph.*
Pintomyia Costa Lima	*Pi.*
Pressatia Mangabeira	*Pr.*
Psathyromyia Barretto	*Pa.*
Psychodopygus Mangabeira	*Ps.*
Sciopemyia Barretto	*Sc.*
Sergentomyia França and Parrot	*Se.*
Spelaeomyia Theodor, 1948	*Sa.*
Spelaeophlebotomus Theodor	*Sl.*
Trichophoromyia Barretto	*Th.*
Trichopygomyia Barretto	*Ty.*
Viannamyia Mangabeira	*Vi.*
Warileya Hertig	*Wa.*

+ Extinct

Proposed abbreviations for subgenera of Phlebotominae

Subgenus	Abbreviation
	Genus *Dampfomyia*
Coromyia	*Cor.*
Dampfomyia	*Dam.*
	Genus *Evandromyia*
Aldamyia	*Ald.*
Barrettomyia	*Bar.*
Evandromyia	*Eva.*
	Genus *Lutzomyia*
Castromyia	*Cas.*
Lutzomyia	*Lut.*
Helcocyrtomyia	*Hel.*
Tricholateralis	*Trl.*
	Genus *Micropygomyia*
Coquilletimyia	*Col.*
Micropygomyia	*Mic.*
Sauromyia	*Sau.*
Silvamyia	*Sil.*
	Genus *Migonemyia*
Blancasmyia	*Bla.*
Migomemyia	*Mig.*
	Genus *Phlebotomus*
Adlerius	*Adl.*
Anaphlebotomus	*Ana.*
Euphlebotomus	*Eup.*
Kasaulius	*Kas.*
Larroussius	*Lar.*
Paraphlebotomus	*Par.*
Phlebotomus	*Phl.*
Synphlebotomus	*Syn.*
Transphlebotomus	*Tra.*
	Genus *Pintomyia*
Pifanomyia	*Pif.*
Pintomyia	*Pin.*
	Genus *Psathyromyia*
Forattiniella	*For.*
Psathyromyia	*Psa.*
Xiphomyia	*Xip.*

	Genus *Sergentomyia*
Demeillonius	*Dem.*
Grassomyia	*Gra.*
Neophlebotomus	*Neo.*
Parrotomyia	*Par.*
Sergentomyia	*Ser.*
Sintonius	*Sin.*

The abbreviation *Ps.* was utilized for *Psychodopygus,* in a similar way to the proposition of this as a genus (Ready et al., 1980); this genus, narrower than that previously proposed by Forattini (1971), is accepted by Galati (1995, 2003).

The abbreviation *Mt.* was utilized for *Martinsmyia* and *Col.* for the subgenus *Coquillettimyia* to avoid confusion with *Ma.* for *Mansonia,* and *Coq.* for the subgenus *Coquillettidia,* both in the Culicidae. The abbreviation *Th.* was utilized for *Trichophoromyia* and *Ty.* for *Trichopygomyia,* to avoid confusion with *Trichoprosopon* (Reinert 2001); *h* and *y* refer to, respectively, *phoreus* ("carrier") and *pygos* ("rump, buttocks") (Brown 1956). Both genera of Culicidae are common in the American continent (Knight and Stone, 1977), adopting the narrower concept of *Trichoprosopon* of Zavortink (1979).

It was not considered necessary to avoid the utilization of *Mi.* for *Micropygomyia, Mg.* for *Migomemyia, Bar.* for *Barrettomyia,* and *Ch.* for *Chinius* (Galati 2003), because there is no coincidence between the distributions of these groups and those of *Mimomyia, Maorigoeldia, Barraudius,* and *Chagasia* (Knight and Stone, 1977). The coincidence of abbreviations is not important in papers which do not include both families.

The abbreviation *Trl.* was utilized for *Tricholateralis* to prevent any association to *Trichopygomyia* and to recall *lateralis* ("of the side"), and *Sl.* for *Spelaeophlebotomus,* instead of *Sp.,* to prevent confusion with sp. for undefined species.

The maintenance of *Lu.* for the genus *Lutzomyia* agrees with the use in papers also referring to *Leishmania* (Protozoa: Kinetoplastida: Trypanosomatidae), in which the last genus is abbreviated as *Le.* or *L.* (e.g., Lainson et al., 1977).

Since Depaquit et al. (1998) considered *Phlebotomus,* including *Larroussius,* as a paraphyletic group, some modifications may occur in the genus, which would change the status of this subgenus. The study of more characters of Old World Phlebotomine sandflies than those utilized by Rispail and Léger (1998) and of their polarity will possibly lead to modifications on the classification of these species (Galati, unpublished data).

No classification can be considered as perpetual, as confirmed by the new proposals for the raising to the genus level of *Ochlerotatus* (Reinert, 2000) and Stegomyia (Reinert et al., 2004). The classification of Phlebotominae of Galati (1995, 2003) is based on sound morphological basis. It has been confirmed by the molecular study of Depaquit et al. (1998), which showed *Sergentomyia* nearer to *Lutzomyia* than to *Phlebotomus.* Beaty et al. (2004) distinguished two clades, one corresponding to Psychodopygina and other to Lutzomyiina in the classification of Galati (1995, 2003); in the last clade, a subclade, equivalent to genus *Lutzomyia,* and another, equivalent to *Migonemyia*+, both proposed by Galati (1995, 2003), can easily be distinguished.

The adequacy of the acceptance of new proposals for taxonomic changes was recently commented (Marcondes, 2007; but see Polaszek 2007) and, if not disproved in an adequate period, they should be accepted and utilized. The number of known species of Culicidae (ca. 3,500) is greater than that of Phlebotominae (ca. 700). However, since the number of genera of the last group (31) is comparable to that of the first (39) (Reinert, 2001) plus *Stegomyia* (Reinert et al., 2004), the proposed "abbreviations" are also useful.

The proposed abbreviations can be adapted to any future modification of the classification, as done by Reinert (1982, 1992, 2001) for Culicidae. Since generic names of Phlebotomine sandflies are much less known to general public than those of mosquitoes, the acceptance of the new classification (Galati, 1995, 2003; Rispail and Léger, 1998) would be much less traumatic for them; in fact, some medical personnel still refer to sandflies as "*Phlebotomus.*" The recommendations of Editor JME (2005) to manage the modifications for Aedine mosquitoes, if applied for sandflies, will form, for example, *Nyssomyia neivai* (=*Lutzomyia neivai* see Galati, 2003). If, after an adequate study on phylogeny, some subgenus is raised to generic status (or vice-versa), it will be easy to change the abbreviation (e.g., *Xip.* to *Xi* or. *Ny.* to *Nys.*).

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A NEW SPECIES OF *NEOTOURNIERIA* APFELBECK, 1932 (COLEOPTERA: CURCULIONIDAE) FROM TURKEY[1]

Luigi Magnano[2] and Osman Sert[3]

ABSTRACT: *Neotournieria ambigener* n. sp. from Turkey is described and compared with the three known species of the genus. The new species is the only amphigonic known member of *Neotournieria*.

KEY WORDS: *Neotournieria,* new species, amphigony, Turkey, Coleoptera, Curculionidae

Neotournieria was described by Apfelbeck (1932) as subgenus of *Otiorhynchus* Germar, 1822 and raised to generic level by Magnano (1998). Thus far, only three species, all apparently parthenogenetic, are included in it. However, the new species herein described is amphigonic, namely it has both sexes. It can be reminded that Lona (1943) described *Otiorhynchus liebmanni* Lona, 1943 approaching it to the quite unrelated species *O. (Panorosemus) gibbicollis* Boheman, 1843, *O. (Tournieria) veluchianus* Apfelbeck, 1908 and *Neotournieria bureschi* (Apfelbeck, 1932), although he did not included *O. liebmanni* to any of the then described subgenera. Judging from the description, it could be possible that it also belongs in *Neotournieria*, and only the future study of types will clarify its systematic position.

SYSTEMATIC ENTOMOLOGY

Neotournieria ambigener n. sp.

Diagnosis: *Neotournieria* related to *N. bureschi* (Apfelbeck, 1932) with which it shares the minutely granulate elytra, but easily recognizable by its larger size and the patches of golden hairlike scales on elytra.

Type Data: Holotypus ♀: "Turkey Aysebacy village, Balıkesir, 02.06.1994, leg. S. Varlı" in Magnano collection. Genitalia included in Euparal® and sternites 1-5 glued on a transparent label below the specimen and borne by the same pin. Paratypes: 1 ♂ "Turkey Aysebacy village, Balıkesir, 02.06.1994, leg. S. Varlı," in Magnano collection; 2 ♀♀ "Turkey Aysebacy village, Balıkesir, 02.06.1994, leg. S. Varlı," in Sert collection.

Description: Holotypus ♀. Length (prothorax + elytra) mm 8.5, maximum elytral width mm 4.5. Integument black, apex of tibiae, tarsi and antenna dark brown. Rostrum, pterygia included, 1.55 times as long as wide, slightly conically tapering from anterior margin of eyes to posterior margin of pterygia. Scrobe deep, with anterior margin notched, and not extending toward eye. Epistoma shining, acutely arch-shaped and keeled posteriorly. Frons sloping forward at the level of hind margin of scrobe. Epifrons parallel-sided with a faint longitudinal carina, areolate punctures dense and deeper than those on frons, hairlike scales sparse and with weak golden lustre. Clubbed scape almost straight and gradually thickened toward

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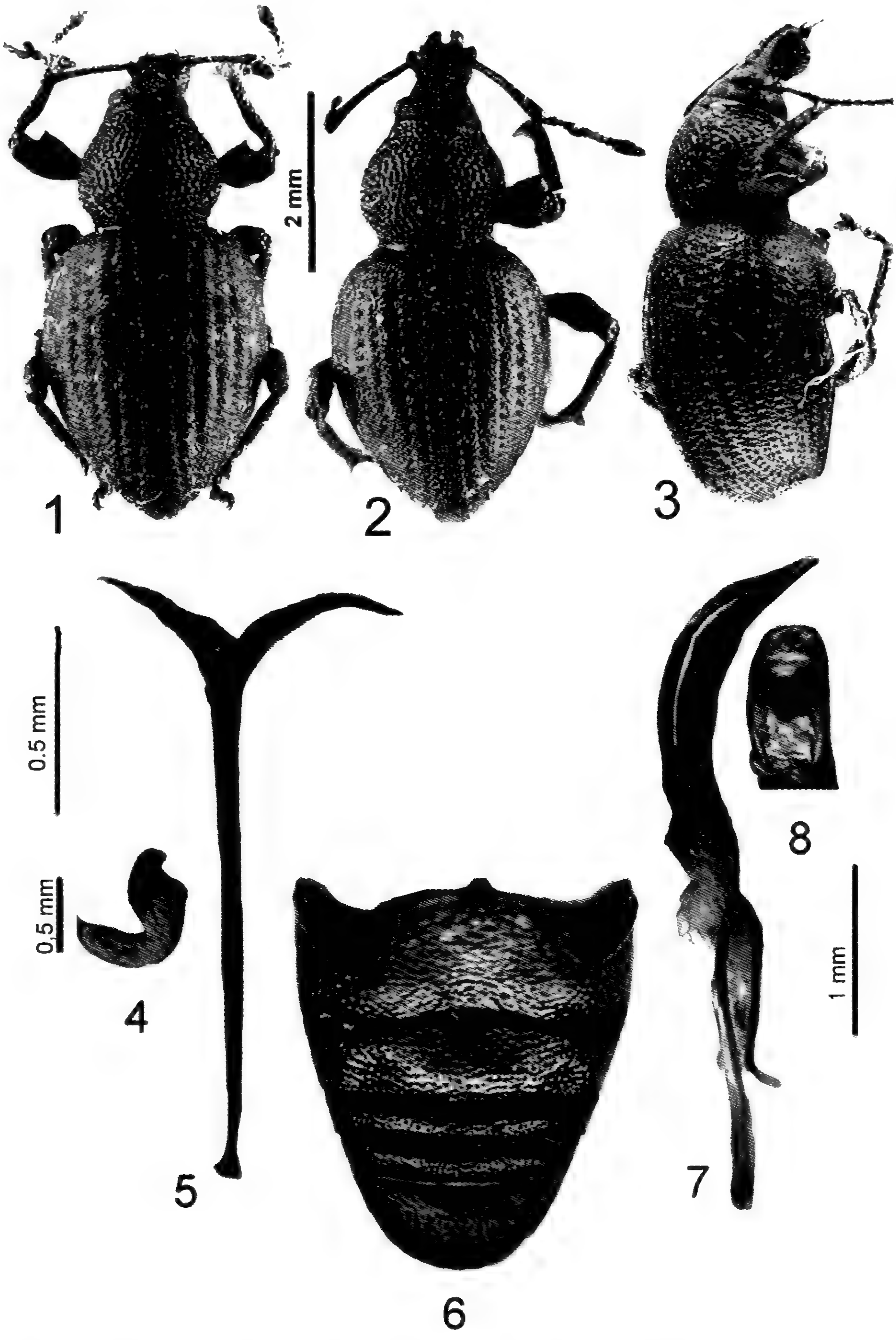
apex, long as to reach the level of the apical third of pronotum in repose. First antennal joint twice as long as wide, subcylindrical; segment two 4.2 times as long as wide and 2.2 times as long as first; third 1.5 times as long as wide; fourth and fifth 1.2 times as long as wide; sixth and seventh as wide as long. Club fusiform, 2 times as long as wide and barely shorter than the five preceding joints. Scape clothed by whitish recumbent setae as long as those on rostrum, antennal segments with lifted similar scales as long as one of them, club with dense short setae. Head 2 times as wide as long. Vertex convex, interocular surface flat and with a small pit in the middle, slightly wider than epifrons at the level of antennal insertion, grained surface with small not deep areolate punctures. Eyes small, slightly oval, convex, their greater diameter 3 times shorter than the width of the interocular distance. Pronotum much convex, 1.2 times as wide as long, maximum width just basad of middle. Anterior to middle part of pronotal disc with middle-sized areolate punctures spaced by a distance equal to the diameter of one of them. Sides and base of pronotal disc with granules gradually more convex and partially fused to form concentric wrinkles. Hairs on pronotum sparse, as long as one diameter of a pit of elytral striae, and white with feeble golden lustre. Elytra oval, 1.6 times as long as wide, maximum width at the level of anterior third. Areolate punctures of dorsal striae large and deep on disc, gradually becoming smaller toward apex, whereas those of lateral striae are just a little smaller at apex than at base. Intervals a little convex, 3 times wider than striae, with minute granules flattened on disc and gradually more convex toward apex. Suture appearing more convex since its granules are so dense that elytral apex is almost vertical (Fig. 3). Elytra clothed by recumbent quite sparse, thin, white with feeble olden lustre setae, which are as long as one of the strial punctures on disc. In addition there are golden piliform scales about twice as long as the whitish ones, and condensed in patches. Anterior legs longer than others. Profemora with a medium-sized tooth, meso and metafemora with small tooth. Femora clothed by sparse short white hairs. Protibiae thin at base, outer margin quite straight and only widening near apex, whereas the inner margin is slightly outcurved up to basal 1/5, then straightly widening toward apex like the inner margin. Meso and metatibiae only slightly widening toward apex. Recumbent setae on tibiae thicker and longer than those on femora. Tarsal segments 1 and 2 equal in length, third deeply bilobe and wider than 2, onychium projecting from 3 half of length of 3. Tarsal vestiture similar to that of apex of tibiae. Urosternites with small not deep punctures, and thin short hairs. Habitus: fig. 1. Spermatheca and spiculum ventrale: figs. 4, 5.

Paratypes females do not differ from the holotype. The single male available is smaller (mm 5.0), thinner, its maximum elytral width is mm 4.2 mm, and its elytra are subtriangular with sides much less rounded than those of females (figs. 2, 3, 6, 7, 8).

Remarks: *Neotournieria ambigener* n. sp. is the first known amphigonic species of the genus, having been collected thus far only females of the three remaining members of *Neotournieria*. The new species is immediately differentiated by the patches of golden scales on elytra.

Comparative Descriptions: The following table will facilitate the identification of all of the four species of the genus.

Neotournieria ambigener n. sp. Eyes scarcely oval, convex. Interocular distance 3.5 times as the greater diameter of an eye, and wider than epifrons between anten-



Figs. 1-8. 1. *Neotournieria ambigener* n. sp., holotype. Habitus. 2. *Neotournieria ambigener* n. sp., male paratype. Habitus in dorsal view. 3. *Neotournieria ambigener* n. sp., male paratype. Habitus, lateral view. 4-5. *Neotournieria ambigener* n. sp., holotype. Spermateca (4) and spiculum ventrale (5). 6. *Neotournieria ambigener* n. sp., male paratype. Urosternites. 7-8. *Neotournieria ambigener* n. sp., male paratype. Aedeagus in lateral (7) and (8) dorsal view.

nal insertion. Second funicular joint 1.3 times as long as 1, 3-7 hardly longer than wide. Pronotum much convex, transversal, sides strongly rounded, disc with areolate punctures intermingled with granules. Elytral sides rounded, intervals slightly convex and thinly granulose. Patches of golden scales on elytra. Turkey.

Neotournieria lodosianus (Magnano, 1977). Eyes scarcely oval, slightly convex. Interocular distance 2 times the greater diameter of an eye, and wider than epifrons between antennal insertion. Second funicular joint slightly longer than 1, 3-7 transverse. Pronotum feebly convex, transversal, sides slightly rounded, disc with areolate punctures. Elytra subtriangular, intervals convex and somewhat wrinkled. No patches of golden scales on elytra. Western Turkey.

Neotournieriawitzgalli (Braun, 1991). Eyes oval, convex. Interocular distance equal to the width of epifrons between antennal insertion. Second funicular almost twice longer than 1, 3-7 longer than wide. Pronotum much convex, much wider than long, disc without areolate punctures. Elytral intervals flat and feebly wrinkled-granulose. No patches of golden scales on elytra. Turkey.

Neotournieriabureschi (Apfelbeck, 1932). Eyes scarcely oval, convex. Interocular distance 3 times the greater diameter of an eye, and as wide as epifrons between antennal insertion. Second funicular joint 1⅓ longer than 1, 3-7 as long as wide. Pronotum feebly convex, transversal, sides slightly rounded, disc with areolate punctures. Elytral sides rounded, intervals flat and thinly granulose. No patches of golden scales on elytra. Bulgaria, Turkey.

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REDESCRIPTION OF THE PUPA OF *PARYPHOCONUS OLIVEIRAI* LANE (DIPTERA: CERATOPOGONIDAE) FROM BRAZIL[1]

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ABSTRACT: The pupa of *Paryphoconus oliveirai* Lane is described from a specimen collected from a sandy bottom of a shallow human disturbed stream near Manaus, Brazil. The pupa of *P. oliveirai* is compared with previous descriptions of the pupa of this species and with the pupae of its congeners, *P. flavidus* (Johannsen), and *P. mayeri* Wirth.

KEY WORDS: *Paryphoconus oliveirai*, predaceous midge, pupa, Diptera, Ceratopogonidae, Manaus, Brazil

The predaceous midge genus *Paryphoconus* Enderlein is exclusively Neotropical, and includes medium-sized to large midges (female wing lengths 1.5-7.0 mm). Presently there are 40 species in this genus (Borkent and Spinelli, 2000), and Spinelli and Wirth (1984) provided a key to females of 38 of these. The pupae of only three species have been previously described: *P. flavidus* (Johannsen) (as *P. lanei*) and *P. mayeri* Wirth by Mayer (1959), and *P. oliveirai* Lane by Wirth and Ratanaworabhan (1972). These prior pupal descriptions are very brief and incomplete, and it is almost impossible from them to determine the most relevant structures at even the generic level.

During recent field sampling by DSC in the vicinity of Manaus, Brazil, one pupa of *P. oliveirai* was collected. The purpose of this paper is to redescribe and illustrate the pupa of this species, the first detailed description of a pupa of *Paryphoconus* sp.

METHODS

A single live pupa of *P. oliveirai* was collected from the sandy bottom of a shallow human disturbed stream (Fig. 1). The sandy sediment was collected with an aquatic net (Fig. 2) and transported to the laboratory with water from the natural environment in a 5 liter plastic container. The pupa was lab reared and the adult eventually emerged and its exoskeleton allowed to harden before preservation in 70% ethanol.

This adult female and its pupal exuvia was slide-mounted in Canada balsam following the technique of Borkent (2000), and examined and measured with a binocular compound microscope. Illustrations were made with pen and ink using an attached camera lucida.

This specimen is deposited in the collection of Invertebrates, Instituto Nacional de Pesquisas da Amazônia, Manaus, Brazil (INPA). Photomicrographs

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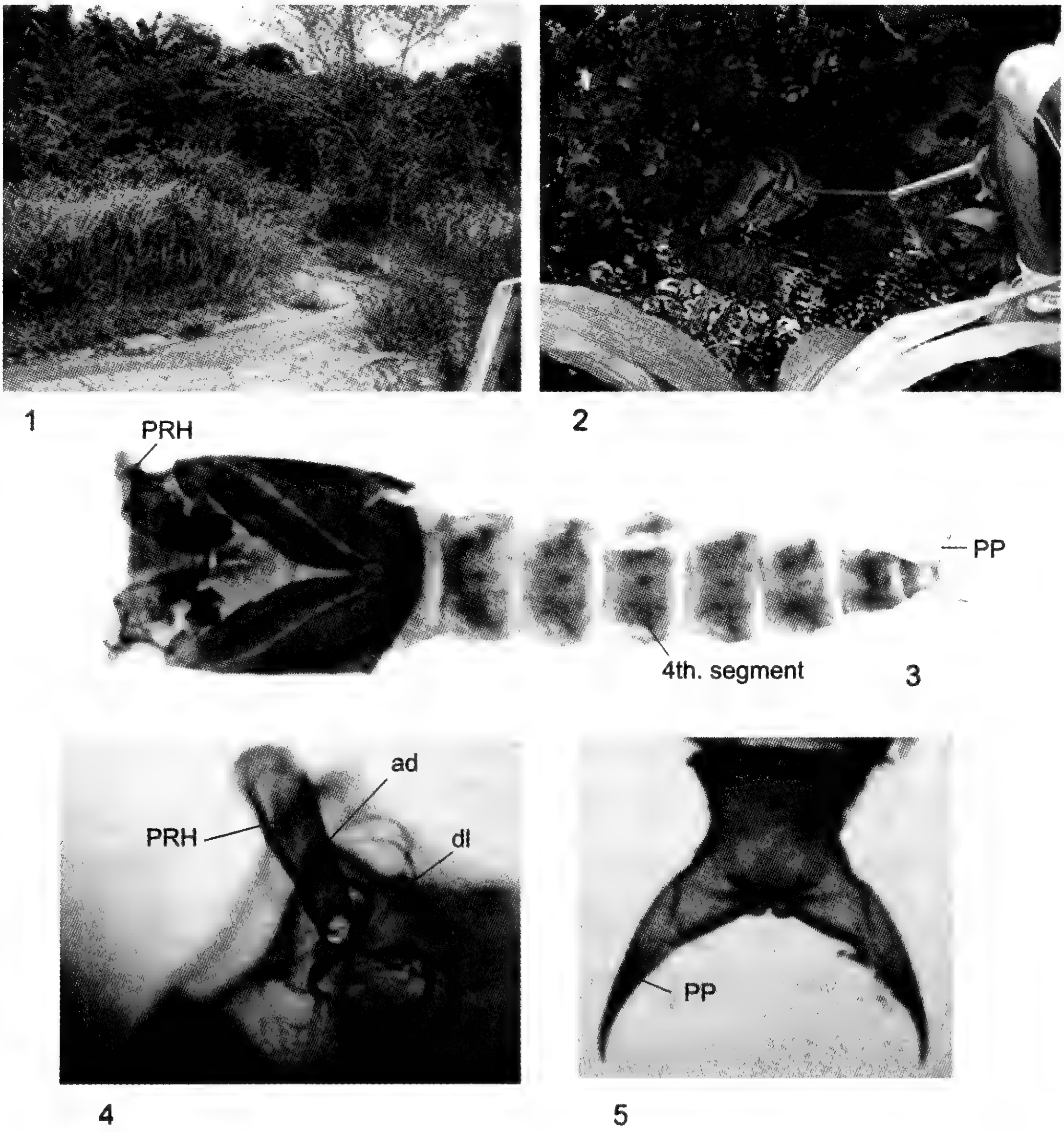
of pupa were taken with a Pentax Optio, Power Shot, S60, digital camera through a Leitz, SM-Lux microscope at 10X and 40X, and the images assembled in Photoshop 7.0. For special terminology of ceratopogonid terminology, see Nevill and Dyce (1994).



Figs. 1-5: *Paryphoconus oliveirai*, female pupa. 1, collecting site; 2, collecting with aquatic net; 3, female pupa; 4, prothoracic respiratory horn (PRH) and anterodorsal (ad) and dorsolateral (dl) tubercles; 5, caudal segment, posterolateral processes (PP).

SYSTEMATIC ENTOMOLOGY

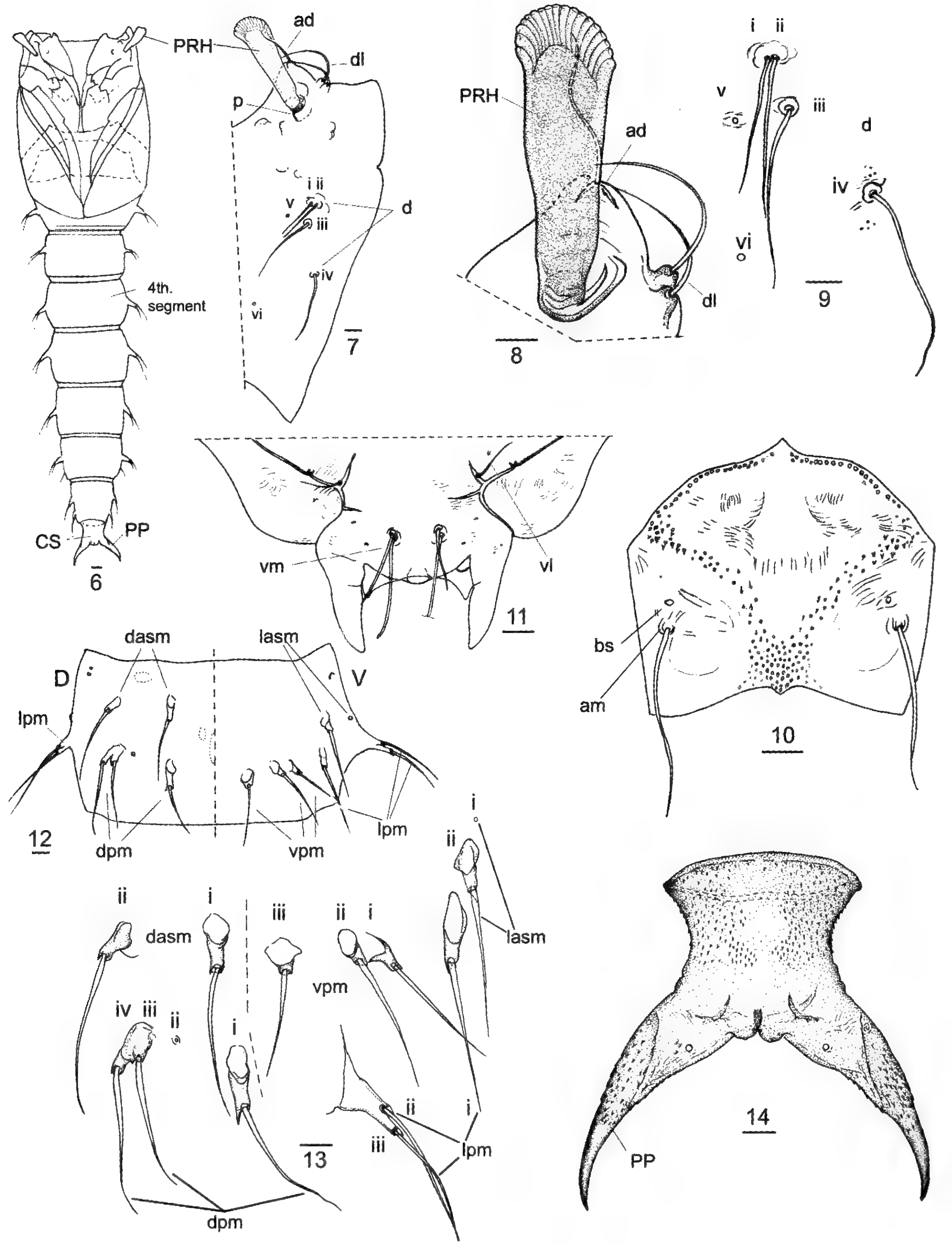
Paryphoconus oliveirai Lane
(Figs. 3-14)

Paryphoconus oliveirai Lane, 1956: 303 (female; Brazil); Wirth and Ratanaworabhan, 1972: 1374 (female, male, pupa; Brazil); Spinelli and Wirth, 1984: 902 (in key; Colombia record); Borkent and Spinelli, 2000: 66 (in catalog).

Redescription of female pupa. Length 6.00 mm. Exuvia dark brown (Figs. 3, 6). Cephalothorax quadrangular, length 2.07 mm, width 1.56 mm; cephalothoracic tubercles (Figs.7-9) as follows: anterodorsal tubercle (ad) (Figs. 4, 7-8) with one long, thin seta; dorsolateral tubercle (dl) (Figs. 4, 7-8) with two long, thin, subequal setae; dorsal tubercles (d) (Figs. 7, 9): i-iii,v with long, thin seta, iv pore, setae of iii,v slightly longer than setae of i-ii; two stout ventromedian setae (vm) (Fig. 11), one longer than other; apparently one very thin ventrolateral seta (vl) (Fig. 11). Respiratory horn (Figs. 4, 8) 4.57 times longer than broad, length 0.26 mm, surface with reticular cell-like pattern, apex with 18-20 spiracles; pedicel short, stout, length 0.10 mm; P/H 0.38. Operculum (Fig. 10) as long as broad; anterior margin pointed with single row of marginal rounded tubercles; mesal V-shaped band of spicules extending 0.13 mm under the angle of disc, disc mostly smooth; two anteromarginal tubercles (am) with single long seta and basal sensillum present; posterior margin concave with small, rounded, anteromesal tubercles; OL 0.1 mm; OW 0.3 mm; OW/OL 3.0. Abdominal segments with abundant spicules. Fourth abdominal segment (Figs. 3, 12-13) with two dorsal anterosubmarginal tubercles (dasm): i,ii with long, stout, subequal setae; four dorsal posteromarginal tubercles (dpm): i,ii,iv with long, stout, subequal setae, iii pore; three lateral posteromarginal tubercles (lpm): i,ii with long stout setae, sharing stout triangular base, iii with long, stout seta; two lateral anterosubmarginal tubercles (lasm), i pore, ii with long, stout seta; three ventral posteromarginal tubercles (vpm), each with long, stout seta; tubercles with stout, quadrangular base (except lpm i, ii). Caudal segment (Figs. 5-6, 14) length 0.45 mm, width 0.25 mm, lateral margins concave; ventral surface with abundant posteriorly directed spinules, also present on posterolateral processes. Posterolateral processes (PP) stout, curved, divergent, with base broad, apical 1/3 pigmented, tips bare, sharply pointed.

Distribution. Brazil (Amazonas, Pará), Colombia.

Material Examined. Brazil, Amazonas, Igarapé, Parque das Garças (bacia Mindú) Trecho Tributario, 03°03'41,2"; 59°58'09,0", 14-X-2005, D. Carrasco-J. Oliveira, 1 female (with pupal exuvia) (in slide in Canada balsam, INPA); Brazil, Amazonas, rio Aripuana, Igarapé das Pedras, 18-I-1962, E .J. Fittkau, 1 female, at light (in Museo de La Plata, Argentina, MLP).



Figs. 6-14. *Paryphoconus oliveirai*, female pupa. 6, entire pupa; 7, cephalothorax, dorsolateral view: prothoracic respiratory horn (PRH), pedicel (P), anterodorsal tubercle (ad), dorsolateral tubercle (dl); 8, prothoracic respiratory horn (PRH), anterodorsal tubercle (ad), dorsolateral tubercles (dl); 9 dorsal tubercles (d); 10, operculum, anteromarginal tubercle (am), basal sensillum (bs); 11, ventral setae: ventrolateral setae (vl), ventromedian setae (vm); 12, 4th abdominal segment; 13, abdominal tubercles of 4th abdominal segment: lateral anterosubmarginal tubercle (lasm); dorsal posteromarginal tubercle (dpm); dorsal anterosubmarginal tubercle (dasm); ventral posteromarginal tubercle (vpm); lateral posteromarginal tubercle (lpm); 14, caudal segment, posterolateral processes (PP). Scale bars: 0.05 mm

Remarks. The adult female keys out to *P. oliveirai* in couplet 26 in the key by Spinelli and Wirth (1984). It was also compared with one female examined by Wirth and Ratanaworabhan (1972) as *P. oliveirai,* who briefly described the pupa of this species based on material from the same locality and date. However, their pupa differs from the pupa described herein in having 13 spiracles on the respiratory horn and in the shape of the caudal segment, has subparallel lateral margins and the posterolateral processes are nearly straight, not divergent.

Mayer (1959) described the pupa of *P. mayeri,* which is much smaller (length 4.3 mm) than our pupa of *P. oliveirai.* Also, despite the terminology of the cephalothoracic tubercles is different from the one used in this redescription, Mayer mentioned one ad and three dl tubercles (as a spine devoid of seta and 3 setae at the base of the respiratory organ, respectively) and only one vm seta, which are the most important differences with respect to the pupa of *P. oliveirai.* Mayer (1959) also described the pupa of *P. flavidus* (as *P. lanei*), and stated that it is very similar to the one of *P. mayeri* except for the vm which is represented by a short seta.

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A NEW GENUS AND A NEW SPECIES OF ACRIDIDAE (ORTHOPTERA) FROM YUNNAN, CHINA[1]

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ABSTRACT: A new genus *Sinocaryanda* gen. nov. is proposed for *Sinocaryanda macrocercusa* sp. nov. from Yunnan, China. The new genus is an aberrant member of the Oxyinae and resembles *Caryanda* Stål, 1878, and *Nepalocaryanda* Ingrisch, 1990. It differs from the latter two by the following features in male: terminalia dorsally broad; 10th tergite broadly interrupted in midline with widened, rounded, medial margins; cerci reaching to or beyond apex of subgenital plate; epiphallus not divided in middle, and aberrant connecting mode of anchorae with bridge.

KEY WORDS: Orthoptera, Acrididae, new genus, new species, China

While identifying the grasshoppers collected from the western Yunnan, we found a new species belonging to a new genus, herein named *Sinocaryanda* gen. nov. Type specimens are deposited in the College of Life Sciences and Chemistry, Dali University (CLDU), Yunnan Province. In this paper, we adopt the classification system of Vickery and Kevan (1983) which seems to be the most appropriate at the present knowledge, and follow the methods used by Ingrisch (1989) and the main terminology utilized by Dirsh (1975).

Sinocaryanda, NEW GENUS

Diagnoses: Size small. Head conical. Vertex convex with apex roundly angular, fastigum moderately broader than long; face oblique in lateral view; frontal ridge sulcated in whole length; lateral facial carinae straight. Antennae filiform, surpassing hind margin of pronotum. Eyes long oval. Pronotum cylindrical, anterior margin broad round, posterior margin with a triangular breach; median carina faint, intersected by three sulci, lateral carinae absent. Prosternal spine long conical. Mesosternal interspace longer than wide. Squamipterous. Tympana distinct. Hind femora with upper carina smooth, terminating in a short spine; lower genicular lobes spinous. Hind tibiae with apical half nearly cylindrical; external apical spine present. Terminalia broad in dorsal view; 10th abdominal tergite broadly interrupted in midline with widened, rounded, medial margins; cerci compressed, triangular, reaching to or beyond apex of subgenital plate. Subgenital plate short conical. Epiphallus very broad with only one pair of large lophi; bridge nearly entire, not divided in middle; anchorae hooked, dorsad projecting in a 90° angle from bridge, connected with bridge by membrane. Oval sclerites elongate. Cingular valves not fused apically, paired.

Type species: *Sinocaryanda macrocercusa*, sp. nov.

Remarks: The keys in Willemse (1955) and Li and Xia (2006) run to *Caryanda*

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Stål, 1878, which is listed under the Oxyinae (Vickery and Kevan, 1983; Otte et al., 2005). However, the new genus has the following striking differences from *Caryanda* except general appearance: male terminalia dorsally very broad; 10th tergite broadly interrupted in midline with widened, rounded, medial margins, instead of with small furculae on posterior margin; cerci reaching to or beyond apex of subgenital plate instead of supra anal plate. Further differences appear on the shape of epiphallus with bridge not divided in middle, large extending lophi, anchorae pointing dorsad, and mode of anchorae connecting with bridge; on cingular valves which is apically divided instead of fused. The new genus also is closest to *Nepalocaryanda* Ingrisch, 1990, but differs from the latter by fastigum that is moderately broad instead of very broad; ventral genicular lobes of posterior femora are spined; apical half of posterior tibiae is nearly cylindrical; and abdominal sternites have tufts of hairs. The differences are listed in detail in Table 1. The new genus is an aberrant member of the Oxyinae. It does not possess the following very characteristic features of the subfamily: the apical expansion of the hind tibiae, the divided bridge of epiphallus, and the fusion of the cingular valves. It agrees with the Oxyinae in general appearance, the apical spine of the ventral genicular lobes of the posterior femora, the tufts of hair on the abdominal sternites. The scientific name derives from its distribution and similarity to *Caryanda* Stål, 1878.

Table 1. Comparisons among *Sinocaryanda* gen. nov. and its allied genera

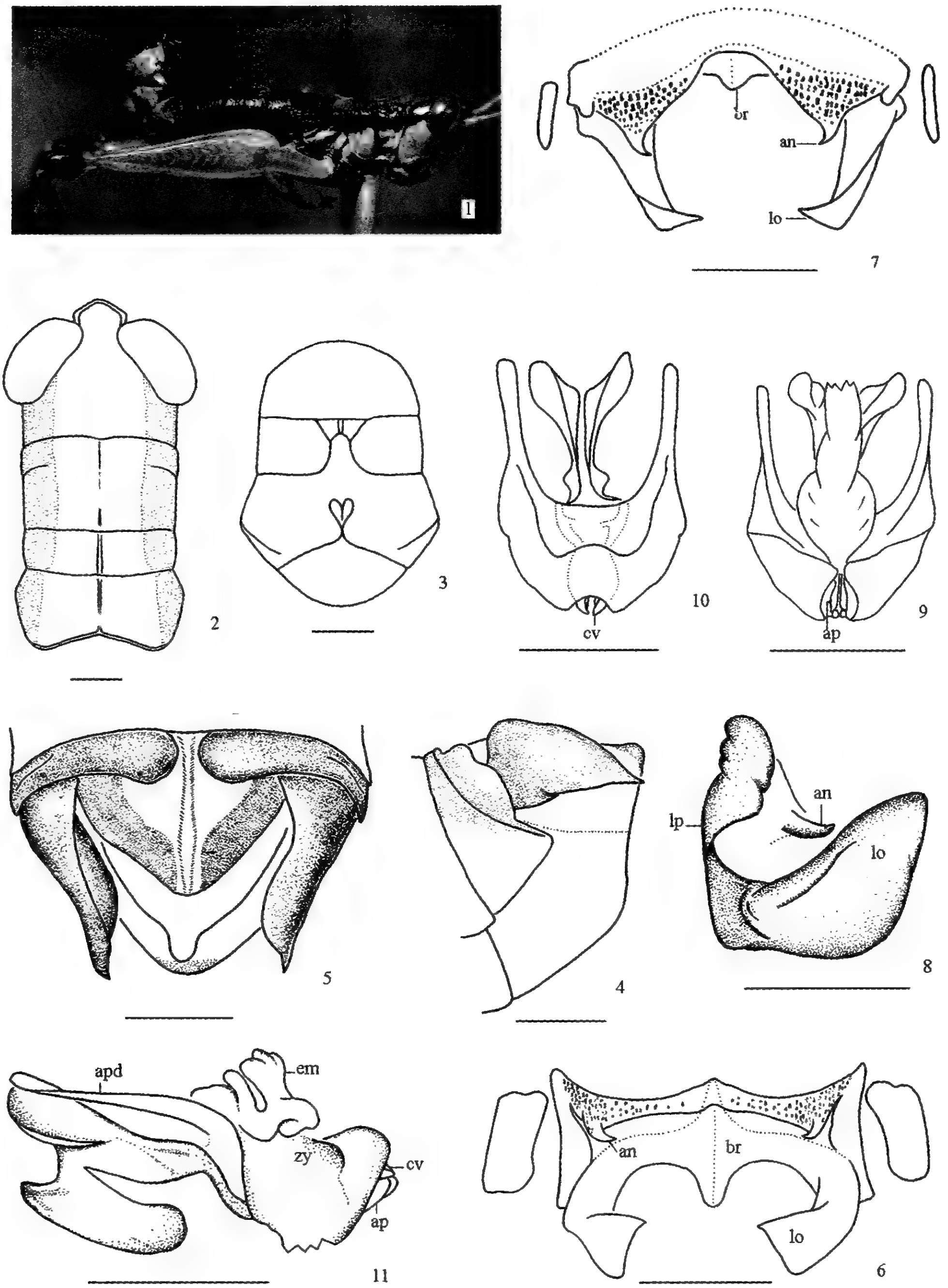
Caryanda	*Sinocaryanda*, gen. nov.	*Nepalocaryanda*
Fastigum moderately broad	Fastigum moderately broad (Fig. 2)	Fastigum very broad
Ventral genicular lobes of posterior femora spined	Ventral genicular lobes of posterior femora spined	Ventral genicular lobes of posterior femora unspined
Posterior tibiae with apical half cylindrical	Posterior tibiae with apical half nearly cylindrical	Posterior tibiae expanded apically
Terminalia dorsally normal; abdominal sternites with tufts of hairs	Terminalia dorsally broad (Fig. 5); abdominal sternites with tufts of hairs (Fig. 1)	Terminalia dorsally normal; abdominal sternites without tufts of hairs
10th tergite in male narrow with or without small furculae	10th abdominal tergite broadly interrupted in midline with widened, rounded, medical margins (Fig. 5)	10th tergite in male narrow, with small, prominent furculae
Cerci conical	Cerci compressed (Figs. 1, 4-5)	Cerci compressed
Epiphallus divided, with 1-2 pairs lophi; cingular valves fused apically; anchorae pointing apicad, directly connected with bridge	Epiphallus not divided, with a pair of lophi; cingular valves divided apically; anchorae hooked, dorsad projecting in a 90° angle from bridge, connected with bridge by a soft membrane (Figs. 6-11)	Epiphallus divided, with a pair lophi; cingular valves divided apically; anchorae pointing apicad, directly connected with bridge

Sinocaryanda macrocercusa, NEW SPECIES
(Figs. 1–11)

Type Locality. Mt. Wuliang, Nanjian County, Yunnan Province, China (24° 12'N, 100°48'E), 2000 m, 17Jul. 2003.

Description. Male (Figs. 1–11). Body small-sized. Vertex convex with apex roundly angular, fastigum moderately broader, width in front of eyes 2.3–2.4 times larger than length. Frons oblique in lateral view; frontal ridge sulcated in whole length, lateral margins somewhat parallel, slightly broad near the median ocellus. Interocular distance about 1.3 times larger than width of frontal ridge between antennae. Lateral facial keels straight. Antennae filiform, reaching base of hind femur, any middle segment about 2.9–3.1 times longer than wide. Eyes long oval, longitudinal diameter about 1.4 times as long as horizontal one, and about 2.4 times as long as subocular furrow. Pronotum nearly cylindrical, anterior margin broad round, posterior margin with a triangular breach; median carina faint, distinctly intersected by three sulci, lateral carinae absent; prozona 2.0 times as long as metazona (Fig. 2). Prosternal spine long conical, apex subacute. Mesosternal interspace about 2.5–2.6 times as long as minimum width; mesosteral lobes 1.2 times wider than long; metasternal lobes contiguous (Fig. 3). Tegmina narrow squamiform, length 2.8–2.9 times as long as maximum width, reaching posterior margin of 1st abdominal tergite (Fig. 1). Hind femur with upper carina smooth, terminating in a short spine; apex of lower knee lobe spinous. Hind tibia with apical half nearly cylindrical, with 7 external and 9 internal spines on dorsal side; external apical spine present. Abdomen with median carinula. Tympana opening nearly rounded. Abdominal sternites with tufts of hairs (Fig. 1). Terminalia broad in dorsal view. Tenth abdominal tergite broadly interrupted in midline with widened, rounded, medial margins. Supra anal plate broadly triangular, 1.6 times wider than long, with a middle longitudinal sulcus along whole length. Cerci laterally compressed, large, triangular; apex pointed, reaching to or beyond apex of subgenital plate. Subgenital plate short conical, apex blunt (Figs. 4–5). Epiphallus very broad with only one pair of lophi projecting in a 90° angle from bridge; lophi large (length about 1.3 mm), stout, triangular with apex gently incurved, acute; lateral plates narrow, undulate; anterior projections obtuse; bridge cross-shaped, not divided or with only indication of split in middle; anchorae hooked, dorsad projecting in a 90° angle from bridge, connected with bridge by a soft membrane which has many cylindrical prominences on the surface. Oval sclerites elongate. Cingulum with apodemes, zygoma and rami; apodemes narrow, lamellate; zygoma posteriorly connected with membraneous sheath covering the apical penis valves, laterally connected with rami. Cingular valves not fused apically, paired (Figs. 6–11).

Coloration. Generally dark green. Frons and genae yellowish green. Antennae yellow. Eyes grey. Postocular bands black, laterally extending to 5th abdominal tergite. Lateral lobes of pronotum with two yellowish green maculae, ventral margins black. Tegmina black. Meso- and metathorax with episterna and epimera yellow. Fore and mid legs with femora yellow, tibiae greenish yellow. Hind femora yellowish green, knee black. Hind tibiae blue.Tenth abdominal tergite, cerci black. Lateral areas of supra anal plate and apex of subgential plate black.



Figs. 1–11. *Sinocaryanda macrocercusa* new species: 1. body of male, lateral view; 2. head and pronotum of male, dorsal view; 3. meso- and metasternum of male; 4. terminalia of male, lateral view; 5. terminalia of male, dorsal view. 6–8. epiphallus: 6. dorsal view; 7. anterior view; 8. lateral view. 9–11. phallic complex: 9. ventral view; 10. dorsal view; 11. lateral view. (Abbreviations: an, ancora; ap, apical penis valves; apd, apodeme; br, bridge; cv, valves of cingulum; em, ectophallic membrane; lo, lophus; lp, lateral plate; zy, zygoma.) Scale bars = 1 mm.

Female. Unknown.

Measurements. (mm). Length of body: male 19.0–19.5; length of pronotum: male 3.6–3.7; length of tegmen: male 3.5–4.0; length of hind femur: male 10.5–10.8.

Type Material. Holotype: male, Mt. Wuliang, Nanjian County, Yunnan Province, China (24°12'N, 100°48'E), 2000 m, 17 Jul. 2003. Collected by Ben-yong Mao. Paratype: 1 male (5th instar nymph, emerged as adult after a week in the laboratory), other data same as holotype.

Etymology. The specific name refers to the size of cercus of male.

Biology. The species live in tussock grass under subtropical bushes and broadleaf trees which grow in the wet and half-shady zone at medium elevation in Yunnan. The food plant of this species has been unknown in field, but in laboratory, it appears to feed on some grass, such as *Arthraxon hispidus* (Thunb.) Makino, *Oplismenus compositus* (Linn.) Beauv. and *Echinochloa crusgalli* (Linn.) Beauv.

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A NEW SPECIES OF *PSYLLIODES* LATREILLE (COLEOPTERA: CHRYSOMELIDAE) FROM TURKEY[1]

Ali Gök[2] and Ebru Gül Aslan[2]

ABSTRACT: A new species of *Psylliodes* (Coleoptera: Chrysomelidae: Alticinae), *P. kasnakensis*, is described and illustrated from Isparta, southwest Turkey. The new species, a member of the *P. picina* Marsham species group, is compared with its congeners. The distinguishing features of the species are specified; habitat and host plant notes are presented.

KEY WORDS: Chrysomelidae, *Psylliodes kasnakensis*, new species, Quercus spp., Fagaceae, Turkey

The genus *Psylliodes* Latreille, one of the cosmopolitan genera of Alticinae, is distributed in all of the zoogeographical regions of the world, comprises nearly 200 species worldwide (Konstantinov and Vandenberg, 1996), and 125 of them are known to occur in the Palearctic region (Baselga and Novoa, 2003). The current number of the Turkish *Psylliodes* is estimated to be over 50.

Recently, during surveys on the diversity of Chrysomelidae of "Kasnak Oak Forests," a nature reserve mainly consisting of pure stands of vulcanic oak [(*Quercus vulcanica* Boiss. & Heldr. ex) Kotschy.], which is endemic to Turkey, a considerable number of specimens belonging to an unknown *Psylliodes* species were found on Quercus spp. The new species belongs to *luteolus* subgroup of *Psylliodes picina* species group and differs from all other known species in the group by having its dorsum conspicuously bicolored. The main purpose of this work is to describe the new species and to present its habitat and host plants.

METHODS

Ten specimens including the largest and smallest ones of each sex were examined. Specimens were measured for six characters that have been found important in comparing closest species in the *picina* species group. Character abbreviations are as follows: Lb = body length; Le = elytron length; Lp = pronotum length; La = aedeagus length (for males); Ls = spermatheca length (for females); We = maximum width of elytra at middle; Wp = pronotum width. The ratio Le/Lp (relative prothorax size) has been calculated which is also useful for differentiation. All measurements were made with an ocular micrometer and given in millimeters.

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Psylliodes kasnakensis Gök and Aslan, sp. nov. (Figs. 1-2)

Type Material. Holotype, Male: Southwest Turkey, Isparta, Kasnak Forest Nature Reserve (37° 44' 53" N, 30° 49' 83" E), 1557 m, leg. A. Gök [printed on red paper]. Paratypes (257 specimens): all same locality as holotype collected at different dates; 14 males, 16 females, 22.06.2006; 21 males, 27 females, 06.07.2006; 25 males, 26 females, 18.07.2006; 31 males, 33 females, 01.08.2006; 18 males, 22 females, 23.08.2006; 9 males, 15 females, 02.09.2006, legs. A. Gök and E. G. Aslan. Holotype and paratypes are deposited in Süleyman Demirel University (SDU), Biology Department, Isparta, Turkey.

Etymology: The species epithet, *kasnakensis*, derived from "kasnak" means "riddle-frame oak" in Turkish and refers to the locality "Kasnak Oak Forest" in Isparta, southwest Turkey where the specimens were collected.

Diagnosis: The new species appears different from all other known taxa of the *Psylliodes picina* species group and can be easily recognized by the following combination of the characters: head and pronotum orange or reddish, elytra black (having bicolored upperside makes *P. kasnakensis* unique in the group); in males first tarsal segment of fore and middle legs obviously widened and extended; humeral calli quite evident, impunctate; elytra with regular rows of punctures effaced towards apex; aedeagus almost parallel sided, ventral groove deep and long, ligula distinct in dorsal view; receptacle of spermatheca long, pump distinctly divided from receptacle, ductus reaches to half of the receptacle, has a thin and long extension at apex.

Description: Measurements. *Males:* Lb = 2.02-2.60 (Mean: 2.37, SD: 0.19); Le = 1.43-1.95 (Mean: 1.70, SD: 0.18); We = 1.04-1.36 (Mean: 1.20, SD: 0.11); Lp = 0.48-0.58 (Mean: 0.53, SD: 0.03); Wp = 0.75-0.97 (Mean: 0.85, SD: 0.06); La = 0.88-1.04 (Mean: 0.97, SD: 0.05); Le/Lp = 2.93-3.33 (Mean: 3.16, SD: 0.15).

Females: Lb = 1.98-2.60 (Mean: 2.33, SD: 0.22); Le = 1.40-1.95 (Mean: 1.68, SD: 0.21); We = 0.97-1.33 (Mean: 1.15, SD: 0.12); Lp = 0.45-0.58 (Mean: 0.52, SD: 0.05); Wp = 0.68-0.97 (Mean: 0.82, SD: 0.11); Ls = 0.29-0.32 (Mean: 0.31, SD: 0.01); Le/Lp = 3.07-3.33 (Mean: 3.24, SD: 0.09).

Holotype, Male: Lb = 2.34; Le = 1.69; We = 1.20; Lp = 0.52; Wp = 0.88; La = 1.04.

Habitus (Fig. 1): Body convex-elongated, about twice longer than broad. Dorsum bicolored; head and pronotum orange or reddish, elytra black or blackish brown. Antennae and legs except metafemora completely yellow. Labrum and apical parts of mandibula brown, maxillary palpi and other mouth appendages yellowish.

Head: seen from above in dorsal view; vertex with few minute punctures; frontal punctures denser and more distinct than those on vertex; background texture smooth; antennal calli evident, moderately raised; frontal ridge wide and flattened, impunctate; antennal sockets and labrum with sparse long hairs; first antennal segment 2.0 times longer than second, fourth 1.2 times longer than third, fifth as long as third.

Pronotum: about 1.5 times broader than long; with two small longitudinal impressions basally; basal border narrower than that of elytra; lateroposterior margins clearly visible from above; surface finely and densely punctate; background texture almost smooth.

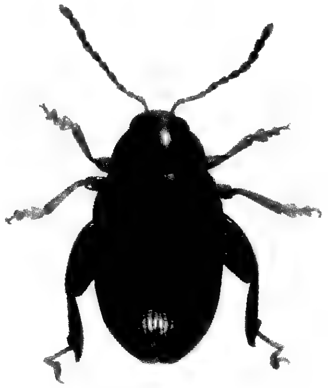

Fig. 1. *Psylliodes kasnakensis*, habitus

Elytra: about 1.4 times longer than broad, widest at middle; slightly tapering posteriorly; humeral calli well developed, without punctures; elytral punctures larger than those on pronotal disc, arranged in longitudinal rows; rows almost effaced towards apex, interrows very slightly convex and minutely punctate.

Venter: abdominal sternites relatively convex; covered with sparse white hairs; in males apical part of the last abdominal sternite depressed.

Legs: completely yellow except blackish metafemora; first tarsal segments of the fore and middle legs remarkably widened in males, normal in females.

Aedeagus (Fig. 2A-C): in ventral view almost parallel sided, rounded apically, with an indistinct apical tip; ventral groove deep and long, reaches to basal opening; in lateral view apex feebly deflexed ventrally; ligula distinct in the apical third in dorsal view basally wide narrowed to the apex.

Spermatheca (Fig. 2D): receptacle fairly long, well delimited from pump; pump moderately long, slightly curved ventrally; ductus simple, attached to lateral side of receptacle with a long, indistinct line shaped extension outgoing from its apex.

Sexual Dimorphism: The most obvious distinction between males and females occurs in tarsal segments. In males first tarsal segments of fore and middle legs are conspicuously wider than the following two segments; the first one is as long as the second and third combined. All tarsal segments are, however, normally sized in females. The other distinguishing feature is the small depression on the last abdominal sternite of males. Both sexes are virtually similar except for the characters mentioned above.

Variation: Some specimens, especially the most poorly developed ones, have pale color variations. In these specimens pronotum, elytra and abdominal segments are somewhat paler than that of original colors described. Aedeagus and spermatheca forms of these specimens are likewise little sclerized. Color of the humeral calli is also variable among different individuals. There are individuals presenting dark brownish or reddish humeral calli although most of the specimens have completely black elytra.

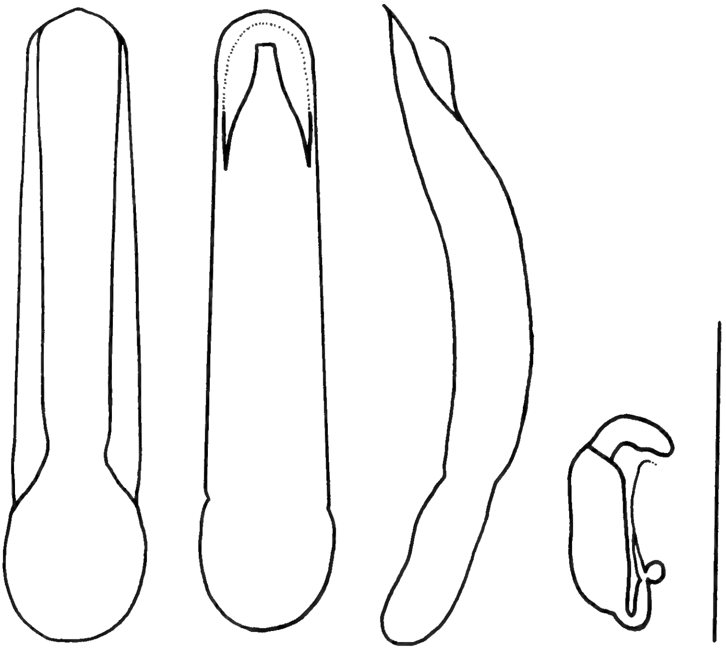

Fig. 2. *Psylliodes kasnakensis*, genitalia. (A) aedeagus ventral view; (B) aedeagus dorsal view; (C) aedeagus lateral view; (D) spermatheca (scale, 0.5 mm).

Habitat and Host Plants: The type specimens were collected from xeric mountain slopes in Kasnak Forest Nature Reserve (Isparta) at an altitude of 1557 m a.s.l. from June to September 2006. Kasnak Forest, covering an area of 1300 ha, presents dense forests composed of mixed conifer, including *Pinus nigra, P. brutia, Cedrus libani, Abies cilicica* (Pinaceae), *Juniperus oxycedrus, J. excelsa, J. foettidissima* (Cupressaceae), and deciduous species, *Quercus vulcanica, Q. cerris, Q. libani, Q. infectoria, Q. coccifera, Q. frainetto* (Fagaceae), *Acer platanoides, A. hyrcanum* (Aceraceae), *Populus tremula* (Salicaceae), *Celtis orientalis* (Legumonosae), *Pistacia terebinthus* (Anacardiaceae), *Cornus mas* (Cornaceae), *Ulmus glabra* (Ulmaceae), and *Phillyrea latifolia, Fraxinus oxycarpa, F. ornus* (Oleaceae). Having such a rich flora, accompanied with important populations of *Quercus vulcanica* (endemic vulcanic oak), makes the Kasnak Forest a natural arboretum in addition to its esthetic beauty. Hence, the area was declared as nature reserve in 1987.

Specimens of *P. kasnakensis* feeding marks consist of minute holes that traverse the blades. They feed primarily on shrub forms of *Q. cerris* and *Q. vulcanica* (about 1.5-2.5 m high), rarely on *Q. libani*. They prefer the young leaves of the host plants and, together with *P. anatolicus* Gök & Çilbiroğlu, they feed in large numbers, particularly on *Q. cerris*.

Cruciferae (or Brassicaceae), Solanaceae, and Graminae (or Poaceae) are the preferred host plant families of species of *Psylliodes* species (Biondi, 1994; Furth, 1983; Mohr, 1966). However, we observed significant series of *P. kasnakensis* feeding simultaneously on the *Quercus* species mentioned above. Similar host records were also reported by Furth (1979) for some alticines especially in the summer and fall months. Anyway, it is difficult to say whether *Quercus* species are the actual host plants of the new species or not.

DISCUSSION

Psylliodes kasnakensis is a member of the *picina* species group because of its general aedeagal shape, shortened orbital lines and very particular shape of hind tibia emphasized by Leonardi (1970, 1978). Having two small longitudinal impressions at the base of the pronotum incorporates the new species into the *Psylliodes luteolus* subgroup (Leonardi, 1970). Among the taxa in the *luteolus* subgroup it resembles *P. algiricus* Allard, *P. wachsmanni* Csiki, and *P. luteolus* (Müller), but is unique because of its conspicuous body coloration as well as the strongly widened first tarsal segments of fore and middle legs in males.

The new species can be easily distinguished from the aforementioned species by its bicolored dorsum (head and pronotum orange or reddish, elytra black) which is entirely yellow reddish in *P. algiricus*, reddish brown in *P. wachsmanni,* and rusty red in *P. luteolus* (Leonardi, 1972; Warchalowski, 2003). Furthermore, it can be seperated from *P. algiricus* by having distinct and dense frontal punctures (almost lacking punctures in *P. algiricus*), parallel sided aedeagus with a rounded apex (distinctly narrowed in the apical third in *P. algiricus*), and the parallel sided receptacle of spermatheca which is strongly narrowed at base in *P. algiricus*. Spermatheca shape of *P. kasnakensis* is more similar to that of *P. wachsmanni,* but it differs from the latter species by the comparatively smaller body length, puncturation of elytra (larger sized in *P. wachsmanni*), and more importantly the symmetric form of aedeagus. (According to Leonardi (1972) *P. wachsmanni* has a recognizable aedeagic asymmetry.) From *P. luteolus*, spermatheca form can seperate it (ductus longer in *luteolus*), as well as the lighter colour of apical antennal segments and form of the aedeagus.

Psylliodes kasnakensis can be incorporated into the key to the taxa of *Psylliodes picina* complex given by Leonardi and Gruev (1993) by modifying couplet 1 as follows:

1. Dorsum usually yellow-reddish or bicoloured, rarely brown. Frons fairly well punctured, or else hind tibiae comparatively elongate (see Leonardi, 1972: 143, fig. 11) and supraorbital grooves close to inner border of eyes, almost at right angle to supratubercular lines (see Leonardi, 1972: 141, fig. 6): complex of *Ps. luteolus* subgroup 1a

— Dorsum usually red-brown, pitchy brown or blackish, often with more or less evident metallic lustre. Frons usually unpunctured or covered with very fine to almost unperceivable punctures which are often more densely distributed and less obscure just behind frontal tubercles. Supraorbital grooves more distant from inner border of eyes, at a largely obtuse angle to supratubercular lines (see Leonardi, 1972: 141, fig. 5). Hind tibia stout and greatly curved: complex of *Ps. picinus* (Marsh.) 2

1a. Dorsum bicoloured; head and pronotum orange or reddish, elytra black or blackish brown .... *P. kasnakensis*

— Dorsum unicoloured, usually yellow reddish, rarely brown.......................... other species of the *P. luteolus* subgroup [*P. luteolus* (Müll.), *P. wachsmanni* Csiki, *P. leonhardi Heiktgr.*, *P. pallidicolor* Pic, *nigripennis* All., *P. algiricus* All., *P. puncticollis* Rosh].

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A NEW SPECIES OF *PHTHEIROPOIOS* EICHLER, 1940 (PHTHIRAPTERA: AMBLYCERA: GYROPIDAE) FROM ARGENTINA, WITH A KEY TO THE MALES COLLECTED FROM *CTENOMYS* (MAMMALIA: RODENTIA) FROM SOUTH AMERICA[1]

Dolores del C. Castro,[2] Armando Cicchino,[3] Marta Arce de Hamity,[4] and Félix Ortiz[4]

ABSTRACT: The species *Phtheiropoios susquensis* sp. nov. is described and illustrated from specimens of *Ctenomys* sp. collected from Laguna Múcar, Susques District, Jujuy Province, Argentina. Diagnostic features for the new species include a proportion of male forficula, male external genitalia, and counts of setae, body measurements in both sexes and external architecture of the egg. Its morphological affinities with allied species are briefly commented. A key to males of all species of the genus *Phtheiropoios* known to parasitize rodents of the genus *Ctenomys*, is included.

KEY WORDS: *Phtheiropoios*, Phthiraptera, descriptions, *Ctenomys*, Jujuy Province, Argentina, new species

To date, the genus *Phtheiropoios* Eichler includes 13 species, all parasitic on mammalian rodents of the genus *Ctenomys* Blainville (Rodentia: Octodontidae: Ctenomyinae). Other two species customarily included in this genus (e.g. Price et al., 2003) parasitize species of *Chinchilla* Bennet (Rodentia: Chinchillidae) (Cicchino and Castro 1998a, Castro and Cichino 2001). A detailed study by the authors now in progress based on adult and egg morphology of these two species led us to conclude that they fit well in the genus *Gyropus* Nitzsch, 1818 and not in *Phtheiropoios*. The only species known from Jujuy Province is *P. nematophallus* (Werneck 1935) from *C. opimus luteolus* Thomas, 1900 (Cicchino et al., 2000). It was our aim to describe a new species from *Ctenomys* sp. collected from western locality in this province near the border with Chile. Also brief comments on the morphological affinities with *P. nematophallus*, its closest morphological relative, are also provided.

METHODS

Specimens were collected from freshly trapped hosts, stained and mounted on slides following the procedure described by Cicchino and Castro (1998a). Type series and most of the specimens are housed in the collections of the Museo de La Plata, Buenos Aires Province, Argentina.

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Body measurements are in millimeters; they include maximum head length and width, maximum abdominal width and total length of the body. Terminology, including counts and notation of abdominal setae, follows that of Cicchino and Castro (1998a).

Eggs taken from freshly trapped individuals of *Ctenomys* were stored in vials with ethanol 70°.

Procedures for scanning electron microscopic study included hydration with decreasing ethanol, cleaned in physiological solution by means of an ultrasonic vibrator, rinsed in distilled water, fixed in 70% ethanol solution, dehydrated with increasing ethanol solution, mounted in stubs, coated with goldpalladium, then observed and photographed at different magnifications in a Jeol/RO 1.1 scanning electron microscope at the Electronic Microscopy Service of Museo de La Plata, Buenos Aires Province. Nomenclature of chorionic structures follows those used by Cicchino and Castro (1994, 1998b). Measurements are expressed in micrometers (μm).

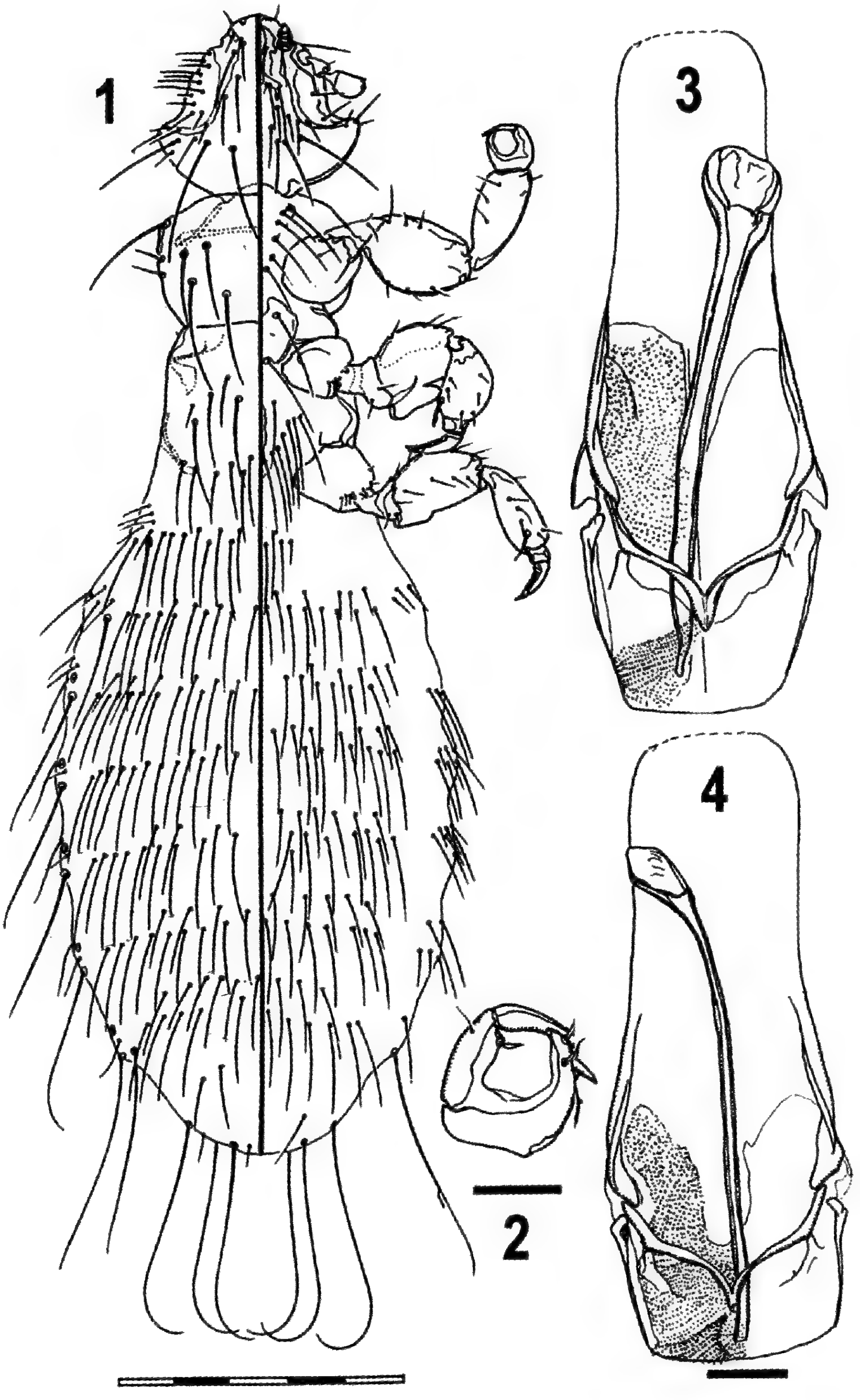
SYSTEMATIC ENTOMOLOGY

Phtheiropoios susquensis sp. nov.

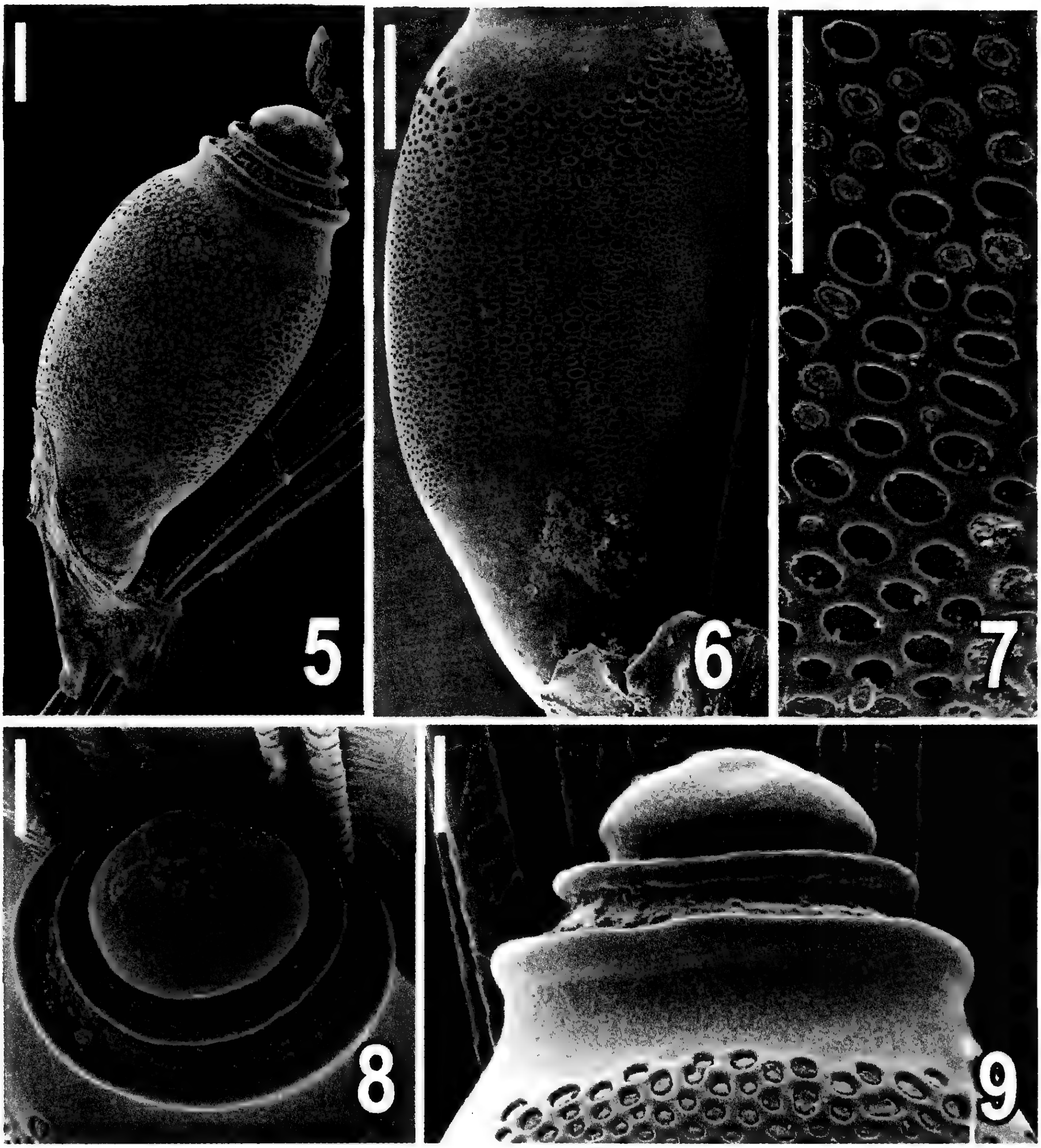
(Figs. 1-9)

Male Holotype (Fig. 1). Body shape elongated, reminiscent of *P. nematophallus*. Measurements. Head length 0.313-0.326; head width 0.333-0.347; maximum width of abdomen 0.687-0.708; total body length 1.926-2.069. Forficulae with "toe" not projected beyond level of second tarsomere (Fig. 2). Abdominal chaetotaxy. Tergal setae: I (3-6) 8-11; II (8-9) 14; III (9-13) 15-18; IV (9-10) 16-20; V (10- 14) 17; VI (10-15) 15-17; VII (10-12) 10-11; VIII (6-7) 2; sternal setae: I (2) 4-6; II (13-17) 14-17; III (14-18) 15-17; IV (15-16) 16-17; V (13-15) 12-15; VI (11-15) 14-16; VII (8-13) 11-14; VIII (6-7) 2. External genitalia. Basal plate and general structure similar to *P. nematophallus*, differing in shape and thickeness of the genital sclerite, shape and proportions of the basal plate, and pseudopenis (Figs. 3-4).

Female: Similar to male, except for larger size and counts of abdominal setae. Measurements. Head length 0.326; head width 0.374-0.391; maximum width of the abdomen 0.694-0.803; total body length 2.096-2.273. Chaetotaxy. Tergal setae: I (6-8) 11; II (12-16) 14-15; III (16-19) 16-19; IV (20-24) 18-19; V (20-24) 20-21; VI (21-23) 17-18; VII (16-19) 10-11; VIII 5-8; sternal setae: I (2-3) 4-6; II (19-21) 18; III(19-24) 17-18; IV (22) 17-18; V(21-22) 16-17; VI (16-20) 16; VII (12-17) 13-15. External genitalia: vulvar margin not differing significantly from that of *P. mendocinus* (see Cicchino and Castro 1998).



Figures 1-3 *Phtheiropopios susquensis* sp. nov. 1. Male, dorsal-ventral view (scale = 500 μm); 2. Idem, left forficula (scale = 50 μm); 3. Idem, external genitalia (scale = 50 μm). Figure 4. *P. nematophallus* (Werneck 1935), external genitalia (same scale as Fig. 3).



Figures 5-9 *Phtheiropoios susquensis* sp. nov., egg, SEM pictures: 5. whole egg, 6. lateral aspect of the amphora, 7. detail of the mesh of the amphora, 8. operculum in semipolar view, 9. lateral view. Scales: Figs 5-6 = 100 μm; Fig. 7 = 25 μm; Figs. 8-9 = 50 μm.

External architecture of the egg: Silhouette largely elliptical (Fig. 5), with a prominent eccentric and deciduous phanerum (Fig. 5). Operculum: capitate (see Cicchino and Castro, 1994) strongly convex, with surface smooth (Figs. 8, 9), with 17-21 air chambers (Fig. 8). Opercular callus uniformly thickened, neither raised nor reflexed upwards (Figs. 8, 9). Callus of the amphora scarcely elevated (Figs. 8, 9). Amphora: surface ornamented with an irregular mesh composed of unequal semielliptical areolae (diameter ranging from 2.3 to 13.6 μm), becoming smaller toward the surface faced with the hair and the posterior end of the egg (Fig. 6). Measurements: diameter of the operculum 115-123 μm, opercular height 75.7-81.2 μm, diameter of the amphora 281-360 μm, length of the amphora 544-588 μm, Length of the opercular phanerum 98-105 μm, total length of the egg 611-659 μm.

Specimens Examined: Holotype male, 5 males and 5 females Paratypes. Laguna Múcar, Susques District, Jujuy Province, Argentina, 3700 meters above sea level, 17-IX-2000, Yanina Arzamendia. Holotype and most of the paratypes at the Museum of La Plata.

Etymology: The epithet susquensis refers to the geographical district where the type series was collected, located at the SW Jujuy Province in Argentina.

Diagnosis: This species is close to *P. nematophallus* (Werneck, 1935), differing greatly in shape and structure of the genital sclerite of males; both sexes show a large number of setae in the abdomen, body silhouette and measurements.

Host: *Ctenomys* sp from Laguna Múcar (23°28′ S; 67°8′ W, 3700 meters above sea level), Susques Department, Jujuy Province, Argentina. Within the geographic area, two species and subspecies of *Ctenomys* are cited: *C. frater* Thomas, 1902 from the yunga and andean highlands of Jujuy and Salta Provinces, and *C. opimus luteolus* Thomas, 1900 from the punean highlands of the Andes of Catamarca, Salta and Jujuy provinces (Bidau, 2006). Identity of the specimens from which lice were collected is still uncertain, and it is now under study in the Universidad Nacional de Jujuy, Argentina.

Remarks: Strong morphological similarities to *P. nematophallus* (Werneck, 1935), *P. ewingi* (Werneck, 1936) and *P. susquensis* sp. nov. seem to be consistent with the currently accepted evolutionary theory of the different lineages of *Ctenomys* (Contreras and Bidau, 1999). Hosts of the three species belong to derivatives of the main stem of this genus, originated in the highlands of Bolivia and adjacent parts of Argentina (Reig et al.,1990); some of them are associated with the above cited lice species (Contreras et al., 1999).

Key to males of the genus *Phtheiropoios* known to parasitize species of the genus *Ctenomys*

1. Pseudopenis deeply V-shaped, noticeably widened, thickened, and produced backwards in middle. Apical portion of basal plate slightly widened. No traces of sclerite in genital sac .... *P. tucumanus* Cicchino, 1986

1' Pseudopenis otherwise, slightly widened, and produced backward in middle and sometimes also at sides. Apical portion of basal plate noticeably widened. Sclerite present, or at least discernable at the differentiation of the apex of the genital sac and consistently associated with the latter 2

2. Genital sclerite present as unpigmented or slightly pigmented differentiation of apex of genital sac 3

2' Genital sclerite always well differentiated and pigmented 10

3. Genital sclerite tube-like and partially contorted, unpigmented. Lateral edges of pseudopenis produced caudally .... *P. centralis* Castro and Cicchino, 2001
3' Genital sclerite otherwise, always slightly pigmented. Lateral edges of pseudopenis caudally produced or not 4

4. Genital sclerite not V- or U-shaped 5
4' Genital selerite V-shaped or U-shaped. Pseudopenis always slightly thickened and caudally produced in middle.. 6

5. Genital sclerite pear-shaped, caudally round. Pseudopenis greatly thickened and produced medially.................*P. rionegrensis* Cicchino and Castro, 1994
5' Genital sclerite rounded, caudally produced and forming a double series of small sclerites. Pseudopenis slender and caudally produced in the middle .... *P. inaequalis* Castro and Cicchino, 2007

6. Genital sclerite V-shaped 7
6' Genital sclerite U-shaped 9

7. "Thumb" of forficula short, not reaching level of second tarsomere. Body silhouette slender: maximum width of abdomen 0.52-0.58 mm ....*P. mendocinus* Cicchino and Castro, 1998
7' "Thumb" of forficula long, exceeding level of apex of second tarsomere. Body silhouette stout 8

8. Maximum width of abdomen 0.63-0.67.. *P. cordobensis* Castro and Cicchino, 2002
8' Maximum width of abdomen 0.73-0.78 mm .... *P. forficulatus* (Neumann, 1912)

9. Tibia almost as wide as pro-femur. Meta-femur almost as wide as meso-femur. Thumb of forficula greatly enlarged and its apical third somewhat curved inwards ....*P. latipollicaris* (Ewing, 1924)
9' Tibia 1 more slender than pro-femur. Meta-femur noticeably more slender than the meso-femur. Thumb of forficula not enlarged or curved inwards .... *P. gracilipes* (Ewing, 1924)

10. Genital sclerite short and stout, composed of two subtriangular and superimposed pieces. Pseudopenis very narrow...............*P. wetmorei* (Ewing, 1924)
10' Genital sclerite elongated, composed of single piece 11

11. Genital sclerite short (length 68-75 µm), bacilliform .... *P. pollicaris* (Ewing, 1924)

11' Genital sclerite very long (over 200 μm), with its basal end widened.......12

12. Genital sclerite deflexed, spoonlikev.................. *P. ewingi* (Werneck, 1936)
12' Genital sclerite almost straight 13

13. Maximum width of the genital sclerite 6.8-8 μm ....
.... *P. nematophallus* (Werneck, 1935)
13' Maximum width of the genital sclerite 14-16 μm ....*P. susquensis* sp. nov.

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TWO NEW GENERA AND SIX NEW SPECIES OF LEAFHOPPERS (HEMIPTERA: CICADELLIDAE: CICADELLINAE) FROM HISPANIOLA [1]

Paul H. Freytag[2]

ABSTRACT: Two new genera and six new species related to the genus *Hadria* are described from Hispaniola. Parahadria new genus, includes but the type species *P. octolineata* n. sp. *Neohadria* new genus, includes five new species, *N. maculata,* type species, *N. amaurota, N. delecta, N. diversa,* and *N. grisea. Parahadria octolineata* is found commonly throughout the island, while all Neohadria species are found only in the higher elevations of the central and western part of the island.

KEY WORDS: Hemiptera, Cicadellidae, Cicadellinae, *Parahadria, Neohadria, Hadria,* Dominican Republic, Hispaniola

Two new genera closely related to the genus *Hadria* Metcalf and Bruner (1936) are described from Hispaniola. Both genera include species which look much like the species found in *Hadria,* but differ in the number of anteapical cells in the forewing and some differences in the male and female genitalia. Young (1977) included sixteen species in the genus *Hadria* from Cuba and Hispaniola. Dlabola and Novoa (1976a, 1976b) added two species to the genus *Arezzia* Metcalf and Bruner (1936) and two species to the genus *Hadria.* Young (1977) considered *Arezzia* and *Lucumius* Metcalf and Bruner (1936) synonyms of *Hadria,* as all species have two anteapical cells in the forewing. In this paper I accept Young's concept of the genus, so there are about 20 species in the genus *Hadria.* The new genera being described have but one anteapical cell or none, and are only found on Hispaniola. This difference is usually easily seen, so the two new genera are quickly separated from *Hadria.*

The acronyms used for the repositories alluded to in this paper are, as follows: CMNH- Carnegie Museum of Natural History, Pittsburg, Pennsylvania; USNM–National Museum of Natural History, Washington, D.C.; FSCA–Florida State Collection of Arthropods, Gainesville; UKYL–University of Kentucky Collection, Lexington; MHND–Museo Nacional de Historia Natural, Santo Domingo, Dominican Republic.

Key to the species of the *Hadria* complex

1. Forewings with two anteapical cells, either normal sized (Young, 1977, Fig. 790p) or very small (Young, 1977, Fig. 782p), male paraphysis absent, or with one or two processes .... *Hadria* Metcalf and Bruner

1'. Forewings with one anteapical cell (Fig. 4) or none (Fig. 2) 2

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2. Forewings with one anteapical cell (Fig. 4), male paraphysis reduced to small sclerite (Fig. 1) .... *Neohadria* Freytag n. g.
2'. Forewings with no anteapical cell (Fig. 2), male paraphysis with long thin base and long single process (Fig. 9) .... *Parahadria* Freytag n. g.

Parahadria Freytag NEW GENUS

Body: Length 5.9-7 mm. Head moderately produced, ocelli slightly closer to eye than median line. Thorax with pronotal width less than transocular width of head, lateral margins rounded. Forewing with membrane extending over all apical cells, except basal portion of third and outer apical cell, second and third apical cells nearly equal in length, wider at wing margin, with no anteapical cell. Hindleg with femoral setal formula 2:1:1.

Male genitalia: Pygofer moderately produced, apex rounded, macrosetae few located on posterior half. Subgenital plates extending two-thirds length of pygofer, with uniseriate mirosetae. Style small, extending about half length of connective, pointed at apex. Connective T-shaped, long. Aedeagus with shaft short, without processes. Paraphysis present, asymmetrical with a single, long apical process. Female seventh sternum large, rounded at posterior margin, with median slightly produced, bifurcate.

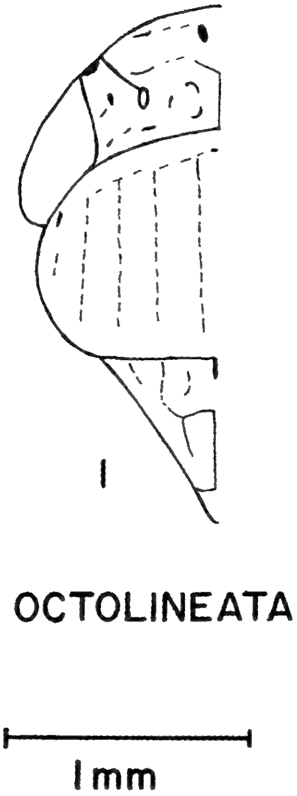
Type species: *Parahadria octolineata* Freytag, n. sp.

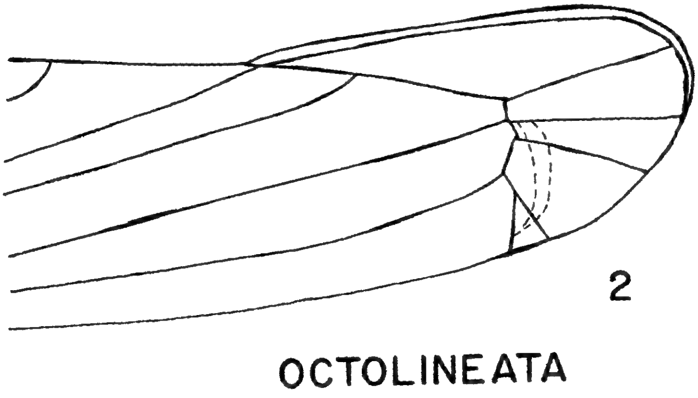
Remarks: This genus is close to the genus *Hadria*, but differs from that genus by having no anteapical cell in the forewing, and the male paraphysis has a longer, thinner base than found in any of the *Hadria* species.

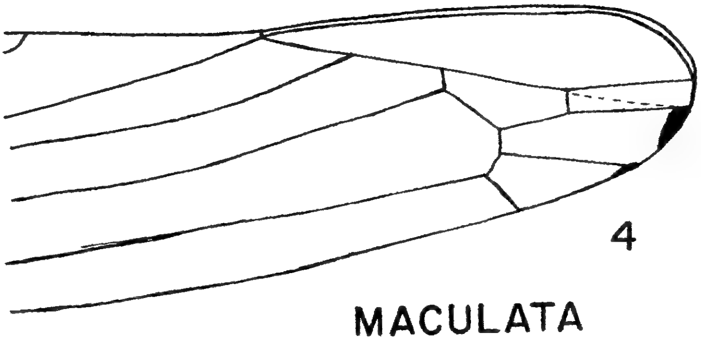
Parahadria octolineata Freytag NEW SPECIES

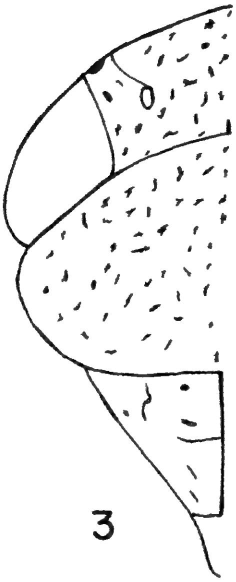
(Figures 1-2 and 7-11)

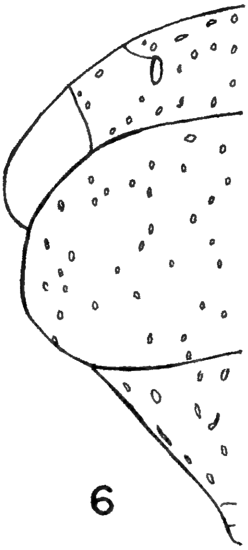
Description: Length of male 5.9-6.1 mm, female 6.5-7 mm. Similar to *Hadria maldonadoi* but slightly larger and with a lighter yellow green color. Head yellow with dark brown markings (Fig. 1), with face mostly yellow with median dark brown spot. Pronotum with anterior, yellow, with posterior two-thirds green, marked with eight longitudinal thin lines of black dots (Fig. 1). Scutellum yellow, with brown markings (Fig. 1). Forewings mostly green, with yellow costal area, viens brown; apical cells membranous, except for whitish patch across base of third and forth cells (Fig. 2). Legs yellow. Abdomen yellow ventrally, dark brown dorsally. Male genitalia: Pygofer rounded at apex (Fig. 7). Subgenital plates with wide base narrowing to thin, rounded apex (Fig. 8), about half length of pygofer. Aedeagus (Fig. 9) short, finger-like, curving ventrally. Connective T-shaped, with long shaft. Paraphysis (Fig. 9) with long narrow base, with single long wide process narrowing near apex which is pointed. Style (Fig. 10) small, narrowing from base to sharply pointed apex. Female seventh sternum (Fig. 11) long, rounded to slightly prolonged median bifurcate apex.



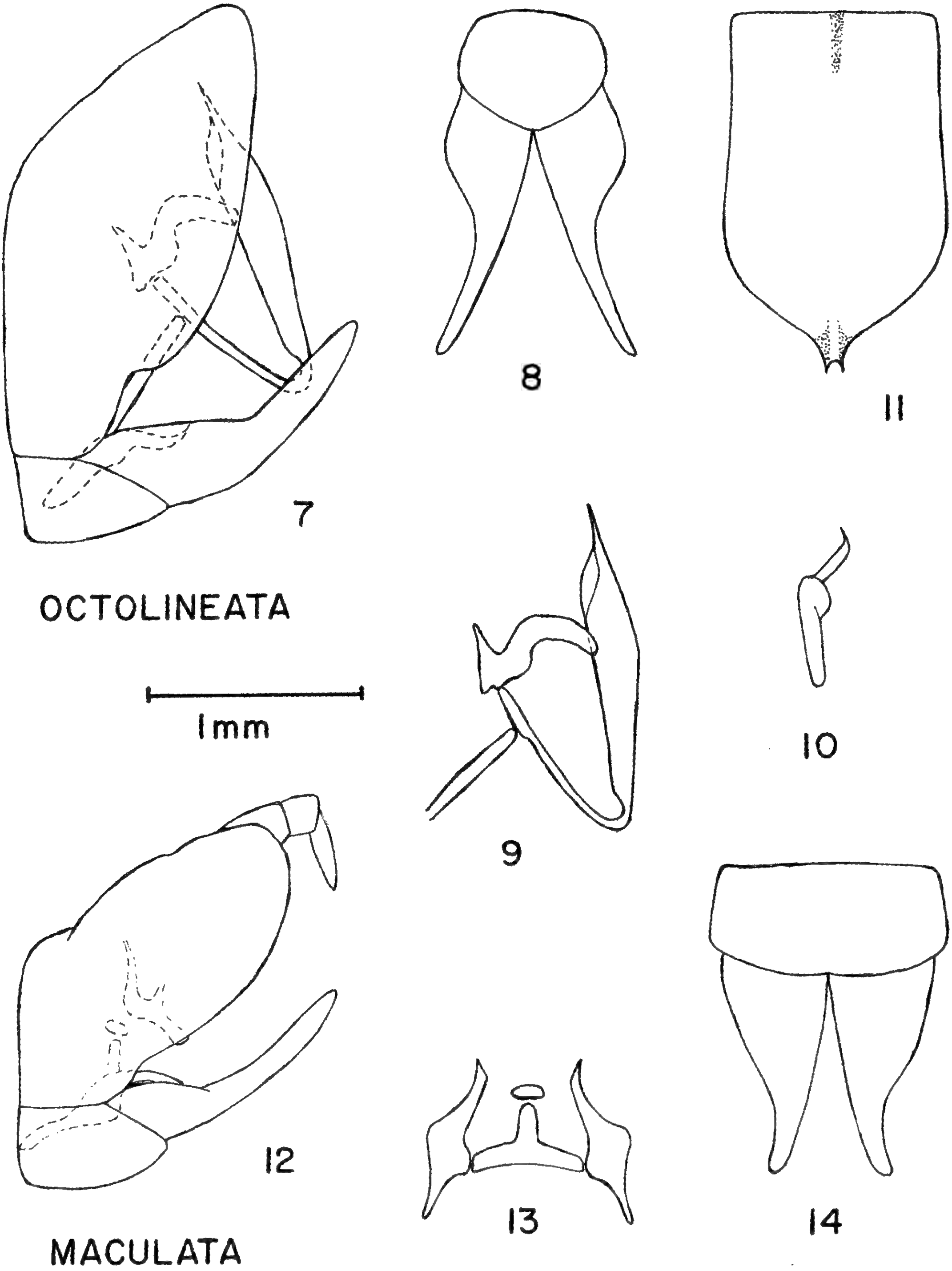








Figures 1-2. *Parahadria octolineata* n. sp. Fig. 1. Dorsal view of head, pronotum and scutellum. Fig. 2. Forewing, apical half. Figures 3-4. *Neohadria maculata* n. sp. Fig. 3. Dorsal view of head, pronotum and scutellum. Fig. 4. Forewing, apical half. Figure 5. *Neohadria diversa* n. sp., dorsal view of head, pronotum and scutellum. Figure 6. *Neohadria amaurota* n. sp., dorsal view of head, pronotum and scutellum. All drawn to the same scale.



Figures 7-14. Figures 7-11. *Parahadria octolineata* n. sp. Fig. 7. Male genital capsule, lateral view, setae not shown. Fig. 8. Male valve and subgenital plates, ventral view, setae not shown. Fig. 9. Male aedeagus, paraphysis and apex of connective, lateral view. Fig. 10. Male style, lateroventral view. Fig. 11. Female seventh sternum, ventral view. Figures 12-14. *Neohadria maculata* n. sp. Fig. 12. Male genital capsule, lateral view, setae not shown. Fig. 13. Male styles, connective and paraphysis, ventral view. Fig. 14. Male valve and subgenital plates, ventral view, setae not shown. All drawn to the same scale.

Type Data: Holotype male: Dominican Republic: Duarte, Reserva Loma Quita Espuela, canelo, 13.1 km NNE San Francisco de Macoris, 19-24-44 N 70-09-47 W, 512 m., 6-IV-2004, C. Young, R. Davidson and J. Rawlins, burned patch in broadleaf forest, uv light, sample 11313 (CMNH). Paratypes: Three males, three females, same data as holotype; 1 male, 2 females, same data as holotype, except 13.2 km, 19-24-46 N 70-09-52 W, 515 m., edge of wet broadleaf forest; and 5 males, 2 females, same data as holotype, except 13.2 km, 19-24-47 N 70-09-54 W, 523 m., disturbed field near wet forest fragment. Nine male, seven female paratypes (CMNH); two male, two female paratypes (FSCA); and two male, two female paratypes (UKYL).

Additional Specimens: Over 600 specimens have been seen from nearly all parts of the Dominican Republic. Over 200 specimens (CMNH), 150 specimens (MHND); 150 specimens (FSCA); 55 specimens (UKYL); and the remainder (USNM).

Remarks: This species is larger than *Hadria maldonadoi*, and with a different color pattern. However, this species was mixed with the specimens Young (1977) had when he described that species. All specimens of *H. omaldonadoi* from the type locality appear to be that species. The other specimens in the series from other localities appear to be *octolineata*. Some of the drawings, such as the wing (Young, 1977, fig. 794p), are also probably of *octolineata*. This species is fairly common throughout the island, while *H. omaldonadoi* is uncommon and rarely collected.

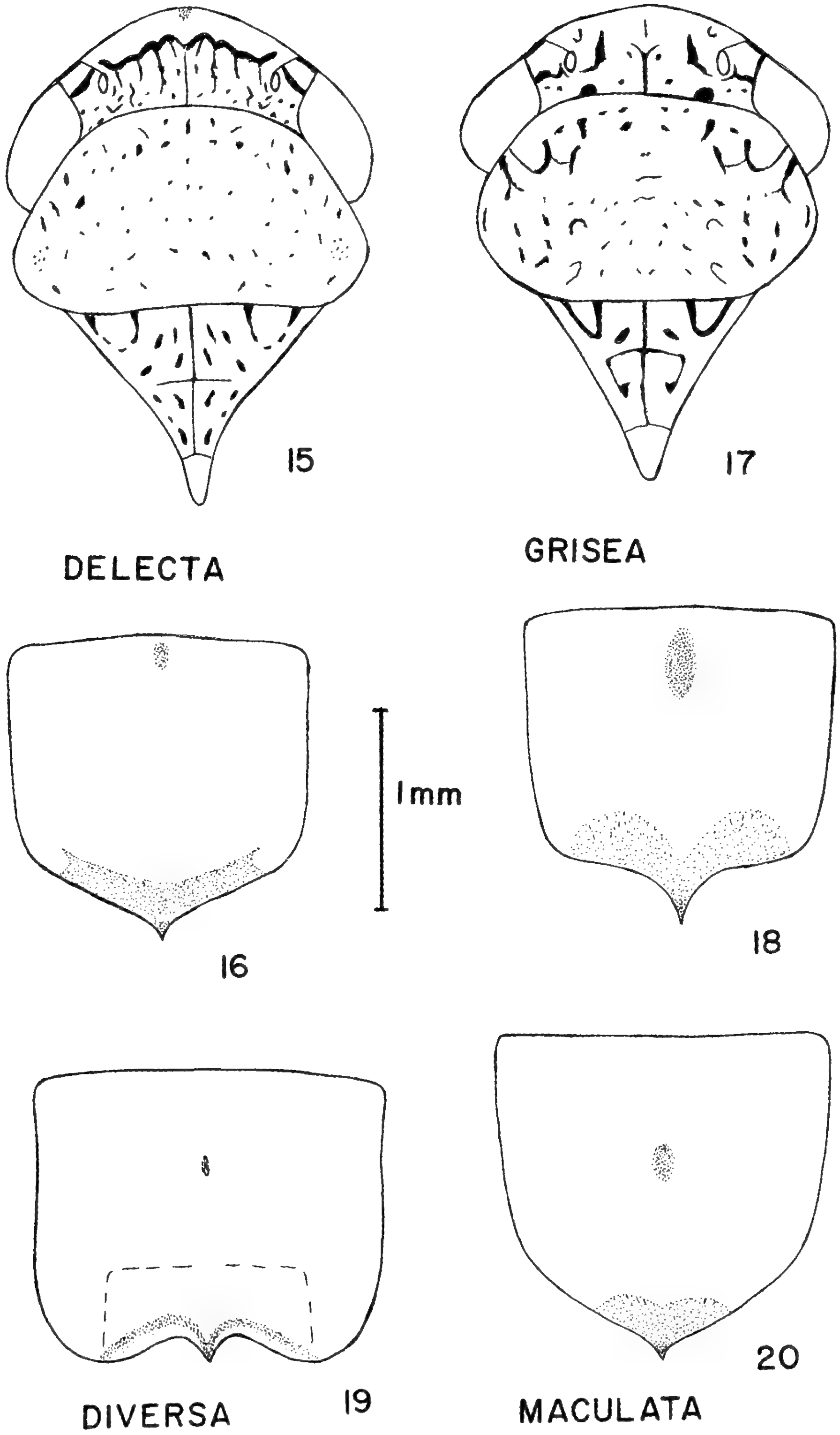
Neohadria Freytag NEW GENUS

Body: Length 6-8.5 mm. Head moderately produced, ocelli closer to eye than median line. Thorax with pronotal width nearly same as transocular width of head, lateral margin rounded. Forewing with membrane extending to second apical cell, except for basal portion of second cell, second apical cell small, parallel sided, shorter then third apical cell, one anteapical cell. Hindleg with femoral setal formula 2:1:1.

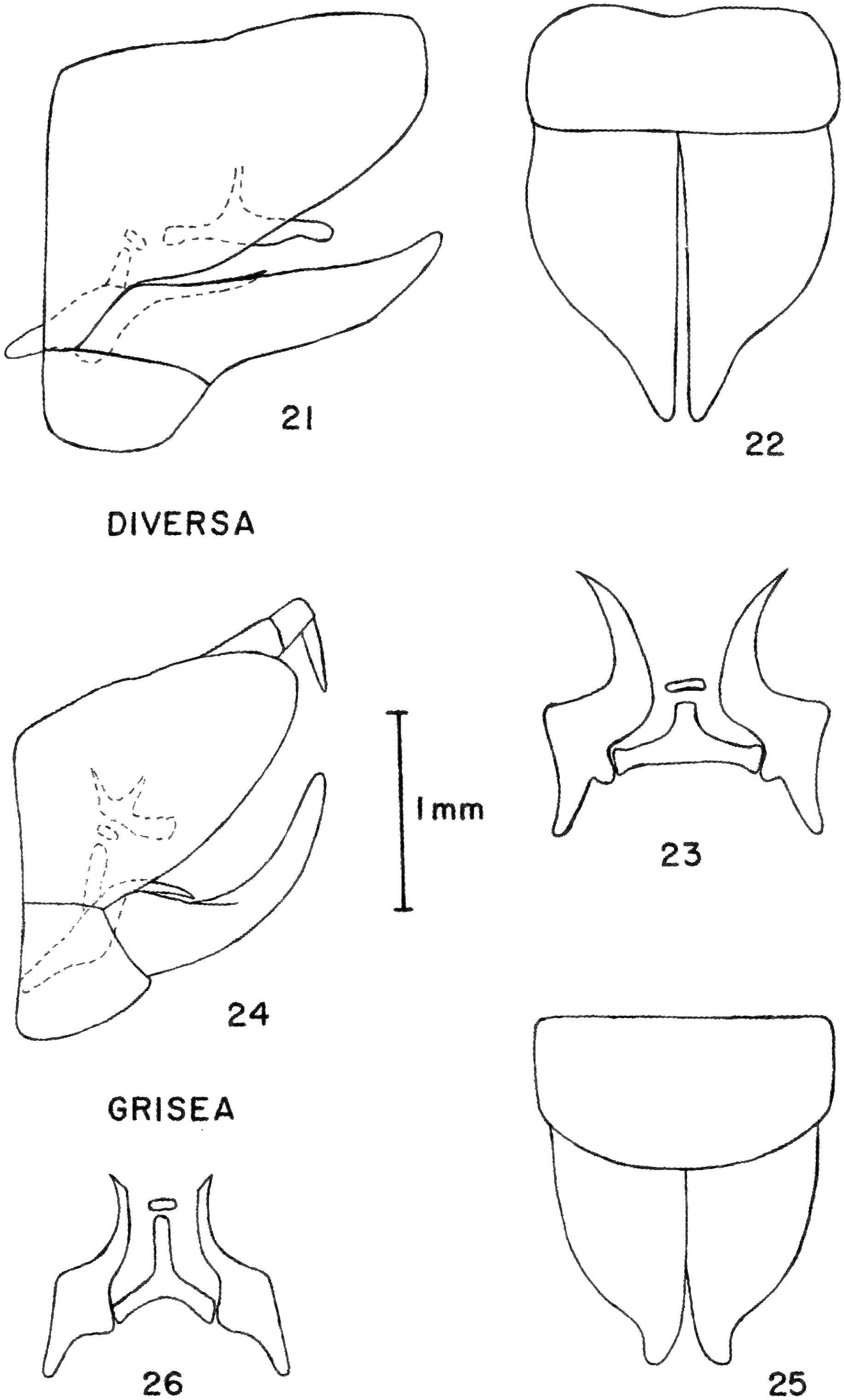
Male genitalia: Pygofer moderately produced, apex rounded, macrosetae few located on posterior half. Subgenital plates variable, extending nearly to pygofer apex, with uniseriate microsetae. Styles variable, usually with pointed apex. Connective T-shaped, short. Aedeagus with shaft short, without processes. Paraphysis vestigial, represented by small sclerite between connective and aedeagus. Female seventh sternum large, wide, with posterior margin rounded to small sharply pointed median.

Type species: *Neohadria maculata* Freytag, n. sp.

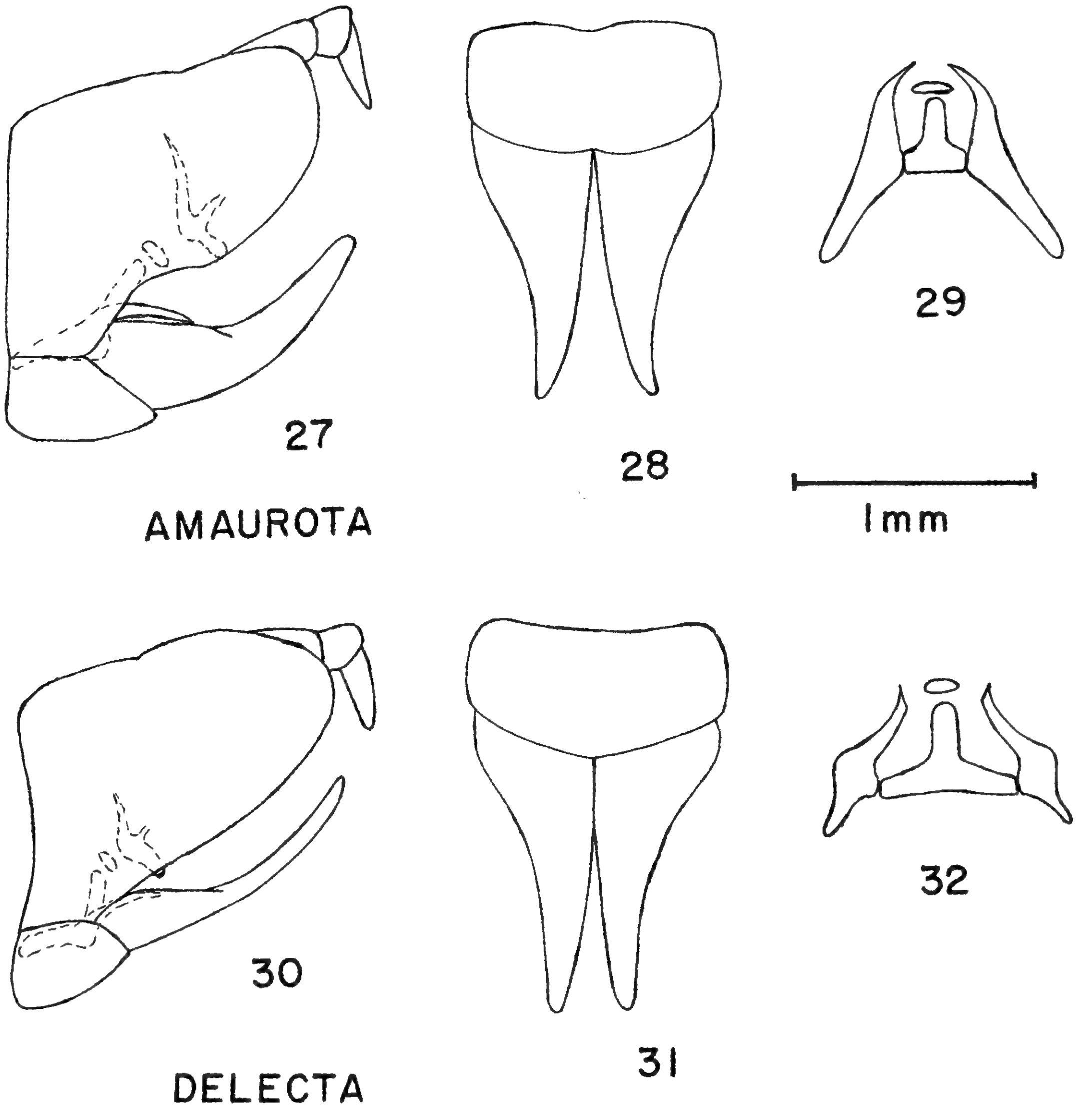
Remarks: This genus is near the genus *Hadria*, but has only one anteapical cell in the forewing, and the male paraphysis is represented by a small sclerite, which is not found in any of the species of *Hadria*.



Figures 15-20. Figures 15-16. *Neohadria delecta* n. sp. Fig. 15. Head, pronotum and scutellum, dorsal view. Fig. 16. Female seventh sternum, ventral view. Figures 17-18. *Neohadria grisea* n. sp. Fig. 17. Head, pronotum and scutellum, dorsal view. Fig. 18. Female seventh sternum, ventral view. Figure 19. *Neohadria diversa* n. sp., female seventh sternum, ventral view. Figure 20. *Neohadria maculata* n. sp., female seventh sternum, ventral view. All drawn to the same scale.



Figures 21-26. Figures 21-23. *Neohadria diversa* n. sp. Fig. 21. Male genital capsule, lateral view, setae not shown. Fig. 22. Male valve and subgenital plates, ventral view, setae not shown. Fig. 23. Male styles, connective and paraphysis, ventral view. Figures 24-26. *Neohadria grisea* n. sp. Fig. 24. Male genital capsule, lateral view, setae not shown. Fig. 25. Male valve and subgenital plates, ventral view, setae not shown. Fig. 26. Male styles, connective and paraphysis, ventral view. All drawn to the same scale.



Figures 27-32. Figures 27-29. *Neohadria amaurota* n. sp. Fig. 27. Male genital capsule, lateral view, setae not shown. Fig. 28. Male valve and subgenital plates, ventral view, setae not shown. Fig. 29. Male styles, connective and paraphysis, ventral view. Figures 30-32. *Neohadria delecta* n. sp. Fig. 30. Male genital capsule, lateral view, setae not shown. Fig. 31. Male valve and subgenital plates, ventral view, setae not shown. Fig. 32. Male styles, connective and paraphysis, ventral view. All drawn to the same scale.

Key to the species of *Neohadria*

1. Male subgenital plates smaller and triangular (Figs. 14, 28, 31).................. 2
1’. Male subgenital plates larger and rounded (Figs. 22, 25)..............................4

2. Dorsal part of head and pronotum black with many small yellow spots (Fig. 6).. *amaurota* n. sp.
2’. Dorsal part of head and pronotum mostly green or gray 3

3. Head and pronotum green with randomly spaced dark spots (Fig. 3) ....*maculata* n. sp.
3'. Head and pronotum gray with irregular dark spots and a prominent horizontal line anterior to ocelli (Fig. 15) ....*delecta* n. sp.

4. Male styles large, evenly curving to a sharp apex (Fig. 23) ..... *diversa* n. sp.
4'. Male styles small, curving to near apex which is slanted (Fig. 26)..*grisea* n. sp.

Neohadria maculata Freytag NEW SPECIES

(Figures 3, 12-14 and 20)

Description: Length of male 6.4-7 mm, female 6.5-7.5 mm. Head yellow with dark brown markings (Fig. 3). Pronotum yellow, except for posterior margin and much of median, green, with brown markings (Fig. 3). Forewings green with brown viens and numerous small brown spots in most cells, first and most of second apical cells, membranous; third apical cell with small dark brown spot near apex (Fig. 4). Legs yellow. Abdomen mostly yellow ventrally, reddish brown dorsally. Male genitalia: Pygofer broadly rounded at apex (Fig. 12). Subgenital plates triangular, gradually narrowing to rounded apex (Fig. 14), about three-fourths length of pygofer. Aedeagus (Fig. 12) short, stout with truncate apex. Style (Fig. 13) robust at base narrowing to apex which is angled, pointed. Connective (Fig. 13) T-shaped, short. Paraphysis vestigial, represented by a small sclerite. Female seventh sternum (Fig. 20) robust, posterior margin rounded to a small pointed median projection .

Type Data: Holotype male: Dominican Republic, Barahona, Eastern Sierra Bahoruco, Reserva Cachote, 12.8 km NE Paraiso, 18-05-52N 71-11-19W, 1198 m., 21-23-III-2004, J. Rawlins, C. Young, R. Davidson, C. Nunez, M. Rial, semi-disturbed wet broadleaf, UV light, Sample 44313, specimen 364,226 (CMNH). Paratypes: Nine males, three females, same data as holotype, except for specimen number (5 males, 1 female, CMNH; 2 males, 1 female, FSCA; 2 males, 1 female, UKYL).

Additional Specimens: Over 400 specimens of this species have been seen from Barahona and Independencia (CMNH, FSCA). Some 150 specimens from other areas including Puerto Plata, Pedernales, Santiago, Elias Piña, Duarte, La Vega, San Christóbal and Distrito Nacional (CMNH, FSCA, MHND, UKYL, USNM).

Remarks: At this time this is the most common species in this genus. It somewhat resembles *Hadria cubana,* but can easily be separated by having but one anteapical cell in the forewing, and quite different male and female genitalia.

Neohadria diversa Freytag NEW SPECIES

(Figures 5, 19 and 21-23)

Body: Length of males 7.5-8 mm, females 8.2-8.5 mm. Head yellow, with black irregular markings from ocelli back to posterior margin (Fig. 5), eyes reddish brown. Pronotum and scutellum with many black irregular markings (Fig. 5). Forewings yellowish green, covered with many black irregular markings, except first and over half of second apical cells, membranous. Legs yellow orange. Abdomen mostly yellow ventrally, dark brown dorsally with band of reddish orange between each segment.

Male genitalia: Pygofer (Fig. 21) narrowing to a truncate apex. Subgenital plates (Fig. 22) robust, rounded then narrowed to rounded apex. Aedeagus (Fig. 21) simple, long, finger-like. Style (Fig. 23) large, crescent-shaped, sharply pointed at apex. Connective (Fig. 23) T-shaped, with short shaft. Paraphysis vestigial, represented by a small sclerite. Female seventh sternum (Fig. 19) robust, posterior margin rounded on each side of convex area each side of small pointed median projection.

Type Data: Holotype male: Dominican Republic, Independencia, Sierra de Neiba near crest, 5.5 km NNW Angel Feliz, 18-41N 71-47W, 1750 m., 21-22-VII-1992, J. Rawlins, S. Thompson, C. Young, R. Davidson, Dense Cloud Forest (CMNH). Paratypes: Two males, same data as holotype (1 male, CMNH; 1 male FSCA).

Additional Specimens: One male, two females, similar data to holotype, except south slope near summit, 4.1 km N Angel Feliz, 18-40-24N 71-46-04W, 1851 m., 1-2-IV-2004, canopy trap, sample 34193 (CMNH); 4 males, same, except sample 34113 (CMNH); 3 males, 5 females, same, except sample 34243 (CMNH); 13 males, 6 females, same, except sample 34213 (9 males, 2 females CMNH; 2 males, 2 females FSCA; 2 males, 2 females UKYL); 1 male, same, except sample 34283 (CMNH); 1 male, same, except sample 34263 (CMNH).

Remarks: This species is related to maculata but with a different color pattern and male genitalia.

Neohadria amaurota Freytag NEW SPECIES

(Figures 6 and 27-29)

Body: Length of males 7-7.5 mm, females unknown. Head, pronotum and scutellum blackish brown with yellow spots (Fig. 6). Face uniformly black, eyes reddish orange. Forewings blackish brown with numerous small grayish spots overall, except for membranous first and apical half of second apical cells. Legs orange red. Abdomen blackish brown with orange red membranous areas.

Male genitalia: Pygofer (Fig. 27) robust, with a truncate apex. Subgenital plates (Fig. 28) triangular, narrowing to a nearly pointed apex. Aedeagus (Fig. 27) small, short, truncate. Style (Fig. 29) gradually narrowing to a pointed apex. Connective (Fig. 29) small, with lateral arms short. Paraphysis vestigial, represented by small sclerite.

Type Data: Holotype male: Dominican Republic, Independencia, Sierra de Bahoruco, Loma del Toro, 5.3 km SW El Aguacate, 18-17-16 N 71-42-46 W, 2316 m., 29-30-III-2004, C. Young, R. Davidson, J. Rawlings, Pinus, Garrya montane forest, Malaise trap, sample 43283, specimen # CMNH 364,337 (CMNH). Paratypes: Three males, same data as holotype, except specimen # 362,977, 363,194 and 364,345 (one in each CMNH, FSCA and UKYL).

Remarks: This species has a unique color pattern which separates it from the other species of the genus.

Neohadria delecta Freytag NEW SPECIES

(Figures 15-16 and 30-32)

Body: Length of males 6.8-7.1 mm, females 7.3-7.5 mm. Head yellow, marked with blackish brown (Fig. 15). Face yellow with faint brown markings overall. Pronotum and scutellum yellow, with brown markings (Fig. 15). Forewings greenish yellow, with first and second apical cells membranous, and two dark brown spots, one in base of anteapical cell, other at apex of third apical cell. Legs yellow. Abdomen yellow ventrally, red dorsally.

Male genitalia: Pygofer (Fig. 30) gradually narrowed to rounded apex. Subgenital plates (Fig. 31) triangular, narrow, elongate, extending nearly to apex of pygofer. Aedeagus (Fig. 31) short, stubby. Style (Fig. 32) with a stout base, narrowing to bent, sharply pointed apex. Connective (Fig. 32) T-shaped. Paraphysis vestigial, represented by small sclerite. Female seventh sternum (Fig. 16) robust, posterior margin angled to a small pointed median projection.

Type Data: Holotype male: Dominican Republic, Barahona, Filipinas, Larimar Mine, 1006 m., 12-IV-1997, blacklight trap, R. E. Woodruff (FSCA). Paratypes: Ten males, two females, same data as holotype (6 males, 1 female FSCA; 2 males, 1 female CMNH; 2 males UKYL).

Additional Specimens: Six males, one female, same data as holotype, except at light, 16-17-XII-1995 (FSCA); 1 male, 1 female, same data as holotype, except mercury vapor light, 6-11-VII-1993 (FSCA); 1 male, Barahona, Eastern Sierra Bahoruco, Reserva Cachote, 12.8 km NE Paraiso, 18-05-52N 71-11-19W, 1198 m., 22-23-XI-2004, J. Rawlins, V. Verdecia, C. Young, C. Nunez, W. Zanol, semi-disturbed wet broadleaf, UV light, sample 44315, specimen 383,217 (CMNH).

Remarks: This species is closely related to maculata with a different color pattern and different male genitalia.

Neohadria grisea Freytag NEW SPECIES

(Figures 17-18 and 24-26)

Body: Length of males 6.4-7.1 mm, females 7.3-7.5 mm. Head, pronotum and scutellum grayish yellow, with numerous brown markings (Fig. 17). Forewings grayish yellow, with brown veins, brown modeling overall, with first and second apical cells, membranous. Legs grayish yellow. Abdomen grayish yellow ventrally, reddish brown dorsally.

Male genitalia: Pygofer (Fig. 24) narrowing to rounded apex. Subgenital plates (Fig. 25) robust, with stubby rounded apex. Aedeagus (Fig. 24) small, short, truncate. Style (Fig. 26) with robust base, narrowing to slanted, sharply pointed apex. Connective (Fig. 26) T-shaped, with shaft same length as arms. Paraphysis vestigial, represented by a small sclerite. Female seventh sternum (Fig. 18) robust, truncate, with sharply pointed median projection.

Type Data: Holotype male: Dominican Republic, Barahona, Filipinas, Larimar Mine, 1006 m., 12-IV-1997, blacklight trap, R. E. Woodruff (FSCA). Paratypes: 9 males, 6 females, same data as holotype (5 males, 2 females FSCA; 2 males, 2 females CMNH; 2 males, 2 females UKYL).

Additional Specimens: One male, Dominican Republic: Barahona, Eastern Sierra Bahoruco, Reserva Cachote, 12.8 km NE Paraiso, 18-05-54N 71-11-21W, 1230 m., 21-23-III-2004, J. Rawlins, C. Young, R. Davidson, C. Nunez, M. Rial, cloud forest with tree ferns, Malaise trap, sample 44283 (CMNH); one female, Independencia, Sierra de Neiba just south of crest, 5 km NW Angel Feliz, 1780 m., 18-41N 71-47W, 13-15-X-1991, J. Rawlins, R. Davidson, C. Young, S. Thompson, cloud forest (CMNH); one male, two females, Independencia, Sierra de Neiba south slope near summit, 4.0 km N Angel Feliz, 18-40-21N 71-46-05W, 1825 m., 1-2-IV-2004, J. Rawlins, C. Young, R. Davidson, broadleaf cloud forest without pine, UV light, sample 34213 (CMNH); one female, same data, except 18-40-17N 71-46-03W, 1821 m., disturbed cloud forest with fields, sample 34313 (CMNH); one female, La Vega, Cordillera Central, Loma Casabito, 15.4 km NW Bonao, 19-02-00N 70-30-58W, 1385 m., 28-V-2003, J. Rawlins, C. Young, R. Davidson, C. Nunez, P. Acevedo, disturbed evergreen cloud forest, UV light, sample 21312 (CMNH); one male, similar data to last, except 15.8 km NW Bonao, 19-02-12N 70-31-08W, 1455 m., sample 21212 (CMNH); one female, similar data as last, except 19-03N 70-31W, 1390 m., 3-XI-2002, V. A. Zanol, C. W. Young, C. Staresinie, J. Rawlins, wet cloud forest, sample 24119 (CMNH).

Remarks: This species is related to *maculata,* but is gray in color and has different male genitalia.

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Dlabola, J. and N. Novoa. 1976b. Dos Nuevas Especies del género *Arezzia* Metcalf y Bruner, 1936 (Homoptera: Auchenorrhyncha) y Revisión de Otras Especies Cubanas. Poeyana 158: 1-27.

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TAXONOMIC STUDY ON THE GENUS *LAMBERTIODES* DIAKONOFF (LEPIDOPTERA: TORTRICIDAE), WITH DESCRIPTION OF A NEW SPECIES FROM CHINA[1]

Xinpu Wang[2,3] and Houhun Li[2]

ABSTRACT: The genus *Lambertiodes* Diakonoff is reviewed, with *Lambertiodes multipunctata* sp. nov. described as new to science. The adult and genital structures of the new species are illustrated, and keys to distinguish the two known species of *Lambertiodes* are provided.

KEY WORDS: Lepidoptera, Tortricidae, *Lambertiodes*, new species, China

Lambertiodes is a monotypic genus in the tribe Sparganothini. It was proposed by Diakonoff in 1959 to include *Epagoge harmonia* Meyrick. To date, the genus contains only the type species, which is distributed in China, Burma, Thailand, India and Nepal (Meyrick, 1908, 1913; Clarke, 1958; Diakonoff, 1959, 1976; Horak, 1991, 1998; Tuck, 1995; Liu and Li, 2002; Brown, 2005).

The tribe Sparganothini is widely distributed and diverse in the Nearctic Region, but has limited distribution in the Palaearctic Region. Razowski (1993) recognized only five Palaearctic species of the genus *Sparganothis*. *Lambertiodes* is another genus of Sparganothini occurring in the Oriental Region. Based on the known distribution, we think that *Lambertiodes* might be confined to the Oriental Region.

In this paper, we describe one species, *Lambertiodes multipunctata* sp. nov. and distinguish it from *L. harmonia* (Meyrick). All the studied specimens, including the type series, are deposited in the Insect Collection, College of Life Sciences, Nankai University, Tianjin, China.

Lambertiodes Diakonoff, 1959

Lambertiodes Diakonoff, 1959, Ark. Zool., 12(13): 166.
Type Species: *Epagoge harmonia* Meyrick, 1908, by monotype.

Head with appressed scales, a long pointed tuft projecting over forehead. Ocellus posterior. Labial palpus in male long, more than 2.5 times length of diameter of compound eye. Forewing with vein R_1 arising from middle of cell, strongly bent in middle; veins R_4 and R_5 long stalked to 1/3 length, R_3 from beyond middle of distance between R_{4+5} and R_2, Cu_1-M_2 rather remote, CuP present but not developed. Hindwing without cubital pecten, Cu_1 and M_3 connate from angle, M_2 closely approximate at base.

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Male genitalia. Uncus long and slender, curved down. Socius usually longer than length of tegumen, densely setose. Gnathos arm slender, fused with socius. Transtilla spinose along upper edge. Valva simple.

Female genitalia. Sterigma with length half width of SVIII. Antrum with internal sclerites. Signum present.

Biology unknown.

Key to species of the genus *Lambertiodes* based on the external characters

1. Forewing with 25-30 dark brown dots throughout and a large spot at middle, without median fascia .... *L. multipunctata* sp. nov.
- Forewing with 8-12 dark brown dots, without large spot at middle, with a distinct but short median fascia .... *L. harmonia* (Meyrick)

Key to species of the genus *Lambertiodes* based on the genital characters

1. Uncus slender, nearly as long as socius; socius distinctly narrowed apically; aedeagus slender, with a small subapical tooth dorsally .... *L. harmonia* (Meyrick)
- Uncus stout, shorter than socius; socius thick, without distinctly narrowed part; aedeagus stout, without subapical tooth..... *L. multipunctata* sp. nov.

Lambertiodes multipunctata sp. nov.

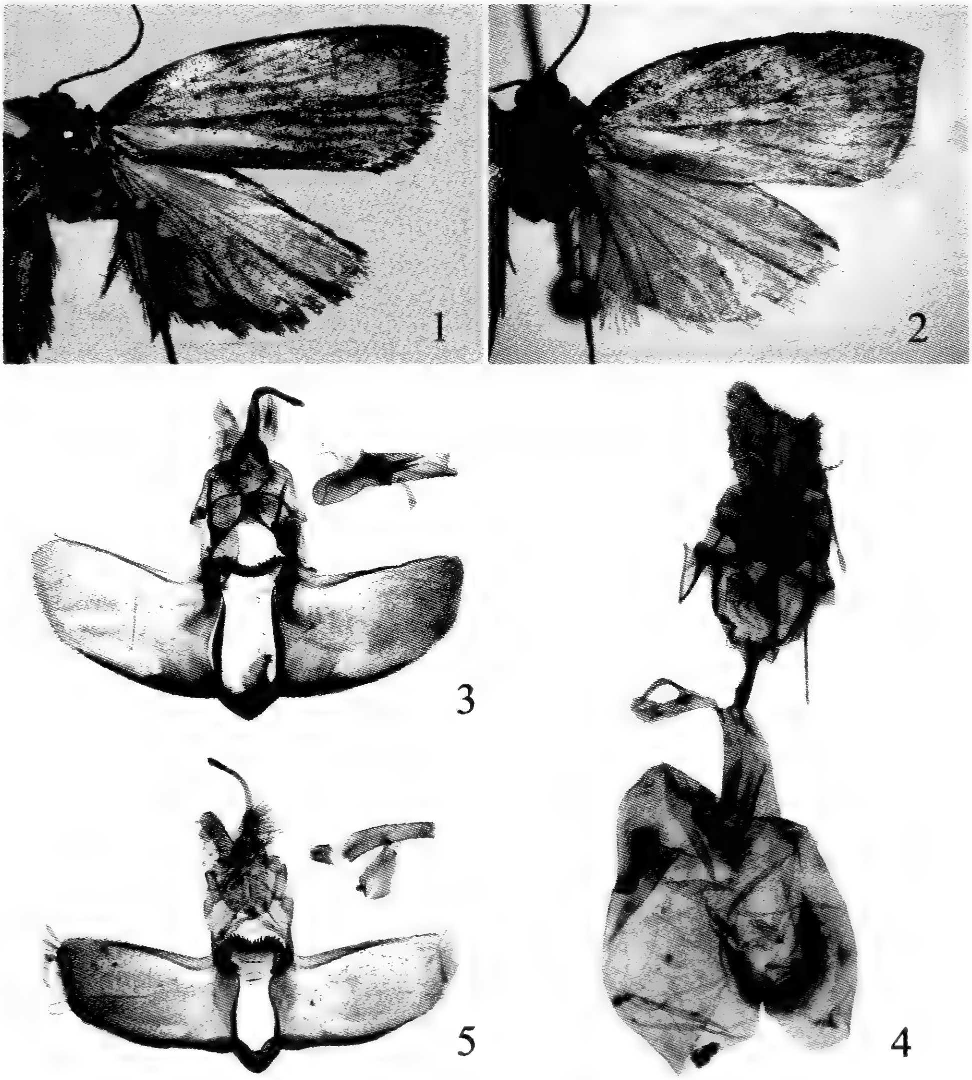
Type Material. Holotype ♂, China, Mêdog County (29°13'N, 95°18'E), Tibet, alt. 2380 m, 9. Aug. 2003, leg. WANG Xinpu and XUE Huaijun. Paratypes 2 ♂♂, 1 ♀, same data as holotype.

Description. Adult (Fig. 1): Wingspan 27.5-29.5 mm in male, 31.5 mm in female. Labial palpus about 2.5 times as long as diameter of compound eye; first segment short, yellowish brown; second segment long, curved upward, dilated apically, rust brown; third segment short, porrect, dark brown. Frons and vertex with erect and rough yellowish brown scales. Antenna thick, ciliate, dark brown. Tegula brown basally, yellowish brown distally. Thorax yellowish brown, mixed with some rusty brown scales. Forewing broad, expanded distally; costal margin arched slightly; apex blunt; termen almost straight, sinuate slightly beyond apex; tornus broad. Forewing with ground color pale yellow, with 25-30 scattered dark brown dots; costal margin dark brown in basal 1/4, with a yellowish brown blotch at middle; a large yellowish brown blotch extending from costal 2/3 almost to apex, stretching nearly to middle of termen; a large dot at middle, mixed with yellowish brown and pale brown scales; some yellowish brown scales along basal portion of dorsum; cilia yellowish brown. Hindwing pale gray, slightly yellowish at apex; cilia darker than ground colour. Legs yellowish brown, with some dark brown scales. Abdomen slender, gray dorsally, pale yellowish ventrally.

Male genitalia (Fig. 3): Tegumen about 4/5 length of socius. Uncus stout, curved, with a few bristles apically, expanded basally. Socius long and thick, without distinctly narrowed part, covered with dense long hairs. Gnathos thin and short. Transtilla half as long as width, sclerotized dorsally, densely with long and short spinules along upper edge. Valva broad, more or less narrowed distally, costa developed basally. Sacculus short and narrow. Aedeagus stout, somewhat curved, smooth and narrowed subapically, with 8-9 spinose cornuti. Juxta broad, coecum penis developed, caulis slender.

Female genitalia (Fig. 4): Papilla analis with length 3 times width. Posterior apophysis with broad basal plate. Lateral portion of sterigma spinulate. Antrum short and broad, with two internal sclerites. Ductus bursae membranous; ductus seminalis arising from near middle. Corpus bursae ovoid; signum a U-shaped sclerite.

Diagnosis. The new species is similar to *L. harmonia* (Meyrick) in appearance and male genitalia, but can be separated from the latter by the forewing with 25-30 dark brown dots and a large spot at middle, but lacking median fascia; the uncus shorter than socius, the socius without distinctly narrowed part, and the aedeagus smooth and narrowed subapically.



Figs. 1-5. *Lambertiodes* spp. Figs. 1, 3, and 4: *L. multipunctata* sp. nov. 1. Adult, holotype. 3. Male genitalia, holotype. 4. Female genitalia, paratype. Figs. 2 and 5: *L. harmonia* (Meyrick). 2. Adult. 5. Male genitalia.

Biology. Unknown.

Etymology. The new specific name is derived from the Latin prefix multi- = numerous and word punctatus = punctate, referring to forewing having many dark brown dots.

Remarks. There are two small "sclerites" inside the corpus bursae posteriorly. The "sclerites" cannot be removed with pin when making genital slide. They might represent two signa, but further study is needed for confirmation.

Lambertiodes harmonia (Meyrick, 1908)

Epagoge harmonia Meyrick, 1908, J. Bombay Nat. Hist. Soc. 18: 617.

Capua harmonia (Meyrick): Obraztsov, 1954, Tijdschrift poor Entomologia 97: 154; Clarke, 1958, Catalogue of the Type Specimens of Microlepidoptera in the British Museum described by Edward Meyrick 3: 68, pl. 34, figs. 4-4b; Liu and Li, 2002, Fauna Sinica, 27: 141, pl. XVIII-179a, b, LXVII-179, CX-179.

Lambertiodes harmonia (Meyrick): Diakonoff, 1959, Ark. Zool. 12(13): 167, fig. 1, pl. I, figs. 1-3; Diakonoff, 1976, Zool. Verh., 144: 69; Tuck, 1995, Microlepid. Thailand 3: 89; Brown, 2005, World Catalogue of Insects 5: 398.

Materials Examined. China: 2 ♂♂, Bomi County (29°53'N, 95°45'E), Tibet, alt. 2800 m, 2003-VIII-19, leg. WANG Xinpu and XUE Huaijun; 1 ♂, Mêdog County (29°13'N, 95°18'E), Tibet, alt. 1200 m, 2003-VIII-10, leg. WANG Xinpu and XUE Huaijun; 2 ♂♂, Xiaoheishan, Longling County (24°35'N, 98°41'E), Yunnan, alt. 2300 m, 2005-VIII-10, leg. Ren Yingdang.

Adult (Fig. 2). Wingspan: 21.0-23.0 mm in male.

Male genitalia (Fig. 5): As illustrated.

Distribution. China (Sichuan, Yunnan, Tibet), Burma, Thailand, India, and Nepal.

Remarks. This species can be distinguished easily from *L. multipunctata* sp. nov. by the forewing with a distinct but short median fascia, the uncus nearly as long as socius, smooth and distinctly narrowed apically.

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We wish to express our thanks to Mr. K. Tuck (The Natural History Museum, London) for providing us with helpful references. The research was supported by the National Natural Science Foundation of China (30660151), the Fok Ying Tung Educational Foundation (101022), and the Natural Science Foundation of Ningxia, China (NZ 0518).

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HYPERASPIS BRUNNESCENS DOBZHANSKY (COLEOPTERA: COCCINELLIDAE) NEWLY RECORDED IN CANADA FROM SCATARIE ISLAND, NOVA SCOTIA[1]

Christopher Majka,[2] Kathleen R. Aikens,[3] A. Andrew MacDonald,[3] Sheena M. Townsend,[3] and David B. McCorquodale[2]

ABSTRACT: *Hyperaspis brunnescens* Dobzhansky is newly recorded in Canada and eastern North America from a storm-petrel burrow on Scatarie Island, Nova Scotia. This record extends the range of the species 2,100 km to the east. Hypotheses with respect to the ecology of the species are discussed, as are possible zoogeographic scenarios that might account for its presence in Nova Scotia.

KEY WORDS: *Hyperaspis brunnescens,* Coccinellidae, Scymninae, Hyperaspidini, range extensions

Hyperaspis brunnescens Dobzhansky, 1941 is a rare and little-known lady beetle (Coccinellidae) described from specimens collected in Illinois. Gordon (1985) reported a specimen from Iowa, and Fauske et al. (2003) found it in Minnesota. Only 19 individuals have previously been collected. Consequently, it was of some interest when a specimen of *H. brunnescens* was discovered in Nova Scotia, Canada, circa 2,100 kilometers east of the previously reported range.

SITE DESCRIPTION, METHODS, AND CONVENTIONS

Scatarie is a small (1,497 ha) island located approximately two km off the eastern shore of Cape Breton Island, Nova Scotia, near Main-à-Dieu. Cool ocean waters and salt spray result in vegetation with boreal characteristics; dense stands of black spruce, *Picea mariana* (Mill.), and balsam fir, *Abies balsamea* (L.) Mill (Pinaceae), dominate much of the island (Davis and Browne 1997). Poor drainage contributes to extensive peatlands and small ponds, including coastal barrachois. The headlands in the east are heath barrens characterized by *Empetrum nigrum* L. (Empetraceae), *Cornus canadensis* L. (Cornaceae), and *Vaccinium* spp. (Ericaceae). The shoreline is mostly rocky, with a few small sand and pebble beaches, often with abundant beach wrack accumulation and backshore zones of dune grasses, e.g. *Elymus mollis* Trin., *Ammophila brevigulata* Fern. (Poaceae), and beach pea, *Lathyrus maritimus* (L.) (Fabaceae). Thousands, likely tens of thousands, of Leach's Storm-petrels (*Oceanodroma leucorhoa* (Vieillot)) (Procellaridae) dig nest burrows on the island, primarily among roots of spruces, but also in heath barrens.

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Although the island is now uninhabited and protected under Nova Scotia's Wilderness Protection Act, several dwellings remain on the eastern end of the island (Cameron 2004). European fishers have periodically used the island since the 15th century. During the 19th and 20th centuries, however, permanent residences and communities were established on the island (Chrestien 2001). In areas where land was cleared, paper birch, *Betula papyrifera* Marshall (Betulaceae), and white spruce, *Picea glauca* (Moench) Voss (Pinaceae), are prominent.

A team of researchers visited Scatarie Island from 8-11 August 2005 to document the island's biodiversity. Insects were collected by sweep-netting, pitfall and bowl trapping, and hand collection.

Abbreviations of collections referred to in this study are, as follows: **CASC**, California Academy of Sciences, San Francisco, California, USA; **INHS**, Illinois Natural History Survey, Champaign, Illinois, USA; **NSDU**, North Dakota State University, Fargo, North Dakota, USA; **NSMC**, Nova Scotia Museum, Halifax, Nova Scotia, Canada; **USNM**, United States National Museum, Washington, DC, USA.

RESULTS

On 9 August 2005, Aikens and MacDonald were examining a Leach's Storm-petrel (*Oceanodroma leucorhoa*) burrow at Tin Cove, on the southern coast of Scatarie Island (46° 00.181' N, 59° 43.679' W) when they discovered a specimen of *Hyperaspis brunnescens*. C.G. Majka made the species determination after consulting with R. Gordon and N. Vandenberg. The strongly alutaceous dorsum of the specimen and the vittate colour pattern of the elytra separate the specimen from *H. quadrivittata* LeConte, 1852, the only similar species of *Hyperaspis* (Dobzhansky 1941, Gordon 1985).

The burrow was located in a salt-spray barren dominated by (in decreasing order of abundance) *Empetrum nigrum, Juniperus communis* L. (Cupressaceae), and *Potentilla tridentata* Ait. (Rosaceae). The burrow was located about 50 m from the rocky edge of the seashore and about equally distant from a dense coniferous forest. The entrance of the burrow dropped approximately 10 cm before turning sharply to run parallel with the ground surface. The beetle was located near its mouth.

The specimen represents the first record of *H. brunnescens* in Canada and northeastern North America. It will be deposited for reference in the Nova Scotia Museum collection.

Previous records are: **Illinois:** state record, Hubbard and Schwartz, male, USNM; northern Illinois, Peabody, 3 males & 6 females, USNM, INHS, & C.W. Leng collection; Edgebrook, Cook Co., 2 males & 3 females, CASC. **Iowa:** Iowa Experimental Station, Clarke Co., February 1934, little bluestem grass [*Schizachyrium scoparium* (Michx.) Nash (Poaceae)], USNM. **Minnesota:** Clay

Co., 2.5 mi. SSE of Felton, 9 September 1997, P. Tinerella and G. Fauske, pitfall, NDSU; Clay Co., 2.5 mi. SSE of Felton, 24 September 1997, P. Tinerella, pitfall, NDSU; Clay Co., 2.5 mi. SSE of Felton, 13 August 1997, P. Tinerella and A. Abbott, NDSU.

The following year on July 15-16, 2006, on a second excursion to Scatarie Island, efforts were made to locate additional specimens of *H. brunnescens*, however, they were not successful.

DISCUSSION

The surprising discovery of this species on Scatarie Island, Nova Scotia, raises several questions. In Minnesota, *H. brunnescens* has been found in dry prairie and dry mesic prairie habitats (G. Fauske, pers. comm.), quite different from the salt-spray barren environment where the Nova Scotia specimen was collected. Both, however, are open habitats. Two of the three specimens in Minnesota were captured in pitfall traps (G. Fauske, pers. comm.), and the Nova Scotia specimen was in the mouth of a subterranean burrow suggesting that the species is regularly found on, in, or near the ground. Adults and larvae of *Hyperaspis* are predators of scale insects and mealybugs (Homoptera: Coccoidea) (McClanahan 1970; Booth et al., 1995; Stäubli Dreyer et al., 1997; Vandenberg 2002). Some larvae burrow into the egg sacks of female scales and approach a parasitic mode of existence (Vandenberg 2002). Some species of scales are subterranean, raising the possibility that the larvae of *H. brunnescens* could be specialist feeders on such insects, perhaps accounting for the scarcity of this species in collections. Another possibility might be that *H. brunnescens* could be myrmecophilous. Chapin (1966) described *Hyperaspis acanthicola* Chapin from the nests of *Pseudomyrmex* ants in Mexico and *Hyperaspis reppensis* (Herbst) is found in Europe in association with nests of *Tapinoma erraticum* var. *nigerrimum* Nylander (Chapin 1966).

The presence of *H. brunnescens* on a remote, uninhabited island approximately 2,100 km northeast of its previously known range also raises perplexing questions. Given the rarity of the species and distance from previously known populations in the American Midwest, an arrival by accidental or anthropochorous means seems unlikely. We therefore conclude that the specimen does represent an indigenous population. If that is the case, is there a disjunct or relict population in Nova Scotia, or has the species been overlooked in intervening regions?

Recently Majka and McCorquodale (2006) surveyed the Coccinellidae of the Maritime Provinces of Canada and drew attention to species with apparently isolated or disjunct populations in Nova Scotia. These include *Stethorus punctum punctum* (LeConte, 1852), *Scymnus caudalis* LeConte, 1850, *Diomus amabilis* (LeConte, 1852), *Hyperaspis troglodytes* Mulsant, 1853, *Naemia seriata seriata* Melsheimer, 1847, and *Cycloneda munda* (Say, 1835) – all of which have not otherwise been recorded in Atlantic Canada. Two of these, *D. amabilis* and

N. s. seriata, are known in Canada solely from Nova Scotia. *Diomus amabilis, H. troglodytes,* and *N. s. seriata* are Atlantic coastal plain species whose distribution extends to Nova Scotia, whereas *S. p. punctum, S. caudalis,* and *C. munda* are found broadly in the central and eastern parts of the continent. None are as widely disjunct as *H. brunnescens* appears to be, however, Nova Scotia does support a coccinellid fauna composed of a variety of zoogeographic elements, some of which exist as disjunct populations.

If *H. brunnescens* is a relict species, the postglacial climatic history of Nova Scotia may have provided colonization opportunities. Miller and Elias (2000) interpret post-glacial fossil beetle assemblages (from ~ 12,600 years BP to the present) in the Maritime Provinces as illustrating four historical phases of colonization, each indicative of a different climatic regimen. Miller (1997) found specimens of the coccinellid, *Nephus flavifrons* (Melsheimer, 1847), a more southern species not currently found in Atlantic Canada, in peat deposits dating from circa 12,300 years BP on Cape Breton Island – an illustration of historical colonization by a species that has subsequently disappeared from the region.

Scatarie Island represents part of the southern edge of the range of several northern plants including *Cornus suecica* L. (Cornaceae), *Vaccinium uliginosum* L. (Ericaceae), *Prenanthes nana* (Bigel) Torr. (Asteraceae) (Pronych and Wilson 1993), and *Carex rariflora* (Wahlenb.) J. E. Smith (Cyperaceae) (Roland 1998). The same coastal influence that results in cool summers causes a long frost-free season compared to nearby areas only a few kilometers from the coast. Much of the vegetation, however, is similar to that encountered in other coastal headland environments on Cape Breton Island and other parts of Nova Scotia. Consequently it would be worth investigating neighbouring areas to ascertain if *H. brunnescens* occurs more widely in the province.

Although this discovery raises more questions than it answers, it emphasizes how much remains to be learned about the biodiversity of the Coleoptera of Nova Scotia. Majka and McCorquodale's (2006) recent survey of the Coccinellidae of the region had scarcely appeared when yet another species was discovered.

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NEW STATE RECORD OF THE MAYFLY *BAETISCA LAURENTINA* McDUNNOUGH FOR WEST VIRGINIA (EPHEMEROPTERA: BAETISCIDAE) AND NEW COUNTY RECORDS FOR SPECIES OF *BAETISCA* IN KENTUCKY AND WEST VIRGINIA, U.S.A.[1]

Donald C. Tarter,[2] Dwight L. Chaffee,[3] Jeffery E. Bailey,[4] and Sandy Raimondo[5]

ABSTRACT: *Baetisca laurentina* McDunnough is reported for the first time from West Virginia. One male imago was collected near Twelvepole Creek, Wayne County, West Virginia. This record extends the range of this species eastward to the Mid-Atlantic coastal region. New distributional records (57) of *Baetisca* spp. are reported for Kentucky (15) and West Virginia (42). The following county records have been added to the list of *Baetisca* spp. from the two states: *Baetisca berneri* Tarter and Kirchner (KY/1 and WV/13), *B. carolina* Traver (WV/3), *B. gibbera* (WV/1), *B. lacustris* McDunnough KY/14 and WV/22), *B. laurentina* McDunnough (WV/1), and *B. rubescens* Provancher (WV/2). *Baetisca lacustris* is the most widespread baetiscid in West Virginia (26 counties) and Kentucky (25 counties). This species was found in six drainage basins (I, II, IV, V, VI, VII) in West Virginia. Only one baetiscid mayfly, *B. rubescens,* was recorded for drainage basin III.

KEY WORDS: Ephemeroptera, *Baetisca,* state and county records, Kentucky, West Virginia

The North American endemic family *Baetiscidae* is monotypic, containing only the genus *Baetisca* (Pescador and Berner, 1981). Presently, twelve species are recorded for eastern North American, Great Plains, and the Northwest Territories of Canada (Pescador and Berner, 1981). Nymphs of *Baetisca* live partially buried in silt, sand, gravel of small to moderate sized streams. Distributional and/or ecological information on the *Baetisca* spp. in West Virginia and Kentucky have been reported by the following investigators: Traver (1931, 1935), Needham et al. (1935), Olson (1971), Berner (1977), Faulkner and Tarter (1977), Tarter and Kirchner (1978), Chaffee and Tarter (1979), Morris et al. (1980), Pescador and Berner (1981), Pettry and Tarter (1983, 1985), Tarter and Pettry (1983), Burgess and Tarter (1989), and Randolph and McCafferty (1998).

Baetisca specimens used in this investigation were deposited at the following agencies/institutions: Biological Systems Consultants (Lexington, Kentucky), Colorado State University, Marshall University (West Virginia Benthological Survey), Morehead State University, United States Army Corps of Engineers (Huntington District), West Virginia Department of Environmental Protection (Watershed Assessment Section), and West Virginia University.

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DISTRIBUTIONAL RECORDS

West Virginia

Janssen (1973) divided the state into the following drainage basins (Fig. 1): I. Ohio River (industrialization and farming), II. Monongahela River (high elevations and some acid mine pollution), III. Potomac River (farming, little pollution), IV. Little Kanawha River (slow, low gradient streams), V. Kanawha River (industrialization), VI. Guyandot River (heavy acid mine pollution) and VII. Big Sandy River (mining, low gradient streams). All baetiscid records are listed by drainage basin and county.

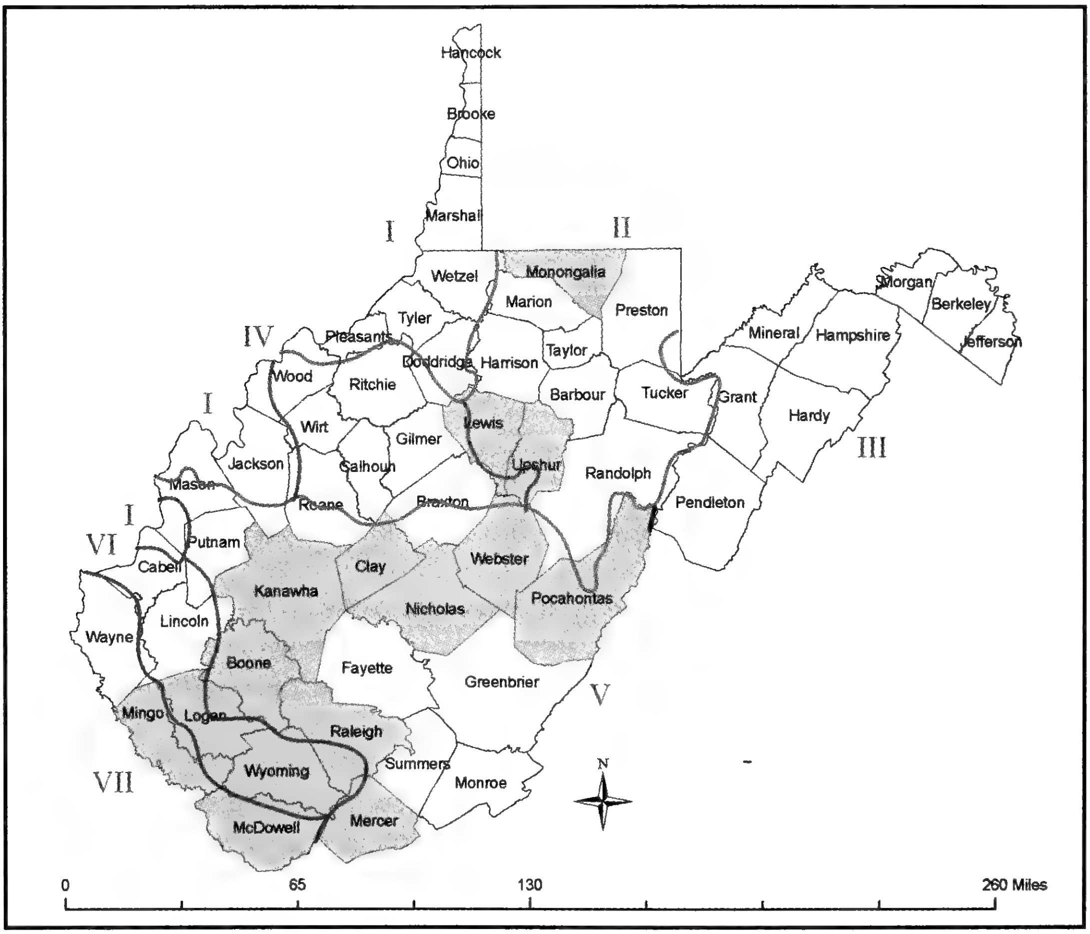

Figure 1. Janssen's (1973) drainage basins in West Virginia.

Baetisca berneri Tarter and Kirchner 1978

Tarter and Kirchner (1978) described mature nymphs from Laurel Fork of Pigeon Creek in Mingo County (drainage basin VII). Pescador and Berner (1981) reported this species from the Morgantown area in Monongalia County (drainage basin II). The following counties (13) are added to the distribution of this species (Fig. 2): Drainage basins II, V, VI, VII (Boone Co.: Bennett Fk., 23-14-97/Left Fk. of Joes Cr., 07-X-97 and Spicelick Fk., 17-IX-97; Clay Co.: Sycamore Cr., 11-IX-02; Kanawha Co.: Bells Cr., 16-VII-03/Slaughter Cr., 26-IX-01/Bradley

Fk., 26-IX-01/Dry Br., 03-X-01 and Blue Cr., 05-IX-02; Lewis Co.: Little Kanawha River, 25-IX-80; Logan Co.: Cow Cr., 09-V-78 and Pine Cr., 14-III-79; McDowell Co.: War Cr., 16-IX-03; Mercer Co.: Camp Cr., 10-VIII-99; Nicholas Co.: Panther Cr., 25-VII-75; Camp Cr., 15-X-05; Pocahontas Co.: Little River, 29-VII- 99; Raleigh Co.: Peachtree Cr., 25-IX-97 and Rock Cr., 07-X-97; Upshur Co.: Right Fk. of Buckhannon River, 06-X-02 and Left Fk. of Buckhannon River, 08-X-02; Webster Co.: Elk River, 07-XI-89; Wyoming Co.: Measle Fk., 05-IX-00).

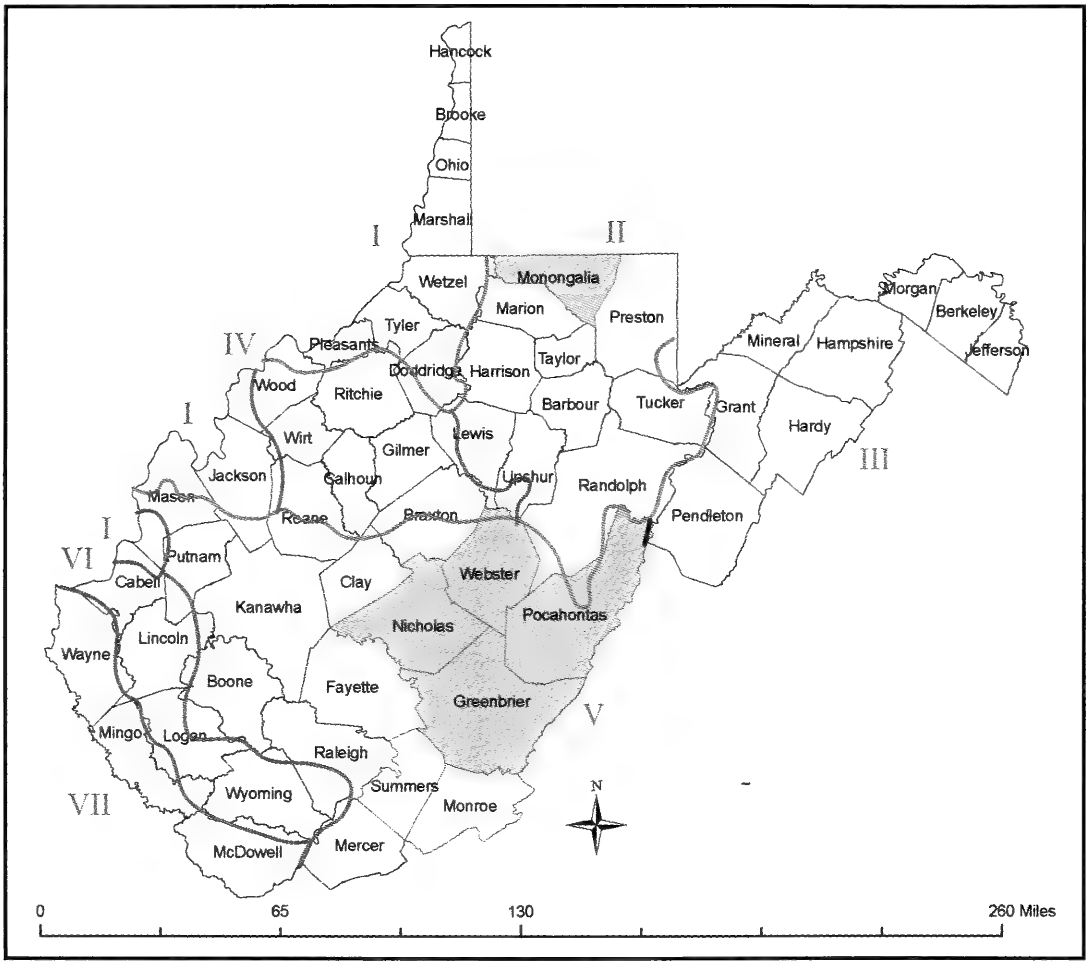

Fig. 2. County distribution records of *Baetisca berneri* in West Virginia.

Baetisca callosa Traver 1931

Traver (1931) described *B. callosa* from a tributary of the Potomac River in West Virginia. However, Pescador and Berner (1981) studied the paratype nymphs from Preston and Mineral counties from West Virginia and concluded that the enigmatic species is not recognizable. From the examination of immature nymphs of the species of *Baetisca*, they reported that *B. callosa* Traver represents a very young stage of some species already described – perhaps *B. carolina* Traver or *B. berneri* Tarter and Kirchner. One author (Tarter) has collected and identified young and mature nymphs of *Baetisca* spp. for 30 years in West Virginia and has identified *B. callosa* from 10 counties. He disagrees with suggestions that *B. callosa* is a young stage of *B. carolina* Traver or *B. berneri* Tarter and Kirchner. Efforts are being made to collect and rear specimens from the type locality and other counties in drainage basin III to resolve the taxonomic problem associated with this enigmatic species.

Baetisca carolina Traver 1931

Pettry and Tarter (1985) reported the ecological life history of this species from Panther Creek, Nicholas County, West Virginia (drainage basin V). Needham et al. (1935) recorded this species from Monongalia County in West Virginia (drainage basin II). The following counties (3) are added to the distribution of this species (Fig. 2): Drainage Basin V (Greenbrier Co.: North Fk. of Cherry River, 25-VII-75; Pocahontas Co.: Tea Cr. of Williams River, 02-VIII-73; Webster Co.: Cranberry River, 05-VIII-77).

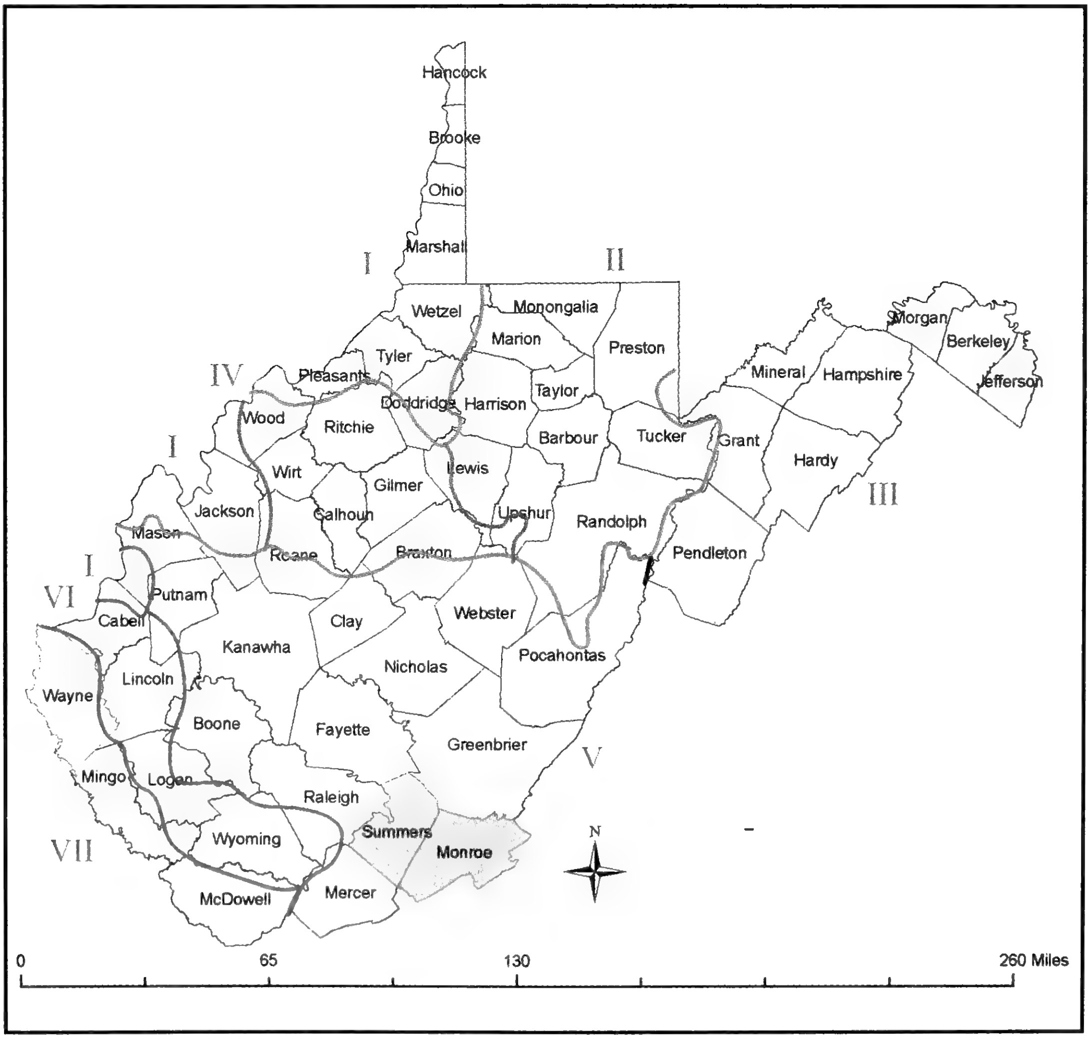

Fig. 3. County distribution records of *Baetisca carolina* in West Virginia.

Baetisca gibbera Berner 1955

Nymphs of *B. gibbera* have been recorded from the cool mountain streams of the Appalachian Mountains and the warm waters of the Coastal Plain (Pescador and Berner, 1981). Burgess and Tarter (1989) recorded this from Indian Creek in Monroe County, West Virginia (drainage basin V). The following county is added to the distribution of this species (Fig. 4): Drainage basin V (Summers Co.: Indian Cr., 28-III-83).

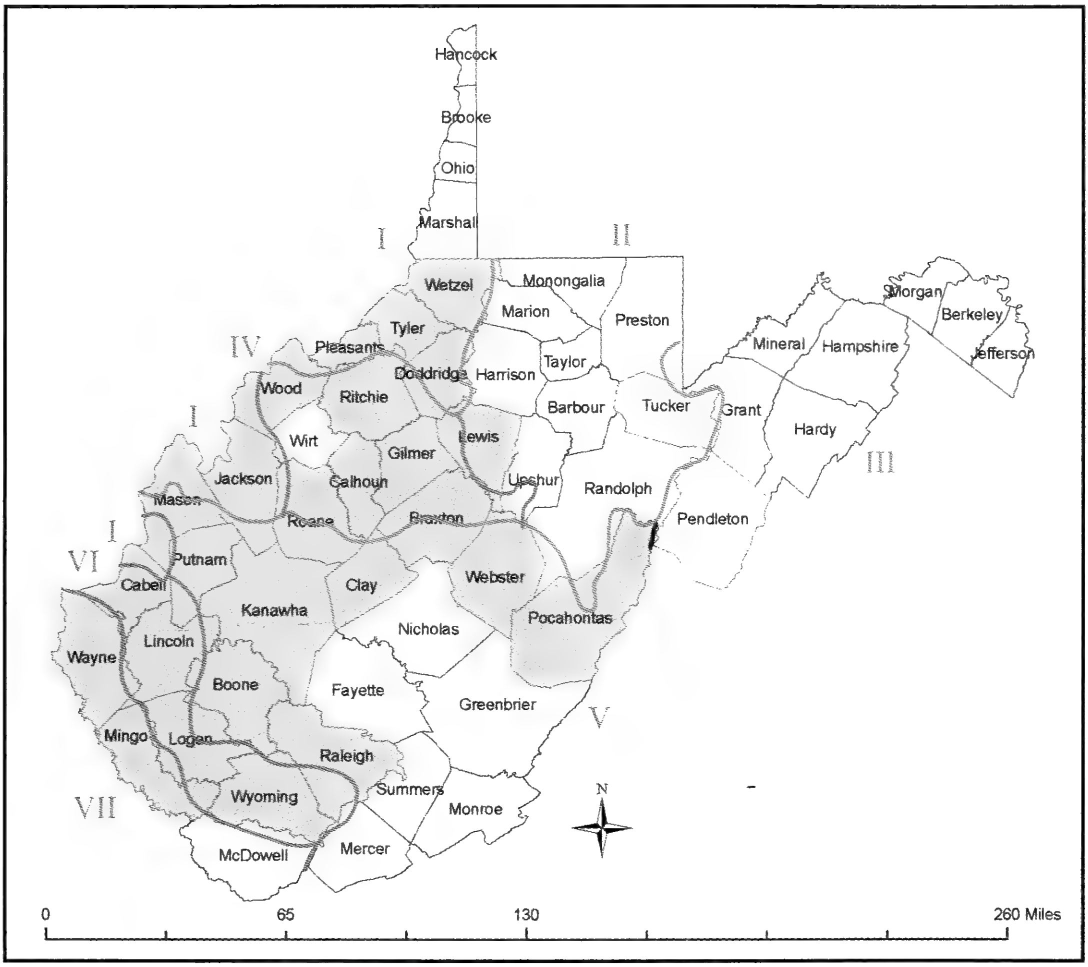

Fig. 4. County distribution records of *Baetisca gibbera* in West Virginia.

Baetisca lacustris McDunnough 1932

Baetisca lacustris (= *B. bajkovi* Neave) has been collected from the Great Lakes region and across the United States and Canada to the eastern slope of the Rocky Mountains (Burks, 1953; Pescador and Berner, 1981). This species has been reported from following counties in West Virginia (drainage basins I, II, VI, VII): Lewis, Lincoln, Pleasants, Wayne (Olson, 1971; Faulkner and Tarter, 1977). Chaffee and Tarter (1979) reported the life history and ecology of this species from Beech Fork in Wayne County. The following counties (22) are added to the distribution of this species (Fig. 5): Drainage basins I , IV, V, VI, VII (Boone Co.: Big Horse Cr., 25-XI-75/Spruce Laurel Fk., 25-IX-97 and Laurel Cr., 07-X-97; Braxton Co.: Coon Cr., no date/Falls Run, 25-IX-80 and Knawl Cr., 17-XI-77; Cabell Co.: Mill Cr., of Mud River, 12-IX-71 and Charley Cr., 16-IX-03; Calhoun Co.: no locality data: Clay Co.: Elk River, 22-VI-73; Doddridge Co.: Toms Fk., 16-IX-03 and Meathouse Fk., 16-IX-03; Gilmer Co.: Steer Run, 25-IV-74; Jackson Co.: Right Fk. of Sandy Cr., 15-IV-99; Kanawha Co.: Kanawha River, 13-IV-82 and Davis Cr., 06-V-02; Logan Co.: Hoover Fk. 04-V-98 and Seng Camp Cr., 07-VIII-02; Mason Co.: Jerry's Run, 17-IV-74; Mingo Co.: East Fk. of Twelvepole Cr., 28-IV-03/Tug Fk. River, 24-IX-03/Guyandotte River, 21-IV-82 and West Fr. of Twelvepole Cr., 03-V-00; Pocahontas Co.: Douthat Cr., 19-V-72/Mullenax Run, 20-VII-99/Little River of West Fk. of Greenbrier River, 29-VII-99 and East Fk. of Greenbrier River, 20-VII-00; Putnam Co.: Coon Cr., 19-III-73 and Clymer Cr., 24-II-73; Raleigh Co.: Marsh Fr. of Big Coal River, 13-XI-86; Ritchie Co.: South Fk. of Hughes River, no date and Indian Cr., 13-V-99; Roane Co.: Green Cr., 28-V-97 and Big Sandy Cr., 10-IX-02; Tyler Co.: Middle Island Cr., 15-X-99 and Indian Cr., 09-IX-03; Webster Co: Left Fk. of Holly River, 09-VII-78; Wetzel Co.: South Fk. of Fishing Cr., 26-IV-99; Wood Co.: Worthington Cr., no date and Walker Cr., no date; Wyoming Co.: Guyandotte River, 21-IV-82 and Measle Fk., 05-IX-00.

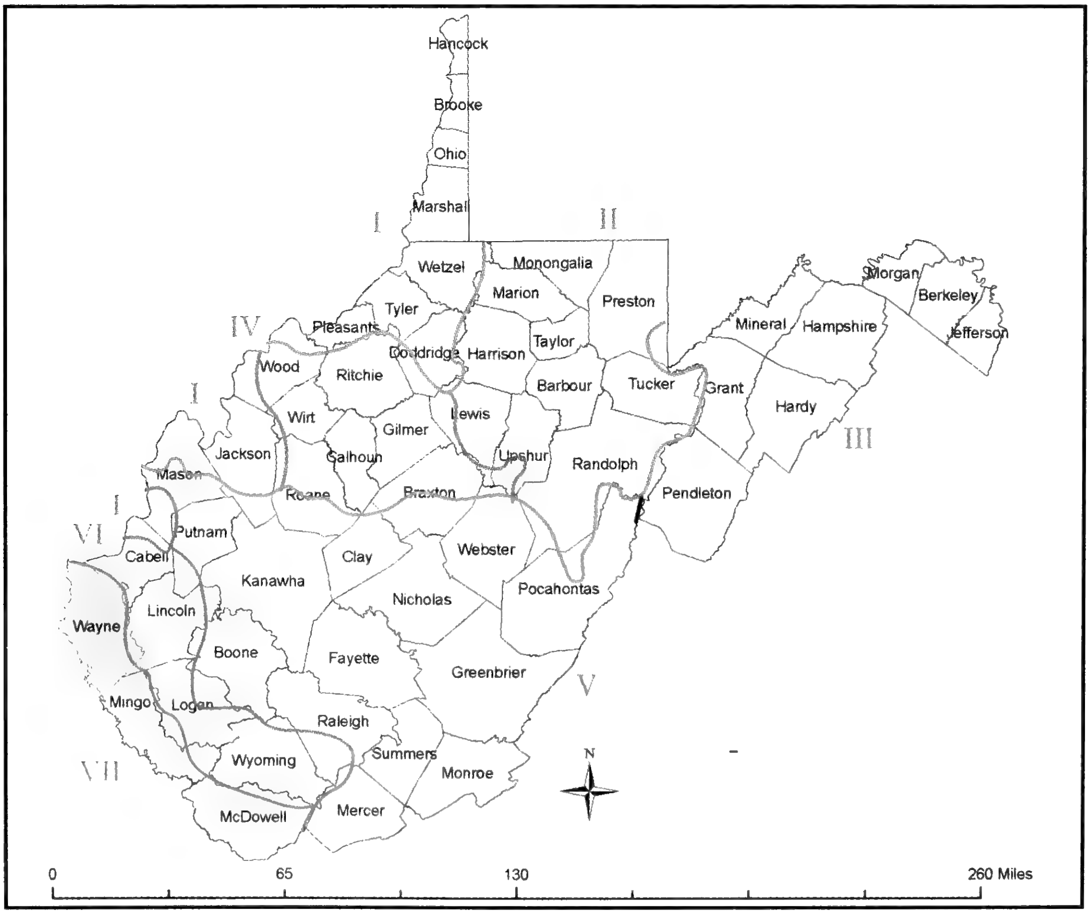

Fig. 5. County distribution records of *Baetisca lacustris* in West Virginia.

Baetisca laurentina McDunnough 1932

Baetisca laurentina is widely distributed in many areas of eastern North America, the Great Plains, through Canada into the Northwest Territories (Pescador and Berner, 1981; Randolph and McCafferty, 1998). On 13 May 1990, one male imago of *B. laurentina* was collected near Twelvepole Creek (Rt. 75, Shoals) in Wayne County, West Virginia (drainage basin VII (by Kondratieff, Welch, and Kirchner) (Fig. 6). This record extends the range of this species eastward to the mid-Atlantic coastal region. Randolph and McCafferty recorded this species from nearby Ohio (Adams, Highland, and Lawrence counties).

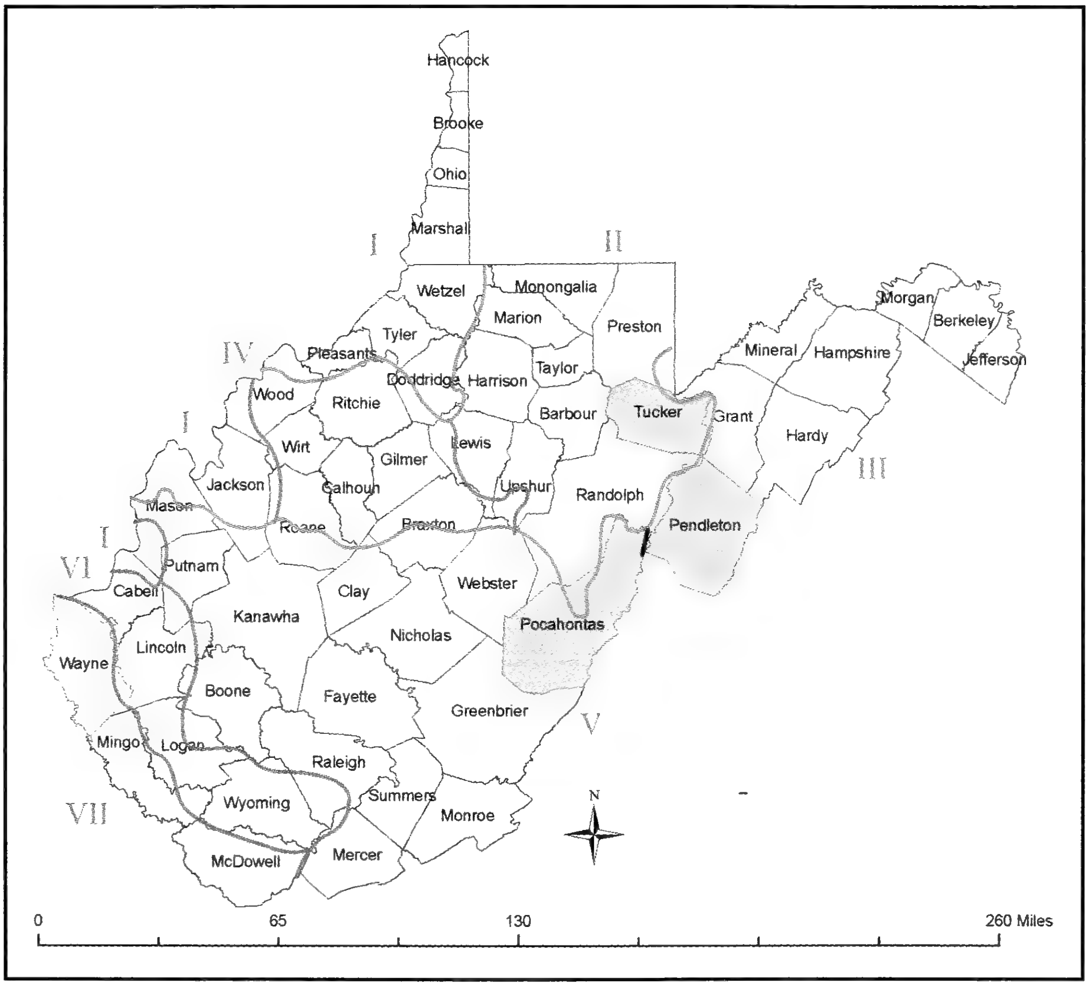

Fig. 6. County distribution records of *Baetisca laurentina* in West Virginia.

Baetisca rubescens Provancher 1876

Tarter and Pettry (1983) reported this species from Red Creek, Tucker County, West Virginia (drainage basin II). The following counties (2) are added to the distribution of this species (Fig. 7): Drainage basin III, V Pendleton Co.: Seneca Cr., 07-X-00; Pocahontas Co.: East Fk. of Greenbrier River, 26-IV-87.

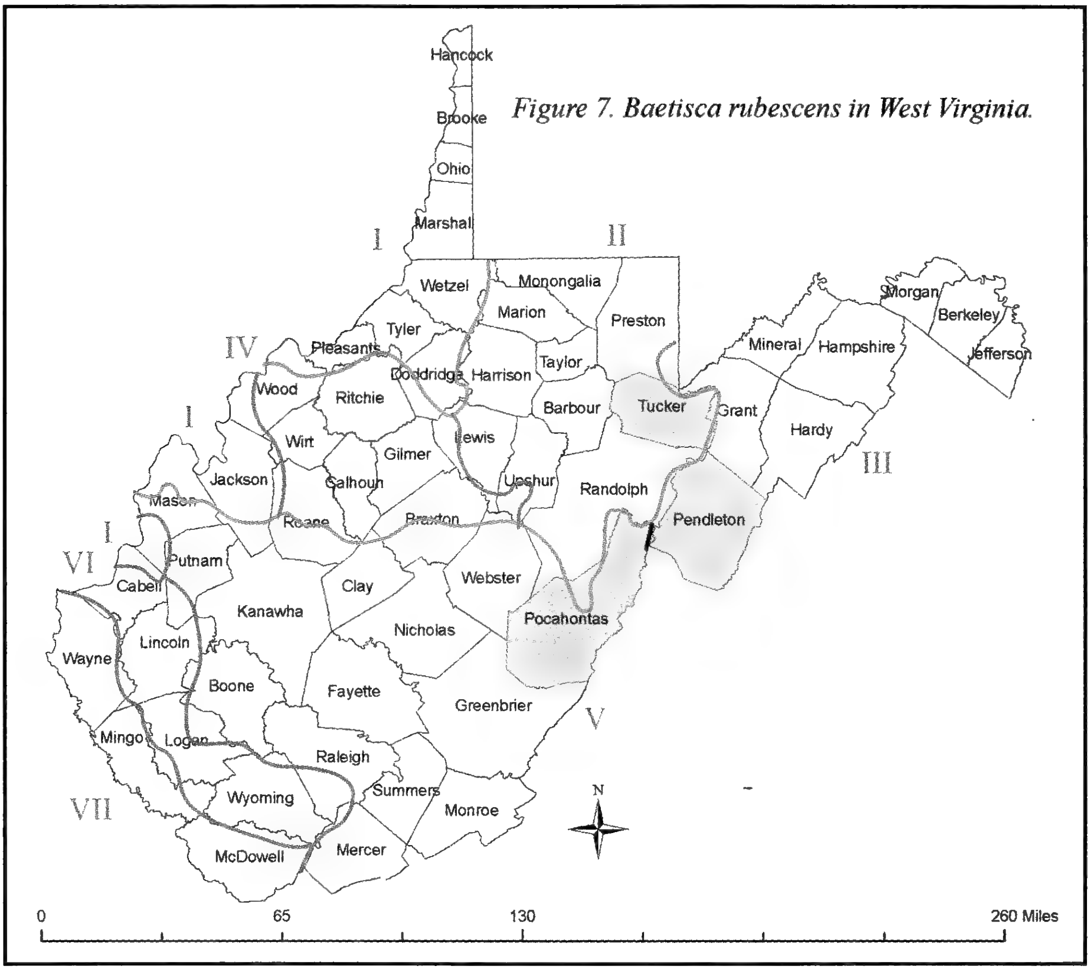

Fig. 7. County distribution records of *Baetisca rubescens* in West Virginia.

Kentucky

Two species of baetiscids, *B. berneri* and *B. lacustris*, have been reported from Kentucky (Pescador and Berner, 1981; Randolph and McCafferty, 1998). Based on collections from Ohio (Randolph and McCafferty, 1998) and western West Virginia, *B. laurentina* may also be found in Kentucky. Randolph and McCafferty (1998) reported B. obesa from southwestern Ohio, suggesting that it also may occur in Kentucky.

Baetisca berneri Tarter and Kirchner 1978

Prior to this investigation, *B. berneri* had been reported only from one drainage in Kentucky (Letcher County) (Randolph and McCafferty, 1998). On 19 October 1999, nymphs were collected from Brownies Creek in Harlan County.

Baetisca lacustris McDunnough 1932

Prior to this study, *B. lacustris* had been reported from 11 counties (Breathitt, Elliott, Floyd, Jackson, Knott, Lawrence, Lewis, Morgan, Pike, Pulaski, Wolfe) in Kentucky (Pescador and Berner, 1981; Randolph and McCafferty, 1998). The following records (14) are added to the distribution of this species (http://www/nws/noaa.gov/mirs/public/prods/maps/cnty_fips_kentucky.htm): Boyd Co.: East Fork of Little Sandy River, 14-XI-78; Carter Co.: no locality data; Clay Co.: Goose Cr., 17-X-78 and Redbird River, 03-III-00; Estill Co: Station Camp Cr., 18-IV-02, Johnson Co.: Little Paint Cr., 09-X-85/Paint Fk., 26-IX-77 and Open Fk. of Paint Creek, 21-XI-75; Lee Co.: Ross Cr., 04-X-00; Letcher Co.: Colliers Cr., no date; Magoffin Co.: Lick Cr., 12-X-00; Martin Co., Horse-Pin Cr., 18-V-04; Menifee Co.: Gladie Cr., 23-X-00; Owsley Co., Wild Dog Cr., 04-X-00; Powell Co.: Fishtrap Br., 05-III-01; Rowan Co.: Elk Lick Fk., 16-II-06; Whitley Co.: Mud Cr., 12-X-04.

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A NEW SPECIES OF *LIRIS* FABRICIUS FROM CHINA, WITH A KEY TO THE CHINESE SPECIES (HYMENOPTERA: CRABRONIDAE)[1]

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ABSTRACT: *Liris ferrugineimarginalis* new species from Guangdong and Fujian, China, is described and illustrated. A key to the Chinese species of the genus is provided.

KEY WORDS: Hymenoptera, Crabronidae, *Liris*, new species, China

Liris Fabricius is a large cosmopolitan genus, most species of which inhabit the tropics. Pulawski listed 308 species and 32 subspecies of the genus *Liris* in the electronic Catalog of Sphecidae in October 2006. Six species and three subspecies occur in the Palaearctic, 94 species and 6 subspecies in the Oriental, 1 species and 2 subspecies in the Nearctic, 38 species in the Neotropical, 47 species and 4 subspecies in the Australian, 71 species and 14 subspecies in the Ethiopian, 5 species and 3 subspecies in the Palaearctic and Oriental, 8 species in the Palaearctic and Ethiopian, 6 species in the Oriental and Australian, 24 species in the Nearctic and Neotropical, 1 species in the Oriental and Nearctic, 2 species in the Palaearctic, Oriental and Australian, 2 species in the Palaearctic, Oriental and Ethiopian, 1 species in the Palaearctic, Ethiopian and Australian, 2 species in the Palaearctic, Oriental, Australian and Nearctic regions (Bohart and Menke, 1976; Tsuneki, 1976, 1982, 1983a, 1983b; Krombein and Shanks Gingras, 1984; Amarante, 2002). Sixteen species and five subspecies have been recorded from China (Smith, 1856; Bingham, 1897; Cameron, 1903; Dover, 1926; Richards, 1928; Gussakovskij, 1938; de Beaumont, 1961; Bohart and Menke, 1976; Tsuneki, 1966, 1967, 1971, 1972, 1983b; Pu, 1986; Wu and Zhou, 1996; Porter et al., 1999). During our study of the Chinese material of *Liris*, a new species from Guangdong and Fujian was discovered. A key to the Chinese species of *Liris* is provided and the new species is described and illustrated. For the terminology we mainly follow Bohart and Menke (1976).

The diagnosis for *Liris* Fabricius is as follows: lateral ocellus reduced, flat and small; frons just below median ocellus with a transverse swelling extending from eye to eye and interrupted by median frontal line, and a linear swelling along inner orbit which joins transverse swelling to form an M shape; mandible simple, most species with a conspicuous notch on outer margin, mostly with one or two teeth on inner margin; pronotal collar, scutum, scutellum and metanotum

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punctuate, punctures longer than one to less than one diameter apart; forewing with three submarginal cells; pronotum is angular in dorsal view, and gaster without petiole. *Liris* Fabricius can be distinguished from *Larra* Fabricius by the following combination of the following characters: in female, last tarsomere angled in lateral view and sides parallel on apical half, pygidial plate mostly with setae and in most species with apically a transverse row of stout apical spinules; in male, propodeal side impunctate and dull or if shiny, then at most with sparse pinprick punctures, fore and hind femur excavate ventrally in some species. Body length 5.0 – 30.0 mm.

METHODS

The material examined during this study is deposited in the following institutions: Zhejiang University, Hangzhou, Zhejiang; Institute of Zoology, Academia Sinica, Beijing, China; China Agricultural University, Beijing; Nanjing Agricultural University, Nanjing, Jiangsu; Shandong Agricultural University, Taian, Shandong; Northwest Science-Technology University of Agriculture and Forestry, Yangling, Shanxi; South China Agricultural University, Guangzhou, Guangdong; Hebei University, Baoding, Hebei; Yunnan Agricultural University, Kunming, Yunnan.

The specimens were observed and figured with the aid of an Olympus stereomicroscope (SZ Series, Japan) with an ocular micrometer. The ratios used in the species descriptions were calculated at the same magnification.

SYSTEMATICS

Key to females of *Liris* from China

1. Mandible without notch on outer margin, pubescence on head and thorax golden, scape and pedicel, legs except basal portions ferruginous, wings purplish dark brown, body length 15.0–22.0 mm. Borneo, Caroline Islands, China (Guangdong, Hainan, Yunnan, Hong Kong, and Taiwan), Guam, Hawaiian Islands, India, Indonesia, Java, Malaysia, Mariana, Marshall, New Guinea, Philippines, Ryukyu and Okinawa Islands, Sri Lanka, Thailand.. *L. aurulentus* (Fabricius), 1787
\- Mandible with well-defined notch on outer margin 2

2. Pygidial plate asetose or nearly so 3
\- Pygidial plate setose 5

3. Pygidial plate dull, alutaceous, tarsal claws with tooth near base, mandible without teeth on inner margin, body length 12.0–13.0 mm. China (Guangdong, Yunnan, and Taiwan)................*L. larroides taiwanus* (Tsuneki), 1967
\- Pygidial plate polished, tarsal claws without tooth, mandible with two teeth on inner margin 4

4. Pygidial plate apically with short, stiff setae; pronotum not thick; anterior margin of clypeus somewhat rounded, mandible mostly black; body length 9.0–13.0 mm. Botel Tobago Islands, Burma, China (Beijing, Hebei, and

Henan), India, Malaysia, Mongolia, North Africa south to Sudan and Erithrea, Southern Europe, Southwestern and Central Asia .... *L. niger* (Fabricius), 1775

\- Pygidial plate asetose, pronotum comparatively thick, clypeus broadly rounded anteriorly, mandible mostly red, body length 10.0–12.0 mm. China (Yunnan and Taiwan), India, Philippines, Thailand.. *L. fuscinervus* (Cameron), 1905

5\. With a transverse sulcus adjacent to the free margin of the lateral clypeal lobe, a coarsely rugose propodeal dorsum, and the presence of a subbasal tooth on the female claw; body length 12.5 mm. China (no specific locality), Sri Lanka .... *L. vigilans* (F. Smith, 1856); ♂ unknown

\- Without a transverse sulcus adjacent to the free margin of the lateral clypeal lobe, or without a subbasal tooth on the female claw 6

6\. Mesopleuron sparsely punctuate, punctures distinctly more than one diameter apart, interspaces polished, body length 8.0–10.0 mm. Africa, China (Jiangsu), Southwestern Europe, Southwestern and Central Asia .... *L. nigricans* (Walker), 1871

\- Mesopleuron punctuate or rugose, punctures no more than one diameter apart, interspaces dull 7

7\. Gaster pruinose, middle sterna with long, black, stiff setae, body length 7.0 mm. China (Hong Kong), India .... *L. anthracinus* Kohl, 1892; ♂ unknown

\- Gaster not pruinose or at most apical portions of segments with bands of pile, middle sterna without long black stiff setae in most specimens 8

8\. Side of propodeum coarsely reticulate, body length 8.0–11.0 mm. Burma, China (Guangxi), India, Indonesia, Java, Okinawa .... *L. tristis* (F. Smith), 1856; ♂ unknown

\- Side of propodeum punctuate or obliquely rugose, not reticulate 9

9\. Pronotum, at least in middle, raised high, nearly reaching level of scutum 10

\- Pronotum depressed much below level of scutum 12

10\. Gaster with four silvery bands of pile, head and thorax densely with silvery or whitish pubescence, body length 7.0–8.5 mm. China (Taiwan), Philippines, Ryukyu Islands, Thailand .... *L. albopilosus* Tsuneki, 1967

\- Gaster with three silvery bands of pile, pubescence on head and thorax sparse 11

11\. Lateral carina of propodeum strong and complete, rugae on side of propodeum mainly longitudinal, punctures on mesopleuron minuter and sparser, body length 6.0–12.0 mm. China (Yunnan, Guangdong, Zhejiang, and Taiwan), Japan, Korea, Ryukyu Islands, Thailand.. *L. festinans japonicus* (Kohl), 1884

\- Lateral carina of propodeum not strong or complete as above, rugae on side of propodeum oblique, punctures on mesopleuron coarser and sparser, body length 6.5–8.5 mm. China (Taiwan), Fiji, Guam, Mariana and Caroline Islands, Micronesia, New Caledonia, Philippines, Samoa ....*L. festinans manilae* (Ashmead), 1904

12. Head and thorax closely with golden or brassy pubescence, punctures on clypeal anteriorly extending to margin and fairly dense, wings markedly yellowish 13
- Head and thorax with appressed silvery pile 14

13. Large species, body length 16.0–21.0 mm, setae erect on vertex and thorax, mesopleuron rugose, setae on pygidial plate dark brown, interocular distance at vertex slightly shorter than flagellomere I, clypeus broadly rounded anteriorly, its free margin slightly emarginate mesally. China (Sichuan, Fujian, Yunnan, Jiangsu and Taiwan); Ryukyu Islands.. ....*L. deplanatus binghami* Tsuneki, 1967
- Medium-sized species, body length 11.0–16.0 mm, setae on head and thorax appressed, mesopleuron punctuate, setae on pygidial plate golden, interocular distance on vertex longer than flagellomere I, free margin of clypeus not emarginate. Burma, China (Yunnan and Taiwan), Malaysia, Mariana Islands, Micronesia, Philippines, Solomon Islands, Thailand.................................... ....*L. laboriosus* (F. Smith), 1856

14. Tibiae, tarsi, hind femur, and mandible mostly red, body length about 12.0 mm. China (Yunnan and Taiwan), Philippines, Thailand ....*L. larriformis* (F. Williams), 1928
- At least tibiae and tarsi black 15

15. Interocular distance on vertex less than flagellomere I, lateral carina of propodeum complete 16
- Interocular distance on vertex equal to flagellomere I, lateral carina of propodeum in most specimens lacking, at most ill defined 19

16. Apical margins of each gastral segment narrowly ferruginous, rhinaria present on flagellomeres IV–IX, elongate, elliptic, anterior margin of clypeus mostly smooth, sparsely punctuate, wings brown, body length 13.0 mm. China (Guangdong and Fujian) ....*L. ferrugineimarginalis* sp. nov.
- Apical margins of gastral segments black, rhinaria present on flagellomeres V–IX 17

17. Large, deep-black species, body length 17.0–20.0 mm, wings strongly infumate, with purplish shimmer, three bands of sparse brownish pile on gaster narrow, ill defined, setae of pygidial plate dark brown. China (Zhejiang, Jiangxi, Sichuan, and Taiwan), Ryukyu Islands... *L. surusumi* Tsuneki, 1966
- Medium-sized species, less black due to more marked pile, wings not so strongly infumate, three bands on gaster fairly well-defined as seen from certain angles 18

18. Body and wings much darker, with three bands of pile on gaster and setae of pygidial plate dark brown, body length 12.0-16.0 mm. China (Taiwan), Ryukyu Islands.....................................*L. rohweri formosanus* Tsueki, 1973

- Body and wings less dark, with four bands of pile on gaster and setae of pygidial plate golden, body length 11.0–15.0 mm. China (Yunnan and Taiwan), Philippines, Ryukyu Islands .... *L. rohweri rohweri* (F. Williams), 1928

19. Median lobe of clypeus broad, apical bevel of clypeus impunctate and polished, body length 12.0–15.0 mm. Bismarck Archipelago, Borneo, China (Taiwan), Malaysia, Okinawa, Philippines, Ryukyu Islands, Thailand .... *L. difficilis* Tsuneki, 1983b

- Median lobe of clypeus comparatively narrow, apical bevel with transverse series of punctures below, or sparsely punctured, dull, body length 12.0–16.0 mm. Bismarck Archipelago, Botel Tobago Islands, China (Jiangsu, Zhejiang, Fujian, Guangdong, Hainan, Yunnan, Taiwan, and Hong Kong), Central to South Asia, Fiji, Hawaiian Islands, Japan, Marshall Islands, Mediterranean basin, Micronesia, Solomon Islands .... *L. subtessellatus* (F. Smith), 1856

Key to males of *Liris* from China

1. Mandible without notch on outer margin, scape, pedicel, and legs except basal portions ferruginous, clypeus not excavate and anterior margin of clypeus not truncate, body length 10.0–22.0 mm. Distributions as the female .... *L. aurulentus* (Fabricius), 1787

- Mandible with well-defined notch on outer margin; scape, pedicel, or legs not ferruginous; clypeus different 2

2. Mandible without teeth on inner margin, at most very weakly incised toward middle, rhinaria on flagellomere III only, in an elliptic flattened impression, length about 9.0 mm .... *L. larroides taiwanus* (Tsuneki), 1967

- Mandible with one or two teeth on inner margin 3

3. Anterior margin of clypeus obtusely angulate, distinctly prominent in middle, length relation among abscissae of radial vein of forewing: $2 < 5 < 3 < 4 < 1$, body length 7.0–9.0 mm .... *L. niger* (Fabricius), 1775

- Anterior margin of clypeus not obtusely angulate, length relation among abscissae of radial vein of forewing usually $4 > 1 > 3 > 5 > 2$ 4

4. Mesopleuron sparsely punctuate, punctures distinctly more than one diameter apart, interspaces polished, hind femur simple, body length 5.0–8.0 mm. .... *L. nigricans* (Walker), 1871

- Mesopleuron punctuate or rugose, punctures equal to or less than one diameter apart, interspaces not polished, hind femur excavate ventrally in some specimens 5

5. Pubescence on frons and clypeus golden, at least with brassy luster 6

- Pubescence on frons and clypeus silvery 9

6. Apical margin of each gastral segment ferruginous, interocular distance on vertex less than combined length of pedicel and flagellomere I, rhinaria on flagellomeres II-XI, on II–X extending over full length of each segment, on XI about 0.75 length, body length 11.0 mm .... *L. ferrugineimarginalis* sp. nov.

- Apical margin of gastral segments black 7

7. Four broad silvery bands of pile on gaster, wings yellowish, apically fuscous punctures on vertex, scutum and mesopleuron minute, body length 10.0–12.0 mm. .... *L. laboriosus* (F. Smith), 1856

- Three bands of pile on gaster, wings markedly darkened, punctures on vertex and scutum comparatively coarse, at least subalar epimeral area of mesopleuron with reticulate rugae 8

8. Pile on frons and clypeus deep golden, clypeus nearly truncate apically, rhinaria with surface smooth, body length 9.0–13.0 mm...................................... .... *L. deplanatus binghami* Tsuneki, 1967

- Pile on frons and clypeus pale yellow, clypeus roundly produced anteriorly, body length 11.5 mm.. *L. surusumi* Tsuneki, 1966

9. Pronotum thick, not transversely carinate on top, mesally raised nearly to level of scutum, body length 7.0–9.0 mm ....*L. fuscinervus* (Cameron), 1905

- Pronotum compressed in front, flattened anteriorly, with top transversely ridged, below level of scutum.. 10

10. Tibiae, tarsi, and hind femur wholly and mandible mostly red, clypeus anteriorly polished, nearly truncate apically, without median incision, body length 7.0–8.0 mm. .... *L. larriformis* (F. Williams), 1928

- Tibiae, tarsi, hind femur and mandible black or at most brown 11

11. Pronotum in middle raised nearly to level of scutum, punctures on scutum comparatively coarse, with well-defined interspaces, radial cell of forewing with apex more or less obliquely truncate 12

- Pronotum depressed much below level of scutum, punctures on scutum minute and dense, radial cell of forewings truncate apically 14

12. Clypeus on anterior margin with median tooth, silvery pubescence on frons, clypeus, gena and thorax thick, dense and long, body length 5.0–7.0 mm..... .... *L. albopilosus* Tsuneki, 1967

- Clypeus on anterior margin without median tooth, silvery pubescence on frons, clypeus, gena and thorax not thick, dense or long 13

13. Interocular distance on vertex slightly less than combined length of pedicel and flagellomere I, clypeus gently rounded and slightly produced in middle, body length 5.0–6.5 mm.................. *L. festinans manilae* (Ashmead), 1904

- Interocular distance on vertex distinctly less than combined length of pedicel and flagellomere I, clypeus roundly produced anteriorly, not produced medially, body length 5.0–10.0 mm................*L. festinans japonicus* (Kohl), 1884

14. Interocular distance on vertex distinctly less than combined length of pedicel and flagellomere I, pubescence on fore femur ventrally long and erect, wings fairly markedly darkened, lateral carina of propodeum complete...............15

- Interocular distance on vertex longer than or as long as combined length of pedicel and flagellomere I, pubescence on fore femur ventrally short and flattened, wings slightly darkened or yellowish, apically darker, lateral carina of propodeum incomplete or lacking 17

15. Body and wings very dark, with only three bands of pile on the gaster, clypeus slightly rounded, body length 8.0 –10.0 mm.. ....*L. rohweri formosanus* Tsuneki, 1973
- Body and wings less dark, with four bands of pile on the gaster 16

16. Clypeus not emarginate medially, without sharp lateral angles, body length 6.7 mm. China (Taiwan) ....*L. menkei* Tsuneki, 1972; ♀ unknown
- Clypeus distinctly emarginate medially, with sharp lateral angles, body length 8.0–13.0 mm..........................*L. rohweri rohweri* (F. Williams), 1928

17. Interocular distance on vertex distinctly longer than combined length of pedicel and flagellomere I, as long as combined length of flagellomeres I and II, body length 5.5 mm China (Taiwan) ....*L. hanedai* Tsuneki, 1971
- Interocular distance on vertex as long as combined length of pedicel and flagellomere I, distinctly less than combined length of flagellomeres I and II... 18

18. Pubescence of femur fairly long ventrally, wings markedly fuscous, stigma and veins black, body length 14.0 mm. China (Taiwan ....*L. fuscatus* Tsuneki, 1971; ♀ unknown
- Pubescence of femur short ventrally, wings hyaline, apical margin darkened, stigma and veins brown 19

19. Fore femur slightly excavate ventrally, median lobe of clypeus broad, paramere of the male genitalia slender, body length 7.0–12.0 mm. ....*L. difficilis* Tsuneki, 1983
- Fore femur strongly excavate ventrally, median lobe of clypeus narrow, paramere of the male genitalia stout, body length 7.0–12.0 mm. ....*L. subtessellatus* (F. Smith), 1856

Liris ferruginimarginalis, NEW SPECIES

Figures 1-8

Diagnosis. This new species can be distinguished from the related *L. silvicola* (F. Williams), 1928 and all other species of the genus by the following combination of characters: apical margin of each gastral segment ferruginous; anterior part of clypeus broadly smooth, sparsely punctate, with median incision in female, emarginate apically in male; wings hyaline and partly brown, male genitalia unique.

Description. Female. Body length 13.0 mm. Black except the following: tibial and tarsal spines, apical margin of each gastral segment ferruginous; mandible apically dark ferruginous; palpi, tegula, stigma and veins of wings dark brown; wings hyaline and partly brown. Head, thorax, and gastral segments I-IV with silvery pubescence, pygidial plate (Fig. 3) with setae stiff, long and recumbent, and with a few erect longer setae, apical margin with 6 long spinules.

Frons and vertex sparsely punctate, punctures on upper portion about one diameter apart, those on lower portion more than one diameter apart. Interocular distance on vertex less than length of flagellomere I. Flagellomere I as long as II and 3.2 times as long as apical breadth. Rhinaria on flagellomeres IV-IX, elongate, elliptic, on IV very small, on V about 0.1 length of the segment, on VI about 0.2 length of the segment, on VII-IX about 0.25 length of each segment. Clypeus (Fig. 1): anterior part broadly smooth, sparsely punctuate, with median incision. Mandible with two teeth on inner margin.

Thorax closely punctuate, punctures distinctly less than one diameter apart, but those on scutum larger, those on metanotum sparser, about one diameter apart, metapleuron with oblique rugae, interspaces between rugae polished; propodeal dorsum reticulate, without median carina, with lateral carina; side of propodeum alutaceous, sparsely obliquely, finely rugose; posterior side of propodeum alutaceous, basally with median furrow, sides of furrow sparsely, transversely rugose. Length relation among abscissae of radial vein of forewings: $5 < 2 < 3 < 1 < 4$.

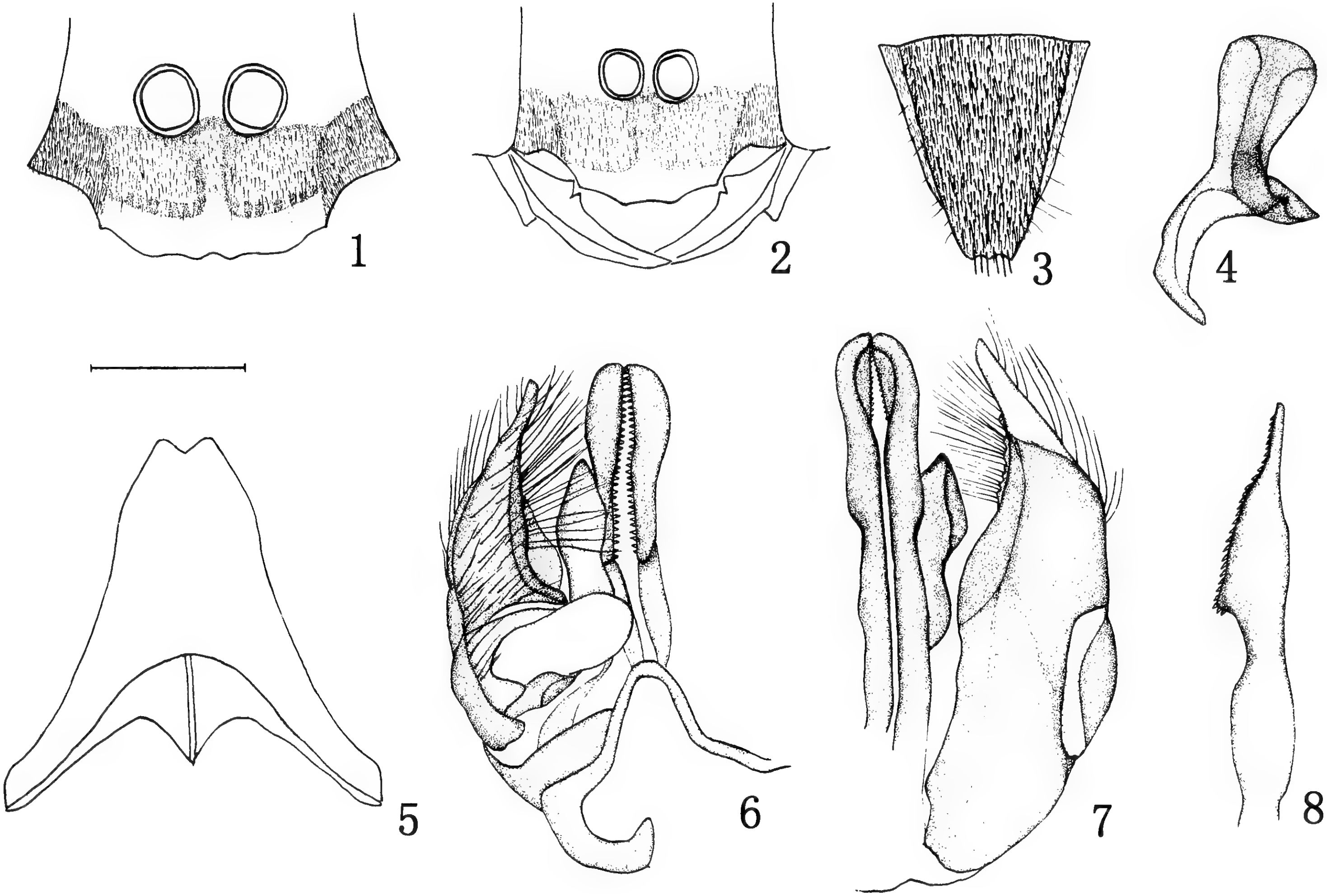
Pygidial plate (Fig. 3); length of tergum I: width at posterior margin = 69: 127.

Male. Body length 12.0 mm. Similar to female. But pubescence on frons and clypeus golden, wings pale brown, the ferruginous apical margin of each segment wider than in female. Interocular distance on vertex longer than the length of flagellomere I, shorter than combined length of pedicel and flagellomere I. Flagellomere I subequal to II and about 2 times as long as apical breadth. Rhinaria on flagellomeres II–XI, on II–X extending over full length of each segment, on XI extending 0.75 length of the segment. Median lobe of clypeus (Fig. 2) narrower than in female, anterior margin medially emarginate. Fore femur distinctly excavate ventrally, hind femur slightly excavate ventrally. Propodeal dorsum reticulate, with short median carina; lateral side of propodeum alutaceous, thin and oblique rugae closer than in female. Gaster without pygidial plate, length of tergum I: width at posterior margin = 59: 82. Length relation among abscissae of radial vein of forewings: $5 < 2 < 3 < 1 < 4$. Sternum VIII (Fig. 5), lateral view of volsella (Fig. 4), inside view of right paramere (Fig. 6), dorsal view of right paramere (Fig. 7), lateral view of penis valve (Fig. 8).

Material Examined. Holotype: ♀, China, Guangdong, Huizhou, Xiangtou Mountain, 18. May 2002, Zaifu Xu; deposited in the Insect Collections of Zhejiang University, Hangzhou, Zhejiang. Paratypes: 1♂, China, Guangdong, Huizhou, Xiangtou mountain, 18 May 2002, Zaifu Xu; 1♂, China, Guangdong, Xinyi, Dawuling, 5 May 2002, Zaifu Xu; 1♀, China, Hainan, Limu Mountain, 14 July 2002, Zaifu Xu; all paratypes deposited in the Insect Collections of Zhejiang University, Hangzhou, Zhejiang.

Distribution: China: Guangdong and Fujian.

Etymology. The name *ferrugineimarginalisis* derived from the Latin words: ferrugineus (= ferruginous) and marginalis (= marginal), with reference to the ferruginous apical margin of each gastral segment in both sexes.



Figures. 1–8. *Liris ferruginimarginalis,* new species. Female. 1, 3. Male 2, 4–8. 1, 2. Frontal view of clypeus. 3. Dorsal view of pygidial plate. 4. Lateral view of volsella. 5. Sternum VIII. 6. Inside view of right paramere. 7. Dorsal view of right paramere. 8. Lateral view of penis valve. Scale bars for Figures 1–3 = 1.0 mm; for Figures 4–8 = 0.49 mm.

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SCIENTIFIC NOTE

SEVEN NEW RECORDS FOR THE TURKISH ARANEOFAUNA (ARACHNIDA: ARANEAE), WITH ZOOGEOGRAPHICAL REMARKS[1]

Aydın Topçu,[2] Hakan Demir,[3] and Osman Seyyar[4]

Arachnological studies of Turkey began towards the end of the 19th century. The spider fauna of Turkey needs further study. To date, 613 species of spiders have been recorded from Turkey (Topçu et al., 2005). In this paper, we add seven species to the spider fauna of Turkey. For each taxon, the paper includes zoogeographical remarks and chorotype information.

The specimens were collected from different parts of Turkey using pitfall traps and manual collection. Examined specimens are deposited in the Arachnology Museum of Nigde University (NUAM). The specimens were preserved in 70% ethanol. The identification was made with a ZX61 Olympus stereomicroscope. The keys of Heimer and Nentwig (1991) and Roberts (1995) were used to identify all specimens. General distribution of all species follows Platnick (2007). The Range section indicates the actual known distribution for each taxon. The species distribution within Turkey is summarized in Remarks. The Chorotype, or zoogeographical characterization for the species, is given following Taglianti et. al. (1999). One chorotype designation is identified for each taxon.

NEW RECORDS

1. *Dictyna pusilla* Thorell, 1856 (Dictynidae). Two males collected in Nigde in Central Anatolia, Turkey. They were collected on oaks (*Quercus* sp., Fagaceae) shrubs on 18.II.2002. Description: Males 2-2.25 mm. Prosoma and sternum brown. Abdomen dark brown and has blackish bands on the upper surface. Legs dark brown, usually annulated distinctly at the ends of segments. This species often resembles *D. arundinacea* closely. The males can be separated by the form and proportions of bifid tibial apophysis.

Range and Chorotype. Palearctic.

Remarks. New to Turkey. This species may be distributed in Central Anatolia.

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2. *Cheiracanthium pennyi* O. P. Cambridge, 1873 (Miturgidae). One male was recorded from Nigde in June 2003. It was found under stone. Description: Male 6.5 mm. Prosoma oval, coppery light brown. Abdomen dark brown with black hairs. Legs long with the same colour of the carapace. This species often resembles *C. erraticum* very closely. The males can be separated by the cymbial spur of the male palp is long and blunt at terminal part.

Range and Chorotype. Palearctic.

Remarks. New to Turkey. This species may be distributed in Central Anatolia.

3. *Micaria formicaria* (Sundevall, 1831) (Gnaphosidae). Only mature female has been taken from Mersin (Sarıısık village) in early July 2002. Specimen has been collected luckily among debris. Description: Female 7.2 mm. Prosoma clearly red-brown. Abdomen dark brown with white dots. Sternum is same colour with abdomen. Epigyne with lengthwise oval spermathecae which reaches at least up to the transverse anterior margin.

Range and Chorotype. Palearctic.

Remarks. New to Turkey. The record of Turkey is indicated the most southern point of known range.

4. *Erigone atra* Blackwall, 1833 (Linyphiidae). Three females and five males were recorded from Meydan Plateau in Nigde. All specimens were collected in a stony grassland from under the same stone during October 2004. Description: Female 2.3-2.5 mm, Male 1.9-2.2 mm. Prosoma blackish-brown. In male, lateral sides of carapace light brown, with 12-14 teeth-like notches. In female, carapace darker than male. Abdomen oval and light brown. Sternum black with dark brown spots. Epigyne black, rather large and cutaneous. Tibialapophysis of male palp with a median rounded flat extension.

Range and Chorotype. Holoarctic.

Remarks. New to Turkey. This species may be distributed in Central Anatolia.

5. *Agroeca inopina* O. P. Cambridge, 1886 (Liocranidae). One female was recorded from Nigde (Maden village) in May 2002. It was collected from under stone. So far, no Agroeca species has been recorded from Turkey (Topçu et al., 2005). Description: Female 4.5 mm. Prosoma with bright central band. Both sides of carapace are blackish-brown. Anterior median eyes smaller than laterals, and equal in size to posterior medians. Abdomen reddish-brown, without recognizable dorsal pattern. Metatarsus I and II, ventrally with three pairs of spines. Epigyne strongly cutaneous, with long curved ducts in posterior half. This species resembles *A. proxima* in general appearance, but can be distinguished by sexual organs, very faint annulations of the legs and absence of a wedge-shaped ventral mark on abdomen.

Range. Europe, Algeria. **Chorotype.** European.

Remarks. New to Turkey. This species may be distributed in Central Anatolia.

6. *Liocranoeca striata* (Kulczyñski, 1882) (Liocranidae). One male was recorded from Adana (Pozanty district) in July 2002. Specimen has been collected under stone. So far, no *Liocranoeca* species has been recorded from Turkey (Topçu et al., 2005). Description: Male 4.1 mm. General habitus resembles *Agroeca*. Prosoma oval, brown with a greyish-black borderline. Colour of chelicerae as carapace. Both rows of eyes procurved. Anterior medians slightly smaller than laterals. Abdomen elliptic, dusky grey with a yellow lighter central band reaching nearly to spinners. Sternum almost circular and light yellow. Legs yellow brown, tibiae and metatarsi I and II sometimes sooty grey or faintly annulated. The male palpal organ has long tibial apophysis.

Range. Europe, Russia. **Chorotype.** Turano-European.

Remarks. New to Turkey. The record of Turkey is southernmost point of its known range.

7. *Scotina palliardii* (L. Koch, 1881) (Liocranidae). One female was recorded from Nigde (Çamardy district) in June 2003. So far, no *Scotina* species has been recorded from Turkey (Topçu et al., 2005). It was collected from under stone. Description: Female 3.2 mm. Prosoma reddish-brown with white hairs posteriorly, but the sides of carapace with black hairs. Abdomen blackish-brown. Legs light brown with black spots. The spermathecae are small.

Range. Europe, Russia. **Chorotype.** Turano-European.

Remarks. New to Turkey. This species may be distributed in Central Anatolia.

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SCIENTIFIC NOTE

NEW RECORD OF THE ALDERFLY *SIALIS MOHRI* (MEGALOPTERA: SIALIDAE) FROM TEXAS AND LOUISIANA, U.S.A.[1]

Jason L. Locklin[2]

Herein I report the occurrence of *Sialis mohri* Ross (Megaloptera: Sialidae) for the first time from Texas and Louisiana. On 15 April 2006, I collected six males and five females of *S. mohri* along the shoreline vegetation of a pond (approximately 5 hectares) just south of Joaquin in Shelby County, TX. I also collected two males of the same species from another pond (approximately 3 hectares) near Zwolle in Sabine Parish, LA on the same date.

Currently 24 species of *Sialis* Latreille are known from America north of Mexico (Ross 1937, Townsend 1939, Flint 1964, Whiting 1991a). Ross (1937) described the holotype of *Sialis mohri* from the Trout River in Boulder Junction, Wisconsin. Known state/province records for this widely distributed species are Arkansas, Connecticut, Illinois, Indiana, Kansas, Kentucky, Maine, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, New Brunswick, New Hampshire, New Jersey, New York, Ohio, Oklahoma, Ontario, Pennsylvania, Quebec, Rhode Island, Tennessee, Vermont, and Wisconsin (Ross 1937, Tarter et al., 1978, Stark and Lago 1980, Whiting 1991b). The two new state records reported here broaden the known southwestern distribution of *S. mohri.*

Before these new records from Texas and Louisiana, three species of *Sialis* had been reported from Texas (*S. velata* Ross, *S. itasca* Ross, *S. americana* Rambur) (Ross 1937, Tarter et al., 1978) and only one (*S. americana* Rambur) from Louisiana (Tarter et al., 1978). The specimens are deposited in the personal collection of the author (11) and in the Texas A&M University Insect Collection (2).

Collection Data: LOUISIANA, Sabine Parish near Zwolle (31°66'99N, 93°58'34W), 15 April 2006, J. L. Locklin, at large; 2 males. TEXAS, Shelby County near Joaquin (31°96'18N, 94°06'67W), 15 April 2006, J. L. Locklin, at large; 6 males, 5 females.

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Entomological News is a fully refereed scientific international journal published by The American Entomological Society (AES). Manuscripts on systematics, ecology, evolution, morphology, physiology, behavior, biodiversity, conservation, paleobiology, and other aspects of insect and terrestrial arthropod life as well as nomenclature, biographies and history of entomology, among others, are appropriate topics for papers submitted to *Entomological News*. Papers on applied, economic, and regulatory entomology or on toxicology and related subjects will be considered only if they also make a major contribution in one of the aforementioned fields. In accordance with the spirit and letter of international codes of biological nomenclature, the Editor of *Entomological News* recommends that name-bearing types and representative (voucher) specimens be deposited in collections where such specimens are well curated and available to qualified researchers.

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A NEW NAME FOR A WHITEFLY, REDESCRIPTION AND INTRASPECIFIC VARIATION IN *ALEUROLOBUS EXCEPTIONALIS* REGU AND DAVID, A NEW RECORD OF *ALEUROLOBUS,* AND DESCRIPTION OF A NEW SPECIES OF *DIALEURODES* (HEMIPTERA: ALEYRODIDAE), ALL FROM INDIA[1]

Anil Kumar Dubey[2] and Chiun-Cheng Ko[2]

ABSTRACT: A new name, *Aleuroclava tarennae,* is proposed for *Aleuroclava davidi* Dubey and Sundararaj, 2005, a homonym of *Aleuroclava davidi* Qureshi, 1982. *Aleurolobus exceptionalis* Regu and David, found infesting *Madhuca latifolia* (Sapotaceae) in India, is redescribed and its intraspecific variation reported. An African whitefly, *Aleurolobus gruveli* Cohic is recorded for the first time in India. A new species, *Dialeurodes atalantiae,* infesting *Atalantia racemosa* (Rutaceae) in India, is described and illustrated.

KEY WORDS: Hemiptera, Aleyrodidae, intraspecific variation, new species, new record, new name, India

The whiteflies comprise a single hemipterous family Aleyrodidae that includes an economically important group of sap-sucking insects, infesting a wide range of host plants. They are small, inconspicuous and often found feeding on leaf surfaces. The family Aleyrodidae includes three subfamilies, Aleurodicinae Quaintance and Baker, Aleyrodinae Westwood and Udamoselinae Enderlein. The Indian whitefly fauna comprises two subfamilies, Aleurodicinae (1 genus and 4 species) and Aleurodinae (50 genera and 352 species). The economic loss is well known due to their activities of sucking the plant sap, acting as a vector of plant viruses causing diseases, and production of honey dew leading to the development of mould on leaves, thus, adversely affecting photosynthesis. In India, a few species that cause such damage are the greenhouse whitefly *Trialeurodes vaporariorum* (Westwood), the sugarcane whitefly *Neomaskellia bergii* (Signoret) and *Aleurolobus barodensis* (Maskell), the jasmine whitefly *Dialeurodes kirkaldyi* (Kotinsky) and *Dialeurodes vulgaris* (Singh), the cardamom whitefly *Singhiella cardamomi* (David and Subramaniam), the citrus whitefly *Aleurocanthus woglumi* Ashby and *Dialeurodes citri* (Ashmead), and the cotton whitefly *Bemisia tabaci* (Gennadius).

The biology includes egg, four nymphal instars and adult stage. The adults develop within the quiescent fourth instar usually referred to as the "puparium." Except the first nymphal instar 'crawler,' the second, third and fourth instars are atrophied and sessile. The taxonomy of this group of insects is exclusively based

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on the characteristics of the fourth nymphal instar so-called 'pupal case' or 'puparium.' It is found attached with leaf surface and often providing host plants identity. The whitefly which infests monocotyledonous host plants do not usually feed on Dicotyledonous hosts. Some polyphagous species showing morphological variation in puparia depend upon the host plant cuticle which often results in misidentification. The genera included herein comprises the maximum number of species in India. We understand the paper includes additional information on morphotaxonomy of Indian aleyrodids. In this paper, we report a new name for a whitefly, redescribe and report the intraspecific variation in *Aleurolobus exceptionalis,* report a new record of *Aleurolobus*, and describe a new species of *Dialeurodes,* all from India.

METHODS

Host plant leaves infested with late instar nymphs of the new species were collected in paper covers and brought to the laboratory. Specimens were prepared for scanning electron microscopy by removing them from the host plant and washing them in 95% ethanol with an ultrasonic mini cleaner at 50-60 Hz for 2 minutes. Then, the specimens were sequentially dehydrated in 95% and 100% ethanol for one minute. Thereafter, specimens were critical point dried by using CO_2 as a transfer fluid, mounted on stubs, and sputter-coated with a gold-palladium alloy. The scanning electron microscope (JEOL S-800) of the Department of Entomology, National Taiwan University (Taipei, Taiwan) was used to examine the specimens and take micrographs. Descriptions and terminology of external morphological structures are based on Bink-Moenen (1983), Martin (1985), and Gill (1990).

Specimen Depositories

ANIC – Australian National Insect Collection, CSIRO Entomology, Canberra, ACT, Australia.
BMNH – British Museum of Natural History, London, U.K.
CDFA – California Department of Food and Agriculture, Sacramento, California, U.S.A.
IARI – Indian Agricultural Research Institute, New Delhi, India.
NMNH – National Museum of Natural History, Tel Aviv University, Israel.
NTU – National Taiwan University, Taipei, Taiwan.
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USNM – U.S. Department of Agriculture, Beltsville, Maryland, U.S.A. (Sternorrhyncha collections of the United States National Museum of Natural History, Washington, D.C.).
ZMU – Zoological Museum, Universitetsparken, Department of Zoology, Copenhagen, Denmark.
ZSI – Zoological Survey of India, Kolkata, India.

SYSTEMATIC ENTOMOLOGY

Part 1. A new name for an Indian whitefly

Aleuroclava tarennae Dubey and Sundararaj, nomen novum

Aleuroclava davidi Dubey and Sundararaj, 2005: 241-172.

Aleurotuberculatus tarennae Dubey and Ko, **nom. nov**. for *Aleuroclava davidi* Dubey and Sundararaj, 2005 (preoccupied by *Aleuroclava davidi* (Qureshi), described as *Aleurotuberculatus davidi* Qureshi. 1982.

Material Examined. Holotype puparium, India: Tamil Nadu: Jamunamarathur Hills, on *Tarenna asiatica*, 19.viii.2001, A. K. Dubey. Paratypes, 5 puparia, data as for holotype (BMNH, SMTD, NMNH, NTU, USDA).

Host Plant. *Tarenna asiatica* (Rubiaceae) (Dubey and Sundararaj, 2005).

Distribution. India: Tamil Nadu (Dubey and Sundararaj, 2005).

Etymology. The replacement name is given after host plant genus, *Tarenna*.

Remarks. Dubey and Sundararaj (2005) described *Aleuroclava davidi* Dubey and Sundararaj from specimens collected on *Tarenna asiatica* in India. Qureshi (1982) described *Aleurotuberculatus davidi* (p.49-50) and used the species name, *Aleurotuberculatus davidae*, in his key, phenogram and discussion (pp. 56-57). Martin (1999) synonymised the genus *Aleurotuberculatus* Takahashi with *Aleuroclava* Singh, therefore making *Aleuroclava davidi* Dubey and Sundararaj, 2005, a junior homonym of the former species. Hence, a replacement name is assigned to it.

Part 2. Redescription and intraspecific variation of a species of *Aleurolobus* from India

The whitefly genus, *Aleurolobus* Quaintance and Baker is represented in India by 49 species (Regu and David, 1993; Meganathan and David, 1994; Martin, 1999). Studies on this genus in the last decade have increased the number of species known from the Indian subcontinent and have revealed some of the complexities involved in determining their identity. This is mainly due to the overlooking of the variation occurring within a species and the use of variable morphological characters for identification. As pointed by Martin (1999), "many of the characters that have been used to separate species of *Aleurolobus* are subtle variations of cuticular folding and setal lengths, and undoubtedly some described species will eventually prove to be synonyms when phenotypic variation (as first described by Mound, 1963) is investigated." Since whitefly taxonomy is largely based on puparial characters, the treatments of puparia with various chemicals and the duration of the treatments may result in the artifacts, the appearance or disappearance of certain characters, such as the presence of minute tubercles in caudal furrow, black spots on dorsum and toothlike processes at base of vasiform orifice. Slide mounting of specimens with curved, deflexed lateral margins or less bleaching of the puparia often results in variations in the number of teeth observed in thoracic tracheal pores. For example, a species that normally has three teeth present in the tracheal pore may have only one tooth. The appearance of a single tooth in the thoracic tracheal pore depends on the prominence of marginal teeth associated with the central one; it varies within a species and with the duration of chemical treatment. The discussion on variation observed in the puparia of *Aleurolobus exceptionalis* Regu and David (1993) emphasized the need for a revision of the species of *Aleurolobus* known from the Indian subcontinent. Regu and David (1993) discussed the puparial characters for the genus *Aleurolobus*. One African whitefly, *Aleurolobus gruveli* Cohic (1969) is recorded for the first time from India and drawings are given for reference. This species is redescribed and its morphological variability reported due to morphological variations observed in type and other material.

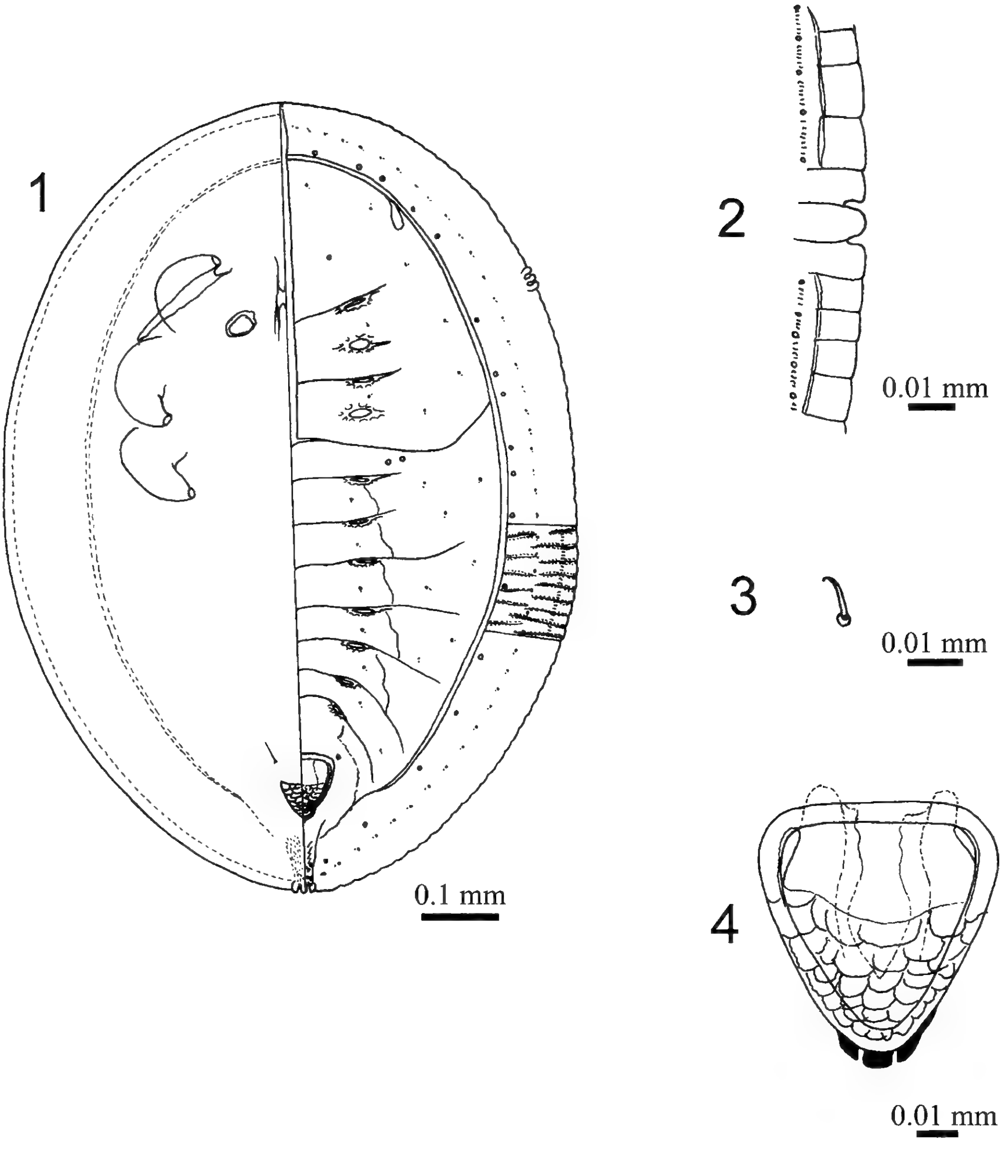
Aleurolobus exceptionalis Regu and David

(Figs. 1-22)

Aleurolobus exceptionalis Regu and David 1993: 25-26.

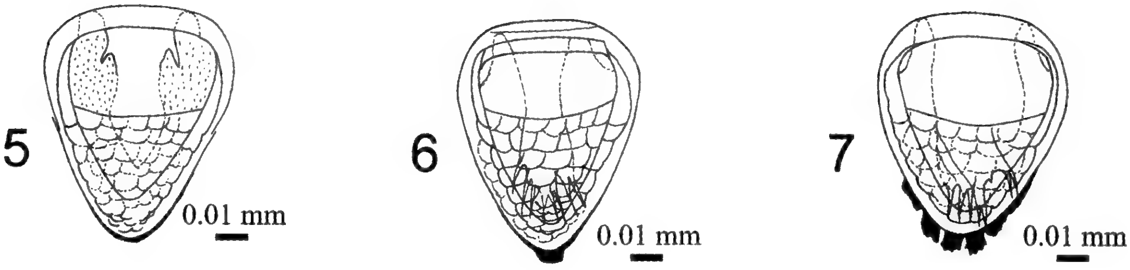
Puparium. Black, most puparia with white wax secretions on dorsum, some puparia without wax secretions; oval in shape, broadest at first abdominal segment, dimorphic, ♂ 1.00-1.04 mm long, 0.62-0.74 mm wide; ♀ 1.08 mm long, 0.76 mm wide, found singly and scattered on the lower surface of leaves, abundant on lower right side of leaves. Margin smoothly crenulate (Fig. 16), 6-7 crenulations in 0.1 mm. Thoracic (Fig. 2) and caudal tracheal comb (Figs. 12, 16) differentiated from lateral margin by three distinct teeth.

Dorsum. (Figs. 1-19). Submargin incompletely separated from dorsal disc by a submarginal furrow. Submedian pockets present on all the abdominal segment sutures. Submedian depressions present on cephalothoracic and abdominal segment sutures. Rhachis well developed on abdominal segments. Longitudinal moulting suture reaching margin and transverse moulting suture reaching submarginal furrow (Fig. 17). Submarginal lines broken. A row of minute granules present on submargin along the margin. Median submarginal area with a row of minute pores with associated porettes. Minute pores and associated porettes scattered throughout dorsum. Eye spots reniform. Vasiform orifice subcordate (Figs. 4, 18), ♂ 82-90 μm long, 72-76 μm wide, ♀ 90 μm long, 78 μm wide; operculum subtriangular shaped, no clear difference is seen in operculum of male and female puparia, 66-70 μm long, 58-64 μm wide. Inner caudal wall of vasiform orifice with irregular transverse markings. Three toothlike processes at base of vasiform orifice usually present (holotype Fig. 11), sometimes absent or one to six in number and simple or fimbriate at apices (Figs 5-7, 18, 19). Lingula tip concealed (Fig. 18, 19). Caudal furrow with few polygonal markings.

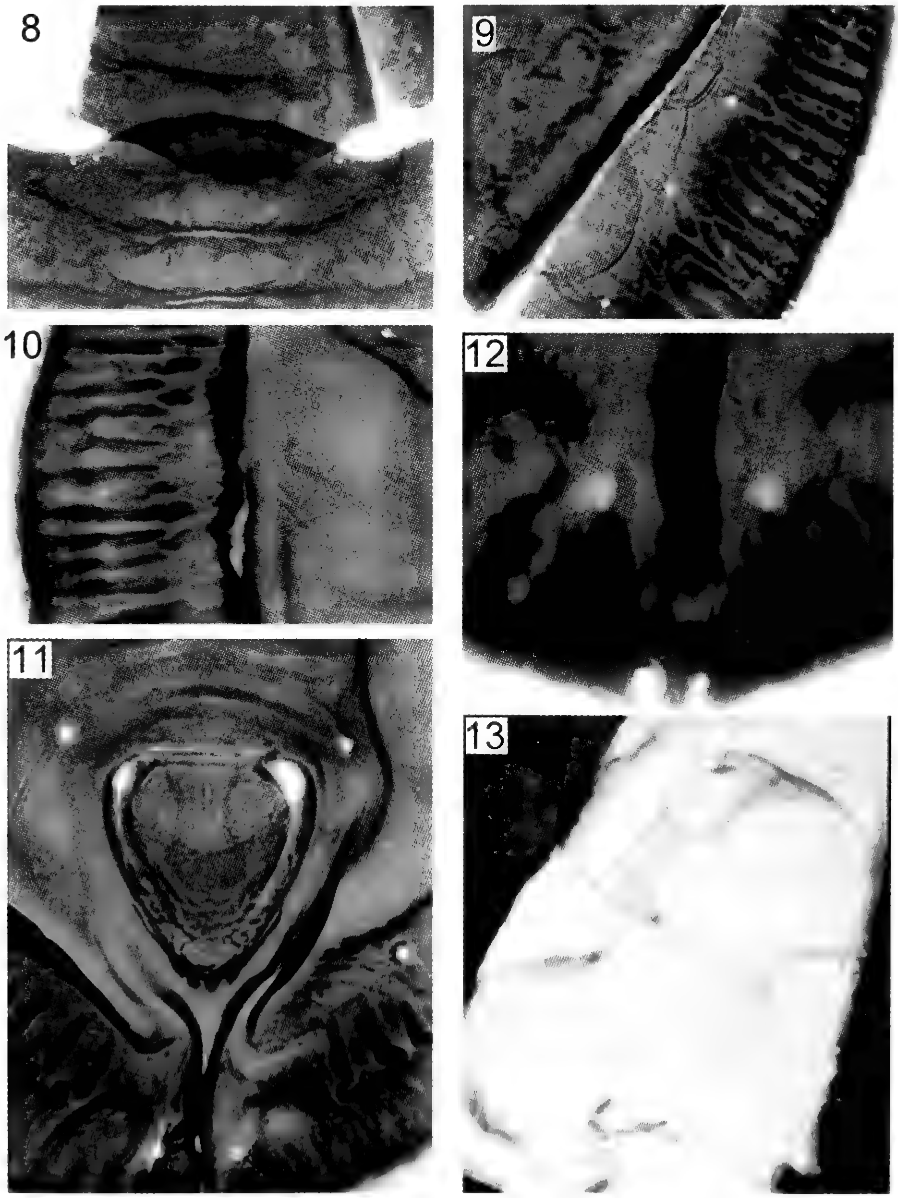


Figures 1-4. *Aleurolobus exceptionalis* Regu and David. 1. Puparium. 2. Thoracic tracheal pore. 3. Submarginal seta. 4. vasiform orifice.

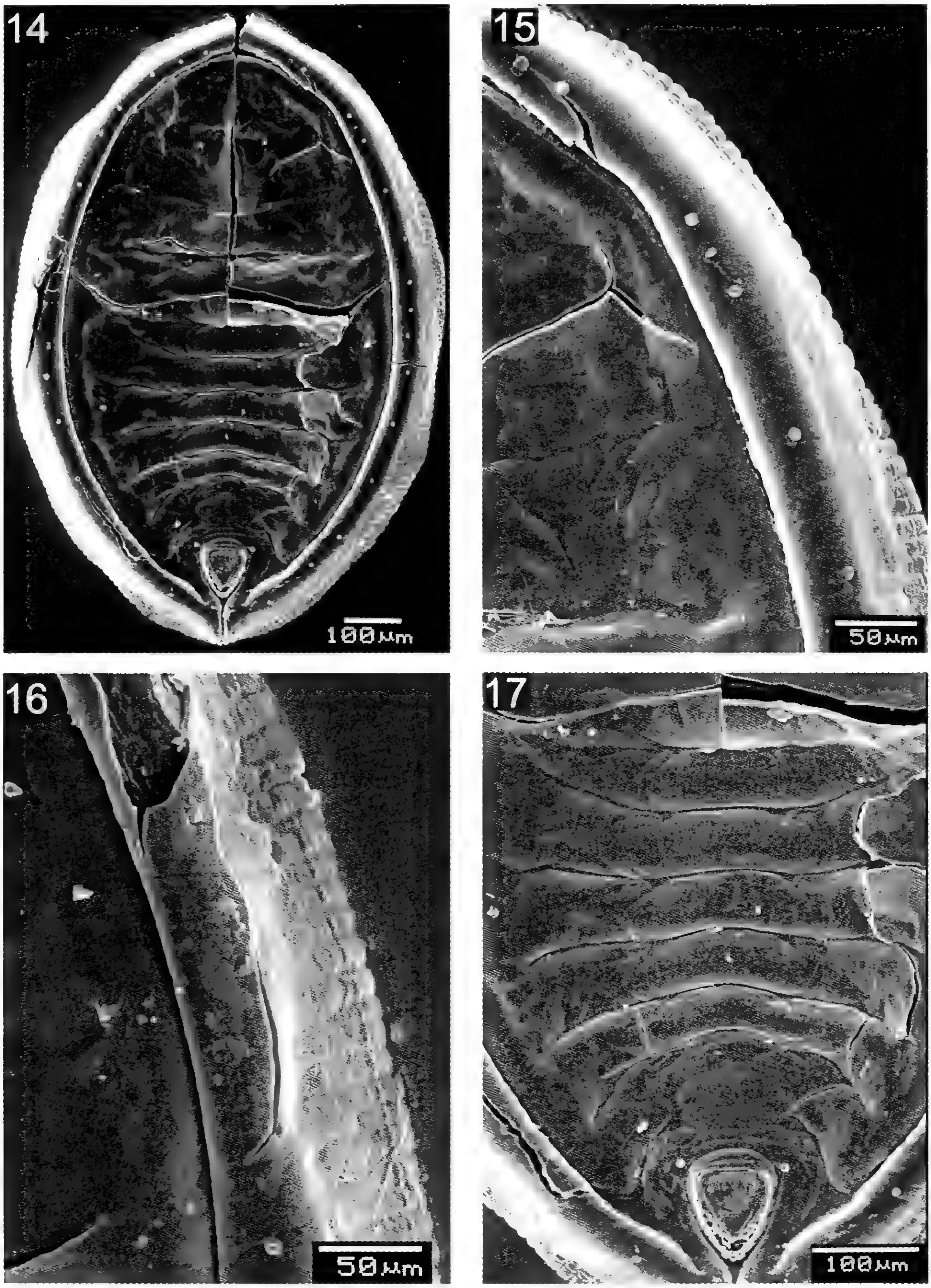
Chaetotaxy. Five pairs of dorsal setae present - one cephalic, two on the first abdominal, one on eighth abdominal segment cephalolaterad of vasiform orifice and one submarginal caudal pair. Submargin with a row of 16 pairs of setae, their bases distinct, (8 pairs each on cephalothorax and abdomen) (Figs. 3, 9, 15). Setae usually broken, in one specimen hook-shaped (Fig. 3), but in holotype stout (Fig. 10). Of the eight pairs of cephalothoracic setae, three pairs are located above the eye spots and five pairs are below them. Of the eight pairs of abdominal submarginal setae, one pair of setae located on each segment of abdominal segments I-VIII, position of setae found varying from subdorsum to submargin (on subdorsum, holotype Fig. 9).



Figures 5-7. *Aleurolobus exceptionalis* Regu and David. Variation in teeth at base of orifice.

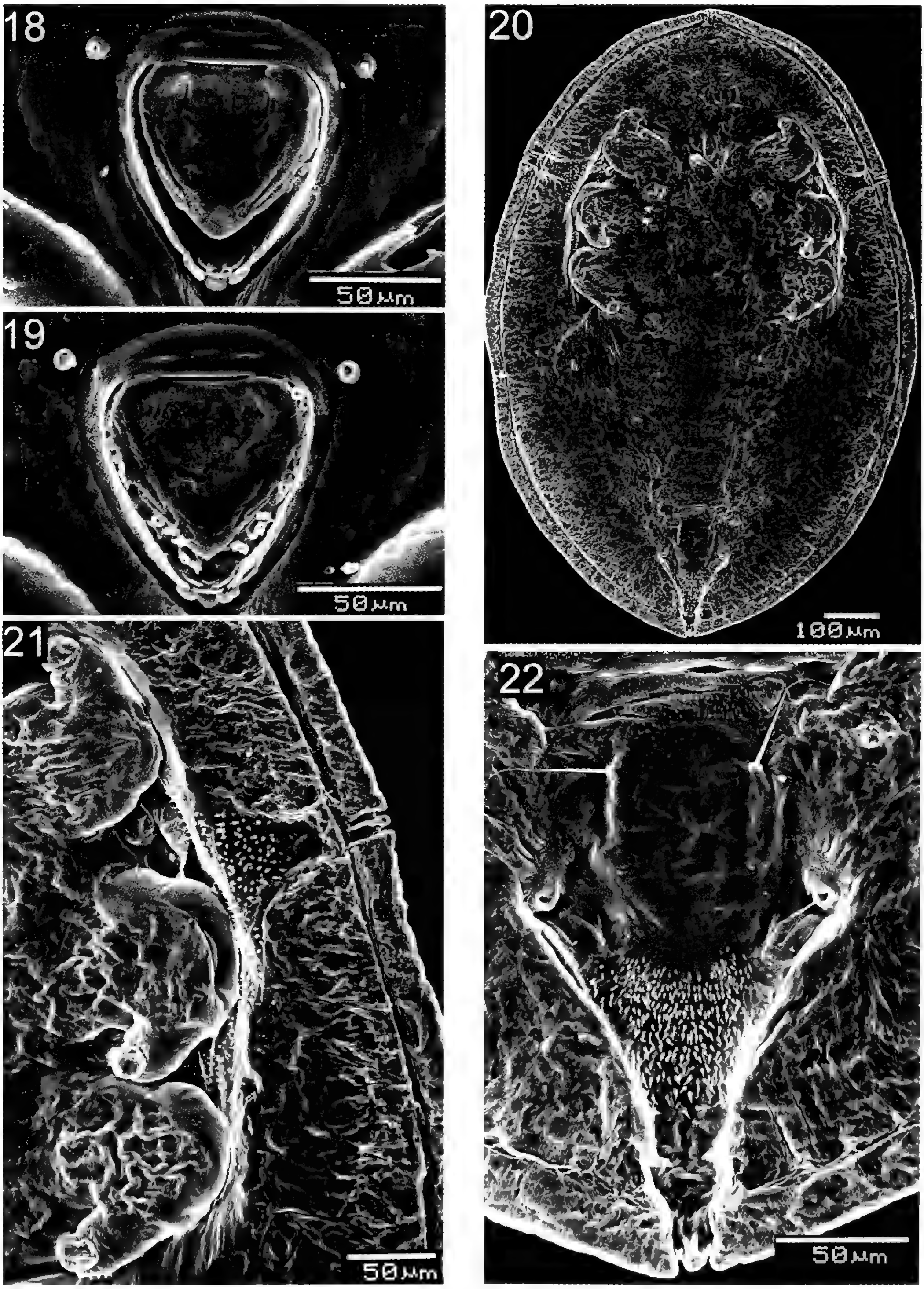


Figures 8-13. *Aleurolobus exceptionalis* Regu and David. Holotype puparium 8-13. 8. First abdominal segment. 9. Cephalic submarginal area. 10. Submarginal seta. 11. Vasiform orifice with teeth at base. 12. Caudal tracheal pore. 13. Antenna and proleg.



Figures 14-17. *Aleurolobus exceptionalis* Regu and David. 14. Puparium dorsal view. 15. Cephalic submarginal setae. 16. Tracheal comb and margin. 17. Abdominal segment.

Venter. (Fig. 20). A pair of setae at base of meso- and metathoracic legs, 2 µm long. Antennae reaching base of mesothoracic legs (holotype Figs. 13; 21). Ventral submargin with fold just below submarginal furrow (Fig. 1). A faint row of smooth papillae also present along margin. Caudal tracheal fold with stipples (Fig. 22), stipples absent in submarginal area of thoracic and caudal tracheal folds. Spiracles and adhesive sacs visible.



Figures 18-22. *Aleurolobus exceptionalis* Regu and David. 18, Vasiform orifice. 19. Vasiform orifice with variable number of teeth. 20. Puparium ventral view. 21. Thoracic tracheal fold, legs, and antenna. 22. Ventral setae and caudal tracheal fold.

Material Examined: Type - Holotype puparium and six paratype specimens, India: Tamil Nadu: Khapoli, on unidentified plant, 12.xi.1988, K. Regu. Additional material (paratypes)- 4 puparia on one slide, on unidentified plant, Khapoli, 12.ii.1988, K. Regu; 9 puparia on five slides, on unidentified plant, Khapoli, 12.xi.1988, K. Regu (loan from K. Regu); 1 puparium, on *Ficus* sp., Karnataka: Kudremukh National Park., 9.viii.2001, A. K. Dubey; 40 puparia on 32 slides, Karnataka: Bangalore, on *Madhuca latifolia*, 25.vi.2006. A. K. Dubey (NTU COLL).

Host Plants. *Ficus beddomei* (Regu and David 1993), *Ficus* sp. (Dubey and Sundararaj 2006); *Madhuca latifolia* (Sapotaceae) (new host record).

Distribution. India: Tamil Nadu: Khapoli (Regu and David 1993); Karnataka: Kudremukh National Park (Dubey and Sundararaj 2006); Bangalore (Dubey and Ko) (new distribution record).

Remarks. This species typically has two pairs of first abdominal setae as does *Aleurolobus delamarei* Cohic. Of the many slide-mounted specimens collected on *Madhuca latifolia*, one puparium had a single seta on one side of the first abdominal segment and two setae on the other side. Examination of holotype (*A. exceptionalis*) confirmed the presence of one seta on one side of the first abdominal segment and two setae on the other side (Fig. 8); however, in the paratype specimens, there are two setae on each side of the first abdominal segment, which was not noted by Regu and David (1993) in their description of the species. Examination of the holotype, six paratypes and additional specimens collected from *Madhuca latifolia* (Sapotaceae) confirmed that the number of submarginal setae varies in number from 14-16. The original description states that there is one pair of setae present on subdorsum above the eye spots: however, we observed that the position of cephalic subdorsal setae and submarginal setae may vary from the subdorsum to submargin. Interestingly, the apparent number of teeth in thoracic tracheal pores was not constant and varied from one to three depending upon the degree of bleaching used in processing the specimen. This suggests that the presence of two pairs of setae on the first abdominal segment (one pair each side) is variable and should not form the basis for the creation of a separate genus for the species of *Aleurolobus* which have this characteristic. The toothlike processes at the base of the vasiform orifice have long been used as characters for species identification. We observed that this character, in itself, is highly variable as the number of teeth varied between zero and six. Some of the teeth are unclearly separated at base and in some puparia the toothlike processes have fimbriate apices (Figs. 4-7). This kind of variation has also been observed in puparia of other *Aleurolobus* species (personal observations). Host-correlated variation occurring in *Aleurolobus marlatti* (Quaintance) (=*Aleurolobus niloticus* Priesner and Hosny) as noted by Regu and David (1993) and Martin (1999), is clear evidence that the lack of knowledge regarding the intraspecific variation occurring in a species has sometimes resulted in description of several new taxa. Regu and David (1993) described seven new species of *Aleurolobus*; namely, *A. cephalidistinctus* with bluish black puparia and *A. cohici, A. diacritica, A. hosu-*

rensis, A. patchily, A. rhachisphora, and *A. sundararaji,* which have black puparia. They distinguished these species from closely related species based on the presence of black spots on dorsum (except *A. sundararaji,* which has black spots that are shown in the diagram (see Regu and David, 1993). We now understand that the appearance of such black spots is a result of not bleaching the puparia prior to slide mounting, and it is very unlikely that the black cuticle of puparia would indeed, have black spots on it. Bleaching of the puparia results in the disappearance of the black spots. With these observations, we conclude that using characters such as the number and characteristics of the tooth-like processes at the base of the vasiform orifice, the position of submarginal setae, and the presence or absence of the black spots on the dorsum as a basis for species identification must be avoided. These variations observed in *A. exceptionalis*, and the facts discussed herein, will help in attaining a proper understanding of similar variation that may occur in other species of *Aleurolobus*, and determining their identity.

Part 3. A new record of *Aleurolobus* from India

Eighteen species of the genus *Aleurolobus* are known to occur in Africa; however, only one species, *Aleurolobus onitshae* Mound, known from Nigeria (Mound, 1965), Ivory Coast (Cohic, 1969) and Tchad (Bink-Moenen, 1983), has been reported to occur in India (Regu and David, 1993). The new record of *Aleurolobus gruveli* Cohic from India indicates the possibility that the distribution range of other African *Aleurolobus* species may extend into the Oriental region.

Aleurolobus gruveli Cohic (Figs. 23-30)

Aleurolobus gruveli Cohic, 1968: 88-91.

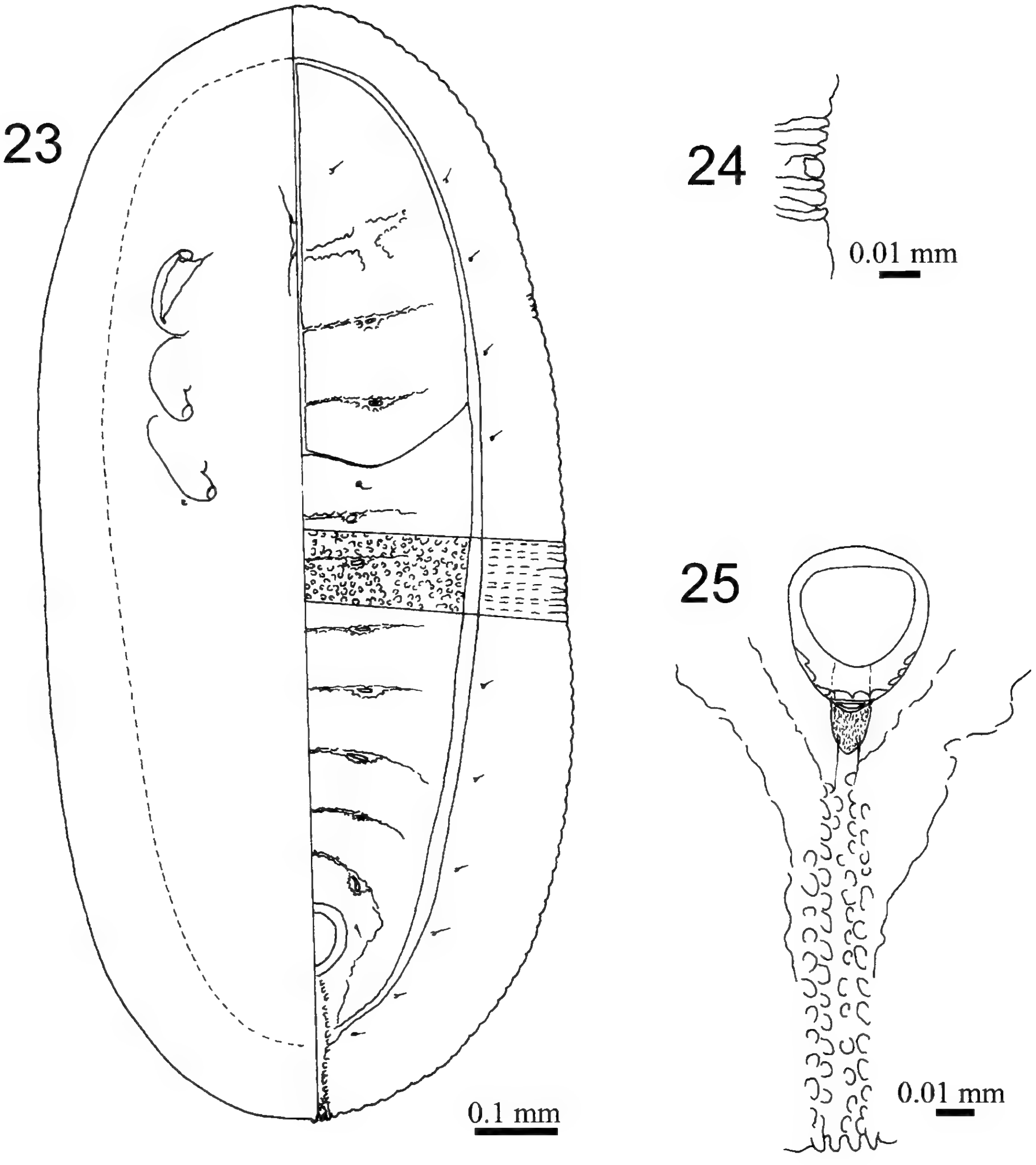
Material Examined. One puparium, India: Karnataka: Bangalore (13.12193' N, 77.54866' E; 930 m. asl.), on *Vetiveria zizanioides* (Poaceae), 22.ix.2005, A. K. Dubey.

Host Plants. Poaceae [=Gramineae] (Cohic, 1968); *Coelorhachis afrautica* (Bink-Moenen, 1983); *Vetiveria zizaniodes* (Poaceae) (new host record).

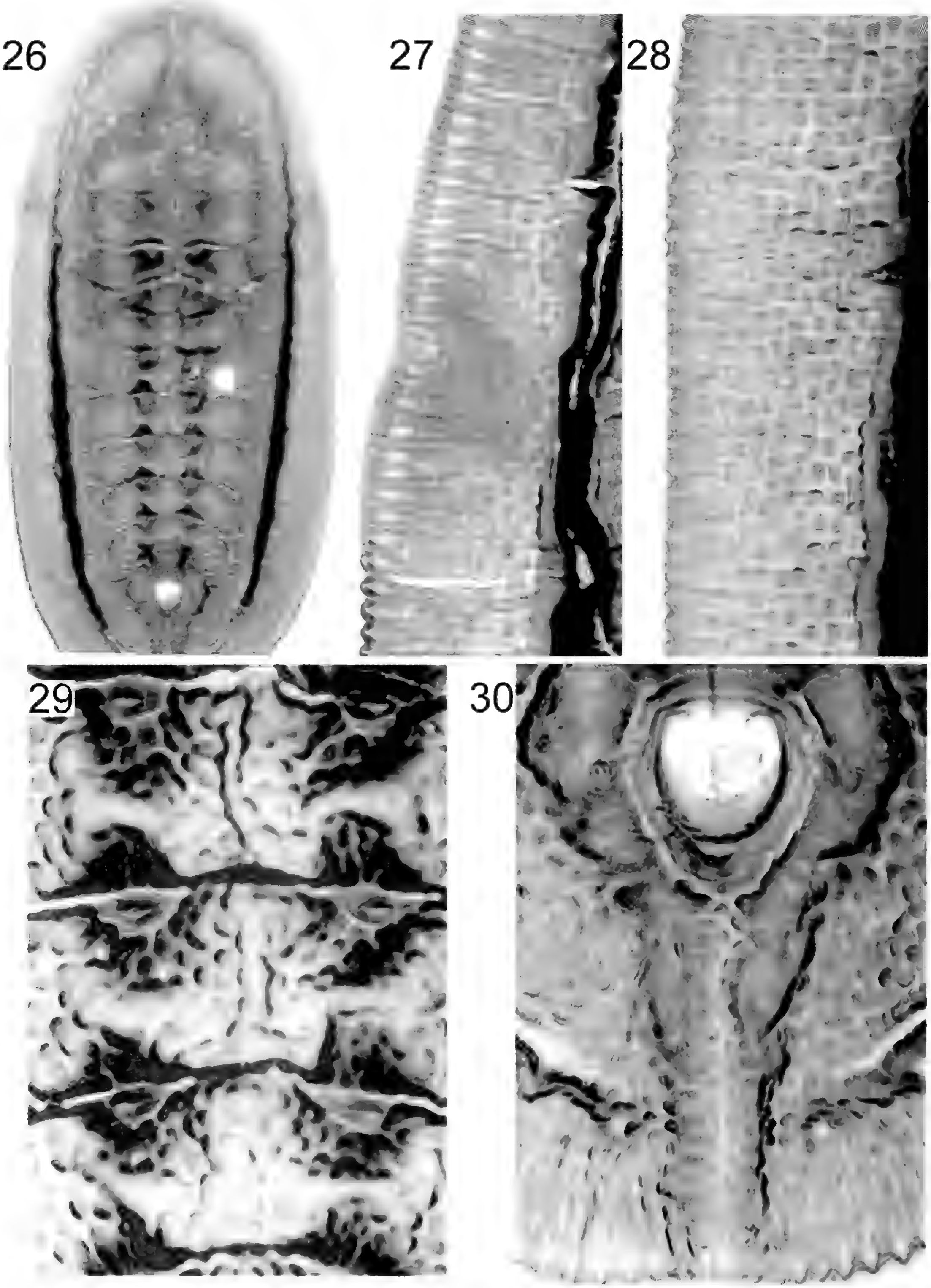
Distribution. South Africa; Cameroon (Cohic, 1968); Tchad: Bebediia (Bink-Moenen, 1983); India: Bangalore (new record).

Remarks. This species was described by Cohic (1968) from the Poaceae [=Graminae] family. The description provided by him and variation noted by Bink-Moenen (1983) are adequate; however, figures are given herein for reference.

Discussion. Bink-Moenen (1983) recorded variation in numbers of submarginal setae occurring in this species as "15 pairs of spine-like setae instead of ten" and observed one of the submedian pairs occasionally missing (see p. 49). The specimen of this species collected from *Vetiveria zizaniodes* from India shows 10 pairs of submarginal setae and no submedian setae; however, the external appearance of puparium is the same as she had observed. We agree that the



Figures 23-25. *Aleurolobus gruveli* Cohic. 23. Puparium. 24. Thoracic tracheal pore. 25. Vasiform orifice, photomicrographs.



Figures 26-30. *Aleurolobus gruveli* Cohic. 26. Puparium. 27. Thoracic tracheal pore. 28. Margin. 29. Abdominal pockets. 30. Vasiform orifice and caudal furrow.

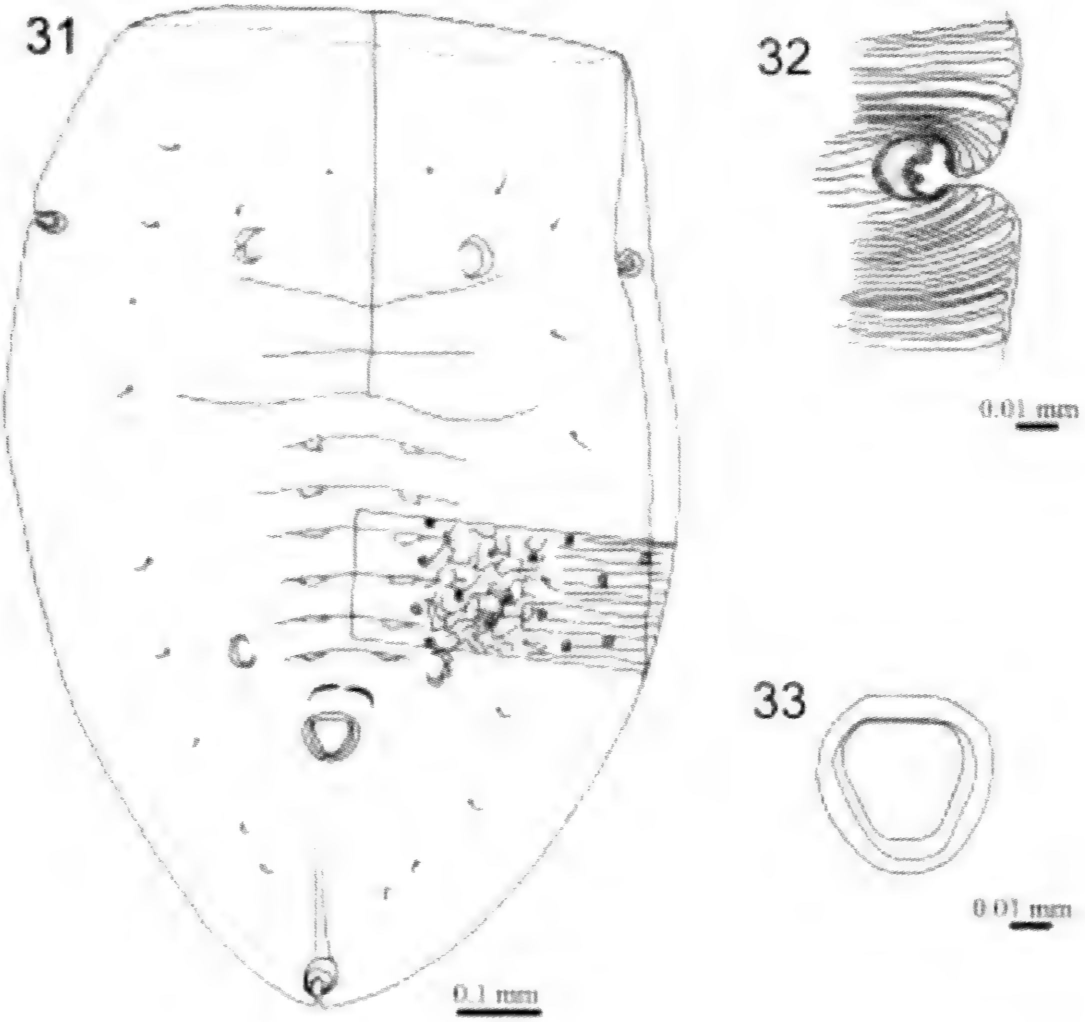
puparia of this species are highly variable in terms of submarginal and submedian setae. Figures are given for reference.

Part 4. Description of a new species of *Dialeurodes* from India

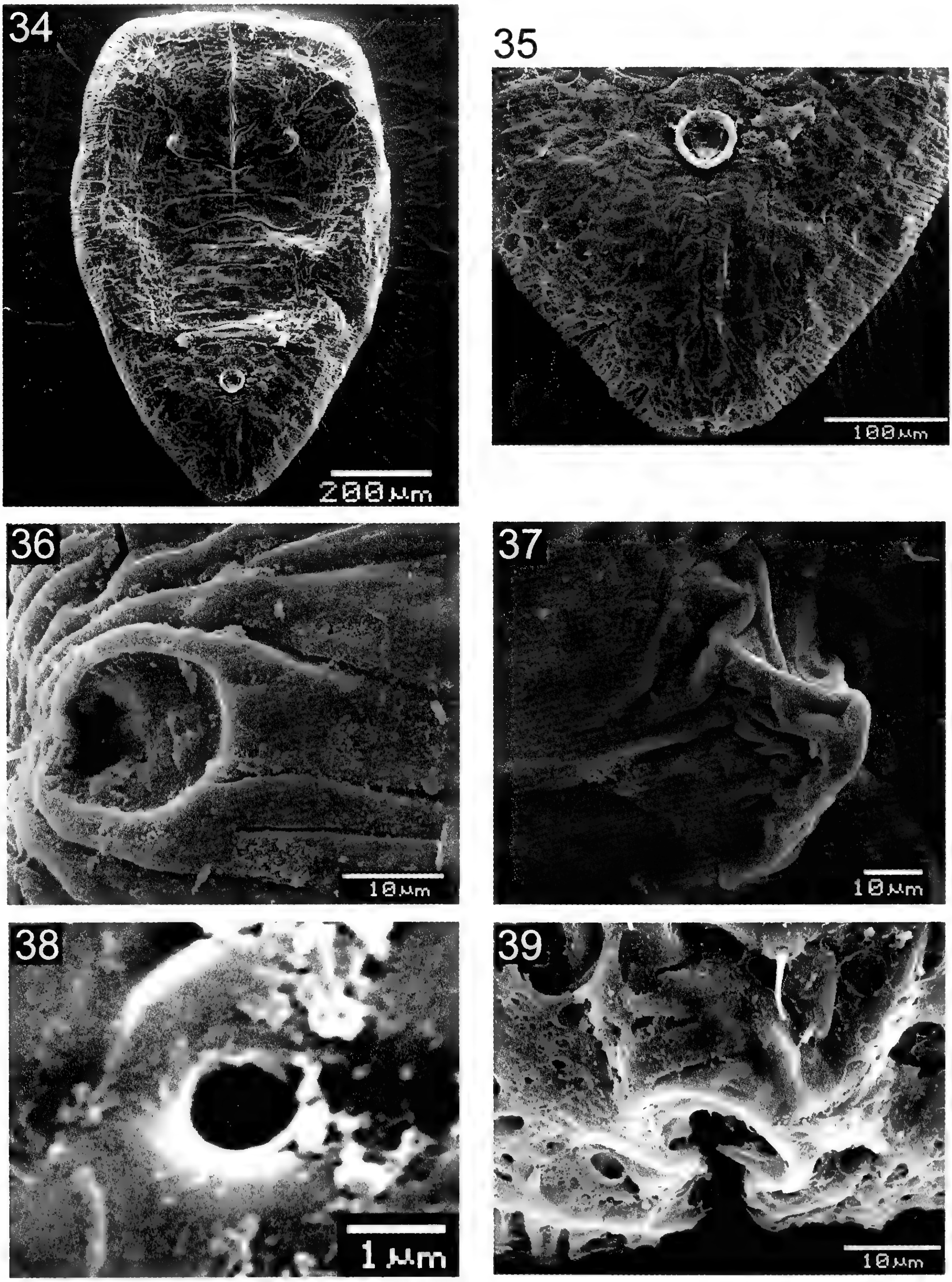
Dialeurodes atalantiae Dubey and Ko, new species

(Figs. 31-42)

Puparium. Pale white, with thin layer of white wax on dorsum, median area of cephalothorax and abdomen with a light red spot in some puparia; subpentagonal in shape, dimorphic, constricted at the posterior abdominal region and widest across the transverse moulting suture region; measures ♂ 1.0-1.08 mm long, 60-68 mm wide, ♀ 1.34-1.36 mm long, 90 mm wide; found singly, one or two per leaf on the lower surface of leaves. Margin smoothly crenulate; thoracic (Figs. 32, 36) and caudal tracheal pores indicated by invaginated internal teeth and inner demarcation of caudal tracheal pore (Fig. 39) bilobed, clear in slide mounting.



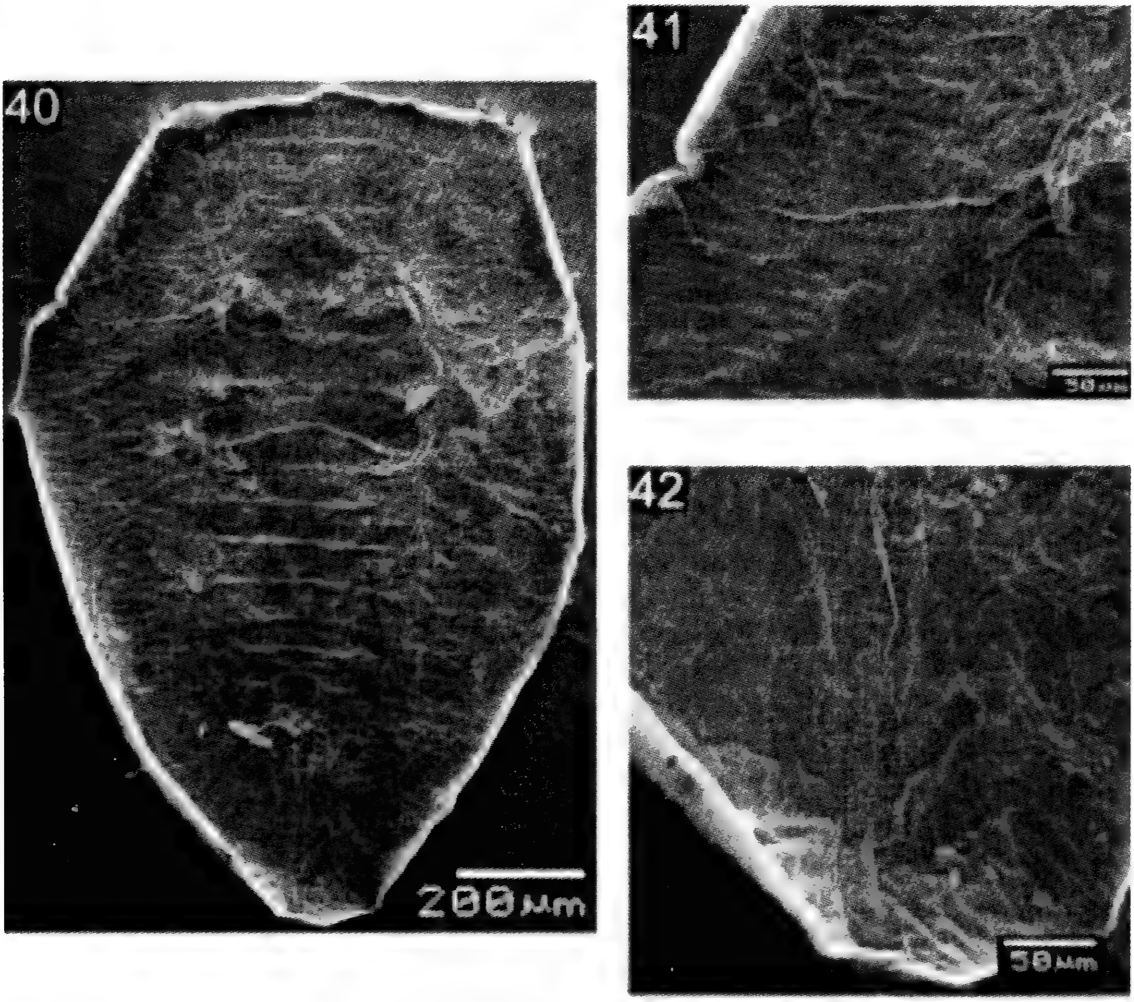
Figures 31-33. *Dialeurodes atalantiae* Dubey and Ko sp. nov. 31. Puparium. 32. Thoracic tracheal pore. 33. Vasiform orifice; photomicrographs.



Figures 34-39. *Dialeurodes atalantiae* 34. Puparium dorsal view. 35. Posterior abdominal area. 36. Thoracic tracheal pore. 37. Obliquely elevated ridges on submedian area of prothorax. 38. dorsal pore and porette. 39. Caudal tracheal pore and seta.

Dorsum. (Figs. 31-39). Dorsum with typical large pores sometimes containing two to three minute scattered porettes (Fig. 38). A pair of obliquely elevated submedian ridges on prothorax and laterad of seventh abdominal segment present (Fig. 37). Submarginal striations reaching subdorsal area. Subdorsum with wavy markings. Median length of abdominal segment VII shorter than VIII (Fig. 35). Submedian pockets present in all the cephalothoracic and abdominal segment sutures. Submedian depressions faintly discernible in all the segments. Longitudinal moulting suture reaching margin and transverse moulting suture reaching submargin. Pockets not contiguous. Vasiform orifice subcircular (Fig. 33, 35), as long as wide or slightly longer than wide, ♂ 49-50 µm long, 50 µm wide, ♀ 60-64 µm long, ♂ 58-60 µm wide, inner posteriolateral wall of orifice without a comb of teeth; operculum subcordate, ♀ 38 µm long, 38 µm wide, ♂ 30 µm long, 30 µm wide, not completely covering the orifice. Lingula obscured. Caudal tracheal furrow not clearly defined and appears to be granulated. A pair of minute setae slightly above the caudal tracheal pore, 8 µm long distinct.

Chaetotaxy. Cephalic setae present, first abdominal setae 12 µm long and eight abdominal setae cephalolaterad of vasiform orifice 14 µm long and submarginal caudal setae 8 µm long (Fig. 39). Submargin with a row of minute setae, each 8 µm long, number and position of setae varying within puparium.



Figures 40-42. *Dialeurodes atalantiae* 40. Puparium ventral view. 41. Thoracic tracheal fold and legs. 42. Caudal tracheal fold.

Venter. (Figs. 40-42). Minute setae at the base of meso- and metathoracic legs, each 10 µm long evident. Ventral setae present. Thoracic (Fig. 41) and caudal tracheal fold (Fig. 42) distinct with stipples. Antennae reaching to base of prothoracic legs, inside. Legs not confluent (Fig. 41). Spiracles and adhesive sacs visible.

Material Examined. Holotype puparium, India: Tamil Nadu: Chennai (13.04°N, 80.17°E), on *Atalantia racemosa*, 16.v.2004, A. K. Dubey (ZSI). Paratypes, 12 puparia, data same as for holotype (ANIC, BNHM, CDFA, IARI, NMNH, SMTD, USNM, ZMU, ZSI and remainder in NTU).

Host Plant. *Atalantia racemosa* (Rutaceae).

Distribution. India: Tamil Nadu.

Etymology. This species is named after its host plant genus, *Atalantia.*

Remarks. This species is similar to *Dialeurodes abbotabadiensis* Qureshi, 1982 in shape but differs from it in having two pairs of obliquely elevated submedian tubercles—one pair each on prothorax and laterad of seventh abdominal segment, variable number of subdorsal setae, wider at abdominal region than *D. abbotabadiensis,* distinct pores with associated porettes on dorsum (Fig. 38) and tracheal folds with dots (Figs. 41, 42). Jensen (2001) mentioned in his cladistic analysis of *Dialeurodes* species group taxa "the practical definition of *Dialeurodes* in use today encompasses a great variety of species, the primary shared characters of which are having some sort of distinct marginal tracheal pore, a vasiform orifice with the lingula included and the operculum nearly filling orifice and usually covering the lingula." Martin (1999) diagnosed the following characteristics to separate species of *Singhiella* from *Dialeurodes:* margin not or very little, modified at thoracic tracheal pore openings at margin, a small caudal indentation present, variably developed submarginal setae present, typically as an even row of 13 pairs, including caudal setae; and ventrally, tracheal folds sometimes developed but not usually sculptured. The new species has very clear, deeply invaginated thoracic and caudal tracheal pores with internal teeth, a variable number of subdorsal setae and characters of the vasiform orifice as defined by Jensen (2001) for the genus *Dialeurodes.* This species differs from *Singhiella* species primarily in having a well-defined tracheal pore opening which according to Martin (1999) is not well defined or little modified from the lateral margin in *Singhiella* species.

In addition, the following 14 species of the genus *Dialeurodes* are already recorded from India: *D. armatus* David and Subramaniam, *D. brideliae* Jesudasan and David, *D. citri* (Ashmead), *D. davidi* Mound and Halsey, *D. delhiensis* David and Sundararaj, *D. icfreae* Sundararaj and Dubey, *D. indicus* David and Subramaniam, *D. kirkaldyi* (Kotinsky), *D. malabaricus* Jesudasan and David, *D. martini* Jesudasan and David, *D. rotunda* Singh, *D. saklespurensis* David, *D. sundararajani* Sundararaj and David, and *D. wendlandiae* Meganathan and David. In general, species of *Dialeurodes* possess 12-14 pairs of submarginal or subdorsal setae. Details of the number of these setae in a few of the Indian species have not been published and, therefore, the specimens need to be reexamined and these data added to their description.

ACKNOWLEDGEMENTS

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ON THE GENUS *SYRISTA* KONOW, WITH THE DESCRIPTION OF A NEW SPECIES FROM CHINA (HYMENOPTERA: CEPHIDAE)[1]

Meicai Wei [2]

ABSTRACT: *Syrista xiaoi* Wei, sp. nov. (Cephidae: Hymenoptera) is described from Sichuan, China. *Syrista xiaoi* is similar to *S. similis* Mocsàry, 1904. *Syrista* Konow 1896 is redescribed in detail. A key to species of the genus is provided and new distribution records are given.

KEY WORDS: Hymenoptera, Cephidae, *Syrista*, new species, China

The genus *Syrista* was proposed by Konow in 1896 for *Cephus parreyssii* Spinola, a stem sawfly species distributed in the West Palaearctic (Benson 1968, Taeger et al., 2006). *Syrista parreyssii* is unique in Cephidae as the anal cell in forewing without cross vein. Mocsàry (1904) described the second species of the genus from Japan, *Syrista similis* Mocsàry, 1904. Benson (1935) described a new genus and a new species, *Neosyrista japonica* Benson, 1935, which has the anal cell in forewing with a normal cross vein. Takeuchi accepted *Neosyrista* Benson but pointed out that *Neosyrista japonica* Benson, 1935 is a synonym of *Syrista similis* Mocsàry, 1904 (Takeuchi, 1938). Benson (1946) himself treated *Syrista* and *Neosyrista* as nomenclatural synonyms. Benson's opinion (Benson, 1946) was accepted by subsequent researchers of Cephidae (Maa, 1949; Okutani, 1974; Muche, 1981; Abe and Smith, 1991; Wei and Nie, 1996). *Syrista xiaoi* sp. nov., a new species similar to *Syrista similis*, is described from China herein. The relationship between the two E. Asian species, *S. similis* and *S. xiaoi* sp. nov., and the West Palaearctic, *S. parreyssii*, requires additional scrutiny. Based on new material *Syrista* Konow is redescribed in detail and a key to the known species provided. The type specimen of the new species is deposited in the Insect Collection of the Central South Forestry University, Changsha, China.

Syrista Konow

Syrista Konow, 1896, Wien. Ent. Zeit. 15: 150, 152-153.
Type species: *Cephus parreyssii* Spinola, 1843, by monotypy.
Neosyrista Benson, 1935, Ann. Mag. Nat. Hist. (10)16: 547.
Type species: *Neosyrista japonica* Benson, 1935, by original designation.

Description: Body slender. Left mandible bidentate, inner tooth feebly shouldered and as long as or slightly longer than outer tooth, outer tooth simple (Fig. 1); right mandible tridentate, inner tooth much longer than middle and outer

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tooth; maxillary palp with 6th segment emerging from middle of 5th, 3rd segment enlarged, 4th segment slender and 1.5 times longer than 6th segment (Fig. 2); labial palp 4-segmented, 1st segment longer than 2nd segment, 2nd segment more than 2 times length of 3rd segment, 4th segment longer and broader than 1st segment; (Figs. 3, 7, 12); clypeus flat and apically truncate; malar space as broad as or slightly broader than diameter of front ocellus; inner margins of eyes feebly divergent downwards, shortest distance between eyes broader than height of an eye; distance between antennal sockets slightly narrower than distance between an antennal socket and inner margin of eye, and clearly shorter than distance between an antennal socket and a tentorial pit on same side; head not strongly swollen behind eyes and 1.5 times broader than long, temple as long as or slightly longer than eye, lateral sides parallel or narrowing backwards in dorsal view; POL slightly narrower than OOL, OCL 2.5-3.2 times POL; occipital carina extending to upper part of hind orbit. Antenna filiform, 25-34 segmented and shorter than abdomen, flagellum not distinctly swelling, pedicel broader than long, 3rd segment much longer than 4th segment. Pronotum distinctly broader than long. Abdomen distinctly compressed laterally, 1st tergite not merged at middle, 2nd segment higher than long. Middle tibia with 1 preapical spur, hind tibia with 2 preapical spurs; hind basitarsus slender and about as long as or slightly longer than following 3 tarsomeres together; claw bifid and without a basal lobe (Figs. 4, 8, 10, 13). Cell C of forewing narrow, vein Sc absent, 1r entire and joining stigma at extreme base, 2r joining stigma beyond middle; hind wing with cell Rs and M closed, both much more than 2 times as long as broad. Ovipositor not shorter than hind tibia and distinctly bent ventrally, sheath about as long as basal plate and about 6-8 times length of cercus (Fig. 5). Lancet very slender and simple with 19-22 serrulae and 5-6 apical annular sutures, serrulae subtruncate and shallowly emarginated ventrally, without fine subbasal tooth (Figs. 6, 9).

Distribution: Eastern Asia, West Palaearctic.

Host: *Rosa* spp. (Rosaceae) (Ho 1936, Maeda 1938, Scheibelreiter 1969).

Three species of the genus have been found, which can be identified using the following key.

Key to species of *Syrista* Konow

1. Female..2
   Male..4

2. Tibia, tarsus and apex of antenna reddish brown; pronotum and hind coxa entirely black; abdominal tergites and mandibles black and red, without yellow macula; area between antennal sockets evenly elevated, without a keel; pterostigma pale brown; head in dorsal view hardly narrowed behind eyes; head and thorax dorsally distinctly punctured; anal cell in forewing without a

cross vein; body length 15-21mm. West Palaearctic............*Syrista parreyssii* (Spinola, 1843)

Hind tibia black with basal third white, antenna entirely black; basal half of mandible yellow, outer side of hind coxa, abdominal tergites 2 and 6 with distinct yellow maculae; area between antennal sockets strongly elevated with a distinct keel; pterostigma dark brown to black; head in dorsal view distinctly narrowed behind eyes; head and thorax dorsally almost impunctate; anal cell in forewing with a cross vein. Asia 3

3. Hind tarsus red brown; abdominal tergites 4-7 largely red; pterostigma black; claw with inner tooth distinctly longer than outer tooth; body length 20mm. West China ....*Syrista xiaoi*, sp. nov.

   Hind tarsus black to dark brown; abdominal tergites 3-5 largely red; pterostigma dark brown; claw with inner tooth hardly longer than outer tooth; body length 13-15 mm. East China, Japan ....*Syrista similis* Mocsàry, 1904

4. Anal cell in forewing without a cross vein; hind tibia, tarsus and apex of antenna reddish brown; pterostigma pale brown; apical half of 7th sternite depressed with posterior margin straight, not emarginated, 8th sternite distinctly emarginated at apex (Fig. 14)................*Syrista similis* Mocsàry, 1904

   Anal cell in forewing with a cross vein; basal 1/3 of hind tibia white, apical 2/3 of hind tibia and hind tarsus entirely black; pterostigma dark brown; posterior margin of 7th sternite deeply incised, apex of 8th sternite round (Fig. 11)..*Syrista parreyssii* (Spinola, 1843)

Syrista xiaoi, NEW SPECIES

(Figs. 1-6, 15)

Diagnosis: Body black with yellow maculae on head and abdomen; claw with inner tooth much longer and broader than outer tooth; area between antennal sockets elevated with a distinct keel; third segment of labial palp 2 times longer than broad; pterostigma black.

Female (Fig. 15): Body (including sheath) length 20 mm, black, basal half of mandible, a stripe on lower inner orbit, a dot on upper inner orbit, a triangular spot on hind orbit and lateral stripes on abdominal tergites 2-7 yellow, abdominal tergites 4-7 largely and sternites 4-5 partly red. Legs black, outside of hind coxa and basal third of each tibia yellow; apex of fore femur, fore and middle tibiae and tarsus largely and hind tarsus entirely pale brown, apical 2/3 of middle tibia dorsally dark brown. Body hairs pale brown. Wings distinctly infuscate toward apex, veins and pterostigma black.

Head and thorax extremely minutely punctured and shining, mesepisternum and metapleuron finely and densely microsculptured, feebly shining; abdomen indistinctly microsculptured. Left mandible as in Fig. 1, inner tooth slightly longer than outer tooth; maxillary palp as in Fig. 2; labial palp as in Fig. 3, third segment 2 times longer than broad; malar space slightly broader than diameter of an ocellus; area between antennal sockets elevated with a distinct keel; middle fovea indistinct; interocellar furrow fine and shallow, postocellar furrow broad and shallow; OOL: POL: OCL =3: 2: 6; head behind eyes slightly longer than eye in dorsal view, lateral margins distinctly narrowing backwards. Antenna 34-segmented, third segment 1.3 times longer than fourth segment. Posterior margin of pronotum clearly incised and 1.5 times breadth of anterior margin; mesoscutellum flat with a low carina posteriorly. Claw with inner tooth much longer and broader than outer tooth (Fig. 4). Anal cell of forewing with a cross vein; cu-a joining cell 1M at its basal 1/4, cell 2Rs slightly longer than 1Rs; cell Rs about as long as cell M and both of them 3 times longer than broad. Abdomen (including propodeum and excluding sheath) 2 times as long as head and thorax (excluding propodeum) together, 2nd segment 1.3 times higher than long; ovipositor 1.2 times as long as hind tibia, sheath as long as basal plate and 7 times length of cercus (Fig. 5). Lancet with 22 serrulae and 5-6 apical annular sutures, middle serrulae oblique, distance between serrulae triple the breadth of a serrula (Fig. 6).

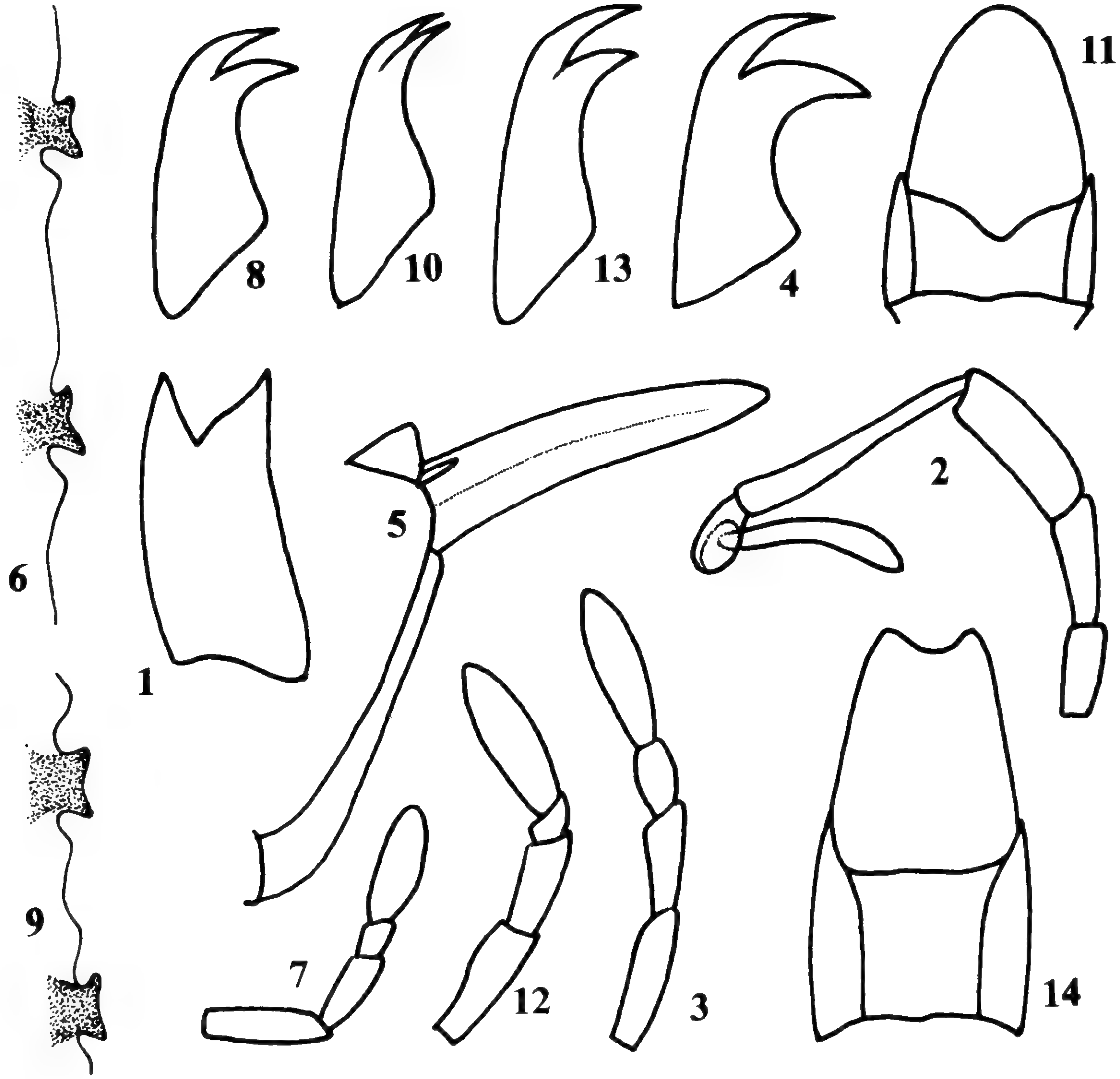
Male: Unknown.

Type Data: Holotype female, Sichuan: Luding, Hailuogou, 2003. VII. 17, W. Liu (deposited in the Insect Collection of the Central South Forestry University, Changsha, China).

Etymology: The species is named after Prof. Gangrou Xiao, a famous sawfly researcher of China.

Distribution: China (Sichuan).

Remarks: The new species is similar to *Syrista similis* but it can be separated from the latter by the following features: body larger (20 mm in female), the 10th abdominal tergite and fore coxa entirely black, the hind tarsus reddish brown, pterostigma black, the inner tooth of claw much longer and broader than the outer tooth, abdomen 2 times longer than head and thorax together, ovipositor distinctly longer than hind tibia, and the middle serrulae smaller and oblique, remote to each other. In *S. similis* the body is smaller (13-15mm in female), a spot on the ventral side of fore coxa, the 10th abdominal tergite yellow, the hind tarsus blackish brown, pterostigma dark brown, the inner tooth of claw hardly longer than the outer tooth, abdomen about 1.7 times longer than head and thorax together, ovipositor as long as hind tibia, the middle serrulae of lancet close to each other and not oblique.



Figures 1-6: *Syrista xiaoi* sp. nov. 1. Left mandible. 2. Maxillary palp. 3. Labial palp. 4. Claw. 5. Ovipositor. 6. The 9-10th serrulae. Figures 7-11: *Syrista similis* Mocsàry. 7. Labial palp. 8. Female claw 9. The 9-10th serrulae. 10. Male claw. 11. The 7th and 8th sternites, male. Figures 12-14: *Syrista parreyssii* (Spinola). 12. Labial palp. 13. Male claw. 14. The 7th and 8th sternites, male.

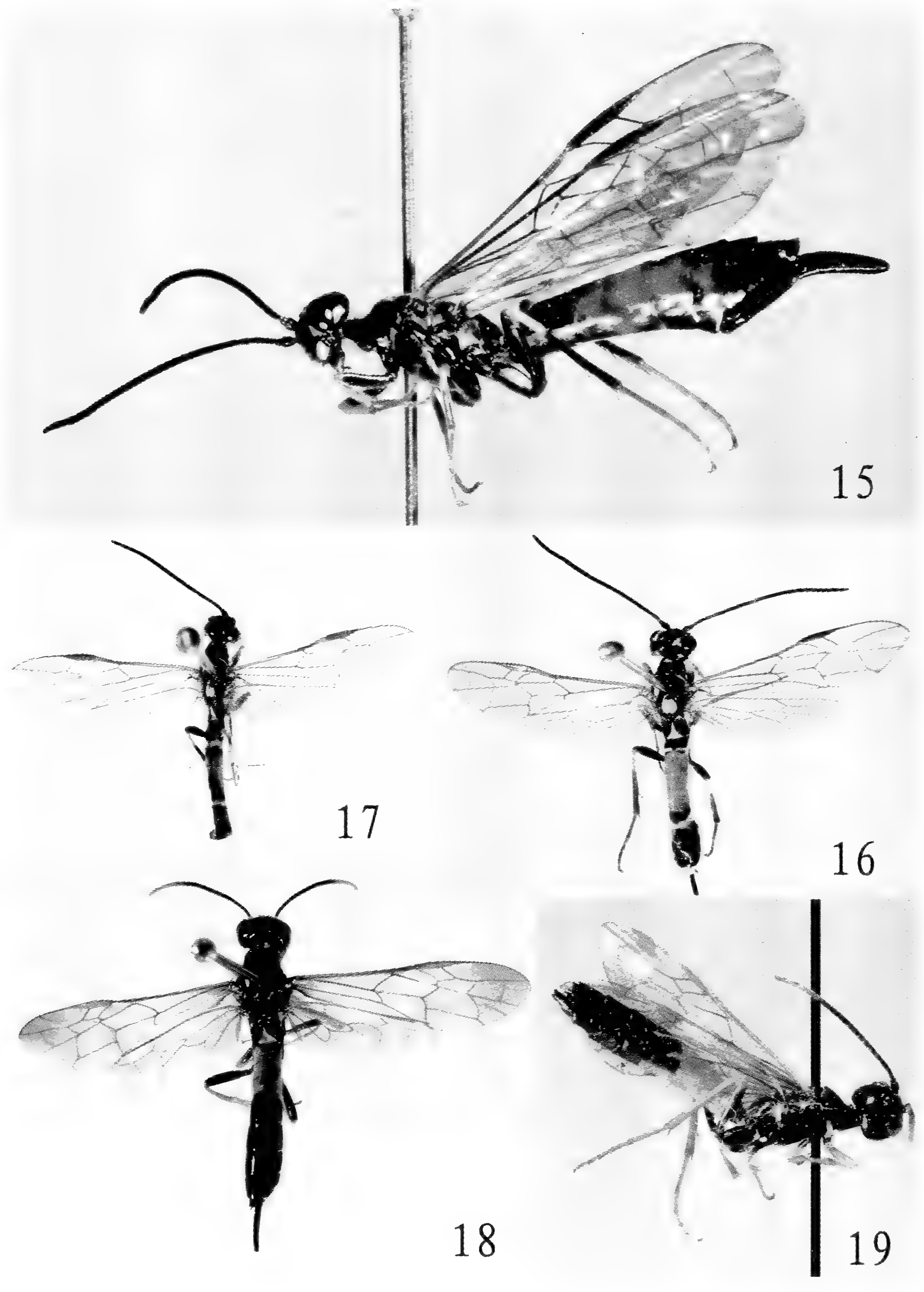


Figure 15. *Syrista xiaoi* sp. nov., Female adult. Figures 16-17. *Syrista similis* Mocsàry: 16. Female adult; 17. Male adult. Figures 18-19. *Syrista parreyssii* (Spinola): 18. Female adult; 19. Male adult.

Syrista similis Mocsàry, 1904
(Figs. 7-11, 16-17)

Syrista similis Mocsàry, 1904, Ann. Mus. Hungar., 2: 496.
Cephus subrufus Matsumura, 1912, Thous. Ins. Jap. Suppl. 4: 212.
? *Neosyrista japonica* Benson, 1935, Ann. Mag. Nat. Hist. s. 10, 16: 552.

Diagnosis: Body length 14-15 mm in female and 13 mm in male. Posterior margin of pronotum, tegulae, mesoscutellum largely, a spot on the ventral side of fore coxa, the 10th abdominal tergite yellow, posterior margins of the 3rd and 7th abdominal tergites each with a distinct yellow band; 3rd segment of labial palp as long as broad (Fig. 7); head distinctly narrowing behind eyes; inner tooth of claw hardly longer than outer tooth (Fig. 8, female; Fig. 10, male); abdomen about 1.7 times longer than head and thorax together, posterior margin of 7th sternite deeply incised, apex of 8th sternite round (Fig. 11); ovipositor as long as hind tibia, middle serrulae of lancet close to each other and not oblique (Fig. 9).

The female and male adults as in Figs. 16-17.

Notes: The above diagnosis is based on the type of the species (in the Hungarian Natural History Museum) and specimens examined by the author from China (in the collection of the Central South Forestry University) and Japan (in DEI, Deutsches Entomologisches Institut, Müncheberg). All those specimens have the pronotum with a distinct yellow hind margin. However, the type specimens of *Neosyrista japonica* Benson, 1935, have the pronotum entirely black. The color of the posterior margin of pronotum may be variable. The male of this species is very variable in the color of the abdominal tergites 4-5, which may be entirely red or dominantly black, and posteriorly reddish or golden yellow.

Specimens Examined: 8 females and 3 males, Zhejiang: Hangzhou, 1984. IV. 25, leg. J. He; 1 male, Zhejiang: Longquan, Mt. Fengyang, 1982. VIII, leg. K. Zhu (Zhejiang University); 1 female and 1 specimen (abdomen missing, possibly a male), Japan, Nose-Hatsutani (Oosaka), 1972. VII. 5, leg. H. Kumamoto (DEI). Type examined (type is deposited in Hungarian Natural History Museum, a female specimen with collecting data and name labels handwritten by Mocsàry. I had recorded the data of the type when I visit Budapest in the summer of 2005 but lost them with my computer in Paris).

Distribution: China (Jiangsu, Zhejiang, Fujian); Japan (Hokkaido, Honshu, Shikoku, and Kyushu after Takeuchi 1938).

***Syrista parreyssii* (Spinola, 1843)**
(Figs. 12-14, 18-19)

Cephus parreyssii Spinola, 1843, Ann. Soc. Ent. France, s. 2, 1: 116-117.
Cephus orientalis Tischbein, 1852, Stett. Ent. Zeit. 13: 139.
Cephus spectabilis Stein, 1876, Stett. Ent. Zeit., 37: 58-59.
Macrocephus robustus Mocsàry, 1883, Magyar. Ak. Termès Ertek 13(11): 9-10.
Cephus parreyssi (Sic!) var. *rufiventris* Jakovlev, 1888, Horae Soc. Ent. Ross. 22: 373. Primary homonym of *Cephus rufiventris* Cresson, 1880.

Diagnosis: Body length 15-21 mm. Body and legs black, abdominal segments 2-4(5) and apex of antenna red, apex of each femur, tibiae and tarsi red or reddish brown, hind tarsus more or less infuscate; wings distinctly infuscate, pterostigma pale brown; third segment of labial palp broader than long (Fig. 12); antenna with 25-30 segments; area between antennal sockets low and evenly elevated, without a keel; head in dorsal view hardly narrowed behind eyes; abdomen about 2 times as long as head and thorax together; anal cell in forewing without a cross vein; claw with inner tooth hardly as long as outer tooth in both sexes (Fig. 13); head and thorax dorsally distinctly punctured; apical half of 7th sternite in male depressed with posterior margin straight, not emarginated, 8th sternite distinctly emarginated at apex (Fig. 14).

The female and male adults as in Figs. 18-19.

Specimens Examined: 2 females and 1 male, USSR, Armenia, Arzakhan, 1700m, 1977.VII., leg. L. Zombori (Hungarian Museum of Natural History); 1 male, Turkey, Nevsehir province, Ürgüp, 1970. VI. 11, leg. J. Gusenleitner (Coll. Blank); 1 female, Turkey, Hakkâri province, on the city limits of Hakkâri, 1800 m altitude, 1988. VII. 24, leg. C. Schmid-Egger (Coll. Blank); 1 female. Turkei, Konya, 20km W., 1978. VI. 12, leg. Max Schwarz (DEI); 2 males, Turkei, Loel, Sertavul, 1978. VI. 9-10, 1400m, leg. Max Schwarz (DEI); 1 male, [possibly Azebaijan], Caucasus, Araxes valley, leg. Leder & Reitter (DEI); 1 female (abdomen missing), Croatia, Dubrovnik ("Ragusa"), leg. Rudolph (DEI); 1 female, without collecting data (DEI); 1 male, Armenien, 40km O Jerewan, 1987. VII. 13, leg. Gechard 1200m, J. Oehlke (DEI).

Distribution: West Palaearctic (Albania, Armenia, Azerbaijan, Bulgaria, Croatia, Cyprus, Greek, Iran, Israel, Italia, Macedonia, Spanish, Turkey).

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THORACONAUPACTUS, A NEW BRAZILIAN GENUS OF BROAD NOSED WEEVIL (COLEOPTERA: CURCULIONIDAE: ENTIMINAE) ASSOCIATED WITH *LEUCAENA* (FABACEAE)[1]

M. Guadalupe del Río[2] and Analía A. Lanteri[2]

ABSTRACT: A new monotypic genus of Naupactini (Coleoptera: Curculionidae), *Thoraconaupactus* del Rio and Lanteri is described based on the new species *Thoraconaupactus vaninii* del Río and Lanteri (Type locality: Brazil, Bahia, Itaji). Two different morphotypes are distinguished by characters of the vestiture: one from Itaji, with integument brown, smooth, and vestiture mostly setose; the other from Ibiraba with integument black, rugose and vestiture mostly squamose. *Thoraconaupactus* is similar to *Naupactus* Dejean and *Teratopactus* Heller in several characters, and shows some unique features such as the strongly transverse pronotum with a sub-basal tooth-like projection on each side. Specimens were collected in association with a species of *Leucaena* (Fabaceae). The paper includes habitus photographs and line drawings of genitalia, mouthparts, and other external features of taxonomic value.

KEY WORDS: Curculionidae, Naupactini, *Thoraconaupactus vaninii*, new genus, new species

The tribe Naupactini (Curculionidae: Entiminae) consists of approximately 65 genera (Alonso-Zarazaga and Lyal, 1999) with over 500 species mainly distributed in Central and South America. Most species of this weevil tribe have been classified in *Naupactus* Dejean, a genus currently under revision, which includes 161 species (O´Brien and Wibmer, 1982; Wibmer and O´Brien, 1986) or 214 according to Morrone (1999), who included all *Pantomorus* Schoenherr species from South America within *Naupactus*. The genus *Naupactus* is not only a key genus to understanding the phylogeny of the Naupactini but also a taxon that contains a great number of agricultural pest species, such as the "white-fringed beetle," *N. leucoloma* Boheman and the "rose weevil," *N. cervinus* Boheman (Scataglini et al., 2005). These species cause serious damage to legumes, citrus, ornamental plants, and several other cultures (Lanteri and Marvaldi, 1995; Lanteri et al., 2002).

In the present contribution we describe a new monotypic genus of Naupactini close to *Naupactus* and *Teratopactus* Heller, the latter recently revised by del Río et al. (2006). The new genus *Thoraconaupactus* is endemic to northeastern Brazil and its single species was collected on *Leucaena* sp. (Fabaceae).

METHODS

This study is based on specimens housed at the Museu de Zoologia da Universidade de São Paulo, SP, Brazil (MZSP). No other specimens have been seen

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in other entomological collections examined. One paratype specimen has been deposited at Museo de La Plata (MLPC).

Dissections of female and male genitalia were made according to standard entomological techniques. Specimens were drawn using a camera lucida adapted to a stereoscopic microscope. Measurements were taken with an ocular micrometer. Abbreviations herein used are the following: WF—width of frons between anterior margin of eyes; WR—width of rostrum across apex; LR—length of rostrum from anterior margin of eye to apex; WC—maximum width of club; LC—maximum length of club; WP—maximum width of pronotum; LP—maximum length of pronotum; WE—maximum width of elytra; LE—maximum length of elytra. The terminology used for the metatibial apex follows Thompson (1992). 'Outer bevel present' is used instead of 'corbel enclosed' (Emden, 1944), and 'metatibial apex simple or bevel absent,' instead of 'corbel open.'

Type labels include the species name, the type status and the authors of the name. They are red and yellow for holotype and paratypes, respectively. The sex of each specimen is also indicated.

SYSTEMATIC ENTOMOLOGY

Thoraconaupactus new genus, del Río and Lanteri

Type species: *Thoraconaupactus vaninii* new species, del Río and Lanteri. Herein designated by monotypy.

Etymology: The generic name is a combination of the latin word *thorax* (referring to the particular subtrapezoidal and tuberculate pronotum) and *naupactus* (alluding to its probable close relationship to *Naupactus* Dejean).

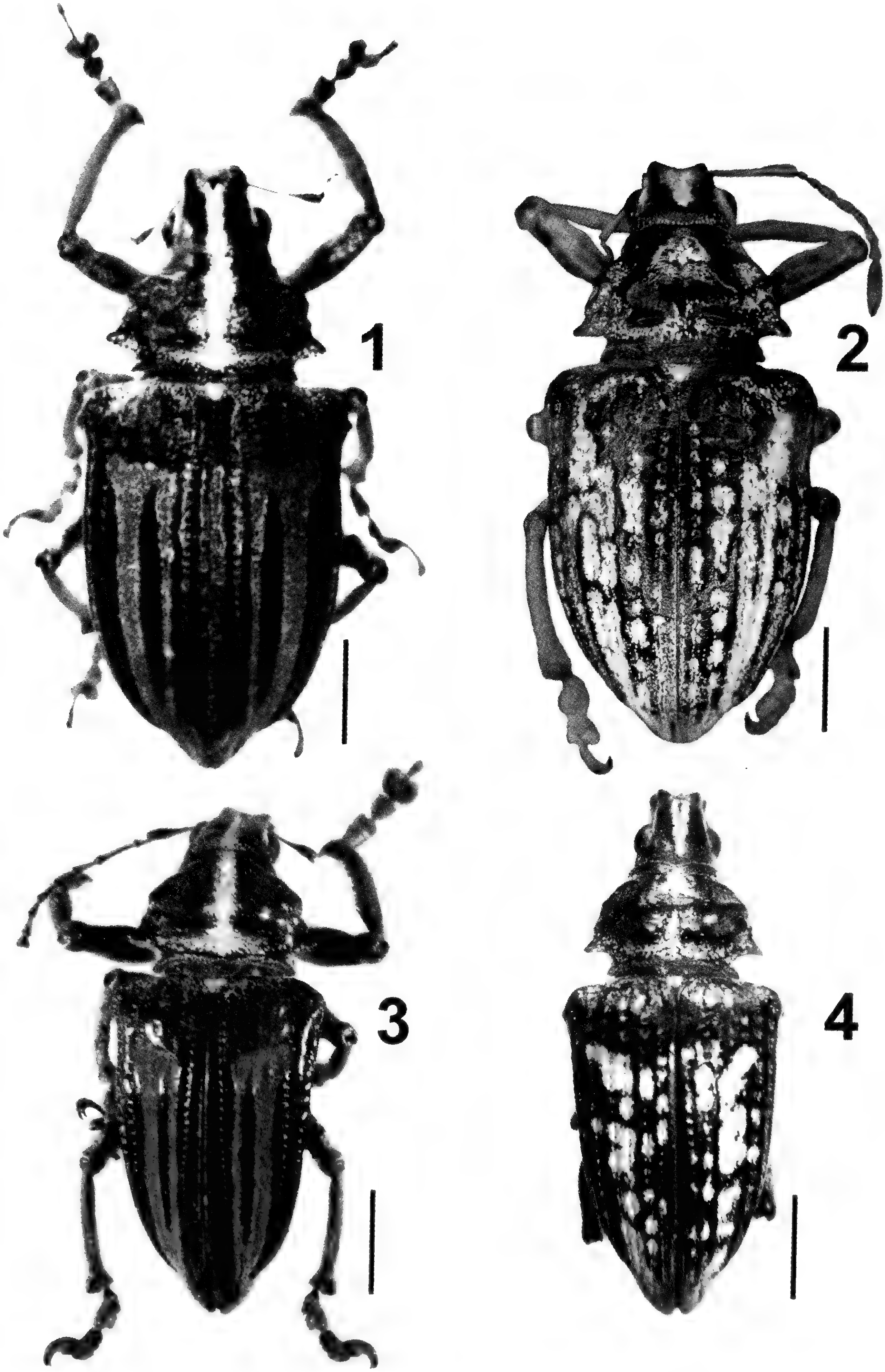
Diagnosis: *Thoraconaupactus* is easily distinguished from other genera of Naupactini by the large body size (close to 20 mm) and the strongly transverse subtrapezoidal pronotum, having a pair of tooth-like projections directed outwards near the base (Figs. 1-4). All tibiae bear a mucro and rows of denticles on the inner margins. Metatibial apex with outer bevel present and oblique with respect to the main tibial axis. The ovipositor has styli and rows of setae on each side of the distal half.

Description: Large and robust (female 17-19.5 mm long; male 15-16 mm). Integument brown to black, mostly visible. *Vestiture* of dorsum mainly composed of scales forming a longitudinal white vitta along rostrum and pronotum and pairs of ocher or white vittae along elytra; venter and inner face of femora and tibiae mostly covered with very long setae. *Rostrum* (Figs. 5-6) about as long as, to slightly longer than wide at apex (LR/WR:1-1.27), lacking lateral carinae but with slightly elevated lateral borders; rostral groove widened at apex, exceeding hind margin of eyes; scrobes slightly curved downwards, ending below eyes; epistome slightly depressed, broad and densely squamose; gular angle obtuse. Frons somewhat depressed. Vertex slightly convex. Eyes (Figs. 5-6) moderately convex; preocular impression distinct. *Mouthparts.* Prementum (Fig. 8) subcordate, external surface slightly concave, without setae; internal surface with a moderately developed median keel flanked by lateral depressions; palpi shorter than prementum and forming an obtuse angle with it. Maxillae (Fig. 9) with mala almost perpendicular to axis of palpus, having seven basal lacinial teeth and numerous setae; article 1 of palpi elongate, article 2 transverse and article 3 subcylindrical, apically papillate. *Antennae* (Fig. 10) very long; scape reaching hind margin of eye; funicular article 2 more than 2x as long as article 1; articles 3-5 about 3x as long as wide; articles 6-7 about 2x as long as wide; club oval to slightly fusiform (LC/WC: 2.50-3.30). *Pronotum* (Figs. 1-4) subtrapezoidal, strongly transverse (WP/LP: 1.69-1.87); anterior margin strongly thickened; disc finely punctuate, elevated regarding the anterior and posterior margins, with various transversal prominences, three pairs near midline (the posterior one crested) and two pairs near sides; flanks with a small hole placed on a distinct elevation and a strong tooth-like projection directed outwards, near base; posterior margin strongly constricted. *Scutellum* distinct, squamose. *Elytra* (Figs. 1-5) moderately elongate (LE/WE: 1.47-1.77); base slightly bisinuate; humeri largely developed; disc slightly convex, forming edges with sides at interval 7; striae distinct, with punctures medium-sized to large; intervals slightly convex; apical declivity slight, apex subacute. Metathoracic wings well developed. Legs. Front coxae slightly separated from each other; slightly closer to anterior than to posterior margin of pronotum; all tibiae with strong mucro and a row of six strong denticles on inner margin, intercalated with smaller denticles (Fig. 7); all denticles decreasing in size from front to hind tibiae; metatibial apex with broad, setose outer bevel, oblique with respect to main tibial axis; apical comb very long, dorsal comb almost indistinct. *Abdomen* (Figs. 11-12). Ventrite 2 as long as 3+4; apex of ventrite 5 subacute in female and truncate in male; tergites strongly sclerotized.

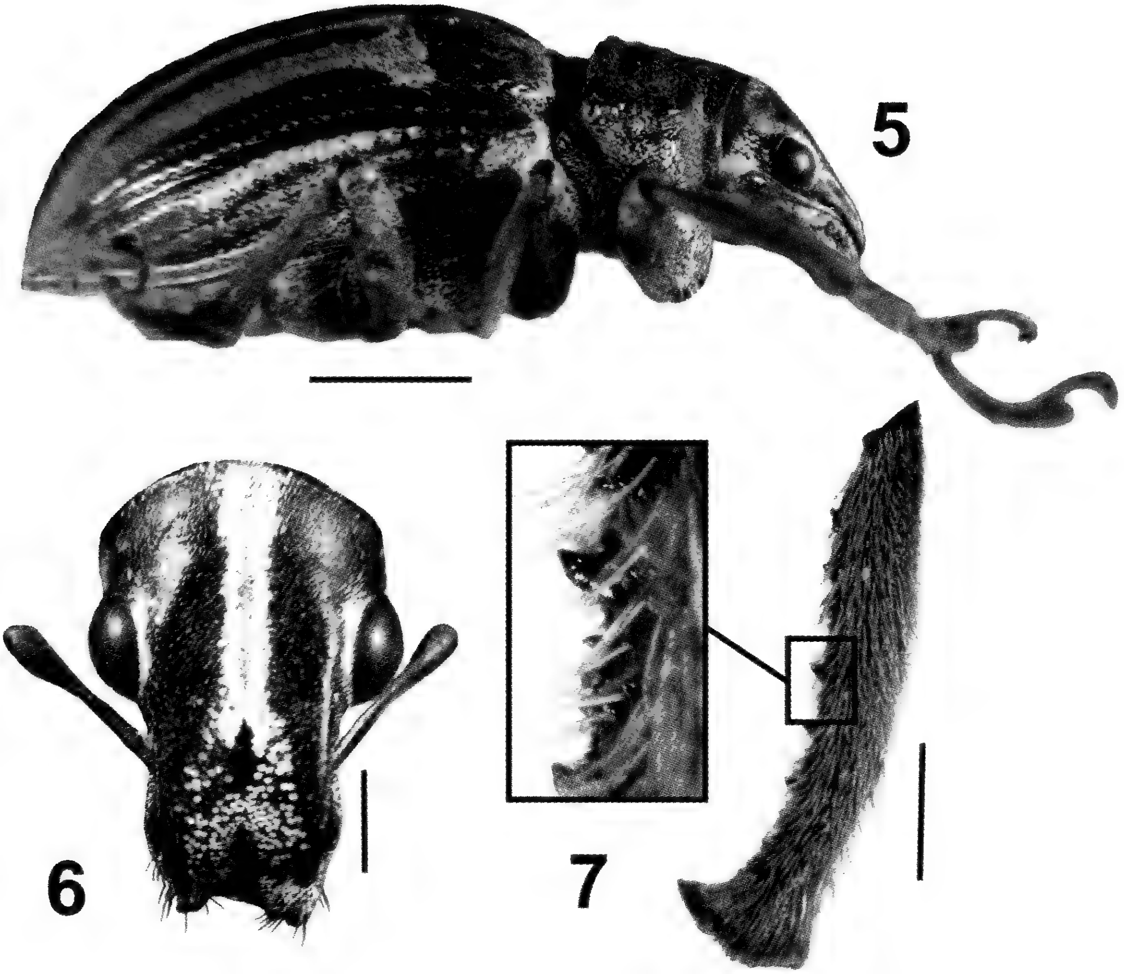
Female genitalia (Figs. 13-16). Sternite VIII (Fig. 14) subrhomboidal, with distal part shorter than proximal part, bearing minute short setae and apical tuft of long setae, base with pair of linear sclerotizations; apodeme about 3x as long as plate. Ovipositor (Fig. 13) slightly longer than abdomen, studded with microscopic oval scales and a row of long setae on each side of baculi, on distal part (Fig. 15); ventral baculi slightly divergent towards proximal end; hemisternites moderately sclerotized; styli present. Spermatheca (Fig. 16) subcylindrical with short conical nodulus, indistinct ramus and moderately long cornu.

Male genitalia (Figs. 17-18). Aedeagus (median lobe plus apodemes) slightly longer than abdomen; median lobe scarcely curved and slightly longer than its apodemes (Fig. 17); apex somewhat expanded and with a distinct point (Fig. 18); endophallus folded and with surface studded with short, pointed spines on distal half, lacking endophallic armature.

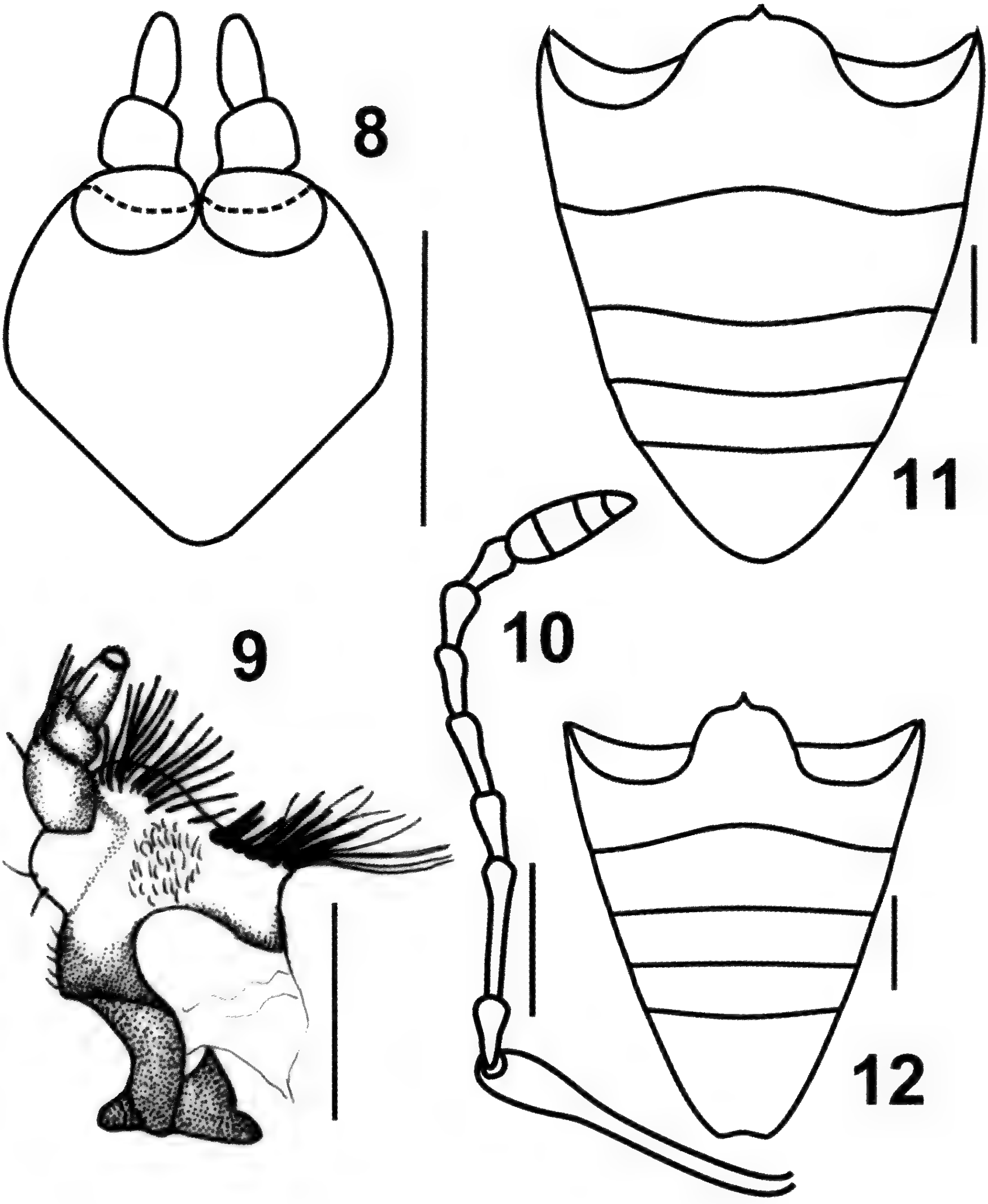
Sexual Dimorphism: Males (Figs. 3- 4) smaller than females (Figs. 1-2); rostrum slightly longer (LR/WR, female: 1-1.10; male: 1.15-1.27); pronotum less transverse (WP/LP, female: 1.76-1.87; male: 1.69-1.72); prominences of the pronotum more distinct; and elytra more slender and elongate than in females (LE/WE, female: 1.47-1.55; male: 1.70-1.77).



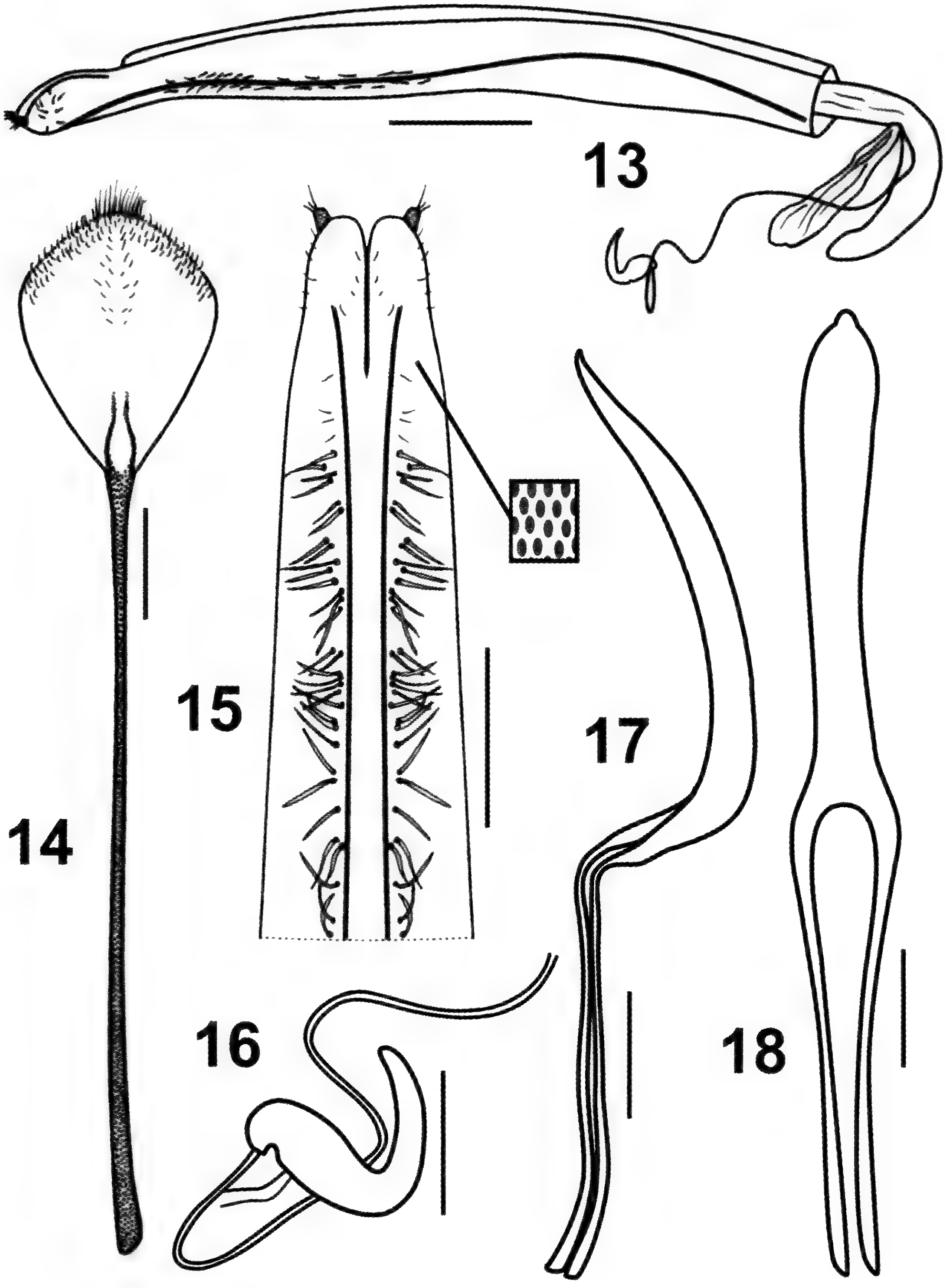
Figs 1-4. Dorsal habitus of *Thoraconaupactus vaninii*. 1 and 3 morphotype A, 1 holotype female, 3 paratype male; 2 and 4 morphotype B, 2 paratype female, 4 paratype male. Scales: 3 mm.



Figs 5-7. External morphology of *Thoraconaupactus vaninii*. 5 Habitus, lateral; 6 head and rostrum, frontal; 7 front tibia, external. Scales: 3 mm (habitus); 1 mm (rostrum and head, tibia).



Figs 8-12. Mouthparts, antenna, and abdomens of *Thoraconaupactus vaninii*. 8 prementun, external; 9 left maxilla; 10 left antenna; 11 abdomen, female; 12 abdomen, male. Scales: 0.5 mm (prementum); 1 mm (maxilla, antenna); 2 mm (abdomens).



Figs 13-18. Genitalia of *Thoraconaupactus vaninii*. 13 ovipositor, lateral, with spermatheca attached to bursa copulatrix through spermathecal duct; 14 sternite VIII; 15 ovipositor, ventral, distal half; 16 spermatheca; 17-18 aedeagus, lateral and ventral. Scales: 0.5 mm (spermatheca); 1 mm (sternite VIII, ovipositor, aedeagus).

Remarks: *Thoraconaupactus* is placed in the tribe Naupactini sensu Emden (1944). It is distinguished by a particular combination of characters and some special features not seen in other genera of Naupactini that justify the description of a new generic entity. The most diagnostic character of *Thoraconaupactus* is the strongly transverse subtrapezoidal pronotum, very constricted at the base, with tooth-like projections directed outwards on the posterior third of the sides, and with an elevated disc bearing several transverse prominences (the posterior ones crested). Other particular character of the new genus is the metatibial bevel oblique with respect to the main axis of the tibia, the very long apical comb of the metatibia, and the presence of a distinct elevation on each side of the pronotum, bearing a small hole on top (function unknown).

The most closely related genera of *Thoraconaupactus* are probably *Naupactus* Dejean and *Teratopactus* Heller. The former is a highly diversified genus mainly distributed in tropical and subtropical South America, and the latter includes seven species mainly distributed along the Chacoan and Parana subregions of the Neotropical region (del Río et al., 2006). *Thoraconaupactus* shares several characters of generic value with the typical *Naupactus* (type species *Naupactus rivulosus* Olivier) such as the shape of the rostrum, the long and slender antennae, the well developed humeri and metathoracic wings, the broad bevel of the metatibial apex, and the ovipositor bearing styli, with moderately sclerotized hemisternites (see Lanteri, 1981). The characters that relate *Thoraconaupactus* to *Teratopactus* are the separate front coxae and the presence of a row of denticles along the inner margin of the three pairs of tibiae, but *Teratopactus* is distinct by the lack of metatibial outer bevels, the presence of humeral teeth, the reduction of metathoracic wings, and the ovipositor lacking styli and with strongly sclerotized hemisternites prolonged in a nail-like process. Among all species of *Teratopactus*, the most similar to *Thoraconaupactus* is the basal *Teratopactus tuberculatus* Arrow, the only species with a primitive type of ovipositor (with styli and lacking hemisternites prolonged in a nail-like process) (del Río et al., 2006).

Moreover, the three genera share the presence of two rows of setae along the distal half of the ovipositor on each side of the ventral baculi that is a character not seen in any other genus of Naupactini.

Geographical Distribution: *Thoraconaupactus* seems to be endemic to the state of Bahia, northeastern Brazil. Its distribution corresponds to the biogeographic province of the Caatinga (American Indian language that means “open forest”), according to the schemes of Cabrera and Willink (1973) and Morrone (2006). This province of the Neotropical region is a dry savanna with scattered xerophyllous forests, bounded by the Brazilian Atlantic forest on the east side and the Cerrado on the west side. The former biogeographic province is a humid tropical forest and the latter is characterized by open xerophyllous forests with low trees, shrub and a stratum of herbs rich in Poaceae and Fabaceae, with gallery forests extended along the rivers.

Host Plants: Fabaceae are one of the main hosts for most Naupactini species and the adults of *Thoraconaupactus* were collected on *Leucaena* sp., a mimosoid legume native to the Neotropical Region. *Leucaena* includes thirteen species that grow as trees and short shrubs, with high quality foliage attractive to herbivores (Zárate, 1994). Three of these species are recorded for Brazil, but only one, *L. leucocephala,* ranges into the state of Bahia, a fact that makes us suspect that it is probably the host plant of *Thoraconaupactus*. *Leucaena leucocephala* is widely distributed in tropical America, restricted to lowlands up to 1000 m and has been introduced as a multipurpose tree to several tropical countries (Shelton and Brewbaker, 1994).

Thoraconaupactus vaninii new species, del Rio and Lanteri

Etymology: The species is named after the outstanding weevil specialist Dr. Sergio Vanin (Museu de São Paulo, Brazil), who loaned us the material for this study. The gender of the name is masculine.

Type Material: Holotype. Female, 19.5 mm long, "F.N.P. Itaji, BA. BRAZIL, 04/06/84, E. Cunha, s/ *Leucaena*, 2290" (MZSP). Genitalia dissected and placed in a vial with glycerine Allotype. Male, 16 mm long, same data as holotype (MZSP). Genitalia dissected and placed in a vial with glycerine. Paratypes. 1 female, same data as holotype (MLPC); 1 female and 1 male, Ibiraba, BA, Brazil, Rocha & Xavier col, 1-III-1996 (MZSP).

Description: Holotype female (Fig. 1) large and robust (19.5 mm long). Integument dark brown, mostly visible. Dorsum with a white median stripe of dense oval scales, from apex of rostrum to base of pronotum; scutellum white; sides with a scarcely defined vittae from apex of rostrum to apex of elytra, passing below eyes, extended along sides of pronotum and covering intervals 8-10 (Fig. 5). Elytra with three pairs of ocher longitudinal vittae (Fig. 1), composed of suberect seta-like scales, covering depressed surfaces of stria 2, interval 4 and intervals 8-9. First and second vittae anteriorly connected by a transverse segment extended from striae 2 to 5 (Fig. 1); third vitta partially overlapped with lateral white stripe (Fig. 5). Elytral apex with disperse erect fine black setae. Legs mostly setose; coxae and femora covered with setae and moderately dense oval scales; setae on anterior face of front coxae, inner face of femora (especially fore femora) and tibiae very long and dense. Venter covered with oval scales distributed along head, sides of thoracic sterna and sides of abdomen, mixed with recumbent long setae, particularly dense along middle of ventrites. Other morphological features as those described for the genus. Morphometric ratios: rostrum LR/WR: 1.05; WF/WR: 1.31; antennal club LC/WC: 2.5; pronotum WP/LP: 1.87; elytra LE/WE: 1.55; LE/LP: 1.33. Allotype male. Smaller and more slender than female, 16 mm long. Morphometric ratios: rostrum LR/WR: 1.15; WF/WR: 1.12; antennal club (missing); pronotum WP/LP: 1.69; elytra LE/WE: 1.77; LE/LP: 1.19.

Variation: Within *T. vaninii* we distinguish two morphotypes mainly based on characters of the vestiture, color pattern and morphometrics: A) Holotype, allotype and other specimen from Itaji (Figs. 1, 3, and 5). Integument brown and smooth. Elytral vittae well defined, composed of ocher suberect seta-like scales. Venter mostly setose; setae very long and dense; ventral scales almost restricted to head, sides of thoracic sterna and sides of abdomen. Pronotal prominences moderate. Elytra moderately elongate (LE/WE, female: 1.55, male: 1.77) B) Specimens from Ibiraba (Figs. 2 and 4). Integument black and slightly rugose. Elytral vittae not well defined, but interrupted, composed of whitish oval scales. Venter mostly squamose; setae long, moderately dense; scales covering most ventral surfaces from head to abdomen. Pronotal prominences strong. Elytra less elongate than in morphotype "A" (LE/WE, female: 1.47, male: 1.70).

We consider that the differences between the morphotypes does not justify a species distinction but corresponds to intraspecific variation. The pattern described for *T. vaninii* was also seen in other species of Naupactini, such as *Naupactus leucoloma* Boheman, *Atrichonotus taeniatulus* (Berg) and *Teratopactus nodicollis* (Boheman) (Lanteri and O' Brien, 1990; Lanteri and Marvaldi, 1995; del Río et al., 2006), all of which have two different morphotypes in some of their populations, distinguished mainly by characters of the vestiture and morphometrics. The localities where morphotypes were collected correspond to areas 600 km distant, with slightly different climate and vegetation conditions. Morphotype "A" comes from Itají (14° 10' S, 40° 00' W), 210 km NW of Salvador and 110 km from the Atlantic coast, at 600 m above sea level. This locality is on the boundary with the Brazilian Atlantic forest, which is a humid environment (tropical forest, 100 km wide, extended from the state of Recife in the north to Rio Grande do Sul in the south). Morphotype "B" comes from Ibiraba (10° 45' S, 42° 48' W), 530 km NW of Salvador and the Atlantic coast, at 400 m above sea level. This location is more distant from the coast, closer to the Cerrado biogeographic province, and drier than the locality of morphotype "A" (although it is near the banks of the San Francisco River). It is possible that the infraspecific variation herein described for *T. vaninii* is associated with the geographic distribution. This hypothesis should be tested with the study of larger samples of specimens from different localities.

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FIRST RECORD OF PHORETIC COPULATION IN *DISSOMPHALUS XANTHOPUS* ASHMEAD (HYMENOPTERA: BETHYLIDAE)[1]

Juan M. Vargas[2]

ABSTRACT: A new record of phoretic copulation is reported for a pair of specimens of *Dissomphalus xanthopus* Ashmead, taken joined using Malaise trap in Lexington, Kentucky U.S.A.

KEY WORDS: *Dissomphalus*, phoretic copulation, Hymenoptera, Bethylidae, U.S.A.

Dissomphalus Ashmead, 1893 (Bethylidae: Pristocerinae), was described based on some male specimens possessing two pubescent tubercles on the second metasomal tergite (Evans 1954). These tergal processes seem to be an ornamented opening of a gland on the surface of this tergite (Evans 1979). Taxonomy of *Dissomphalus* is strongly based on males (Azevedo 1999b), however the females are also highly modified in comparison with males with different species being very similar and hardly separable (Azevedo 1999b). Females are very rare in collections, and association with males is virtually impossible unless couples are taken *in copula* (Azevedo 2003).

The copula is important also because the males can carry the females about during copulation as predicted by Evans (1962), who suggests the phoretic behavior based on two specimens of *D. barberi* mounted on the same pin and without certified genital union between them, from Maine with the following data: 1 male, 1 female, on same pin, August 24, 1947, "flying 6 P.M." (A. E. Broer) [USNM]. This is until now the nearest sign of the phoretic copulation in *Dissomphalus xanthopus*.

The first records of pairs of *Dissomphalus* taken in copula are the specimens sampled by Mr. Fritz Plaumann. These specimens were described by Evans (1966) as *D. connubialis,* with material containing 14 pairs, all from Nova Teutonia, Santa Catarina, Brazil, various dates Oct-March, 1962-65 (F. Plaumann) [MCZ, USNM]. This phenomenon has been recorded again with certainty for this genus by (Azevedo 1999 a, b), through *D. mirabilis, D. bisserratus,* and *D. bifurcatus.*

Dissomphalus xanthopus is the type species of the genus. It has widespread distribution throughout the United States and Mexico (Evans 1978) and the commonest species of the genus in USA collections. The species has been recorded for Kentucky just one time before by Evans (1962), one of these specimens were later further analyzed by Azevedo (1999a). The most recent new locality records in USA were Pennsylvania and Indiana by Azevedo (1999c).

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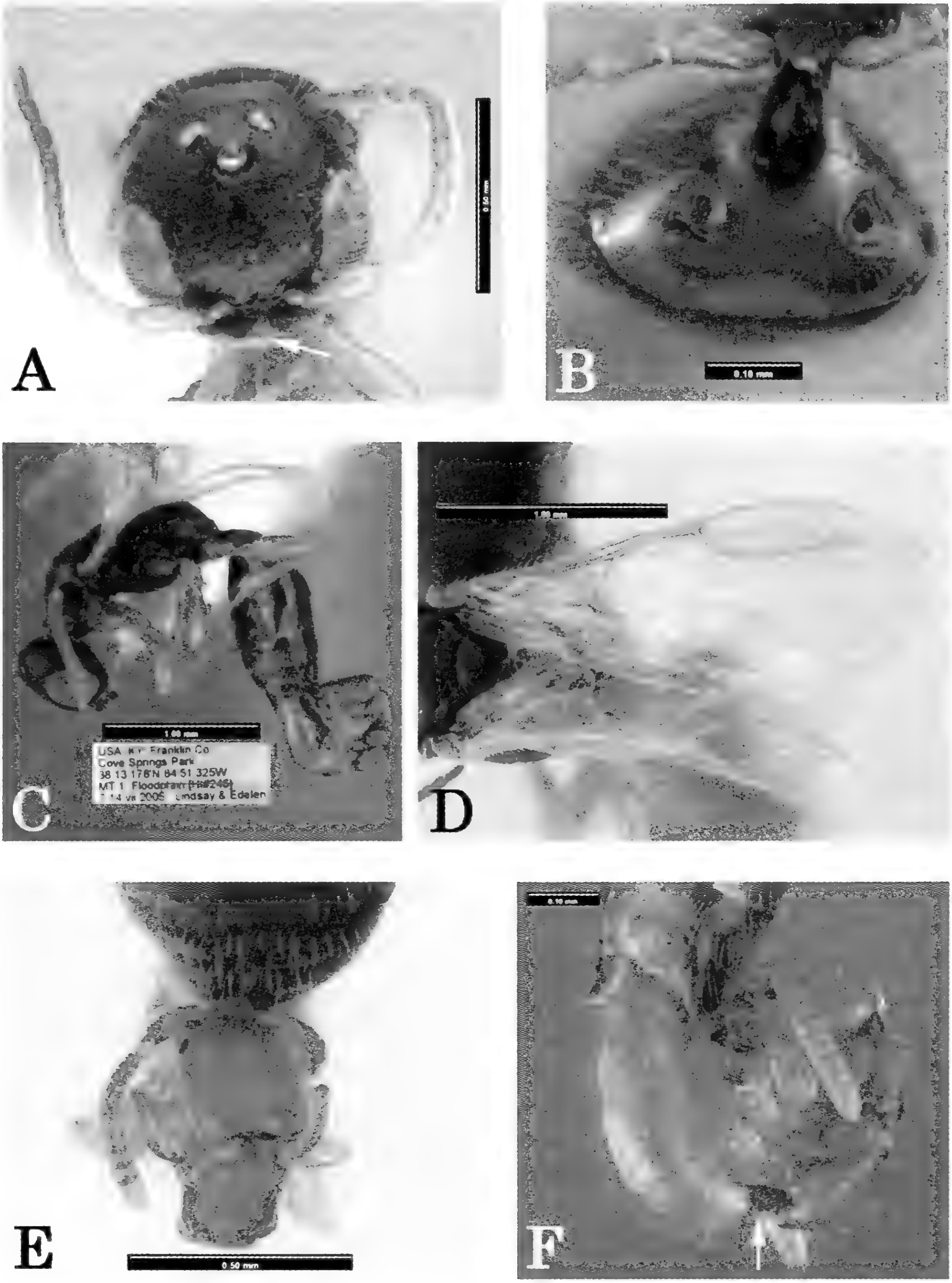

Figure 1. A. Detail of the male head, the arrow shows the clypeal shape in dorsal view, B. Dorsal pits of the male second tergite of the gaster, C. *D xanthopus* pair in copula, D. Male fore wings, E. Posterodorsal view of the female head, F. Lateral view of female in copula, showing the fairly distinct pedicel (arrow).

This species can be recognized by the rather broad and flat-topped median elevation of the clypeus (Fig. 1A). The pits on the second metasomal tergite are characteristic although rather variable in size (Fig. 1B). The females show considerable variation in head shape, and Evans (1962) believes that the female which he described and figured in 1954 as the *allotype* of *D. barberi* is actually *D. xanthopus.* Evans (1954) comments that *D. barberi* Evans is closely allied to *D. xanthopus,* but the male differs in characters of the clypeus, propodeum, second tergite and genitalia, the female is also very similar to that of *D. xanthopus,* differing only in head shape and in the complete lack of sculpturing on the front.

The capture of a male and female *in copula* (Fig. 1C) is important evidence for conspecificity (Gordh 1990) especially in the pristocerine genera because of the profound sexual dimorphism. Gordh (1990) found the first Australian record of the genus *Apenesia* in phoretic copulation, he added that the aedeagal clasp would give the female control over the timing of release, presumably mediated by stimuli from an appropriate habitat or host, and that phoretic copulation possibly evolved once in the subfamily Pristocerinae occurring early in the development of the group of genera which subscribe to it. This paper helps to clarify the sex association between male and female through a short description of them.

METHODS

Abbreviations used in the text are as follow: LH, length of head at middle, measured in frontal view, from the vertex crest to the median apical margin of the clypeus; OOL, ocello-ocular line, measured in latero-dorsal view, the shortest distance from the eye top to the posterior ocellus; VOL, vertex-ocular line, measured in lateral view, the distance from the eye top to vertex crest; WF, width of frons, measured in frontal view, its minimum width, usually about the bottom of the eyes; HE, height of eye, measured in lateral view, across its maximum height (length); WH, largest width of head, measured in frontal view, its maximum width including the eyes; WOT, width of the ocellar triangle, measured in frontal view, the maximum width, including the ocelli. The nomenclature for the sculpture follows Eady (1968). Terminology follows Evans (1964).

Collection Data: USA. KENTUCKY: Franklin Co., Cove Springs Park. 38° 13.178'N 84° 51.325'W. MT 1: Floodplain [HI#246]. 7-14.vii.2005. (Lindsay & Edelen.) Malaise trap. K. Seltman. The material is deposited in UKYC.

RESULTS

This pair is showing a position consistent with the female-above-male copulatory stance, very common in the other bethylids taken before *in copula* (Fig. 3). The characters discussed here do not include the genitalia due to the scarcity of pairs *"in copula."* Furthermore the separation could be unsuccessful as the union may be very firm like in *Apenesia nitida* (Evans 1969).

The main characters of these specimens are: Male: Length 2.88 mm. LH 1.17 x WH; WF 1.84 x WH; WF 1.74 x HE; OOL 1.10 x WOT; VOL 3.47 x HE;

propodeal disc 1.2 x as long as wide. Costal vein not extending beyond the stigma (Fig. 1D). Female: Length 1.65 mm. nearly half the length of male. LH 0.69 x WH; distance eye - mandible 0.084 mm. The female's head position is an obstacle to take the mandible length measure. Body color nearly pale yellowish brown; body sparsely covered with high pale yellowish hairs. Eyes dark; front shining, with very fine reticulate coriaceus sculpturing visible under high magnification; punctures widely separated; sides of head slightly convex. Posterior margin of head, in frontal view, slightly concave (Fig. 1E). Dorsum of thorax and propodeum somewhat shining, with reticulate sculpturing like that of head. Propodeum with small spiracles, directed laterad and carinae along dorsum sides fairly well developed, gaster with pedicel fairly distinct (Fig. 1F).

The characters related here support the inference of Evans 1978 about the differences between the females of the two species (*barberi* and *xanthopus*), now is possible to be categorical about the identity of each species. The key made by Evans (1978) is the very fair tool to the identification of females in the USA.

DISCUSSION

This is the first time *D. xanthopus* Asmead has been found in phoretic copulation. This behavior has been recorded for the genus *Apenesia* from both South America and Australia, for *Pristocera* from Rumania, The Far East and Hungary (Gordh 1990), and for *Dissomphalus* from Brazil (Evans 1966, Azevedo 1999 a, b). Since Evans (1954), who considered that the female is not easily associated with the male, this is the first opportunity to confirm the characters of the female for this species. The features agree with the abridged description on page 296 of the same paper. Several ratios are given here in order to update the description. This is the first record of this behavior for *Dissomphalus* in North America and for the species *D. xanthopus* in the World.

The only *Dissomphalus* species with phoretic copulation recorded are *D. connubialis* (Evans 1966) designated after as synonymy by Azevedo (1999a) of *D. brasiliensis* Kieffer 1910, *D. mirabilis* (Evans 1966), *D. bisserratus* and *D. bifurcatus* (Azevedo 1999b), seemingly *D. barberi* (Evans 1978) and now *D. xanthopus*.

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MORPHOLOGY OF THE SPERMATHECA OF SEVERAL SPECIES OF *DYSMACHUS* (DIPTERA: ASILIDAE) FROM TURKEY: A SCANNING ELECTRON MICROSCOPE STUDY, SECOND PART[1]

Mahmut Erbey,[2] Selami Candan,[3] and Abdullah Hasbenli[3]

ABSTRACT: The spermathecae of four species of the asilid genus *Dysmachus* (*D. cephalenus*, *D. obtusus*, *D. safranboluticus*, and *D. tricuspis*) were studied with both light and scanning electron microscopy (SEM). There are three spermathecae the species examined. The spermatheca consists of receptaculum seminis (reservoir), ductus receptaculum (spermathecal ducts), ejection apparatus, apodemes of furca and furca. Receptaculum seminis of *D. cephalenus*, *D. obtusus*, *D. safranboluticus* and *D. tricuspis* have a swollen structure at the base but it extends apically like a duct. Sperm is kept in receptaculum seminis. In all species, the spermathecal ducts are covered by chitin layer. Spermathecal ducts are not connected with a common duct, but open separately to the bursa copulatrix. The ejection apparatus controls the passage of spermatozoa. The ejection apparatus are covered by strong muscles that regulate its opening and closing. Furca in *D. cephalenus* and *D. tricuspis* divided, with a triangular apodeme, lateral arms broad; Y-shaped in *D. obtusus* and *D. safranboluticus*.

KEY WORDS: spermatheca, *Dysmachus*, Asilidae, Diptera, scanning electron microscopy (SEM)

The spermatheca is an accessory female reproductive organ that occurs in all orders of insects except for Protura and Collembola (Matsuda, 1976). It is a complex organ and it varies greatly in shape and histology between insect groups (Pendergrast, 1957). The spermatheca plays a significant role in sperm storage, copulation, fertilization, and oviposition, among others (Gschwenthner and Tadler, 2000).

In general, insect spermatozoa are transfered during copulation and stored by the female in the spermatheca where they remain viable until they are used to fertilize eggs (Davey, 1965). The period of storage ranges in different insects, from hours to months, and in exceptional cases such as the honey bee, sperm may be stored in the spermatheca for years.

In insects, the spermatheca has different structures depending on the insect group (Lay et al., 1999). The spermatheca opens to the vagina through spermathecal ducts (Dallai et al., 1993). The spermatheca usually consists of a receptaculum seminis (receptacle) and a spermathecal duct (ductus receptaculum), which is covered by muscle fibers. While the receptacle stores and nourishes the spermatozoa, the spermathecal duct transports spermatozoa in opposite directions, first to the receptacle at mating and then to the vagina at fertilization. The structural organization of the spermatheca reflects these two functions (Dallai et

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al., 1993). The ejection apparatus is generally located at the middle of the spermathecal ducts, and it controls the passage of spermatozoa by contractions of muscle fibers (Theodor, 1976; Rodriguez, 1994; Pabalan et al., 1996; Yuval et al., 1996; Bloch Qazi et al., 1998; Gschwentner and Tadler, 2000; Fritz et al., 2002).

In most species of Asilidae, the spermatheca consists of the following parts: reservoir; spermathecal duct, which may be short or very long, it may show differentiations in its various parts; a funnel-shaped valve which opens into a differentiated part of the duct (= the furca); and two accessory glands (Theodor, 1976).

The literature contains little information on the spermathecae of the Asilidae although it has been extensively studied by light microscopy. The spermathecae of *Laphria flava* have been described by Reichardt (1929). Osley (1946), Artigas and Papavero (1988a, b), Artigas et al. (1988), and Artigas and Papavero (1991) described with egg as well as the spermathecae of several American species of asilids and gave information on the glands and musculature but did not describe other structures in more detail.

Sixteen species of *Dysmachus* are known from Turkey (Hasbenli and Geller-Grimm, 1999; Geller-Grimm, 2006). The structure of the spermatheca in four species of *Dysmachus* (*D. fuscipennis, D. picipes, D. praemorsus*, and *D. transcaucasicus*) from Turkey was examined by Candan and Erbey (2006). Also Hasbenli et al. (2006) described a new species (*Leptogaster suleymani*) from Turkey and described the with egg as well as the spermathecal structure. In this study, the spermatheca structure of four additional species of *Dysmachus* has been examined in detail by light and SEM microscopes for the first time.

METHODS

In this study, specimens of *Dysmachus cephalenus*, *D. obtusus, D. Safranboluticus,* and *D. tricuspis* were obtained from dried museum material (Zoological Museum of Gazi University). To prepare the spermatheca, abdomens were first soaked in the 10% KOH (potassium hydroxide) for about 24 hours at 30°C to soften by hydrolysis the surrounding tissues. Then, the tissues were removed manually and the spermatheca were exposed and cleaned by fine dissection. Six cleaned spermatheca of each species were placed in glycerine. Observations and measurement were made using steromicroscope (Olympus SZX12) at a magnification of 40x.

For examination in the scanning electron microscope (SEM), the samples were fixed with 2.5 % glutaraldehyde in sodium phosphate buffer (pH 7.2) for 2 hours. Thereafter, they were washed with same buffer (pH 7.2) for 10 min., and then gradually dehydrated in an increasingly concentrated ethanol series (10 min each in 50-100%). Spermathecae were cleaned, dried, and mounted using a double-sided sticky tape on SEM stubs, coated with gold in a Polaron SC 502 Sputter Coater, and examined with a JOEL JSM 5600 Scanning Electron microscope at accelerating voltage of 20 kV. Spermathecal nomenclature follows Theodor (1976).

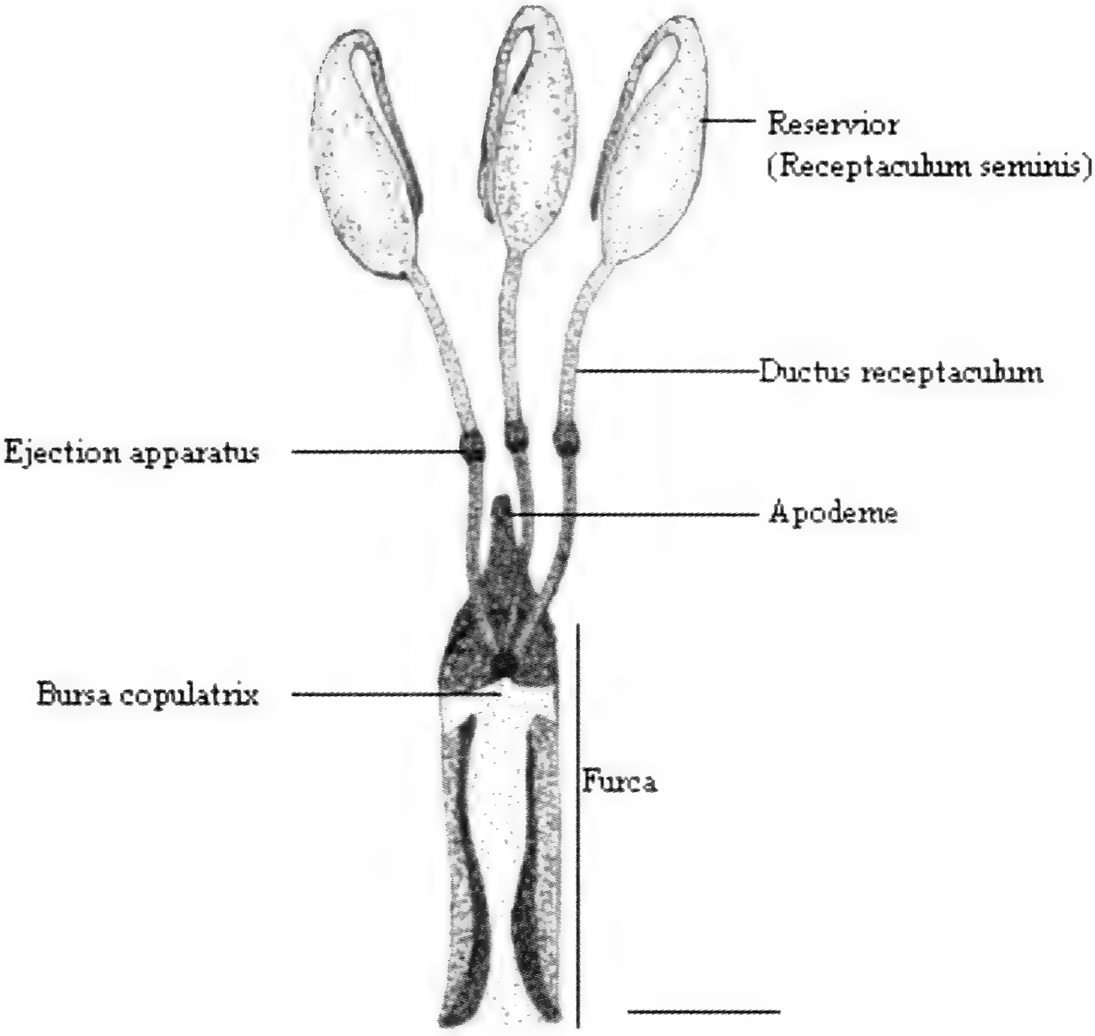


Fig.1. Spermatheca in *Dysmachus* (*D. cephalenus*) Scale bar: 0.5 mm.

SYSTEMATIC ENTOMOLOGY

Dysmachus cephalenus **Loew, 1871**

(Figs. 2 a- d)

The receptacle is very wide at the base and extends cylindirically towards the anterior. In anterior, spines are towards the receptacle (Fig. 2a). The length of receptaculum is 1.7 mm; its diameter, 0.3mm. Posteriorly, the receptacle is connected to spermathecal duct. The surface of the receptacle is covered by layer of chitin. The spermathecal ducts do not connect, instead they open separately into bursa copulatrix. The ducts are covered by chitin in a curly structure (Fig. 2b). The length of ducts between receptacle and ejection apparatus is 0.65 mm; its diameter, 0.03mm. The ejection apparatus is located at the middle of spermathecal duct. The ejection apparatus is a wider, swollen structure than the spermathecal duct (Figs. 2a, c). The spermathecal ducts are connecting to the anterior furca (Fig. 2d). The length of the ducts between the ejection apparatus and furca is 1.15mm; its diameter is 0.02mm. The length of furca is 1.55 mm; its diameter

0.28mm. In the posterior portion of the furca, the lateral signs are clearly evident. The bursa copulatrix extends anteriorly. The spermathecal ducts open to between the extension of bursa copulatrix and the apodeme (Fig. 2d). The furca is strongly chitinized and divided, bearing a triangular apodeme; the lateral arms are broad. Apodeme is chitinized and triangular shaped. The length of apodeme is 0.8mm. The portion of the apodeme that is connected to the furca is wide while the rest is thin (Fig. 2d).

Dysmachus obtusus **Becker, 1923**

(Figs. 3 a- d)

The receptacle is very wide at the base and extends cylindrically. In the anterior, spines are towards receptacle (Fig. 3a). The length of receptaculum is 0.85mm; its diameter, 0. 14 mm. The surface of receptacle is covered by layer of chitin. The spermathecal ducts are not connected but separate from the bursa copulatrix. The ducts are covered by chitin in curly structure. Groove-like structures are present on the surface of ducts, extending parallel to the longitudinal axis of duct (Fig. 3b). The length of duct between receptacle and ejection apparatus is 0.3mm; its diameter, 0.02mm. The ejection apparatus is wider, more swollen than the spermathecal duct. The ejection apparatus is nearer the receptacle than to the furca (Figs. 3a, c). The length of the ejection apparatus is 0.05mm; its diameter 0.03mm. The ejection apparatus is strongly chitinized and has overlapping layers of chitin (Fig. 3c). The length of duct between ejection apparatus and furca is 1.3mm; its diameter 0.01mm. The furca is strongly chitinized. The length of furca is 1.15mm; its diameter 0.3mm. The furca are wide anteriorly, narrow posteriorly and V shaped (Figs. 3a, d). The portion of apodeme that is connected to the furca is narrow and the rest of apodeme is wide. The apodeme is strongly chitinized and triangular shaped (Fig. 3d). The length of the apodeme is 0.45mm.

Dysmachus safranboluticus **Hasbenli and Geller-Grimm, 1999**

(Figs. 4 a- d)

The receptacle is a little wide but it becomes narrow anteriorly. Anteriorly, the spines point toward the receptacle (Fig. 4a). The length of receptaculum is 1.1mm; its diameter 0.14mm. The surface of the receptacle is covered by a layer of chitin. The length of the spermathecal duct between the receptacle and the ejection apparatus is 0.3mm, its diameter 0.05mm. The ducts are covered by chitin forming a curly structure (Fig. 4b). The ejection apparatus is wider and more swollen than the spermathecal duct (Figs. 4a, c). The length of ejection apparatus is 0.05mm, its diameter 0.03mm. The ejection apparatus is strongly chitinized with overlapping layers of chitin. (Fig. 4c). The length of duct between the ejection apparatus and the furca is 1.5mm, its diameter 0.01mm. The furca is strongly chitinized (Fig. 4a). The length of furca is 1.4mm, its diameter 0.5mm. It is wide anteriorly, narrow posteriorly and V shaped. The portion of the apodeme connected to the furca is narrow and other part of apodeme is wide (Figs. 4a, d). The apodeme is strongly chitinized and triangular-shaped (Fig. 4d). The length of apodeme is 0.46mm.

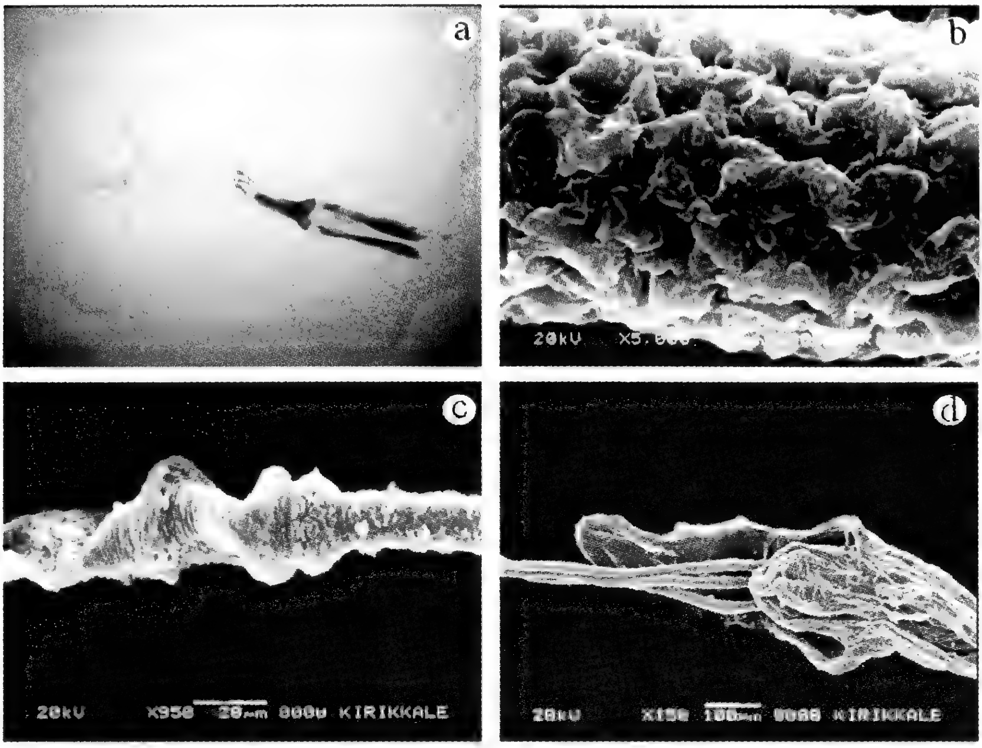


Figure 2 a-d. Light and SEM micrographs of spermatheca of *D. cephalenus* a. Spermatheca general view (Light microscope, scala bar: 0.5mm). b. Spermathecal ducts. c. Ejection apparatus. d. Apodeme and anterior of furca.

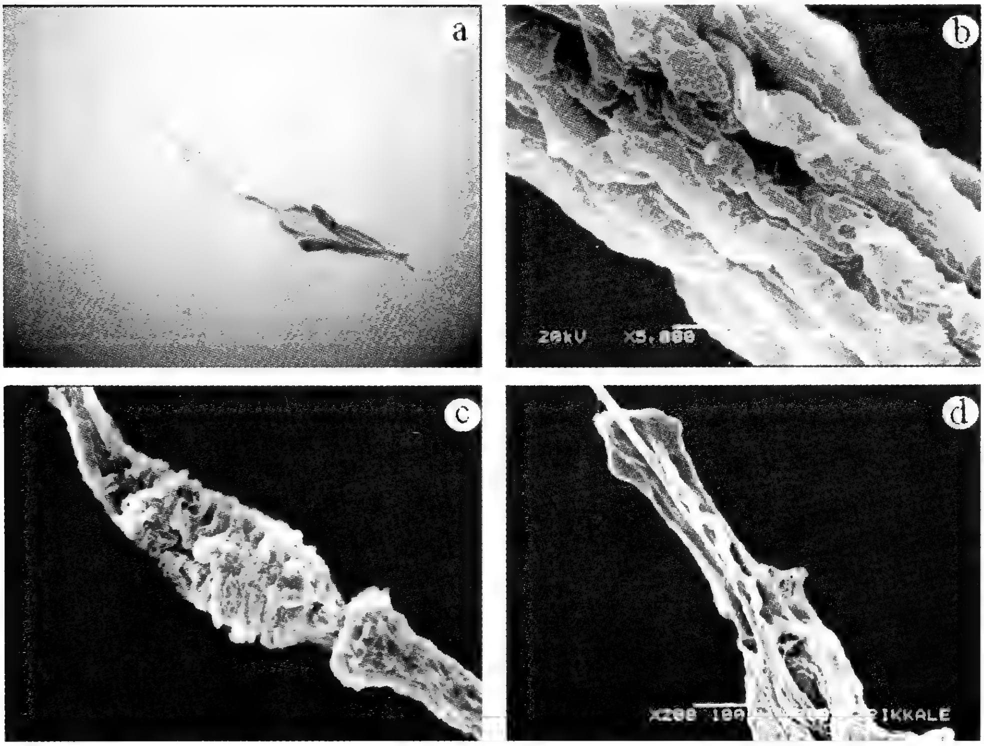
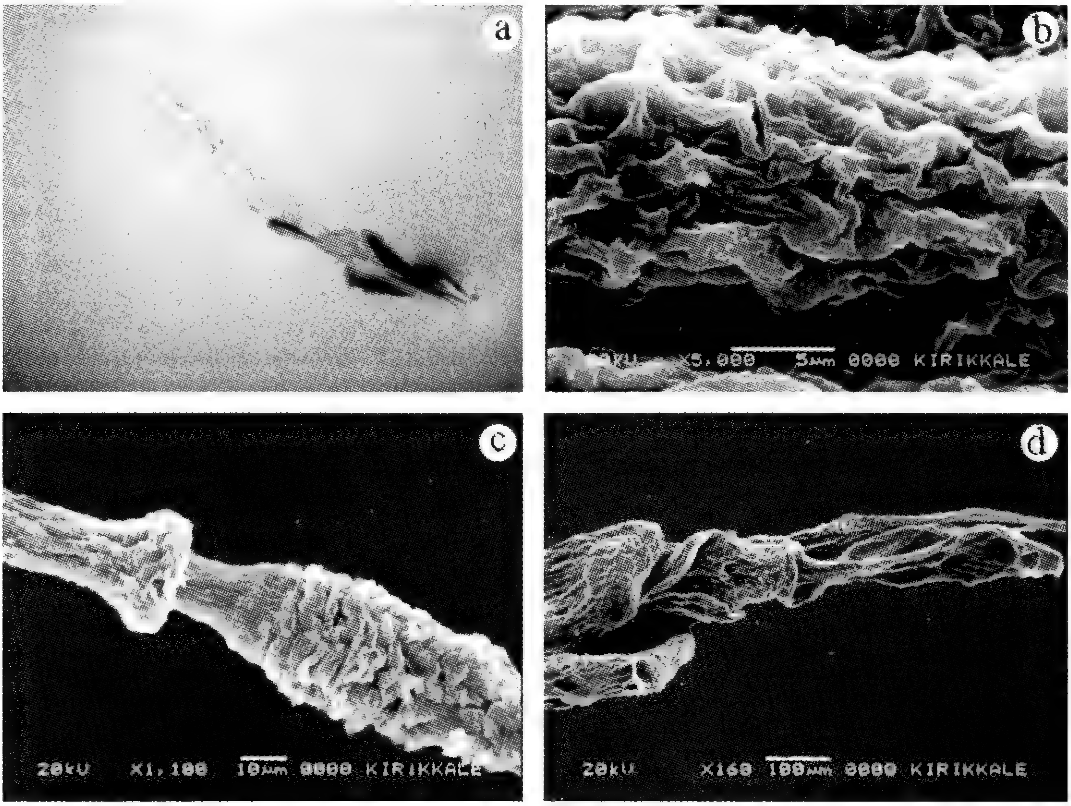


Figure 3 a-d. Light and SEM micrographs of spermatheca of *D. obtusus*. a. Spermatheca general view (Light microscope, scala bar: 0.5mm). b. Spermathecal ducts. c. Ejection apparatus. d. Apodeme and anterior of furca.



Figures 4 a-d. Light and SEM micrographs of spermatheca of *D. safranboluticus*. a. Spermatheca general view (Light microscope, scala bar: 0.5mm). b. Spermathecal ducts. c. Ejection apparatus. d. Apodeme and anterior of furca.

Dysmachus tricuspis **(Loew, 1848)**
(Figs. 5 a-d)

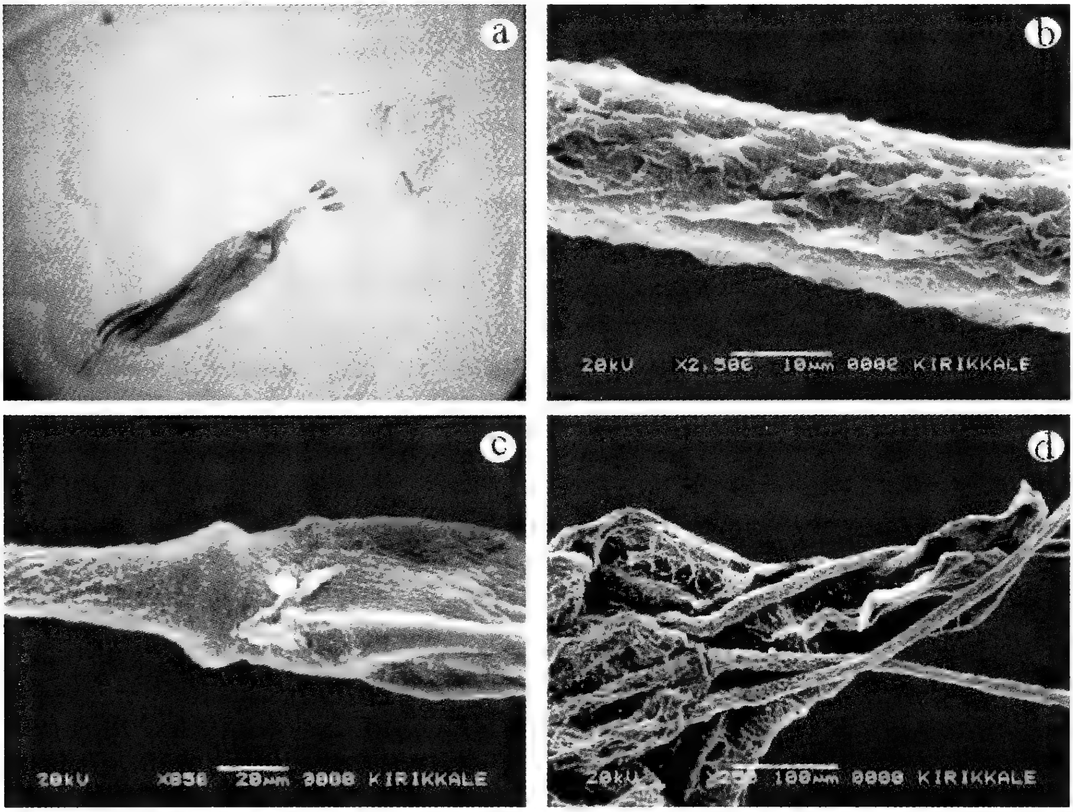
The receptacle is very wide at the base and extends cylindrically anteriorly. Anteriorly, the spines point towards the receptacle (Fig. 5a). The length of receptaculum is 2.4mm; its diameter 0.3 mm. Posteriorly, the receptacle is connected to the spermathecal duct. The surface of receptacle is covered by a layer of chitin. The spermathecal ducts connect separately to the bursa copulatrix. The surroundings of ducts are covered by chitin in curly structure (Fig. 5b). The length of duct between the receptacle and ejection apparatus is 0.65mm; its diameter 0.05mm. The ejection apparatus is located at the middle of spermathecal duct. The ejection apparatus is wider and more swollen than the spermathecal duct (Figs. 5a, c). The length of ejection apparatus is 0.16mm; its diameter 0.08mm. The spermathecal ducts are connected to the anterior of furca. The length of duct between the ejection apparatus and furca is 0.8mm; its diameter 0.02mm. The furca is strongly chitinized and divided, and the lateral arms are broad (Fig. 5d). The length of furca is 2.4mm; its diameter 0.62mm. The apodeme is chitinized and triangular-shaped. The length of apodeme [0.4mm] is short and wide (Fig. 5d).

DISCUSSION

Spermathecae are ectodermal glands opening into the anterior tract of the common oviduct of female insects. It plays a significant role in many functions such as sperm storage, copulation, fertilization and ovipozition (Gschwantner and Tadler, 2000). In the vast majority of insects, spermatozoa are transferred to the genital area of female during copulation. Thereafter, spermatozoa are stored in the spermatheca where they remain until they are used for fertilization (Davey and Webster, 1967; Villavaso, 1975).

In insects, accessory glands of the spermatheca produce secretions that flow into the lumen of the spermathecal duct or to the receptacle, contributing to the protection of the spermatozoa (Villavaso, 1975; Dallai, 1975). Fertilization occurs on the apical part of the bursa copulatrix. The eggs are inseminated by spermatozoa and fertilized eggs are oviposited.

All insects, except the orders Protura and Collembola, have spermatheca (Matsuda, 1976). Some groups of Diptera have one (e.g. Drosophilidae), two (e.g. Tephritidae, a few members of the Asilidae and Muscidae) or three spermathecae (e.g. some of Muscidae, most members of Asilidae and Bombylidae) (Couri 2004; Theodor 1976, 1983, Hasbenli et al., 2006). Three spermatheca are common in flies. Theodor states “There are three spermathecae in all the Asilidae examined exept *Proctacanthus, Eccritosia,* and *Myaptex,*” in which there are



Figures 5 a-d. Light and SEM micrographs of spermatheca of *D. tricuspis*. a. Spermatheca general view (Light microscope, scala bar: 0.5 mm). b. Spermathecal ducts. c. Ejection apparatus. d. Apodeme and anterior of furca.

only two. In this study, we observed that the examined species of *Dysmachus* have three sparmatheca (Figs. 2a, 3a, 4a, 5a). All three spermathecae are usually of the same form, but the median spermatheca is of slightly different form in some species (*Polyphonies*). The only exeptions so far found are *Leptogaster* and *Euscelidae* in which the median spermatheca is markedly different from the lateral spermatheca in some species (Thedor, 1976; Hasbenli et al., 2006).

In most examined *Dysmachus* species, the spermatheca is basally swollen but apically is extended and narrowed, like a duct (Figs. 2a, 3a, 4a, 5a). According to Theodor (1976), there are two different types of receptacle-resorvoir in *Dysmachus*, one type is a cylindrical or tubular; the second type is very wide. In this study, examined species of *Dysmachus* (*D. cephalenus*, *D. obtusus*, *D. safranboluticus* and *D. tricuspis*) have wide types. In all species, the structure of receptacle seems to be similar throughout, but the length of receptacles varies between species (Figs. 2a, 3a, 4a, 5a). Candan and Erbey (2006) stated that there are two different types of receptacles in some *Dysmachus* species. Cylindrical, as in *D. fuscipennis* and rather wide as in *D. praemorsus, D. picipes,* and *D. transcaucasicus.*

In different insect groups, the surface of the receptacle and of the spermathecal duct is covered by a layer of chitin, especially in *Ceratitis capitata* and *Dacus oleae* (Tehpritidae: Diptera), *Locusta migratoria* (Acrididae: Orthoptera), and *Aedes aegypti* (Culicidae: Diptera) (Clements and Potter, 1967; Dallai et al., 1993; Lay et al., 1999). In *Dysmachus*, we determined that the surface of the receptacle and of the spermathecal ducts is also covered by a curly chitin structure. However, the character of the surface is different among species (Figs. 2b, 3b, 4b, 5b). The ejection apparatus differs in the four investigated species. In *D. obtusus* and *D. safranboluticus*, it is strongly chitinized or there are overlapping layers of chitin (Fig. 3c, 4c). Chitin is accumulated in middle part of ejection apparatus, but in *D. cephalenus* and *D. tricuspis*, the ejection apparatus is located at the middle of the spermathecal duct. The ejection apparatus is very wide and more swollen than the spermathecal duct (Figs. 2a, 5a).

In this study, we observed that the spermathecal duct is connected to the anterior portion of the furca. The bursa copulatrix occurs in the anterior portion of the furca. Spermathecal ducts are not connected with a common duct but open separately to the bursa copulatrix. In all species, spermathecal duct connections to bursa copulatrix are different from each other (Figs. 2d, 3d, 4d, 5d). In *D. obtusus* and *D. safranboluticus* spermathacal ducts are similar structurally (Figs. 3b, 4b).

Theodor (1976) noted that the furca has apodeme in some group of Diptera, but he does not provide information on the functional significance of apodeme. Members of the Laphriinae and the Dasypogoninae (Asilidae) have a short and wide apodeme but members of Asilinae have a long apical apodeme (Theodor, 1976). In all species, we observed that apodeme of furca has a different structure (Figs. 2d, 3d, 4d, 5d).

In *D. cephalenus* and *D. tricuspis*, the apodeme is wide basally, but apically it is narrow and triangular. A swollen pillow-like structure is present at the base of the apodeme. This structure probably supports the spermathecal ducts (Figs. 2d, 5d). In *D. obtusus* and *D. safranboluticus*, the apodeme is narrow basally and triangular (Figs. 3d, 4d).

The furca is a modified sternite 9. It consists of a 'frame' with a membrane between the lateral arms in which the ducts, or the common duct, opens. It varies widely in form. It is more or less U or V shaped in the Laphriinae and Dasypogoninae; it consists of only lateral arms connected by a membrane in *Leptogaster* and *Dioctia*. The furca of the Asilinae differs markedly. It consists of a usually long, slender frame, with a distal apodeme of varying form and length and a posterior median sclerite between the posterior ends of the lateral arms (Thedor 1976). In this study, the furca of *D. cephalenus* and *D. tricuspis* is divided and the lateral arms are broad (Figs. 2a, 5a), but it is Y shaped in *D. obtusus* and *D. safranboluticus* (Figs. 3a, 4a).

The structure of the spermathecae has important systematic characters in some groups of insect. It has been used successfully in the systematics of fleas, and may be useful to elucidate taxonomic and phylogenetic relationships among asilids.

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ERRATA

The recently published paper, entitled "New state record of the mayfly *Baetisca laurentina* ..." by Tarter et al. [2007 *Entomological News* 118(4), pp. 407-416] was published with several mistakes in the correspondence between the figures and the legends. Herein, these mistakes are corrected.

Figure 1. County distribution records of *Baetisca berneri* in West Virginia.

Figure 2. County distribution records of *Baetisca carolina* in West Virginia.

Figure 3. County distribution records of *Baetisca gibbera* in West Virginia.

Figure 4. County distribution records of *Baetisca lacustris* in West Virginia.

Figure 5. County distribution records of *Baetisca laurentina* in West Virginia.

Figure 6. County distribution records of *Baetisca rubescens* in West Virginia. Figure 6 was printed twice.

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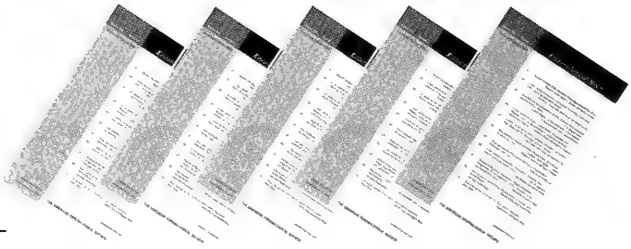

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FIRST SPECIES OF *PLEUROCERINELLA* FROM THE NEW WORLD (DIPTERA: CONOPIDAE), WITH THE DESCRIPTION OF A NEW SPECIES[1]

Sidney Camras[2]

ABSTRACT: A new species of *Pleurocerinella*, *P. neotropica*, from Bolivia is described. It is closest to *P. dioctriaeformis* known from Indomalaysia and Africa.

KEY WORDS: Diptera, Conopidae, *Pleurocerinella*, new species, Bolivia

This is the first species of the genus known from the Western Hemisphere. *Pleurocerinella* was previously known from eastern Asia, Indonesia, and Africa, with five described species. *Pleurocerinella* belongs to a group of genera having a very long first flagellomere two to four times as long as the relatively short pedicel. These genera, known as the *Microconops*-group, are all from Australia. A paper of the Old World species of *Pleurocerinella* is planned.

Pleurocerinella neotropica, NEW SPECIES

(Fig. 1)

Head. Vertex short, dark brownish. Ocellar tubercle black, with three ocelli. Frons black, smooth. Face, parafacial, and gena yellow. Ground color of face gray, covered with yellow-whitish pollen. Antenna black. Scape and pedicel subequal, first flagellomere three times as long as pedicel. Stylus black, two segmented. Proximal segment of stylus black, its process short; apical segment partly yellowish, elongated and sharply pointed. Proboscis black, about 1.75 times as long as head length. Occiput black.

Thorax black, scutellum slightly brownish. Pleural stripe yellowish white pollinose as are the coxae. Legs black. Tibiae yellowish and white pollinose basally. Tarsi somewhat brownish. Pulvillae yellow; claws yellow, black apically. Wings hyaline with a gray stripe filling cell r_{2+3} (submarginal). Remainder of wing hyaline. Halteres yellow.

Abdomen black, partly with black sheen. Tergites with some white pollinose posterior margins, becoming wider and more distinct laterally on second and third tergites. Theca long and narrow, as long as height of its tergite.
Length: 6 mm.

Type Data: Holotype ♀. Bolivia: Cochabomba 26.1.1976 L.E. Pena (Canadian National Collection). Paratype ♀. Same data. (CNC) To be retained in the Field Museum Collection. Very similar to the holotype. Length: 5 mm. See comment about the face under "Remarks."

Remarks. This species is closest to *Pleurocerinella dioctriaeformis* Brunetti (p. 368-9) but has a long proboscis rather than the usual short proboscis as long as the head. The long narrow wing stripe will distinguish *P. neotropica* from all the

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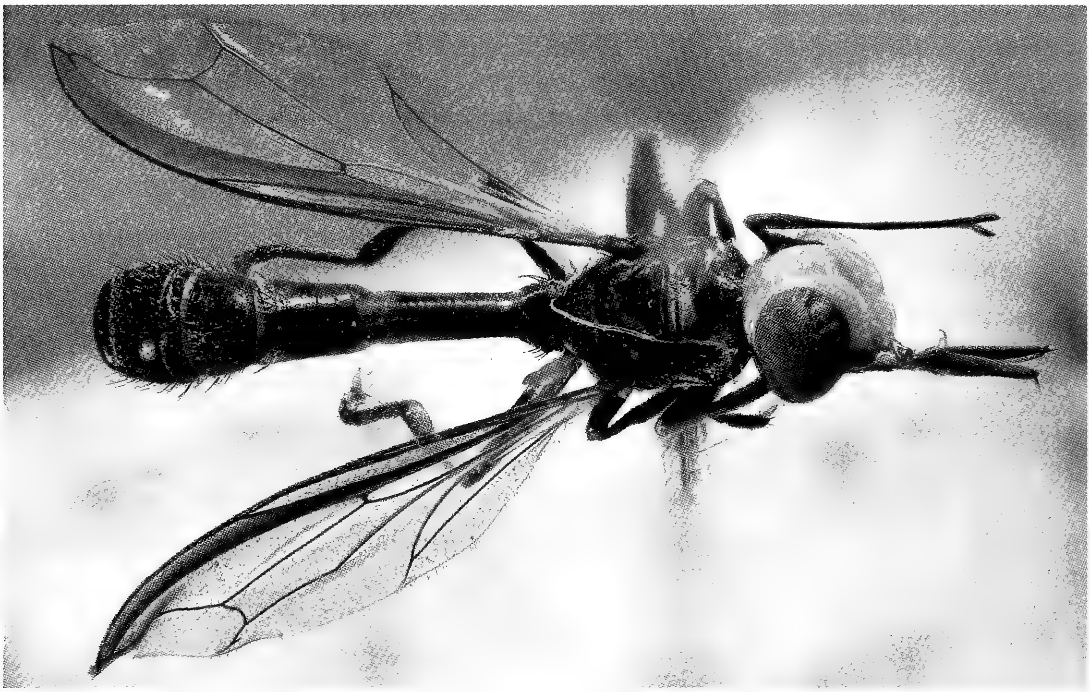

Figure 1. *Pleurocerinella neotropica.* Holotype.

other species of the genus. I believe that this wing pattern is unique. The genus and its tribe are immediately distinguished from all the other new world species of Conopinae by the long first flagellomere being three times as long as the short pedicel. This species is easily distinguished from all of the other Conopidae in the New World by the very long first antennomere and very short pedicel. The wing pattern is also very distinctive.

The narrow face compared to a wide frons in many of the specimens at hand from the Old World, was at first thought to be species significant. Later I realized that the narrow face was due to contraction and drying. The holotype of the new species has the face fully inflated, but in the paratype it is contracted on one side and normal on the other.

ACKNOWLEDGEMENTS

Rebekah Shuman and James Boone of the Division of Insects at the Field Museum (Chicago, Illinois) assisted in the preparation of this work. F. C. Thompson (Department of Entomology, Systematic Entomology Laboratory, National Museum of Natural History, Washington, DC) reviewed the manuscript and made some valuable suggestions and corrections.

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A CONTRIBUTION TO THE ALGERIAN AQUATIC COLEOPTERA (HELOPHORIDAE) FAUNA, WITH TWO NEW RECORDS, AND A DISCUSSION ON TOTAL AEDEAGOPHORE LENGTH OF *HELOPHORUS AQUATICUS* (LINNAEUS, 1758)[1]

Ü. Incekara,[2] H. Ibncherif,[3] and S. Bouzid[4]

ABSTRACT: Distributional and systematic notes on northeastern Algerian Helophoridae species are given. Two newly recorded species [*Helophorus* (*sensu stricto*) *aquaticus* (Linnaeus, 1758) and *Helophorus (R.) lapponicus* Thomson, 1853] are described, and their distribution in Algeria and worldwide is presented. The total aedeagophore length of *H. aquaticus* may reach 1.0-1.1 mm.

KEY WORDS: Coleoptera, Helophoridae, new records, distribution, systematics, Algeria

Although *Helophorus aquaticus* and *H. lapponicus* are frequently collected cosmopolitan coleopterans, there is no record of them from Algeria. In Algeria, *H. aquaticus* is generally widespread in highlands but all samples treated here were collected in lowland to moderate highlands of northeastern Algeria (maximum 523.34 m above sea level).

METHODS

Specimens of aquatic Coleoptera were collected in various parts of Northeastern Algeria (Fig. 1) in different surveys in 2005. The beetles were killed using ethyl acetate or in 96% ethanol. Aedeagophores of the beetles, cleaned with brushes, were dissected under a stereo microscope and left in 10% KOH solution for 1-2h at room temperature. Photographs were taken using an SMZ-1500 Nikon type 104 microscope.

SYSTEMATIC ENTOMOLOGY

Helophorus (sensu stricto) aquaticus (Linnaeus, 1758)

Body 5.9 mm long; females are always larger than males (arithmetic average of 20 specimens, 10 males, 10 females; two males are 6.1 mm). Head bronze to black. "Y" groove large and deep. Antennae brown. Maxillary palpi dark brown and terminal segment asymmetrical. Colouration of pronotum as head, lateral margins narrowed posteriorly. Elytra brown to dark brown. Scutellum small and oval. Sutural Λ-mark easily visible. Legs thick and long. Last segments of tarsi and claws are black; other parts of legs are brown to dark brown. Last abdomi-

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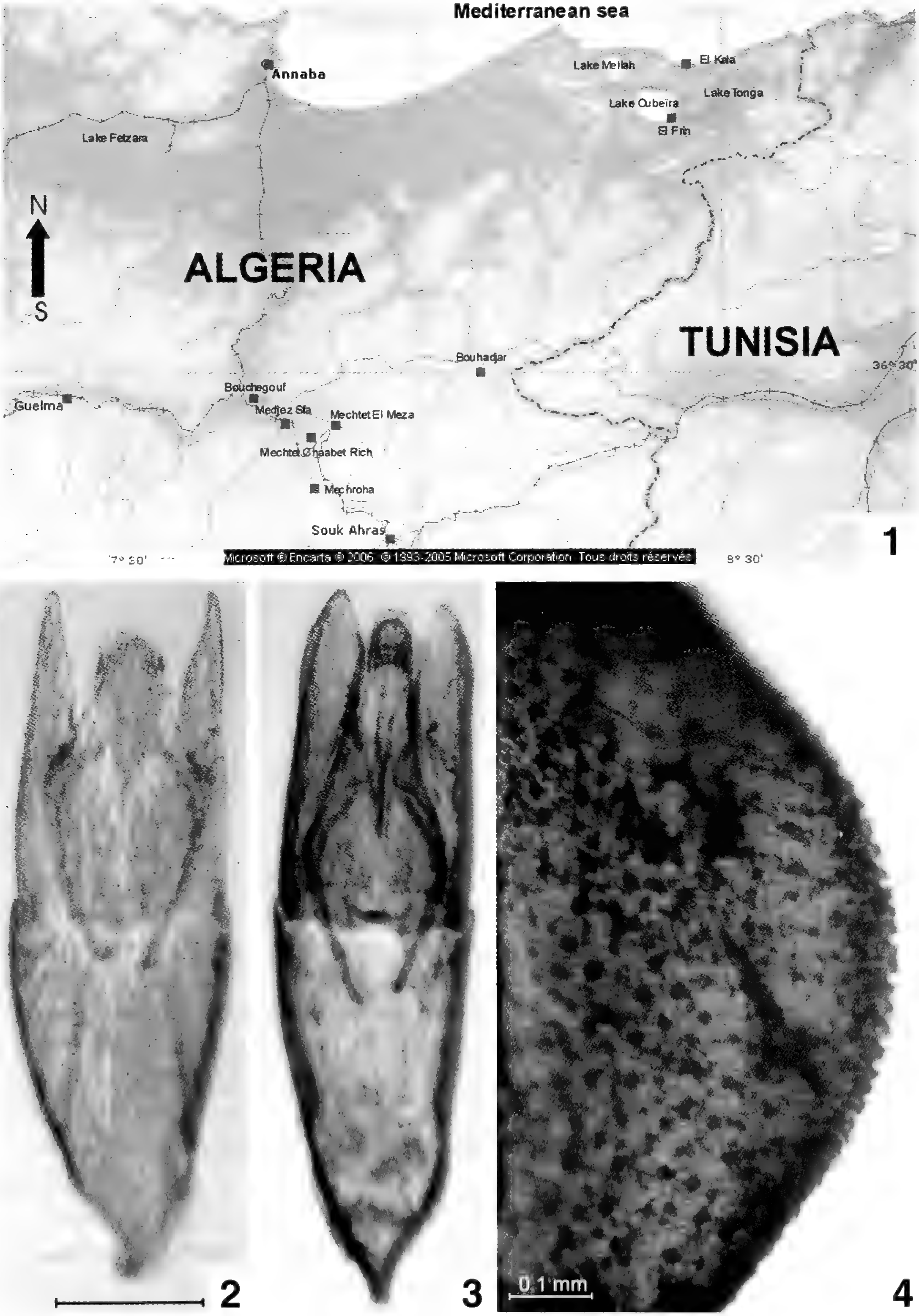
nal sternite rather descriptive (Fig. 4). Aedeagophore 1.0 mm long (two of them are 1.1 mm, arithmetic average of 10 specimens) (Fig. 2).



Figures 1-4. 1. Map of research area in northeastern Algeria. 2. *Helophorus aquaticus,* aedeagophore. 3. *H. lapponicus*, aedeagophore. 4. *H. aquaticus*, last abdominal sternite (scale bar on aedeagophore of *H. aquaticus* represents 0.2 mm for *H. aquaticus*; 0.1 mm for *H. lapponicus*).

Distribution in the World: Austria, Belgium, "Caucasus," Czechoslovakia, Denmark, Estonia, Finland, France, Germany, Hungary, Iran, Italy, Latvia, Lithuania, Netherlands, Poland, Russia, Slovakia, Spain, Switzerland, Turkey, and Ukraine (Angus, 1992, Hansen, 1999; Löbl and Smetana, 2004).

Material Examined: Ain Damous, 19.V.2005, 2 ♂♂, 1 ♀. N 36° 25.350' E 007° 51.367' (523.34 m a.s.l.); Bir Lalalcha, 18.V.2005, 2 ♂♂, 3 ♀♀. N 36° 25.223' E 007° 50.536' (436.78 m a.s.l.); Ain Chef, 18.V.2005, 11 ♂♂, 3 ♀♀, 23.VII.2005, 4 ♂♂, 8 ♀♀. N 36° 25.028' E 007° 50.826' (491.34 m a.s.l.); Medjen Djenen H'mouda, 19.V.2005, 14 ♂♂, 12 ♀♀. N 36° 25.607' E 007° 51.360' (396.24 m a.s.l.); Bir Bentaryaga, 19.V.2005, 3 ♂♂, 5 ♀♀. N 36° 25.427' E 007° 50.652' (414.53 m a.s.l.); Bir Slaymates, 19.V.2005, 4 ♂♂. N 36° 25.188' E 007° 50.752' (476.10 m a.s.l.).

Helophorus (Rhopalhelophorus) lapponicus **Thomson, 1853**

Body 2.65 mm long (range 2.5-2.7) females are always larger than males (arithmetic average of 10 specimens, 5 males, 5 females). Head pitchy with bronze reflections (sometimes with green reflections). Clypeus rather raised medially, "Y" groove distinct, its stem expanded posteriorly. Maxillary palpi yellowish, only darker at the extreme top. Antennae brown, club slightly darker. Pronotum evenly arched, granulate and coloration as head. There is a narrow yellowish band at the anterior margin of pronotum. Pronotal grooves narrow and shallow. Elytra brown, parallel sided, anterior sides curved. Under face black. Legs long, yellowish to brown. Tarsi have well-developed long swimming-hairs. Aedeagophore 0.5 mm long (arithmetic average of 5 specimens, Fig. 3).

Distribution in the world: Belarus, Denmark, Finland, Georgia, Iran, Israel, Kazakhstan, Lebanon, Russia, Spain, Sweden, and Turkey (Angus, 1992; Hansen, 1999; Incekara et al., 2004; Löbl and Smetana, 2004).

Material Examined: Bir Bentaryaga, 19.V.2005, 7 ♂♂, 3 ♀♀. N 36° 25.427' E 007° 50.652' (414.53 m a.s.l.); El Medjen, 09.VII.2005, 5 ♂♂, 4 ♀♀. N 36° 25.535' E 007° 50.693' (412.09 m a.s.l.); Bir Lalalcha, 18.V.2005, 2 ♂♂, 1 ♀. N 36° 25.223' E 007° 50.536' (436.78 m a.s.l.).

DISCUSSION

According to Angus (1992), some *H. aquaticus* from southeastern Europe and adjacent territories, occasionally have an aedeagophore up to 1.0 mm long, instead of the typical size range of 0.75-0.92 mm. Angus (1988, 1992) has pointed out that these differences in aedeagophore size represent local size variants, not a new species. Our study supports that statement. For instance, we have also recorded such samples (aedeagophore up to 1.0 mm long) from various parts of Turkey (Incekara et al., 2004). In Algeria, most specimens have an aedeagophore 1.0 mm long. Furthermore, two of them have aedeagophores 1.1 mm long. These results show that large aedeagophores are common in *H. aquaticus*. No relationship has been found between beetle length and aedeagophore length for this group of beetles. We suspect that aedeagophore shape is more functionally important than its length for this group of beetles.

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A NEW SPECIES OF *OTIORHYNCHUS* GERMAR, 1822 (COLEOPTERA: CURCULIONIDAE: ENTIMINAE) FROM ANATOLIA, TURKEY[1]

Bekir Keskin[2] and I. Ethem Cevik[2]

ABSTRACT: A new species of *Otiorhynchus* is described from western Turkey. *Otiorhynchus* (*Pliadonus*) *lilligi* sp. n., is easily distinguishable from *O.* (*Pliadonus*) *frater* Styerlyn, 1861 by the existence of a sharp tooth on the mesofemora of the former.

KEY WORDS: *Otiorhynchus,* Coleoptera, Curculionidae, Entiminae, Turkey, new species

The genus *Otiorhynchus* Germar, 1822 is one of the most speciose groups of Coleopterous weevils (Coleoptera, Curculionidae) with a mostly Palearctic distribution (Magnano, 1998). In recent years, following the work of Magnano (1998), the taxonomy of the genus *Otiorhynchus* has undergone several important changes: the status of previously recognized species groups have been reorganized and defined as subgenera. Currently, the subgenus *Pliadonus* (Reitter, 1912) is a controversial group of *Otiorhynchus* on its systematic. *Pliadonus* which was previously defined as a species group in the subgenus *Tournieria* (sensu Reitter) by Reitter (1912) is considered as the synonym of the *Tournieria* (Magnano, 1998, Alonzo-Zarazaga, 1999). Based on morphological data, Davidian and Savitsky (2005) also defined this species group as a subgenus. On the other hand, cluster analysis of Bray Curtis similarity indices and their distinction discriminant analysis of data from 43 morphological characters of 24 Western Anatolian species belonging to 16 genera of *Otiorhynchus* indicate that *Pliadonus* should be defined as subgenus (Keskin, 2005).

Only one species, *Otiorhynchus frater* (Stierlin, 1861), belonging to the subgenus *Pliadonus* lives in West Anatolia (Reitter 1913, Lona 1936). The geographical distribution of *O. frater* includes the area comprised by eastern Bulgaria to northwestern Turkey (Angelov 1976). The southernmost border known for this species is Uludag (Lodos et al., 1978). Other species of Turkish *Pliadonus* live in the Alpine and sub-Alpine zones of northeastern Anatolia and the Caucasus (Reitter 1913, Davidian and Savitsky 2005).

Here, a new species of *Otiorhynchus,* subgenus *Pliadonus* is described from Bozdğ, a 2500 m high mountain of Western Anatolia with many endemic species. Most of the species belonging to tribus Otiorhynchini living in *Bozdağ* at only above 1100 m are either endemic *[O. (Cryphiphorus) dubitabilis* Fairmaire, 1866 and *Neotournieria lodosianus* (Magnano, 1977)] or subendemic *[O. (Podoropelmus) kaltakkirani* Voss, 1936 and *O. (Tecutinus) latifrons* Stierlin, 1893]. Apart from these species, the widely distributed species *O. (Melasemnus) ovali-*

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pennis Boheman in Schönherr, 1843 and *O. (Choilisanus) balcanicus* Boheman in Schönherr, 1843 are also found in Bozdağ. Therefore, together with its location in Western Anatolia as refugia for many animal groups during the last glacial maximum (Demirsoy 1996), Bozdağ is currently, one of the important areas of endemism in Western Anatolia.

***Otiorhynchus (Pliadonus) lilligi* sp. n.**

Figures 1 (A-H)

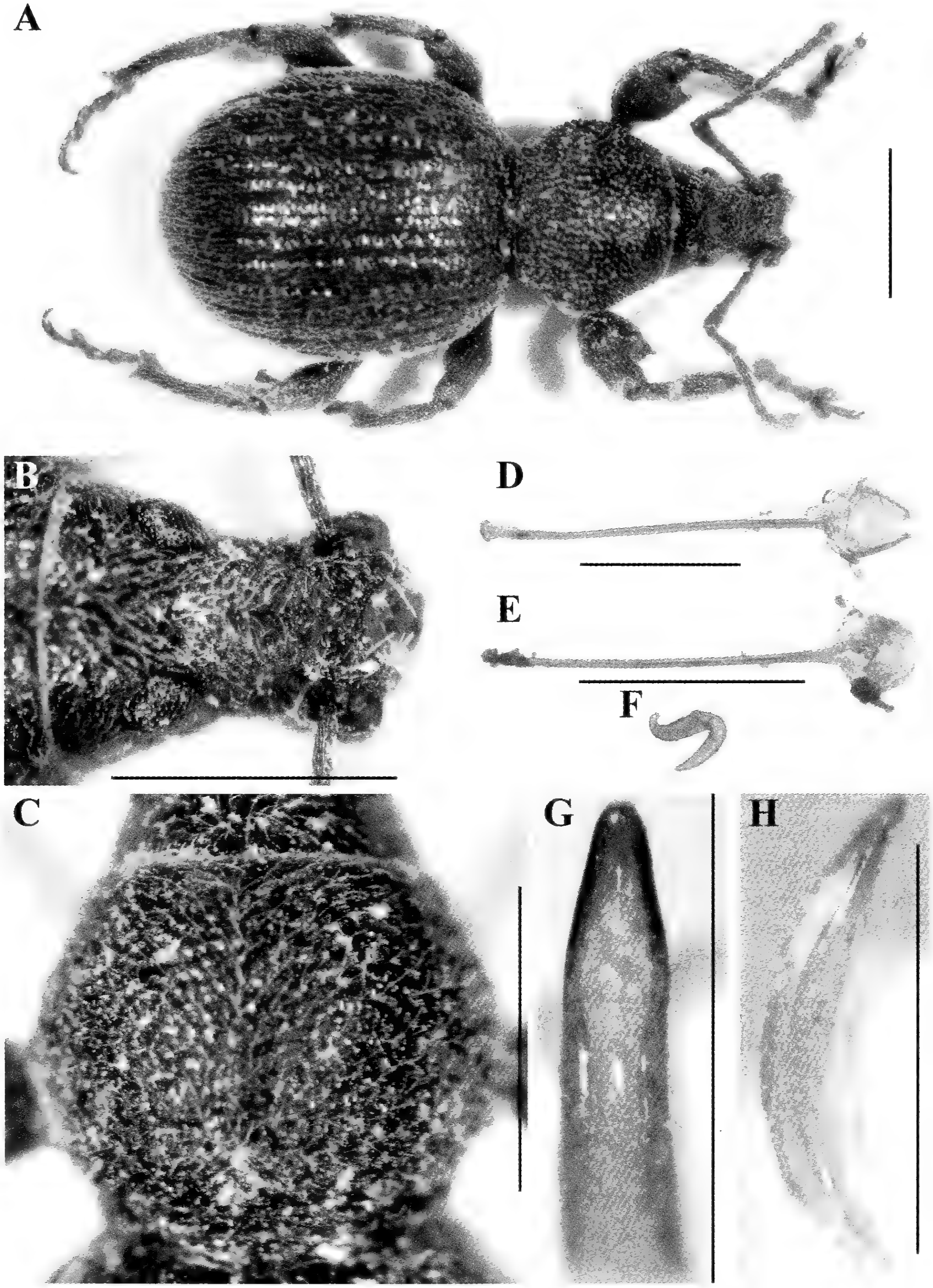
Material Examined. Holotype: Male, ZDEU Ent. 2006/502, 21.V.2006, Bozdağ-Izmir, leg. S. Anlaş, 1537 m, 38°20'28"N-28°06'49"E (Fig. 1, A). Paratypes: 1 Female, 2003/426, 17.VIII.2003, Bozdağ-Izmir, B. Keskin, 1537 m, 38°20'28"N-28°06'49"E; 1 Male, ZDEU Ent. 2006/503, 17.XI.2006, Bozdağ-Izmir, H. Koç, 1537 m, 38°20'28"N-28°06'49"E. The specimens were collected under stones.

Diagnosis. The new species is included in the species group *Pliadonus*, one of the species groups arranged by Reitter (1912), because it has a large triangular tooth on the profemur and a flat protibial inner edge. It resembles *O. (Pliadonus) frater* Stierlin, 1861 distributed in the Marmara Region of Turkey, particularly in elevated regions. *Otiorhynchus* (*Pliadonus*) *lilligi* sp. n. can be distinguished easily from *O. (Pliadonus) frater* by the presence of a larger tooth on the mesofemur and by the morphology of the female genitalia [Fig. 1 (D, E, and F)]. *Otiorhynchus* (*Pliadonus*) *lilligi* sp. n. is dioecious species and the male genitalia illustrated in Fig. 1 (G and H).

Description. Body dark brown, extremities light brown. Head finely punctured, stronger punctures on rostrum and frons. Length of rostrum not more than its width and with an apical U-shaped wide median depression. Rostrum as long as width of pterigia. Dorsal and lateral carinae lengthening till, to the front of eyes. Eyes protruding outward and placed dorsolaterally. In dorsal view, eyes small and spherical and in lateral view, eyes egg-shaped (Fig. 1, B).

Antenna with a long and thin structure. First segment of funicle longer than second segment. Third and all the subsequent segments at least twice longer than width. Clava long, thin and oval. Length of pronotum as much as its width. Widest area placed on hind of the center. Upper part with thin granules and very small hollows on them [Fig. 1 (C)]. Elytra short and oval shaped and quite wide. Punctures strong on elytral lines. Elytral lines little deep on the middle part, but quite deep at the sides; 3 or 4 rows of yellow hairs placed between intervals with very thin granules. A big and triangular tooth on profemur. So, width of this area at least twice more than the width of distal edge of profemur. Tooth on each mesofemur; however, these teeth much smaller than the previous one. No granules on the inner edge of protibia, in other words, flat.

Etymology. This new species has been attributed to Dr. Martin Lillig, German coleopterologist who has been carrying out investigations on the species of the family Tenebrionidae.



Figures 1. A. *Otiorhynchus* (*Pliadonus*) *lilligi* sp. n., (Male) (Holotype), B. Head plate, C. Pronotum, D. Spiculum ventrale of *O.* (*Pliadonus*) *frater* Styerlyn, 1861, E. Spiculum ventrale, F. Spermatheca of *Otiorhynchus* (*Pliadonus*) *lilligi* sp. n., G. Dorsal view of male genitalia, H. Lateral view of male genitalia (bars 1 mm).

ACKNOWLEDGEMENTS

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TWO NEW SPECIES OF THE GENUS *CORNUTRYPETA* HAN AND WANG (DIPTERA: TEPHRITIDAE) FROM CHINA[1]

Xiaolin Chen[2] and Xingjian Wang[3]

ABSTRACT: Two new tephritid species, *Cornutrypeta hunanica* sp. nov. and *Cornutrypeta gansunica* sp. nov. from China are described and illustrated. A revised key to all the *Cornutrypeta* species is provided.

KEY WORDS: Diptera, Tephritidae, *Cornutrypeta*, new species, China

The genus *Cornutrypeta* was erected by Han and Wang (1993) for the type species, *Trypeta superciliata* Frey, 1935 from Finland. Recently, Han (1996) added another species, *Cornutrypeta taiwanensis* Han. The only biological data available for the genus relates to the larvae of *Cornutrypeta spinifrons* (Shroeder) from Europe which has been reported to mine the leaves of *Solidago vergaurea* and *Aster sp.* (Asteraceae) (White, 1988).

In this work, two additional new species, *C. hunania* and *C. gansunica* from China are described. So far, eleven species are known from the Palaearctic and Oriental Regions, eight of which occur in China. A revised key to all the species is provided.

Terminology and abbreviations concerning gross morphology generally follows White el al. (1999), McAlpine (1981), Han et al. (1993), and Han (1996). The abbreviations for type-specimen depositories used in this paper are as follows: IZCAS, Institute of Zoology, Chinese Academy of Sciences, Beijing, China.

SYSTEMATIC ENTOMOLOGY

Cornutrypeta Han and Wang, 1993

Cornutrypeta Han and Wang, 1993: 169. Type species: *Trypeta superciliata* Frey, 1935, by original designation.

Diagnosis. *Cornutrypeta* is a sexually dimorphic genus for which diagnosis is only available for male specimens, the females being almost impossible to separate from the closely related genus *Trypeta* Meigen. Males differ from the other Oriental and Palaearctic Trypetine genera by the following combination of characters: (1) 3-5 frontal setae with at least 2 anterior frontal setae greatly enlarged, the remaining setae normal in shape; (2) frons enlarged to accommodate the extensive elaboration of the anterior frontal setae; (3) glans with median granulate sclerite large, apicodorsal rod usually present (Han et al., 1993).

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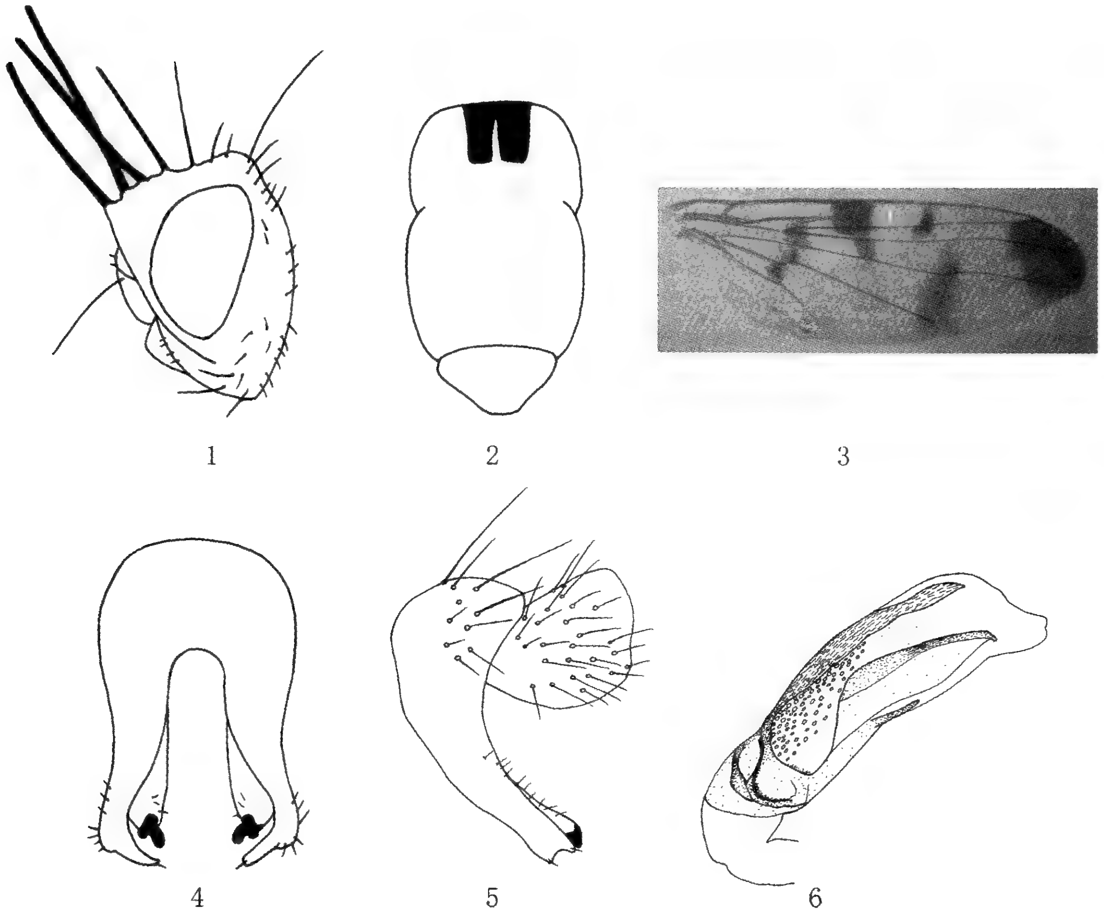
A key to the species of *Cornutrypeta* Han and Wang

1. Scutum largely dark brown 2
   Scutum almost entirely yellowish brown to orange brown 3
2. Wing with small brown spot from middle of cell r_{2+3} to costa.........................
   ....*C. yushunia* Han and Wang
   Wing without such spot ....*C. nigritata* (Wang)
3. Mediotergite dark brown 4
   Mediotergite yellow brown 8
4. Head with 3 frontal setae in both sexes .... *C. superciliata* (Frey)
   Head with 4-5 frontal setae in male 5
5. Head with 4 frontal setae in male; antennae dark brown......*C. taiwanensis* Han
   Head with 5 frontal setae in male; antennae yellow brown 6
6. Wing with discal band not extending to cell dm 7
   Wing with discal band extending to cell dm..............*C. spinifrons* (Schroeder)
7. Wing with the subapical brown band incomplete, broken between r_{2+3} and midway across r_{4+5} (Fig. 3); scutum subshiny with large pre-sutural square black spot in middle of anterior margin, dimension of the cleft in its posterior margin deeply (Fig. 2); abdomen yellow brown..............*C. gansunica* sp. nov.
   Wing with the subapical brown band almost complete (Fig. 9); scutum subshiny with pre-sutural quadrate black spot in middle of anterior margin, dimension of the cleft in its posterior margin shallowly (Fig. 8); abdomen dark brown ....*C. hunanica* sp. nov.
8. Postpronotal lobe and upper 2/3 of anepisternum ivory white; 4 of 5 frontal setae in male greatly enlarged ....*C. nigrifemur* Han and Wang
   Postpronotal lobe and anepisternum mostly yellowish brown to orange-brown; male with less than 4 enlarged frontal setae 9
9. Scutum anteriorly with large quadrate black spot...*C. melanonotum* (Brunetti)
   Scutum without such spot 10
10. Fifth tarsomere dark brown; head with single orbital setae ....
    ....*C. omeishana* Han and Wang
    Fifth tarsomere yellow brown to orange brown; head with two orbital setae....
   11
11. Wing with small brown spot around the middle of vein CuA_1; head with 3 pairs of frontal setae ....*C. gigantocornuta* Han and Wang
    Wing without such a spot; head with 4 pairs of frontal setae in male ....
    ....*C. triceratops* (Bezzi)

Cornutrypeta gansunica, NEW SPECIES

(Figs. 1-6)

Description. Male: Length of body 6.5 mm, of wing 6.2 mm. Head yellow, higher than long, with frontal-head ratio 0.51, eye ratio 0.57, genal-eye ratio 0.20. Frons distinctly wider than eye, concave medially and elevated laterally. Face concave, slightly protuberant at ventral margin. All setae black; 5 frontal and 1 orbitals;



Figs. 1-6. *Cornutrypeta gansunica* sp. nov. 1. Head (lateral view). 2. Thorax (dorsal view). 3. Wing. 4. Epandrium (posterior view). 5. Epandrium and proctiger (lateral view). 6. Glans (lateral view).

frontal setae greatly enlarged, 1st-3rd frontal setae longer than frons, apically pointed; 4th-5th frontal setae smaller, 0.60-0.66 times as long as anterior setae (Fig. 1). Ocellars rudimentary; genal, vertical and postocellars well developed. Occiput slightly convex. Antennae yellow brown, shorter than face; 1st flagellomere dorsoapically rounded; arista pubescent.

Thorax yellow-brown in ground color, with black setae; 2 anepisternals and 2 scutellars; 1 dorsocentral seta, aligned posterior to postsutural supra-alars; 1 prescutellar acrostichal setae. Scutum subshiny with large black pre-sutural square bifurcate spot in middle of anterior margin, dimension of the cleft in its posterior margin deeply (Fig. 2). Scutellum almost bare, yellow brown, slightly convex with basal setae 2.0 times as long as scutellum. Mediotergite dark brown.

Legs entirely yellow-brown; femur swollen; fore femur with row of posteroventral black setae; mid tibia with black apical spine.

Wing with the subapical brown band incomplete, broken between r_{2+3} and midway across r_{4+5}; discal brown band extends from stigma to crossvein R-M; basal brown band extending from base of R_{2+3} to apex of cell bcu; cell sc about half as long as cell c; lobe of cell bcu short; crossvein R-M slightly proximal to middle of cell dm; vein R_{4+5} ratio 2.1, vein M ratio 1.1 (Fig. 3).

Abdomen 1.5 times as long as wide; shiny, yellow brown ground color with dark brown setulae; tergite 3-5 each with vague dark-brown lateral marks. Lateral surstylus with both anterior and posterior corners angulated, truncate apically in lateral view; medial surstylus with subapical and apical prensisetae approximated, and subapical prensiseta smaller than the apical prensiseta (Figs. 4, 5); aedeagal apodeme wide, fan shaped; glans with median granulate sclerite; dorsal sclerite with pattern of closely approximated, narrowly oblong cells (Fig. 6).

Female: Unknown.

Etymology. This species is named after the type locality.

Types. Holotype male, China: Shatanlinchang, Zhouqu, Gansu Province, 14 July 1999, collected by Yao Jian (IZCAS).

Biology. Unknown.

Distribution. China (Gansu).

Remarks. This species is similar to *C. taiwanensis* Han in the wing pattern, but differing by having 5 frontal setae in male and yellow brown antennae. It is also similar to C. *hunanica* sp. nov. in the 1st-3rd frontal setae being large and apically pointed, the 4th-5th frontal setae much smaller than the anterior three setae, scutum with pre-sutural square black spot in middle of anterior margin, but differing by the wing with subapical brown band incomplete, broken between r_{2+3} and midway across r_{4+5}, and scutum with deep cleft in posterior margin of pre-sutural black spot.

Cornutrypeta hunanica, NEW SPECIES

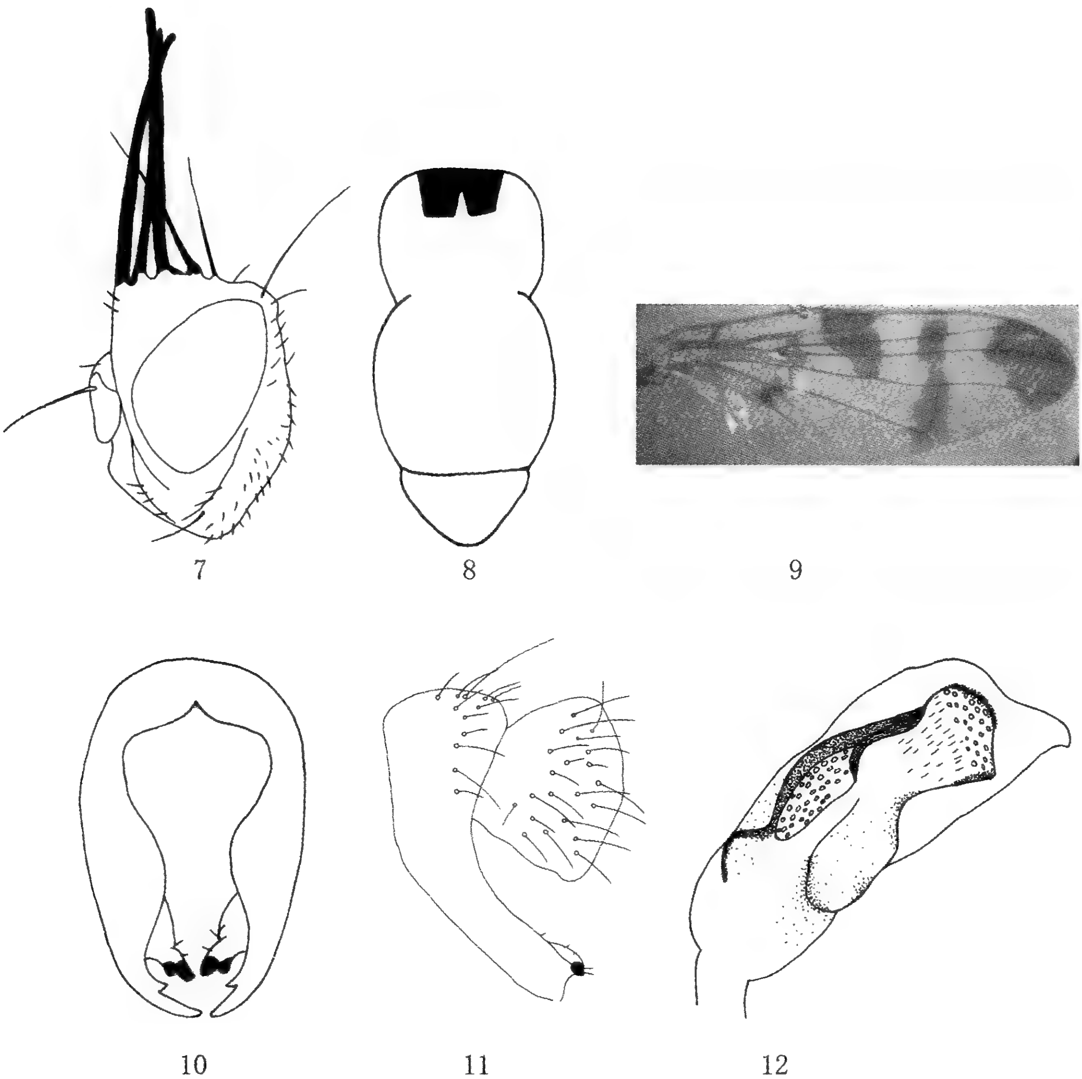
(Figs. 7-12)

Description. *Male:* Length of body 5.1 mm, of wing 6.6 mm. Head yellow, higher than long, with frontal-head ratio 0.50, eye ratio 0.64, genal-eye ratio 0.26. Frons distinctly wider than eye, concave medially and elevated laterally. Face concave, slightly protuberant at ventral margin. All setae black; 5 frontal and 1 orbitals; frontal setae greatly enlarged, 1st-3rd frontal setae large, 1.75 times as long as frons, apically pointed; 4th-5th frontal setae much smaller, about 0.5-0.6 times as long as anterior setae (Fig. 7). Ocellars absent; genal, vertical and postocellars well developed. Occiput slightly convex. Antenna yellow brown, shorter than face; 1st flagellomere dorsoapically rounded; arista pubescent.

Thorax yellow-brown in ground color, with black setae; 2 anepisternals and 2 scutellars; 1 dorsocentral seta, aligned posterior to postsutural supra-alars; 1 prescutellar acrostichal setae. Scutum subshiny with pre-sutural quadrate bifurcate black spot in middle of anterior margin, dimension of the cleft in its posterior margin shallowly (Fig. 8). Scutellum almost bare, yellow brown, slightly convex with basal setae 2.0 times as long as scutellum. Mediotergite dark brown.

Legs entirely yellow-brown; femur strongly swollen; fore femur with 5-6 posteroventral black setae; mid tibia with black apical spine.

Wing with large dark brown mark occupying the entire apex; subapical brown band almost complete; discal brown band extends from stigma to crossvein R-M;



Figs. 7-12 *Cornutrypeta hunanica* sp. nov. 7. Head (lateral view). 8. Thorax (dorsal view). 9. Wing. 10. Epandrium (posterior view). 11. Epandrium and proctiger (lateral view). 12. Glans (lateral view).

basal brown band extending from base of R$_{2+3}$ to apex of cell bcu; cell sc about half as long as cell c; lobe of cell bcu short; crossvein R-M slightly beyond middle of cell dm; vein R$_{4+5}$ ratio 2.2, vein M ratio 0.8 (Fig. 9).

Abdomen 1.4 times as long as wide; shiny, entirely dark brown. Lateral surstylus with both anterior and posterior corners angulated, truncate apically in lateral view; medial surstylus with subapical and apical prensisetae approximated, and subapical prensiseta smaller than the apical prensiseta (Figs. 10, 11); aedeagal apodeme wide, fan shaped; glans with median granulate sclerite; dorsal and apical sclerite with pattern of closely approximated, narrowly oblong cells (Fig. 12).

Female: Unknown.

Etymology. This species is named after the type locality.

Types. Holotype male, China: Zhangjiajie, Hunan Province, 10 October 1985, collected by Fa-sheng Li (IZCAS).

Biology. Unknown.

Distribution. China (Hunan).

Remarks. This species is similar to C. *gansunica* sp. nov. in 1st-3rd frontal setae large and apically pointed, 4th-5th frontal setae much smaller than anterior setae, scutum with a black spot in the middle of anterior margin, but differing by wing with subapical brown band almost complete; scutum with dimension of the cleft in its posterior margin of pre-sutural black spot shallowly and abdomen dark brown.

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THE GENUS *TRICHONTA* WINNERTZ (DIPTERA: MYCETOPHILIDAE) IN CHINA, WITH DESCRIPTIONS OF TWO NEW SPECIES[1]

Wu Hong,[2] Yiping Wang,[3] and Huachao Xu[4]

ABSTRACT: The species of the genus *Trichonta* Winnertz (Diptera: Mycetophilidae) from China are revised. Six species are recognized, including two species new to science: *T. aberransida* sp. nov. and *T. rostriforma* sp. nov. A key to species of the genus is provided.

KEY WORDS: Mycetophilidae, *Trichonta*, new species, China

The genus *Trichonta* Winnertz, 1863 belongs to the subfamily Mycetophilinae, family Mycetophilidae. For the identification of the genus see Vockeroth (1981), and the genus can be identified by the combination of the following characters: Antenna with 14 flagellomeres. Palpi with 4 segments. Pronotum and proepimeron only partially separated, each usually with 2 strong seta and several weaker ones. Mesanepisternum hexagonal, 0-4 seta along anterodorsal and 3-7 along posterodorsal border, usually 1-4 additional seta immediately cephalad of posterodorsal row. Mesokatepisternum and mesepimeron bare. Laterotergite with numerous long seta. Metepisternum with 0-5 short or long seta. Hind coxa with 0, 1-2 posterobasal, or a row of strong posterior seta. Tibial bristles small and weak, at most a little longer than tibial diameter. Fore tibia with 1 apical spur. Middle and hind tibia each with 2 apical spurs; middle tibia with 4-5 longitudinal rows of seta; hind tibia with usually strong anterior and dorsal seta along entire length, shorter posterior setae along distal half at least. Vein C only slightly extending beyond apex of vein R_5. Vein Sc ending free or in vein R. Posterior fork usually based occasionally even with or slightly distal of vein m-stalk. Vein CuA petiole with or without setae. Branches of veins M and CuA usually setose except basely a weak to strong. Male abdomen with tergites 1-6 broad and tergites 7 - 8 very short. Female abdomen with tergites 1-7 broad, of various shapes. Cerci 2-segmented.

Little is known for the biology of the species of *Trichonta*, but some of the larvae develop in bark encrusting fungi (Jakovlev, 1994).

At present, there are 69 species described from Palaearctic area and 45 species from Nearctic area (Chandler, 2005; Hackman et al., 1988; Zaitzev, 2003). Outside the Holarctic region, there are five, two and one species known from Oriental, Australasian and African region, respectively (Bechev, 2000). There are four Chinese species known to date (Yang and Wu, 1996).

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In the paper, all Chinese species of *Trichonta* are reported and diagnosed, including two species new to science, and a key to species is provided.

METHODS

For the morphological terminology used in this paper see Vockeroth (1981) and Søli (1997). The voucher and type specimens are deposited in the Zhejiang Forest University, Lin'an (ZJFU), China. All descriptions and measurements were made under a Leica MZ 12.5 microscope, and figures made under a Leica MZ APO microscope with the help of Leica Image 1000 system.

Part of the material we studied had been mounted on slides by authors. Other specimens were collected using a Malaise trap or sweep net, and were preserved in 75% ethanol. They were treated in 10% KOH, dehydrated through an ethanol from 75% to 95%, and then mounted on microscope slides using Euparal after treatment in clove oil based on total 63 specimens from China.

SYSTEMATIC ENTOMOLOGY

Key to Chinese species of the genus *Trichonta* Winnertz

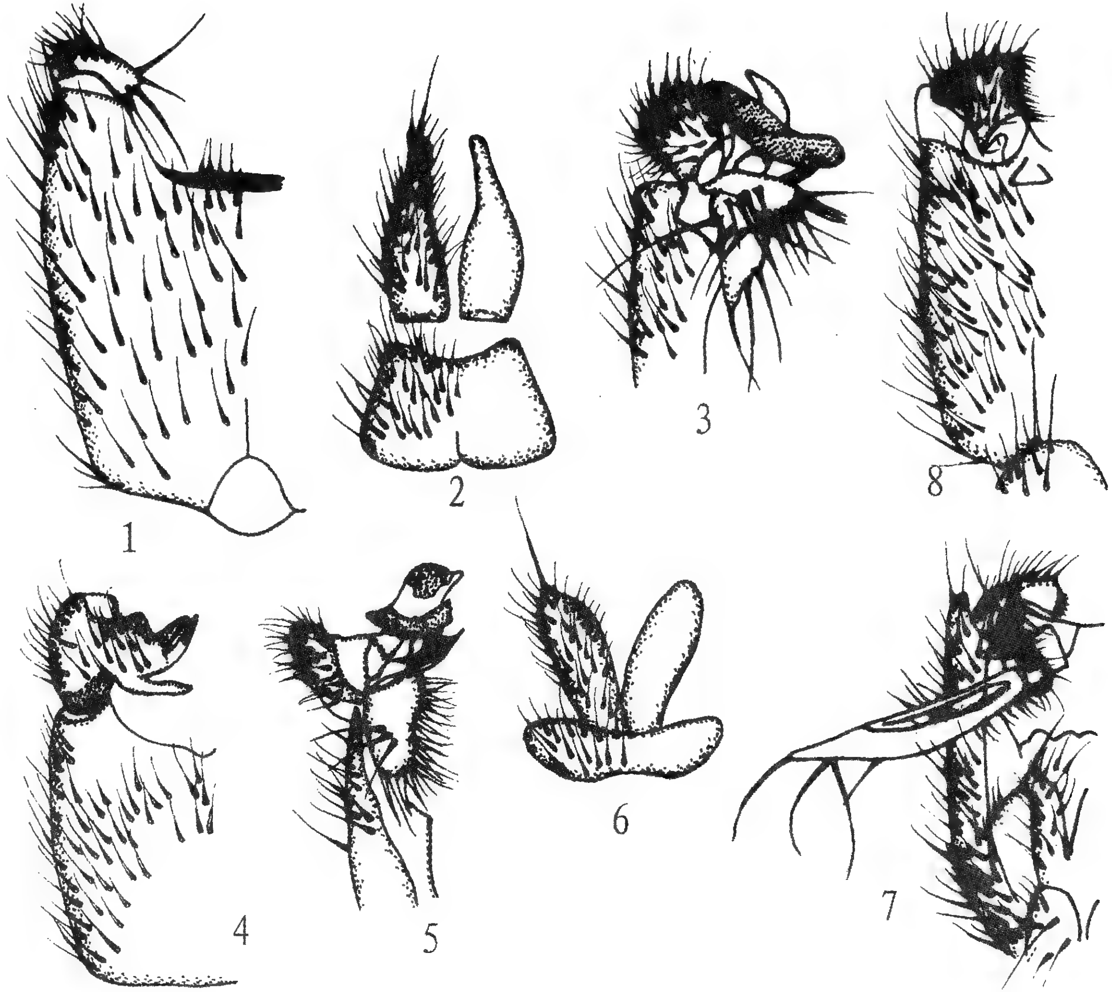
1. Wing with apical third fumose 2
- Wing clear, without markings 3

2. Base of posterior fork at middle of vein Rs; cerci moderately long; dorsal branch of gonostylus scutate (Figs. 9-11) .... *T. fuliginosa* Wu et Yang
- Base of posterior fork before vein Rs; cerci extremely slender; dorsal branch of gonostylus extremely slender (Figs. 12-14).......... *T. orientalia* Wu et Yang

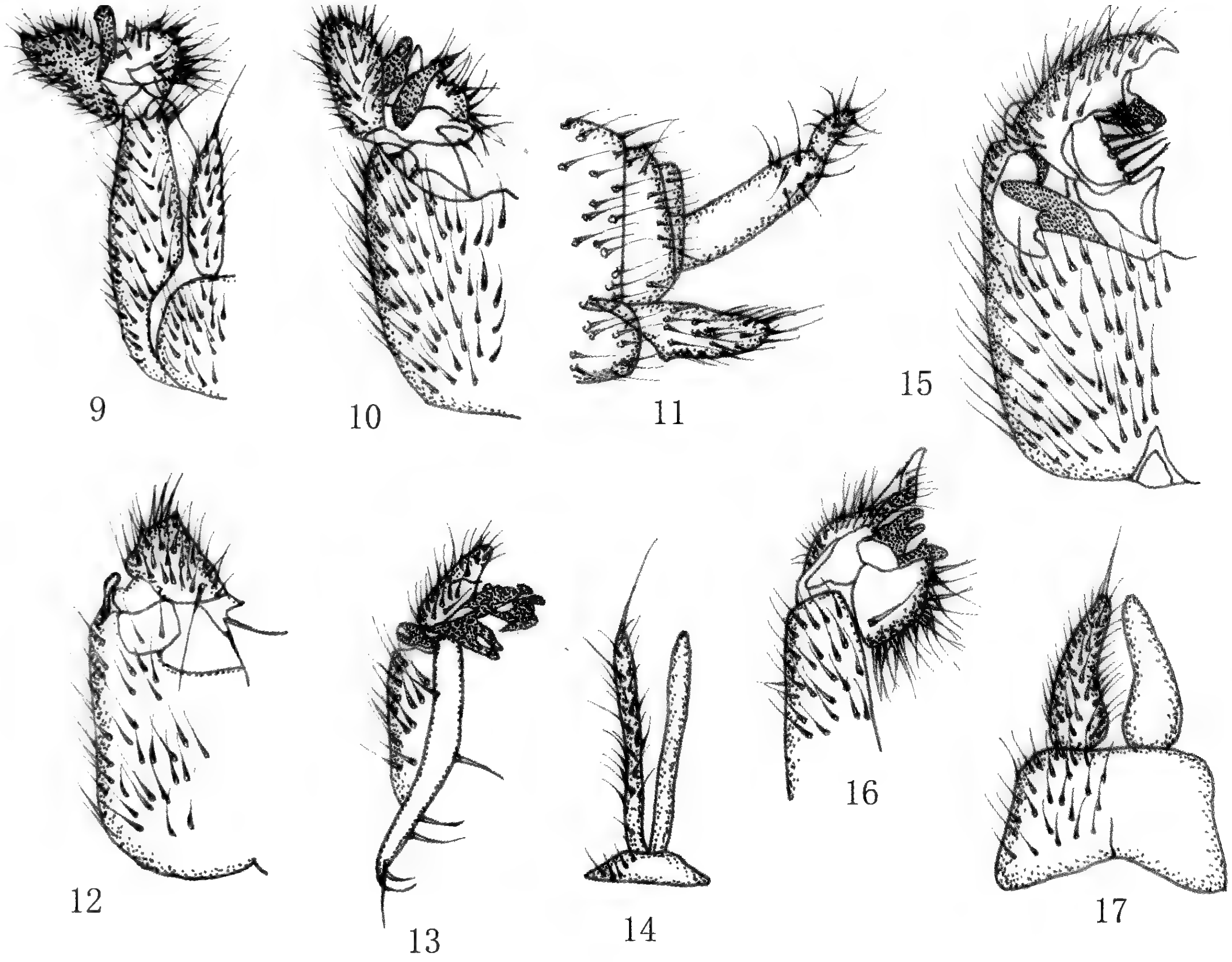
3. Legs at least with basal ventral of middle and hind femora and hind coax brown.. 4
- Legs without distinct brown markings.. 5

4. Base of posterior fork beyond vein Rs; middle tibia with 4 lines of bristles; ventral branch of gonostylus subquadrate (Figs. 1-3) .... *T. aberransida* sp. nov.
- Base of posterior fork before vein Rs; middle tibia with 3 lines of bristles; ventral branch of gonostylus rostriform apically (Figs. 15-17).. *T. rostriforma* sp. nov.

5. Base of posterior fork before vein Rs; dorsal branch of gonostylus slender, with 2 basal branches and with 3 long setae apically (Figs. 7-8).. *T. chinensis* Yang et Wu
- Base of posterior fork beyond vein Rs; dorsal branch of gonostylus broad and short, covered with broad long setae apically (Figs. 4-6).. *T. aureola* Wu et Zheng



Figures 1-8. Figs. 1-3 *Trichonta aberransida* sp. nov. 1. male terminalia, ventral view; 2. tergite 9 and cerci; 3. gonostylus, dorsal view. Figs. 4-6 *Trichonta aureola* Wu et Zheng. 4. male terminalia, ventral view; 5. gonostylus, dorsal view; 6. tergite 9 and cerci. Figs. 7-8 *Trichonta chinensis* Yang et Wu. 7. male terminalia, dorsal view; 8. male terminalia, ventral view.



Figures 9-17. Figs. 9-11 *Trichonta fuliginosa* Wu et Yang. 9. male terminalia, dorsal view; 10. male terminalia, ventral view; 11. female terminalia, lateral view. Figs. 12-14 *Trichonta orientalia* Wu et Yang. 12. male terminalia, ventral view; 13. gonostylus, dorsal view; 14. tergite 9 and cerci. Figs. 15-17 *Trichonta rostriforma* sp. nov. 15. male terminalia, ventral view; 16. gonostylus, dorsal view; 17. tergite 9 and cerci.

Trichonta aberransida NEW SPECIES

(Figs. 1-3)

Diagnosis: Frontal tubercle with 1 distinct, dark setae; mesoscutum blackish brown, somewhat lighter at humeral areas; scutellum with 6 long setae; laterotergite and mediotergite with numerous small and some larger setae; hind tibia with 11*d*, 9*a*, 8*p*; gonostylus slender apically, with 1 apical dark setae, distinctly longer than the other; ventral branch of gonostylus subquadrate.

Description: Male. Body length 3.5 mm; wing length 3.8 mm; palpi and mouthpart brown; posterior part of head blackish brown; antennae dark brown, with scape, pedicel and base of the first flagellomere yellow. Length of flagellum 1.95 mm or 1.8 times as long as mesonotum; frontal tubercle with 1 distinct, dark setae, frons weak in front of ocelli; face 1.65 times as long as wide.

Thorax: length of mesonotum 1.05 mm; pronotum brown, with a few dark setae; mesoscutum blackish brown, somewhat lighter at humeral areas; mesanepisternum dark brown, with 4 long setae in the upper part; mesokatepisternum dark brown; scutellum blackish brown, with 6 long setae; laterotergite and mediotergite dark brown, with numerous small and some larger setae. Wings: wing length 3.3 mm, clear yellowish brown; vein Sc ending free; base of posterior fork beyond vein Rs; vein CuA bare; halter yellow. Legs: yellow brownish, but hind coxa brown, and base of middle and hind femora with ventral brown markings; middle tibia with 3*d*, 4*a*, 6*p-v,* 10*p*; hind tibia with 11*d*, 9*a,* 8*p*.

Abdomen: sternites I-IV brown, sternites V-VI dark brown. The male terminalia blackish brown. Gonostylus slender apically, with 1 apical dark setae, distinctly longer than the other; ventral branch of gonostylus subquadrate. Parameres with a short row of membraneous setae apically. Aedeagus robust, slightly protruding beyond tip of parameres. Tergite 9 elongated.

Distribution. South of China (Zhejiang).

Female: unknown.

Holotype male, Zhejiang: Anji, Longwang mountain, 1996. V. 13, Wu Hong, No. 960096.

Etymology: The specific name refers to the type character of ventral branch of gonostylus.

Remarks: This species is similar to *T. aberrans* Lundstrom, 1911, but can be separated from the latter by base of posterior fork beyond vein Rs; middle tibia with 4 lines of bristles; the male terminalia with tergite IX medium sized; ventral branch of gonostylus subquadrate, with some setae apically.

Trichonta aureola Wu et Zheng, 1995

(Figs. 4-6)

Trichonta aureola Wu et Zheng, 1995: Insects and Macrofungi of Gutianshan, Zhejiang: 198. Type locality: China, Zhejiang (Gutianshan).

Material Examined: 1♂, Zhejiang, Kaihua, Gutianshan, 500m (29° 16' N, 118° 06' E), 1992-10-28, Wu Hong, No. 931694(H).

Male. Head: palpi and mouthpart yellow; posterior part of head dark brown. Antennae brownish. Thorax: pronotum yellow; mesoscutum dark brown, with humeral angles yellow, and 2 yellow longitudinal stripes; mesanepisternum brown, with 4 long setae in the upper part; scutellum brown, with 4 long setae; rest of thorax brown. Wings: wing length 2.9mm; clear yellow brownish; vein Sc ending free; base of posterior fork beyond vein Rs; vein CuA bare; halter yellow. Legs: yellow; base of hind coxa with 1 strong seta at posterior side; middle tibia with 2*d*, 5*a*, 6*p-d,* 4*p*; hind tibia with 5-7*d*, 11*a*, 6*p*. Abdomen: tergites brown, with posterior margins and anterior angles yellow; sternites yellow; the male terminalia brown.

Distribution: South of China (Zhejiang).

Remarks: This species is allied to *T. chinensis* Yang et Wu, but can be distinguished from the latter by the characters: Base of posterior fork beyond vein Rs; dorsal branch of gonostylus broad and short, covered with broad long setae apically (Figs. 4-6).

Trichonta chinensis Yang et Wu, 1996

(Figs. 7-8)

Trichonta chinensis Yang et Wu, 1996: Reserch Resour. Xinglong nat. Reser. Gansu: 284. Type locality: China, Gansu (Xinglongshan).

Material Examined: 1♂, Gansu, Yuzhong, Xinglongshan, 2000m (34°25'N, 105°43'E), 1980-08-20, Yang Chi-kun, No. 880495.

Male. Head: palpi and mouthpart yellow; posterior part of head brown; antenna yellowish brown. Thorax: pronotum brownish yellow; mesoscutum brown, with yellow humeral markings and 3 brownish narrow longitudinal stripes; mesanepisternum brown, with 4 long setae in the upper part; mesokatepisternum brown to blackish brown; scutellum brown, with 7-9 long setae; laterotergite and mediotergite brown. Wings: wing length 3.5mm; clear yellowish; vein Sc ending R; base of posterior fork before vein Rs; vein CuA bare; halter yellowish. Legs: brownish yellow. Abdomen: tergites brown, with tergites 1, 5 darker and tergites 2, 3 lighter, posterior and lateral margins yellow; sternites 1, 5, 6 brownish, sternites 2-4 yellow; the male terminalia brown.

Distribution: North of China (Gansu).

Remarks: This species is similar to *Trichonta aureola* Wu et Zheng, but can be separated by the characters: base of posterior fork before vein Rs; dorsal branch of gonostylus slender, with 2 basal branches and 3 long setae apically (Figs. 7-8)

Trichonta fuliginosa Wu et Yang, 1992

(Figs. 9-11)

Trichonta fuliginosa Wu et Yang, 1992: J. Zhejiang For. Coll. 9:426. Type locality: China, Zhejiang (Moganshan).

Material Examined: 1♂1♀, Zhejiang, Moganshan (30°37'N, 119°51'E), 1992-04-18, Wu Hong, No. 920060(H), 920059(A).

Male. Head: palpi and mouthpart brown; posterior part of head brown to dark brown; antennae brownish to brown, with scape, pedicel and the first flagellum yellowish. Thorax: pronotum yellow; mesoscutum dark brown, with yellow humeral markings; mesanepisternum brown, with 7-8 long setae in the upper part; mesokatepisternum brown; scutellum dark brown, with 6 long setae; latrotergite and mediotergite brown. Legs: yellowish, but middle coxa, fore and middle tarsi brown, hind coxa dark brown, apical parts of hind femur and tibia brown. Wings: wing length 3.8mm; clear yellowish, with apical 1/3 fumose vein Sc ending free; base of posterior fork at middle of vein Rs; vein CuA bare; halter yellowish. Abdomen: tergites brown to dark brown, with lateral margins of tergites 2-5 yellow; sternites brown; the male terminalia blackish brown.

Female. wing length 3.6mm; coloration and characters the same as in the male, but anterior margins of sternites 3-6 yellowish; the female terminalia yellow.

Distribution: South of China (Zhejiang).

Remarks: This species is similar to *T. orientalia* Wu et Yang, but differs from the latter by the characters: base of posterior fork at middle of vein Rs; cerci moderately long and dorsal branch of gonostylus scutate (Figs. 9-11).

Trichonta orientalia **Wu et Yang, 1995**

(Figs. 12-14)

Trichonta orientalia Wu et Yang, 1995: Insects and Macrofungi of Gutian mountain, Zhejiang: 199. Type locality: China, Zhejiang (Gutian mountain).

Material Examined: 1♂, Zhejiang, Kaihua, Gutianshan, 500m (29°16'N, 118°06'E), 1992-10-28, Deng Yifei, No. 930333(H).

Male. Head: palpi and mouth part yellow; posterior part of head dark brown; antenna brownish, with scape, pedicel, the first and base of the second flagellums yellow. Thorax: pronotum yellow; mesoscutum dark brown, with humeral angles yellow; mesanepisternum brown, with 4 long setae in the upper part; mesanepisternum brown; scutellum dark brown, with 6 long setae; laterotergite and mediotergite brown, covered setae. Wings: wing length 2.9mm; clear yellowish brown, but apical 1/3 fumose; vein Sc ending R; base of posterior fork before vein Rs; vein CuA bare; halter yellowish. Legs: yellow, but base of middle femur, base and apical parts of hind femur and tibia brown; middle tibia with 3*d*, 2*a*, 6*p-d*, 4*p*; hind tibia with 8*d*, 9*a*, 9*p*. Abdomen: tergites brown, with lateral margins of tergites 2-3 as well as anterior margins of tergites 3-4 yellow; sternites 1-4 yellow, sternites 5-6 brown; the male terminalia blackish brown.

Distribution: South of China (Zhejiang).

Remarks: This species is closely similar to *Trichonta fuliginosa* Wu et Yang, but differs from the latter by the characters: base of posterior fork before vein Rs; cerci extremely slender and dorsal branch of gonostylus extremely slender (Figs. 12-14).

Trichonta rostriforma NEW SPECIES
(Figs. 15-17)

Diagnosis: frontal tubercle with 2 distinct, dark setae; mesoscutum blackish brown, hardly lighter at humeral areas; scutellum with 6 long setae; scutellum dark brown, with 5 long setae; laterotergite and mediotergite bright brown, with several small and some larger setae; hind tibia with 5*d*, 6*a*, 7*p*; gonostylus strong apically, without apical dark setae, only evenly equal long setae; ventral branch of gonostylus rostriform apically.

Description: Male. Body length 3.4 mm; wing length 3.65 mm; palpi and mouth part dark brown; posterior part of head blackish brown; antenna brown, with scape, pedicel and the first flagellum yellow brown; length of flagellum 1.80 mm or 1.65 times as long as mesonotum; frontal tubercle with 2 weak, dark setae, frons weak in front of ocelli; face 1.60 times as long as wide.

Thorax: length of mesonotum 0.95 mm; pronotum brownish yellow, with humeral angles yellow and a few dark setae; mesoscutum black brown, hardly lighter at humeral areas; mesanepisternum brown, with 6 long setae in the upper part; mesokatepisternum brown; scutellum dark brown, with 5 long setae; laterotergite and mediotergite bright brown, with several small and some larger setae. Wings: wing length 3.4-3.5 mm, clear yellow brownish; vein Sc ending in vein R; base of posterior fork before vein Rs; vein CuA bare; halter yellow. Legs: yellowish brown, but middle and hind coxae brown, base of middle and hind femora with ventral brown markings; middle tibia with 4*d*, 3*a*, 5*p*; hind tibia with 5*d*, 6*a*, 7*p*.

Abdomen: tergites 1-4 brown, with sides of tergites 2-3 yellow brown; tergites 5-6 dark brown; sternites 1-2 brownish, sternites 3-6 brown; the male terminalia blackish brown; gonostylus strong apically, without apical dark setae, only evenly equal long setae; ventral branch of gonostylus rostriform apically; parameres with a long row of membraneous setae apically; aedeagus strongly robust, distinctly protruding beyond tip of parameres; tergite 9 elongated.

Distribution: South of China (Zhejiang and Hubei).

Female: Unknown.

Holotype male, Zhejiang: Anji, Longwangshan (30°23'N, 119°24'E), 1996-05-13, Wu Hong, No. 960102. Paratypes (2♂♂): 1♂, Zhejiang, Zhoushan (30°01'N, 122°06'E), 1991-04-19, Wu Hong, No. 910105; 1♂, Hubei, Wudangshan (32°23'N, 110°56'E), 1000m, 1984-06-01, Yang Chi-kun, No. 880547.

Etymology: The specific name refers to the type character of ventral branch of gonostylus.

Remarks: This species is similar to *T. beata* Gagne, 1981, but can be separated from the latter by the male terminalia with tergite IX medium sized; gonostylus strong apically, without apical dark setae, only evenly equal long setae; ventral branch of gonostylus rostriform apically; parameres with a long row of membraneous setae apically; aedeagus strongly robust, distinctly protruding beyond tip of parameres.

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A NEW SPECIES OF *PACHYOTOMA* BAGNALL, 1949 (COLLEMBOLA: ISOTOMIDAE) FROM CHINA[1]

Yufeng Ding,[2] Guofu Gao,[2] and Shiping Bai[2]

ABSTRACT: *Pachyotoma emeiensisis* sp. nov. characters is described from Sichuan Province, P. R. China. It differs from the 15 known species of the genus *Pachyotoma* in presence of both secondary granulation and endoskeletal reticulation on the body and 3 distinct teeth on mucro. Remarks on the taxonomical status of genera *Pachyotoma* and *Bonetrura* are provided.

KEY WORDS: Collembola, Isotomidae, *Pachyotoma*, endoskeletal reticulation, new species

The genus *Pachyotoma* consists of isotomids with secondary granulations on the integument, a well-developed furcula and a mucro separated from the dens. Densis straight, cylindrical or gradually narrowed, not crenulated, with granulated surface on the posterior side. Macrochaetae are not differentiated and all species have numerous sensilla on the body tergites except for *Pachyotoma thermaquatica* Potapov, 2005.

In the course of a study of collembolan communities made in Guangxi Province, one isotomid that falls in the genus *Pachyotoma* Bagnall, 1949 was discovered and it is new to science. Species of the genus had never been reported from China until Potapov (2005) moved *P. dabeiensis* Tamura and Zhao 2000 from the genus *Bonetrura* Christiansen and Bellinger, 1980 into *Pachyotoma* Bagnall, 1949.

METHODS

The specimens were cleared in Nesbitt's fluid and mounted in Hoyer's solution. Fixed slides were heat dried under lamp lights for 5–6 days.

Pachyotoma emeiensis, Ding, sp. nov.
Figs. 1–14

Type Data. Holotype: female, China: Sichuan Province: Emei City, 6-VIII-2006, collection number 1001. **Paratypes:** 7 females and 1 male, and about 100 specimens in alcohol, same data as holotype. All specimens were collected at the peak of Mount Emei. Type specimens are deposited in the School of Life Science, Nanjing Agricultural University.

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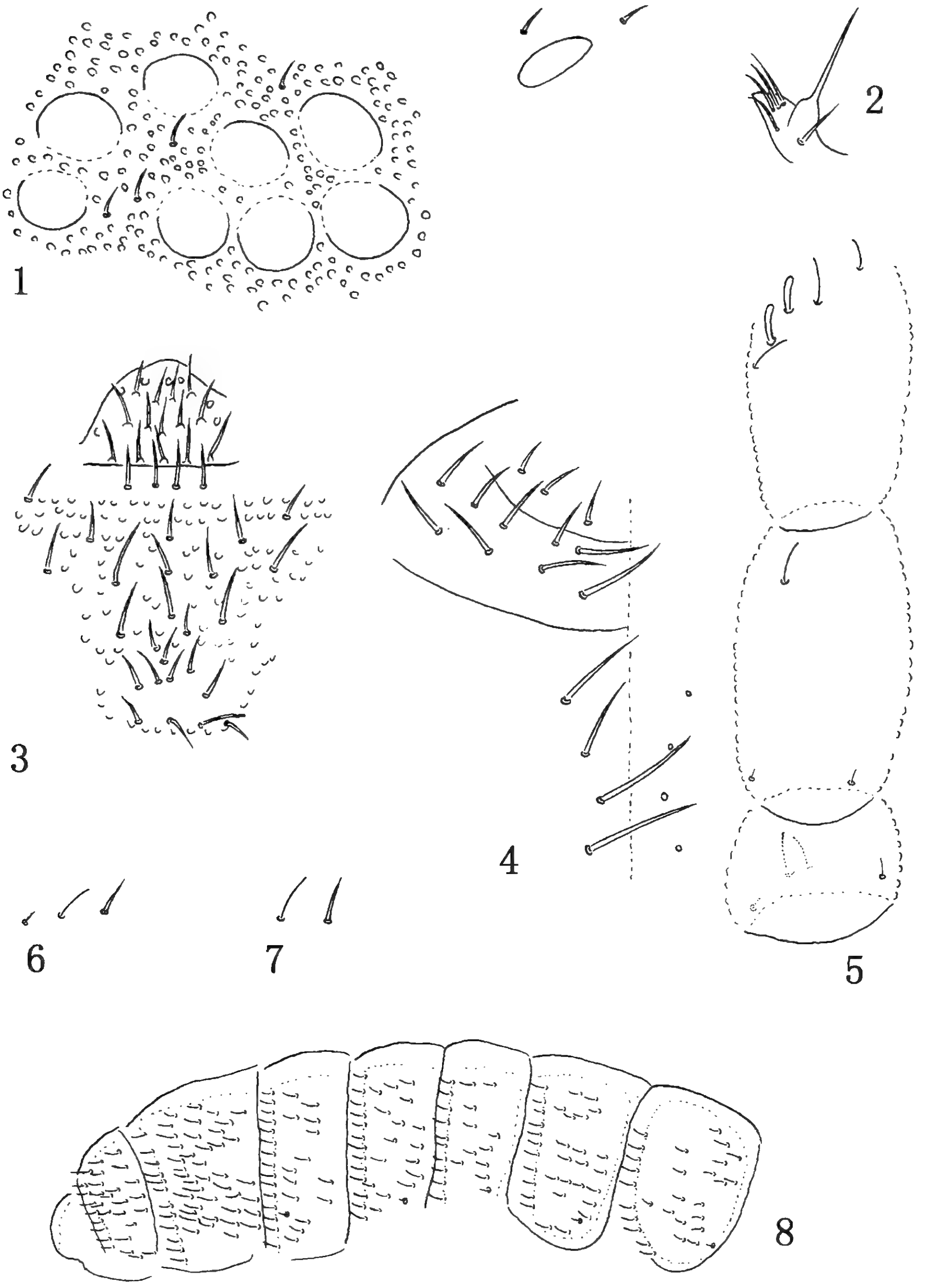
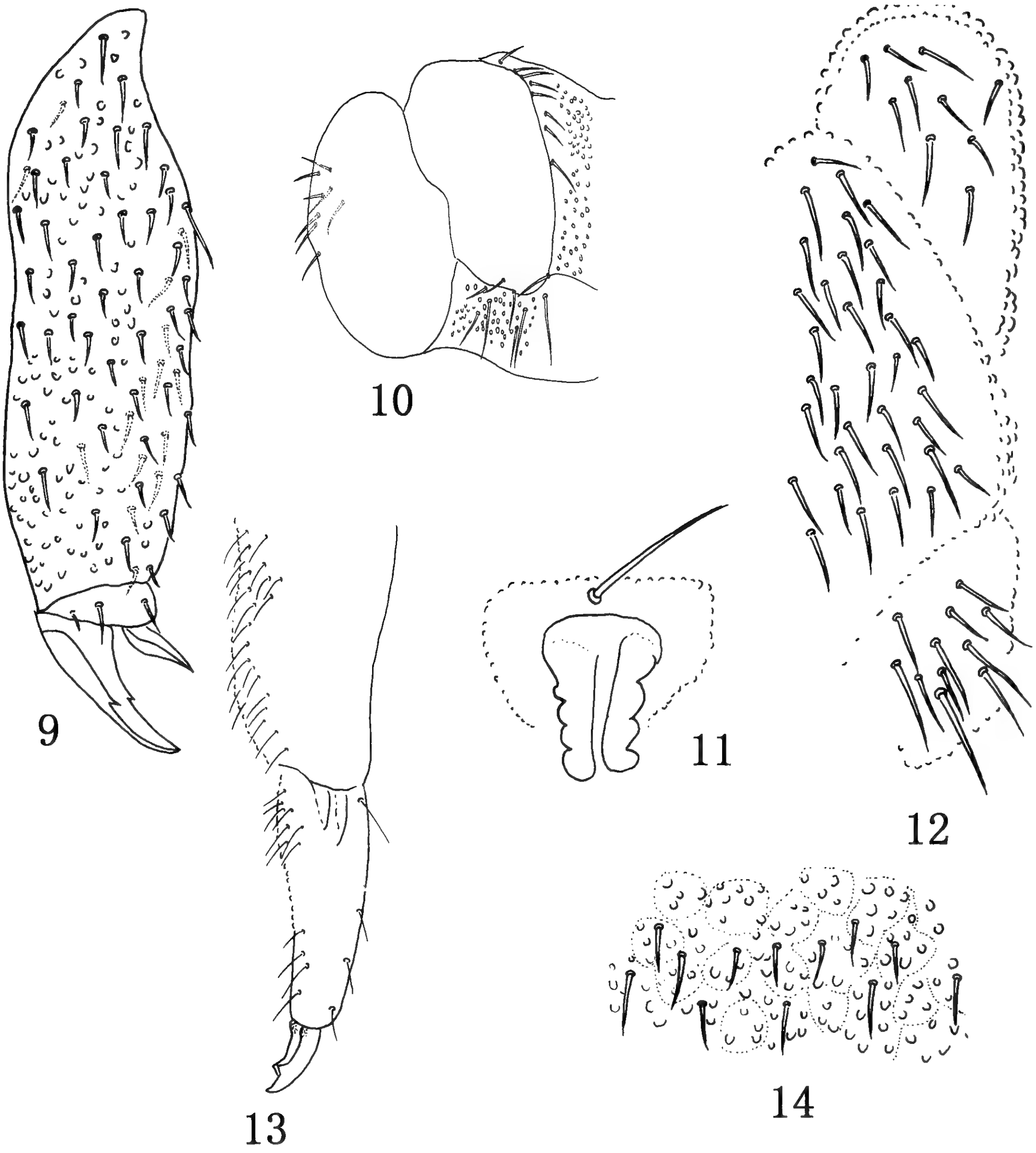


Figures 1-8. *Pachyotoma emeiensis,* sp. nov. 1. PAO and eyes; 2. maxillary outer lobe; 3. head (part), front view; 4. groups of proximal, basomedial and postlabial chaetae; 5. Ant. 1-3 (only sensillae and basal microsensillae shown); 6. sensillae, microsensillae and common chaetae on Th. II; 7. sensillae and common chaetae on Abd. IV; 8. general distribution of sensillar elements on body.



Figures 9-14. *Pachyotoma emeiensis,* sp. nov. 9. tibiotarsus and claw of hind leg; 10. ventral tube; 11. retinaculum; 12. chaetotaxy of subcoxa furcalis, (right side); 13. furcula (lateral view); 14. cuticle of Th. II (part).

Abbreviations. AO, antennal organ of third antennal segment; PAO, postantennal organ; Abd. I–VI, abdominal segments I – VI; Ant. 1, 2, 3, 4 - antennal segments; 1, 2, 3, 4, VT, ventral tube; al, anteriolateral furcal subcoxa; am, anteriomedial furcal subcoxa; p, posterior furcal subcoxa; bms, basal microsensillum on antennal segments; ms – microsensillum; p-row, posterior row of tergal chaetae; s, sensillum.

Description. Maximum body length 1.3 mm.

Color. Heavily darkish black including appendages.

Integument. With inner reticulation and large secondary granulation all over the tergites; secondary granulation also present on appendages but inner reticulation absent there.

Head. Ommatidia 8+8, G and H slightly smaller or subequal to the other six. PAO oval, without distinct constriction nor inner denticles, almost as long as nearest ommatidia and basal width of Ant. 1, and with 2 guard chaetae along its outer margin (Fig. 1). Maxillary palp simple, maxillary outer lobe with 4 sublobial hairs (Fig. 2). Labral formula 4/5, 5, 4. Clypeus with about 25 chaetae, those in the 3 transversal rows closer to labrum stronger than the rest (Fig. 3). Labium with 3+3 proximal cheatae and 4+4 basomedian chaetae. Ventral side of head with 4+4 chaetae along linea ventralis (Fig. 4). Ant. 1 with 2 bms, dorsal and ventral, and 2 ventral s; Ant. 2 with 2 bms and 1 latero-distal s; Ant. 3 with 5 distal s (2 inner, 2 outer and 1 lateral) and without bms; inner sensilla of AO are elongate, of almost the same size as outer sensilla, just slightly shorter than common chaetae on Ant. 3 (Fig. 5). Numerous sensilla present on Ant. 4, subapical organelle small.

Body Chaetotaxy. Macrochaetae (Mac) generally not differentiated, only distally on Abd. VI with 1+1 macrochaetae. Length of the two macrochaetae twice that of longer common chaetae and almost equal to that of mucro. Most of body sensilla slightly shorter than common chaetae except those on Abd. IV. Sensilla on Abd. IV curved more than those on other body segments and relatively longer than common chaetae on the same segment (Figs. 6 and 7). Tergites of Th. II – Abd. V covered with numerous sensilla along p-row and on medial and lateral parts. Sensilla and common cheatae along p-rows of the segments mostly alternately arranged. Sensillar and microsensillar formulae respectively as 25–28, 29–33/ 17–20, 28–31, 24–29, 51–57, 26–29(s) and 1, 1/1, 1, 1, 1 (ms). Axial setae (common setae along median line on each side) of Th. II–Abd. III: 10–11, 8–10/6–7, 6-7, 6–7 (Fig. 8). Th. III with 45-48 chaetae in p-row. Thorax without ventral chaetae.

Appendages. Upper and lower subcoxa of leg 1, 2, 3 with 0, 2, 2 and 1, 5, 6 chaetae respectively. Unguis of normal size and shape, with inner tooth. Tibiotarsi of all legs with numerous additional chaetae (Fig. 9). Tenent hairs thin and pointed. Ventral tube with 8+8 latero-distal and 8–10 posterior chaetae (Fig. 10). Retinaculum with 4+4 teeth on rami and 1 chaetae on ventral side of corpus (Fig. 11). Anterior part of furcal subcoxa divided into two groups, anteriolateral with 10–11 chaetae and anteriomedial with 30–34 chaetae, posterior furcal subcoxa with 11–15 chaetae (Fig. 12). Anterior side of manubrium smooth and with no chaetae present, posterior side granulated and with 30–40 chaetae. Medial part of manubrium thickening bispinose. Dens with 4 anterior chaetae, 1 distal and 3 basomedial. Posterior side of dens with clear secondary granulation and 12–13 chaetae, with 8–9 chaetae in basal part and 4 in distal part. Mucro strong, with 1 apical tooth, 2 symmetrical subapical teeth and 2 lamella. Each subapical tooth connected with base of mucro by one lamella. Mucro with a hook-shaped apex (Fig. 13). Ratio of manubrium: dens: mucro as 3.3–3.5: 2.7–3.0: 1.

Ecological Remarks. Found under rocks in a mixed forest comprising of Musa, bamboo and broad-leaf trees.

Etymology. The new species is named after the type locality.

DISCUSSION

There were no reports of the genus *Pachyotoma* in China before Potapov et al. (2005) moved *P. dabeiensis*, which was described from southwest China, from *Bonetrura* into *Pachyotoma*. Potapov made the change because *Bonetrura* Christiansen and Bellinger, 1980 was established mostly on missing chaetae located on the anterior side of dens (*P. dabeiensis* does have these chaetae). We agree with this placement and wish to supplement it.

According to the original description of *Bonetrura boneti* its pronotum is well-developed. This remarkable character is found that the same occurs in our specimens collected from Yellow Mountain, Anhui Province, China. Also, all these specimens should be placed in the genus *Bonetrura* for possessing secondary granulation and a well-developed dens lacking chaetae on its anterior side. Likewise, they also possess a well-developed and elongate pronotum, which is equal to or longer than the mesonotum. However, Tamura and Zhao did not mention this in their description of *P. dabeiensis* and according to the original figure, the pronotum of the species is reduced.

The presence of both endoskeletal reticulation and secondary granulation is shown in the descriptions for *Jestella siva* and *J. armata,* but not found in the described species of *Pachyotoma*. Mucro shape of the new species is distinct from all other species of *Pachyotoma*. These two characters clearly define *P. emeiensis* sp. nov.

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SCIENTIFIC NOTE

NEW ADDITIONS TO THE INVENTORY OF COLORADO MAYFLIES (EPHEMEROPTERA) AND CADDISFLIES (TRICHOPTERA)[1]

L. W. Myers[2] and R. E. Younghanz[2]

There are currently 102 species of mayflies (McCafferty et al., 1993, Durfee and Kondratieff 1994, Durfee and Kondratieff 1997) and 198 species of caddisflies (Herrmann et al., 1986, Ruiter 1990, Ruiter 1999) known from Colorado. In this paper, we report one new species record of mayfly *Stenacron interpunctatum* (Say) and one new species record of caddisfly *Brachycentrus numerosus* (Say) for the state. Both species were collected from the North Fork Republican River in Wray, Colorado, near the Kansas border. These collections extend the range westward for these two common, primarily eastern North American species (McCafferty and Huff 1978, Flint 1984). *Stenacron interpunctatum* is known to occur throughout Nebraska and Kansas (McCafferty et al., 2001). Likewise, *B. numerosus* is known from the central Nebraska counties of Brown and Thomas (unpublished data, C. P. Gillette Museum of Arthropod Diversity, Colorado State University), as well as from southwestern Kansas (Hamilton et al., 1983). These recent collections provide further evidence of the western dispersal of numerous aquatic insects via the Missouri River tributaries of eastern Colorado (Kondratieff and Ward 1987, Evans 1988, Zuellig et al., 2006). Further study is needed to determine where the two species occur in other suitable habitats of eastern Colorado in the South Platte and Arkansas River basins. The presence of both *S. interpunctatum* and *B. numerosus* in southwestern Kansas suggests their possible occurrence in the Arkansas River basin near the Kansas-Colorado border.

Selected Material Examined: *Stenacron interpunctatum*, Yuma Co., North Fork Republican River, Hatchery Bridge Recreation Area 0.5 miles East of Wray, N 40° 4.738', W 102° 14.840', 5 November 2005, L. Myers and R. Younghanz, 4 larvae. *Brachycentrus numerosus*, Yuma Co., North Fork Republican River, Hatchery Bridge Recreation Area 0.5 miles East of Wray, N 40° 4.738', W 102° 14.840', 5 November 2005, L. Myers and R. Younghanz, 4 larvae; Yuma Co., North Fork Republican River, Park in Wray, Colorado, N 40° 4.800', W 102° 13.159', 9 January 2005, B. Kondratieff, R. Younghanz and L. Myers, 4 males, 2 females (reared). Yuma Co., North Fork Republican River, Hatchery Bridge Recreation Area 0.5 miles East of Wray, N 40° 4.738', W 102° 14.840', 9 January

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2005, B. Kondratieff, R. Younghanz and L. Myers, 3 males (reared). All material is deposited in the C. P. Gillette Museum of Arthropod Diversity, Colorado State University, Fort Collins, Colorado.

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We thank Dave Ruiter, Centennial, Colorado, for confirming the identification of *B. numerosus* and Dr. Boris C. Kondratieff, Department of Bioagricultural Sciences and Pest Management, Colorado State University for review of this manuscript and assistance collecting material. Also we would like to thank Dr. Robert E. Zuellig of the USGS Fort Collins, Colorado, for review of this manuscript.

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SCIENTIFIC NOTE

TELENOMUS (HYMENOPTERA: SCELIONIDAE), EGG PARASITOID OF *CALIGO BRASILIENSIS* (C. FELDER, 1862) (LEPIDOPTERA: NYMPHALIDAE) IN SOUTHERN BRAZIL[1]

Cecilia B. Margaría,[2] Hélcio R. Gil-Santana,[3] Oton Meira Marques,[4] and Marta S. Loiácono[2]

Caligo brasiliensis (C. Felder, 1862) (Lepidoptera: Nymphalidae: Morphinae: Brassolini) (Casagrande, 2004), is a common butterfly in southern Brazil. The larvae feed on leaves of *Musa argentea* L., *Musa sapientum* L., *Musa parasidiaca* L. (Musaceae), *Hedychium coronarium* Koen. (Zingiberaceae) and *Euterpe edulis* Mart. (Palmae) according to Silva (1907), Silva et al. (1968) and D'Abrera (1987).

Caligo spp. larvae, sometimes, are even abundant enough to be considered as a pest on banana plantations (Hogue, 1993) but rarely reaching economic importance (Fancelli et al., 1998). Nevertheless, Malo and Willis (1961) suggested that *Caligo eurilochus* (Cramer, 1775), a very close species of *C. brasiliensis*, in the absence of effective natural biological control, could easily become a serious banana pest.

Information about egg parasitoids of *Caligo* spp. is scanty. In banana plantations particularly, the attack of the trichogrammatid species related to *Xenufens ruskini* Girault, 1915 is recorded for *C. eurilochus* in Ecuador (Malo and Willis, 1961); *Xenufens ruskini* for *Caligo memnon* (C. Felder et R. Felder, 1867). In Honduras and Colombia the attack of the encyrtid *Ooencyrtus caligo* Noyes is the record for *Caligo illioneus* (Cramer, 1775) eggs (Noyes, 1985) and *Ooencyrtus* sp. in eggs collected in Costa Rica (Harrison, 1963). There is no record about *Caligo brasiliensis* egg parasitoids in literature.

Johnson (1984) established eleven host-specific groups of *Telenomus* Haliday: *T. tabanivorus* from Diptera, *T. californicus, T. arzamae,* and *T. dalmanni* species group complex from Lepidoptera, *T. floridanus*, *T. crassiclava*, *T. podisi, T. phymatae, T. laricis, T. nigricoxalis* from Hemiptera, and *T. longicornis* with host unknown. From Brazil, several species of *Telenomus californicus* species group (Johnson, 1984) were recorded as endoparasitoids of lepidopteran eggs (Loiácono and Margaría, 2002).

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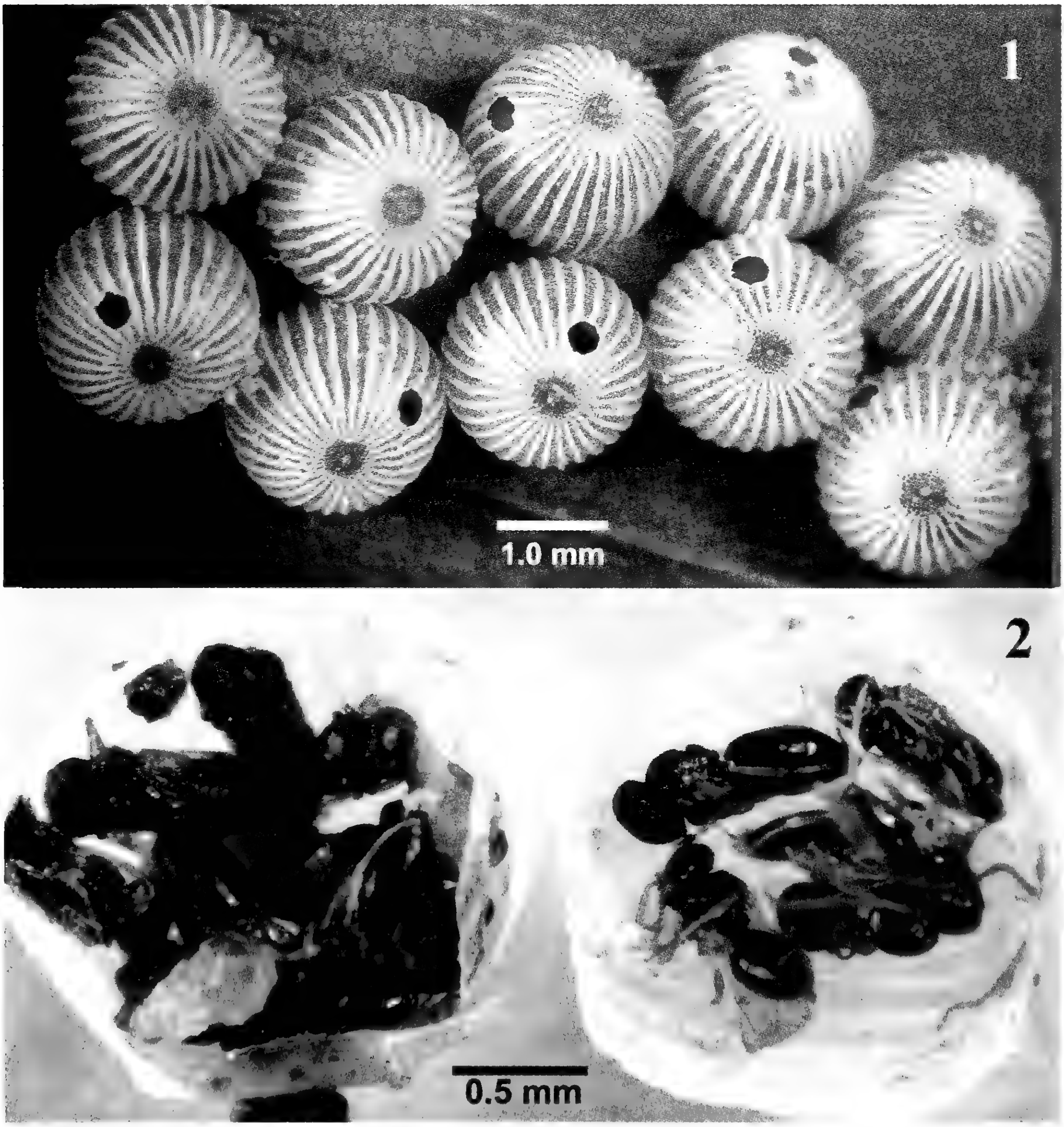
The vast majority of species of *Telenomus* are solitary egg parasitoids, i.e., one parasite develops per host egg. However, a few gregarious species attack large-sized host eggs of different insect orders, e.g., *T. monilicornis* Ashmead, 1894, *T. dendrolimi* Matsumura, 1925 and *T. fariai* Costa Lima, 1928. In these cases usually five to ten wasps complete development within an egg (Johnson, 1984).

METHODS

Caligo brasiliensis egg clusters (Figure 1) were collected on leaves of *Musa argentea* by the second author in Cabo Frio (22° 51' S - 42° 03' W), State of Rio de Janeiro in August and September 2005 and maintained in laboratory conditions.



Figures 1-2. 1. *Caligo brasiliensis* egg cluster after the emergence of adults wasps. 2. The wasps in a sectioned *Caligo brasiliensis* egg before their emergence.

The lepidopteran species was identified based on D'Abrera (1987) and is deposited at "Coleção Entomológica do Museu Nacional da Universidade Federal do Rio de Janeiro (MNRJ)."

The Scelionidae species that emerged from *Caligo brasiliensis* was identified following Johnson (1984) and the voucher specimens are deposited at Coleção Entomológica do Museu Nacional da Universidade Federal do Rio de Janeiro (MNRJ, Brazil) and División Entomología of the Museo de La Plata (MLP, Argentina).

RESULTS AND DISCUSSION

Two clusters of host eggs were attacked by *Telenomus*: 235 adults emerged from an eleven-egg butterfly cluster (1.VIII.2005) and 190 specimens from a ten-egg cluster (5.IX.2005) (Figure 1, see previous page), showing gregarious behavior with more than twenty parasitoid adults emerging per egg (Figure 2, see previous page).

The specimens reared belong to the *Telenomus californicus* species group as defined by Johnson (1984), and are closed to *Telenomus solitus* Johnson, 1983, differing principally on the basis of genitalia structure. *Telenomus solitus* has been reared from an unidentified noctuid egg and also it was cultured in laboratory from *Trichoplusia ni* (Hübner) (Lepidoptera: Noctuidae) in Guatemala (Johnson, 1983). This record confirms the Lepidoptera host-specific of *T. californicus* species group. This is the first record of *Caligo brasiliensis* egg parasitoid species.

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We thank Olaf H.H. Mielke by information about the taxonomy of *C. brasiliensis* and financial support from the Secretaría de Ciencia y Técnica de la Universidad Nacional de La Plata, Consejo Nacional de Investigaciones Científicas y Técnicas (Argentina).

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SCIENTIFIC NOTE

CONFIRMATION DATA FOR THREE SPECIES OF MAYFLIES IN THE STATE OF WASHINGTON, U.S.A. (EPHEMEROPTERA: EPHEMERELLIDAE, EPHEMERIDAE, HEPTAGENIIDAE)[1]

W. P. McCafferty[2] and M. D. Meyer[3]

Eaton (1885) reported *Cinygma integrum* Eaton (Heptageniidae) from "Washington Territory" and Mount Hood, Oregon. No collection data were given by Eaton, and there have been no additional reports from the state of Washington. Spieth (1941) listed Washington (as Washington Territory) among states and provinces from where he had seen specimens of *Hexagenia limbata limbata* (Serville) [now *H. limbata*] (Ephemeridae). No other data were given by Spieth, and there have been no additional reports from the state of Washington. Landa et al. (1982) noted *Caudatella edmundsi* Allen (Ephemerellidae) from Washington but provided no other data. There have been no other reports from the state of Washington.

From our study of numerous collections (see below), we are able to confirm each of the three species mentioned above with Washington State collection data, as per required for establishing valid species ranges (McCafferty 2000) as follows:

Caudatella edmundsi (all larvae): Chelan Co, Wenatchee R, 10-VII-2003 (United States Environmental Protection Agency, Corvallis, OR); Okanogan Co, North Fork Toats Coulee Cr, 7-IX-1995 (WDE: Washington Dept Ecology, Olympia, WA); Spokane Co, Deadman Cr, Deadman Rd, 7-VII-1962 (PERC: Purdue Entomological Research Collection, West Lafayette, IN); Whatcom Co, Thompson Cr, 16-IX-1996 (WDE).

Hexagenia limbata: adults, Benton Co, Snake R, 20-VII-1996 (RN: Robert Newell-Flathead Lake Biological Station Collection, Polson, MT); adults, Chelan Co, Lake Chelan, 6-VII-1964 (PERC); adults, Columbia Co, Touchet R, 15-VIII-1999 (RN); larvae, Spokane Co, Spokane, 1940 (Illinois Natural History Survey, Champaign, IL).

Cinygma integrum (all larvae): Asotin Co, Fields Spring St Prk, 22-IV-1972 (WSU: Washington State University, Pullman, WA); Challam Co, Indian Cr, Lake Aldwell, 18-VI-2001 (PERC); Lewis Co, Ohanapecosh, Mt Rainier Natl Prk, 16-V-2001 (C. P. Gillette Museum, Colorado State University, Fort Collins,

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CO); Okanogan Co, 8 Mile Cr, Winthrop, 24-VI-1936 (WSU); Pierce Co, West End Rd, Mt Rainier Natl Prk, 12-VIII-1977 (WSU); San Juan Co, Deadman Cr, San Juan Island, 19-V-1978 (Monte L. Bean Life Science Museum, Brigham Young University, Provo, UT); Yakima Co, Rimrock Lake, 12-VI-1973 (WSU).

Possible confusion regarding one other "Washington" species with no state of Washington data involves *Procloeon vicinum* (Hagen) (Baetidae). This species was described from "Washington" by Hagen (1861) (as *Cloe vincina*). That record, however, is referable to Washington (District of Columbia) as indicated by Edmunds (1962).

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SCIENTIFIC NOTE

NOTES ON THE SYNONYMY OF THE CENTIPEDE *OTOSTIGMUS ETHONYX* CHAMBERLIN, 1955 (SCOLOPENDROMORPHA: SCOLOPENDRIDAE: OTOSTIGMINAE) FROM PERU[1]

Amazonas Chagas-Junior[2]

The subfamily Otostigminae in the Neotropical Region is represented by two genera: *Otostigmus* Porat, 1876 and *Rhysida* Wood, 1862. *Otostigmus* is divided into two subgenera: *Otostigmus* and *Parotostigmus* Pocock, 1896. Only *Parotostigmus* occurs in the Neotropics.There are also six species of *Parotostigmus* in West and Central Africa. *Parotostigmus* is one of the most diverse subgenera of scolopendromorphs from Neotropics, with 56 species and 14 subspecies (Minelli, 2006). Eight species, five endemic, and one subspecies have been recorded from Peru. Half of the species have been described by Chamberlin (1914, 1944, 1955, 1957). Chamberlin (1955) described three species of *Otostigmus*: *O. ethonyx*, *O. leior,* and *O. volcanus*, all of them without illustration. The last two species cited by Chamberlin (1955) were by the original description assigned to the subgenus *Parotostigmus,* however *O. ethonyx* was not. The characters given in the brief description of *O. ethonyx* such as prefemur of the ultimate leg with spines and the coxopleuron with a conical process are characteristics of the species of the subgenus *Otostigmus* that occurs only in the Old World. Kraus (1957) investigated the Myriapoda fauna from Peru and kept Chamberlin's arrangement, listing four species of *Otostigmus*, three of them were placed in the subgenus *Parotostigmus*, while *O. ethonyx* was classified under *Otostigmus*. Apparently, Kraus did not collect any other specimen of *O. ethonyx* or analyzed the holotype described by Chamberlin (1955). Because of this, he followed Chamberlin (1955) but pointed out that the occurrence in Peru of a species of the Old World subgenus *Otostigmus* was remarkable and that the species was inadequately described. Bücherl (1974) was the first author who listed *O. ethonyx* under the subgenus *Parotostigmus*; however he did not give any explanation about this alternative arrangement. Therefore the status of *O. ethonyx* needs to be reassessed. For this project, the holotype of *O. ethonyx* has been borrowed and analyzed. Four characters mentioned by Chamberlin (1955) such as ultimate legs incrassate, tergites from the first to twentieth with two complete paramedian sutures, claws of the legs as long as the second tarsal and tarsi of the legs without spines are characteristics of the genus *Cormocephalus* Newport, 1844. Of the characters cited above, legs without spines are present in only *Otostigmus* (P.) *limbatus* Meinert, 1886. Moreover, no species of *Parotostigmus* has paramedian sutures on the first tergite and claw longer than the second tarsus. The spiracles in Otostig-

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minae do not have flaps and in *Cormocephalus* they are divided into three flaps, the diagnostic feature of Scolopendrinae. The holotype of *O. ethonyx* was compared with the holotype of *C. andinus*. The former presents nine relevant characters that match those in the latter: antenna with 17 antennomeres, first seven or eight antennomeres glabrous, cephalic plate with two longitudinal sutures diverging anteriorly, tooth plates 3+3, complete paramedian sutures present from 1st to 20th tergites, ultimate tergite with complete longitudinal suture, complete paramedian sutures present from 2nd to 20th sternites, coxopleuron with a short process and two apical spines, prefemora of the ultimate leg with two apical dorsolateral spines, two lateral spines, two median spines and four ventral spines and from the medial portion of the dorsal face of the prefemora, femora and tibia with a longitudinal depression, like a sulcus. Therefore, I conclude that the holotype of *O. ethonyx* actually corresponds to a juvenile of *Cormocephalus andinus* (Kraepelin, 1903). *Cormocephalus andinus* is the most common of the six species of *Cormocephalus* recorded from Peru. The comparison of the two types was necessary because there is another species of *Cormocephalus* – *Cormocephalus mundus* Chamberlin, 1955 – in Abancay, type locality of *O. ethonyx*.

The results presented here support the following conclusions: 1) *O. ethonyx* is a junior subjective synonym of *C. andinus* and 2) there are no known representatives of the subgenus *Otostigmus* in the Neotropics, corroborating the hypothesis of Kraus (1957).

ACKNOWLEDGMENTS

I am grateful to Charles Griswold of the California Academy of Sciences for the loan of the holotype of *O. ethonyx* for this study and to Hieronymus Dastych for the facilities during my visit to the Zoologisches Institut und Zoologisches Museum, Hamburg, Germany, for the study of the holotype of *C. andinus*. I thank Adriano Brilhante Kury and several anonymous reviewers for the helpful suggestions and criticisms of the manuscript. This research was supported in part by scholarships from Conselho Nacional de Desenvolvimento Cientifíco e Tecnológico (CNPq) and Fundação Carlos Chagas Filho de Amparo à Pesquisa do Estado do Rio de Janeiro (FAPERJ). Several anonymous reviewers offered helpful comments to an earlier version of this manuscript.

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SCIENTIFIC NOTE

THE USE BY RED IMPORTED FIRE ANTS, *SOLENOPSIS INVICTA* (HYMENOPGEFA: FORMICIDAE), OF *POTAMOGETON NODOSUS* (POTAMOGETONACEAE) LEAVES AS PLATFORMS INTO THE LITTORAL ZONE IN TEXAS, U.S.A.[1]

Richard J. W. Patrock[2]

It has become increasingly clear that waterways facilitate the invasion process for many species, including terrestrial species, such as ants (Walker 2006). The underlying reason may be directly related to transportation, as in the case of the red imported fire ant, *Solenopsis invicta* Buren whose colonies can spread by rafting on moving water (Banks et al., 1981). In other instances, periodic flooding along riparian courses often creates disturbance regimes, which promote invasions (Ellis et al., 2001). Additional habitat considerations include elevated soil moisture (Holway et al., 2002) and high productivity associated with riparian ecosystems (Kennedy 1998, Paetzold et al., 2006). These conditions are likely to promote high colony growth rates and an associated higher propagule pressure, furthering the invasion process. Ants that are predisposed to be around water are more likely to be able to take opportunistic advantage of waterways for their dispersal (Suarez et al., 2005).

Many *Solenopsis* species, especially the most widely distributed species, commonly forage around water (Wilson 1986). The black imported fire ant, for instance, has been found preying on tubeworms exposed during low tides (Palomo et al., 2003), while *S. invicta* is considered a threat to wildlife in wetland habitats (Freed and Neitman 1988). The latter study noted that the fire ants were able to extend their reach into the pond by utilizing unspecified vegetation as a walkway but gave no additional details. This note offers further information as to the use by fire ants of floating vegetation as natural roads.

In June of 2002, I first observed *S. invicta* workers crossing long leaf pondweed, *Potamotegon nodusus* leaves lying on the water surface of a manmade lake in Lee County, TX (N30.14, W96.88). *Potamotegon nodosus* is a fast-growing aquatic plant that forms extensive platforms of networked leaves on the water surface of the littoral zone. In the situation observed, these platforms were growing in an emergent area of the lake with seasonal inundation. I was able to observe the ants closely out over the water because of the presence of a 15m long raised pier that paralleled the pondweed. Many of my observations were made using a Sony PCV DCR-TRV9.

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Foraging fire ants set up observable trails over the leaves that extended ca. 8 meters from the edge of the lake. No other ants were observed on the leaves, nor on the edge of the lake at this vicinity during 22 visits to the field site. I was unable to record any instances of prey capture by the ants, despite the panoramic view and the abundance of various insects and other invertebrates on or near the leaf surfaces. In only a few cases were ants seen running in tandem, and the multi-directional paths seen for all the ants at any given time suggested that I was observing only scouting.

The surface temperatures of the leaves measured using a MiniTemp MT4 Portable IR thermometer was almost identical to that of the water surface, as well as being significantly cooler and much less variable than the soil surface temperatures registered at midday (ca. 5-25°C less depending on the level of shade and moisture). On two separate days (15 July and 12 August 2003), I followed the activity of the fire ants on the pondweed, as well as at bait transects in an adjacent meadow. The transects consisted of 10 hotdog baits, spaced at 10m intervals, set out in the late morning until the late afternoon, before and after surface soil temperatures reached 30°C and at least 40°C, respectively. As expected, recruitment was temperature limited with no ants moving to the baits when surface temperatures were above 45°C. There was a corresponding reduction and negation in fire ant movements on the pondweed at these times, as well, despite the much cooler surface temperatures (25-27°C). These observations suggested that a temperature constraint existed somewhere on the path to the pondweed or there was a general termination of foraging by the colony(ies) according to ambient soil conditions. Foraging on the pondweed therefore did not appear to allow for an expansion of the temporal window of activity for the fire ants.

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The inspiration for this note came from Fernando Pessoa: "Navegar é preciso; viver não é preciso". Many thanks go to the owners and managers of the Delta P for allowing our laboratory access to the property. I am grateful to Jerry Cook who read an early draft of the manuscript. Support came through the Lee and Ramona Bass Foundation, the Robert J. Kleberg and Helen C. Kleberg Foundation and the State of Texas Fire Ant Research and Management Project (FARMAAC) to Lawrence E. Gilbert at the University of Texas at Austin.

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ERRATA

The recently published paper, entitled "Redescription of the pupa of *Paryphoconus oliveirai* Lane (Diptera: Ceratopogonidae) from Brazil" by Ronderos et al. (2007) was published with several mistakes, herein corrected:

Page 363: lines 11 and 12 — where it reads "dorsal tubercles (d) (Figs. 7, 9): i-iii,v with long, thin seta, iv pore, setae of iii,v slightly longer than setae of i-ii" — it should read "dorsal tubercles (d) (Figs. 7, 9): i-iv, with long, thin seta, v,vi pore, setae of iii,iv slightly longer than setae of i-ii;

Page 363: lines 24-27 — where it reads "four dorsal posteromarginal tubercles (dpm): i,ii,iv with long, stout, subequal setae, iii pore; three lateral posteromarginal tubercles (lpm): i,ii with long, stout setae, sharing stout triangular base, iii with long, stout seta" — it should read "four dorsal posteromarginal tubercles (dpm): i,iii,iv with long, stout, subequal setae, ii pore; three lateral posteromarginal tubercles (lpm): ii,iii with long, stout setae, sharing stout triangular base, i with long, stout seta";

Page 363: line 29 — where it reads "except lpm i,ii" — it should read "except lpm ii,iii."

SCIENTIFIC NOTE

RANATRA QUADRIDENTATA STÅL (HETEROPTERA: NEPIDAE) FROM LOUISIANA, U.S.A., A NEW STATE RECORD[1]

Ethan Bright[2] and Robert W. Sites[3]

The family Nepidae in the United States and Canada was last reviewed by Sites and Polhemus (1994), who gave a diagnosis of *Ranatra quadridentata* Stål. This species ranges from southwestern California towards eastern Texas, and south through Mexico to Nicaragua. The combination of 1) a long, penultimate antennal segment, 2) a strongly developed profemoral distal tooth followed by a unique deep notch, and 3) a raised, arcuate, digitate metaxyphus distinguishes this species from other species of *Ranatra* known to occur in the United States.

Examining specimens from samples collected many years before their sorting and processing can often lead to interesting surprises. One specimen of *R. quadridentata* was identified in 2003 by EB and confirmed by RWS, from a batch of samples collected on September 12, 1940, from Louisiana, in Lincoln Parish, by Reeve Bailey and Max Davis, of the University of Michigan Museum of Zoology (UMMZ) Fish Division. This location represents an eastward extension of over three hundred kilometers from its known range (Sites and Polhemus 1994), and a new state record. From Dr. Bailey's field notes and personal communication, the collection site (approximate lat-long: 32.519°N, 92.455°W) was located in an overflow pool of Bayou Chaudrant, 5 miles west of Calhoun, along US-80 at Tremont. The site was described as a turbid, stagnant overflow pool, about 18 m in diameter and less than 1 m depth, with bare mud flat shores. Specimens were collected with a 10-foot seine, preserved on site in 10% formalin and later transferred to 70% EtOH. The specimen is deposited at the UMMZ-Insect Division and preserved in 80% EtOH.

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SCIENTIFIC NOTE

A LONG JOURNEY: OBSERVATIONS ON THE STEEL-BLUE CRICKET HUNTER *CHLORION AERARIUM* PATTON (HYMENOPTERA: SPHECIDAE)[1]

G. K. Lechner[2]

According to Bohart and Menke (1963), the Steel-Blue Cricket Hunter, *Chlorion aerarium* Patton, ranges throughout the United States into southern Canada and to the Mexican state of Puebla. Reports on this large (25 mm – Peckham and Kurczewski, 1978) metallic colored bluish-violet wasp appear scattered in the literature going back to the late 19th century. Most references are somewhat limited in scope. The Peckhams (1898, 1900) observed *C. aerarium* (as *C. coeruleum*) carrying a cricket (*Gryllus abbreviatus*). Williams and Hungerford (1912), Rau and Rau (1918), Krombein (1953, 1959), Evans (1974), O'Brien (1989), and Lechner (2006) also report observations of *C. aerarium* interactions with prey. Bohart and Menke (1976) synopsized the published reports up to that time. The most comprehensive paper I am aware of discussing *C. aerarium* is Peckham and Kurczewski (1978), where they detail the nesting behavior and prey transport. As an addition to the knowledge of *Chlorion aerarium* interactions with its prey, I offer the following intriguing encounter from the summer of 2005.

Just prior to noon on 21 July 2005, I observed a female *C. aerarium* fly in and land on the curb of the concrete driveway of a single-family dwelling at 3624 Virginia Street, Sioux City, Iowa, U.S.A. Her landing point was six paces west of the free-standing garage at this residence. Upon approach, I saw that this wasp was carrying a cricket, and I dropped an insect sweep net over her. Unfazed she continued to walk around carrying her cricket. By manipulating the net, I induced her to climb into the net with her prey. Seeking a more convenient place to examine my capture, I took the wasp into the garage, and using the trunk lid of the car as a work surface, I introduced a jar into the net and caught the wasp in it. By this time, however, she had dropped her cricket which landed venter upward on the trunk lid. The cricket remained motionless. It was a black field cricket (*Gryllus*) intact except for a missing right rear tibia.

In an effort to see if the wasp would reclaim her prize, I inverted the capture jar over the cricket and dumped the wasp out. She immediately investigated the cricket. Faster than my eye could follow, the female *C. aerarium* flipped the cricket so that it was now dorsum upward and head-to-head with her as she straddled it and began carrying it with short hopping flights across the trunk lid and

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then down to the concrete floor of the garage. This is at variance with O'Brien (1989) who reported prey transport by *C. aerarium* in the venter upward position. Peckham and Kurczewski (1978), however, report prey transport as dorsum upward.

Upon landing on the garage floor, the wasp gave up her grip on the cricket briefly, then restraddled it and began walking westward. Although the garage door for the car was fully open, the wasp chose to leave the garage through the adjacent foot traffic door. After exiting, and instead of continuing west toward her original landing site, the wasp turned northward and then eastward walking onto the concrete patio which abuts the garage along its entire north side. She released the cricket again briefly. The she continued walking eastward, flew forward a short distance, landed, and continued walking until she arrived at the northeast corner of the garage. As she walked, she flicked her wings almost constantly.

At this location, she paused on one of the pieces of broken concrete that form a perimeter border around the small garden on the east side of the garage. I approached her very closely at this time, and she was persuaded to move. Instead of walking through the garden, she climbed while still carrying her prey to the top surface of a nearly horizontal enclosed metal rain spout that runs near the foundation along the east side of the garage. The wasp continued southward along the top surface of the spout until reaching the southeast corner. Here the rain spout turns upward and runs vertically to the rain gutter along the south eave. The wasp began climbing this spout; but after only a few steps, she dropped to the ground into a bed of tansy (*Tanacetum vulgare*). Because the tansy had been thinned out recently, I could see the wasp as she walked westward staying near to the garage foundation. She even once set the cricket down and appeared to malaxate her victim briefly in the area anterior to the pronotum before picking it up again and resuming her walk.

After reaching the southwest corner, the wasp walked onto the top of the driveway curb, briskly continuing west until she arrived at the approximate location where I originally captured her. Here, she seemed to recognize that she was near her destination, but she hesitated and walked back and forth a bit, even entering the *Sedum* adjacent to the driveway curb a couple times before re-emerging. This *Sedum* provides protective ground cover at the top of a concrete slab retaining wall which bears some of the load of the driveway. I have written of this wall in a previous note on *C. aerarium* (Lechner 2006). She retreated eastward and entered the *Sedum* again. This was apparently the spot she wanted for she did not come back out of the *Sedum,* and I discontinued observation. Peckham and Kurczewski (1978) reported that *C. aerarium* nests in burrows constructed by *Sphecius speciosus;* and although these hunters of cicadas are frequent nesters in the retaining wall, and have been for several years, I can neither confirm nor rule out that the *C. aerarium* that is the subject of this report was using an *S. speciosus* burrow. Following the wasp's path into the *Sedum* was not deemed prudent since excavating here might compromise the structural integrity of the wall and lead to collapse of the driveway.

This entire episode lasted five to seven minutes, and because the garage is of fairly standard dimensions, by traversing the long way around, this persistent wasp undertook an expedition at least three times the length of the direct route she could have taken to her burrow and more than 800 times her entire length.

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SCIENTIFIC NOTE

AGATHIS MONTANA SHESTAKOV (HYMENOPTERA: BRACONIDAE), A NEW PARASITOID OF *PANDEMIS CERASANA* HÜBNER (LEPIDPOTERA: TORTRICIDAE) IN TURKEY[1]

Coskun Guclu[2] and Hikmet Ozbek[2]

The genus *Agathis* Latreille is well documented in West Palaearctic region (Simbolotti and van Achterberg, 1999), in Central Asia, Eastern Europe (Tobias, 1986; Nixon, 1986; Simbolotti and van Achterberg, 1999), and in Turkey (Nixon, 1986; Zettel and Beyarslan, 1992; Cetin and Beyarslan, 2000; Guclu and Ozbek, 2002). The members of *Agathis* are koinobiont endoparasitoids of the larvae of some lepidopteran families, especially Gelechiidae, Coleophoridae, Noctuidae, Tineidae, Oecophoridae, Heliodinidae, Pyraustidae, Cochylidae, Momphidae, Epermeniidae Incurvariidae and Tortricidae (Tobias 1976, 1986; Simbolotti and van Achterberg, 1999). Some species of *Agathis* are very significant as biological control agents of economically important insects (Raske and Schooley, 1979). *Agathis* females prefer to lay their eggs in concealed hosts like larvae of *Pandemis* spp. *Agathis montana* Shestakov is reported for the first time as a parasitoid of *Pandemis cerasana* Hübner (Lepidoptera, Tortricidae) in Turkey. It frequently causes economic damage to flowers, fruitlets or fruits of some pome fruits directly (Labanowski 1979). There is no information on the hosts of *A. montana* in the present literature. The host, *Pyrausta aurata* Scopoli (Lepidoptera, Pyralidae), given by Tobias (1986), for this species is probably based on misidentifications (Simbolotti and van Achterberg, 1999).

Material Examined: Turkey, Erzurum, Askale, 1900 m 11.VII.2004, 4 females, 2 males (leg. C. Guclu).

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Jorge A. Santiago-Blay
Editor, *Entomological News*

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During the time I have served as editor of *Entomological News* [Volumes 114 (2003) to the present], over 600 post-submission reviewers from all continents, except Antarctica, have generously donated their time and expertise. Herein I wholeheartedly and gratefully acknowledge all who have contributed towards the completion of these volumes, to pre-submission reviewers (not listed), and to reviewers who prefer to remain anonymous for help maintaining and increasing the scientific quality standards of *Entomological News.*

Jorge A. Santiago-Blay

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