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Review of the Nearctic genus *Lacconotus* LeConte (Coleoptera, Mycteridae, Eurypinae)

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Abstract

Lacconotus LeConte, the sole Nearctic representative of the eurypine Mycteridae, is revised, based on morphological features of adults. The following **syn. n.** is proposed: *L. pallidus* Van Dyke, 1928 = *L. pinicola* Horn 1879. The former is a light-colored form with a southern California distribution. A **subgen. n.,** *Alcconotus*, is described for *L. pinicola*, producing the following **comb. n.**: *Lacconotus* (*Alcconotus*) *pinicola* (Horn). A lectotype is designated for *L. pinicola*. A key separating the two subgenera and species is provided, as are photographs and illustrations of salient structures of adults, and maps showing collection localities. *Lacconotus punctatus* is newly recorded in Alabama, Arkansas, Massachusetts, Oklahoma, Texas, and Wisconsin; *L. pinicola* is newly recorded in Arizona and Utah in the USA, and Baja California Norte in Mexico. Phenology information shows a north-to-south gradation in occurrence time.

Keywords

Coleoptera, Mycteridae, Eurypinae, North America, new records, range extensions

Introduction

Among the three subfamilies of Mycteridae, the Eurypinae (= Lacconotinae) are the most diverse with 26 genera and 160 species recognized worldwide, the greatest diversity being in New and Old World tropical regions (Pollock 2010). The Nearctic fauna of Mycteridae is not large, but represents all three subfamilies: six species of *Mycterus* Clairville (Mycterinae), three species of *Hemipeplus* Latreille (Hemipeplinae), and two species of Eurypinae. The latter are represented by *Lacconotus punctatus* LeConte and *L. pinicola* Horn (= *L. pallidus* Van Dyke). The distribution of the family in North America is decidedly either western or eastern, i.e., there are no species represented in the interior of the continent, and no single species bridges this distributional gap (Pollock 2002).

According to Horn (1879: 339), "The Mycteridae seem to have been cast about from place to place by the various students who have had occasion to write about them." Indeed, the constituents of the 'modern' concept of Mycteridae have been placed in multiple families, ranging from Cucujidae (for *Hemipeplus*) (e.g., LeConte 1854), to Melandryidae (e.g., LeConte and Horn 1883; Van Dyke 1928), and Pythidae (e.g., Seidlitz 1917; Blair 1928). In a phylogenetically based analysis of families related to Mycteridae, Beutel and Friedrich (2005) elucidated the following relationship: (Prostomidae + (Mycteridae + Boridae)); however, they stated that the relationships among the Mycteridae and related families are far from settled.

This study of *Lacconotus* was undertaken for several reasons. For some time, it was recognized (Pollock, personal observation) that the eastern and western species of the genus were rather dissimilar structurally; recent collections of specimens, especially through Michael Caterino's "California Beetle Project", have added much more material for study; and, it is the first author's goal to revise all genera of world Mycteridae, including the many presently poorly known genera of Eurypinae.

Natural History

As with many other groups of Tenebrionoidea, and Coleoptera generally, relatively little is known of the specific habits of eurypine Mycteridae. Larvae have been described for only a few species; these descriptions (see references in Pollock 2010) indicate that larvae occur under loosened tree bark (e.g., *Physcius fasciatus* Pic, *Physiomorphus* spp., *Phaeogala rufa* Abdullah) or in palm leaf axils or dead foliage (e.g. *Eurypus* spp.). With the exception of *Stilpnonotus* spp., eurypine larvae have flattened bodies and well-developed, complex urogomphal plates, typical of larvae that move subcortically. Lawrence (1991) indicated that mycterid larvae are phytophagous, and that plant-derived material has been found in gut contents of several species.

The biology of *Lacconotus* seems typical of eurypines: larvae occur under bark of various tree species. Lawrence (1991) illustrated the larva of *L. pinicola* (Apache Co., Arizona) and indicated that larvae of this species occur under bark of poplar (*Populus*) and fir (*Abies*). Crowson and de Viedma (1964) mentioned a larva, presumed to be that of *L. pallidus* (= *L. pinicola*), from under bark of dead oak (*Quercus* sp.).

Other specific details pertinent to natural history, derived from label data or other sources, are given under *L. punctatus* and *L. pinicola*, below.

Methods and conventions

Standard taxonomic methods were used in this study. Habitus photographs were taken with a Nikon Coolpix 5000® digital camera fitted to a Leica MZ95 stereoscope. Approximately 30 separate photographs were taken for each specimen/structure; these were imported into Combine ZP (Hadley 2010), which stacked and aligned the individual images to create a final photograph completely in focus.

Several measurements were used: HL = length of head from anterior margin of pronotum to labrum; PL = length of pronotum along middle; EL = length of elytron from anterior to posterior extent; GHW = maximum width of head, across eyes; GPW = maximum pronotal width; GEW = maximum width of both elytra; TL = HL + PL + EL.

Label data on type specimens are recorded *verbatim*, with all label data enclosed in quotes and individual labels separated by a slash (/). Information added by the authors for clarity is enclosed in square brackets ([ ]).

Abbreviations of collections (largely following Evenhuis 2011) consulted and referred to in this study are:

AAAC	Albert A. Allen Collection, Boise, Idaho, USA
AMNH	American Museum of Natural History, New York City, New York, USA
CAS	California Academy of Sciences, San Francisco, California, USA
CMNH	Carnegie Museum of Natural History, Pittsburgh, Pennsylvania, USA
CNC	Canadian National Collection of Insects, Arachnids, and Nematodes, Ottawa, Ontario, Canada
CSCA	California State Collection of Arthropods, Sacramento California, USA
CUIC	Cornell University Insect Collection, Ithaca, New York, USA
DAPC	Darren A. Pollock Collection, Eastern New Mexico University, Portales, New Mexico, USA
EMEC	Essig Museum of Entomology, University of California, Berkeley, California, USA
FMNH	Field Museum of Natural History, Chicago, Illinois, USA
MCZ	Museum of Comparative Zoology, Harvard University, Cambridge, USA
NMNH	National Museum of Natural History, Washington, District of Columbia, USA
NSMC	Nova Scotia Museum, Halifax, Nova Scotia, Canada
QMOR	Collection Entomologique Ouellet-Robert, Université de Montréal, Montréal, Québec, Canada
RBC	Rick Buss Collection, Albuquerque, New Mexico, USA
SBMN	Santa Barbara Museum of Natural History, Santa Barbara, California, USA
TAMU	Texas A & M University, College Station, Texas, USA
UAIC	University of Arizona Insect Collection, Tucson, Arizona, USA
UBC	University of British Columbia, Vancouver, British Columbia, Canada
UCR	University of California-Riverside, Riverside, California, USA
UNHC	University of New Hampshire, Durham, New Hampshire, USA

WFBM	W.F. Barr Entomological Collection, University of Idaho, Moscow, Idaho, USA
WIRC	Wisconsin Insect Research Collection, University of Wisconsin, Madison, Wisconsin, USA

Identification

Adults of *Lacconotus* can be differentiated with the following key:

1 Dorsal color dark brown to near black, except for variously developed lateral reddish areas on pronotum (Fig. 1) (in some specimens reduced to the extreme posterolateral corners, e.g., Fig. 4); elytral punctation coarse, punctures obvious; antennae short, antennomeres submoniliform; male sex patch large, bulbous, glabrous, and with contrasting pink-red color (Fig. 5); known from eastern North America, west to Texas (Fig. 15) .... ***Lacconotus (Lacconotus) punctatus*** **LeConte**

– Dorsal color uniform, light brown (Fig. 3) to nearly black (Fig. 2); punctation of elytra fine, punctures not conspicuous; antennae relatively long, antennomeres longer than wide; male sex patch small, oval, setose, and not distinctly contrasting in color to venter (Fig. 6); known from western North America, east to Colorado and New Mexico (Fig. 15).. ***Lacconotus (Alcconotus) pinicola*** **Horn**

Lacconotus LeConte

http://species-id.net/wiki/Lacconotus

Lacconotus LeConte 1862: 255. – Gemminger and Harold 1870: 2179; Horn 1879: 338; Austin 1880: 41; LeConte and Horn 1883: 401; Fall 1901: 177; Dury 1902: 174; Blatchley 1910: 1302; Seidlitz 1917: 99; Leng 1920: 240; Leng and Mutchler 1933: 25, 36; Blair 1928: 33; Spilman 1951: 48; Spilman 1952: 10-11; Spilman 1954: 89; Arnett 1963: 717; Hatch 1965: 88; Campbell 1991: 267; Lawrence and Newton 1995: 896; Poole and Gentili 1996: 315; Arnett 2000: 473; Pollock 2002: 532; Bouchard et al. 2011: 443. **Type species:** *Lacconotus punctatus* LeConte, by monotypy.

Description. [note: "*Lacconotus*" indicates the character states for subgenus *Lacconotus*, while "*Alcconotus*" refers to the corresponding states in subgenus *Alcconotus* (see below)].

Body elongate oval (TL/GEW 2.8-3.4), parallel-sided to widened posterior of middle, slightly (*Alcconotus*) to moderately (*Lacconotus*) flattened dorsally. TL 4.6–7.5 mm.

Head relatively short, narrowed slightly posterior of eyes; eyes moderately large, distinctly convex, inner margins convergent anteriorly; facets moderately coarse, with

Figure 1. Dorsal habitus photograph of *Lacconotus* (*L.*) *punctatus*; female, New Hampshire. TL = 5.1 mm. Photo credit: Darren Pollock, Eastern New Mexico University.

intrafacetal setae (especially noticeable in *Alcconotus*); frontoclypeal suture indistinct, indicated by slight furrow only; antennal insertions slightly concealed dorsally by raised lateral margins of frons; labrum transverse, anterior margin straight to shallowly sinuate.

Antennae relatively short (Fig. 1) (*Lacconotus*) to moderately elongate (Figs 2–3) (*Alcconotus*), not exhibiting distinct sexual dimorphism; scape and pedicel moniliform (*Lacconotus*) to slightly elongate (*Alcconotus*); antennomere 3 elongate, antennomeres 4–10 wider than long, submoniliform (*Lacconotus*) to elongate, triangular to subserrate (*Alcconotus*); antennomere 11 narrowed distally; sensilla present on distal surface of antennomeres 5–10.

Mandibles relatively short, stout, slightly asymmetrical, apically bidentate; terebral teeth absent, or represented by several minute crenulae; molae approximately equal in size, subquadrate, with slightly developed surface texture; both mandibles with abrupt incision distal of mola; ventral row of microtrichia absent; prostheca distinct, about half length of mandible, inserted near distal edge of mola; maxilla with galea slightly longer than lacinia; galea bluntly rounded distally, relatively densely pubescent; maxillary palpi elongate, apical palpomere securiform (*Lacconotus*) to slightly cultriform (*Alcconotus*); inner margins of palpomeres 1 and 2 straight (*Lacconotus*) to slightly sinuate (*Alcconotus*); mentum short, about 2 × wider than long, posterior suture straight (*Alcconotus*) or distinctly arcuate (*Lacconotus*).

Thorax. Prothorax subquadrate (Figs 1–3), slightly wider than long (GPW/PL = 0.90–1.29); pronotal margins straight and convergent anteriorly, to slightly arcuate and widest near midlength; pronotal disc flat to slightly convex, with variously developed shallow, paired depressions; lateral pronotal carinae absent, margin smooth; posterior margin with pair of small, deep, punctiform pits; prosternum anterior of procoxae short (*Lacconotus*) to moderately elongate (*Alcconotus*), surface flat to slightly

Figure 2. Dorsal habitus photograph of *Lacconotus* (*A.*) *pinicola*; female, Utah. TL = 6.3 mm. Photo credit: Darren Pollock, Eastern New Mexico University.

Figure 3. Dorsal habitus photograph of *Lacconotus* (*A.*) *pinicola* ('*pallidus*'); female, California. TL = 6.5 mm. Photo credit: Darren Pollock, Eastern New Mexico University.

sunken medially; intercoxal process short, knife-like, extended to about half length of procoxae; procoxae rounded (*Lacconotus*) to elongate (*Alcconotus*); procoxal cavities open externally and internally; protrochantin concealed.

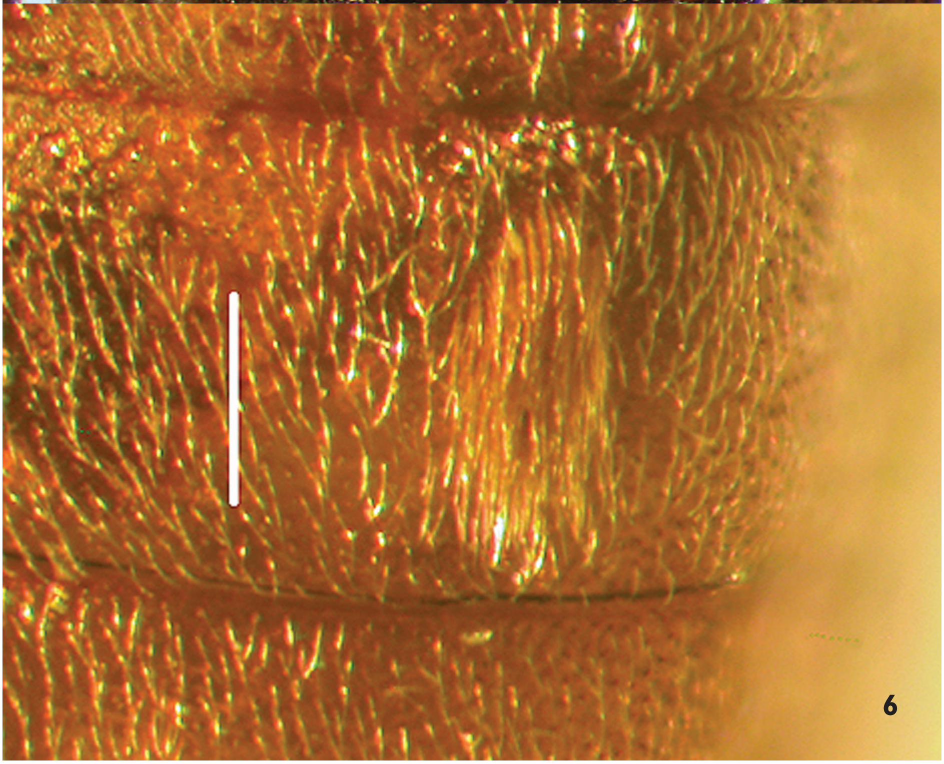
Elytra elongate, subovate, disc flat (*Lacconotus*) to slightly convex (*Alcconotus*), upper surface uniformly and moderately coarsely punctate and setose (slightly more coarse in *Lacconotus*), setae closely appressed to elytral surface; apical elytral patch present, but not conspicuous dorsally, not contrasting in color with respect to remainder of elytron; epipleuron narrow, traceable only to abdominal ventrite 3 or 4; mesosternum with posterior intercoxal process parallel-sided, extended posteriorly to near pos-

Figure 4. Forebody of *L.* (*L.*) *punctatus*, dark form. Photo credit: Darren Pollock, Eastern New Mexico University.

terior extent of mesocoxae; mesocoxae narrowly but completely separated, trochantins exposed; coxal cavities partly closed laterally by mesepimera; metasternum large, convex, anterior margin with indistinct (*Lacconotus*) to distinct (*Alcconotus*) process, in contact with posterior mesosternal process; median impressed line distinct to at least half distance to anterior margin of metasternum; metendosternite with long, relatively wide stalk; anterior tendons inserted on anterior margin of metendosternite body; laminae large, produced and somewhat angulate laterally.

Wing (Figs 7–8) fully developed, membrane beyond distinct radial cell moderately short (esp. in *Lacconotus*); venation similar in both species, but wing membrane and veins relatively darkly pigmented in *Alcconotus* (Fig. 8), very pale in *Lacconotus* (Fig. 7); wedge cell present; 3 MP veins reaching wing margin, proximal to CuA+AA; pigmented patches (flecks) present near junction of RP and MP, and near radial cell (*Alcconotus*), indistinct in *Lacconotus*.

Legs well developed, similar in relative shape and size on all thoracic segments; middle and hind femora slightly more expanded than front femora; femora relatively slender, but distinctly widened toward midlength; tibiae straight, about same length



Figures 5–6. Male sex patch of species of *Lacconotus* **5** *L.* (*L.*) *punctatus*, scale bar = 0.75 mm; **6** *L.* (*A.*) *pinicola*, scale bar = 0.25 mm. Photo credit: Darren Pollock, Eastern New Mexico University.

as femora, tibial spurs very short, equal in length; tarsomeres slender, 5–5-4; all tarsomeres simple ventrally, except for penultimate tarsomere with large ventral lobe; basal tarsomere on hind tarsus subequal in length to other tarsomeres combined; tarsal claws with large blunt tooth.

Abdomen with all ventrites freely articulated, uniformly punctate and setose, except for male sex patch; sex patch of two forms: small, longitudinally oval, setose patch on ventrite 2, not contrasting in color with ventrite (Fig. 6) (*Alcconotus*); or large, somewhat bulbous, glabrous area occupying and somewhat distorting the shape of ventrite 2, distinctly contrasting in color to dark ventrite surface (Fig. 5) (*Lacconotus*).

Male genitalia with median lobe dorsal to tegmen; sternite 9 forming ring-like sclerite, U-shaped in *Alcconotus* (Fig. 11), Y-shaped in *Lacconotus* (Fig. 9); tegmen relatively short, stout; basale broader than long, proximal margin deeply emarginate; length of apicale subequal to that of basale (along lateral margins); parameres of apicale short (Fig. 11) (*Alcconotus*) to slightly elongated (Fig. 9) (*Lacconotus*), with distal, inwardly-directed hook; median lobe (Figs 10, 12) stout, longer than tegmen; ventral side deeply emarginate, dorsal side proximally subquadrate, laterally produced, explanate; apex of median lobe triangular, relatively blunt.

Female genitalia with elongate, flexible, and only slightly sclerotized ovipositor; coxites 4-segmented, sparsely setose; distal segment short, distinctly more sclerotized than remainder of coxite; styli short, setose, with several very long distal setae; dorsal and ventral baculi well developed, extended to base of coxites; spiculum long, far exceeding length of segment 8; bursa copulatrix small (Fig. 13) (*Lacconotus*) to very large (Fig. 14) (*Alcconotus*), separated from vagina by narrow constriction, without conspicuous surface texture; spermatheca present, inserted near or at base of bursa, with elongate spermathecal gland.

***Lacconotus* (*Lacconotus*) *punctatus* LeConte**

http://species-id.net/wiki/Lacconotus_punctatus
Figs 1, 4–5, 7, 9–10, 13, 15–16

Lacconotus punctatus LeConte 1862: 255. –Type locality: "Pennsylvania." Gemminger and Harold 1870: 2179; Dury 1902: 174; Blatchley 1910: 1302; Seidlitz 1917: 99; Leng 1920: 240; Blair 1928: 33; Van Dyke 1928: 257; Spilman 1954: 89, 93; Arnett 1983: 3; Campbell 1991: 267; Poole and Gentili 1996: 315; Pollock 2002: 530 (fig. 9.112), 532; Majka 2006: 38; Majka and Selig 2006; Ulyshen et al. 2010.

Type. HOLOTYPE, male, labeled: "[pink circle] / ♂ / Type 4760 / Lacconotus punctatus Lec. / HOLOTYPE ♂ Lacconotus punctatus LeC. exam. Pollock 2000", in MCZC.

Diagnosis. This species is easily diagnosed by the following characteristics: body color dark piceous to near black, pronotum with reddish margins and black center (Figs 1, 4); antennae relatively short, antennomeres submoniliform; male sex patch on

Figures 7–8. Wing of species of *Lacconotus* **7** *L.* (*L.*) *punctatus*, wing length = 4.5 mm **8** *L.* (*A.*) *pinicola*, wing length = 5.1 mm. Photo credit: Darren Pollock, Eastern New Mexico University.

ventrite 2 bulging, glabrous, yellow-orange, contrasting with dark color of venter (Fig. 5); distribution in eastern North America (Fig. 15).

Re-description. To general features of *Lacconotus* (see description, above) the following can be added: TL 4.4–5.8 mm; GEW 1.5–2.0 mm; TL/GEW 2.9–3.3. Dorsal body surface uniformly piceous to near black, except for lateral areas of pronotum red-orange (Fig. 1); extent of light area varying, from extreme posterolateral corners to fully 2/3 of pronotal disc; ventral surface and legs dark, piceous to near black; antennomeres 5–10 short, distinctly wider than long, submoniliform; antennal sensilla completely annular, covering entire distal antennal surface, around insertion point of next antennomere; wing very pale, veins present, but inconspicuous; male sex patch (Fig. 5) very large, occupying entire length of second ventrite, prolonged onto ventrite one, glabrous and bulging ventrally; color of sex patch yellow-orange, distinctly contrasting background color of ventrite; tegmen of male genitalia (Fig. 9) moderately elongate, parameres of apicale relatively slender; bursa copulatrix (Fig. 13) spherical, small.

Lacconotus punctatus is newly recorded in Alabama, Arkansas, Massachusetts, Oklahoma, Texas, and Wisconsin (see Appendix A). Published records of *L. puncta-*

tus are from Ontario (Campbell 1991)[1], Québec (Campbell 1991)[2], and Nova Scotia (Majka and Selig 2006) in Canada [Horn (1879) first reported it from "Canada"], and Georgia (Ulyshen et al. 2010), Michigan (Hubbard et al. 1878; Horn 1879), New Hampshire (Chandler 2001), Ohio (Dury 1902; Blatchley 1910), and Pennsylvania (LeConte 1862) in the United States.

The new records above make clear that the distribution of *L. punctatus* in North America is much wider than previously known (Fig. 15). Less than a decade ago, Pollock (2002) reported the species from only four jurisdictions in North America (Québec, Pennsylvania, Ohio, and Michigan). There are now records from 14 states and provinces on the continent. The records from Wisconsin constitute a northwestern range extension of 650 km; and those from Oklahoma a southwestern range extension of 1,000 km. The present distribution indicates that *L. punctatus* is found over much of eastern North America, from a latitude of 33.6° to 44.3°N, and between longitudes of 64.5° and 95.3°W, much of the continent west of the prairies.

There is also much more information on the range of habitats that *L. punctatus* occupies. In Nova Scotia a specimen was found in a mixed forest of white pine (*Pinus strobus* L.), balsam fir (*Abies balsamea* (L.) Mill), eastern hemlock (*Tsuga canadensis* (L.) Carr.), and maple (*Acer* spp.) (Majka and Selig 2006). In New Hampshire, W.J. Morse and D.S. Chandler collected 26 specimens at a water tower in a mixed hardwood forest with eastern hemlocks. In Oklahoma a specimen was collected on a dead oak and in Wisconsin a specimen was found in an oak savanna. In Arkansas a specimen was found in a mixed forest/old field.

In Georgia, specimens were collected in mature bottomland hardwood forests in April with flight intercept traps in the forest canopy (Ulyshen et al. 2010). Dominant trees included box elder (*Acer negundo* L.), oak (*Quercus* spp.), ash (*Fraxinus* spp.), eastern cottonwood (*Populus deltoides* (Bartr.) ex. Marsh.), and sweetgum (*Liquidambar styraciflua* L.) with some loblolly pine (*Pinus taeda*) (M. Ulyshen, pers. comm.). Five of six specimens were found 15 m above the forest floor (Ulyshen et al. 2010). Ulyshen et al. (2010) proposed that *L. punctatus* may be an early-seasonal canopy specialist, a reason why it has been so infrequently collected.

The phenology information that is available (Fig. 16) indicates that adults can be found between 31 March and 16 June. Specimens from southern areas (i.e., Georgia) were found in mid April (Ulyshen et al. 2010), whereas those from northern latitudes (i.e., New Hampshire) occur mainly during the last two weeks of May and first week

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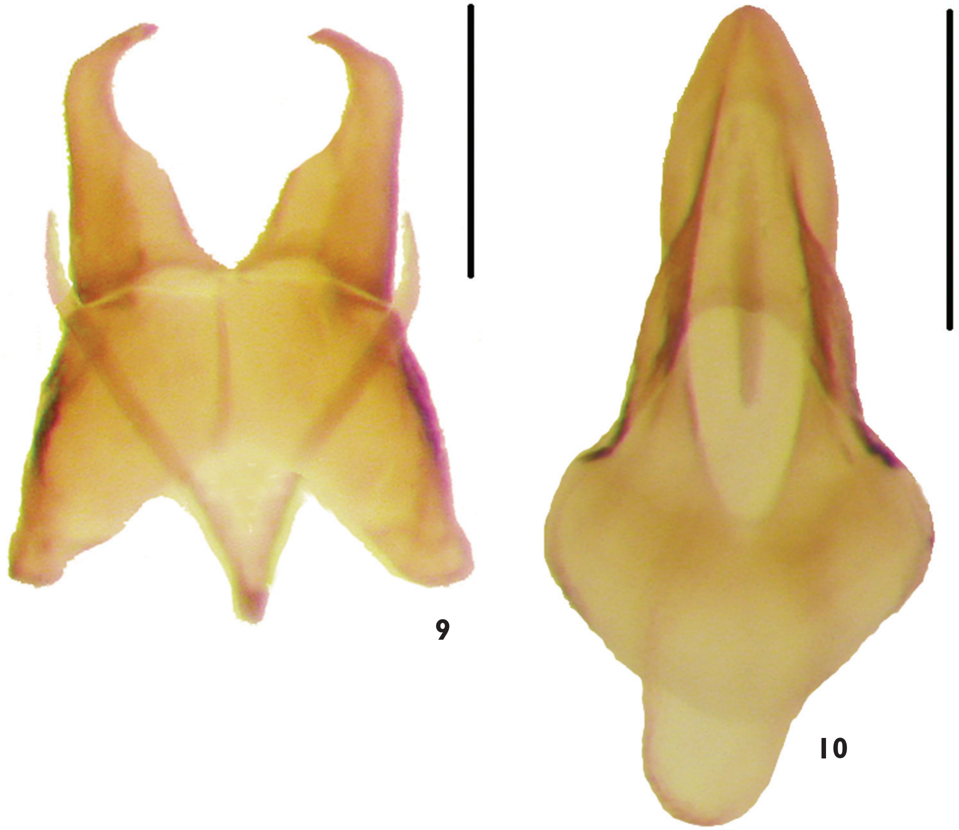
[1] Although listed from Ontario in Campbell (1991), we have not been able to find any published record, or any vouchers specimen in any North American collection that would substantiate this report. Consequently, pending verification of its occurrence in this jurisdiction, we remove Ontario from the known distribution of this species.

[2] In addition to the specimen from Montreal in the CUIC (Appendix 1) a second specimen from Québec was formerly in the Ouellet-Robert collection of the Université de Montréal, however, the specimen was stolen before being databased so its collection date and locality in the province are unknown (pers. com., Louise Cloutier).



Figures 9–10. Male genitalia of *L.* (*L.*) *punctatus* **9** tegmen **10** median lobe. Scale bar = 0.25 mm. Photo credit: Darren Pollock, Eastern New Mexico University.

of June (D.S. Chandler, pers. comm.), indicating a north-to-south gradation in occurrence period.

Alcconotus Pollock & Majka, subgen. n.

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http://species-id.net/wiki/Alcconotus

Type species. *Lacconotus pinicola* Horn, by present designation.

Derivation of name. a partial anagram of *Lacconotus*, in which its species was formerly placed.

Taxonomic notes. Pollock (2002) stated that it might be necessary to establish a new genus for the two western species of *Lacconotus*, although no details were given to justify this possibility. There are many differences between the eastern and western species of *Lacconotus* (see description above, for *Lacconotus*), but the most significant reason for proposal of this new subgeneric name is the structure of the male sex patch, which differs greatly between *L. punctatus* and *L. pinicola*. It could be argued that this might justify separation into two genera; however, within the related genus *Mycterus* Clairville (Mycterinae) there are also significant differences in this structure. Also, there are significant differences in the structure of the bursa copulatrix and spermatheca between the two groups (see Figs 13–14); it is impossible to compare these intrageneric differences with other eurypine or mycterid taxa, since the internal female genitalia have yet to be studied in detail in most groups.

Description. See description above, for *Lacconotus*; characteristics unique to *Alcconotus* are indicated with the alternatives for *Lacconotus* (*s. str.*).

***Lacconotus* (*Alcconotus*) *pinicola* Horn, comb. n.**

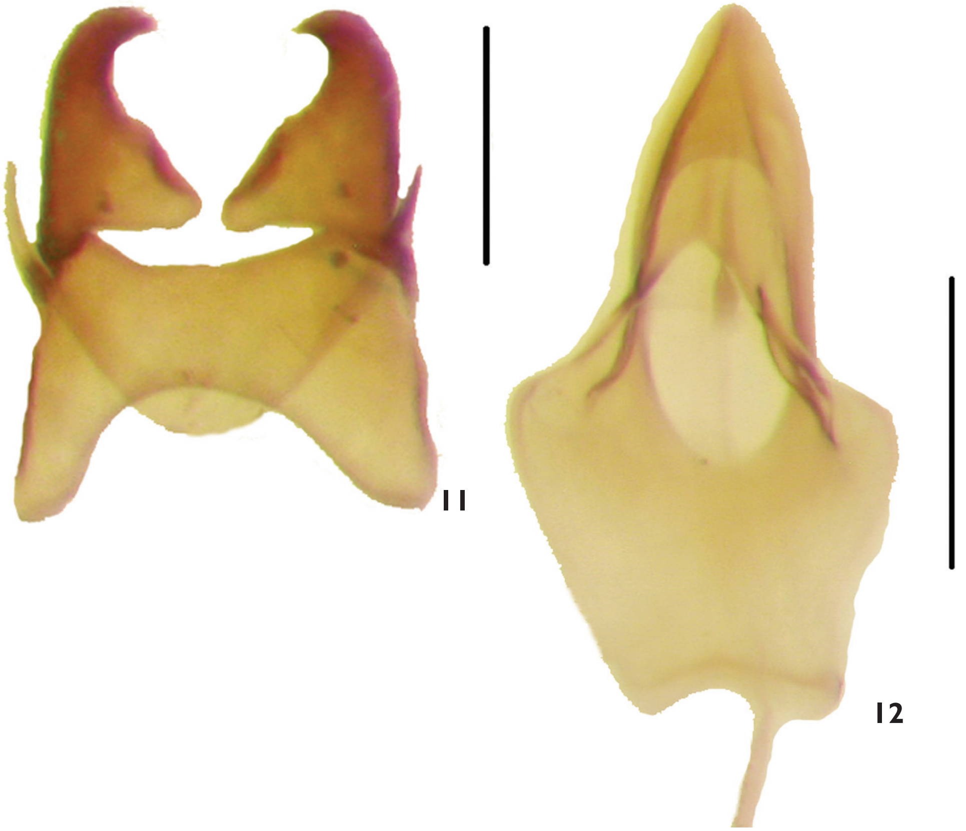
http://species-id.net/wiki/Lacconotus_pinicola
Figs 2–3, 6, 8, 11–12, 14, 15–16

Lacconotus pinicola Horn 1879: 338. – Type locality: Veta Pass [= La Veta Pass?], Colorado. LeConte 1879: 500, 506; Austin 1880: 41; Snow 1882: 44; Cockerell 1893: 334; Coquillett and Orcutt 1900: 54 [= *pallidus*?]; Wickham 1902: 297; Woodworth 1913: 194; Seidlitz 1917: 99; Leng 1920: 240; Blair 1928: 33; Van Dyke 1928: 257; Spilman 1951: 50, fig. 15; Hatch 1965: 88; Arnett 1983: 3; Campbell 1991: 267; Poole and Gentili 1996: 315; Pollock 2002: 532.

Lacconotus pallidus Van Dyke 1928: 256; Fall 1901: 32 (as *Lacconotus pinicola*), 177; Leng and Mutchler 1933: 36; Spilman 1951: 50; Crowson and de Viedma 1964; Pollock 2002: 531 (fig. 2.112), 532. syn. n.

Types. (***L. pinicola***, all in MCZC).—LECTOTYPE (here designated), female, labeled: “Veta Pass 27.6 Col / 592 / [red] Type 7976 / [handwritten] Lacconotus pinicola (Schwz) / J.L. LeConte Collection / LECTOTYPE ♀ *Lacconotus pinicola* Horn 1879; design. D.A. Pollock 1994”. PARALECTOTYPE. female, labeled: “Col / [blue] Para-Type 8047. / G.H. Horn Collection”, in MCZC.

Types. (***L. pallidus***, all in CAS).—HOLOTYPE, male (CAS type # 2585), labeled “Mt. Wilson Cal. 6.13.3 / 7701 / Van Dyke Collection / Holotype [along left margin of label covered in red ink] ♂ Lacconotus pallidus Van Dyke". ALLOTYPE, female, labeled "Carmel, Monterey Co VI-4-1916 Cal. / Van Dyke Collection / Allotype [along left margin of label covered in red ink] ♀ Lacconotus pallidus Van Dyke". Four PARATYPES. Male, labeled "Carmel, Monterey Co VI-4-1916 Cal. / Van Dyke Collection / Paratype [along left margin of label] ♂ Lacconotus pallidus Van Dyke". Male, labeled "ParaisoSpgsCal V.28 1924 L.S. Slevin / L.S. Slevin Collection / Paratype [along left margin of label] Lacconotus pallidus Van Dyke". Female, labeled "ParaisoSprings V.31 1916 Cal. / L.S. Slevin Collection / Paratype [along left margin of label] Lacconotus pal-

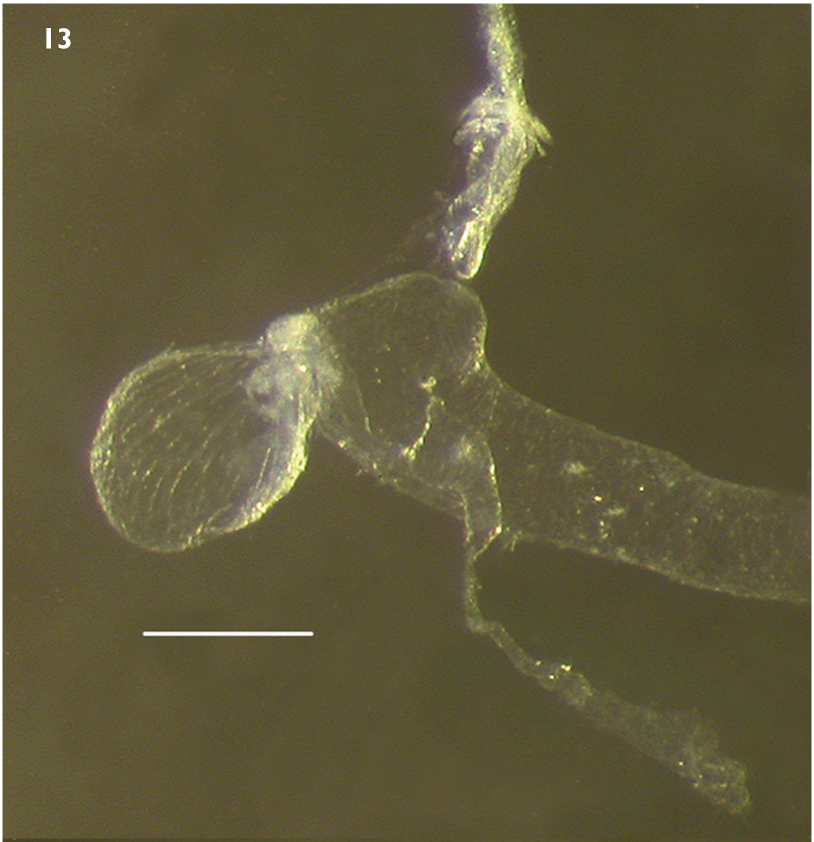


Figures 11–12. Male genitalia of *L.* (*A.*) *pinicola* **11** tegmen **12** median lobe. Scale bar = 0.25 mm. Photo credit: Darren Pollock, Eastern New Mexico University.

lidus Van Dyke". Female, labeled "Paraiso Springs V.29 1916 Cal. / CHAMISAL / L.S. Slevin Collection / Paratype [along left margin of label] Lacconotus pallidus Van Dyke".

Diagnosis. *Lacconotus* (*Alcconotus*) *pinicola* may be distinguished from *L. punctatus* by the following features: body color ranging from testaceous to dark brown, uniform dorsally (Figs 2–3); antennae relatively long, subserrate; male sex patch on ventrite 2 small, oval, densely pubescent (Fig. 6); distribution in western North America (Fig. 15).

Re-description. (see Horn 1879 and Van Dyke 1928) – With general features of subgenus *Alcconotus* (as described above) with the following: TL 4.8–7.5 mm; GEW 1.5–2.3 mm; TL/GEW 2.8–3.4. Dorsal body surface uniformly testaceous to dark brown or piceous (Figs 2–3), without any color contrast; antennomeres 5–10 relatively elongate, subserrate; antennal sensilla not completely surrounding opening of antennomere, restricted to triangular side of antennomeres; wing membrane distinctly pigmented, veins very conspicuous (Fig. 8); male sex patch longitudinally oval, occupying about 2/3 length of ventrite 2, densely covered with short setae (Fig. 6), not bulbous or contrasting in color; tegmen of male genitalia (Fig. 11) short, parameres stout; bursa copulatrix (Fig. 14) very large, spherical.



Figures 13–14. Internal female genitalia of *Lacconotus* **13** *Lacconotus* (*L.*) *punctatus* **14** *Lacconotus* (*A.*) *pinicola*. Scale bar = 0.25 mm. Photo credit: Darren Pollock, Eastern New Mexico University.

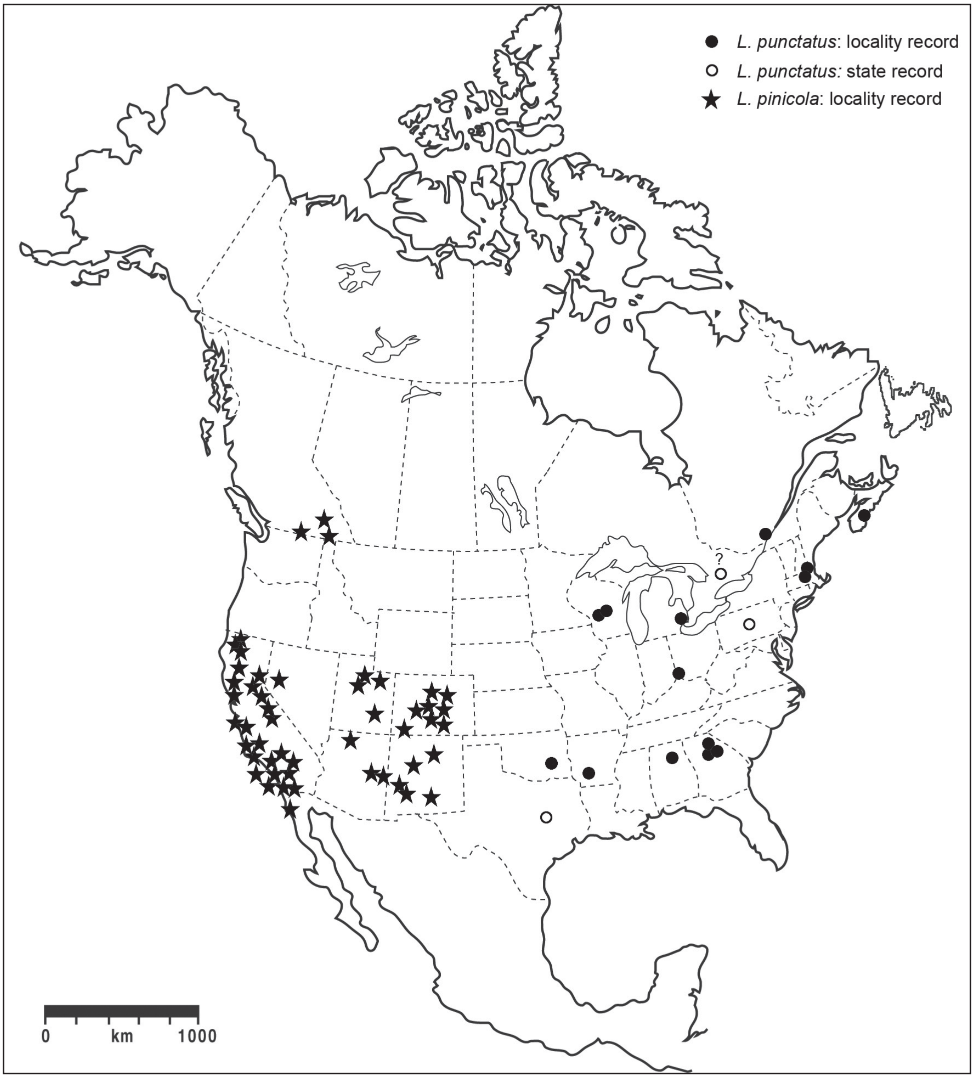


Figure 15. Distribution of *Lacconotus* (*L.*) *punctatus* and *Lacconotus* (*A.*) *pinicola* in North America and Mexico.

Notes. Van Dyke (1928) established *L. pallidus* (as distinct from *L. pinicola*) based on its lighter color, relatively narrower pronotum, shorter relative length of the elytra, and deeper punctation. However, upon examination of the type series and other specimens, we have determined that the only feature of Van Dyke's that withstands scrutiny is the habitus color. As well, more detailed examination has revealed that the male and female genitalia and male sex patch are virtually identical between *L. pinicola* and *L. pallidus*. One feature, mentioned by Van Dyke (1928) that does seem noteworthy is the somewhat restricted distribution of *L. pallidus* in southern California. We herein consider *L. pallidus* a pale "form" of *L. pinicola*.

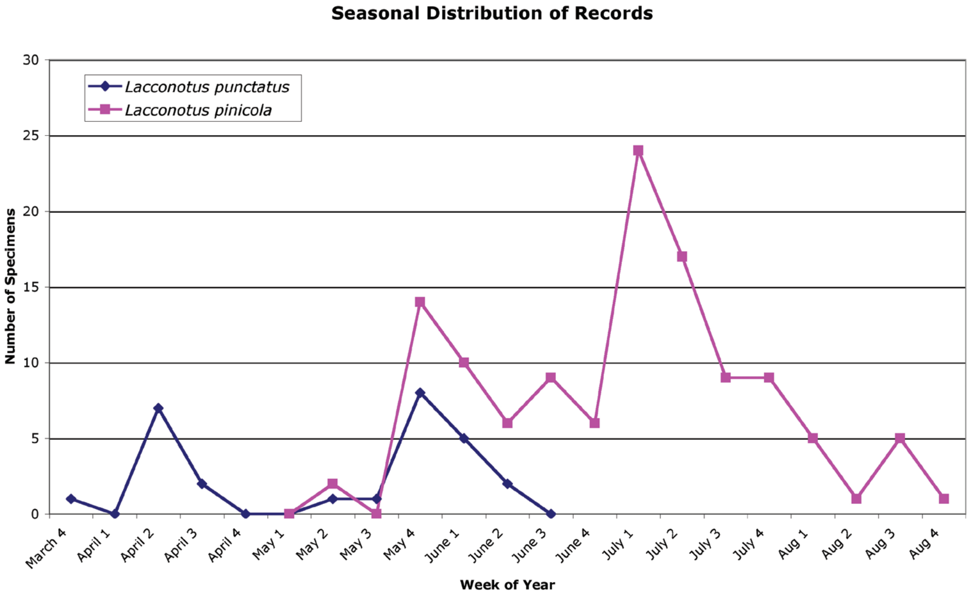


Figure 16. Phenology of *Lacconotus* (*L.*) *punctatus* and *Lacconotus* (*A.*) *pinicola* in North America and Mexico.

Lacconotus (*Alcconotus*) *pinicola* is newly recorded from Arizona, Utah, and Baja California Norte in Mexico (see Appendix A). Published records of *L. pinicola* are from British Columbia (Hatch 1965), California (Fall 1901; Van Dyke 1928), Colorado (Horn 1879; Cockerell 1893; Van Dyke 1928), western Nevada (Horn 1879), and New Mexico (Snow 1882, 1906; Knaus 1907). The range of the species (Fig. 15) shows it to be widely distributed in the southwestern United States (Arizona, California, Colorado, Nevada, New Mexico, and Utah) extending south to Baja California Norte in Mexico, and in southeastern British Columbia. Specimens should be sought in intervening areas in Idaho, Oregon, and Washington to ascertain if these populations are actually disjunct.

A number of specimens examined were found on ponderosa pine (*Pinus ponderosa* Douglas ex. C. Lawson), including one specimen which was recorded as emerging from a dead *P. ponderosa* branch. It has also been found on Engelmann spruce (*Picea engelmanni* Parry ex Engelm.), scrub oak (*Quercus turbinella* Greene), and cherry (*Prunus* sp.). Specimens have been collected at UV lights, with malaise and flight-intercept traps, and by beating vegetation. Fall (1901: 177) wrote "...rare during May and June; found always on oaks, notwithstanding its name." The larva of *L. pinicola* has been illustrated by Lawrence (1991), but not described in detail. The phenology information that is available (Fig. 16) indicates that adults can be found between 13 May and 29 August with two specimens having been found in the autumn (6 October and 6 November). The peak in adult numbers appears to be in the first half of July.

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Appendix I

Non-type specimen records

Lacconotus (*Lacconotus*) *punctatus* LeConte

CANADA: NOVA SCOTIA: Lunenburg County: Bridgewater, 16 June 2004, G. Selig, adjacent to mixed forest (NSMC, 1); **QUEBEC:** Montreal Island, 24 May 1902 (CUIC, 1).

UNITED STATES: ALABAMA: Jefferson County: Rocky Ridge, 17 April 1982 (AAAC, 1); Rocky Ridge, 31 March 1982, T. King, (AAAC, 1). **ARKANSAS: Hempstead County:** Hope Upland Wildlife Management Area (33°44'20"N; 93°38'59"W), 13 April 2003, J.P. Gruber, swept from low foliage in mixed forest/old field (1, WIRC); **MASSACHUSETTS: Middlesex County:** Tyngsboro, H.C. Fall collection, (MCZ, 1); state record only, (MCZ, 1). **MICHIGAN: Wayne County:** Detroit, Hubbard & Schwarz collection, (NMNH, 1). **NEW HAMPSHIRE: Strafford County:** 1 mi. SW Durham, 5 June 1981, 25 May 1982, 27 May 1988, 29 May 1988, 31 May 1988, 5 June 1990, water tower, W.J. Morse (DAPC, 7); 1 mi. SW Durham, 30 May 1982, 3 June 1982, W.J. Morse, water tower (MCZ, 2); 1 mi. SW Durham, 21 May 1982, D.S. Chandler, water tower (DAPC, 1). **OKLAHOMA: Latimer County:** April 1985, K. Stephan, beating dead oak (1, TAMU); Latimer County: May 2001, K. Stephan, ultra-violet light (1, TAMU). **PENNSYLVANIA:** state record only, H. Ulke collection, (CMNH, 1). **TEXAS:** state record only, H. Ulke collection, (CMNH, 1). **WISCONSIN: Monroe County:** Ft. McCoy, 1 mi. west of Big Rock, 12–15 June 1997, J.A. Maxwell, oak savanna, flight intercept trap (WIRC, 1); **Juneau County:** Necedah National Wildlife Refuge, 30 May 1996, 6 June 1996, K. Pope, flight intercept trap (WIRC, 4).

Lacconotus (*Alcconotus*) *pinicola* Horn

CANADA: BRITISH COLUMBIA: Kaslo, 8 July, A.N. Caudell (NMNH, 1); Creston, 19 July 1946, G. Stace Smith (UBC, 1); Osoyoos, 2 July 1948, R. Scott, at light (UBC, 1).

MEXICO: Baja California Norte. Ensenada: S[ierr]a Juarez, 3.6 mi. SSE El Rayo, 2.vii.1960, E.L. Sleeper, (CASC, 1).

UNITED STATES: ARIZONA: Apache or Navajo County: McNary, 6 July 1945, F.H. Parker (UAIC, 1); **Apache County:** White Mts., 25 July 1944, Parker (UAIC, 1); **Coconino County:** 22 mi. S. Jacob Lake, De Motte Park cmpgrnd, 8700', 17 July 1969, L.N. & C.J. Bell, (CAS, 1). **CALIFORNIA:** ["*pallidus*" form] **Fresno or Tulare County:** Kings Canyon N[ational] P[ark], 24 June 1955, P.S. Bartholomew (CAS, 1); **Kern County:** Tehachapi Mts., Antelope Canyon, 18 July 1976, 6000 ft. (UCR, 2); **Los Angeles County:** Santa Catalina Island, Blackjack Rd.

(33.3919°N, 118.4001°W), 17 June 2008, Caterino & Chatzimanolis (1, SBMN); Santa Catalina Island, nr. Echo Lk., (33.3974°N, 118.3946°W) 18 June 2008, Caterino & Chatzimanolis (1, SBMN); Angeles National Forest, Ruby Canyon (34.6060°N, 118.5523°W), 22 June 2007 (1, SBMN); Angeles National Forest, Big Dalton Canyon (34.1811°N, 117.7978°W), 13–23 June 2007, Caterino & Chatzimanolis, flight intercept trap (1, SBMN); Angeles National Forest, Tanbark Flat (34.2048°N, 117.7611°W), 23 June 2007, Caterino & Chatzimanolis, at light (1, SBMN); Muchmore, 29 July 1920, (MCZ, 1); Tanbark Flat, 30 June 1950, B. Adelson, at electric light (EMEC, 1); Tanbark Flat, 24 June 1950, H.M. Graham, (EMEC, 1); Santa Monica Mts., Fryman Canyon, 25 May 1991, J. Rifkind (WFBM, 1); county record only (NMNH, 1); Madera County: Bass Lake, 3 June 1942, *Pinus ponderosa* (TAMU, 1); S[ierra] Madre, June, (CAS, 1); Mt. Lowe, June (CAS, 2); **Madera County:** Bass Lake, 3 June 1942, *Pinus ponderosa* (TAMU, 1). **Marin County:** Phoenix Lake, 30 May 1927, H.H. Kelfer (CAS, 1); San Gabriel Mts., 5 June 1910, 3500 ft. (MCZ, 1); Mt. Wilson, 6 November 1904, 23 July 1905, 5 June 1917, (MCZ, 2; NMNH, 1); Mt. Wilson, 29 June 1940, G.P. Mackenzie, (UCRC, 1); Pasadena, 29 May 1897, 31 May 1897, June 1922, 22 June 1902, (MCZ, 5); Pasadena, 2 July 1926, (NMNH, 1); Pasadena, May, (CAS, 1; AAAC, 1); Pasadena, A. Fenyes, (CMNH, 3); Pasadena, (CUIC, 1; NMNH, 1; FMNH, 2); Pom[ona?] Mts., 6 October 1893, (MCZ, 1); Sequoia Nat. Park, Potwisha, 25 May 1929, 3000–5000 ft. (CAS, 1); Los Gatos, Hubbard & Schwarz, (NMNH, 1); Santa Cruz Mountains, July (FMNH, 2); Fairfax, 18 June 1939 (CAS, 1); **Monterey County:** UC Big Creek Reserve, Highlands Camp (36.062°N, 121.571°W), 31 May–8 June 2003, M. Caterino, flight-intercept trap (1, SBMN); Paraiso Springs, 31 May 1916, (CAS, 1); Paraiso Springs, 9 June 1932, L.S. Slevin (CAS, 1); **Napa County:** N. side Howell Mt., 2 mi. NNE Angwin, 5 June 1978, H.B. Leech, emerged ex dead branch of *Pinus ponderosa*, 1300 ft. (CAS, 1); **Orange County:** Silverado Cyn., 22 June 1958, E.L. Sleeper (CAS, 1); **Riverside County:** James Reserve (33.8081°N, 116.7784°W), 15 July 2006, Caterino & Chatzimanolis (1, SBMN); **San Bernardino County:** Oak Glen, 26 July 1967, M.J. Wargo (CDAE, 1); Gobbler's Knob (34.3116°N, 117.5835°W), 3 July 2005, M. Caterino (6, SBMN; 1 AAAC); Forest Home, 14 June 1928 (CAS, 1); [?Big] Bear Lake, 18 May 1919 (CAS, 1); **San Diego County:** Poway, F.E. Blaisdell (CAS, 1); **San Luis Obispo County:** Los Padres National Forest, Cuesta Ridge (35.3630°N, 120.6573°W), 9 July 2008, Caterino & Polihronakis (1, SBMN); **Santa Barbara County:** UC Sta. Cruz Isl. Res. (34.0013°N, 119.7512°W), 6 June 2005, M. Caterino & J. Jacobs, (SBMN, 1); UC Sta. Cruz Isl. Res. (34.0013°N, 119.7967°W), 6 June 2005, M. Caterino & J. Jacobs, (SBMN, 1); UC Sta. Cruz Isl. Res. (33.9963°N, 119.7281°W), 5–7 June 2005, Lindgren trap, M. Caterino & J. Jacobs, (SBMN, 1); UC Santa Cruz Island Res., Cañada del Puerto (34.0019°N, 119.7127°W), 13 May 2009, Caterino, Chatzimanolis, Hopp & Polihronakis, (SBMN, 1); UC Sedgwick Reserve (34.7246°N, 120.0351°W), 14 May 2005, M. Caterino, beaten from *Prunus*, (SBMN, 1); Los Padres National Forest, Fremont

Tr. (34.5158°N, 119.8069°W), 19–27 June 2001, Malaise, E.I. Schlinger & S. Regan, (SBMN, 2); Freemont Tr. nr. Painted Cave, 8–15 July 2001, E. Schlinger & S. Regan, malaise trap (SBMN, 1); Arroyo Hondo Preserve, 25 mi. W of Santa Barbara (34.486°N, 120.135°W), 2 July 2003. M. Caterino (1, SBMN); Los Padres National Forest, 15 mi. NW of Santa Barbara, west of Camino Cielo (34°30'N, 119°49.8'W), 4 July 2001 M. Caterino, 900 m (1, SBMN); Los Padres National Forest, 5 mi. north of Santa Barbara (34°29.58'N, 119°41.13'W), 5 July 2001, M. Caterino, 1050 m (2, SBMN); 3 mi. N. Refugio Beach, 28 June 1965, J.R. Stephenson (CAS, 1); **Santa Clara County:** Los Gatos, Hubbard & Schwarz (NMNH, 1); Santa Cruz Mountains, July (FMNH, 2); **Santa Cruz County:** 4 mi. SE Big Basin, 4 July 1967, A.R. Gillogly, uv light (TAMU, 2); **Tulare County:** Sequoia Nat. Park, Potwisha, 25 May 1929, 3000–5000 ft. (CAS, 2); **Tuolumne County:** Phoenix Lake, 30 May 1927, H.H. Kelfer (CAS, 1); **CALIFORNIA:** ["*pinicola*" form] **Butte County:** 2.8 mi NW French Creek, 15 July 1990, light trap, W.D. Shepard & C.B. Barr, (CAS, 2). **El Dorado County:** Blodgett Forest, 18 mi. E. Georgetown, 1 July 1967, J. Powell, at light (EMEC, 1); Pollock Pines, 27 July-18 August 1987, R.B. Flint, blacklight (CSCA, 1); **Placer County:** Tahoe National Forest, Pineland Drive 3.2 km S. of Tahoe City, 1900 m, 30 July 1983, T.W. Davies (CAS, 1); **Siskiyou County:** 9 mi. NW Happy Camp, blacklight trap, 22 August 1982, F.D. Horn (CSCA, 1); **Trinity County:** Carrville, 10 June 1913, (CAS, 1); **Tuolumne County:** 4 mi. W. Pinecrest, 12 July 1961, J.G. Rozen (AMNH, 4); Lyons Dam Rd., 29 August 1968, W.F. & F.C. Tyson, attracted to black light (NMNH, 1); **COLORADO: Boulder County:** Longs P[ea]k Inn, 13 July 1926, E.C. Van Dyke, 9000 ft. (CAS, 1); Ward, July 1905, CKU (MCZ, 1); Custer County, T.D.A. Cockerell (NMNH, 1); **Delta County:** Paonia, 14 June 1926, E.C. Van Dyke (CAS, 1); **El Paso County:** Waldo Canyon, 25 June 1916, W.D. Edmonston, *Pinus ponderosa* (NMNH, 1); Manitou [?Springs], 23 June 1926, E.C. Van Dyke (CAS, 1); **Grand or Jackson County:** Rabbit Ears [Pass], 24 July 1930, *P*[*icea*] *engelmanni* (NMNH, 1); **Huerfano County:** [La] Veta Pass, 21 June, Hubbard & Schwarz (NMNH, 1); [La] Veta Pass, 1 July, F.C. Bowditch Coll. (MCZ, 1); **La Plata County:** Durango, 10 July 1968, E.C. Becker, beating scrub oak, 7000' (CNC, 5); Durango, 7 July 1968, E.C. Becker, 7500' (CNC, 3); Durango, Horse Canyon, 21 July 1968, E.C. Becker, beating scrub oak, 7000' (CNC, 1); **Teller County:** Florissant, 7 July 1902, S.A. Rohwer (MCZ, 1); County unknown: Florentine, July 1879, Pourtales (MCZ, 1); county unknown, Pike Nat. For, Top-of-the-World Camp, 7 August 1976, B.F. & J.L. Carr (CNC, 1); State record only, Ulke Collection (CMNH, 1; MCZ, 1). **NEW MEXICO: Bernalillo County:** Albuquerque, 29 May 1994, 10 June 2007, R. Buss, UV light (2, RBC); **Socorro County:** Bear Trap Camp, 28 mi. SW Magdalena, 7 July 1965, F. P. & M. Rindge, 8500' (AMNH, 1). **Lincoln County:** Cedar Creek, 5 miles N. Ruidoso, 2 July 1961, F., P. & J. Rindge, 7500' (AMNH, 1); Holman Pass, NW of Holman, C.C. Hoff, (AMNH, 1); State records only, Ulke Collection, (CMNH, 3); F.A. Eddy Collection (MCZ, 2). **UTAH: Garfield County:** Lonesome Beaver, Henry

Mts., 25 July 1968, A.T. Howden, 7500' (CNC, 1); **Salt Lake County:** 6.4 km E. Granite, R.F. Rockwell, Wasatch-Cache National Forest Survey (40° 34' 20"N; 111°43' 47"W), 21 July 1998, 29 July 1998, 5 August 1998, 22 August 1998, 1945m, uv light trap (CMNH, 12); **Utah County:** Squaw Peak near summit, 5.3 km SSE Springdell, (40°16'57"N; 111°36'19"W), 16 July 1998, R.F. Rockwell (Uinta National Forest Survey), grassy knoll, 2390 m, uv light trap (CMNH, 1); American Fork Canyon, near mouth, 8.0 km N. Pleasant Grove (40°26'08"N; 111°43'45"W), 12 August 1998, R.F. Rockwell (Uinta National Forest Survey), 1580 m, uv light trap (CMNH, 1).

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Rove beetle subtribes Quediina, Amblyopinina and Tanygnathinina: systematic changes affecting Central European fauna (Coleoptera, Staphylinidae, Staphylinini)

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Abstract

In preparation for the new edition of the identification keys of rove beetles of Central Europe (Volume 4 of the "Die Käfer Mitteleuropas"), the following systematic problems affecting the Central European fauna of the tribe Staphylinini are addressed: phylogeny-based, new concepts for the subtribes Quediina and Amblyopinina; status of the subtribe Tanygnathinina; systematic position of the genus *Astrapaeus*; status of *Quedionuchus*, the subgenus of *Quedius*; identity of some species of *Quedius* and *Heterothops*. As a result, new wordwide and Central Europe-based diagnoses are given for the subtribes Quediina and Amblyopinina; earlier recognized but not widely accepted synonymies of the genera *Quedius* and *Velleius*, and of the species *Heterothops praevius* and *H. niger*, are justified; new synonyms are established for: *Quedius pseudonigriceps* Reitter, 1909 (= *Quedius noricus* Bernhauer, 1927, **syn. n.**); *Quedius maurorufus* (Gravenhorst, 1806) (= *Quedius richteri* Korge, 1966, **syn. n.**); *Quedius suturalis* Kiesenwetter, 1845 (= *Quedius merlini* Drugmand & Bruge 1991, **syn. n.**); lectotypes are designated for *Quedius meridiocarpathicus* Smetana, 1958, *Quedius noricus* Bernhauer, 1927, and *Quedius pseudonigriceps* Reitter, 1909. As a result of synonymy of *Quedius* and *Velleius,* the following new combinations are proposed: *Quedius amamiensis* (Watanabe, 1990), **comb. n.**; *Quedius circumipectus* (Cho, 1996), **comb. n.**; *Quedius elongatus* (Naomi, 1986), **comb. n.**; *Quedius japonicus* (Watanabe, 1990), **comb. n.**; *Quedius pectinatus* (Sharp, 1874), **comb. n.**; *Quedius setosus* (Sharp, 1889), **comb. n.**; *Quedius simillimus* (Fairmaire, 1891), **comb. n.** As a result of new combinations, *Quedius japonicus* (Watanabe, 1990) (non *Quedius japonicus* Sharp, 1874) is replaced with the new name *Quedius watanabei* Solodovnikov, **nom. n.,** while *Quedius pectinatus* Lea, 1908 (non *Quedius pectinatus* (Sharp, 1874)) is replaced with the new name *Quedius arthuri* Solodovnikov, **nom. n.**

Keywords

Staphylinini, Quediina, Amblyopinina, Tanygnathinina, *Heterothops*, *Quedius*, *Velleius*, phylogeny, new synonyms, lectotype designations, misidentifications, Central Europe

Introduction

Central Europe (territories of Denmark, Germany, Poland, Benelux-states, Austria, Czech Republic, Slovakia and Switzerland) is a conventional area that has no integrity in terms of biogeography. But since this region has a strong common entomological tradition, the insect fauna of Central Europe is often viewed as such despite not being cohesive either zoogeographically or phylogenetically. Currently it is perhaps the best known entomofauna in the world as far as any other territory of comparable size is concerned. At least this is true for the beetle family Staphylinidae covered in the milestone volumes 4 and 5 of the well-known series “Die Käfer Mitteleuropas”. In the course of time however, the inevitable obsolescence of these reference books necessitates new editions. Gladly, a new version of the Volume 4 (Lohse 1964) was recently accomplished by an international team of authors led by German colleagues Volker Assing (Hannover) and Michael Schülke (Berlin) (Assing and Schülke 2012).

Being involved in that project as an author of the sections equivalent to “Quediini” and “Atanygnathinini” (Staphylininae) in Lohse (1964), I came across a necessity of publishing some formal taxonomic changes for the Central European fauna to be used in Assing and Schülke (2012). Also, some earlier published world-wide systematic work on Staphylinini (Solodovnikov and Newton 2005; Solodovnikov 2005, 2006; Solodovnikov and Schomann 2009; Chatzimanolis et al. 2010) that affected the Central European fauna, needed a concise digest specifically targeting a European user. All these issues are addressed in the present paper, and grouped in the following three categories: subtribal classification of Staphylinini; *Quedius*-complex; and species-level problems in *Heterothops* and *Quedius*.

Material and methods

Material examined in this paper came from the following institutional and private collections:

FMNH	Field Museum of Natural History, Chicago, U.S.A (M. Thayer, J. Boone)
HNHM	Hungarian Museum of Natural History, Budapest, Hungary (G. Makranczy)
NHMW	Vienna Museum of Natural History, Austria (H. Schillhammer)
NMPC	National Museum, Prague, Czech Republic (Jiřĭ Hájek)
ZMUC	Zoological Museum of the University of Copenhagen (part of the Danish Natural History Museum), Denmark

cAS	Private collection of A. Smetana (Ottawa)
cKrg	Private collection of H. Korge (Berlin)
cSch	Private collection of M. Schülke (Berlin)

Subtribal classification of Staphylinini

With more than 200 genera and more than 5,000 species worldwide, Staphylinini is one of the largest tribes of rove beetles. As mentioned in recent works (e.g., Smetana and Davies 2000; Solodovnikov 2006; Solodovnikov and Schomann 2009; Chatzimanolis et al. 2010), the supra-generic classification of Staphylinini currently in use (e.g., Herman 2001; Newton and Thayer 2005; Bouchard et al. 2011) needs modification. Although many aspects of the phylogeny of Staphylinini are still unclear, certain parts of it are already resolved and translated into a classification. Some aspects affecting the fauna of Central Europe are summarized here.

On the systematic position of the genus *Astrapaeus* Gravenhorst, 1802

Both morphology- and molecular-based analyses, no matter how they disagree in detail, place certain members of the conventional subtribe “Quediina” (genera *Afroquedius* Solodovnikov, 2006*, Astrapeus* Gravenhorst, 1802*, Parisanopus* Brèthes, 1900 and *Valdiviodes* Smetana, 1981) as basal lineages of Staphylinini (see for example fig. 6 in Solodovnikov 2006, fig. 1 in Solodovnikov and Schomann 2009; and fig. 1 in Chatzimanolis et al. 2010). These genera are species-poor and have narrow distributions scattered around the globe, such evidence also suggesting their ancient, relict nature among Staphylinini. Contrary to the formal classification where they are placed in the subtribe Quediina, neither of them form a monophyletic group with the “core” clade of “*Quediina*” (the monophyletic part of the conventional Quediina hosting the type species of *Quedius;* e.g, the clade marked in red in fig. 1 in Solodovnikov and Schomann 2009). To balance the formal classification of Staphylinini with the underlying phylogeny, a series of monobasic supra-generic groups (possibly subtribes) has to be erected for those isolated basal genera. However, to avoid premature creation of several new family-group names when the phylogeny of the entire Staphylinini is not stabilized yet, Chatzimanolis et al. (2010, table 1) classified such genera as *incertae sedis* within Staphylinini. Since *Astrapeus* is the only genus in Central Europe that falls in this category, and the European authors are used to its placement in Quediina, the species *Astrapaeus ulmi* (Rossi, 1790) is still listed as a member of that subtribe in the new edition of the “Die Käfer Mitteleuropas” (Assing and Schülke 2012). Unlike the specialized phylogenetic paper of Chatzimanolis et al. (2010), the keys to Central European fauna is a practical tool, limited geographically, but targeting a very broad scope of users with varying taxonomic background. Therefore, for those keys, the exact and familiar classification of a phylogenetically unstable taxon seems a more useful solution, as opposed to its uncertain position, even though the latter may reflect the current phylogenetic knowledge more accurately.

New limits and diagnosis of the subtribe Quediina Kraatz, 1857

Similarly to basal groups like *Astrapaeus,* some other genera across Staphylinini display "*Quedius*-like" habitus. That similarity is mostly caused by their deflexed hypomera of pronotum and variously shaped "infraorbital ridges" (the latter often combine non-homologous structures, as discussed in Solodovnikov 2006). The "*Quedius*-like" habitus of unrelated Staphylinini misled systematists who gradually inflated Quediina to a largely polyphyletic taxon. Contrary to the currently accepted classification but according to the abovementioned new phylogenetic data, the limits of the subtribe Quediina should be restricted to the north temperate Holarctic core of the current genus *Quedius*, plus some other, mostly Holarctic, smaller genera of the traditional "Quediina". An example of Quediina in such new definition is marked by red in fig. 1 in Solodovnikov and Schomann (2009), while the entire list of genera of the newly defined subtribe Quediina is provided in the table 1 in Chatzimanolis et al. (2010). Within the Central European fauna all species of the genus *Quedius* (including *Velleius* as a synonym of *Quedius,* see below), as well as genera *Euryporus* and *Acylophorus,* belong to Quediina in the newly defined sense. But the genus *Heterothops* that also occurs in Central Europe and that traditionally stayed in the subtribe "Quediina", however, belongs to the subtribe Amblyopinina, also in a newly defined sense (see below). To accommodate these changes, new global and regional diagnoses of Quediina are here provided.

Quediina: new diagnosis based on world fauna. Small to medium size beetles with pronotum having deflexed hypomera and thus not visible in lateral view; head with well-developed infraorbital ridges (as defined in Smetana and Davies 2000) extending from neck towards base of mandibles and often reaching the latter; tarsal formula 5-5-5; mesoscutellum with two basal carinae (in normal position that part of mesoscutellum is hidden under base of pronotum); aedeagus of variable shape, but with paramere never very closely attached or fused to median lobe, mostly with distinct, heavily sclerotized sensory peg setae.

Except a few (mostly montane) species extending into (sub)tropical latitudes of the Oriental and Neotropical regions, and some adventive species that occur nearly world-wide, the group is restricted to the north temperate zone of the Holarctic region and is markedly absent in the Sub-Saharan Africa. Many Quediina are confined to leaf litter of the north temperate forests, some also occur in ground-based debris of various open landscapes.

Quediina: diagnosis based on Central European fauna. Small to medium size beetles; head with well-developed infraorbital ridges; pronotum with deflexed hypomera and thus not visible in lateral view, on disc with 2–4 punctures in dorsal rows; tarsal formula 5-5-5; apical segment of maxillary and labial palps never very narrow or aciculate, mostly (but not always) fusiform with more or less truncate apex; aedeagus with well developed paramere that is separated from the median lobe along most of its length, mostly with sensory peg setae.

New limits and diagnosis of the subtribe Amblyopinina Seevers, 1944

Along with the new definition of Quediina, the mentioned phylogenetic studies reveal an earlier unrecognized monophyletic lineage that consists of: some south temperate genera of Staphylinini most of which were in the conventional subtribe "Quediina" (for their list see table 1 in Chatzimanolis et al. 2010); many Staphylinini species from Australia and New Zealand currently misplaced in the genus *Quedius* (e.g., represented by *Q. calogaster* Lea, 1929 in the analysis of Solodovnikov and Schomann 2009); and several genera of truly remarkable staphylinids from South America and Australia (members of the subtribe Amblyopinina Seevers 1944 in the conventional system, e.g., Herman 2001). As far as the Central European fauna is concerned, it is only the genus *Heterothops* (globally distributed, poorly defined genus, for details see Solodovnikov and Schomann 2009) that belongs to this lineage. Since Amblyopinina Seevers, 1944 is the oldest available family-group name for this newly found large monophyletic lineage, its meaning has to be expanded far beyond the initial scope that included only highly specialized "very exotic" Neotropical and Australian symbionts of small mammals. The strongly modified morphology of the latter is an adaptation to a very special habitat like the fur of a mammal body; such strong autapomorhy simply disguised sister relationships of these beetles for decades. Moreover, it is apparent that the symbiosis with mammals and associated specialized morphology may have originated independently in several lineages of free living "usual *Quedius*-like" south temperate Amblyopinina (Ashe and Timm 1988). Following the discussed phylogenetic results, and in agreement with the here provided new diagnosis of Amblyopinina in Assing and Schülke (2012), *Heterothops* is treated used in the subtribe Amblyopinina, not in Quediina.

Amblyopinina: new diagnosis based on world fauna. Small to medium size beetles with pronotum having deflexed hypomera and thus not visible in lateral view; tarsal formula 5-5-5; mesoscutellum with one basal carina (in normal position that part of mesoscutellum is hidden under base of pronotum); aedeagus: paramere longer than, and closely attached to, median lobe; often median lobe relatively poorly developed or, in the ultimate case of *Heterothops,* reduced and entirely fused to strongly developed paramere.

Except the global genus *Heterothops*, the group is restricted to the southern hemisphere, and is especially species-rich and abundant in leaf and log litter of the south temperate and subtropical forests of southern South America, Australia, New Zealand, and less so in Papua New Guinea and New Caledonia. A few genera of Amblyopinina, possibly not closely related to each other, are symbionts of mammals and have peculiar "ectoparasitic" morphology.

Amblyopinina: diagnosis based on Central European fauna. Small beetles with pronotum having deflexed hypomera not visible in lateral view, disc of pronotum with two punctures in dorsal row; tarsal formula 5-5-5; apical segment of maxillary and labial palps very narrow, aciculate, at base much narrower than their respective penultimate segments; aedeagus with median lobe reduced and entirely fused to strongly developed paramere.

Status of the subtribe Tanygnathinina Reitter, 1909

In connection with the discussion about Amblyopinina in the new sense, the systematic position of the genus *Atanygnathus* Jakobson, 1909, represented in Central Europe by a single species *A. terminalis* (Erichson, 1839), should be also commented. Adult and larval morphology of *Atanygnathus* is very peculiar (Solodovnikov 2005; Staniec 2005), but according to the morphology-based phylogenetic analyses (Solodovnikov 2006; Solodovnikov and Schomann 2009), these peculiarities apparently are autapomorphies, while the genus shares synapomorphies with the above discussed large south temperate lineage Amblyopinina. Contrary to morphology though, the molecular analysis (Chatzimanolis et al. 2010) did not support affiliation of *Atanygnathus* with that group and, at the same time, did not suggest a plausible alternative placement. Conflicts among various datasets, especially as different as animal morphology and DNA-sequences, are not unusual in systematic biology. Given a very high impact of morphology on practical systematics, and instability of molecular phylogenies when they are based on few genes (as opposed to generally more robust multigene phylogenies), a morphology-based solution for the systematic placement of a taxon would have been given a priority over a conflicting hypothesis that is based on limited molecular dataset. But, as far as *Atanygnathus* is concerned, there are two practical considerations against the placement of *Atanygnathus* in Amblyopinina. Firstly, immediate acceptance of the morphology-based hypothesis would necessitate the synonymy of the family-group names Tanygnathinina Reitter, 1909 and Amblyopinina Seevers, 1944, where the former name would be valid due to its priority while being tied to the phylogenetically most unstable taxon. Secondly, the monobasic Tanygnathinina can be easily characterized and keyed out by striking autapomorphies of *Atanygnathus*: very elongate mouthparts and tarsal formula 5-4-4, both features unique among Staphylinini. Inclusion of *Atanygnathus* into Amblyopinina, on the contrary, would diffuse the diagnosis of the latter subtribe. As a result, a separate monobasic subtribe Tanygnathinina is currently maintained for that genus, also in Assing and Schülke (2012).

Quedius–complex

One of the biggest systematic problems at the genus level within the tribe Staphylinini is the so-called "*Quedius*-complex" (Solodovnikov 2006). As it stands now (for example, Herman 2001; Newton and Thayer 2005), the genus *Quedius* is highly polyphyletic and lacks a consistent intrageneric division. Operational species groups in *Quedius* were defined only for some regional faunas like America North of Mexico, and parts of the Palearctic and Oriental regions, while the originally very inconsistent subgeneric division, although once improved by Smetana (1971) for the Holarctic fauna, still needs a rigorous phylogenetic and broader overview. As a result, there remains a plethora of genus-group taxa within and around *Quedius*, whose status remains controversial. With respect to Central European fauna, *Quedionuchus* Sharp, 1884 and *Velleius* Leach, 1819 are such groups.

On the status of *Quedionuchus* Sharp, 1884

Quedionuchus was originally established as a genus (Sharp 1884) (with the type species *Quedius impunctus* Solsky, 1868, designated by Blackwelder 1952). Eventually various European authors downgraded *Quedionuchus* to a subgenus of *Quedius* and expanded its limits to include also some species of *Distichalius,* another subgenus of *Quedius* (Smetana 1971). Smetana (1971) corrected the volume of *Quedionuchus* by removing members of *Distichalius* from the former, but he left *Quedionuchus* as a subgenus of *Quedius*. Analysis in Solodovnikov (2006) placed *Quedionuchus* outside *Quedius,* suggesting that a separate generic status for the former would be a better solution. Because the formal reclassification of the "*Quedius*-complex" is pending a broader study, in Assing and Schülke (2012) the traditional subgeneric status of *Quedionuchus* is maintained for practical reasons.

Synonymy of *Quedius* Stephens, 1829 and *Velleius* Leach, 1819

Leach (1819) described the genus *Velleius* to accommodate two species, *Staphylinus dilatatus* Fabricius, 1787 and *S. concolor* Marsham, 1802 (currently a synonym of *Velleius dilatatus* (F.)), the latter species subsequently (Westwood 1838) designated as a type species. Although all eight currently known species of *Velleius* (Herman 2001; Smetana 2004; new combinations below) share characteristic large size and pectinate antennae, doubts regarding a separate generic status for this group were expressed by a number of earlier authors who treated *Velleius* as a synonym of *Quedius* (e.g., Erichson 1839; Lacordaire 1854; Kraatz 1857; Schaum 1859). Also Smetana (1988) pointed out a case when it was difficult to assign a species, *Quedius inquietus* (Champion, 1925) (originally described as *Velleius*), to either *Velleius* or *Microsaurus*, a subgenus of *Quedius*. The habitus, taxonomically important chaetotaxy and aedeagus of *Velleius* are essentially the same as in *Microsaurus*. The larva of *Velleius* is *Quedius*-like (Paulian 1941; Strassen 1957; Pototskaya 1967; data matrix in Pietrykowska-Tudruj et al. 2011). Molecular-based phylogenetic analysis (Chatzimanolis et al. 2010) also placed species of *Velleius* nested within *Quedius* (*Microsaurus*). Even a peculiar biology, known for *Velleius dilatatus* (larvae of this species live in the nests of the European hornet *Vespa crabro* (e.g., Strassen 1957)) is just a strongly expressed case of an overall evolutionary trend towards nidicoly seen in many other species of *Microsaurus*. Therefore, following some earlier authors, *Velleius* and *Quedius* should be considered as synonyms, that is also followed in Assing and Schülke (2012). Because *Quedius* is a much more species-rich and abundant genus than *Velleius*, in the interests of stability of the zoological nomenclature, an application to the International Committee for the Zoological Nomenclature has been prepared to suppress the Priority Rule and give precedence to the younger generic name *Quedius* Stephens, 1829 over the older generic name *Velleius* Leach, 1819. Since the species *V. dilatatus* (F.) was used in the combination with the genus *Quedius* before, the following new combinations are here proposed: *Quedius* *amamiensis* (Watanabe, 1990), comb. n.; *Quedius circumipectus* (Cho, 1996), comb. n.; *Quedius elongatus* (Naomi, 1986), comb. n.; *Quedius japonicus* (Watanabe, 1990), comb. n.; *Quedius pectinatus* (Sharp, 1874), comb. n.; *Quedius setosus* (Sharp, 1889), comb. n.; *Quedius simillimus* (Fairmaire, 1891), comb. n. To avoid the resulting homonyms, the name *Quedius japonicus* (Watanabe, 1990) (non *Quedius japonicus* Sharp, 1874) is replaced with the new name *Quedius watanabei* Solodovnikov, nom. n., while the name *Quedius pectinatus* Lea, 1908 (non *Quedius pectinatus* (Sharp, 1874)) is replaced with the new name *Quedius arthuri* Solodovnikov, nom. n. New names are provided because neither of these two junior homonyms had available synonyms that could be valid names in new combinations.

Species-level problems in *Heterothops* and *Quedius*

On the synonymy of *Heterothops praevius* Erichson, 1839 and *Heterothops niger* Kraatz, 1868

Controversy over the status of *Heterothops praevius* and *H. niger* had begun soon after the publication of the original description of *Heterothops niger.* Although already a few earlier authors considered *H. niger* as a synonym of *H. praevius* (e.g., Fauvel 1874; Fowler 1888; Ganglbauer 1895; Porta 1907), a predominant approach was to treat the former either as a distinct species, or as some kind of the intraspecific form of *H. praevius*. A long history of this controversy is summarized in Israelson (1979) and Lott (2008). Israelson (1979), based on the detailed morphological examination of specimens from Sweden and survey of the literature covering other regions, came to the conclusion that *H. praevius* and *H. niger* differ slightly in the body coloration (*H. praevius* is paler, while *H. niger* is darker), distribution (*H. praevius* has broader distribution, while *H. niger* has narrower distribution within the range of *H. praevius*) and ecology (*H. praevius* is free living, while *H. niger* is nidicolous). Lott (2008), based on the morphological examination of British material, also came to the conclusion that *H. praevius* (paler) and *H. niger* (darker) differ in coloration. However he denied the sharp ecological difference between these species defined as "free living *H. praevius versus* nidicolous *H. niger*". Contrary to expectations, in his survey *H. praevius* was found not only in free habitats but also in the badger setts, while *H. niger* was found only in the mole nests. Israelson (1979) proposed to consider *H. niger* as a subspecies of *H. praevius*, that clearly was not a good decision for sympatric (and even syntopic) forms. Lott (2008) removed such inconsistency by stating that these sympatric taxa are two separate species, even though the morphological difference between them is very vague.

My examination of the abundant material identified by various people as both species from various parts of Denmark, and similar combined but sparser sample from various parts of Europe, reveals the following. Firstly, there is no such clear coloration difference (pale *versus* dark) as it was stated by Israelson (1979) or Lott

(2008) for limited samples. Intermediately colored specimens that are hard to assign to either of these two (dark or pale) categories of coloration are not exceptional even among the Danish material alone. Secondly, consistently with Israelson (1979), there is no hiatus in a continuous variation of the structures of the aedeagus within the pool combining paler (presumable *H. praevius*) and darker (presumable *H. niger*) specimens. Therefore there are no genitalic characters that would break a combined sample of the putative *H. praevius* and *H. niger* into two or any other number of groups. Thus, no structural character supports the vague division between paler and darker specimens. With such a weak basis for morphological delineation of *H. niger* from *H. praevius*, secondary data like ecology or distribution become unreliable, while a synonymy of *H. praevius* and *H. niger* is considered a preferable solution that is followed in Assing and Schülke (2012).

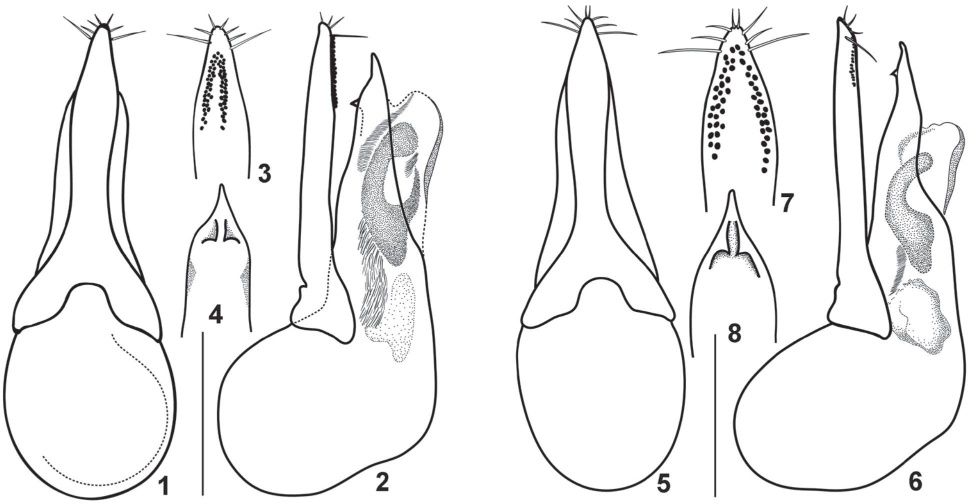
***Quedius meridiocarpathicus* Smetana, 1958**

http://species-id.net/wiki/Quedius_meridiocarpathicus

Type material examined. *Lectotype* (here designated): ♂, **Slovakia:** "Slovakia mer. Kamen. Most 5.5.1955 Smetana 1955/ Quedius meridiocarpathicus s. Smetana det. 1957/ Lectotype Quedius meridiocarpathicus Smetana A. Solodovnikov des. 2009/ Quedius meridiocarpathicus Smetana A. Solodovnikov det. 2009" (cAS); *paralectotypes*: 3 ♂, 6 ♀, same data as in lectotype (2 ♂, 5 ♀ in cAS; 1 ♂, 1 ♀ in ZMUC); 1 ♂, "Slovakia mer. or. Slanec Smetana 1953/ Quedius meridiocarpathicus spec. n. det. A. Smetana/ Paralectotype Quedius meridiocarpathicus Smetana A. Solodovnikov des. 2009/ Quedius molochinus (Grav.) A. Solodovnikov det. 2009" (cAS).

Additional material examined. Italy: 1 ♂, Istria, Noghera (ZMUC); **Greece:** 1 ♂, 1 ♀, Parnass (ZMUC); 1 ♂, Janina, IV.1927, leg. C. Purkyně (ZMUC); **Turkey:** 1 ♂, Saray, 30 km W of Ankara, 23.II.1973 (ZMUC); **Bulgaria:** 1 ♂, Macedonia, Sandanski, 6–11.V.1984, leg. Wrase (cSch); 1 ♂, "Bulgaria, July 1975" (cSch); **Romania:** 1 ♂, 2 ♀, Eastern Romania, Mamaia/ Black Sea, 12–16.VII.1981, Wrase/ Fietzke (cSch); **Ukraine:** 1 ♂, 1 ♀, Crimea, Simferopol, 30.III.1999 (cSch); 2 ♂, 2 ♀, Environs of Odessa, right bank of Kujalnitskij estuary, 10.VI.2005, under stones, leg. A. Gontarenko (ZMUC); **Russia:** Krasnodar territory: 2 ♂, 15 km S of vill. Taman', 15.V.1995, sandy sea shore, under logs; 1 ♀, Karabetova Gryada 5 km SE of vill. Taman', in litter at the bank of the permanent pond; 1 ♂, Mt. Tkhab, valley of river Zhene, 21.VI.1992, in forest litter, leg. M. Savitsky; 1 ♂, distr. of Tuapse, env. of vill. Massazhay, 15.III.1999, bank of river Tuapse, under stone, leg. K. Egorov; 1 ♀, distr. of Tuapse, env. of vill. Krasnoe, 17.III.1999, bottomland meadow of river Tuapse, under stone, leg. K. Egorov (ZMUC).

Discussion. *Quedius meridiocarpathicus* Smetana, 1958 is very similar to *Q. molochinus* (Gravenhorst, 1906). Both species can be reliably distinguished only by the shape of their aedeagi (Figs 1–8) and mostly by the shape of the largest (C-like) sclerite of the internal sac (cf. Figs 2 and 6). External characters hitherto used for



Figures 1–8. Details of the aedeagus of *Quedius molochinus* **1–4** and *Q. meridiocarpathicus* **5–8**): **1, 5**, aedeagus dorsally (parameral side); **2, 6**, aedeagus laterally; **3, 7**, apical portion of paramere, side with sensory peg setae; **4, 8**, apical portion of median lobe, dorsal (parameral) side. Scale bars: 1 mm for **1, 2, 5, 6**; 0.8 mm for **3, 4, 7, 8**.

separation of these species (details of punctuation of the elytra and abdomen, slight difference in the proportions of the body parts), as well as details of the shape of the aedeagus are variable in both species. Since some specimens of *Q. meridiocarpathicus* in the collections are misidentified as *Q. molochinus* and *vice versa*, the hitherto published distribution records for both of them (for a summary of literature see Herman 2001) in Central, Southern and Eastern Europe need revision. In fact, even the type series of *Q. meridiocarpathicus* includes one male specimen of *Q. molochinus*, an ambiguity here eliminated by designation of the lectotype (see below). Based on the material which I have examined (listed above, and more), *Q. meridiocarpathicus* is reliably known from the south of Central and Eastern Europe, as well as from the Balkan Peninsula and Turkey.

Lectotype designation. The only information about the type material published in the original description of *Quedius meridiocarpathicus* is that it was collected at "Kamenný most" and "Slanec" in southern Slovakia (Smetana 1958). Aleš Smetana kindly sent me 11 specimens as a type series of *Q. meridiocarpathicus*, all of them were collected by himself: 10 (4 males, 6 females) at Kamenný Most on 3.V.1955, and one male at Slanec in 1953. All these specimens are considered as syntypes. Of them, a single male from Slanec is undoubtedly *Q. molochinus*, but all males from Kamenný Most belong to *Q. meridiocarpathicus*. Females from Kamenný Most are also identified as *Q. meridiocarpathicus* based on the association with the respective males. To avoid future ambiguity about the identity of *Q. meridiocarpathicus* one male from Kamenný Most is here designated as a lectotype of this species.

Quedius pseudonigriceps Reitter, 1909

http://species-id.net/wiki/Quedius_pseudonigriceps

Quedius noricus Bernhauer, 1927, syn. n.

Type material examined. *Quedius pseudonigriceps*: **Bosnia and Herzegovina:** *Lectotype* (here designated): ♂, "Nevesinje, V. Zoufal/ coll. Reitter/ Paratypus Quedius humeralis v. pseudonigriceps Reitter 1909" (HNHM); *paralectotypes*: 1 ♀, same data as in lectotype; 1 ♂, "Herzegovina Velež-Planina 1900 – 9/ Quedius humeralis Steph. coll. Reitter/ Q. (Sauridus) pseudonigriceps Reitt. H. Coiffait det. 1967" (HNHM); **Turkey:** 1 ♀, "Alem-Dagh/ coll. Reitter/ Holotypus Quedius humeralis var. pseudonigriceps Reitter 1909" (HNHM).

Quedius noricus: **Austria:** *Lectotype* (here designated): ♀, "Hofgastein tal Juli 1926 Bernhauer/ noricus Bernh. Typus [in Bernhauer's handwriting]/ Chicago NH Mus M. Bernhauer Collection"; (FMNH); *paralectotype*: 1 ♀, "Hofgastein tal Juli 1926 Bernhauer/ noricus Bernh. Cotypus [in Bernhauer's handwriting]/ Chicago NH Mus M. Bernhauer Collection" (FMNH).

Additional material examined. Austria: 1 ♂, "Gesteinertal Brugg AU 900 m Bernh/ Erlenlaub Juni 1928/ noricus Brnh. Det. Bernhauer [in Bernhauer's handwriting]/ ex. Coll. Sceerpeltz" (NHMW); " Gesteinertal Brugg AU 850 M. Bernh./ Erlenlaub 21.VI. 1928/ noricus Brnh. Det. Bernhauer [in Bernhauer's handwriting]/ Chicago NH Mus M. Bernhauer Collection" (FMNH); 1 ♀, "Bad Brugg, Erlenlaub, VI.1936 Bernhauer/ Chicago NH Mus M. Bernhauer Collection" (FMNH); 1 ♀, "Badbruck, 900 m, VI.1930, Erienlaub/ Chicago NH Mus M. Bernhauer Collection" (FMNH); 1 ♀, "Gesteinertal Angertal VI.1929 Erle/ noricus Brnh. Det. Bernhauer [in Bernhauer's handwriting]/ Dr. M. Bernhauer donavit/ ex. Coll. Sceerpeltz/ Cotypus Quedius noricus Bernhauer [pink label in Scheerpeltz' handwriting]" (NHMW); 1 ♀, "Gesteinertal Angertal VI.1929 Erle / Chicago NH Mus M. Bernhauer Collection" (FMNH); 1 ♂, "Bad Gastein, Bad Bruck F. Leeder [Leder] leg./ Q. noricus det. F. Schubert" (NHMW); 1 ♂, "Gastein Umg. Saltsburg/ leg. Kaiser 6.1932/ Bruck/ noricus Bh. [not Bernhauer's handwriting]" (NHMW); 1 ♀, "Hofgastein tal Juli 1926 Bernhauer/ noricus Bernh. Det. bernhauer [in Bernhauer's handwriting]/ Chicago NH Mus M. Bernhauer Collection" (FMNH); 1 ♀, "Hofgastein Juli 1926 / noricus Bernh./ Chicago NH Mus M. Bernhauer Collection" (FMNH); **Bosnia and Herzegovina:** 2 ♂, 6 ♀, Majavica Bosna, VI. Zoufal (NMPC and ZMUC); 2 ♂, "Nevesinje, K. Kyselý"; **Republic of Macedonia:** 1 ♂, "AliBotuš VI.29 Maced. Mařan et Táborský lgt." (NMPC); 1 ♂, "Maced. Perister Sv. Petka 7.14. Dr. Rambousek" (NMPC); 1 ♂, Maced. Galičica plan. VIII.1930, Dr. Rambousek (NMPC); **Romania:** 1 ♂, 7 ♀, Romania, Herculesbad (NMPC and ZMUC); 1 ♂, 2 ♀, Romania, Bălle Herculan, legt. Ing. Machulka (NMPC); **Hungary:** 1 ♂, Hungaria Com. Bihar, Dr. Fleischer (NMPC).

Discussion. *Quedius noricus* was described from two females collected at "Hofgastein Tal Juli 1926 Bernhauer" [label data from two syntypes] in Austria (Bernhauer

1927). Coiffait (1963, 1978) included this species in his determination keys, provided its redescription and outlined its distribution as "Alpes orientales, montagnes d'Europe centrale" [Eastern Alps, mountains of Central Europe]. He provided illustrations of the aedeagus of this species based on the material from Chech Republic ("chaîne Bryb"). For some reason *Quedius noricus* was not included in the keys to the Central European Staphylinidae (Lohse 1964), but it was added there later (Lohse 1989), based on the mentioned accounts of this species by Coiffait (1963, 1978). Horion's (1965) brief account about *Q. noricus* was also based on the earlier published Bernhauer's original description and data in Coiffait (1963) only. Additionally, based on the personal communications from Scheerpeltz and Korge, Horion (1965) mentioned some other specimens of *Q. noricus* from Estern Alps ("Bad Gastein, Leder leg., det. Bernhauer (i.l.) Badbruck (900 m) [here examined, see above] und Kötschental (1300 m): Bernhauer leg.; Kolm-Saigurn Käufel leg.": material from Scheerpeltz' collection), and from the southern part of Romania (1 specimen from "Banat" identified by Korge based on the illustrations in Coiffait (1963). No other material identified as *Q. noricus* was ever mentioned in the literature.

It is difficult to establish the identity of two female syntypes of *Q. noricus* because they belong to the complex of species (resembling *Q. limbatus*) where the study of male genitalia is critical for the species identification. However, among the additional material from the Vienna Museum of Natural History (see above), there are three male specimens, one of which was identified by Bernhauer as *Q. noricus*. Although neither of them are syntypes of *Q. noricus*, they were collected near the type locality of that species. Examination of this valuable authentic material shows that *Q. noricus* is conspecific with *Q. pseudonigriceps* Reitter, 1909, the latter species earlier revised in Solodovnikov (2004). *Quedius pseudonigriceps* (Figs 9–11) is widely distributed in Southern Europe, Asia Minor, and Transcaucasia, while this new synonymy clarifies its distribution in the southern Central Europe.

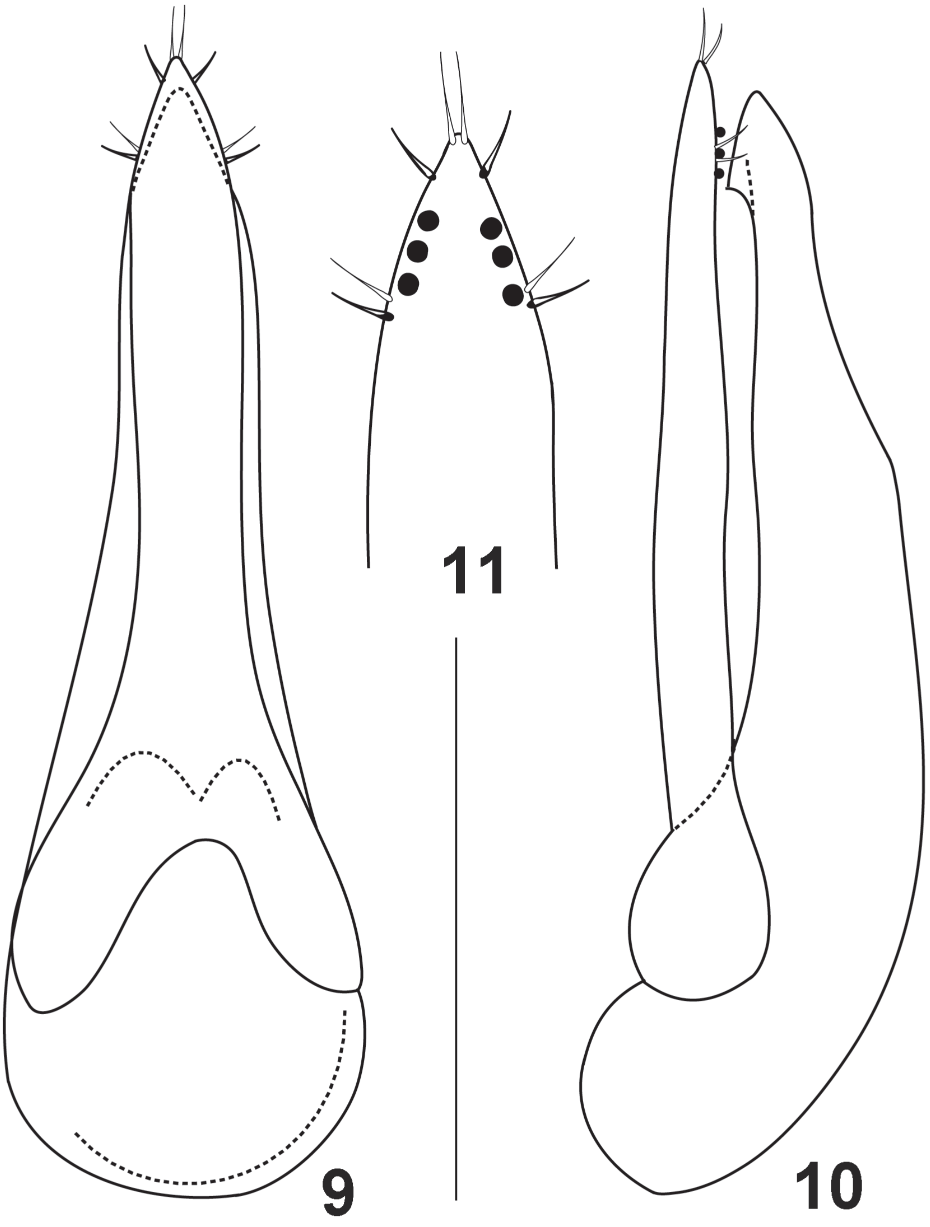
Lectotype designation. To fix the identity of *Quedius noricus* Bernhauer, 1927, one of the syntypes (with the Bernhauer's label "type") is designated as a lectotype. The syntypes of *Q. pseudonigriceps* were revised in Solodovnikov (2004), of them one male is designated here as a lectotype. Both lectotype designations are done for the unambiguous fixation of the names placed in synonymy.

***Quedius maurorufus* (Gravenhorst, 1806)**

http://species-id.net/wiki/Quedius_maurorufus

Quedius richteri Korge, 1966, syn. n.

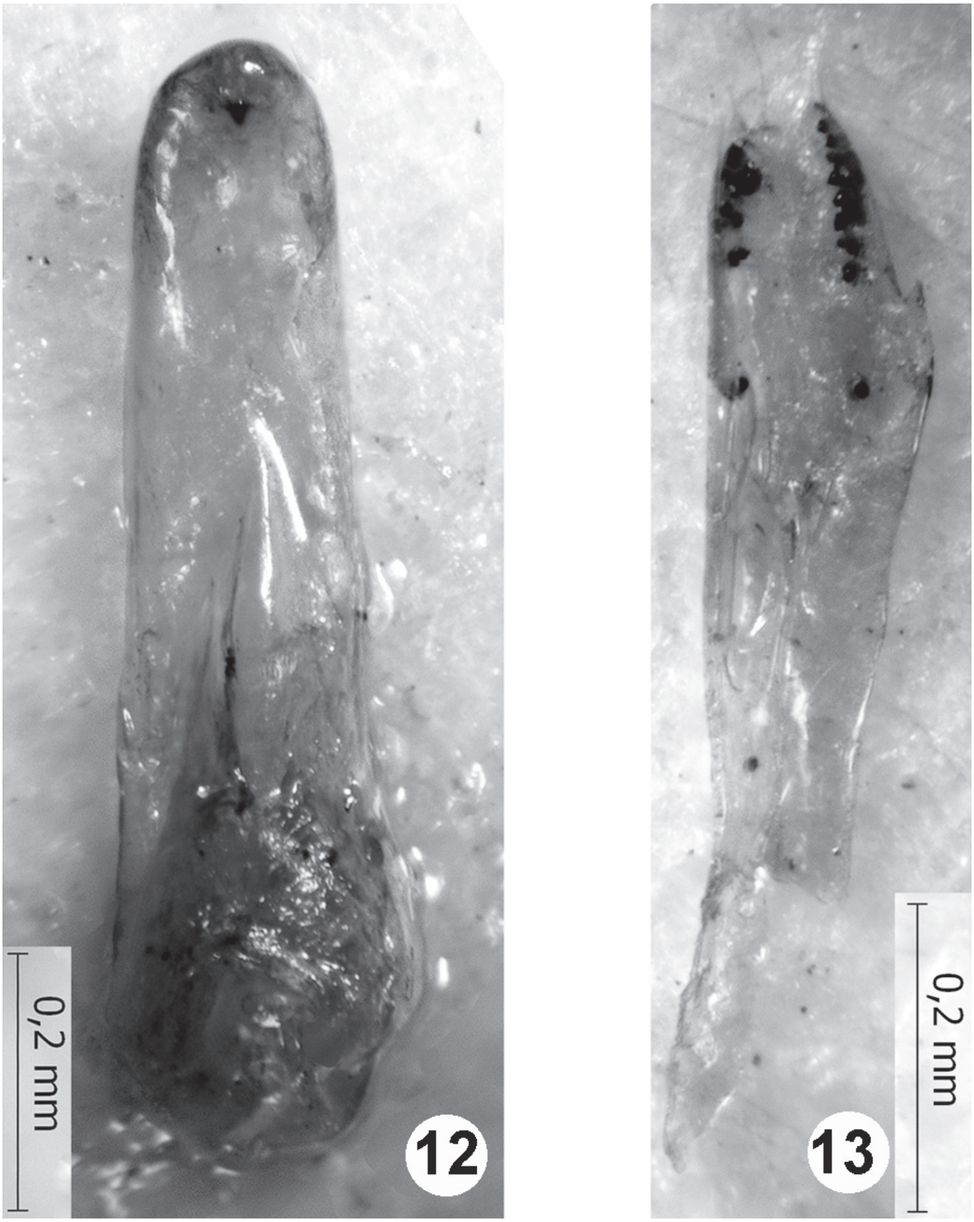
Type material examined. *Quedius richteri:* Holotype: **Germany:** female, "Stolpe a. Oder Uckermark, 1986/ Quedius (Sauridus) richteri Korge ♀ - Holotypus"; paratype: 1 male, "Stolpe/ Mark leg. D. Richter / Glykolfallen August 1965/ Paratypus Quedius richteri Korge" (cKrg). Additional specimen: 1 ?female [apex of the abdomen missing],



Figures 9–11. Aedeagus of *Quedius pseudonigriceps*: **9** dorsally (parameral side) **10** laterally **11** apical portion of paramere, side with sensory peg setae. Scale bar: 0.5 mm for **9, 10;** 0.25 mm for **11**.

same data as in paratype, marked as paratype [but not listed in the type series in the original description].

Remarks. The female holotype, the damaged male paratype (Figs 12, 13), and the unsexed specimen (without apex of abdomen, marked as "paratype" but not listed



Figures 12–13. Aedeagus of the paratype of *Quedius richteri*: **12** median lobe dorsally (parameral side, paramere detached) **13** detached paramere, side with sensory peg setae. Scale bars: 0.2 mm.

in the original description) are the only specimens known as *Quedius richteri* Korge, 1966. As stated in the original description of *Quedius richteri* (Korge 1966), and confirmed by the study of the type material here, externally this species is identical with *Q. maurorufus* (Grav.). The only available male of *Q. richteri* differs from *Q. maurorufus* (Grav.) in the shape of the aedeagus (Figs 12, 13). The aedeagus of that single male of

Q. richteri shares the same structural plan with the aedeagus of *Q. maurorufus,* and, at the same time, it displays some abnormal asymmetry. These facts, combined with the somewhat deformed external morphology of the corresponding male paratype of *Q. richteri*, suggest that it is a teratological specimen of *Q. maurorufus* (Grav.). Therefore, the name *Q. richteri* Korge, 1966 is placed in synonymy with *Q. maurorufus* (Gravenhorst, 1806), a wide-spread European species that is rather common in Central Europe. Lack of any other collecting events of *Q. richteri*, described from the area of very strong entomological attention, is additional strong evidence for the mentioned teratology of *Q. maurorufus* and resulting synonymy.

Quedius suturalis **Kiesenwetter, 1845**

http://species-id.net/wiki/Quedius_suturalis

Quedius merlini Drugmand & Bruge 1991, syn. n.

Remarks. *Quedius merlini* was described from three specimens (one male, two females) collected in Belgium (Tenneville, Fange Massa) in 1986 in a Lundgren trap (Drugmand and Bruge 1991). Unfortunately the type material of this species was not located at the Royal Institute of Natural Science at Brussels, but the original description and illustrations of *Q. merlini* leave no doubts that those specimens are misidentified *Q. suturalis* Ksw. After the description, *Q. merlini* was never recorded again either in Belgium or anywhere else. For such an entomologically popular region as Central Europe, this is additional evidence that *Q. merlini* is not a valid species.

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Revision of *Tipula* (*Yamatotipula*) *stackelbergi* Alexander (Diptera, Tipulidae), and a short discussion on subspecies among crane flies

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Abstract

All available type material of *Tipula stackelbergi* Alexander, *T. usuriensis* Alexander and *T. subpruinosa* Mannheims were examined. *Tipula* (*Yamatotipula*) *stackelbergi* **stat. rev.** is elevated from a subspecies of *T.* (*Y.*) *pruinosa* Wiedemann to a valid species. Two new synonyms are proposed: *Tipula usuriensis* **syn. n.** proved to be a junior synonym of. *T.* (*Y.*) *pruinosa* and *T. subpruinosa* **syn. n.** a junior synonym of *T.* (*Y.*) *freyana* Lackschewitz. *Tipula* (*Y.*) *stackelbergi* is redescribed, male and female terminalia of *T.* (*Y.*) *pruinosa* are illustrated and discussed. Female terminalia of *T.* (*Y.*) *freyana* are described and illustrated for the first time. A key to both sexes of *T.* (*Y.*) *stackelbergi* and *T.* (*Y.*) *pruinosa*, and a key to females of *T.* (*Y.*) *chonsaniana*, *T.* (*Y.*) *freyana* and *T.* (*Y.*) *moesta* are provided. Subspecies are not uncommon among crane flies, but their ranges and traits are poorly known. An interdisciplinary approach (genetics, ecology, taxonomy) is suggested if subspecific ranks are to be used in tipuloid systematics.

Keywords

Palaearctic region, crane flies, *Tipula*, new synonyms

Introduction

The description of *Tipula stackelbergi* (Diptera, Tipulidae) was based on male holotype collected from Russian East Siberia (Alexander 1934). Later this species was also recorded from the Russian Far East (Savchenko 1961; Pilipenko 2009). Savchenko (1961) considered *T. stackelbergi* as a subspecies of *T. pruinosa* Wiedemann, based on the small structural differences between the two taxa. He also transferred *T. stackelbergi* to the subgenus *Tipula* (*Yamatotipula*) Matsumura. In the same publication, Savchenko suggested two synonyms for *T. stackelbergi*, namely *T. usuriensis* Alexander, 1925 and *T. subpruinosa* Mannheims, 1954. However, both synonyms were uncertain because Savchenko did not examine the type material of these two species. The description of *T. usuriensis* was based on male holotype, collected from Siberia (exact locality uncertain) and the description of *T. subpruinosa* was based on two females, collected from northern Finland (holotype) and Sweden (paratype) (Alexander 1925; Mannheims 1954). Since the taxonomic treatment by Savchenko (1961), both species have remained synonyms of *T. stackelbergi* (e.g. Oosterbroek and Theowald 1992) and apparently the type material has remained unstudied. In addition, *Tipula stackelbergi* has been used as an example of a tipulid (sub)species with a large but disjunct range in the Palaearctic region (Oosterbroek et al. 2001).

Subspecies are traditionally held as geographically separate and genetically distinct populations within the species' range, permitting gene flow in the area of contact (Wilson and Brown 1953; O'Brien and Mayr 1991; Patten and Unitt 2002). Despite possible interbreeding between subspecies, subspecies may retain differences in respective life cycles or other traits (Hewitt 2002; Kothera et al. 2009). Among birds, high subspecies richness was associated with large breeding ranges, island dwelling, inhabiting montane regions, habitat heterogeneity and low latitude; on the other hand, species phylogenetic age was a poor predictor of subspecies richness (Phillimore et al. 2007). Definition of subspecies, and propensity of naming subspecific taxa, vastly differs among taxonomic groups. High proportions of higher plants, mammals and birds have subspecies, less so compared to invertebrates (Haig et al. 2006). New molecular methods have revolutionized subspecific classifications: i) formerly held subspecies gain no support at all, ii) subspecies are proposed to be valid species or iii) their status as operational evolutionary units is supported (Ball and Avise 1992; Patten and Unitt 2002; Tsao and Yeh 2008; Miller et al. 2011). Despite problems in correct recognition and delineation of subspecies, subspecific taxa are seen as powerful tools in conservation and as meaningful biological entities (Haig et al. 2006; Phillimore and Owens 2006).

In crane flies (Diptera, Tipuloidea) subspecific ranks are not uncommon. For example, out of 493 and 168 Palaearctic Tipulidae taxa described by C.P. Alexander (1889–1981) and E.N. Savchenko (1909–1994), respectively, 24 and 26 taxa are currently ranked as subspecies (data from Oosterbroek 2011). However, the recent tendency has been to elevate former subspecies to valid species (Starý 2006; Salmela and Autio 2009; Starý and Brodo 2009). In these cases, former subspecies are clearly separated upon differences in male and female hypopygial structures. In addition, due to the improved faunistic knowledge, range-sizes of former subspecies are in reality much larger than was previously known. On the other hand, some western Palaearctic (sub) species are most probably recent origin of Pleistocene glacial and interglacial periods; examples of such species are present in especially in the Iberian peninsula and Asia minor (Oosterbroek 1980). In general, tipuloid subspecies are elusive and very poorly known, and no rigorous assessment on the suitability of subspecific rank among crane flies has been carried out. Based on subjective opinion, perhaps a majority of the current Palaearctic tipuloid subspecies are in fact valid species. Furthermore, most allopatric or parapatric crane fly populations, that are genetically distinct from nominotypical (sub)species, are still to be found by biologists. Based on above mentioned references, subspecies should not be proposed on exiguous basis, relying on a small number of studied specimens and subtle differences in coloration or other structures. Instead, an interdisciplinary approach (genetics, ecology, taxonomy) is suggested if subspecific ranks are to be on a solid ground.

In this article I present the results of an examination of all available type material of *T. stackelbergi*, *T. usuriensis* and *T. subpruinosa*. I propose changes to the nomenclature of these species and I also review the morphology of *T. pruinosa* and *T. stackelbergi*, with an emphasis on male and female genitalia. In addition, female genitalia of *T.* (*Y.*) *freyana* are illustrated and a key to *T.* (*Y.*) *freyana* and females of *T.* (*Y.*) *chonsaniana* and *T.* (*Y.*) *moesta* are provided.

Material and methods

The morphological terminology used here mainly follows Alexander and Byers (1981). Terminology of some special parts of male genitalia was taken from Frommer (1963) or is explained in the figures. The following acronyms for museums and collections are used in the text: MZHF – Finnish Museum of Natural History (Zoological Museum), University of Helsinki, Helsinki, Finland; PVM – Private Collection of V.-M. Mukkala, Kaarina, Finland; USNM – Smithsonian Institution, National Museum of Natural History, Washington DC, USA; ZMUC – Zoological Museum, University of Copenhagen, Copenhagen, Denmark; ZMUT – Zoological Museum, University of Turku, Turku, Finland; ZISP – Zoological Institute Russian Academy of Sciences, St. Petersburg, Russia. Due to the courtesy of Valentin Pilipenko (Moscow State University, Russia), I was able study high quality digital photos of male hypopygium of *T.* (*Y.*) *pruinosa* (Russia: Moscow, 1 male, Altay, 1 male) and *T.* (*Y.*) *stackelbergi* (Russia: Primorski kray, 1 male).

Layer photos were taken using an Olympus SZX16 stereomicroscope attached to an Olympus E520 digital camera. Digital photos were captured using the programmes Deep Focus 3.1 and Quick PHOTO CAMERA 2.3. Layer photos were finally combined with the program Combine ZP.

Tipula **(*Yamatotipula*)** ***stackelbergi*** **Alexander, stat. rev.**

http://species-id.net/wiki/Tipula_stackelbergi
Figs 1, 2, 3e, 6a, c, d

Tipula (*Tipula*) *stackelbergi* Alexander 1934: 305.
Tipula (*Yamatotipula*) *pruinosa stackelbergi* Savchenko 1961: 292.

Tipula (*Yamatotipula*) *pruinosa stackelbergi* Oosterbroek and Theowald 1992: 165.
Tipula (*Yamatotipula*) *pruinosa stackelbergi* Oosterbroek 2011: http://nlbif.eti.uva.nl/ccw/

Material examined. Holotype of *T. stackelbergi*: male, pinned specimen (ZISP). "Tigrovaja, Suchan./ rn.Uss.kr. 16.VI/ Stackelberg. 927" (white label, partly hand written, in Cyrillic letters). "81" (white label, handwritten). "HOLOTYPE/ Tipula stackelbergi/ C.P. Alexander" (red label, partly handwritten) (Fig. 1a).

With except of the male hypopygium, the holotype specimen is in rather good condition (Figs 1b, c). All legs are detached from the specimen, but four legs are glued to the pin below the specimen. Tips of wings are broken. Right antenna is broken, only scape and pedicel are left; left antenna has seven flagellomeres. Tip of abdomen is broken; apparently hypopygium is mounted on a celluloid strip, which is attached on a pin. The surface of this strip is heavily cracked, and the structure of the hypopygium cannot be examined.

Other material. Russia, Vladivostok, Nekrutenko leg, 2.VI. 1957, 1 male, 1 female (ZISP).

Redescription. Male. Head yellowish brown, with grey pruinosity. Rostrum yellowish, nasus distinct, bearing numerous light hairs. Palpi brown. Scape yellowish, elongate, length 387–450 µm, width 126–131 µm (n=2). Pedicel yellowish, globular, length 147 µm, width 139 µm (n=1). Flagellomere 1 yellowish brown, length 486 µm, width 91 µm (n=1). Flagellomere 2 length 464 µm, width 79 µm (n=1). Flagellomeres bear erect short hairs, giving silvery appearance. Flagellomeres 2–7 elongate, brown, with dark verticils (Fig. 1c).

Prescutum with four brown stripes (Fig. 1e). Pronotum, prescutum, scutum, anepisternum, katepisternum and meron brownish, with grey pruinosity. Scutellum, anepimeron and laterotergite yellowish. Anterior part of mediotergite yellowish, more brownish in posterior part, having two weak longitudinal brown stripes. Coxa 1 brown. Anterior part of coxa 2 brown, posterior part yellow. Coxa 3 yellow. Femorae yellowish brown, darkening toward tarsi. Wings without markings, pterostigma brown (Fig. 1f). Wing length 13.8 mm (n=1). Halter yellowish.

Abdominal tergites yellowish brown, slightly darkening toward tip of abdomen. 9th tergite with two median projections, densely covered by dark bristles. Lateral corners of 9th tergite glabrous, pointed (Fig. 2a). 9th sternite with median incision, bearing two fleshy and hairy outgrowths in the margin of the incision. Outer gonostylus wormlike, apical half covered by light hairs (Fig. 2b). Inner gonostylus elongate (Figs 2b, c, 3e); beak rounded, with ten stout apical bristles and four subapical weaker bristles; central ridge with few weak bristles along its length; lower beak roundish, not angular. Posterior immovable apodeme of sperm pump almost straight (Fig. 2d). Distal end of compressor apodeme of sperm pump club-shaped, roundish (Fig. 2f). Aedeagal guide as in Fig. 2e.

Female. In general similar to male. Scutellum brown, abdominal tergites brown. Wing length 18.4 mm (n=1). Female terminalia as in Fig. 6a. Basal part of hypogynial

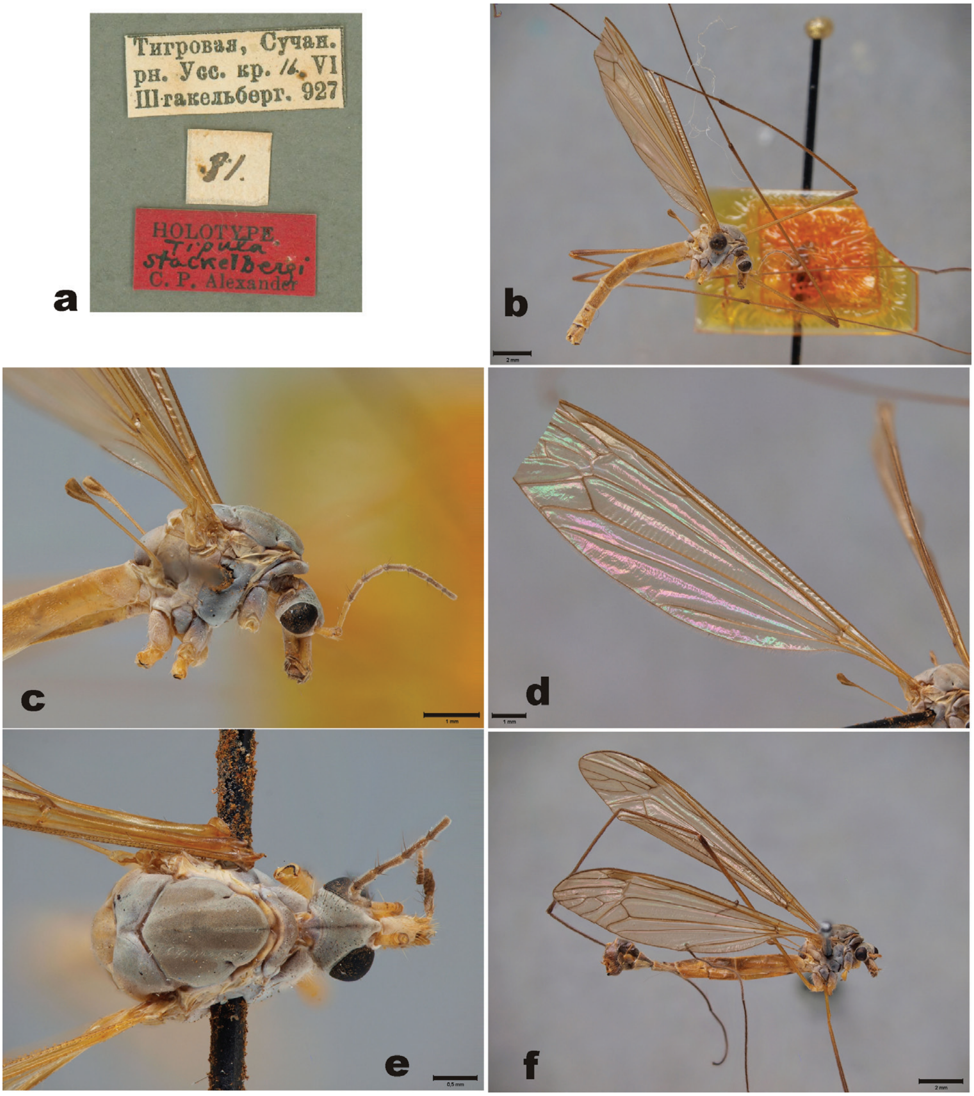

Figure 1. *Tipula* (*Yamatotipula*) *stackelbergi* Alexander **a** Label of the holotype **b** Holotype male, habitus, lateral view. Yellowish celluloid board is attached below the specimen; most probably C.P. Alexander dissected hypopygium on this board. The surface of the board is heavily cracked, no details of the hypopygium are discernible **c** Thorax and head, holotype, lateral view **d** Right wing, holotype **e** Thorax and head, holotype, dorsal view **f** Male (Russia, Vladivostok), habitus, lateral view. Scale bars: **b**, **f** 2 mm; **c** & **d** 1 mm; e 0.5 mm.

valves with dense black setae. Proximal ends of valves roundish, tapering toward bases (Fig. 6c). Genital fork of vaginal apodeme brown, rather narrow in its whole length (Fig. 6d). Dorsal view of vaginal apodeme as in Fig. 6d.

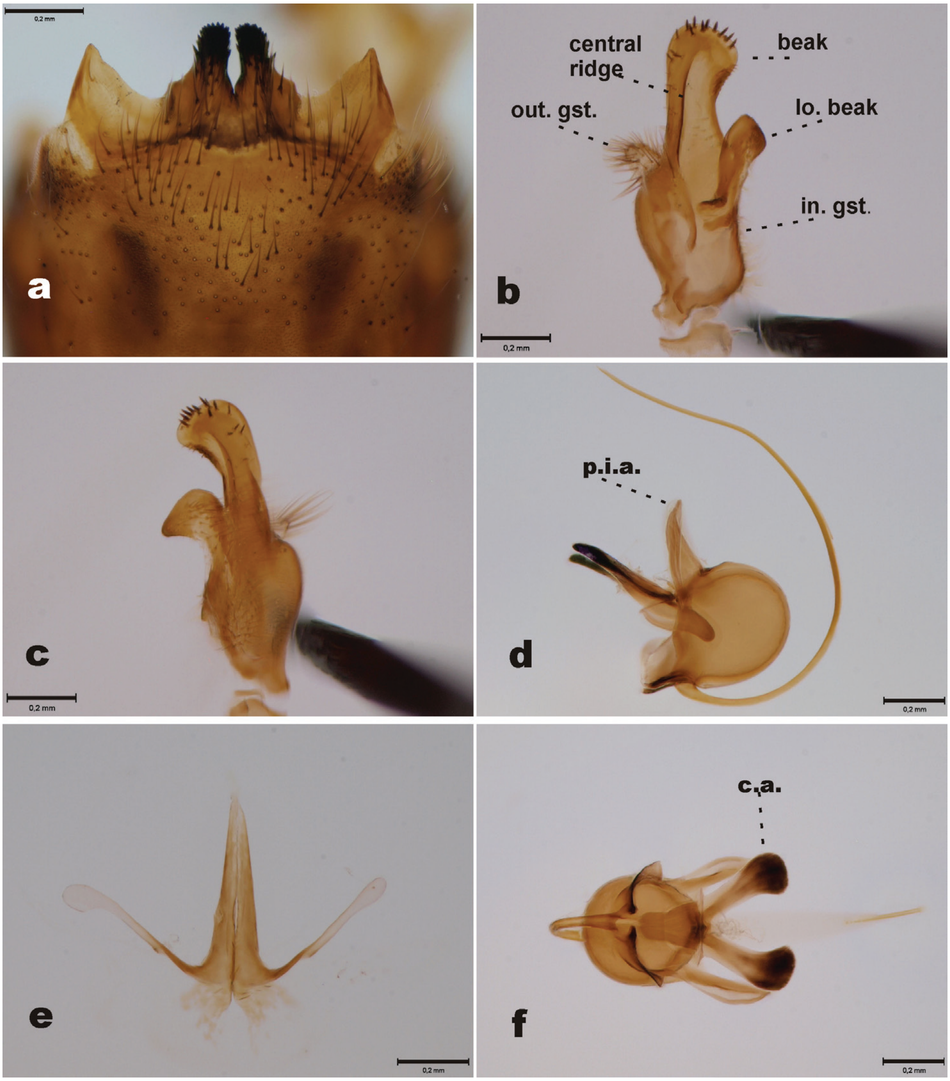

Figure 2. *Tipula* (*Yamatotipula*) *stackelbergi* Alexander, male (Russia, Vladivostok) **a** 9th tergite, dorsal view **b** Outer and inner gonostylus, posterior view; abbreviations: out. gst.= outer gonostylus, in. gst. = inner gonostylus, lo. beak = lower beak **c** Inner gonostulys, anterior view **d** Sperm pump, lateral view; abbreviation: p.i.a. = posterior immovable apodeme **e** Aedeagal guide, dorsal view **f** Sperm pump, ventral view; abbreviation: c.a. = compressor apodeme. Scale bars: 0.2 mm.

Tipula (*Yamatotipula*) *pruinosa* Wiedemann

http://species-id.net/wiki/Tipula_pruinosa
Figs 3a–d, 3f–g, 4, 6b, e, f

Tipula pruinosa Wiedemann 1817: 64.
Tipula usuriensis Alexander 1925: 18, **syn. n.**

Tipula (*Tipula*) *pruinosa* Mannheims 1952: 91.
Tipula (*Yamatotipula*) *pruinosa pruinosa* Savchenko 1961: 288.
Tipula (*Yamatotipula*) *pruinosa* Oosterbroek and Theowald 1992: 165.
Tipula (*Yamatotipula*) *pruinosa pruinosa* Oosterbroek 2011: http://nlbif.eti.uva.nl/ccw/ (for unlisted European references, see Mannheims 1952 and Savchenko 1961).

Material examined. Holotype of *T. usuriensis*: male, pinned specimen (USNM). "Kudia River/Amagu Siberia/Cockerell/July 1923" (white label, printed). "HOLOTYPE /Tipula/ usuriensis/ C.P. Alexander" (red label, partly handwritten). Slide, permanently mounted wing. "Tipula usuriensis Alex./ ♀ Siberia, Amagu,/ Kudia River/ July 1923, (T.D.A. Cockerell) / The Alexander Collection of Crane-Flies/ HOLOTYPE 2967" (white label, partly handwritten). (Figs 3a, b). The holotype specimen of *T. usuriensis* is in quite bad condition (Fig. 3c). Half of the abdomen (distal part) and four legs are glued to a card. One wing (length 14.0 mm) is slide mounted and one wing is glued to a white card, one leg is also glued to the same card. Scape, pedicel and three flagellomeres of antennae are present. The holotype is also laterally flattened, perhaps due to compression of the freshly collected specimen. Hypopygium was detached by the author from the cardboard, macerated in KOH and finally preserved in glycerol in a microvial.

Other material. Finland. Savonia borealis: Kiuruvesi, Jynkänjärvi 63.5194°N; 26.6941°E, 13.VII. 2008, J. Salmela leg, 2 males (ZMUT); Ostrobottnia australis: Ilmajoki, Kivistönmäki 62.8492°N; 22.6623°E, 1 female, V.-M. Mukkala leg (PVM); Regio aboensis: Taivassalo, Orikvuori 60.6027°N; 21.6653°E, 26.VI. 2005 V.-M. Mukkala leg, 1 female (PVM); Regio aboensis: Turku, Piipanoja 60.4918°N; 22.3017°E, 22.VI. 2011 A. Teräs leg, 1 female, 4 males (ZMUT).

Redescription of male and female terminalia. Male. 9th tergite (Fig. 4a) essentially similar to *T.* (*Y.*) *stackelbergi*. 9th tergite with two median projections, densely covered by dark bristles, lateral corners of the tergite glabrous, pointed (Fig. 4a). 9th sternite with median incision, bearing two fleshy and hairy outgrowths. Outer gonostylus worm-like, apical half covered by dark hairs (Figs 4b, c). Inner gonostylus elongate. Beak rounded, rather wide, resembling helmet (Figs 4b, c, 3f–g). Apical portion of beak bearing around 20 stout bristles, central ridge with numerous weak bristles, along the whole length of the ridge. Lower beak angular. Posterior immovable apodeme of sperm pump curved in lateral and ventral view (Figs 4d, f). Distal end of compressor apodeme of sperm pump truncated (Fig. 4f). Aedeagal guide as in Fig. 4e.

Female. Female terminalia as in Fig. 6b. Basal part of hypogynial valves with dense black setae, proximal ends of valves rounded, widest sub-basally, not tapering toward proximal end (Fig. 6e). Stalk of genital fork gradually widening toward caudal and proximal ends, being narrowest around midpoint (Fig. 6f). Dorsal view of vaginal apodeme as in Fig. 6f.

Geographical variation: The above mentioned description of male terminalia suites well to European specimens. The beak of the inner gonostylus among specimens from Asia is somewhat more i) sinuous, ii) slender and iii) with fewer stout bristles. Variation

Figure 3. *Tipula usuriensis* Alexander (=syn. of *T.* (*Yamatotipula*) *pruinosa* Wiedemann), holotype male **a** Label of the holotype **b** Slide mounted wing **c** Habitus, lateral view **d** Sperm pump (lateral view) and aedeagal guide (dorso-lateral view). Scale bars: c 1mm; d 0.5 mm.

related to the geographical origin of the specimens is not detected in the structure of sperm pump. It is likely that *T.* (*Y.*) *pruinosa sinapruinosa* Yang & Yang, 1993 is similar to the holotype of *T. usuriensis* and to a male from Russia, Altay. These eastern Palae-

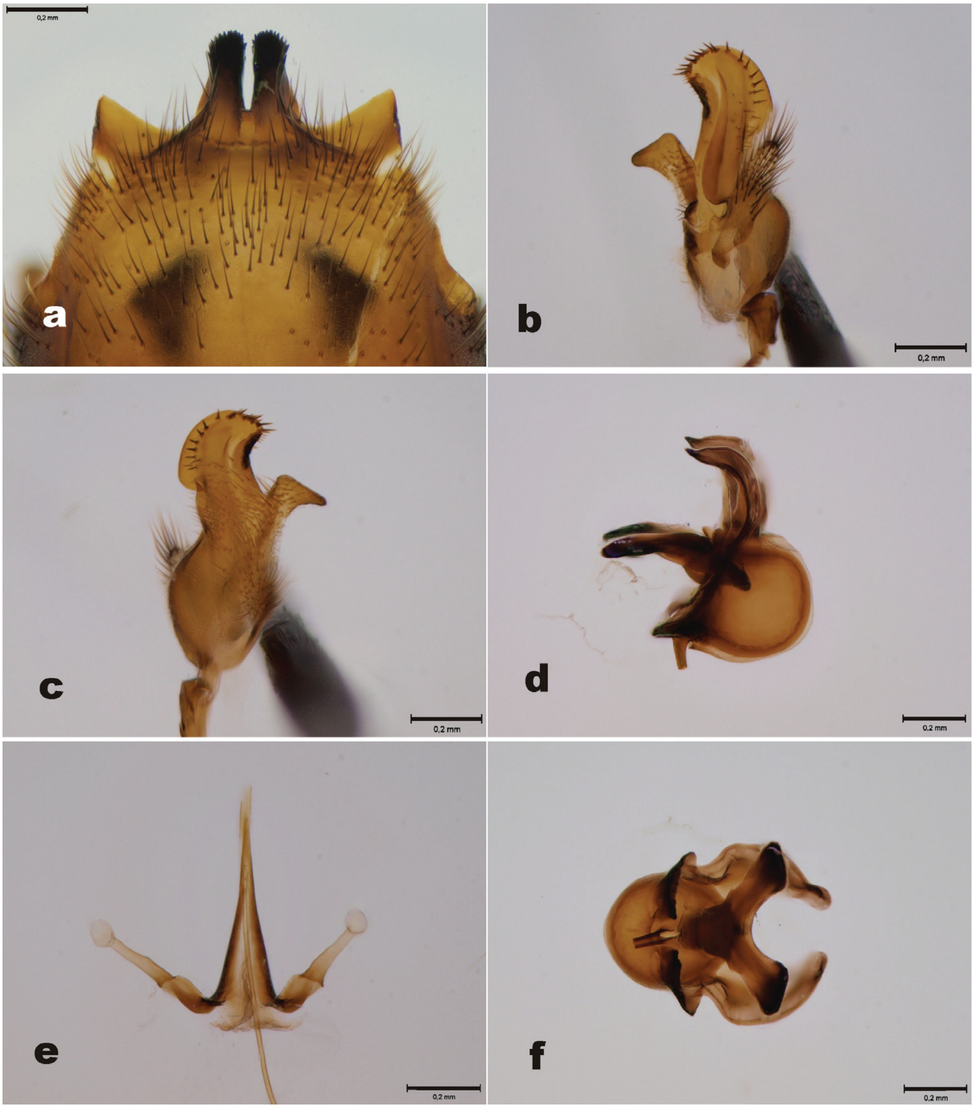

Figure 4. *Tipula* (*Yamatotipula*) *pruinosa* Wiedemann, male (Finland, Turku) **a** 9th tergite, dorsal view **b** Outer and inner gonostylus, posterior view **c** Inner gonostulys, anterior view **d** Sperm pump, lateral view **e** Aedeagal guide, dorsal view **f** Sperm pump, ventral view. Scale bars 0.2 mm.

arctic specimens could perhaps be given a subspecific or infrasubspecific rank under *T.* (*Y.*) *pruinosa*. However, one widespread species with slight geographic variation in the coloration of head and abdomen (see Alexander 1925; Yang and Yang 1993) and appearance of inner gonostylus is recognized here.

***Tipula* (*Yamatotipula*) *freyana* Lackschewitz**

http://species-id.net/wiki/Tipula_freyana
Figs 5, 7a–c

Tipula freyana Lackschewitz 1936: 292.
Tipula (*Tipula*) *subpruinosa* Mannheims 1954: 42, **syn. n.**
T. (*Yamatotipula*) *freyana freyana* Savchenko 1961: 251.
Tipula (*Yamatotipula*) *freyana* Salmela and Autio 2009: 54.

Material examined. Holotype of *T. subpruinosa*: female, pinned specimen (MZHF). "Suomi/ KemL./ Pallastunturit/ 1.8.1951/ leg J. Kaisila" (white label, partly handwritten; backside: "Pyhäkuru" handwritten). "Tipula (Oreom.)/ stigma n. sp./ Mannheims det. 1953" (white label, partly handwritten). "Holotypus" (red label, printed). "Museum/ Helsinki/ Frey" (white label, handwritten). "Mus. Zool. H:fors/ Spec. typ. No 14227/ Tipula/ subpruinosa Mann." (grayish label, partly handwritten) (Fig. 5a). Pyhäkuru is located in NW Finland, Muonio, Pallas-Yllästunturit National Park, rough coordinates of the type locality are 68.079°N; 24.083°E.

The holotype specimen is in good condition (Figs 5b, c, d). Left mid leg is missing, other legs are intact. Right wing has minor rupture proximal to the pterostigma, Costa is slightly damaged. Abdominal terminalia of the specimen were detached by me, macerated in KOH and later preserved in glycerol in a microvial. This microvial is attached to the same pin as the specimen. The name "*stigma*" has never been published, and it has most probably been a working title by Mannheims while compiling his first account of Finnish tipulids (Mannheims 1954).

Paratype: female, pinned specimen (ZMUC). "Lpl Sorsele/ Vallnäs tr / 18.7.1925 / S. Gaunitz" (white-gray label, unclear hand writing) "ex coll./ Peder Nielsen" (white label, printed) "Tipula (Tipula) / subpruinosa n sp.) / Mannheims det 1953" (white label, partly handwritten) "Tipula (Tipula) / subpruinosa n sp.) / Mannheims det 1953" (white label, partly handwritten) "Paratypoid" (red label, printed). The paratype specimen is in rather bad condition. Left antenna has nine and right antenna ten segments. All legs are broken, remnants of two legs are glued to a card below the specimen.

Other material. Finland. Karelia borealis: Lieksa, Nurmespuro 63.4030°N; 28.1972°E, 19.VI.–14.VII. 2008, J. Salmela leg, 2 females (ZMUT); Lapponia kemensis pars occidentalis: Kittilä, Palovaara E 68.0054°N; 24.7736°E, 23.VI. 2009 J. Salmela leg, 1 female (ZMUT); Lapponia enontekiensis: Enontekiö, Tarvantovaara, Pahtavaara SE 68.6518°N; 22.5909°E, 11.VI.–19.VII. 2009, J. Salmela leg, 2 males, 1 female.

Description of female terminalia. Female terminalia as in Fig. 7a. Basal part of hypogynial valves with modest setosity, proximal ends of valves pointed (Fig. 7b). Genital fork of vaginal apodeme dark brown, slightly sinuous in lateral view. Dorsal view of vaginal apodeme and genital fork as in Fig. 7c.

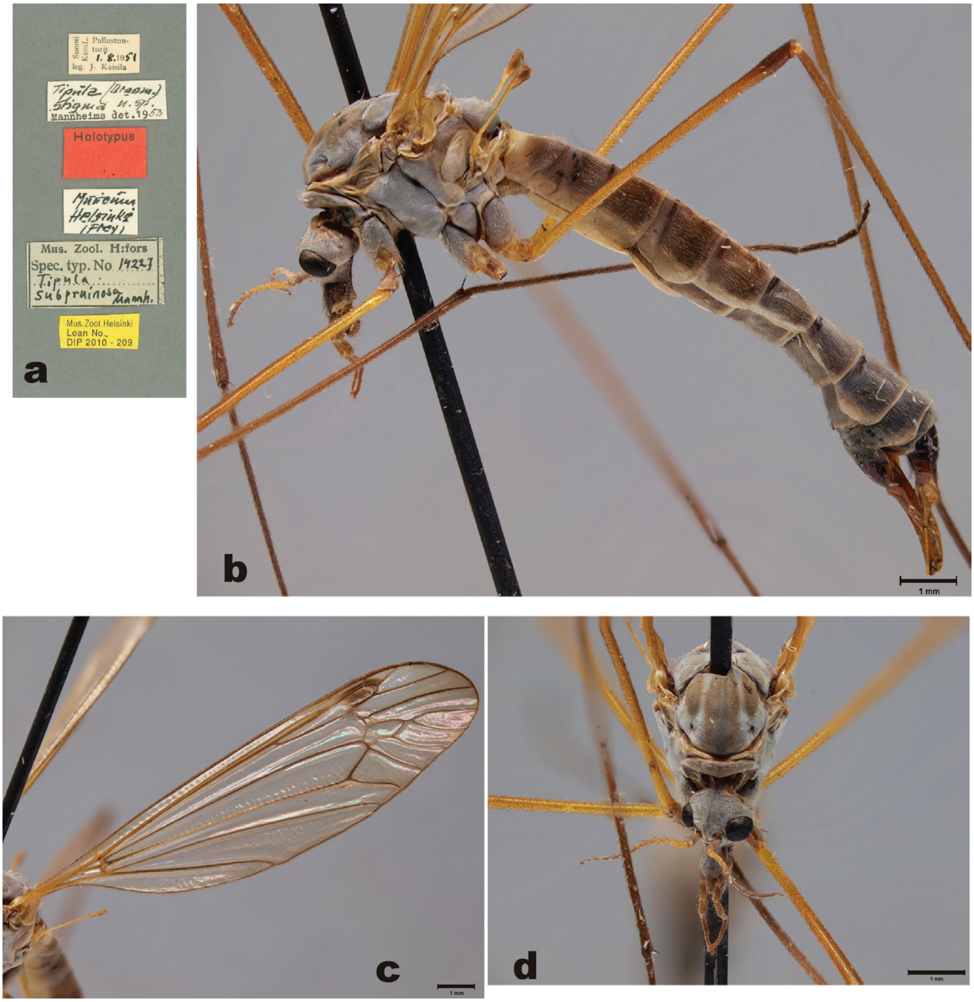

Figure 5. *Tipula subpruinosa* Mannheims (=syn. of *T.* (*Yamatotipula*) *freyana* Lackschewitz), holotype female **a** Label **b** Habitus, lateral view **c** Left wing **d** Thorax and head, dorsal view. Scale bars: 1 mm.

Key to the *Tipula* (*Y.*) *pruinosa* and *T.* (*Y.*) *stackelbergi*

1 Males **2**

– Females **3**

2 Beak of inner gonostylus relatively wide, helmet-like, with numerous (ca. 20) stout bristles (Figs 4b, c). Sperm pump dark, posterior immovable apodeme curved in lateral and ventral view (Figs 4d, f) .... ***T.* (*Y.*) *pruinosa***

– Beak of inner gonostylus rather narrow, with ca. 10 stout bristles (Figs 2 b, c). Sperm pump lighter, posterior immovable apodeme almost straight in lateral and ventral view (Figs 2d, f) .... ***T.* (*Y.*) *stackelbergi***

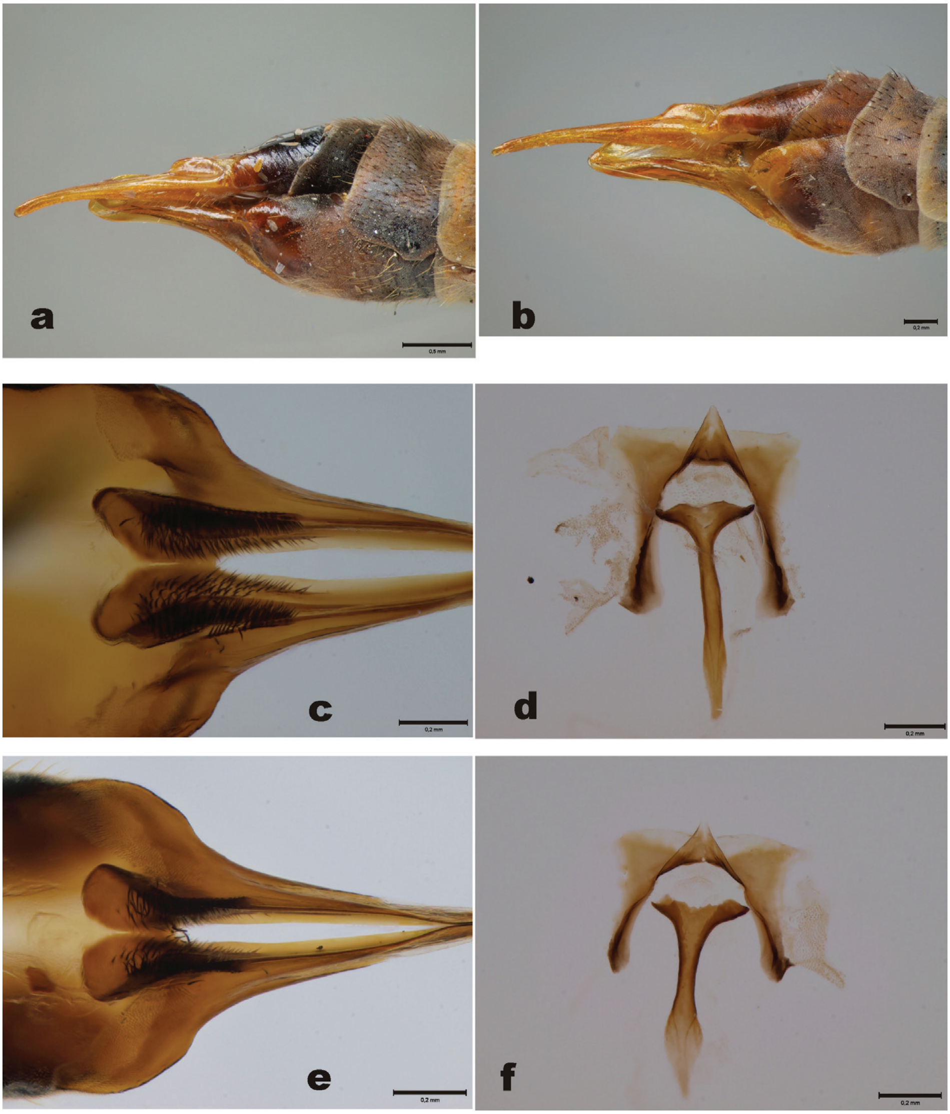

Figure 6. Female terminalia. *Tipula* (*Yamatotipula*) *stackelbergi* Alexander (Russia, Vladivostok) **a** Female cerci, lateral view, pinned specimen **c** Hypogynial valves, dorsal view **d** Vaginal apodeme and genital fork, dorsal view. *Tipula* (*Y.*) *pruinosa* Wiedemann (Finland, Turku) **b** female cerci, lateral view, pinned specimen **e** Hypogynial valves, dorsal view **f** Vaginal apodeme and genital fork, dorsal view. Scale bars: a 0.5 mm; b, c, d, e, f 0.2 mm.

3 Basal part of hypogynial valves widest sub-basally, not tapering toward base (Fig. 6f). Stalk of genital fork gradually widening toward caudal and proximal ends, being narrowest around midpoint (Fig. 6g)................***T.* (*Y.*) *pruinosa***

– Basal part of hypogynial valves roundish, tapering toward base (Fig. 6d). Genital fork rather narrow in its whole length (Fig. 6e) .. ***T.* (*Y.*) *stackelbergi***

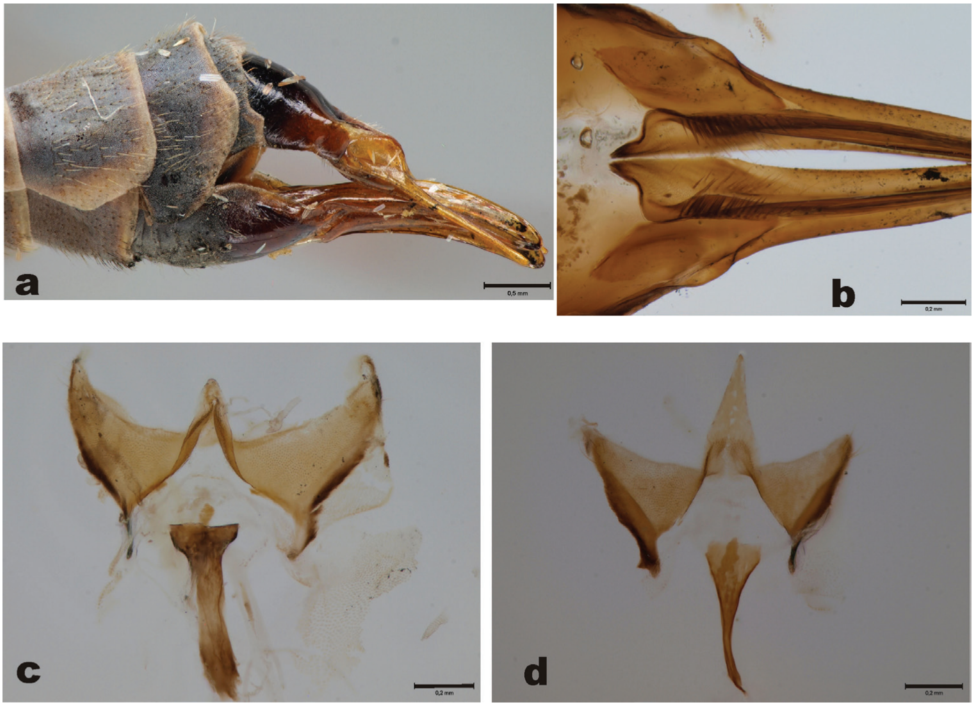

Figure 7. Female terminalia. *Tipula* (*Y.*) *freyana* Lackschewitz (holotype of *T. subpruinosa* Mannheims (Finland, Pallastunturit) **a** Female cerci, lateral view, pinned specimen **b** Hypogynial valves, dorsal view **c** Vaginal apodeme and genital fork, dorsal view. *Tipula* (*Y.*) *chonsaniana* Alexander (Finland, Taivalkoski) **d** Vaginal apodeme and genital fork, dorsal view.

Key to the females of *Tipula* (*Yamatotipula*) *moesta* and related species

1 Body coloration dark; scape, pedicel and 1st flagellomere dark brown........................ ***T.* (*Y.*) *moesta***
– Body coloration lighter; scape, pedicel and 1st flagellomere yellowish..........**2**
2 Stalk (proximal 2/3) of genital fork very narrow, needle-like (Fig. 7d)........................ ***T.* (*Y.*) *chonsaniana***
– Stalk (proximal 2/3) of genital fork wider, as in Fig. 7c.......... ***T.* (*Y.*) *freyana***

Discussion

In the present paper I suggest three changes to the nomenclature of Palaearctic Tipulidae: i) *Tipula* (*Yamatotipula*) *stackelbergi* is a valid species, not a subspecies of *T.* (*Y.*) *pruinosa* ii) *Tipula usuriensis* is neither a valid species nor a synonym of *T.* (*Y.*) *stackelbergi*, it is instead a junior synonym of *T.* (*Y.*) *pruinosa* and iii) *Tipula subpruinosa* is not a synonym of *T.* (*Y.*) *stackelbergi*, it is a junior synonym of *T.* (*Y.*) *freyana*. It remains questionable whether *T.* (*Y.*) *pruinosa sinapruinosa* is a valid subspecies. Based on the original description (Yang and Yang 1993) it is likely that Chinese specimens are conspecific with other eastern Palaearctic *T.* (*Y.*) *pruinosa* specimens. If these eastern Palaearctic specimens are to be ranked as subspecies below *T.* (*Y.*) *pruinosa*, *T. usuriensis* is the oldest available name for the taxon. However, as discussed above, subspecies should be delineated through several criteria, e.g. ecology and genetics. More data on Asian *T.* (*Y.*) *pruinosa* populations should be available for the assessment of speciation and reliable use of subspecific rank.

Tipula (*Y.*) *pruinosa* and *T.* (*Y.*) *stackelbergi* are closely related but valid species. The species pair is well separated due to the differences in male genitalia (see the key to the species), but less so regarding female genitalia. More females of *T.* (*Y.*) *stackelbergi* should be studied in order to firmly validate the diagnostic differences presented here. *Tipula* (*Y.*) *stackelbergi* is a very rarely collected species, known only from East Siberia and the Russian Far East (Alexander 1934; Savchenko 1961; Pilipenko 2009).

Tipula subpruinosa, described from Finland and Sweden, was thought to be a synonym of *T.* (*Y.*) *stackelbergi* (Savchenko 1961; Oosterbroek and Theowald 1992). Due to this tentative synonymy, *T.* (*Y.*) *stackelbergi* was erroneously thought to be present in Fennoscandia. However, examination of the holotype of *T. subpruinosa* revealed that the species is a junior synonym of *T.* (*Y.*) *freyana*, not *T.* (*Y.*) *stackelbergi*. Hence, *T.* (*Y.*) *stackelbergi* should be removed from the list of European crane flies. It should be noted that the description of *T. subpruinosa* was very short and lacking any figures; it is not surprising it led to fallacious interpretation. In a similar vein, *T. usuriensis* was also tentatively synononymized by Savchenko (1961) with *T.* (*Y.*) *stackelbergi*. In his description of *T. usuriensis* Alexander (1925) provided figures depicting male 9th tergite and lateral view of hypopygium, but these figures can now be considered too general to discriminate between *T.* (*Y.*) *pruinosa* and *T.* (*Y.*) *stackelbergi*.

Compared to *Tipula* (*Y.*) *stackelbergi* and *T.* (*Y.*) *pruinosa*, *T.* (*Y.*) *freyana* is phylogenetically rather distant to these two species, being instead close to *T.* (*Y.*) *moesta* Riedel and *T.* (*Y.*) *chonsaniana* Alexander (e.g. Salmela and Autio 2009). Although illustrations of male hypopygium, or parts of it, of *T.* (*Y.*) *freyana* have been provided by several authors (see Salmela and Autio 2009), no figures of female terminalia have been hitherto published. A key to the females of *T.* (*Y.*) *chonsaniana*, *T.* (*Y.*) *freyana* and *T.* (*Y.*) *moesta* explains the diagnostic differences between these three species (see above). Figures of female genital forks of *T.* (*Y.*) *moesta* and *T.* (*Y.*) *chonsaniana* were provided by Salmela and Autio (2009).

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A conspectus on the Canacidae (Diptera) of Brazil

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Abstract

Species of Canacidae *sensu lato* of Brazil are reviewed, including the subfamilies Canacinae and Tethininae. Included are seven species in five genera with two species, *Nocticanace austra* and *N. packhamorum*, from southern Brazil being newly described. To facilitate identification, we have included keys and diagnose to taxa at all levels.

Keywords

Diptera, Canacidae, conspectus, new species, Brazil

Introduction

The Canacidae of Brazil have never been treated comprehensively even though specimens are often abundant and species are relatively diverse on beaches of this large Neotropical and biologically diverse country where life on the beach is often a way of life. This deficiency is not uncommon, however, and characterizes many insect families occurring on beaches, especially groups that have relatively few species, that are collected infrequently despite being common locally, and that have no species of known economic importance. Although the Canacidae lack pestiferous species, study of the family is warranted, as its species comprise an important component of the beach fauna. Beyond satisfying the immediate objective--a taxonomic conspectus of the Brazilian fauna--we are also seeking to discover and contribute toward other aspects of their natural history, such as their distribution, historical biogeography, ecology, behavior, and biodiversity. The underlying basis for all of these studies, however, is the taxonomy of the included taxa.

True flies of the family Canacidae occur in cool-temperate and tropical zones of the world, primarily on or near seashores with oceanic climates. A few species are found inland, usually in saline or alkaline environments, but occasionally in meadow-like habitats or in freshwater, such as the streams of Hawaii. Worldwide there are 308 species in the family (6 subfamilies, 27 genera) (Munari and Mathis 2010; Munari and Stuke 2011), and from Brazil, we now have records of seven species and others are likely to be discovered here. The species of Brazil are in two subfamilies and five genera. Although the Canacidae of Brazil have never been treated comprehensively until now, the research published here had its genesis and basis in the works of others, as noted in the synonymy for the taxonomic categories from family to species that are included here. The classification adopted here is intended to provide perspective for this faunistic study and to serve as the organizational structure for this paper.

The historical record concerning Canacidae from Brazil began slightly more than a century ago when Williston (1896) described two species (*Anthomyza cinerea* (= *Tethina willistoni* (Melander)) and *Rhicnoessa xanthopoda*) from specimens collected on the island of St. Vincent (Caribbean). During the intervening 100 years, another species, *Tethina albula* (Loew), had been reported from Brazil (Melander 1952; Mathis and Munari 1996) but was apparently based on a misidentification. We have not examined any specimens of *T. albula,* and all specimens that are light colored, including mostly pale setae, are *T. willistoni.* Herein we review seven species in five genera that occur in Brazil. Three of these genera are reported for the first time from Brazil, as are four of the species. Two species, *Nocticanace austra* and *N. packhamorum,* are new to science and are described in this paper.

Because many species of Canacidae are widespread, especially those that occur in coastal marine habitats, we have examined most New World species, including primary types, to determine the correct identifications and valid names for the included species.

Materials and methods

The descriptive terminology for external structures and many internal structures follows that published in the Manual of Nearctic Diptera (J. F. McAlpine 1981). For structures of the male terminalia, however, we have adopted the terminology that Cumming et al. (1995) have suggested. Because specimens are small, usually less than 5.0 mm in length, study and illustration required use of dissecting and compound microscopes. Two wing ratios used in the descriptions are defined below (ratios are averages of three specimens: the largest, smallest, and one other).

1. Costal section ratios are the relative straight line distances between the apices of the subcosta and vein R_1: apices of R_1 and R_{2+3}; and apices R_{2+3} and R_{4+5}.
2. M vein ratio: the straight line distance along M between crossveins (r-m and dm-cu)/distance apicad of crossvein dm-cu.

Label data from each specimen were recorded and listed alphabetically according to country, state or province, county, and specific locality, such as city. As available, date of collection, collector, sex, and specimen location were listed. Label data from holotype specimens were recorded exactly, and clarifying information, such as script style and label color, is enclosed within brackets.

Dissections of male and female genitalia and descriptions were performed using the method of Clausen and Cook (1971) and Grimaldi (1987). Microforceps were used to remove abdomens, which were macerated in a potassium or sodium hydroxide solution. Cleared genitalia were rinsed in distilled water and 70% ethanol and then transferred to glycerin for observation. If necessary for proper orientation, the genitalia were transferred from glycerin to glycerin jelly. The glycerin jelly was heated, and the genitalia appropriately oriented. After cooling, the embedded specimen became immobilized. Abdomens were placed in an attached plastic microvial filled with glycerin and attached to the pin supporting the remainder of the insect from which it was removed. For freshly caught specimens, we recommend that the epandrium and associated structures of the male terminalia be teased open, thus allowing examination of these structures and identification of the species without need of dissection.

Species' descriptions are composite and not based solely on the holotypes, and paired structures are described in the singular except where the context makes this inappropriate.

Although most specimens for this study are in the Department of Zoology, Universidade Federal do Paraná, Curitiba, Brazil (DZUP) and the National Museum of Natural History, Smithsonian Institution, Washington, D. C. (USNM), we also studied numerous specimens that were borrowed and are deposited elsewhere. These include (acronyms that are used in the text are noted first):

BPBM	Bernice P. Bishop Museum, Honolulu, Hawaii, USA
BMNH	The Natural History Museum (former British Museum (Natural History)), London, United Kingdom
FIOC	Fundação Instituto Oswaldo Cruz, Rio de Janeiro, Brazil
MCZ	Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, USA
MZUSP	Museu de Zoologia da Universidade de São Paulo, São Paulo, Brazil
TAU	Tel Aviv University, Tel Aviv, Israel

Systematics

Family Canacidae Jones

http://species-id.net/wiki/Canacidae

Canacenae Jones 1906: 170, 198 [as a subfamily of Ephydridae, incorrect formation of the family-group name]. Type genus: *Canace* Haliday 1837.

Canaceidae. Hendel 1916: 297 [incorrect formation of the family-group name]. Wirth 1951: 245–275 [revision]; 1975: 1–5 [Neotropical catalog]; 1987: 1079–1083 [North American manual].

Canacidae. Enderlein 1935: 235. Mathis 1982: 1–29 [classification]. Buck 2006: 391–392 [familial status]. Munari and Mathis 2010: 1–84 [world catalog].

Tethinidae Hendel 1916: 297; 1917: 45. Type genus: *Tethina* Haliday. Foster 1976b: 1–4 [Neotropical catalog]. Mathis and Munari 1996: 1–27 [world catalog]. McAlpine 2007: 42 [synonymy].

Diagnosis. The family Canacidae, *sensu lato,* is distinguished from other families of the Carnoidea by the following combination of characters: Exclusively or tending to occur in saline habitats (secondarily in freshwater habitats). Minute to moderately small flies, length 0.91–5.0 mm. *Head:* Postocellar setae developed (absent or reduced in some Canacinae); dorsal fronto-orbital seta lateroclinate; oral vibrissae weakly differentiated, except for *Dasyrhicnoessa* Hendel species. Arista dorsal. Face sometimes characterized by 2 shiny protuberances laterad to the facial cavity, just above vibrissal pore (*Tethina, Pseudorhicnoessa*) or nearby (*Afrotethina*, *Horaismoptera*); face strongly depressed and short (*Dasyrhicnoessa*, Horaismopterinae) or with medial carina (*Tethina*) or even distinctly convex (Canacinae). Gena bare, except for ventral or nearly ventral row of setae (peristomal setae), or even with a few anaclinate, strong setae (Canacinae). Buccal parts generally strongly sclerotized in Canacinae. *Thorax:* Precoxal bridge developed. Prescutellar acrostichal setae developed; presutural dorsocentral setae differentiated; anepisternum with 2–3 developed posterior setae, bearing enlarged, dorsally curved seta at posterodorsal corner; usually 1 katepisternal seta present; proepisternal seta developed. Wing generally hyaline, bearing fine, dense microtrichia; subcosta weakened apically, close to vein R_1; vein A_1 short (except in the sub-Antarctic genus *Apetaenus*); vein A_2 long, present as a fold. *Abdomen:* Pregenital sclerites of male short and fused; male tergite 6 fused with sternite 8, forming a usually symmetrical (except in some species of *Tethina*), pregenital sclerite; male sternite 7 lost; postgonites firmly connected laterally to base of phallapodeme, distinctly anterior to basiphallus; hypandrium forming a sheath or phallic mantle around the postgonite and basiphallus; epandrium bearing 1–2 pairs of surstyli ventrally, sometimes anterior surstylus lacking (Canacinae, *Tethina*); posterior surstylus partially articulated or fused with epandrium; inner basal corner of surstylus connected to broad interparameral sclerite; cercus very short to exceptionally developed (Horaismopterinae); postabdomen of female more or less telescopically retractile; 2 sclerotized spermathecae variable in shape, below with a narrower cylindrical extension into the spermathecal duct; cercus subcylindrical to compressed, or even tapered distally, sometimes bearing stout to pointed, spinelike setulae.

Discussion. Our concept of Canacidae includes what had been considered as two families, the Canacidae and Tethinidae. At the familial level, J. F. McAlpine (1989: 1472) identified five synapomorphies that link Canacidae with Tethinidae and noted that "...these are clear indications of a sister-group relationship between them ... and may even indicate that they are subgroups of a single family." Other authors (Hennig 1958; Griffiths 1972; McAlpine 1982; Freidberg 1995) have also suggested a relationship with the family Tethinidae, and Griffiths (1972) further noted some affinities with the Chloropidae and Milichiidae. According to J. F. McAlpine's (1989) cladogram, which included an analysis of 25 characters for the families Canacidae and Tethinidae, the superfamily Carnoidea (= Chloropoidea) comprises the families with the following relationships in parenthetic notation: ((Australimyzidae, Braulidae) Carnidae)((Tethinidae, Canacidae)((Milichiidae, Risidae) ((Cryptochetidae, Chloropidae)))).

More recently, Buck (2006) and D. K. McAlpine (2007) provided rather compelling character evidence, substantiating that these two families are closely associated, and more specifically that the Canacidae *sensu stricto* are an included lineage within the Tethinidae. Thus, not to include the Canacidae within the Tethinidae would render the Tethinidae as a paraphyletic family. Buck and D. K. McAlpine cited ten synapomorphies that corroborate the monophyly of the family Canacidae *sensu lato* (the family-group name Canacidae is older than Tethinidae). These synapomorphies are (only derived state cited): (1) Precoxal bridge present; (2) anepisternum with enlarged, dorsally curved setae at posteroventral corner; (3) vein A_2 long, present as a fold; (4) male sternite 6 reduced and divided medially; (5) male tergite 6 fused with sternite 8, forming a symmetrical pregenital sclerite; (6) male sternite 7 lost; (7) postgonites firmly connected laterally to base of phallapodeme, distinctly anterior to basiphallus; (8) hypandrium forming a sheath or phallic mantle around the postgonite and basiphallus; (9) cuticle of larva with covering of fine spicules, and (10) halobiontic in habitat preference, secondarily in freshwater habitats. Buck (2006) further suggested that the sister group to Canacinae *sensu stricto* is the subfamily Apetaeninae and not Zaleinae and provided four characters as corroborative evidence for this relationship: (1) antennae broadly separated, inserted more or less on protuberant facial tubercles; (2) clypeus distinctly enlarged and produced anteriorly; (3) prementum distinctly emarginated apically; and (4) tentorial arms of head capsule enormously developed and strongly sclerotized.

Key to Subfamilies of Canacidae *sensu lato* from Brazil

1 Frontal orbit with 3–5 major lateroclinate setae, foremost near level of ptilinal fissure, in addition to inner series of 3 or more proclinate-inclinate, shorter setae or setulae; proclinate-inclinate interfrontal setae in 2 distinct series; pair of convergent, often widely spaced, postocellar setae present; if absent then wing with distinct, black spots (*Tethina lusitanica*); costa along marginal cell with a continuous series of closely placed, short, black, anterior spinules, and

no series of longer, widely spaced spines; discal and second basal cells separate; anal cell closed; vein A_1+CuA_2 (6th longitudinal) not extending distinctly beyond anal cell, even as a sharp fold in membrane................. **Tethininae**

– Fronto-orbital setae not arranged as above; if biseriate interfrontal setae present, then either convergent postocellar setae absent or anal cell open distally; other characters variable... **2**

2 Wing either vestigial, or with long vein A_1+CuA_2 extended to margin; fronto-orbital setae normally 3, of which middle one is reclinate and further from eye than others; female: syntergite 1+2 longer than rest of abdomen; endemic in the subantarctic archipelagos ....**Apetaeninae (not yet known from South America)**

– Wing normally developed, with vein A_1+CuA_2 scarcely extended beyond anal cell; if 3 fronto-orbital setae present, then middle one not farther from eye than others; syntergite 1+2 at most as long as or normally shorter than rest of abdomen; not inhabiting the subantarctic archipelagos................C**anacinae**

Subfamily Canacinae

http://species-id.net/wiki/Canacinae

Canaceinae. Hendel 1913: 93 [as a subfamily of Ephydridae, incorrect formation of the subfamily-group name].

Canacinae. Enderlein 1914: 326 [as a subfamily of Ephydridae]. Malloch 1933: 4 [as a subfamily of Ephydridae]. Mathis 1982: 2 [as a subfamily of Canacidae, phylogeny]. McAlpine 2007: 43 [review, diagnosis, status]. Munari and Mathis 2010: 11–27 [world catalog].

Diagnosis. Adult. Minute to moderately large surf flies, body length 1.60–5.00 mm; blackish, brownish, yellowish, or gray, often invested with whitish to grayish microtomentum. *Head:* Antennae broadly separated, inserted more or less on protuberant facial tubercles; subcranial cavity large; 3–5 lateroclinate fronto-orbital setae. Face slightly convex to concave; setae usually sparse except for mesoclinate vibrissal seta; vibrissal angle unmodified; clypeus prominent, enlarged, wide. Gena high, bearing 1–4 dorsoclinate genal setae. Subcranial cavity enlarged; labella short, nongeniculate; prementum short, broad, deeply incised distally, distinctly emarginated apically; tentorial arms of head capsule enormously developed and strongly sclerotized. *Thorax:* Mesonotum with 4 or more dorsocentral setae. Wing usually hyaline; C extended to M and with subcostal break only; Sc complete and separate from R_1 almost to its apex; cells br, bm, dm, and cup complete; A_1 short. Precoxal bridge present. *Abdomen:* Male tergites 1–6 exposed; spiracles 1–6 in posteroventral portion of tergite, spiracle 7 also in tergite 6; terminalia symmetrical; surstylus fused with epandrium; hypandrium usually with lateral arms extended above aedeagus, fused into posteriorly directed process; aedeagus relatively short; cercus usually weak. Female cerci well sclerotized, long, approximate, bearing a strong apical seta, sometimes preceded by similar but smaller setae; ventral wall of genital chamber with V- or ring-shaped sclerite; spermathecae 2.

Egg. Simple, ovoid; with microscopic reticulations.

Third-instar larval length 5–6 mm; tapered anteriorly and posteriorly from about 4th abdominal segment and terminated posteriorly in a slender retractable respiratory tube. Abdominal segments 2–7 with creeping welts. Prothoracic spiracle a slender retractable filament. Posterior spiracles with 3 oval spiracular openings arranged with longitudinal axis at slightly less than right angles to adjacent opening; each spiracular plate with 4 tufts of interspiracular setae. Cephalopharyngeal skeleton with ventral cornu truncate, appearing broken at apical margin; mandibles approximate anteriorly, separated posteriorly by small V-shaped accessory oral sclerite; anterior ventrolateral extensions of tentoropharyngeal sclerite narrowly fused with ventral bridge of hypopharynx; parastomal bars prominent, united by a thin fenestrated epipharyngeal sclerite.

Puparium. Brown, similar in size and form to third-instar larva, rather spindle-shaped, curved at each end; integumental spinules more prominent than on larva and anterior respiratory processes fully extended.

Biology. All Canacinae from the New World occur in intertidal habitats and are sometimes called surf flies. Although the natural history of the subfamily is poorly known, the larvae and adults are probably grazers on algae or are saprophytic in both saline and freshwater habitats. In Brazil, all species of the subfamily Canacinae occur in the littoral biotic region.

Discussion. Adult of Canacinae are similar and sometimes confused with shore flies (Ephydridae) and most species described in the 19th century were placed in the Ephydridae. Canacids are distinguished by the wing venation (cells bm and cup complete) and by the additional abdominal segments (5 in ephydrid males, 6 in canacids), which in females terminate as an elongate and fused epiproct+cercus that bears enlarged, apical setae.

The Canacinae now include 122 valid species that are placed in 11 genera (Wirth 1951; Mathis 1992; Munari and Mathis 2010). The New World fauna comprises five genera and 35 species (Wirth 1965, 1975, 1987; Mathis 1992). No fossils are known. Mathis' catalog (1992) included all species then known plus references to papers containing keys and illustrations. The recent catalog of Munari and Mathis (2010) is a complete updating, including keys to all known genera. In the New World, Mathis (1989, 1997) reviewed the surf-fly fauna for the Caribbean and Gulf of Mexico.

Mathis (1982) proposed a classification for the Canacinae *sensu stricto* that should be revised. The subfamily includes two tribes, Canacini and Nocticanacini. The Canacini are represented in the New World by a single genus, *Canacea* Cresson, which belongs to the subtribe Dynomiellina. The Nocticanacini are represented by three genera in the New World, *Canaceoides* Cresson, *Nocticanace,* and *Paracanace. Procanace,* the fifth New World genus, was initially placed in Nocticanacini, but it is now evident that this genus is the sister group to all other genera of the subfamily Canacinae.

Key to Genera of Canacinae from Brazil

1 Interfrontal setae absent, although anterior 1/3 of frons occasionally with scattered setulae .... ***Procanace* Hendel**

– Interfrontal setae present, 1 or more pairs in additional to any setulae **2**

2 One interfrontal seta present; postocellar setae either much reduced or lacking .... ***Nocticanace* Malloch**

– Two interfrontal setae present; postocellar setae well developed, proclinate and slightly divergent.................................. ***Paracanace* Mathis and Wirth**

Genus *Nocticanace* Malloch (35 species worldwide; 2 from Brazil)

http://species-id.net/wiki/Nocticanace

Nocticanace Malloch 1933: 4. Type species: *N. peculiaris* Malloch, by original designation. Wirth 1951: 269–274 [revision]; 1975: 2–3 [Neotropical catalog]. Munari and Mathis 2010: 20–24 [world catalog].

Diagnosis. Small to medium-sized beach flies, body length 1.80–3.70 mm; general coloration grayish black to black. *Head:* Interfrontal setae 1 pair; postocellar setae either absent or much reduced, less than 1/4 length of ocellar setae; ocelli arranged to form an isosceles triangle, distance between posterior ocelli greater than that between either posterior ocellus and the anterior ocellus. Two-3 long dorsoclinate genal setae; anteroclinate genal setae moderately well developed, at least 1/2 length of larger dorsoclinate genal setae. Epistomal margin sinuous; clypeus low, width subequal to length of antenna. Palpus grayish black, bearing 1 to several long setae, each seta 2–3 times greatest width of palpus. *Thorax:* Anepisternum with scattered setulae; proepisternal seta absent; katepisternal seta present, well developed. Legs entirely dark colored, grayish black; forefemur bearing 4–6 long and evenly spaced setae along posteroventral margin, length of setae at least equal to and usually greater than width of femur.

Discussion. This is the most species-rich genus of surf flies (Canacinae; 35 species) and has greatest species diversity in the Old World (Mathis 1992). The New World fauna now comprises 14 species. The species known from Brazil belong to the *pacifica,* and *galapagensis* groups.

Annotated Key to Species Groups of the Genus *Nocticanace*

1 Anterior notopleural seta absent.. **2**

– Anterior notopleural seta present **3**

2 Apical scutellar setae distinctly dorsoclinate ....**the *pacifica* group** [20 species; New World (Brazil) and Old World (Pacific and Indian Oceans, especially Oceania)]

– Apical scutellar setae straight to very slightly curved dorsally........................ .... **the *texensis* group** [4 species; Caribbean, Gulf of Mexico and southeastern United States; revised by Mathis 1989: 594–599]

3 Length of apical section of vein CuA_1 twice or more length of crossvein dm-cu .... **the *galapagensis* group** [9 species; Galápagos Islands, Brazil (Paraná, São Paulo), and southwestern North America]

– Length of apical section of vein CuA_1 subequal to length of crossvein dm-cu.... **4**

4 Apical scutellar setae distinctly dorsoclinate ....**the *ashlocki* group** [1 species, *N. ashlocki* Wirth; Galápagos Islands]

– Apical scutellar setae not dorsoclinate............**the *chilensis* group** [1 species, *N. chilensis* (Cresson); Chile (there are numerous undescribed species in this group)]

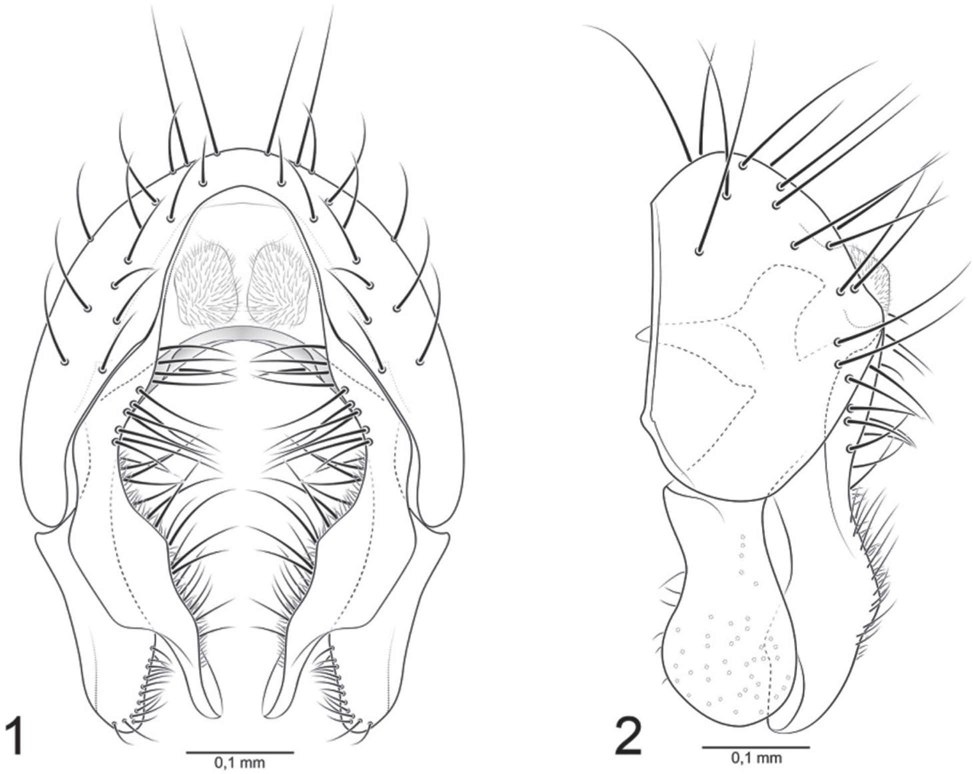
The *pacifica* Group

Diagnosis. Coloration generally dark, grayish brown to grayish black but with exceptions (*N. flavipalpis* and *N. litorea:* lighter, with some tan coloration on the body and legs extensively yellowish). *Head:* 2 large, dorsoclinate, genal setae. *Thorax:* Acrostichal setulae absent; apical scutellar setae distinctly dorsoclinate; anterior notopleural seta absent; proepisternal seta(e) present; anepisternum with scattered setulae; katepisternal seta present. Legs usually entirely dark, grayish brown to black (*N. flavilpalpis* and *N. littorea* are exceptions with yellowish legs); forefemur with 4–6 long and evenly spaced setae along posteroventral margin, length greater than width of femur; midfemur of male lacking a comblike row of setae; hindtibia lacking spinelike setae apically. Wing with length of apical section of vein CuA_1 long, about twice length of crossvein dm-cu; vein M index 0.44.

Nocticanace packhamorum Mathis & Marinoni, sp. n.

urn:lsid:zoobank.org:act:47F40DBB-80C5-4D20-B07D-256F39CFA758
http://species-id.net/wiki/Nocticanace_packhamorum
Figs 1–2

Diagnosis. As in species group diagnosis with the following additions: Small to moderately small beach flies, body length 1.85–2.45 mm, of the *pacifica* group (see key to species groups). *Head:* Coloration of face and gena lighter, mostly whitish gray. Palpus yellowish gray to gray. *Thorax:* Brown coloration of mesonotum extended laterally and ventrally to about dorsum of notopleuron, thereafter gradually becoming more whitish gray with some very faint greenish tinges. Pleural areas mostly whitish gray. Legs concolorous, mostly gray to blackish gray; dorsum of femur and to a lesser extent tibia somewhat microtomentose, lightly grayish; tarsi black. *Abdomen:* Dorsum mostly grayish; median portion of each tergite with some brownish-purplish coloration, lateral margins often faintly bluish gray. Male terminalia (Figs 1–2): Surstylus deeply cleft



Figures 1–2. *Nocticanace packhamorum* **1** epandrium, posterior view **2** same, left lateral view.

ventrally, with a distinct anterior and posterior lobe; anterior lobe moderately slender and long, in lateral view with posterior margin angulate, moderately rounded apically, in posterior with medial surface bearing numerous, prominent, setulae along most of margin, medial portion in posterior view rectangular, apical 1/3 abruptly narrowed; posterior lobe in posterior view narrowed sub-basally, thereafter ventrally slightly expanded to form a broadly rounded apex, in posterior view with short setulae along medial surface apically.

Type material. The holotype male is labeled **"BRAZIL.** S[anta]. Catarina: Barra Velha (26°38'S, 48°40.9'W; beach), 29 Apr 2010[,] D. & W. N. Mathis/USNM ENT 00118070 [plastic bar code label]/HOLOTYPE ♂ *Nocticanace packhamorum* Mathis & Marinoni, DZUP [red]."The holotype is double mounted (minuten in a block of plastic), is in excellent condition, and is deposited in DZUP. Seventeen paratypes (13♂, 4♀; DZUP, USNM) bear the same label data as the holotype.

Distribution. *Neotropical:* Brazil (Santa Catarina).

Etymology. The specific epithet, *packhamorum,* is a Latin genitive patronym to recognize and honor Dean and Ieda Packham, who guided us to the type locality and offered hospitality.

Remarks. Finding a species of the *pacifica* group along the Atlantic beaches of southern Brazil was unanticipated.

The *galapagensis* Group

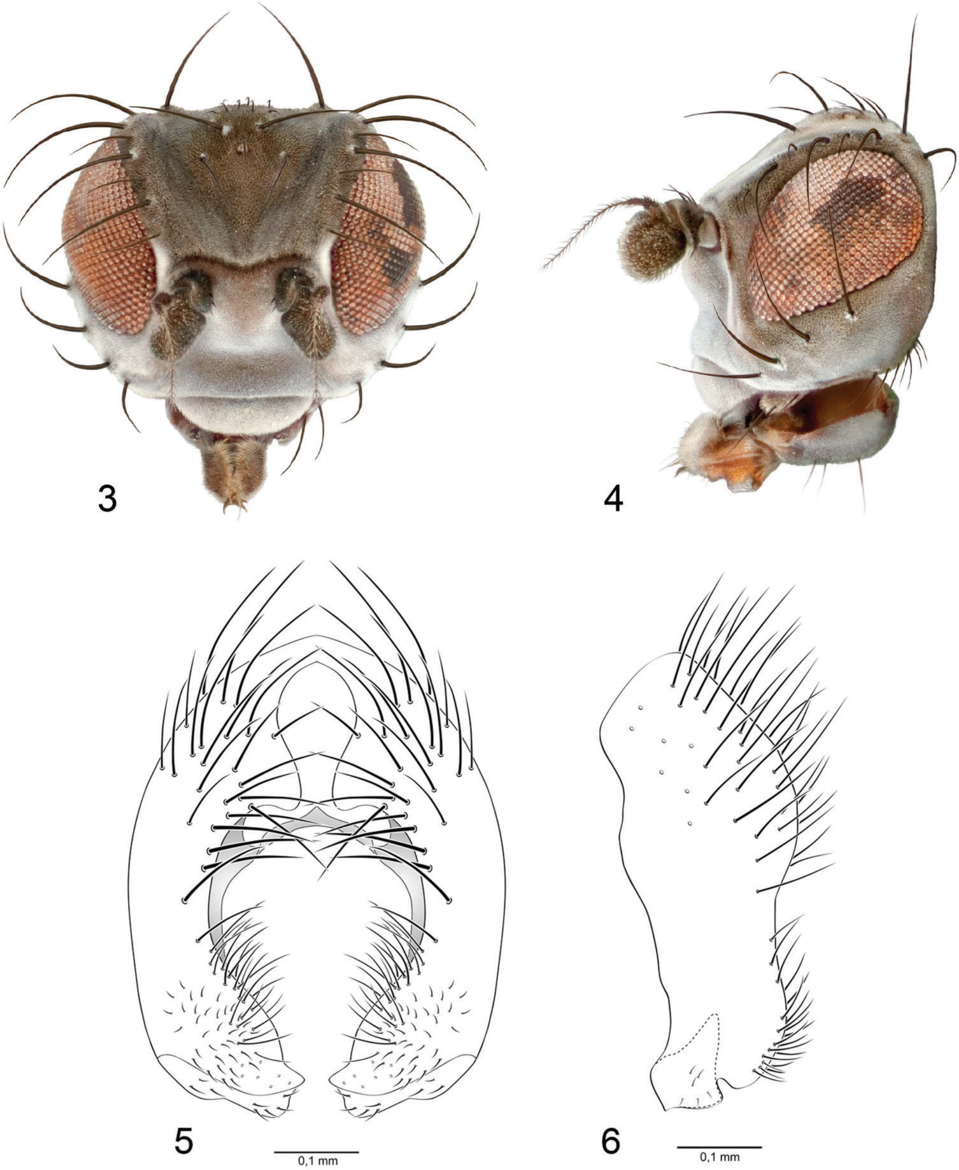
Diagnosis. *Thorax:* Acrostichal setae lacking; apical scutellar setae nearly straight in lateral view, slightly convergent in dorsal view, but not distinctly curved dorsally; anterior notopleural seta present but weaker than posterior seta; proepisternal seta(e) present; midfemur of male lacking comblike row of setae; hind basitarsomere lacking spinelike basoventral setae. Wing with length of apical section of vein CuA_1 long, length nearly twice that of crossvein dm-cu; M vein index 0.42–0.49.

Discussion. The *galapagensis* group now comprises nine species with the addition of the new species described below. Previously, there were eight species (*Nocticanace arnaudi* Wirth, *N. cancer* Wirth, *N. curioi* Wirth, *N. darwini* Wirth, *N. galapagensis* (Curran), *N. scapanius* Wirth, *N. spinicosta* Wirth, and *N. usingeri* Wirth) that were only known from the Galápagos Archipelago and southwestern Nearctic Region. The discovery of *N. austra* from southern Brazil is a major range extension for this species group and perhaps indicates a more extensive distribution in southern South America for the group. Better sampling in southern South America is urgently needed to test this possibility.

Nocticanace austra Mathis & Marinoni, sp. n.

urn:lsid:zoobank.org:act:8852F673-4335-4CB4-B99A-A53F9E0F250B
http://species-id.net/wiki/Nocticanace_austra
Figs 3–6

Diagnosis. As in the species group diagnosis with the following additions: Small to moderately small beach flies, body length 1.80–2.40 mm, of the *galapagensis* group (see key to species groups). *Head* (Figs 3–4): 3 large dorsoclinate and 1 inclinate genal setae. *Thorax:* Scutellar disc with 1 pair of setae, apical scutellar setae very shallowly curved, not distinctly oriented dorsally compared with lateral scutellar setae. Legs generally gray, with basitarsomeres blackish gray dorsally. *Abdomen:* Tergites generally gray or slightly brownish gray medially. Male terminalia as follows (Figs 5–6): Epandrium in posterior view bearing long setulae on dorsal half, with medial projection at level of dorsal 1/3 from each lateral arm, forming a cercal cavity, but cerci not evident; medial margin thereafter ventrally forming a wide cavity that narrows ventrally because of medially directly surstyli; surstylus broadly attached or fused to ventral margin of epandrium, in lateral view only slightly narrower than ventral portion of epandrium, essentially an extension of epandrium, slightly swollen posteroventrally, bearing numerous short setulae along posterior margin, ventral margin shallowly bifurcate, forming posterior and anterior lobes, posterior lobe slightly shorter than anterior lobe, gently



Figures 3–6. *Nocticanace austra* **3** head, anterior view **4** same, lateral view **5** epandrium, posterior view **6** same, left lateral view.

rounded; anterior lobe more robustly developed than posterior lobe, bluntly rounded to truncate apically, very slightly produced anteroventrally as a shallow, obtuse, point, in posterior view with posterior lobe of surstylus extended medially, pointed apically, anterior lobe more broadly developed apically.

Type material. The holotype male is labeled "**BRAZIL.** São Paulo: Praia do Estaleiro (23°20.5'S, 44°53'W; beach), 30Mar2010[,] D. & W. N. Mathis/USNM

ENT 00118071 [plastic bar code label]/HOLOTYPE ♂ *Nocticanace austra* Mathis & Marinoni, DZUP [red]." The holotype is double mounted (minuten in a block of plastic), is in excellent condition, and is deposited in DZUP. Five paratypes (4♂, 1♀; DZUP, USNM) bear the same label data as the holotype.

Other Specimens examined from Brazil. *PARANÁ.* Matinhos (N.; 25°46.4'S, 48°30.8'W; 3 m; beach/estuary), 9 Apr 2010, D. and W. N. Mathis (1♂; USNM); Paranaguá (Rio Itiberê; 25°31.4'S, 48°30.3'W; 3 m), 23 Jan 2010, D. and W. N. Mathis (1♀; DZUP).

Distribution. *Neotropical:* Brazil (Paraná, São Paulo).

Etymology. The specific epithet, *austra,* is of Latin derivation and means southern, referring to the distribution of this species in the Southern Hemisphere.

Remarks. This species differs from congeners in the *galapagos* group in structures of the male terminalia, especially the shape of the surstylus (see figures and description above). The surstylus has a shallow, ventral bifurcation, somewhat like *N. wirthi,* but is more narrowly developed, like *N. panamensis.* The anteroventral surstylar lobe is slightly longer than the posterior lobe.

Genus *Paracanace* Mathis and Wirth (8 species in the New World; 1 from Brazil)

http://species-id.net/wiki/Paracanace

Paracanace Mathis and Wirth 1978: 524. Type species: *Paracanace hoguei* Mathis and Wirth 1978, by original designation. Mathis 1989: 600–603 [review of Caribbean and nearby fauna]; 1992: 10 [world catalog]; 1997: 140–148 [review of *hoguei* group]. Munari and Mathis 2010: 24–24 [world catalog].

Canace, in part, of authors. Wirth 1975: 1 [Neotropical catalog].

Diagnosis. Small to moderately small beach flies, body length 1.40–2.60 mm; generally densely microtomentose, gray, with face and gena usually whitish gray, frons light brown, mesonotum with some brown coloration. *Head:* Interfrontal setae 2; postocellar seta well developed, proclinate and very slightly divergent, subequal in length to interfrontal setae; ocelli arranged in isosceles triangle, with greater distance between posterior ocelli. Two to 3 large dorsoclinate genal setae; anteroclinate genal seta well developed, subequal in length to larger dorsoclinate genal setae; epistomal margin sinuous; clypeus low, width more than 4× height; palpus yellowish. *Thorax:* Mesonotum darker than pleural areas, usually light to blackish brown, becoming lighter laterally. Acrostichal setulae in 2–4 irregular rows, with a distinctly larger prescutellar pair; scutellar disc lacking setulae; apical scutellar setae not oriented dorsally; anterior notopleural seta usually present (very weak or absent in one species); proepisternal seta(e) present; anepisternum with scattered setulae; katepisternal seta present. Femora and tibiae gray to blackish gray; tarsomeres yellow to dark brown, apical 2–3 tarsomeres darker; midfemur of male bearing comblike row of setae along posteroventral surface; midtibia bearing short evenly spaced setulae along ventral surface; hindtibia lacking spinelike setae apically. Wing with length of apical section of vein CuA$_1$ twice or more that of crossvein dm-cu; M vein ratio 0.35–0.45. *Abdomen:* Male terminalia: Surstylus a simple, narrow, posteriorly shallowly curved, setulose process extended from ventral margin of epandrium.

Discussion. Like *Canacea,* all of the described species of *Paracanace* occur in the New World, with primarily tropical or subtropical distributions (Mathis and Wirth 1978).

Although two species groups are recognized in the key to species within *Paracanace,* adhering to the cladogram for the species of this genus (Mathis and Wirth 1978: 535), these groups are mostly for convenience and no phylogenetic signal should be attributed.

Key to Species of *Paracanace*

1 Costal vein between humeral crossvein and subcostal break bearing a row of long spinelike setae, setal length subequal or greater than width of 1st costal cell (the *hoguei* group) **2**

– Setae along anterior margin of wing much shorter, not more than 1/2 width of 1st costal cell (the *maritima* group) **5**

2 Three subequal dorsoclinate genal setae **3**

– Middle dorsoclinate genal seta about 1/2 length of setae on either side **4**

3 Acrostichal setulae in about 2 rows; surstylus broadly spatulate in lateral view, anteroventral angle very broadly rounded, posteroventral angle relatively broadly projected medially as an acutely pointed process; anterior margin of surstylus bearing distinct row of long setulae (Puerto Rico) .... ***P. wirthi* Mathis**

– Acrostichal setulae in about 4 rows; surstylus narrow in lateral view, digitiform, slightly angulate; anterior margin of surstylus with few setulae, these not as long as those along posterior margin (Costa Rica: Cocos Islands) .... ***P. hoguei* Mathis & Wirth**

4 Surstylus relatively narrow in lateral view, appearing slipperlike, anterior margin slightly swollen and broadly rounded, tapered ventrally to broadly rounded, ventral margin; posterior margin of surstylus lacking distinct row of longer setulae; posteroventral angle of surstylus noticeably produced apically (widespread in Caribbean) .... ***P. aicen* Mathis & Wirth**

– Surstylus in lateral view broad on distal 1/2, especially evident in lateral view; ventral, surstylar margin broadly truncate in lateral and posterior views; posterior margin of surstylus bearing distinct row of longer setae (Jamaica) .... ***P. lebam* Mathis & Wirth**

5 Fore- and midfemora of male with row of about 20 long, white setae along proximal ½ of posteroventral margin; surstylus with sub-basal anterior lobe setose and constricted before apical enlargement (Galápagos Islands) .... ***P. maritima* (Wirth)**

– Fore- and midfemora of male with not more than 10 long, white setae along posteroventral margin at base; surstylus simple, lacking anterior setose lobe or sub-basal constriction **6**

6 Tarsi mostly dark, concolorous with tibiae (Galápagos Islands) ....***P. cavagnaroi* (Wirth)**

– Tarsi mostly pale, yellowish, especially basitarsomere of hindleg..................7

7 Surstylus slender, angulate, length about 3X width (Brazil) ....***P. oliveirai* (Wirth)**

– Surstylus broad, truncate ventrally, length not more than twice width, posteroventral angle slightly produced (Panama) ....***P. blantoni* (Wirth)**

***Paracanace oliveirai* (Wirth)**
http://species-id.net/wiki/Paracanace_oliveirai
Fig. 8

Canace oliveirai Wirth 1956: 164. [Brazil. Rio de Janeiro: Ilha Guaiba, Baia de Sepetiba (22°58.3'S, 43°52.6'W); HT ♂, FIOC]; 1975: 1 [Neotropical catalog].
Paracanace oliveirai. Mathis and Wirth 1978: 524 [generic combination, key], 527 [key]. Mathis 1992: 10 [world catalog]. Munari and Mathis 2010: 24 [world catalog].

Diagnosis. This species is similar to other species of the *maritima* group but can be distinguished from other congeners by the following combination of characters: As in generic descriptions and key to species with the following details: Generally appearing setulose, although less so than *P. maritima;* body length 1.54–2.05 mm. *Head:* Frons moderately densely golden brown to brownish tan microtomentose; face microtomentose, mostly silvery white, with some faint grayish blue near middle; gena similar in coloration and vestiture to face but more silvery white, with some gray adjacent to anteroventral margin of eye; middle dorsoclinate genal seta subequal in length to setae on either side. *Thorax:* Mesonotum tan to brown, becoming more grayish brown toward lateral margins and posteriorly; acrostichal setulae in 2 rows, posterior pair longer; scutellum gray; pleural area pale gray with some faint bluish coloration. Wing evenly faintly infumate, pale grayish brown; spinelike setulae along costal margin short, length less than half width of 1st costal cell; costal vein ratio 0.13–0.20; M vein ratio 0.37–0.40. Femora and tibiae gray with some darker coloration dorsally; basal 3 tarsomeres yellow, apical 2 yellowish brown to brown; long setae along posteroventral margin of forefemur with apical 1–2 black, others pale. *Abdomen:* Generally gray, dorsum darker, somewhat shiny, with faint metallic reflections, lateral margins dull. Male terminalia (Fig. 8): surstylus pale colored, especially apical half, yellowish orange to pale yellow; surstylus subrectangular in lateral view, oriented posteroventrally, ventral margin broadly and shallowly rounded, not pointed, with posteroventral and anteroventral angles relatively similar, posterior margin in posterior view with shallow

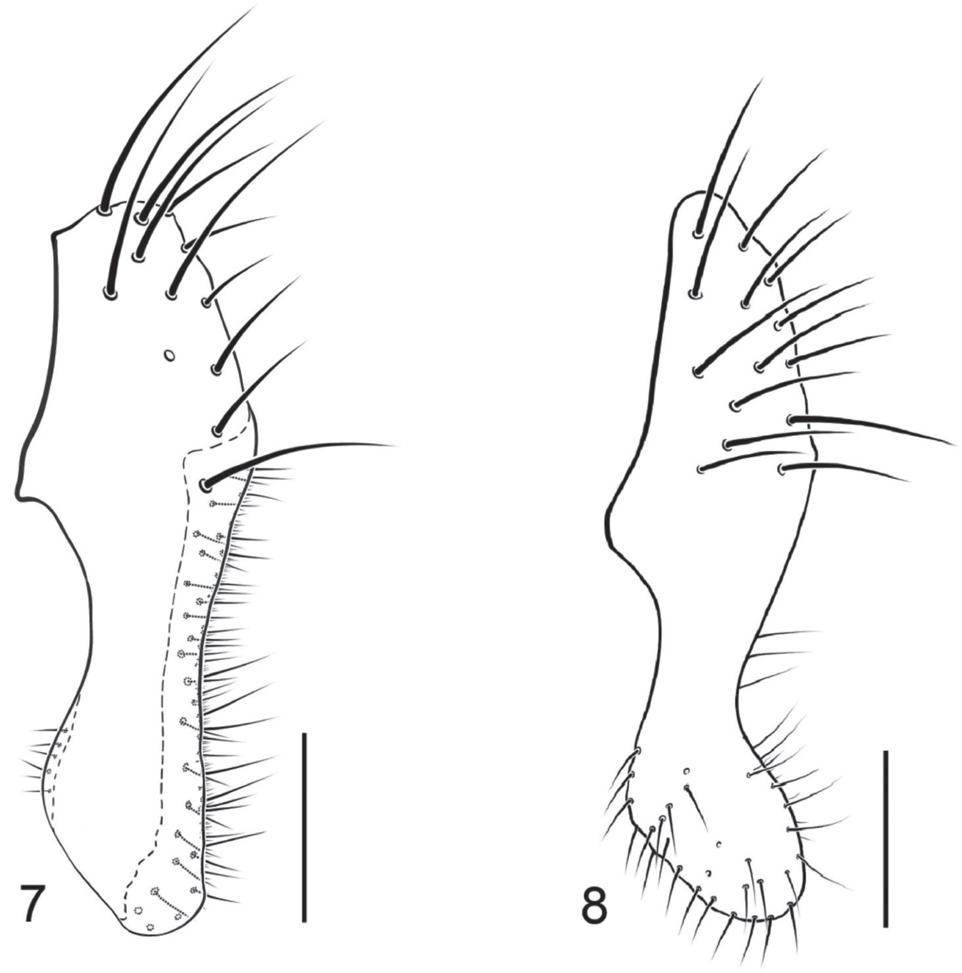


Figure 7–8. *Paracanace* species **7** *Paracanace aicen,* epandrium, cerci and surstylus, lateral view **8** *Paracanace oliveirai,* epandrium, cerci and surstylus, lateral view

swelling subapically, posteroventral portion projected medially, setulae along anterior and posterior margins small and indistinct.

Specimens examined from Brazil. *PARANÁ.* Antonina (25°28.4'S, 48°40.9'W; beach/mangal), 3 Feb-9 Apr 2010, D. and W. N. Mathis (21♂, 4♀; DZUP, USNM); Antonina (25°27.1'S, 48°41.1'W; beach; Ponta da Pita), 3–15 Feb 2010, D. and W. N. Mathis (1♂, 1♀; DZUP, USNM); Prainha (5 km S Matinhos; 25°51.2'S, 48°33.6'W; beach), 15 Nov 2010, D. and W. N. Mathis (1♂; USNM).

RIO DE JANEIRO. Ilha da Marambaia (23°3.6'S, 43°59.1'W), 4 Sep 2000, D. and W. N. Mathis (14♂, 6♀; USNM).

Distribution. *Neotropical:* Brazil (Paraná, Rio de Janeiro).

Remarks. This species is similar and evidently closely related to *P. aicen* Mathis and Wirth from the West Indies, and these two species have been confused. Wirth's original description and illustration of *P. oliveirai,* for example, included specimens of both species in the type series, and Wirth's illustration, which is based on a specimen from the Dominican Republic, is actually *P. aicen* (Fig. 7), not *P. oliveirai* (Fig. 8). Because these two species have been confused, we present here comparable lateral views of the respective epandrium, surstylus, and cercus for both species to facilitate their identification. The illustration of *P. oliveirai* is the first for that species. Please note that the lateral view of the fused surstylus of *P. oliveirai* (Fig. 8) is more rectangular than the more elliptical shape of the comparable structure of *P. aicen* (Fig. 7)

Genus *Procanace* Hendel (30 species worldwide; 1 from Brazil)

http://species-id.net/wiki/Procanace

Procanace Hendel 1913: 93. Type species: *Procanace grisescens* Hendel, by original designation. Mathis 1988: 329–333 [first record of genus from Western Hemisphere]. Munari and Mathis 2010: 25–27 [world catalog].

Diagnosis. General coloration whitish gray, olivaceous, to blackish brown. *Head:* Interfrontal setae absent, but with a few setulae inserted anteriorly; fronto-orbital setae 3; ocelli arranged to form equilateral or isosceles triangle, if isosceles, the greater distance is between posterior ocelli. Arista pubescent over entire length. Two large dorsoclinate genal setae; anteroclinate genal seta moderately well developed. Palpus not bearing long setae. Epistomal margin, in lateral view, more or less horizontal. *Thorax:* Acrostichal setae, especially a prescutellar pair of large setae, usually lacking (setulae present in species of the *williamsi* group); scutellar disc lacking setae (1–2 pairs of scutellar disc setulae occur in *P. nakazatoi* Miyagi of the *williamsi* group); 2 pairs of marginal scutellar setae, apical pair not dorsoclinate; anterior and posterior notopleural setae present, length of both subequal; anepisternum with scattered setulae. Katepisternal seta usually present (lacking in species of the *grisescens* group). Hindtibia lacking spine-like setae apically. *Abdomen:* Male genitalia as follows: Epandrium in posterior view wider than high; cerci reduced, poorly sclerotized; surstylus with an anterior and posterior lobe, the latter larger, sometimes markedly so and shape unique to species.

Discussion. Mathis (1988) first reported the occurrence of *Procanace* in the New World from specimens collected along the tidal shores of the Potomac River in Virginia. This species is now known from coastal habitats on Bermuda and from Virginia south through the West Indies to Brazil. Whether this species is adventive to the New World is unknown but likely.

The only species known from the New World is *P. dianneae,* which is in the *cressoni* group of *Procanace* (Mathis 1988). The *cressoni* group is diagnosed by the following combination of external characters: *Head:* Postocellar setae present, subequal to length of ocellar seta; clypeus low, width at least 4X height; palpus yellowish. *Thorax:* Acrostichal setulae lacking; proepisternal seta(e) present; katepisternal seta present.

Procanace dianneae **Mathis**

http://species-id.net/wiki/Procanace_dianneae
Figs 9–11

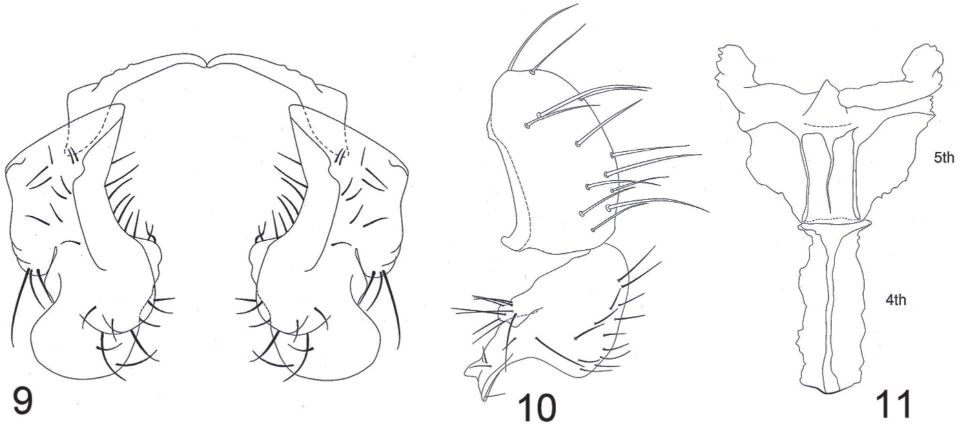
Procanace dianneae Mathis 1988: 330 [United States. Virginia. Westmoreland: Westmoreland State Park (banks of Potomac River); figs. of ♂ terminalia; HT ♂; USNM]; 1989: 606–607 [review]; 1992: 11 [world catalog]. Munari and Mathis 2010: 25 [world catalog].

Diagnosis. Externally this species is very similar to those of the *cressoni* group, and we are tentatively placing it in that group. It differs from the two species of that group, *P. cressoni* Wirth and *P. taiwanensis* Delfinado, as well as other congeners by the following combination of characters: Moderately small to medium-sized beach flies, body length 2.00–3.10 mm; general coloration whitish gray, olivaceous to brown, scutum darker. *Head:* Postocellar setae well developed, subequal in length to ocellar setae; clypeus low, height 1/4 width; palpus yellowish. *Thorax:* Scutum mostly bluish black, sparsely microtomentose, scutum densely microtomentose, brown; proepisternal seta present, pale; katepisternal seta present; acrostichal setae absent. *Abdomen:* Unicolorous, olivaceous gray with some faint brownish coloration. Male abdomen as follows: Sternite 4 (Fig. 11) narrowly rectangular, over 2X as long as wide; sternite 5 (Fig. 11) wider than long, width of anterior margin subequal to that of sternite 4, becoming wider posteriorly, lateral margins irregular, widest at posterior margin, bearing a short process posterolaterally; epandrium wider than high in posterior view, bearing numerous setae, in lateral view (Fig. 10) posterodorsal margin broadly rounded, ventral margin nearly flat, anterior margin nearly straight except for anteroventral prong and irregular dorsal 1/3; surstylus (Figs 9–10) as 2 processes, anterior one much smaller, digitiform, bearing several setulae preapically and apically, posterior process much larger, length nearly equal to that of epandrium and equally as wide, in lateral view with posterior margin irregularly arched, anteroventral process very angulate in lateral view and spatulate in posterior view.

Specimens examined from Brazil. *PARANÁ.* Antonina (25°27.1'S, 48°41.1'W; beach; Ponta da Pita), 3 Feb 2010, D. and W. N. Mathis (3♂; DZUP, USNM); Antonina (25°28.4'S, 48°40.9'W; beach/mangal), 3 Feb-14 Nov 2010, D. and W. N. Mathis (13♂, 4♀; DZUP, USNM); Paranaguá (Rio Itiberê; 25°31.4'S, 48°30.3'W; 3 m), 23 Jan 2010, D. and W. N. Mathis (4♂, 2♀; DZUP, USNM).

RIO DE JANEIRO. Ilha da Marambaia (23°3.6'S, 43°59.1'W), 4 Sep 2000, D. and W. N. Mathis (11♂, 3♀; USNM).

SÃO PAULO. Ubatuba, Praia do Estaleiro (23°20.5'S, 44°53'W; beach), 30 Mar 2010, D. and W. N. Mathis (6♂, 1♀; DZUP, USNM).



Figures 9–11. *Procanace dianneae* **9** surstyli, posterior view **10** epandrium and surstylus, lateral view **11** sternites **4** and **5** ventral view.

Distribution. *Nearctic:* Bermuda, United States (Alabama, Delaware, Florida, Maryland, Mississippi, North Carolina, South Carolina, Virginia). *Neotropical:* Brazil (Paraná, Rio de Janeiro, São Paulo), West Indies (Cuba).

Natural History. All specimens of the type series were collected from the shoreline of the tidal portion of the Potomac River at Westmoreland State Park (Virginia, United States). At the park, the river is over a mile wide, and the water is slightly brackish due largely to the tidal influence. The shore is either almost entirely sandy, the bathing area of the beach, or a combination of sand, considerable gravel, and some cobble and large rocks. In the latter habitat, the shore is quite narrow, at most two to three meters, and immediately adjacent to the shore is a cliff. In the sandy area, specimens occurred along the protected sides of narrow, wooden jetties that were installed perpendicular to the shoreline to break up the action of waves and prevent erosion of the beach. In the sand/cobble/rock habitat, specimens were found only on rocks and were easily collected by sweeping immediately over and between the rocks. Most of the rocks and jetties were covered in part with algae, and we suspect that the larvae of this species were feeding on them.

Remarks. Much of the temperate and tropical Atlantic Coast of the New World has some of the busiest commercial waterways in the world, and we do not dismiss the possibility that this species was introduced in conjunction with the large volume of traffic on these waters.

This species has a demonstrated ability to disperse well. Although initially discovered in Virginia, where it occurs widely along the state's maritime coast, the species has now been found from Delaware south to Florida, along the Gulf Coast (Alabama and Mississippi), and into the Neotropics (Cuba and Brazil). The records from the state of Paraná are the southernmost thus far.

Subfamily Tethininae

http://species-id.net/wiki/Tethininae

Tethinidae Hendel 1916: 297 [as a family]; 1917: 45. Type genus: *Tethina* Haliday. Mathis and Munari 1996: 1–27 [world catalog]. Munari and Mathis 2010: 40–66 [world catalog].

Diagnosis. Adult. Small to moderately large flies, body length 1.43–3.66 mm; frequently invested with pale yellowish to brown microtomentum. 3–4 lateroclinate fronto-orbital setae, 3 inclinate frontal setae; postocellar seta convergent. Face sometimes characterized by 2 shiny protuberances laterad of facial cavity above vibrissal pore (*Tethina*); vibrissal seta variable, if present usually weak. 1 proepisternal seta; 1 proepimeral seta (sometimes absent in the genus *Tethina)*; anepisternum with 1 or more setae and some setulae posteriorly. Precoxal bridge present. Wing hyaline to infuscate or pale yellow or even patterned (*Tethina pictipennis* Freidberg and Beschovski and *T. lusitanica* Munari, Almeida and Andrade); C with Sc break only; cell cup present but small; A_1 weakened apically, not reaching wing margin. Tibiae lacking preapical dorsal seta. Male epandrium bearing 2 lobes ventrally (the lobe that articulates dorsally with the subepandrial sclerite is considered to be the true surstylus while the anterior surstylar-like lobe may or may not be surstylar in origin); the true surstylus is generally strongly setulose; aedeagal apodeme long, slender; ejaculatory apodeme usually large; aedeagus usually elongate, ribbonlike, sinuous, subcylindrical, with a more or less dense ventral pubescence, often with several microscopic papillae. Female with 2 sclerotized spermathecae; cercus subcylindrical or compressed, sometimes bearing strong, spinelike setulae (pseudacanthophorites); tergites 7–8 mostly with characteristic pigmented areas; epiproct generally small, bearing a pair of setulae dorsally on apical third; hypoproct large.

Natural History. Tethininae are mostly halobiont/thalassophiles, occurring in coastal marine habitats. Adults of thalassophilous species are commonly found in coastal marine habitats (Karl 1930; Munari and Vanin 2007), including the intertidal zone, wrack heaps (usually brown algae that are most abundant along temperate seashores bathed by cold currents), salt marshes, dune vegetation, and on salty soils or bare sand. We have also observed adults often in large numbers on carcasses of marine animals on beaches.

The immature stages of the subfamily are incompletely known. Ferrar (1987) provided some observations on the puparia of *Tethina grisea* (Fallén). Gorczytza (1988) reported on the spatial and seasonal distribution of some European species (*Pelomyiella mallochi* (Sturtevant), *Tethina albosetulosa* (Strobl), *T. illota* Haliday, *T. flavigenis* (Hendel), and *T. grisea* (Fallén)) from a study using color traps on the Frisian Islands of Mellum and Memmert. In nature, an abundance of individuals and a paucity of species sometimes characterize sandy sites where tethinids occur.

Key to Genera of Tethininae from Brazil

1 Eyes densely though minutely setulose. A true vibrissal seta present on vibrissal angle (lacking shiny tubercle above the foremost strong peristomal seta). Male with an anterior surstylarlike lobe in addition to true surstylus, which is fused to epandrium in some species .... ***Dasyrhicnoessa*** **Hendel, 1934**

– Eye bare or sparsely setulose. A true vibrissal seta absent but foremost peristomal setae inclinate and simulating vibrissae (the bare vibrissal angle a shiny tubercle above each false vibrissae). Male lacking a surstylarlike lobe but with a true surstylus usually positioned ventrad of epandrium and articulating with it .... ***Tethina*** **Haliday, 1837**

Genus *Dasyrhicnoessa* Hendel (25 species worldwide; 1 from Brazil)

http://species-id.net/wiki/Dasyrhicnoessa

Dasyrhicnoessa Hendel 1934:38. Type species: *Rhicnoessa fulva* Hendel, original designation. Malloch 1935:93 [discussion]. Mathis and Munari 1996:11–13 [world catalog]. Munari and Mathis 2010: 43–46 [world catalog].

Diagnosis. *Dasyrhicnoessa* is distinguished from other genera of the family by the following combination of characters: *Head:* Frons bearing some setulae in addition to larger setae; fronto-orbital and orbital setae usually with similar orientation, mostly reclinate or lateroclinate; fronto-orbital setae 3–4; paravertical setae more or less convergent. *Head:* Face lacking shiny tubercle above vibrissal pore; vibrissal seta present on apex of vibrissal angle. Eye mostly densely covered with small, pale, interfacetal setulae. Gena bare except for a ventral or nearly ventral row of setae (peristomal setae); gena narrow, about 1/8–1/3 eye height. Palpus and proboscis usually normally developed; clypeus small, if exposed not protruding anteriad beyond oral margin. *Thorax:* Scutum with numerous rows of coarse setulae arising from punctures; scutellar disc bare; postpronotum with 3 main setae, ventral seta curved upward; acrostichal setulae in two or more complete or nearly complete rows; prescutellar acrostichal setae present; scutellar disc bare except for marginal setae. Wing with costa not spinose; vein A_1+CuA_2 short, much shorter than discal cell; wing usually short, about twice as long as wide (less often 2.5–3.0 times); cell bm and discal cell distinct. Forefemur generally bearing an anteroventral ctenidial comb on distal third; mid and hind tibiae evenly setulose, lacking anterodorsal or posterodorsal setae. *Abdomen:* Tergites wider than long; tergite 6 well differentiated from short syntergosternite 7+8, the latter forming a dorsal pregenital sclerite. Male terminalia: Epandrium with a posterior (true) surstylus, articulating with sternite 10. In some species, articulating broadly with ventral margin of epandrium, in others, reduced and positioned more dorsad, along posterior margin of epandrium. Anterior process a surstylarlike lobe, not articulating with sternite 10 but only with anterior margin of epandrium. This lobe much reduced in some species (absent in *D. platypes* Sasakawa) and positioned more or less medially along anterior margin of epandrium. Aedeagus long, sinuous, ribbonlike.

Discussion. In the New World, a single species, *D. insularis* (Aldrich), is known, and was probably introduced through human commerce. Woodley and Hilburn (1994) and Mathis and Munari (1996) first recorded this genus from the New World (as *D. ferruginea* (Lamb)), and here we provide detailed locality data and descriptive documentation for the genus and the only known species that occurs there. We first discovered the genus and species on barrier islands off the coast of Belize and at the western margin of the Caribbean. Since then, we have found it in the United States (Florida), Mexico (Tabasco), on the Lesser Antilles (Dominica, St. Lucia, St. Vincent), and Bermuda in the western North Atlantic. The genus was probably introduced through human commerce and is now widespread throughout the Caribbean Region and perhaps beyond. Elsewhere, the genus occurs primarily within the Pacific and Indian Ocean basins where 25 species have been described thus far (Munari and Mathis 2010).

Dasyrhicnoessa is distinctive and is easily distinguished, especially from other genera of the subfamily Tethininae, by the densely setulose eyes, prominent oral vibrissal seta, vibrissal angle lacking a shiny tubercle, an anterior surstylarlike lobe, and a posterior (true) surstylus in males.

Dasyrhicnoessa insularis **(Aldrich)**

http://species-id.net/wiki/Dasyrhicnoessa_insularis
Figs 12–14

Tethina insularis Aldrich 1931: 395 [(United States) Wake Island; HT ♀, USNM (41629)].

Rhicnoessa insularis. Hendel 1934: 44 [key], 48 [generic combination, citation].

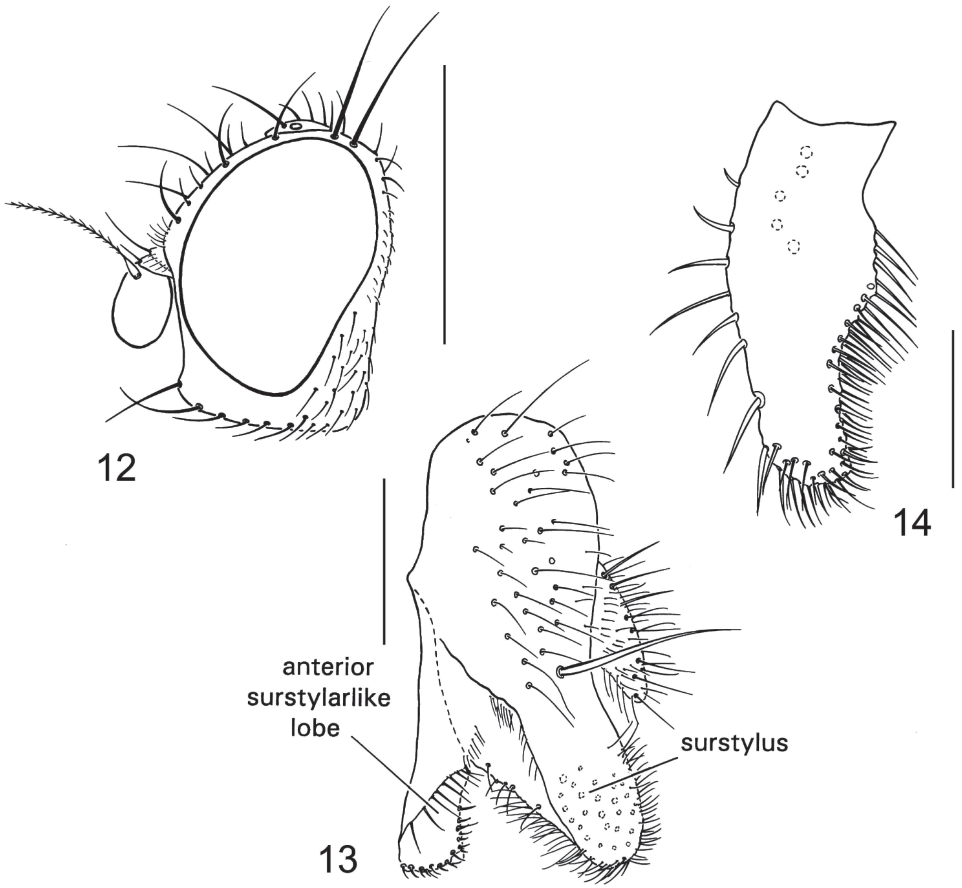
Dasyrhicnoessa insularis. Hardy and Delfinado 1980: 371–373 [generic combination, citation, figs. of head, wing, ♂ and ♀ terminalia, Oahu, Maui, Hawaii, Frigate Shoal, Pearl and Hermes Reef, Canton Island, and Palmyra Island]. Mathis and Munari 1996: 12 [world catalog]. Munari and Mathis 2010: 44–45 [world catalog].

Tethina lasiophthalma Malloch 1933: 17 [Marquesas. Hivaoa: Tahauku; HT ♂, BPBM]. Munari 1988: 48 [synonymy with *R. ferruginea* Lamb].

Dasyrhicnoessa lasiophthalma. Sasakawa 1974: 2 [generic combination]. Steyskal and Sasakawa 1977: 394 [Oriental catalog]. Foster and Mathis 1998: 606–608 [revision, Caribbean and Gulf of Mexico, figs. of ♂ terminalia]. Munari and Evenhuis 2000: 145 [synonymy].

Dasyrhicnoessa ferruginea of authors, not Lamb 1914 [misidentification]. Woodley and Hilburn 1994: 53 [citation, Bermuda]. Munari and Evenhuis 2000: 145 [citation].

Dasyrhicnoessa freidbergi Munari 1994: 20 [Cameroon. Kribi (beach, Rt. N7); HT ♂, TAU]. Mathis and Munari 1996: 12 [world catalog]. Munari and Evenhuis 2000: 145 [synonymy].



Figures 12–14. *Dasyrhicnoessa insularis* **12** head, lateral view **13** epandrium, surstylus and anterior surstylarlike lobe, lateral view **14** anterior surstylarlike lobe, posterior view.

Diagnosis. This species is distinguished from congeners by the following combination of characters: *Head* (Fig. 12). *Thorax:* dark orangish brown; acrostichal setulae in 6 rows; legs yellow; forefemur bearing comb of closely set, peglike setae along distal half of anteroventral surface; midfemur bearing ctenidial comb of setae on distal half of posteroventral surface. *Abdomen:* Male terminalia (Figs 13–14): length of anterior surstylar-like lobe equal to or slightly shorter than surstylus; anterior surstylar-like lobe somewhat kidney shaped; surstylus bearing normal to slightly developed setae, none thickly developed.

Specimens examined from Brazil. *PARANÁ.* Antonina (25°28.4'S, 48°40.9'W; beach/mangal), 3 Feb–9 Apr 2010, D. and W. N. Mathis (16♂; DZUP, USNM); Matinhos (N.; 25°46.4'S, 48°30.8'W; 1 m; beach/estuary), 9 Apr 2010, D. and W. N. Mathis (3♂; DZUP, USNM); Paranaguá (Rio Itiberê; 25°31.4'S, 48°30.3'W; 3 m), 23 Jan 2010, D. and W. N. Mathis (5♂, 1♀; DZUP, USNM).

SÃO PAULO. Ubatuba, Praia do Estaleiro (23°20.5'S, 44°53'W; beach), 30 Mar 2010, D. and W. N. Mathis (1♂; USNM).

Distribution. *Afrotropical*: Cameroon, Madagascar, Nigeria. *Australasian/Oceanian*: American Samoa (Tutuila), Australia (Queensland), Bismark (Dyaul), Canton Island, Caroline Islands (Ponhpei, Chuuk, Yap, Palau), Fiji Islands (Ovalau, Suva, Viti Levu), ?French Polynesia (Society Islands: Moorea), Hawaii (French Frigate Shoals, Hawaii, Hilo, Lisiansky, Maui, Midway Atoll, Molokai, Oahu, Pearl and Hermes Reef), Kiribati (Butaritari, Makin, Eita, Tarawa, Abemama), Line Islands (Christmas), Mariana Islands (Saipan, Tinian), Marquesas (Hivaoa, Nuku Hiva), Marshall Islands (Majuro, Japtan, Parry, Lib, Jibu, Jaluit, Namorik), Hebrides (Erromanga), Palmyra Island, Pitcairn Island, Rapa Island, Society Islands (Bora Bora), Wake Island. *Nearctic*: Bermuda, United States (Florida). *Neotropical*: Bahamas (South Bimini), Belize, Brazil (Ceará, Paraná, São Paulo), Mexico (Tabasco), West Indies (Cuba, Dominica, St. Kitts, St. Lucia, St. Vincent).

Remarks. This species was known previously only from the Indo-Pacific area, and its occurrence in the Caribbean, Gulf of Mexico, Bermuda, and now in Brazil represents a significant range extension.

Genus *Tethina* Haliday (77 species worldwide; 3 from Brazil)

http://species-id.net/wiki/Tethina

Tethina Haliday, in Curtis 1837: 293 (as a subgenus of *Opomyza;* published in synonymy; first made available by use in Haliday 1838: 188). Type species: *Opomyza (Tethina) illota* Haliday 1838, by subsequent monotypy (Haliday 1838: 188). Sturtevant 1923: 5–7 [discussion of synonymy, listing of Nearctic species]. Thompson and Mathis 1981: 86 [citation, nomenclature]. Mathis and Munari 1996: 13–19 [world catalog]. Foster and Mathis 1998: 608–630 [revision of Caribbean and Gulf of Mexico species]. Sabrosky 1999: 32, 304 [citations, nomenclature]. Munari and Mathis 2010: 48–66 [world catalog].

Rhicnoessa Loew 1862: 174. Type species: *Rhicnoessa cinerea* Loew, by monotypy. Loew 1865: 34–39 [revision]. Williston 1908: 292, 296 [fig. of head, key]. Collin 1911: 234 [probable synonymy with *Tethina*]. Malloch 1913: 147 [discussion, fig. of head]. Hendel 1917: 46 [synonymy in key]; 1934: 46 [references]. Munari 1990: 60–61 [status as a subgenus of *Tethina*].

Phycomyza Melander 1952: 198. Type species: *Rhicnoessa milichioides* Melander, by original designation. Vockeroth 1965: 727 [Nearctic catalog]. Foster 1976a: 338 [synonymy].

Diagnosis. *Tethina* is distinguished from other genera of the subfamily Tethininae by the following combination of characters: *Head:* Frons bearing some setulae in addition to larger setae; fronto-orbital and orbital setae usually with similar orientation, mostly reclinate or lateroclinate; fronto-orbital setae 3–4; postocellar setae more or less convergent (lacking in *T. lusitanica*). Face with shiny tubercle above vibrissal pore. Eye appearing bare, setulae very sparse or lacking. Gena bare (except for *Tethina pictipennis* and *T. lusitanica,* which have scattered, inconspicuous setulae) except for a ventral or nearly ventral row of setulae; gena high in many species, height 0.50–0.75 that of eye height. Palpus and proboscis usually normally developed; clypeus small, if exposed not protruding anteriad beyond oral margin. *Thorax:* Scutum generally with more or less numerous rows of coarse setulae arising from punctures; scutellar disc bare; postpronotum with 3 or more setae, ventral seta curved upward; acrostichal setulae in two or more complete or nearly complete rows (lacking in *T. lusitanica*); prescutellar acrostichal setae present (lacking in *T. lusitanica*). Wing with costa not spinose; vein A_1+CuA_2 short, much shorter than discal cell; wing usually shorter, about twice as long as wide (less often 2.5–3.0 times); cell bm and discal cell distinct. Mid and hind tibiae evenly setulose, lacking anterodorsal or posterodorsal setae. *Abdomen:* Tergites wider than long; tergite 6 well differentiated from short syntergosternite 7+8, the latter forming a dorsal pregenital sclerite. Male terminalia: Surstylus positioned at ventral margin of epandrium, usually broadly articulated externally with epandrium, internally with subepandrial sclerite; aedeagus usually very long and sinuous, either thick and straplike or narrow and ribbonlike; aedeagus micropubescent dorsally.

Discussion. Worldwide among genera of Tethininae, *Tethina* has more than half of the described species (77 of 115) (Munari 2002). Two species occur in the study area and a third, *T. albula* (Loew), has been reported (Prado and Tavares 1966) but not seen as part of this study. Since *T. albula* has been reported from Brazil, and as there is the possibility of its occurrence there, we have included it in the key to species. The included species of *Tethina* occur along maritime beaches of the littoral biotic region. Specimens are sometimes abundant, especially on fresh and decomposing wrack.

Key to Species of *Tethina* from Brazil

1 Gena short, 0.33 or less height of eye; setae and setulae black. Apex of scutellum with yellowish to reddish spot (may vary in size but always obvious) .... ***T. xanthopoda*** **(Williston)**

– Gena high, 0.37–0.75 height of eye; setae and setulae mostly white. Apex of scutellum uniformly gray microtomentose **2**

2 Surstylus in lateral view straight .... ***T. willistoni*** **(Melander)**

– Surstylus in lateral view curved anteroventrally .... ***T. albula*** **(Loew)**

Tethina willistoni Melander

http://species-id.net/wiki/Tethina_willistoni
Figs 15–17

Anthomyza cinerea Williston 1896: 444 [West Indies. St. Vincent. Wallilabou beach (13°15'N, 61°16'W); NT ♂ (designated by Foster and Mathis 1998: 615), USNM; preoccupied, Loew 1862].

Rhicnoessa cinerea. Czerny 1902: 256 [generic combination].

Rhicnoessa willistoni Melander 1913: 298 [new name for *A. cinerea* of Williston 1896, not Loew 1862]. Hendel 1934: 51 [citation]. Melander 1952: 201 209 [key, citation].

Tethina willistoni. Foster 1976b: 3 [generic combination, Neotropical catalog]. Mathis and Munari 1996: 19 [world catalog]. Foster and Mathis 1998: 611, 613, 615–618 [revision, Caribbean and Gulf of Mexico, neotype designation, figs. head and ♂ terminalia]. Munari and Mathis 2010: 65 [world catalog].

Rhicnoessa bermudaensis Melander 1952: 203 [Bermuda. Castle and Cooper Islands; LT ♂ (designated by Foster and Mathis 1998: 612), USNM]. Mathis and Foster 2007: 421 [synonymy].

Tethina bermudaensis. Vockeroth 1965: 727 [generic combination, Nearctic catalog]. Woodley and Hilburn 1994: 53–54 [citation, Bermuda]. Mathis and Munari 1996: 15 [world catalog]. Foster and Mathis 1998: 611–613 [revision, lectotype designation, Caribbean and Gulf of Mexico, fig. of ♂ terminalia].

Rhicnoessa variseta Melander 1952: 209 [United States. California. Orange: Corona del Mar; LT ♂ (designated by Foster and Mathis 1998: 616), USNM]. Foster and Mathis 1998: 615 [synonymy, lectotype designation].

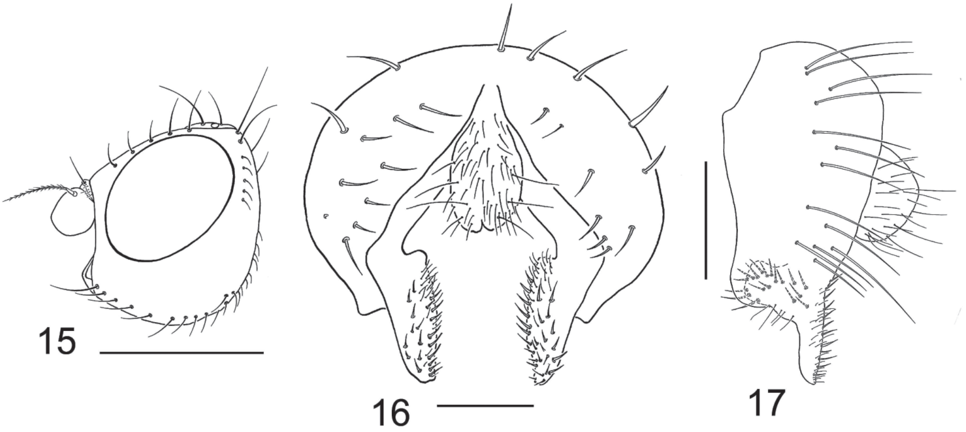
Tethina variseta. Vockeroth 1965: 728 [generic combination, Nearctic catalog]. Mathis and Munari 1996: 19 [world catalog].

Tethina carioca Prado and Tavares 1966: 433 [Brazil. Rio de Janeiro: Ilha do Governador (Galeão); HT ♂, FIOC (13356); figs. of ♂ terminalia and wing]. Foster 1976b: 2 [Neotropical catalog]. Mathis and Munari 1996: 15 [world catalog]. Foster and Mathis 1998: 615 [synonymy].

Tethina albula of authors, not Loew 1869 [misidentification]. Frey 1919: 15.

Diagnosis. This species is distinguished from congeners by the following combination of characters: Body length 1.65–3.00 mm; body generally whitish gray to gray, microtomentose; setae generally white to slightly off white but sometimes with all setae black. *Head* (Fig. 15): Gena high, greater than 0.5 eye height. *Thorax:* 4 irregular rows of acrostichal setulae; scutellum uniformly gray; femora mostly yellow to mostly gray; hindfemora of male similar to or only slightly more swollen than fore- and midfemora; tibiae yellow; basal 4 tarsomeres yellow, apical tarsomere brown. *Abdomen:* Male terminalia (Figs 16–17): Surstylus articulated with and broadly attached to epandrium, broadly spatulate/triangular in posterior view, length 2–3× width, apex broadly rounded; medial margin bearing numerous short, stout setulae along entire length; surstylus in lateral view narrow, tapered to apical point, posterior margin almost straight; basal portion produced anteriorly as a broadly rounded lateral lobe bearing several short setulae medially; aedeagus thick, straplike.

Specimens examined from Brazil. *PARANÁ.* Matinhos (N.; 25°46.4'S, 48°30.8'W; 1 m; beach/estuary), 25 Mar-9 Apr 2010, D. and W. N. Mathis (6♂; DZUP, USNM); Paranaguá (Rio Itiberê; 25°31.4'S, 48°30.3'W; 3 m), 23 Jan 2010, D. and W. N. Mathis (8♂, 1♀; DZUP, USNM).



Figures 15–17. *Tethina willistoni* **15** head, lateral view **16** epandrium, cerci and surstylus, posterior view **17** same, lateral view.

RIO DE JANEIRO. Ilha do Governador (Galeão; 22°47.8'S, 43°14.7'W), 11 Oct 1966, A. P. do Prado and Tavares (1♂; MZUSP).

SANTA CATARINA. Barra Velha (26°38'S, 48°40.9'W; beach), 29 Apr 2010, D. and W. N. Mathis (8♂, 1♀; DZUP, USNM).

SÃO PAULO. Ubatuba, Praia Puruba (23°21'S, 44°55.6'W; beach), 29 Mar 2010, D. and W. N. Mathis (6♂, 2♀; DZUP, USNM); Ubatuba, Praia do Estaleiro (23°20.5'S, 44°53'W; beach), 30 Mar 2010, D. and W. N. Mathis (1♂; USNM).

Distribution. *Australasian/Oceanian*: Hawaii (French Frigate Shoals, Hawaii, Kahoolawe, Kauai, Lisiansky, Maui, Oahu), Midway Islands. *Nearctic*: Bermuda, United States (California, Connecticut, Delaware, Florida, Maryland, Massachusetts, North Carolina, South Carolina, Virginia). *Neotropical*: Bahamas, Belize, Brazil (Paraná, Rio de Janeiro, Santa Catarina, São Paulo), Cuba, Curaçao, Ecuador, Mexico (Chihuahua, Tabasco), Panama, Peru, Tobago, Turks and Caicos, West Indies (Anguilla, Antigua, Barbados, Barbuda, Dominica, Dominican Republic, Grand Cayman, Grenada, Jamaica, Montserrat, Puerto Rico, St. Croix, St. Lucia, St. Vincent).

Remarks. Some slight variation was evident in the shape of the surstyli within specimens of this species. In posterior view the surstylus varies from being shorter and more exactly triangular to being slightly longer but still triangular. Previously we considered these differences to represent separate species, *T. bermudaensis* and *T. willistoni.* After examination of many dissected specimens from Canada south through southern Brazil, we agree with Foster and Mathis (2008) that this variation is intraspecific.

The variation in setal coloration and size of *T. willistoni* is remarkable. The variation in external characters is as follows: the more robust specimens from the Carribean areas have mostly stout, black setae and often present a very “bristly” habitus (similar to *T. spinulosa* and *T. horripilans*). Smaller, more delicate specimens have only the apical scutellar setae black with all other setae being white. Many specimens fall between these two extremes, making it virtually impossible to distinguish between *T. willistoni* and other species on the basis of external structures alone. A very similar chaetochromatic variation is also found in the Western Palearctic *Tethina albosetulosa* (Strobl) (Munari and Canzoneri 1992; Munari and Vanin 2007).

Tethina xanthopoda **(Williston)**

http://species-id.net/wiki/Tethina_xanthopoda
Figs 18–20

Anthomyza xanthopoda Williston 1896: 445 [West Indies. St. Vincent; LT ♂ (designated by Foster and Mathis 1998: 620); BMNH]. Czerny 1902: 256 [citation, placement in *Rhicnoessa*].

Tethina xanthopoda. Foster 1976b: 3 [generic combination, Neotropical catalog]. Woodley and Hilburn 1994: 54 [citation, Bermuda]. Mathis and Munari 1996: 19 [world catalog]. Foster and Mathis 1998: 620–624 [revision, Caribbean and Gulf of Mexico, lectotype designation, figs. of head and ♂ terminalia]. Munari and Mathis 2010: 66 [world catalog].

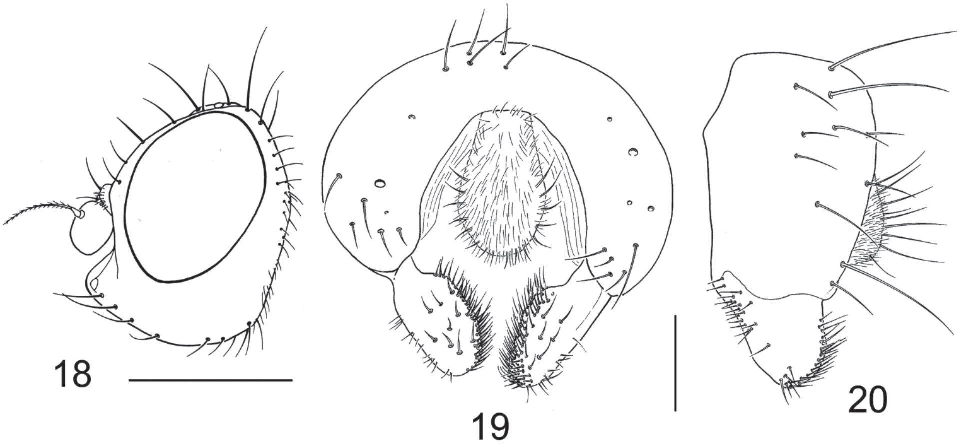
Rhicnoessa xanthopoda. Czerny 1902: 256 [generic combination]. Melander 1913: 298 [key]; 1952: 202 209 [key, citation]. Hendel 1934: 51 [citation].

Rhicnoessa seriata Melander 1952: 206 [United States. Florida. Dade: Miami; LT ♂ (designated by Foster and Mathis 1998: 620), USNM]. Foster and Mathis 1998: 620 [synonymy, lectotype designation].

Tethina seriata. Vockeroth 1965: 728 [generic combination, Nearctic catalog]. Mathis and Munari 1996: 18 [world catalog].

Tethina brasiliensis Prado and Tavares 1966: 435 [Brazil. Rio de Janeiro: Ilha do Governador (Galeão); HT ♂, FIOC (13358); figs. of ♂ and ♀ terminalia]. Foster 1976b: 2 [Neotropical catalog]. Artigas et al. 1992: 127–129 [figs. of puparium]. Mathis and Munari 1996: 15 [world catalog]. Foster and Mathis 1998: 620 [synonymy].

Diagnosis. This species is distinguished from congeners by the following combination of characters: Body length 1.70–3.10 mm; body with gray microtomentum; setae generally black. *Head* (Fig. 18): Gena short, less than 0.5 eye height. *Thorax:* 4 somewhat irregular rows of acrostichal setulae; apex of scutellum with yellowish to reddish spot (sometimes variable in size but always obvious); femora yellow; hindfemora of male similar to or only slightly more swollen than fore- and midfemora; tibiae and basal 4 tarsomeres yellow, apical tarsomere brown. *Abdomen:* Male terminalia (Figs 19–20): surstylus articulated with and broadly attached to epandrium, broadly spatulate in posterior view, length less than twice width, median margin bearing dense patch of robust setulae along entire length, apex broadly rounded; surstylus in lateral view broadly developed, lateral margin only slightly narrowed posteriorly, apex broadly rounded, lateral surface mostly bare, basal portion only slightly produced anteriorly, bearing moderately dense patch of setulae; aedeagus narrow, ribbonlike.



Figures 18–20. *Tethina xanthopoda* **18** head, lateral view **19** epandrium, cerci and surstylus, posterior view **20** same, lateral view.

Specimens examined from Brazil. *RIO DE JANEIRO.* Ilha do Governador (22°47.8'S, 43°14.7'W), Nov 1963, H. Souza Lopes (1♂; MZUSP).

SANTA CATARINA. Barra Velha (26°38'S, 48°40.9'W; beach), 29 Apr 2010, D. and W. N. Mathis (12♂; DZUP, USNM).

SÃO PAULO. Ubatuba, Praia do Estaleiro (23°20.5'S, 44°53'W; beach), 30 Mar 2010, D. and W. N. Mathis (3♂; USNM).

Distribution. *Nearctic*: Bermuda, Canada (Alberta), United States (Florida). *Neotropical*: Bahamas, Belize, Brazil (Bahia, Rio de Janeiro, Rio Grande do Norte, Santa Catarina, São Paulo), Guyana, Mexico (Quintana Roo, Yucatan), Panama, Trinidad and Tobago, Turks and Caicos, West Indies (Antigua, Barbados, Barbuda, Cuba, Curaçao, Dominica, Dominican Republic, Grand Cayman, Grenada, Jamaica, St. Lucia, St. Vincent).

Remarks. This widespread species can easily be distinguished from *T. cohiba* (often collected at the same locality) in having an obvious reddish yellow spot on the apex of the scutellum. Some specimens must be examined with the scutellum oriented to be directly viewed from behind and with good lighting. In most specimens, however, the spot is immediately obvious. Additional external characters include the mostly yellow femora, which are moderately swollen, as in *T. cohiba.*

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