

## NOTES ON THE BIOLOGY AND IMMATURES OF THE ISSID PLANTHOPPERS *THIONIA BULLATA* AND *T. SIMPLEX* (HOMOPTERA: FULGOROIDEA)

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*Abstract.*—Observations on host plants and descriptions of nymphs of *Thionia bullata* (Say) and *T. simplex* (Germar) are provided. *T. bullata* was recorded from three species of pines in Alabama and *T. simplex* from 12 species of herbaceous and woody dicotyledonous plants from North Carolina, Pennsylvania, Tennessee, and District of Columbia. Salient features of nymphs include number and arrangement of body pits, spination of the metathoracic legs, and form of the abdominal waxpads.

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The issid genus *Thionia* Stål contains 72 mostly neotropical planthoppers (Metcalf, 1958; Fennah, 1965; Wheeler and Wilson, 1987). Little ecological information is available for the 8 species found north of Mexico. These species are usually poorly represented in collections with some of the eastern species characterized as "rare" or "quite rare" (e.g., Dozier, 1926; Osborn, 1938). Only *T. elliptica* (Germar) has been studied in any detail; Wheeler and Wilson (1987) reported its seasonal history on scrub oak, *Quercus ilicifolia* Wang., in Pennsylvania and described and illustrated the immature stages.

*Thionia bullata* (Say) is recorded from Pennsylvania and New Jersey west to Illinois and south to Mississippi and Florida (Metcalf, 1958; Wilson and McPherson, 1980a). This planthopper has been taken on oak (*Quercus* sp.) in Mississippi, where nymphs and adults were said to be abundant at many localities (Dozier, 1926), and on dogwood (*Cornus* sp.) and river weeds in Indiana (Heaton, 1934). Wilson and McPherson (1979) listed *T. bullata* as a host of the parasitic moth *Fulgoraecia exigua* (Hy. Edwards) (= *Epipyrops barberiana* Dyar) (Lepidoptera: Epipyropidae) in Illinois.

*Thionia simplex* (Germar) has a recorded distribution similar to that of *T. bullata* (Metcalf, 1958; Wilson and McPherson, 1980a). Adults have been swept from a grassy field in Florida (Van Duzee, 1909) and "low deciduous woods" in Mississippi (Dozier, 1926). Hook (1981) reported the wasp *Tanyoprymnus moneduloides* (Packard) (Hymenoptera: Sphecidae) provisioning its nest with *T. simplex* in Georgia.

Here we record host plants for *T. bullata* and *T. simplex*, describe and illustrate nymphal instars of both species, and compare them with those of *T. elliptica*. The host records are based on field observations by AGW; nymphal descriptions were made by SWW.

### MATERIALS AND METHODS

Specimens, including nymphs used in the descriptions, were collected by A. G. Wheeler, Jr. (or G. L. Miller—indicated as GLM) at the following localities and dates:



*T. bullata*—ALABAMA: Clay Co., Rt. 9, Barfield, 11 May 1986, ex. *Pinus taeda*, 3 fifth, 7 fourth, 3 third instars; Conecuh Co., County Rt. 29 at Sepulga R. s. of Deans, 10 May, ex. *Pinus taeda*, 4 fifth instars; nr. Owassa, 10 May, ex. *Pinus echinata* and *P. taeda*, 1 fifth, 1 fourth instar; Lee Co., Auburn, Auburn University Campus, 11 May, ex. *Pinus virginiana*, 11 fifth instars, 4 male, 1 female adult; 6 June, ex. *Pinus virginiana*, 1 male, 6 female adults (GLM); Montgomery Co., I-85 s. of Macon Co. line nr. Waugh, 10 May, ex. *Pinus taeda*, 8 fifth instars; Tallapoosa Co., Rt. 280 and Rt. 50, Camp Hill, ex. *Pinus echinata*, 1 fifth, 4 fourth instars; ex. *Pinus taeda*, 6 fifth instars; Tuscaloosa Co., Tuscaloosa, 8 June 1987, ex. *Pinus echinata*, 2 males. *T. simplex*—NORTH CAROLINA: Mecklenburg Co., Charlotte, 4 June 1983, ex. *Elaeagnus multiflora*, 3 second, 1 first instar; 3 July 1982, ex. *Elaeagnus* sp., 7 fifth, 2 fourth instars, 1 male adult; ex. *Baccharis halimifolia*, 1 female adult; ex. privet, 1 male adult; 2 July 1983, on various tree and shrub species, 5 fifth, 6 fourth, 1 third instar; 7 July 1984, ex. *Baccharis halimifolia*, 1 male adult; 4 September 1983, ex. *Baccharis halimifolia*, 1 male adult; PENNSYLVANIA: York Co., Shenks Ferry, ex. *Physalis* sp., 22 July 1981; TENNESSEE: Knox Co., Knoxville, University of Tennessee campus, 16 July 1982, ex. *Elaeagnus* sp., 2 fifth instars; WASHINGTON, D.C.: National Arboretum, 17 July 1983, ex. *Solanum carolinense* and *S. dulcamera*, late instar nymphs (not collected).

Nymphs were preserved in 70% ethyl alcohol. Measurements are given in mm as Mean  $\pm$  SD. Length was measured from apex of vertex to apex of abdomen for nymphs, thoracic length along the midline from the anterior margin of the pronotum to the posterior margin of the metanotum, and width across the widest part of the body. At least one specimen of each instar was cleared in 10% cold KOH then immersed in water; this allowed for determination of the number and arrangement of pits and waxpads. In each of the instars, the lateralmost pits on the tergites are not always visible in dorsal view due to curving of the tergites onto the ventral aspect. The five nymphal instars of *T. elliptica* were described in detail by Wheeler and Wilson (1987); the following descriptions include those features that distinguish nymphs of *T. bullata* and *T. simplex* from those of *T. elliptica*.

## RESULTS AND DISCUSSION

### *Thionia bullata* (Say)

*Host plants.* In Alabama, *T. bullata* was collected from three species of pines from 10–12 May 1986 (Table 1). Late instars were beaten from loblolly pine, *Pinus taeda* L., and shortleaf pine, *P. echinata* Mill., in Clay, Conecuh, Montgomery, and Tallapoosa counties. Nymphs were particularly numerous on loblolly pine in the Red Hills region of Conecuh Co. Late instars, many with attached epipyropid larvae, were common on an isolated scrub pine, *P. virginiana* Mill., in Lee Co. on the Auburn University campus; a few teneral adults also were present.

Our discovery that pines serve as host plants is difficult to reconcile with Dozier's (1926) and Heaton's (1934) reports and suggests misidentifications of their plant-hoppers or observation of planthoppers resting on plants but not necessarily feeding.

*Descriptions.* FIFTH INSTAR (Fig. 1a–c). Length  $5.0 \pm 0.58$ ; thoracic length  $2.2 \pm 0.09$ ; width  $3.3 \pm 0.30$ . N = 34.

Body light brown to tan dorsally, intermittent orange longitudinal markings ex-



Table 1. Host plants of *Thionia bullata* and *T. simplex*.

Taxon	Common name	Stage <sup>a</sup>	Locality <sup>b</sup>
<i>Thionia bullata</i>			
Pinaceae			
<i>Pinus taeda</i> L.	loblolly pine	N	AL
<i>Pinus echinata</i> Mill.	shortleaf pine	N	AL
<i>Pinus virginiana</i> Mill.	Virginia pine	N, A	AL
<i>Thionia simplex</i>			
Altingiaceae			
<i>Liquidambar styraciflua</i> L.	sweetgum	N	NC
Anacardiaceae			
<i>Rhus copallina</i> L.	winged sumac	N	NC
Asteraceae			
<i>Baccharis halimifolia</i> L.	sea myrtle	N, A	NC
Elaeagnaceae			
<i>Elaeagnus multiflora</i> Thunb.	cherry eleagnus	N, A	NC
Fabaceae			
<i>Albizia julibrissin</i> Durazz.	mimosa	N	NC
Magnoliaceae			
<i>Magnolia grandiflora</i> L.	southern magnolia	N	NC
Oleaceae			
<i>Ligustrum amurense</i> Carr.	Amur privet	N, A	NC
Rosaceae			
<i>Prunus</i> sp.	cherry	N	NC
Solanaceae			
<i>Physalis</i> sp.	ground cherry	N	PA
<i>Solanum carolinense</i> L.	horsenettle	N	DC
<i>Solanum dulcamara</i> L.	bitter nightshade	N	DC
Ulmaceae			
<i>Ulmus alata</i> Michx.	winged elm	N	NC

<sup>a</sup> N = nymph, A = adult.<sup>b</sup> AL = Alabama; DC = Washington, D.C.; NC = North Carolina; PA = Pennsylvania; see text for detailed collection records.

tending from posterior margin of vertex across thorax and abdominal tergites 1–6. Venter pale tan with light to medium brown markings.

Vertex length subequal to width, anterior margin carinate, subacute; appearing pentagonal. Frons slightly longer than wide, anterodorsal margin arcuate, lateral margins strongly convex and carinate (outer carinae), paralleled by inner carina on each side, median longitudinal carina fading in posterior half; 34–39 pits between each inner and outer carina. Eyes red without pale stripes. Antennal pedicel ca. 4 × length of scape.



Mesonotal plates each with cluster of 9–11 pits just lateral to carina and 9–11 pits on wingpad. Metanotal plates each with weak longitudinal carina originating on anterior margin in median  $\frac{1}{3}$ , curving mesad then fading in posterior  $\frac{1}{3}$  of plate. Metatibiae with longitudinal row of 3 lateral spines on shaft and transverse apical row of 8–9 spines on plantar surface. Metatarsomere 1 with transverse apical row of 6–9 spines (generally 8) apically on plantar surface; tarsomere 2 with 2 apical spines.

Abdominal segments 8–9 telescoped anteriorly; tergites 7 and 8 each with a pair of elongate, oval, white caudal waxpads; those on tergite 7 are hidden on the ventral aspect and are only readily apparent if the specimen is cleared. Tergites each with the following number of pits on either side of midline: tergite 3 with 5–6 pits, 4 with 7–8, 5 with 8, 6 with 8, 7 with 8–9, and 8 with 5–7.

FOURTH INSTAR. Length  $3.4 \pm 0.30$ ; thoracic length  $1.5 \pm 0.05$ ; width  $2.0 \pm 0.08$ .  $N = 12$ .

Frons with 30–32 pits between each inner and outer carina. Antennal pedicel ca.  $3 \times$  length of scape, bulbous portion of flagellum ca. 0.25 length of pedicel; pedicel with ca. 10 very obscure pits.

Pronotal plates each with ca. 25–26 pits in 3 irregular rows. Mesonotal plates each with 8–9 pits just lateral to carina and 8 laterally on wingpad; wingpad broadly lobate and covering ca.  $\frac{1}{2}$  metanotal wingpad laterally. Metanotal wingpad with 4 pits in lateral  $\frac{1}{3}$  and 3 laterally on wingpad. Metatibiae with apical transverse row of 8 spines on plantar surface. Metatarsomere 1 with apical transverse row of 7 spines on plantar surface.

Abdominal tergites each with the following number of pits on either side of midline: tergite 3 with 5 pits, 4 with 6–7, 5 with 7, 6 with 6–7, 7 with 6–7, 8 with 5.

THIRD INSTAR. Length  $2.5 \pm 0.06$ ; thoracic length  $1.1 \pm 0.17$ ; width  $1.5 \pm 0.12$ .  $N = 3$ .

Frons with ca. 25–26 pits between each inner and outer carina. Antennal pedicel with fewer very obscure pits.

Pronotal plates each with 23–25 pits in 3 irregular rows. Mesonotal plates each with 6–7 pits just lateral to carina and 7 pits in lateral  $\frac{1}{3}$ . Metanotal plates each with 3 very obscure pits just lateral to carina and 3 pits in lateral  $\frac{1}{3}$ . Metatibiae with an apical transverse row of 6 spines on plantar surface. Metatarsi with 2 tarsomeres; tarsomere 1 cylindrical, with an apical transverse row of 6 spines on plantar surface.

Abdominal tergites each with the following number of pits on either side of midline: tergite 3 with 3 pits, 4–7 each with 5, 8 with 3.

### *Thionia simplex* (Germar)

*Host plants.* *T. simplex* was collected from 12 host plant species in 10 families (Table 1). Nymphs collected in Washington, D. C. were observed feeding on stems and lower leaf surfaces of bitter nightshade, *Solanum dulcamara* L., and horsenettle, *S. carolinense* L.

The collection of *T. simplex* on various herbs, shrubs, and trees appears to contrast with *T. elliptica*, which has been taken only on oaks (Wheeler and Wilson, 1987), and *T. bullata*, an apparent pine feeder. *Thionia simplex* thus is polyphagous like several other eastern North American planthoppers: the acanaloniines *Acanalonia bivittata* (Say) and *A. conica* (Say) (Wilson and McPherson, 1980b, 1981a); flatids



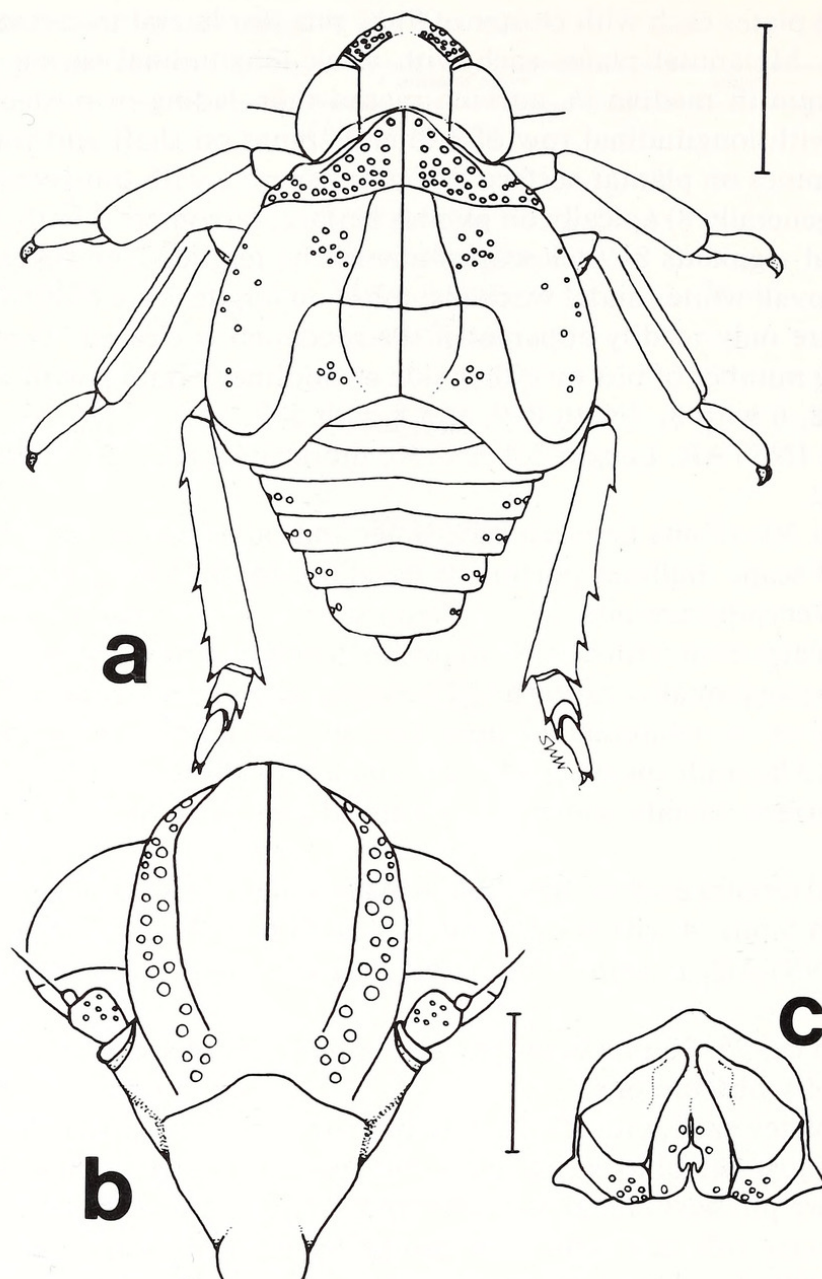


Fig. 1. *T. bullata* fifth instar. a. Habitus. b. Frontal view of head. c. Caudal view of abdomen. Bar = 1 mm (a); 0.5 mm (b, c).

*Anormenis chloris* (Melichar) (= *septentrionalis* (Spinola); see O'Brien, 1985), *Metcalfa pruinosa* (Say), *Ormenaria rufifascia* (Walker) and *Ormenoides venusta* (Melichar) (Wilson and McPherson, 1980b, 1981b; Wilson and Tsai, 1984) and *Cyarda* sp., near *acutissima* Metcalf and Bruner (Wheeler and Hoebeke, 1982); and tropiduchid *Pelitropis rotulata* Van Duzee (Wilson and Wheeler, 1984).

**Descriptions.** FIFTH INSTAR (Fig. 2a–c). Length  $5.0 \pm 0.91$ ; thoracic length  $1.7 \pm 0.06$ ; width  $3.0 \pm 0.27$ ; N = 14.

Body light tan; very faint, brownish longitudinal stripes dorsally.

Vertex length ca.  $0.7 \times$  width; anterior margin carinate and arcuate, lateral margins carinate, posterior margin concave. Frons with weak median longitudinal carina fading in posterior  $\frac{1}{3}$ ; 36–40 pits between each inner and outer carina. Eyes red



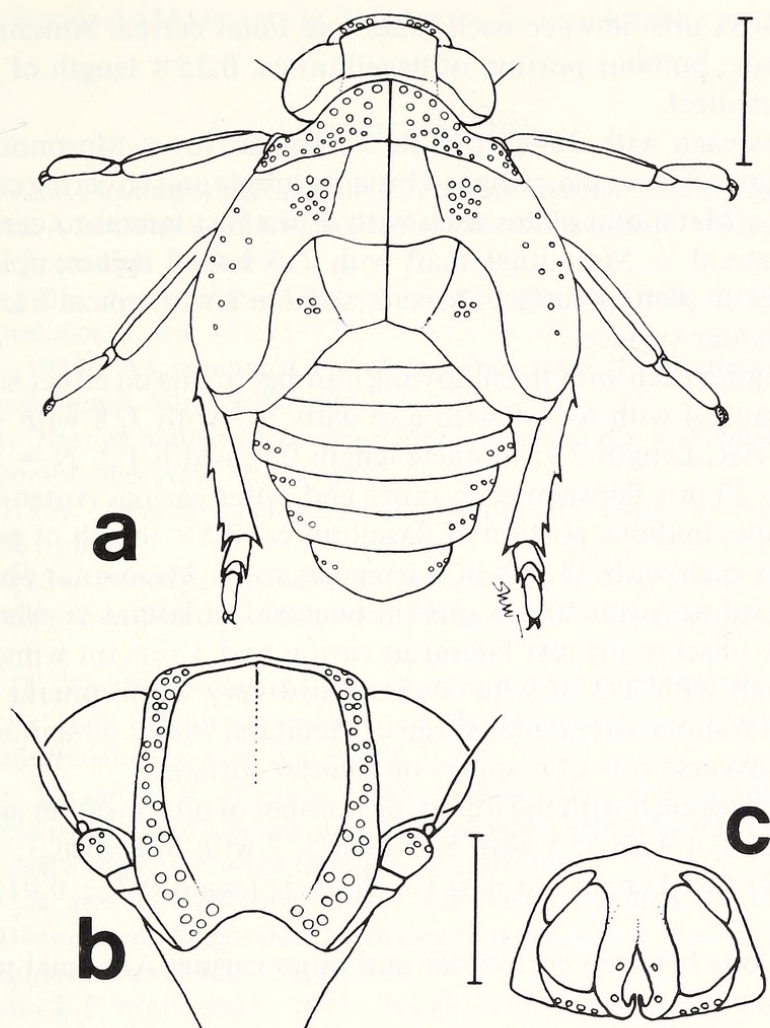


Fig. 2. *T. simplex* fifth instar. a. Habitus. b. Frontal view of head. c. Caudal view of abdomen. Bar = 1 mm (a); 0.5 mm (b, c).

without pale stripes. Antennal pedicel with numerous obscure pits, ca.  $4 \times$  length of scape.

Pronotal plates each with 26–29 pits in 4 irregular rows. Mesonotal plates each with straight longitudinal carina originating on anterior margin in median  $\frac{1}{4}$  and extending posterolaterally to posterior margin; cluster of 11–12 pits just lateral to carina and 9 pits on wingpad. Metanotal plates each with weak longitudinal carina originating on anterior margin in median  $\frac{1}{3}$  and fading in posterior  $\frac{1}{4}$ ; 3–5 pits just lateral to carina. Metatibiae with longitudinal row of 3 lateral spines on shaft and transverse apical row of 8–10 spines on plantar surface. Metatarsomere 1 with transverse apical row of 8–9 spines apically on plantar surface.

Abdominal segments 8–9 telescoped anteriorly; tergites 7 and 8 each with a pair of elongate, oval, white caudal waxpads; those on tergite 7 are hidden on the ventral aspect and are only readily apparent if the specimen is cleared. Tergites each with the following number of pits on either side of midline: tergite 3 with 5 pits, 4 with 7–8, 5 with 7, 6 with 8, 7 with 7–8, and 8 with 5–6.

FOURTH INSTAR. Length  $3.7 \pm 0.37$ ; thoracic length  $1.3 \pm 0.03$ ; width  $1.9 \pm 0.08$ .  $N = 8$ .



Frons with 30–32 pits between each inner and outer carina. Antennal pedicel ca.  $3 \times$  length of scape; bulbous portion of flagellum ca.  $0.25 \times$  length of pedicel; fewer obscure pits on pedicel.

Pronotal plates each with 26–27 pits in 3 irregular rows. Mesonotal plates each with 10 pits just lateral to carina; wingpad broadly lobate and covering ca.  $\frac{1}{2}$  metanotal wingpad laterally. Metanotal plates each with 4 pits just lateral to carina and 4 pits on wingpad in lateral  $\frac{1}{3}$ . Metatibial shaft with 2–3 lateral spines; apical transverse row of 6–8 spines on plantar surface. Metatarsomere 1 with apical transverse row of 7–8 spines on plantar surface.

Abdominal tergites each with the following number of pits on either side of midline: tergite 3 with 5 pits, 4 with 6–7, 5 with 6, 6 with 7, 7 with 7, 8 with 4.

THIRD INSTAR. Length 2.7; thoracic length 0.9; width 1.2.  $N = 1$ .

Frons with ca. 20 pits between each inner and outer carina. Antennal pedicel ca.  $3 \times$  length of scape; bulbous portion of flagellum ca.  $0.5 \times$  length of pedicel.

Pronotal plates each with 23 pits in 3 irregular rows. Mesonotal plates each with 7–8 pits just lateral to carina and 6 pits on wingpad in lateral  $\frac{1}{3}$ . Metanotal plates each with 1 very obscure pit just lateral to carina and 3 pits on wingpad in lateral  $\frac{1}{3}$ . Metatibial shaft with 2–3 (if with 3, then third very weak) lateral spines; apical transverse row of 6 spines on plantar surface. Metatarsi with 2 tarsomeres; tarsomere 1 with apical transverse row of 6 spines on plantar surface.

Abdominal tergites each with the following number of pits on either side of midline: tergite 3 with 3 pits, 4 with 5, 5 with 5, 6 with 5, 7 with 4, 8 with 3.

SECOND INSTAR. Length  $1.6 \pm 0.13$ ; thoracic length  $0.7 \pm 0.01$ ; width  $0.9 \pm 0.08$ .  $N = 3$ .

Frons with 16 pits between each outer and inner carina. Antennal pedicel ca.  $2 \times$  length of scape.

Pronotal plates each with 17–18 pits in 2 distinct transverse rows. Mesonotal plates each with group of 5 pits just lateral to carina and 4 pits on wingpad in lateral  $\frac{1}{3}$ . Metanotal plates each with 2 pits on wingpad in lateral  $\frac{1}{3}$ . Metatibia with 2 lateral spines on shaft and an apical transverse row of 5 spines on plantar surface. Metatarsomere 1 with an apical transverse row of 5 spines on plantar surface.

Abdominal tergites each with the following number of pits on either side of midline: tergite 3 with 1 pit, 4–7 each with 3 pits, 8 apparently with 1 pit.

FIRST INSTAR. Length 1.6; thoracic length 0.45; width 0.65.  $N = 1$ .

Frons with 11 pits between each outer and inner carina.

Pronotal plates each with 11 pits in distinct transverse row. Mesonotal plates each with group of 2 pits just lateral to carina and 2 pits on wingpad in lateral  $\frac{1}{3}$ . Metanotal plates each with 1 pit on wingpad in lateral  $\frac{1}{3}$ . Metatibia without lateral spines on shaft; apical transverse row of 4 spines on plantar surface. Metatarsomere 1 with an apical transverse row of 4 spines on plantar surface.

Abdominal tergites each with the following number of pits on either side of midline: tergite 3 without pits, 4–7 each with 3 pits, 8 apparently with 1 pit.

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