



The New World Belonopterygini (Neuroptera: Chrysopidae): descriptions of a new genus and species from the West Indies and comparisons among the genera

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Abstract

Pantaleonius toschiorum Tauber, **n. gen., n.sp.**, is described from several islands in the Bahamas and Greater Antilles of the West Indies. For comparison, *Abachrysa eureka* Banks from southeastern United States is redescribed, and data on the three remaining New World belonopterygine genera, *Vieira* Navás, *Nacarina* Navás, and *Belonopteryx* Gerstaecker, are summarized. A key for identifying the New World belonopterygine genera is included. Although recognizably distinct, *Pantaleonius* shares several features with *Vieira*, which is considered basal within Belonopterygini. Both genera are quite different from *Abachrysa* Banks, which is known to be derived among the New World belonopterygines and also closely related to the Old World belonopterygine clade.

Key words: Morphology, myrmecophily, Caribbean, *Vieira*, *Nacarina*, *Abachrysa*

Introduction

The green lacewing tribe Belonopterygini (Chrysopidae: Chrysopinae) currently has four genera in the New World and ~ten in the Old World (Brooks & Barnard 1990, Winterton & Brooks 2015, Oswald 2020). Recent studies based on molecular phylogenetics and larval morphology yielded congruent hypotheses for the evolution of the tribe (Garzón-Orduña *et al.* 2019; Winterton *et al.* 2019, Tauber *et al.* 2020). Specifically, these studies proposed that: (i) Within the tribe, the New World genera are basal to the Old World clade, with *Vieira* Navás and *Nacarina* Navás both basal to the monotypic *Abachrysa* Banks. (ii) An *Abachrysa*-like ancestor, presumably from the New World, gave rise to the diverse belonopterygine clade in the Old World. (iii) The phylogeny of the tribe has been shaped by the evolution of its unique lifestyle—myrmecophily. As stated above, these proposals are consistent with evidence from two independent sources—molecular analyses (Garzón-Orduña *et al.* 2019; Winterton *et al.* 2019, and literature cited therein) and studies of larval morphology and natural history (Principi 1943, 1946; New 1983, 1986; Brooks 1984; Tauber & Winterton 2014; Tauber *et al.* 2006; Tauber *et al.* 2020). Unfortunately, a phylogenetic study focused on the adult morphology of the clade is lacking, and the tribe needs a broadly based comparative analysis with careful attention to structural detail in the adults.

The recent discovery of adult specimens of a previously unknown belonopterygine species from the West Indies provides an opportunity to increase the range of information available on the diversity of the New World members of the tribe. This species does not fall comfortably into any of the previously described New World genera. As a result, it is assigned to a new, fifth genus of belonopterygine lacewings known from the New World. **Part 1** of this paper delineates and describes the new genus and new species. In **Part 2**, the sole species in *Abachrysa* is redescribed. **Part 3** compiles and compares currently available and new information on all five of the known New World belonopterygine genera. In doing so, it highlights possible phylogenetic and systematic implications, and areas in need of future study. **Part 4** provides a brief key to the New World genera of the tribe Belonopterygini.

Materials and methods

The specimens studied here are held in the following institutions:

AMNH—American Museum of Natural History, New York, NY, USA

CMNH—Carnegie Museum of Natural History, Pittsburgh, PA, USA

CUIC—Cornell University Insect Collection, Ithaca, NY, USA

FSCA—Florida State Collection of Arthropods, Gainesville, FL, USA

LACM—Los Angeles County Museum of Natural History, Los Angeles, CA, USA

MACN—Museo Argentina de Ciencias Naturales “Bernardino Rivadavia”, Buenos Aires, Argentina

TRC—M. J. & C. A. Tauber Research Collection, Davis, CA, USA

Procedures for measuring wing and body features follow those of Tauber (2010, 2019). The bracketed numbers following the names of the various body parts in the descriptions refer to the number of specimens measured; if no number is present, assume it is one. I also used certain standard abbreviations in the descriptions and on the figures, as follows—S1–S7: first to seventh abdominal sternites; S8+9: fused eighth and ninth abdominal sternites; T1–T9: first to ninth abdominal tergites; T9+e: fused ninth abdominal tergite and ectoproct.

With the following two exceptions, the terminology for the wing venation follows the traditional scheme of Tillyard (1916), as modified by the study of Breitkreuz *et al.* (2017) and notes by Tauber (2019). For convenience, I retained the use of the abbreviation *im1* for the *mamp* cell when it conformed to the definition for an intramedian cell as provided by Breitkreuz *et al.* (2017). And, for continuity with earlier studies, *b*, *b'*, and *t* cells are as defined by Tillyard (1916), and the abbreviation *f* indicates the furcation (splitting) of a vein. Also, in keeping with Tjeder (1966), I used the term velum (pl. vela) in reference to the robust, slitted covering above the spermatheca. The structure and membranes that connect the spermatheca with the bursa copulatrix in the New World genera are very similar to those in *Italochrysa* and thus fit Tjeder’s usage quite well.

During the course of this study, the definition of an important male genital structure, the parameres, was reexamined and reinterpreted. In previous work on the *Vieira* species (Tauber *et al.* 2006, 2020; Sosa & Tauber 2017), I failed to recognize the similarities between the “hood”, a term used for the four *Vieira* species, and the parameres of other belonopterygine genera (e.g., Tjeder 1966). The hood was defined as an articulated, sclerotized, quadrate structure having three sclerotized lengths, associated with the gonarcus and mediuncus. In two of the *Vieira* species its membranous base is attached to the dorsum of the gonarcus bridge, and in the other two species it is immediately below the gonarcus and mediuncus. However, on re-examination I noted that the membranes attached to the sides of these structures are also attached to S8+9, and it appears likely that the structure is derived from the fused parameres which normally are associated with the terminus of S8+9. Thus, the gonarcus “hood” of *Vieira* may be homologous with the parameres of other belonopterygine genera. It appears that in *Vieira* the paired arms of the parameres have fused in such a way that they form three sides of a roughly quadrangular structure that is open at the base, rather than the typical V-shaped structure that is seen in *A. eureka*, some *Nacarina* spp, and some Old World belonopterygine genera (see Tjeder 1966; Brooks & Barnard 1990; Freitas & Penny 2001; Tauber *et al.* 2006, 2020; Sosa & Tauber 2017; and Figs 17, 18 here).

Part 1. Description of New Genus and New Species

Pantaleonius Tauber, New Genus (Figs. 1–11)

Type species. *Pantaleonius toschiorum* Tauber, New Species.

Etymology of the genus name. The genus *Pantaleonius* is named in honor of Professor Roberto A. Pantaleoni, Dipartimento di Agraria, Università degli Studi, via Enrico De Nicola, Sassari SS, Italy. Prof. Pantaleoni is a distinguished researcher, educator, colleague, and enthusiastic student of Neuroptera. Most importantly here, he challenged my earlier erroneous, generic determination for this new species and encouraged me to broaden my outlook. The genus-group name is derived from a Latin-based personal name and has a masculine suffix.

Tribal association. Relatively recent molecular studies of chrysopid genera worldwide indicate that the tribe Belonopterygini is monophyletic (Garzón-Orduña *et al.* 2019; Winterton *et al.* 2019, and literature cited therein). Also, the known belonopterygine larvae exhibit a set of synapomorphic character states that are sufficiently distinct so as to typify a monophyletic tribe (Tauber *et al.* 2014, Tauber & Winterton 2014, Tauber *et al.* 2020). However, to

my knowledge, currently no single trait or suite of traits have been proposed to distinguish belonopterygine adults definitively and consistently from those in other Chrysopinae tribes. Although the adults of some species, especially those of the Old World, express features that traditionally have united them as a tribe (see Tjeder 1966, Brooks 1984, Brooks & Barnard 1990, Breitzkreuz 2018), many of these features have been shown to be variable among New World members of the tribe [Tauber 2006 (as *Berchmansus*), 2007; Tauber *et al.* 2006 (as *Berchmansus*); Sosa & Tauber 2017]. Thus, to delineate the adult features that unite the tribe, a re-examination that includes all known New World taxa is now necessary (also see Breitzkreuz 2018).

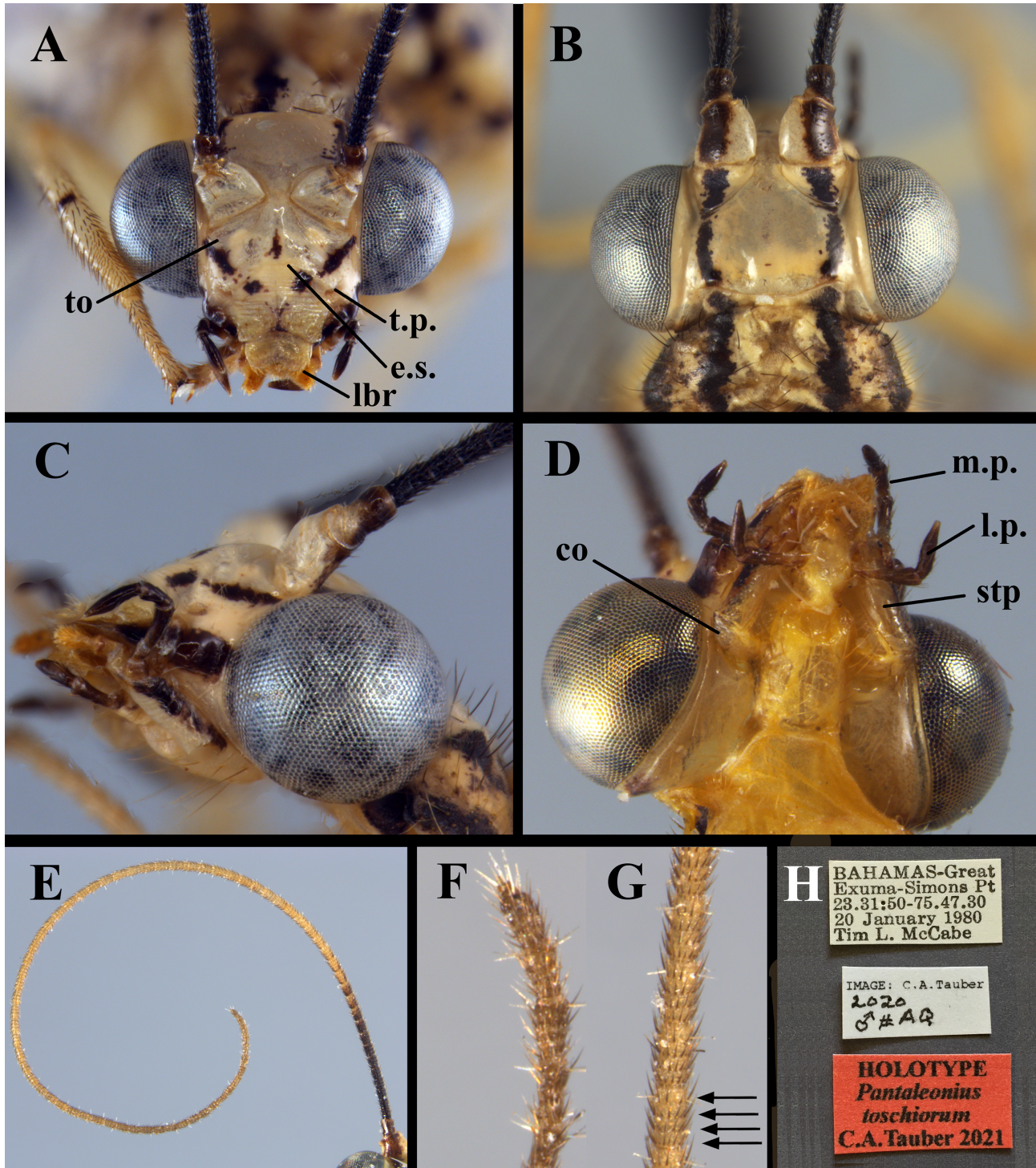


FIGURE 1. *Pantaleonius toschiorum* sp.nov. A. Head, frontal. B. Head, dorsal. C. Head, lateral. D. Head, ventral. E. Antenna, dorsal. F. Terminal flagellomeres. G. Midantennal flagellomeres; arrows indicate four rows of setae on flagellomere. H. Holotype labels. Abbreviations: **co**, cardo; **e.s.**, epistomal suture; **lbr**, labrum; **l.p.**, labial palp; **m.p.**, maxillary palp; **stp**, stipe; **to**, torulus; **t.p.**, tentorial pit. [A–D: Andros Island, female, FSCA; E–G: Exuma Island, female, CUIC].

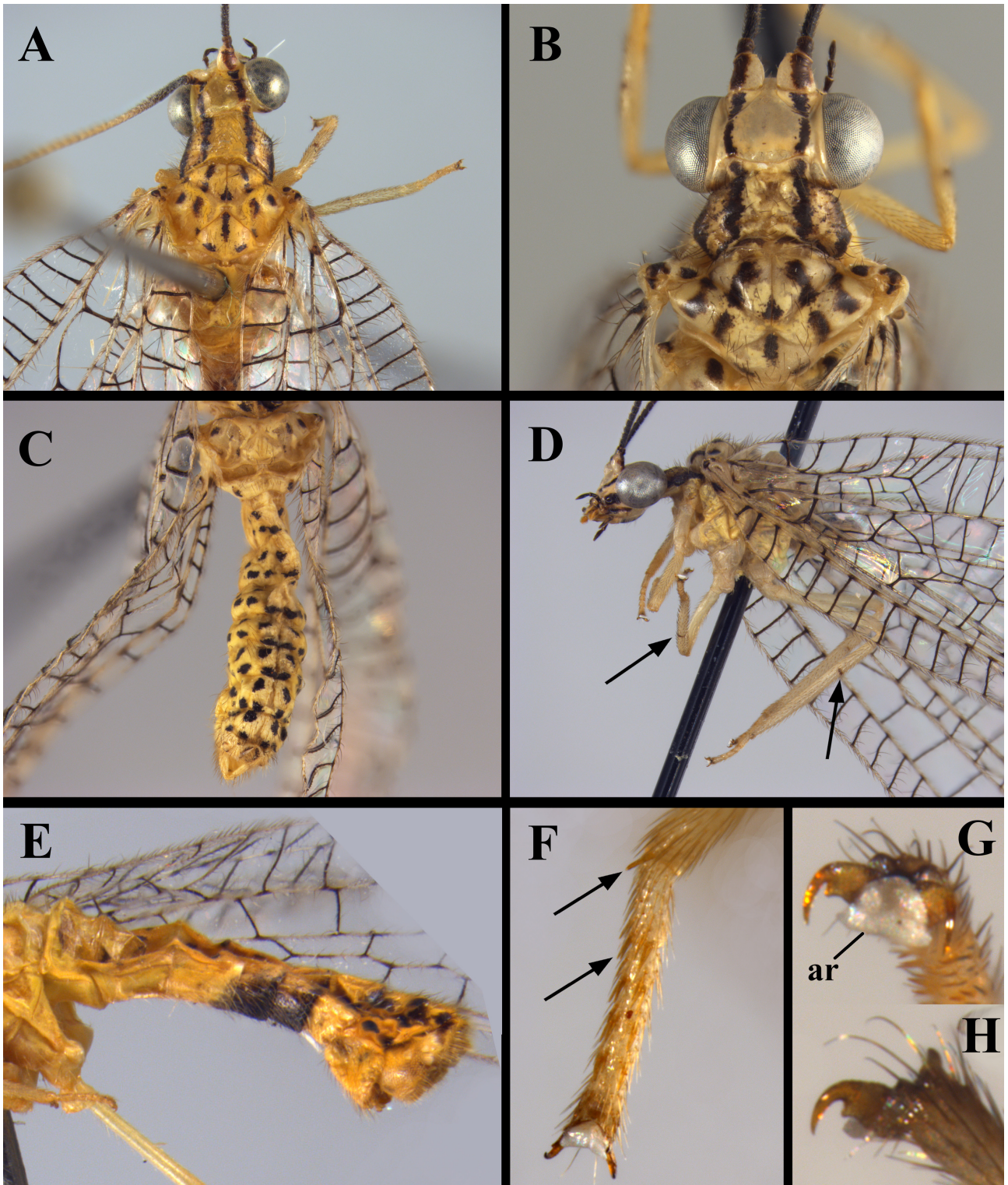


FIGURE 2. *Pantaleonius toschiorum* sp.nov. A. Head, prothorax, mesothorax, dorsal. B. Head, prothorax, mesothorax, dorsal. C. Abdomen, dorsal. D. Upper body, lateral; arrows indicate lateral tibial markings. E. Abdomen, ventrolateral. F. Tarsus, ventral; upper arrow indicates tibial spur; lower arrow indicates one of several tarsal spurs. G. Tarsal claws and arolium, frontal. H. Tarsal claw, lateral. Abbreviations: **ar**, arolium. [A–D, F–H: Andros Island, female, FSCA; E: Exuma Island, female, CUIC].

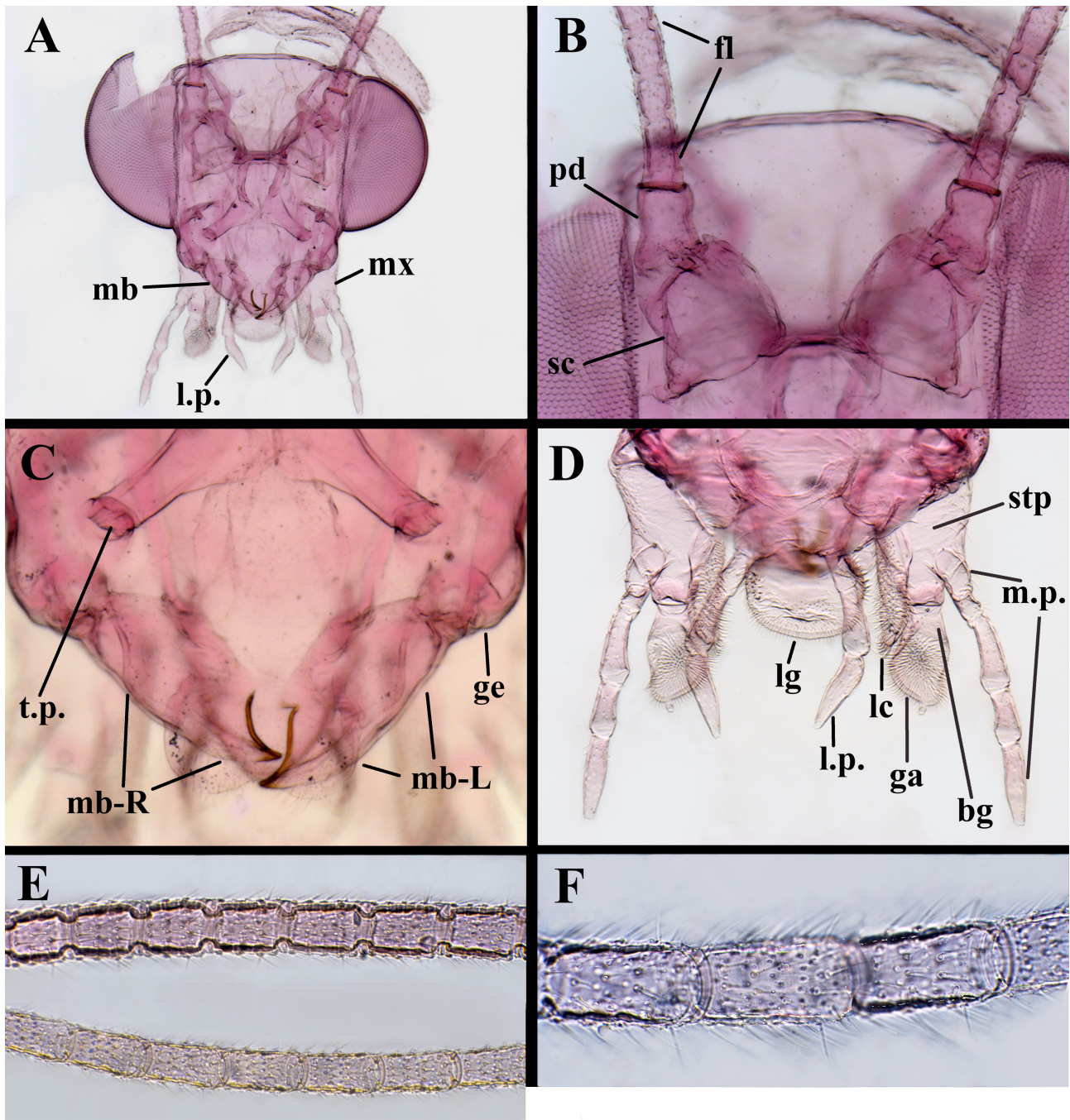


FIGURE 3. *Pantaleonius toschiorum* sp.nov. Head, cleared. A. Head, frontal. B. Upper region of head, frontal. C. Lower region of head, dorsal. D. Lower region of head, ventral. E. Flagellomeres x100, near base (upper), midantenna (lower). F. Flagellomeres x200, midantenna. Abbreviations: **bg**, basigalea; **fl**, flagellum; **ga**, galea; **ge**, gena; **lc**, lacinia; **lg**, ligula; **l.p.**, labial palp; **mb**, mandible; **mb-L**, **mb-R**, mandible, left, right; **mx**, maxilla; **m.p.**, maxillary palp; **pd**, pedicel; **sc**, scape; **stp**, stipe; **t.p.**, tentorial pit. [All: Exuma Island, female, CUIC].

As shown on Table 1, *Pantaleonius toschiorum* n. gen., n. sp. expresses many of the traditional belonopterygine features, most notably: flagellar setae in four rings (Figs 3E–F); mandibles broad; palpomeres round apically; galea broad (Figs 3A–D); pronotum wide, relatively short (Figs 2A–B); forewing with first cubital cell longer than the second cell, which is quadrate with perpendicular angles (Fig. 4A); gonarcus simple, without gonocornua or entoprocesses; mediuncus large; gonosaccus without setae (Fig. 7A–D); female with relatively large spermatheca, velum present, opening directly to bursa copulatrix; praegenitale present (Figs 10A–F, 11A–D). Two features of this species differ from traditional belonopterygine characteristics: its relatively long flagellomeres and the absence of

parameres in the male. Both of these features have been shown to vary among other belonopterygine taxa, especially those from the New World (see Table 1, also Sosa & Tauber 2017).

Generic description and comparison with other New World belonopterygine genera.

Body: Moderate size and form; wing length 12.0–13.1 mm; males and females of similar appearance. Coloration: Cream to tan with moderately bold black body markings; antennal flagellum dark basally. Wings of regular proportion, not narrowed; ratio of forewing length to width = ~2.5 : 1; costal area of forewing without splayed crossveins or dark markings; forewing and hindwing without dark patches; longitudinal veins mostly pale, darkened at intersections with crossveins. Claws with heavy basal dilation. Abdomen: S3–S8 with moderate to sparse covering of moderately long setae; S9 with denser, slightly more robust setae. Male: Dorsal apodeme of T9+e straight, with basal section extending proximally into A8, with ventral spur below callus cerci extending downward below margin of ectoproct. S8+9 fused with prominent suture; microtholi present on S8 and distal region of S7, not dense or widespread. Gonarcus broad, U-shaped, without gonocornu, entoprocessus, or frontal plate; mediuncus with lateral wings, beak, frontal setae. Parameres, gonapsis absent. Female: abdominal tergites without longitudinal mesal suture; dorsum of T9+e without deep mesal invagination; praegenitale present; subgenitale elongate; spermatheca doughnut-shaped with large velum; spermathecal duct elongate, curved.

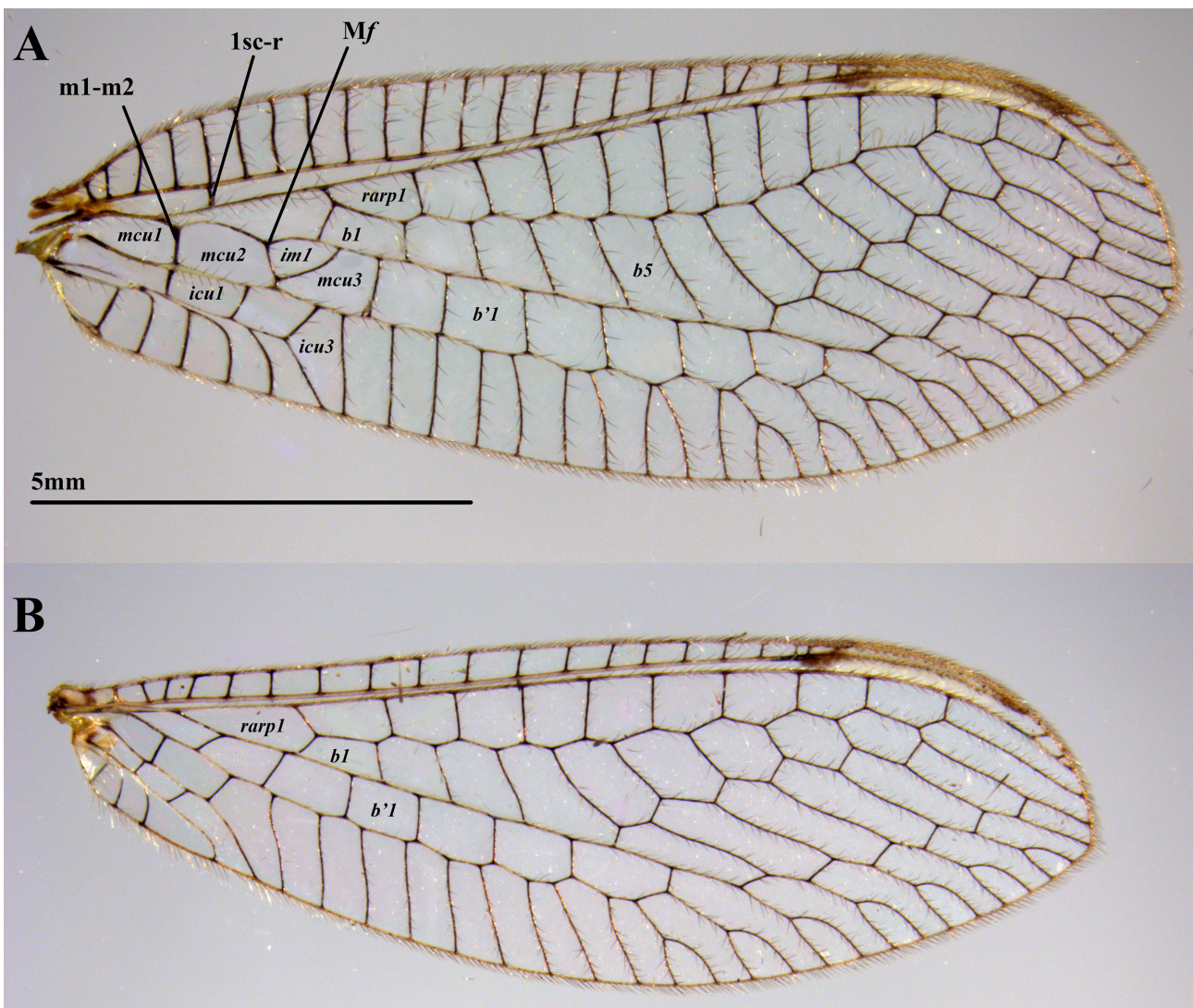


FIGURE 4. *Pantaleonius toschorum* sp.nov. A. Forewing. B. Hindwing. Scale applies to both A and B. Forewing length: 13.0 mm; hindwing length: 12.4 mm. Abbreviations: **b1**, **b5**, first and fifth *b* cells; **b'1**, first *b'* cell; **icu1**, **icu3**, first and third intracubital cells; **im1**, first intramedian (*mamp1*) cell; **mcu1**, **mcu2**, **mcu3**, first, second, and third medial (*mcu*) cells; **m1-m2**, crossvein between *mcu1* and *mcu2*; **Mf**, furcation of *M*; **rarp1**, first radial (*rarp*) cell; **1sc-r**, first subcostal crossvein. [A, B: Exuma Island, male, CUIC].

In summary, among the New World Belonopterygini, *Pantaleonius* is the only genus to have a yellow to tan body with prominent but not large dark spots, and wings with dark veins but without markings or splayed venation. The male abdomen is also unique in that the dorsal apodeme of S8&9 has a ventral spur that articulates with a robust, somewhat sclerotized membrane extending from the ventral spur of the dorsal apodeme to the dorsum of the mediuncus. In addition, the male has a broad U-shaped gonarcus, winged mediuncus, and no parameres. In the female, a praegenitale is present; the subgenitale is elongate; and the spermatheca is doughnut shaped and bears a large, tubular velum.

***Pantaleonius toschiorum* Tauber, New Species**

(Figs. 1–11)

Holotype. Male from the West Indies, **Bahamas**, Great Exuma Island, Simons Pt [23.31.50–75.47.30], 20 Jan 1980, Tim. L. McCabe (Cornell University Insect Collection, Ithaca NY, CUIC, with red Holotype label).

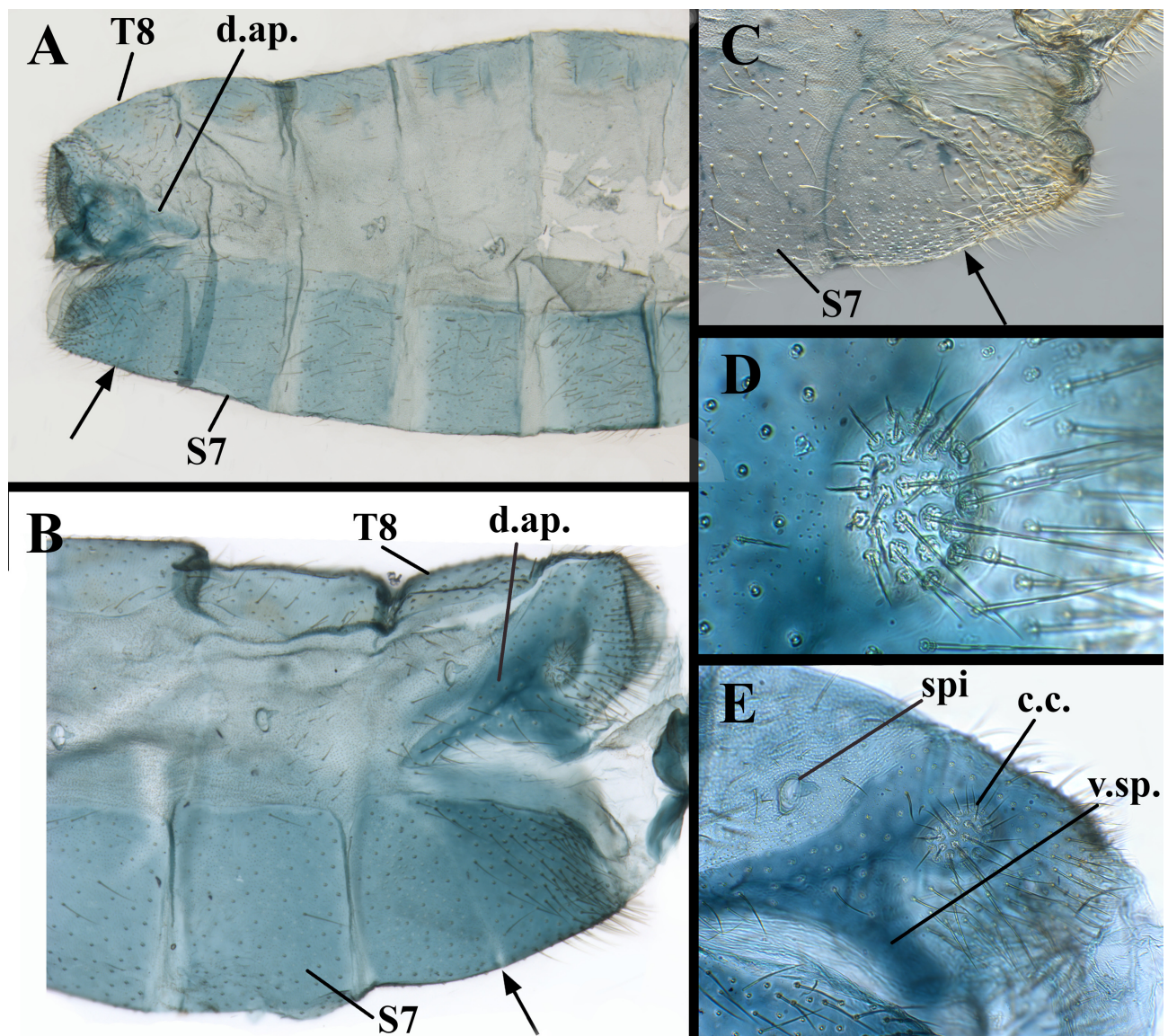


FIGURE 5. *Pantaleonius toschiorum* sp.nov. Male abdomen. A. Segments A4 to terminus, lateral, with gonarcus partially exposed. B. Segments A6 to terminus, lateral, with gonarcus extruded. C. Eighth and ninth sternites, lateral. D. Callus cerci. E. Eighth tergite and ninth tergite+ectoproct, lateral, showing dorsal apodeme and callus cerci. The arrows on A, B, and C indicate the position of the suture between S8 and S9 and demonstrate the variation in the line of fusion. Abbreviations: **c.c.**, callus cerci; **d.ap.**, dorsal apodeme; **spi**, spiracle; **S7**, seventh abdominal sternite; **T8**, eighth abdominal tergite; **v.sp.**, ventral spur of dorsal apodeme. [A: Andros Island, FSCA; B–E: Exuma Island, CUIC].

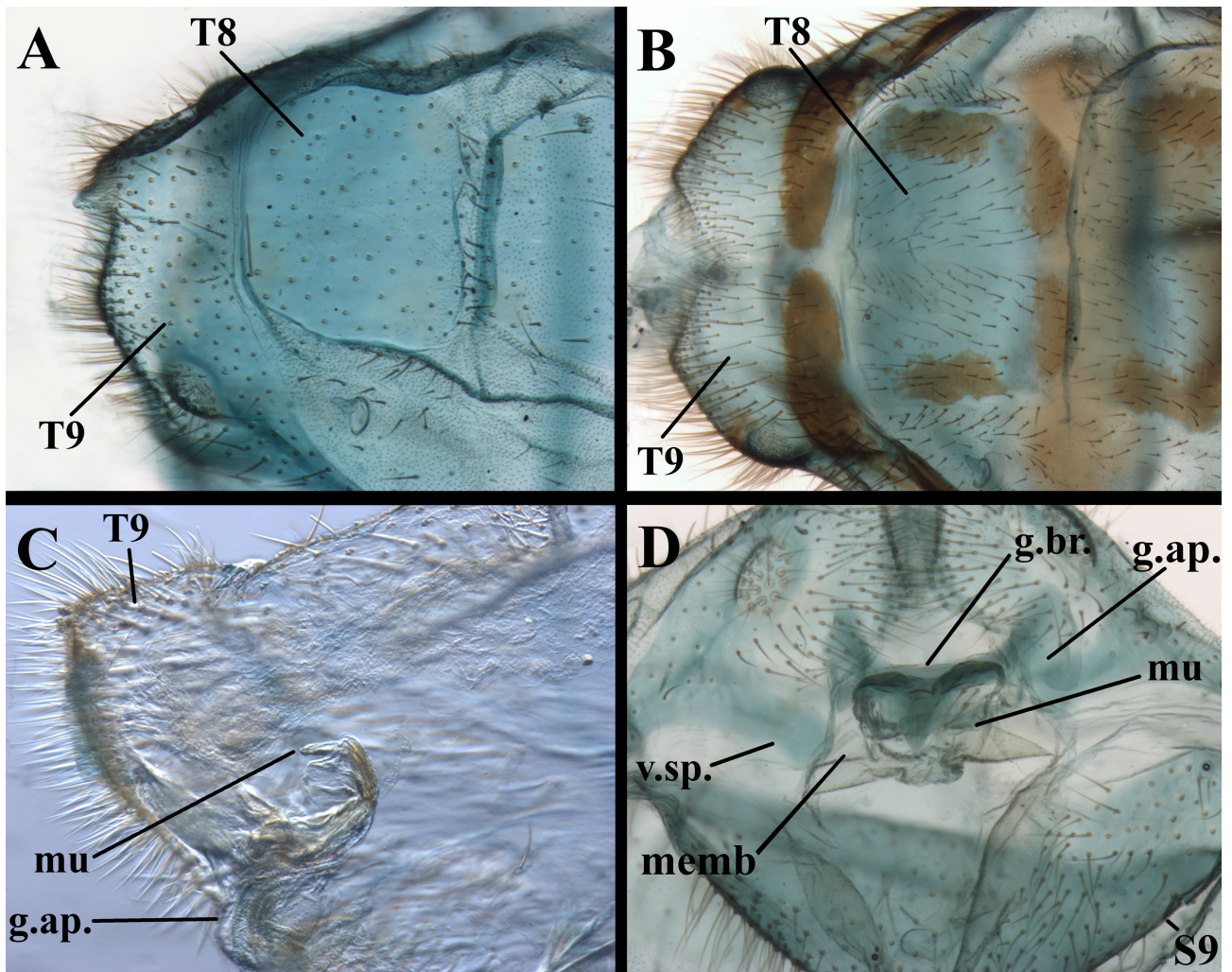


FIGURE 6. Terminus of male abdomen. A. *Pantaleonius toschiorum* sp.nov., eighth and ninth tergites, dorsal. B. *Abachrysa eureka* (Banks) eighth and ninth tergites, dorsal. C. *P. toschiorum* sp.nov., abdominal terminus, with gonarcal complex *in situ*, lateral, teneral. Note inverted position of gonarcus, with gonarcal apodemes located posterior to tip of mediuncus. D. *P. toschiorum* sp.nov., abdominal terminus with gonarcal complex *in situ*, slightly everted, caudal. Abbreviations: **g.ap.**, gonarcal apodeme; **g.br.**, gonarcal bridge; **memb**, stiff membrane between ventral spur of the dorsal apodeme to base of mediuncus; **mu**, mediuncus; **S9**, ninth abdominal sternite; **T8**, **T9**, eighth and ninth abdominal tergites; **v.sp.**, ventral spur of dorsal apodeme. [A, C: Exuma Island, CUIC; B: Alabama, TRC; D: Andros Island, FSAC].

Etymology of the species name. The species, *P. toschiorum*, is named in honor of the author's brother (recently deceased) and sister-in-law, Steven Richard Toschi and Mary Jane Toschi, a wonderful pair. In accordance with ICZN Article 31.1.2, the species name, which is formed from a family name that refers to both a male and a female person, is assigned the Latin, masculine, plural genitive ending “-orum”.

Diagnosis. Relative to other New World belonopterygines, this species is distinctive in its small body size, its bold head and body markings, and its lack of markings on the wings (Figs 1–2, 4). Externally, it is quite similar in size and coloration to *Pseudomallada luctuosus* (Banks), a relatively uncommon chrysopine species reported from central and southwestern United States. However, unlike the new species, *P. luctuosus* does not express the antennal features typical of belonopterygine lacewings. The male and female genitalia of the two species are very distinctive and should be used in making identifications (see Adams & Garland 1982 for *P. luctuosus* and Figs 5–11 here for *P. toschiorum*).

Description. Head. (n=4; Figs 1, 2A, 2B, 3). Width (frontal, including eyes) 1.35–1.72 mm; ratio of head width to eye width = 2.0–2.4 : 1; width between tentorial pits 0.41–0.46 mm; length mid-antenna to midway between tentorial pits 0.55–0.73 mm; length midway between tentorial pits to tip of clypeus ~0.20–0.26 mm. Scape with lateral margin straight, mesal margin rounded; vertex with surface smooth, cream on fresh specimens. Frons shiny, with

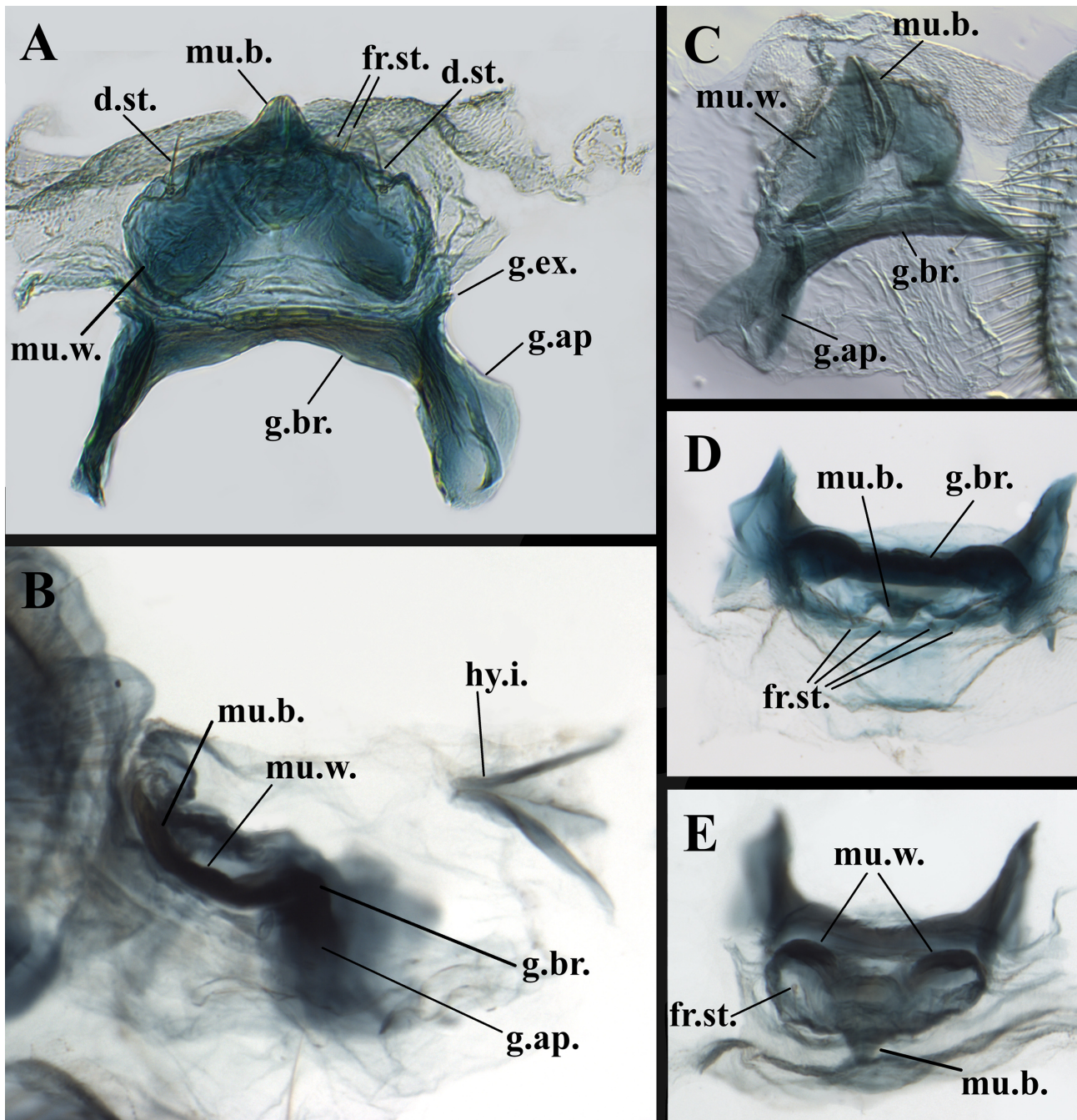


FIGURE 7. *Pantaleonius toschiurum* sp.nov. Gonarcular complex. A. Dorsal. B. Lateral, with hypandrium internum. C. Dorsal, showing internal structure of mediuncus. D. Frontal. E. Dorsofrontal. Abbreviations: **d.st.**, dorsal seta; **fr.st.**, frontal seta; **g.ap.**, gonarcular apodeme; **g.br.**, gonarcular bridge; **g.ex.**, dorsolateral extension of gonarcular apodeme; **hy.i.**, hypandrium internum; **mu.b.**, mediuncal beak; **mu.w.**, mediuncal wing. [All: Exuma Island, CUIC].

large torulli; epistomal suture not distinct, probably convex with slight transverse fold below. Clypeus with surface transversely striated, distal margin indented. Labrum rounded laterally, not withdrawn; distal margin indented mesally. Antennal length 8.4–9.2 mm (n=3); scape about equal in length and width [length 0.29–0.30 mm, width 0.27–0.30 mm (base, frontal, n=2 specimens, left and right each)]; flagellomeres short basally (length 0.10–0.13 mm, basal seven flagellomeres), becoming longer distally (length 0.11–0.12 mm, midantenna; length 0.14 mm, distal); ratio of flagellomere length to width = 1.0–1.6 : 1 basally, 2.3–2.5 : 1 distally; each flagellomere (except very basal ones) with setae in four rings, with fewer setae in fourth ring than in basal three rings. Most flagellar setae short, brown, extending distally; each flagellomere with one to two pairs of long, erect, white setae near distal margin. Mandibles broad throughout, asymmetrical; right mandible without mesal tooth, with inner margin of apex smooth,

crescent-shaped; left mandible with short, acute mesal tooth, inner margin of apex broadly J-shaped. Labium with ligula bulbous, bearing short stout setae basolaterally and fine long setae distally. Maxilla with stipe and galea broad, stout, extending beyond labrum in some specimens. *Coloration*: Largely cream with dark brown markings. Dorsum (vertex, dorsal torulli, scapes) with dark brown lateral stripe that extends posteriorly through cervix and pronotum. Face with torulli unmarked; frons with small oblong mark mesally, slightly below torulli, pair of lateral streaks extending from mesal surface of eye inward toward pair of spots on upper margin of clypeus; genae, lateral margins of clypeus dark brown; labrum amber, unmarked. Antenna: scape with wide, dark brown longitudinal stripe dorsolaterally; pedicel dark brown except tan frontobasally; flagellum with basal ~1/5 dark brown, distal ~4/5 light brown. Maxilla pale except galea bright orange, apex of cardo, lateral margin of stipe, and palp dark brown; labium pale, except palp dark brown distally, brown basally.

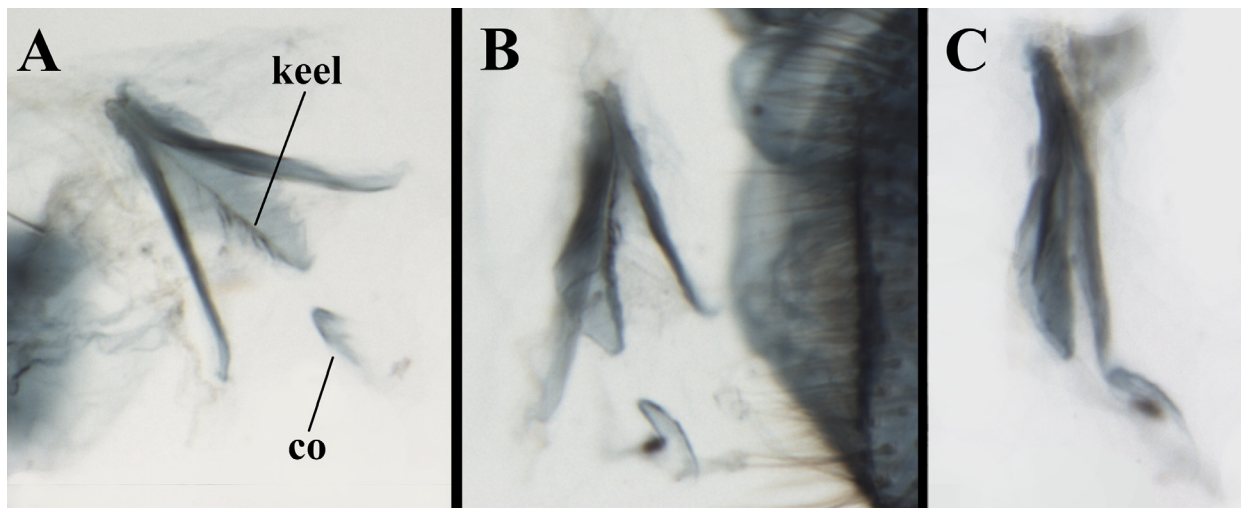


FIGURE 8. *Pantaleonius toschorum* sp.nov. Hypandrium internum. A. Dorsal. B. Ventrolateral. C. Lateral. Abbreviation: **co**, comes. [All: Exuma Island, CUIC].

Thorax. (n=4; Fig. 2). Robust; pronotum broad, 2.0–2.7 times wider than long; pronotum, mesonotum with long, dark setae. Legs long, slender; tibia with straight, elongate dorsal spur on distal margin; tarsal subsegments each with ~two pairs of small spurs embedded within tarsal setae along lateral margin; tip of pretarsus with pair of elongate slender setae; tarsal claws elongate, recurved, each with large quadrate base; tip of claw extending well below base; arolium large, membranous. *Coloration*: Background cream to amber. Pronotum with two pairs of dark brown longitudinal stripes, one submesal, one lateral. Mesothorax with prescutum bearing two pairs of dark brown oblong spots in longitudinal arrangement submesally and posterior margin with single fused, dark brown spot; scutum with two pairs brown spots; scutellum with elongate brown spot anteromesally, pair of brown spots above posterior margin. Metanotum gold, without marks. Pleural regions pale, unmarked. Legs pale, with setae gold to brown; protibia, mesotibia with brown transverse stripe frontolaterally that aligns with costal and radial crossveins of forewing; metatibia with similar, lighter stripe posterolaterally; tarsal claw amber to brown; arolium shiny, white.

Wings. (n=3; Fig. 4). Forewing length 12.0–13.1 mm, maximum height 4.3–4.8 mm; slightly broad throughout, with tallest portion of wing being third distal quadrant; height at distal end of basal quadrant 3.1–3.6 mm; height at basal end of distal quadrant 4.2–4.6 mm; anterior margin relatively straight; apex broad, rounded. Costal area slightly raised basally; tallest costal cell (*c9*, *c10*) tall, 0.17–0.19 times maximum height of wing. Subcosta, radius slightly sinuous to straight; most costal veinlets and radial crossveins straight or very slightly curved; basal sc-r crossvein 0.30–0.31 mm distal to crossvein between *mcu1* and *mcu2*, slightly less than half the distance to *Mf*. Eleven to twelve closed radial cells (*rarp*); height of tallest radial cell (#5, 6) 1.5–1.9x width. First rp-m crossvein meeting M at first intramedian cell (*mamp1*); *mamp1* triangular, composed of MA, MP, no distal crossvein (therefore true *im1* cell), width 0.74–0.82 times width of third medial cell (*mcu3*); gradate veins in two rows, with five to six inner gradates, five to six outer gradates, both rows regularly spaced, slightly divergent distally, with last pair of gradate veins convergent. Five *b* cells, five *b'* cells. Three intracubital cells; *icu1* slightly longer than *icu2*; *icu3* (*dcc*) open distally; CuP forked at *icu2*. Vein A1 forked. Hindwing length 10.7–12.0 mm, maximum height 3.6–4.1 mm; fairly broad throughout, with apex rounded. Nine to twelve radial cells (*rarp*); base of M merged with R, *t* cell

absent; five to six inner gradates; six outer gradate veins; three *b* cells; four 4 *b'* cells. *Coloration*: Forewing and hindwing hyaline, glossy; stigmata prominent, white with dark brown spots basally and distally. All longitudinal veins pale with large dark marks at each intersection; all veinlets, crossveins dark brown to black; setae dark.

Abdomen—Male. (n=4; Figs 5–8). *Exterior*: Texture of integument soft, flexible, with tendency to fold or tear. Tergites, sternites (except T9, S9) with sparse, medium-length, slender setae; T9+e, S9 with longer, more dense, slightly more robust setae. Microtholi inconspicuous but present distally on S7, widely on S8 (always absent from S9). Pleural region large, with medium-length to short, sparse setae; spiracles medium sized (length ~0.06–0.08 mm, width 0.03–0.05 mm), round, simple. Tergites (dorsal view) entire, without division or mesal suture visible, roughly quadrate with rounded sides, slightly broader than long; T9 and ectoproct entirely fused, without mesal suture dorsally; distal margin (dorsal view) straight to very slightly concave; ventral margin (lateral view) fairly straight, sloping steeply in straight line proximally, with basal section ending well below T8; dorsal apodeme extending through middle of T9+e, encircling callus cerci, with broad, rounded ventral spur/branch extending below callus cerci; areas ventral and distal to dorsal apodeme with elongate setae. Tip of ventral spur articulating with stiff scabrous membrane that extends below and slightly around tip of mediuncus. Callus cerci almost circular (height 0.15–0.17 mm, width ~0.12–0.14 mm), with ~29–30 trichobothria. Basal sternites tall, e.g., for S6, ratio of length to height (lateral view) = 2.0–2.1 : 1; S7 shorter, ratio of length to height = 0.72–0.87 : 1. Sternite S8+9 fully fused, with suture present (teneral specimens) or not visible (mature specimens); proximal margin approximately as tall as adjoining distal margin of S7; dorsal margin sloping very slightly through most of sternite; terminus truncate; ventral apodeme along dorsal margin of S8+9 lightly sclerotized (difficult to see in teneral specimens). Terminus of S9 with smooth, relatively straight margin; parameres, gonapsis absent. *Coloration*: Dorsum, pleural region cream, with dark brown to black spots in regular pattern, similar to female (Fig. 2C); venter cream to tan without spots (male only); callus cerci cream, encircled with dark brown ring.

Genitalia: Gonarcual complex slender, erect (lateral view), without gonocornua or frontal plate; gonarcual bridge straight, dorsoventrally flattened, with gonarcual apodemes extending perpendicularly from lateral margins. Gonarcual apodemes expanded and rounded distally, with frontal margin (at attachment to gonarcual bridge) bearing small protruding spurlike extensions dorsally and ventrally. Mediuncus flattened dorsoventrally, extending from frontal surface of gonarcual bridge, composed of mediuncal beak mesally and pair of round lateral wings attached to lateral margins of beak, with one to several relatively elongate setae projecting forward from distal margin; mediuncal beak bifurcated, bearing short, slender process mesally; area below mediuncus with scabriculous membrane (probably not a gonosaccus) extending from extensions of gonarcual apodeme, below mediuncal wings, around and above mediuncal beak, and attaching to ventral spur of T9+e dorsal apodeme. Hypandrium internum V-shaped, relatively large, with tall, elongate keel dorsally; comes sickle-shaped, smaller than keel. Gonosaccus, gonosetae absent.

Abdomen—Female. (n=2; Figs 2C, 2E, 9–11). *Exterior*: Integument soft, flexible, with tendency to fold or tear. Tergites, sternites (A2–A8) with relatively dense, long, slender setae throughout; pleural regions (A2–A7) with sparser, smaller setae. T9+e, gonapophyses laterales, with dense, short setae throughout; pleural region large, with sparse, medium-length to short setae. Spiracles oblong (length ~0.04–0.06 mm, width 0.03–0.05 mm), with simple atria. Tergites, sternites quadrate, with relatively straight margins (lateral view), rounded corners. S6 (lateral view) approximately same length as height; S7 ~2 times longer than tall (lateral view: length along ventral margin, height along basal margin), with dorsal margin straight over basal three quartiles, steeply sloped over distal quartile. Ninth tergite short; dorsal surface smooth, entire, without mesal suture; proximal margin with shallow invagination; apical margin with deep, round invagination (Figs 8C, 8E). T9 and ectoproct fused, with suture and indentation visible below callus cerci, with lateral margins expanding abruptly below level of anus, becoming very broad ventrally, sometimes extending over entire lateral surface of gonapophyses laterales (width of T9+e along ventral margin >0.6 times entire length of T9+e). Callus cerci ~round (height 0.12–0.13 mm, width 0.13–0.14 mm), with approximately ~35 trichobothria. Gonapophyses laterales slender, crescent shaped (height ~0.60 mm, width ~0.15 mm). Subgenitale relatively small, externally visible as protruding knob; base largely membranous with slender, lightly sclerotized lateral arms supporting knob. Praegenitale slender, transversely elongate, embedded in membrane below subgenitale and above tip of S7. (The praegenitale is obvious in mature, sclerotized specimens. In teneral specimens, it is not visible, but the robust membrane between the subgenitale and the tip of S7 is elongate.) *Coloration*: Exterior cream to tan with dark brown to black marks as follows: tergites of each segment with one pair of large spots anteriorly, two pairs of spots (sometimes coalesced) posteriorly; pleuron of each segment with spot anteriorly, two posteriorly; sternites S4 and S5 dark brown to black (female only).

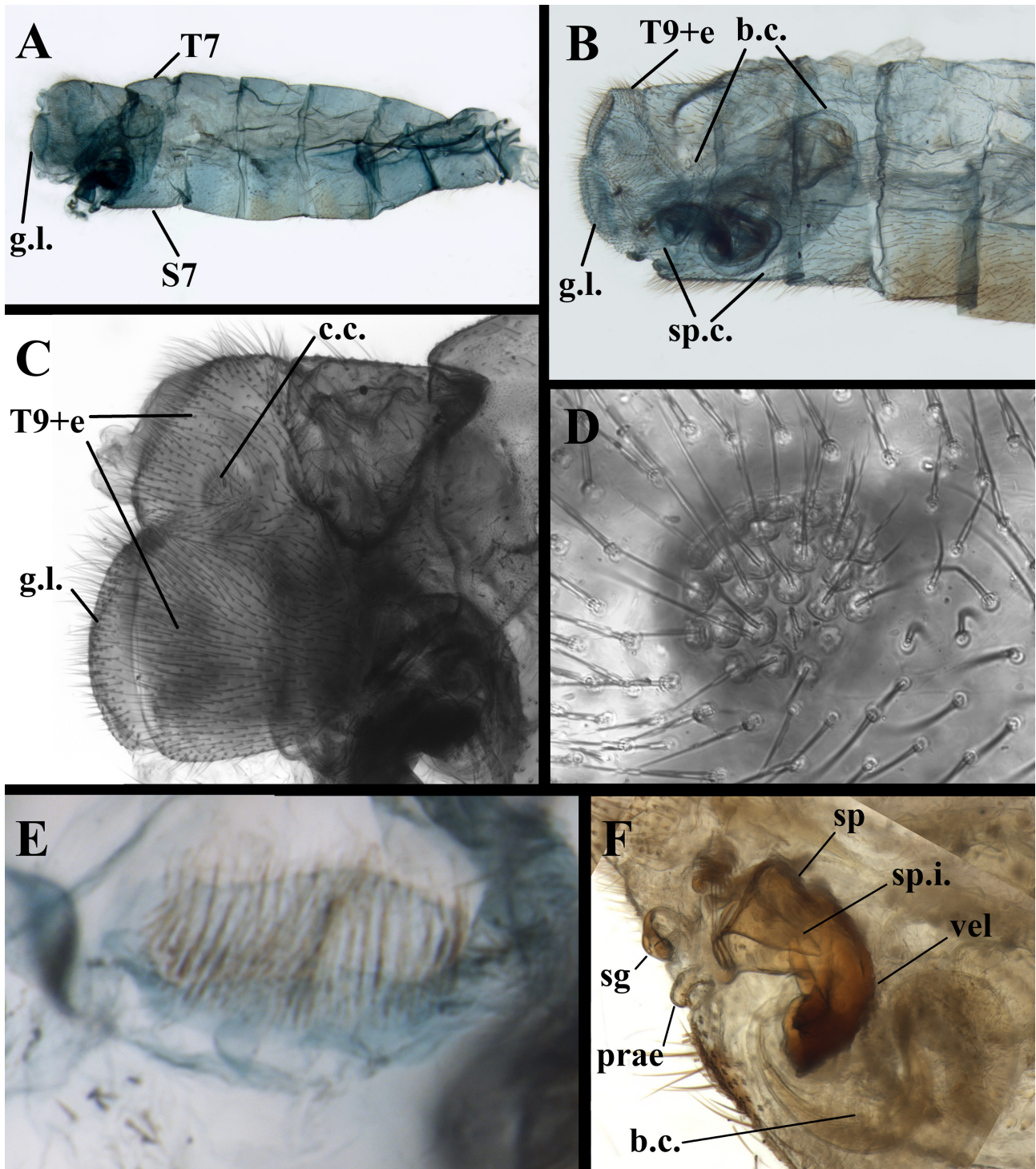


FIGURE 9. *Pantaleonius toschiorum* sp.nov. Female abdomen. A. Abdominal segments A2-terminus, lateral. B. Terminal abdominal segments with genitalia, lateral. C. Abdominal segments A8-A9+ectproct, lateral. D. Callus cerci. E. Transverse sclerite. F. Genitalia, lateral. Abbreviations: **b.c.**, bursal complex; **c.c.**, callus cerci; **g.l.**, gonapophysis lateralis; **prae**, praegenitale; **sg**, subgenitale; **sp**, spermatheca; **sp.c.**, spermathecal complex; **sp.i.**, spermathecal invagination; **S7**, seventh abdominal sternite; **T7**, seventh abdominal tergite; **T9+e**, ninth abdominal tergite and ectoproct; **vel**, velum. [A, C–E: Exuma Island, CUIC; B: Andros Island, FSCA; F: Dominican Republic, CMNH].

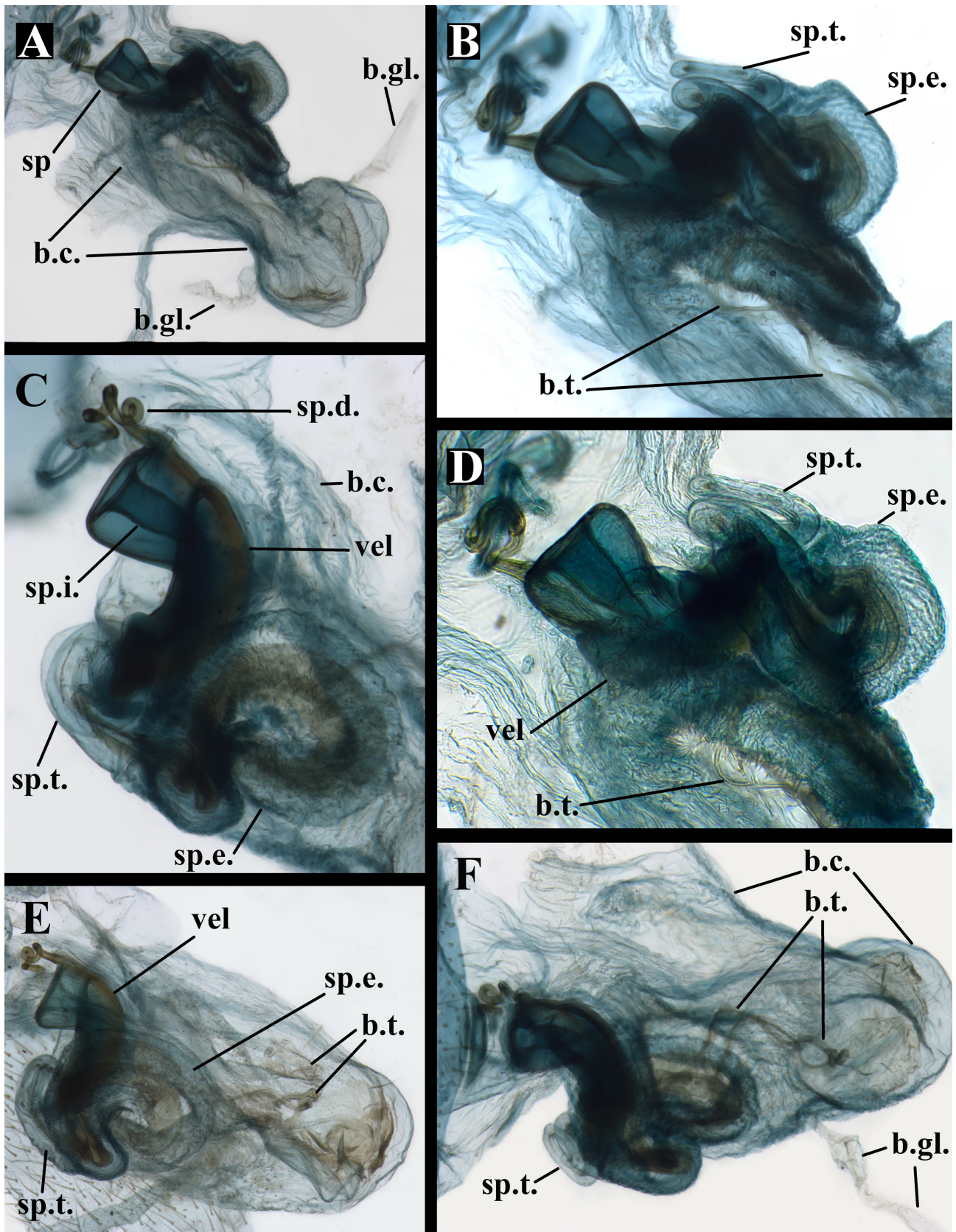


FIGURE 10. *Pantaleonius toschiurum* sp.nov. Female genitalia. A. Genital complex, ventral. B–D. Spermathecal complex, ventral (B, D) and lateral (C). E, F. Bursal complex, lateral. Abbreviations: **b.c.**, bursa copulatrix; **b.gl.**, bursal gland; **b.t.**, tubule within bursa copulatrix; **sp**, spermatheca; **sp.d.**, spermathecal duct; **sp.e.**, external section of spermatheca running into bursa copulatrix; **sp.i.**, spermathecal invagination; **sp.t.**, tubular section of spermatheca leading to closed end; **vel**, velum. [A–D, F: Exuma Island, CUIC; E: Andros Island, FSAC].

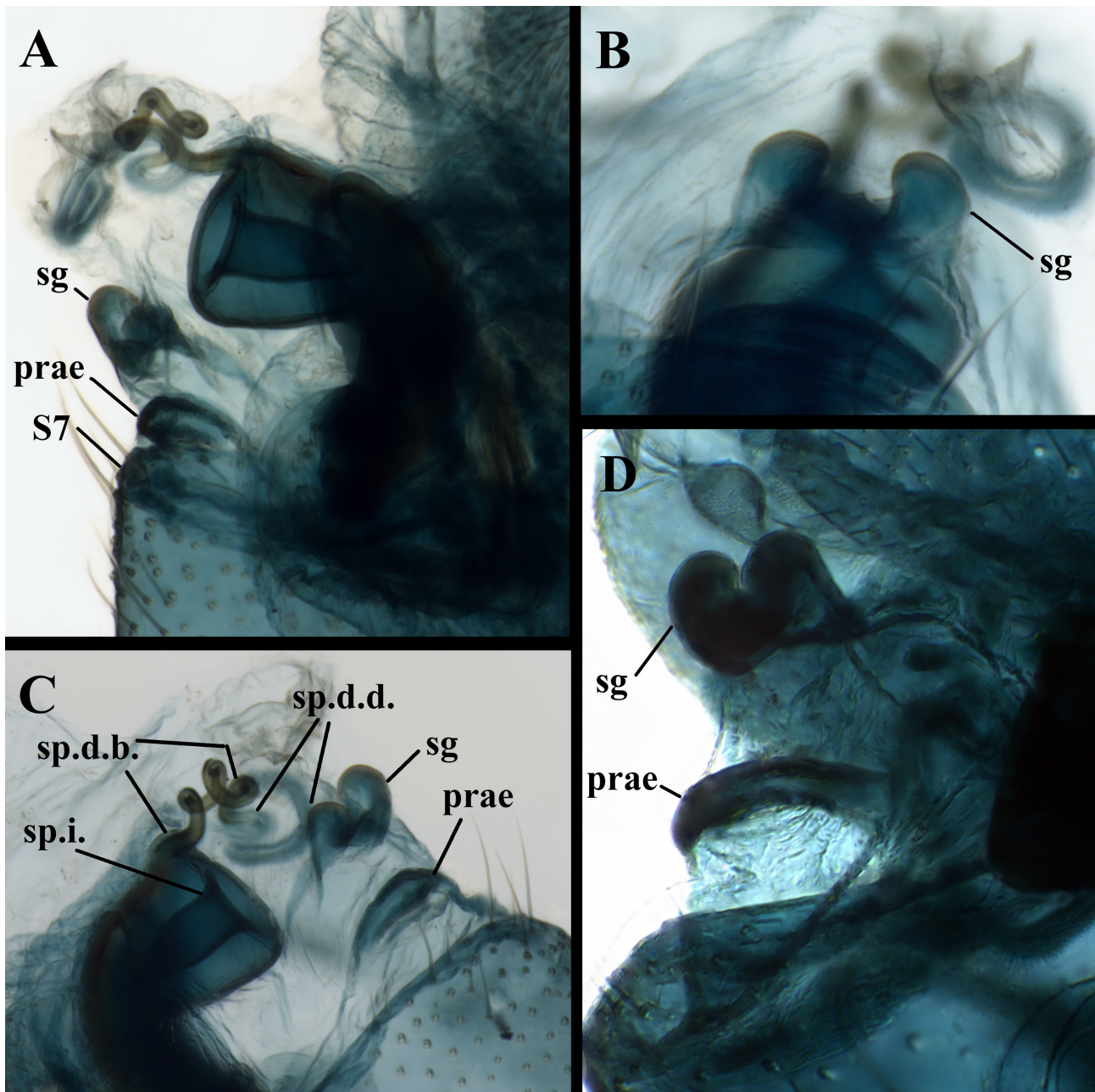


FIGURE 11. *Pantaleonius toschiorum* sp.nov. Subgenitale and associated structures, *in situ*. A. Lateral. B. Dorsal. C. Caudolateral. D. Caudoventral. Abbreviations: **prae**, praegenitale; **sp.i.**, spermathecal invagination; **sg**, subgenitale; **sp.d.b.**, basal (sclerotized) section of spermathecal duct; **sp.d.d.**, distal (brushy) section of spermathecal duct; **S7**, seventh abdominal sternite. [All: Exuma Island, CUIC].

Genitalia: Internal female genitalia large, filling most of S7 abdominal cavity (Fig. 9A, 9C). Spermatheca tubula, bent, tapering; length (opening to U-shaped bend) 0.80 mm, width at mouth 0.22 mm, with prominent, U-shaped invagination (width 0.11 mm, depth 0.20 mm) (Fig. 9F). Dorsal surface of spermatheca with large velum giving rise to spermathecal duct; base of spermathecal duct and velum with slit along their dorsal surfaces; slit contiguous with bursa copulatrix. Spermathecal duct straight, attached to top of spermathecal base, becoming tightly coiled after extending from spermathecal opening, length ~1.15 mm, with basal ~half slender and smooth, distal ~half brushy, partially attached to membrane within and above subgenitale. Distal end of spermatheca bent, bifurcated; far section giving rise to smooth, robust, moderately slender tube with two fully circular curves leading to closed end (Fig. 10D, **sp.t.** on figure); basal section (with internal tubule), making sharp, U-shaped turn, and extending back along dorsal surface of spermatheca, becoming textured and delicately fluted, ultimately coalescing with large circular

pouch on side of bursal copulatrix (Fig. 10E, **sp.e., b.t.** on figure). Bursa copulatrix large, saclike; basal section near spermatheca with irregular folds; distal section large, membranous, relatively smooth, with pair of sclerotized, very slender, elongate, intertwined tubules extending proximally. Single pair of elongate bursal glands extending laterally from distal section of bursa. Colleterial complex consisting of very delicate membranes; structures not distinguished. Transverse sclerite roughly rectangular, slightly expanded in middle, with numerous elongate setae extending dorsally (Fig. 9E).

Specimens examined. In addition to the Holotype, twenty-one paratypes (15♀, 6♂) from the West Indies: **Bahamas:** Andros Island, Forfar Field Station, nr. Stafford Creek, 9-VI-2009, M. Thomas (1♀, 1♂, FSCA), 25-July-2006, M. Thomas & T. Smith (4♀, 1♂, FSCA); Eleuthera Island, Rainbow Bay, I-VII-1958, E. W. & D. B. Wiley (1♀, FSCA); Great Exuma Island, Simons Pt., 23.31.50–75.47.30, 17–26 Jan 1980, Tim. L. McCabe (7♀, 4♂, CUIC); South Bimini Island, 12-vi-1950, Cazier & Rindge (1♀, AMNH). **Greater Antilles:** Dominican Republic, La Altagracia, 2 km N Bayahibe, 18-23N, 68-41W, 10 m., 3-July-1992, C. Young, R. Davidson, S. Thompson, J. Rawlins, Dry seasonal forest on limestone (1♀, CMNH).

Known geographic distribution. West Indies. Four islands of the **Bahamas** (Andros, South Bimini, Eleuthera, and Great Exuma); one island of the **Greater Antilles** (Hispaniola).

Part 2. Redescription of *Abachrysa eureka* (Banks, 1931) (Figs. 6, 12–22)

Taxonomic Synonymy (selected references).

Chrysopa eureka Banks, 1931, *Psyche* 38: 174; “Hope, Ark., 22 Aug. (L. Knobel), at light”. Holotype in Museum of Comparative Zoology”; only one specimen mentioned, sex unknown, not examined.

Abachrysa eureka (Banks). Banks 1938: 75 [new combination, designated type species of new genus *Abachrysa* Banks]. Brooks & Barnard 1990: 164-5, 266 [redescription, figures]; Garzón-Orduña *et al.* 2019 [phylogeny within Neuroptera]; Winterton *et al.* 2019 [phylogeny within Neuroptera]; Tauber *et al.* 2020: 481 [description of first and third instars, images, biology, myrmecophily, evolutionary considerations].

Diagnosis. *Abachrysa eureka* is distinguished from other New World belonopterygines by its fairly large, robust body and distinctive markings; head gold, without markings, except pedicel black, flagellum mostly black, only distal ¼ pale; labial and maxillary palpi black distally; venter of thorax and abdomen heavily marked with black spots throughout; legs pale, except tarsal tips, tibial bases, femoral tips black. Forewing somewhat narrow, with most or all veinlets reaching posterior margin forked (except 3A and 1–2 small veinlets). Male genitalia with large, paired, elaborate parameres; female with praegenitale (*sensu* Tjeder 1966) tubule-like, looping externally from base to tip of subgenitale.

Redescription. Head. (n=3; Figs 12 & 13). Width (frontal, including eyes) 2.3–2.4 mm; ratio of head width to eye width = 4.1–5.0 : 1; width between tentorial pits 0.72–0.73 mm; length mid-antenna to midway between tentorial pits 0.55–0.73 mm; length midway between tentorial pits to tip of clypeus ~0.60–0.65 mm. Scape with lateral margin straight, mesal margin slightly rounded; vertex rounded, raised posteriorly, with surface smooth, shiny. Frons smooth, shiny, with large torulli; epistomal suture slightly convex with slight transverse fold below. Clypeus with surface transversely striated, distal margin indented. Labrum rounded laterally, not withdrawn; distal margin deeply indented mesally. Antennal length 12.9–13.6 mm (n=2 from one specimen); scape slightly wider than long; basal flagellomeres (#2-#6) with length 0.13–0.16 mm, width 0.15–0.17 mm, ratio of length to width = 0.87–0.93 : 1; flagellomeres (midantenna) of similar length (0.13–0.16 mm), smaller width (0.10–0.12 mm), higher ratio of length to width = 1.2–1.4 : 1). Flagellar setae short, brown, positioned in four rings, with consistently fewer setae in fourth ring than in three basal rings; almost all flagellar setae extending distally; each flagellomere with pair of pale laterally projecting setae near edge of distal margin. Mandibles broad, symmetrical, heavy throughout; both mandibles with mesal tooth, with inner margin straight after tooth. Labium with ligula bulbous, bearing numerous stout setae basolaterally, numerous fine setae distally. Maxilla with stipe robust; galea large, greatly expanded distally, extending well beyond labrum in most specimens; all segments densely setose. *Coloration:* Head gold, without markings. Antenna: scape gold; pedicel, basal ¾ flagellum black; distal ¼ flagellum pale; labrum gold, unmarked. Maxilla with distal three palpomeres black, basal two pale; galea, cardo, stipe pale. Labium with distal palpomere black, middle palpomere black laterally, basal palpomere pale,

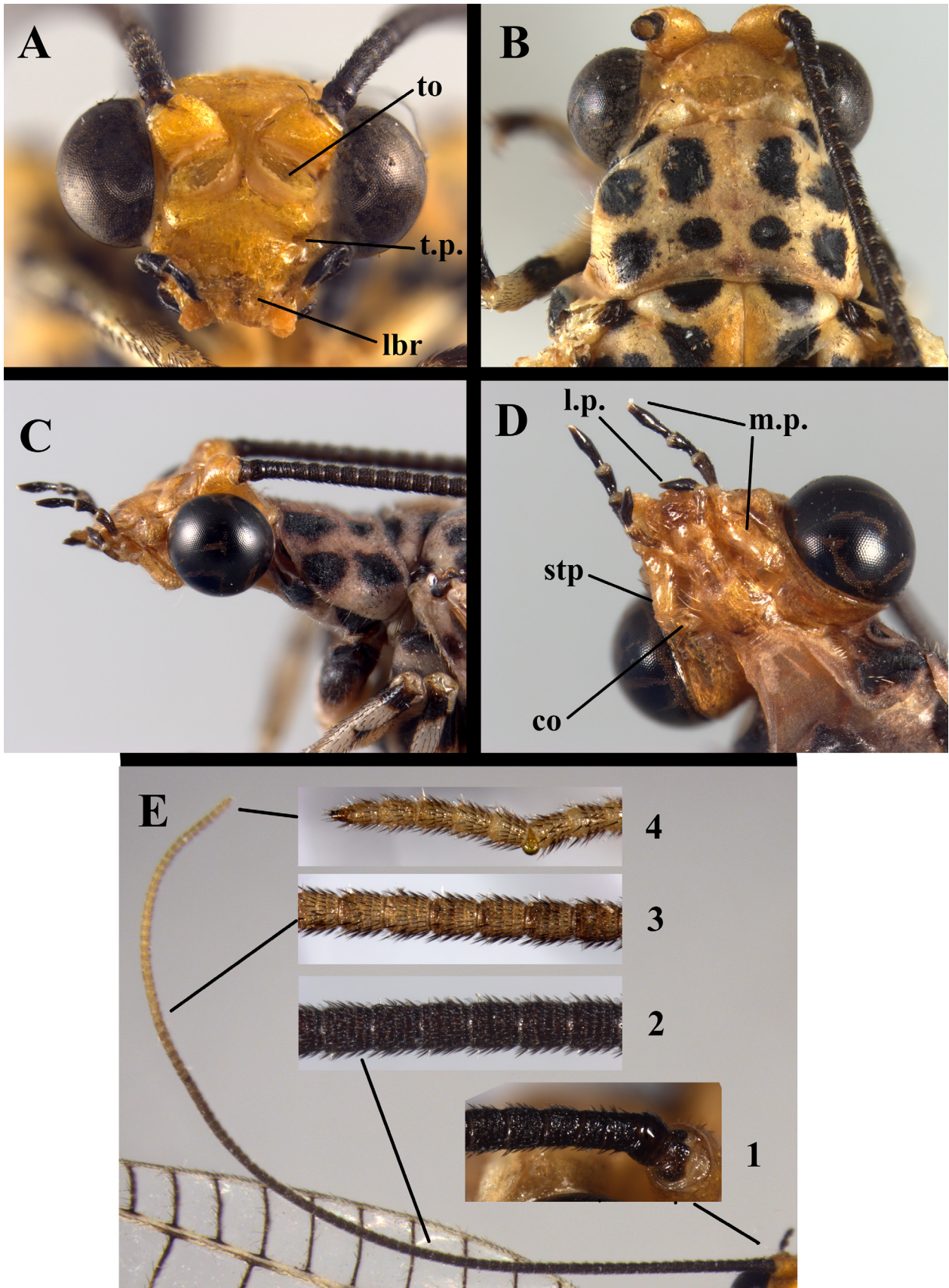


FIGURE 12. *Abachrysa eureka* Banks. Head and antenna. A. Head, frontal. B. Head, prothorax, dorsal. C. Head, prothorax, lateral. D. Head ventral. E. Antenna, dorsal and close-up: E1. Pedicel and basal flagellomeres. E2. Flagellomeres near base. E3. Flagellomeres midantenna. E4. Terminal flagellomeres. Abbreviations: **co**, cardo; **lbr**, labrum; **l.p.**, labial palp; **m.p.**, maxillary palp; **stp**, stipe; **to**, torulus; **t.p.**, tentorial pit. [All: Alabama, female, TRC].

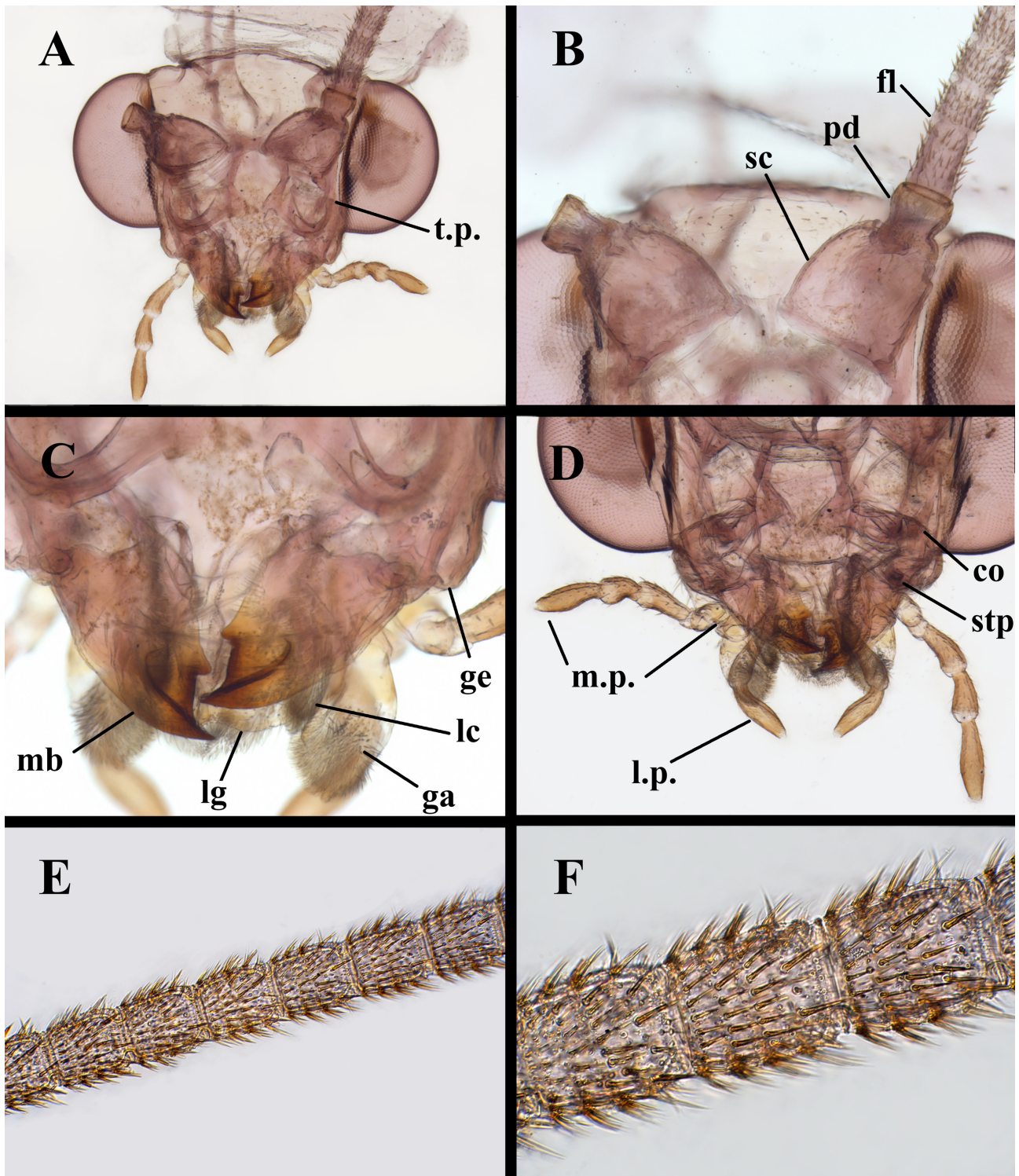


FIGURE 13. *Abachrysa eureka* Banks. Head and antenna, cleared. A. Head, frontal. B. Upper region of head, frontal. C. Lower region of head, frontal. D. Lower region of head, ventral. E, F. Flagellomeres, midantenna, E. x100, F. x200. Abbreviations: **co**, cardo; **fl**, flagellum; **ga**, galea; **ge**, gena; **lc**, lacinia; **lg**, ligula; **l.p.**, labial palp; **mb**, mandible; **m.p.**, maxillary palp; **pd**, pedicel; **sc**, scape; **stp**, stipe; **t.p.**, tentorial pit. [All: Florida, female, TRC].

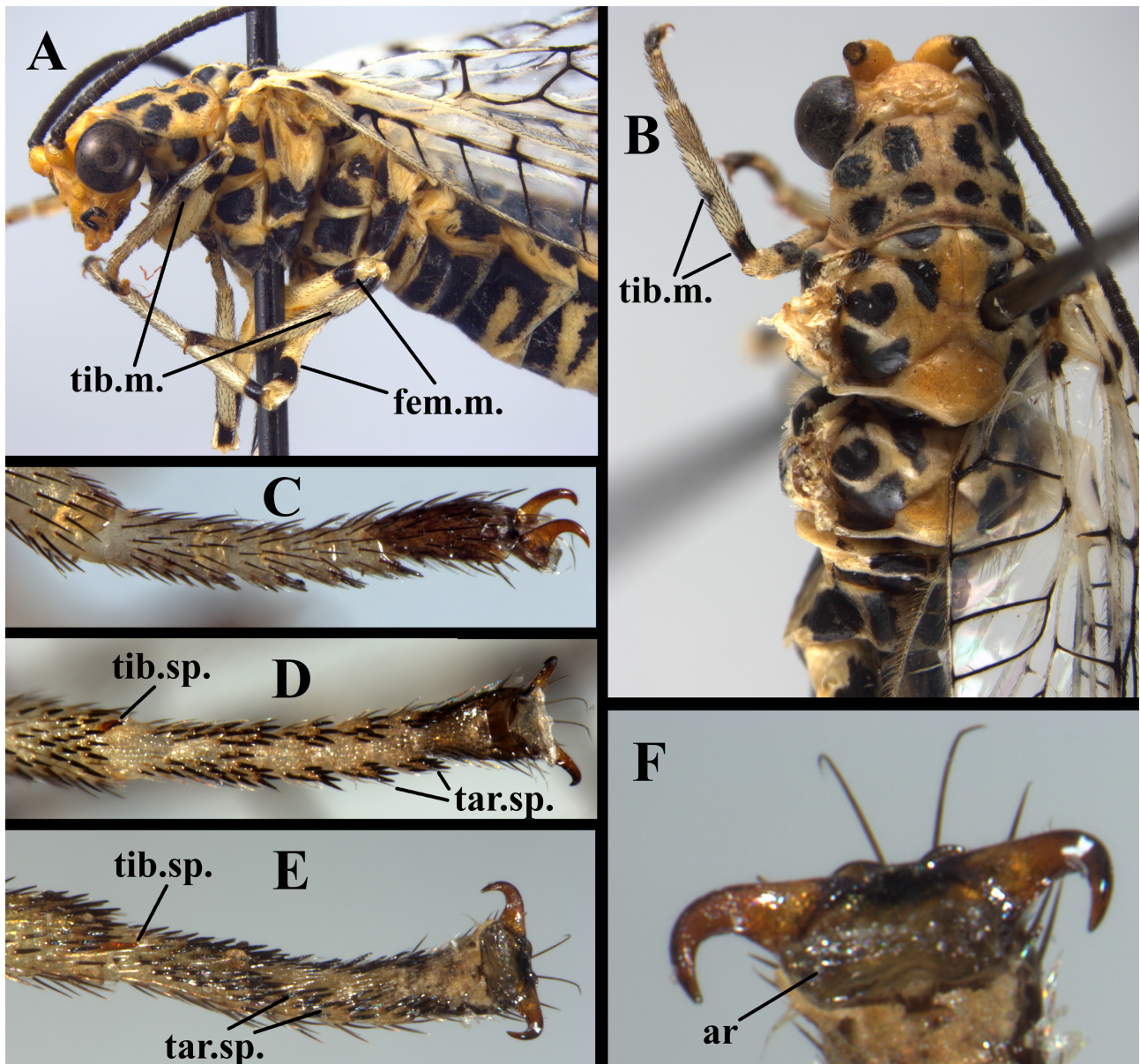


FIGURE 14. *Abachrysa eureka* Banks. Thorax, legs. A. Head, thorax, anterior abdomen, lateral. B. Head, thorax, dorsal; note double marking on tibia. C. Metatarsus, dorsal; note distal tarsomere black. D. Metatarsus, ventral; note tibial and tarsal spurs. E. Metatarsus, ventrolateral; note tibial and tarsal spurs; F. Metatarsal claw, ventral. Abbreviations: **ar**, arolium; **fem.m.**, femoral marking; **tar.sp.**, tarsal spur; **tib.m.**, tibial marking; **tib.sp.**, tibial spur. [A–D: Alabama, female, TRC; E–F: Florida, female, TRC].

Thorax. (n=2; Fig. 14). Robust; pronotum broad, width ~two times greater than length, with small lateral patch of medium-length, pale setae, with sparse, short, dark setae elsewhere; mesonotum, metanotum with relatively few short, dark setae. Legs robust with short, dark setae; mesotibia, metatibia with small, brown spur on distal margin; protibia without distal spur; tarsal subsegments with ventral setae modified as robust spurs along lateral edge; pretarsus with pair of elongate, slender setae, pair of shorter setae; tarsal claws simple, recurved, without quadrate base, with tip not greatly extended beyond base. **Coloration:** Background cream to amber. Pronotum with four pairs of large, round, dark brown spots, evenly arranged over surface. Membranous region behind prothorax, anterior to wing base, with two pairs of dark brown spots. Mesonotum with prescutum bearing pair of large dark brown spots on frontal margin, posterior margin with single pair of irregularly shaped dark brown spots; scutum with two pairs of brown spots; scutellum gold, without marks. Metanotum with each side of scutum bearing round, dark brown marks above and below; scutellum gold, without marks. Pleural regions cream, each segment with large dark brown spots. Legs light cream, with dark brown setae; femur with dark brown mark distally; tibia with dark brown spot basally,

smaller dark lateral spot at $\frac{1}{4}$ distance from femoral junction (spot also present on metatibia, but sometimes very small); distal tarsomere with dorsal surface dark brown; pretarsus with claws and arolium dark amber to brown.

Wings (n=2; Fig. 15). Forewing length 18.0–19.0 mm, maximum height 5.7–6.1 mm; slightly broad throughout, with tallest portion of wing being about midwing; height at distal end of basal quadrant 4.5–4.9 mm; height midwing 5.6–6.0 mm; height at basal end of distal quadrant 5.3–5.6 mm; anterior margin relatively straight; apex rounded with very slight angulation at tip. Costal area slightly expanded basally; tallest costal cell (*c5*) 0.20–0.21 times maximum height of wing. Subcosta, radius slightly sinuous to straight; subcosta bordered by abrupt fold basally which tends to obscure view of sc-r crossvein; most costal veinlets, radial crossveins straight or very slightly curved; basal sc-r crossvein ~ 0.35 – 0.69 mm distal to crossvein between *mcu1* and *mcu2*, slightly more than half the distance to *Mf*. Ten to eleven closed radial cells (*rarp*), height of tallest radial cell (*rarp5*) 1.4–1.7 times width. First rp-m crossvein meeting M at first intramedian cell (*mamp1*); *mamp1* triangular in shape, composed of MA, MP, no distal crossvein (therefore true *im1* cell), width ~ 0.55 times width of third medial cell (*mcu3*); gradate veins in two rows (sometimes with a single additional gradate vein), with five to six inner gradates, six to seven outer gradates, both rows regularly spaced, slightly divergent distally, with last pairs of gradates convergent. Three to four *b* cells, four to five *b'* cells. Three intracubital cells: *icu1* usually, but not always longer than *icu2*; *icu3* open distally; CuP forked at *icu2*. Vein A1 forked. Hindwing fairly broad, with apex rounded; length 16.0–17.1 mm, maximum height 4.8–5.3 mm. Eleven radial cells (*rarp*); base of M merged with R, *t* cell absent; five inner gradates; seven outer gradate veins; three *b* cells; four 4 *b'* cells. **Coloration:** Forewing, hindwing hyaline, glossy; stigma prominent, white with dark brown suffusion around subcostal crossveins. All longitudinal veins pale with large dark marks at each intersection; most at base of hindwing pale; all veinlets and crossveins dark brown to black; radial crossveins, crossveins below PsM with pale areas mesally; setae dark.

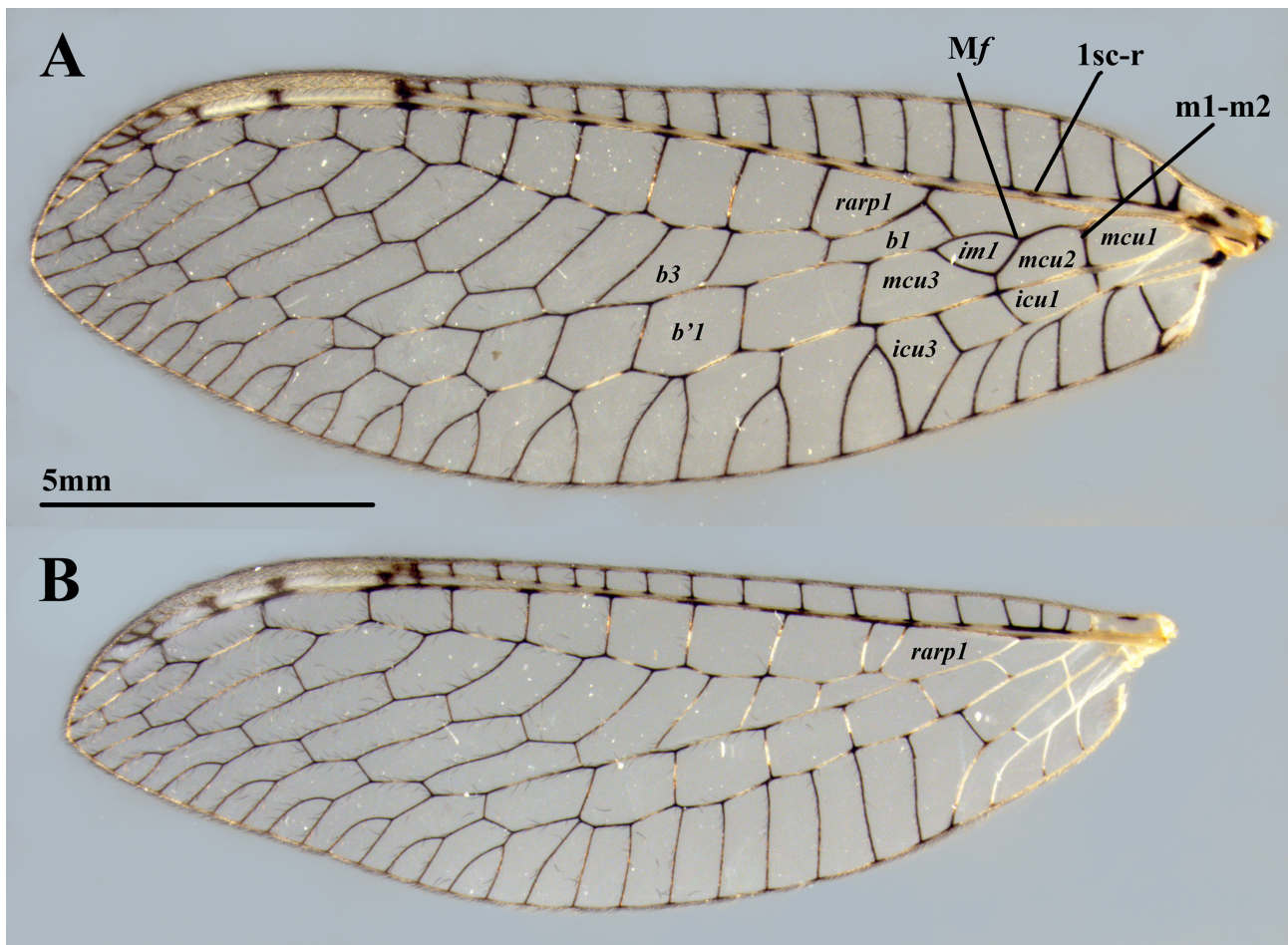


FIGURE 15. *Abachrysa eureka* Banks. A. Forewing. B. Hindwing. Scale applies to both A and B. Forewing length: 19.1 mm; hindwing length: 17.1 mm. Abbreviations: *b1*, *b3*, first and third *b* cells; *b'1*, first *b'* cell; *icu1*, *icu3*, first and third intracubital cells; *im1*, first intramedian cell (*mamp1*); *mcu1*, *mcu2*, *mcu3*, first, second, and third medial cells; *m1-m2*, crossvein between *mcu1* and *mcu2*; *Mf*, furcation of M; *rarp1*, first radial cell; *1sc-r*, first subcostal crossvein. [A, B: Alabama, female, TRC].

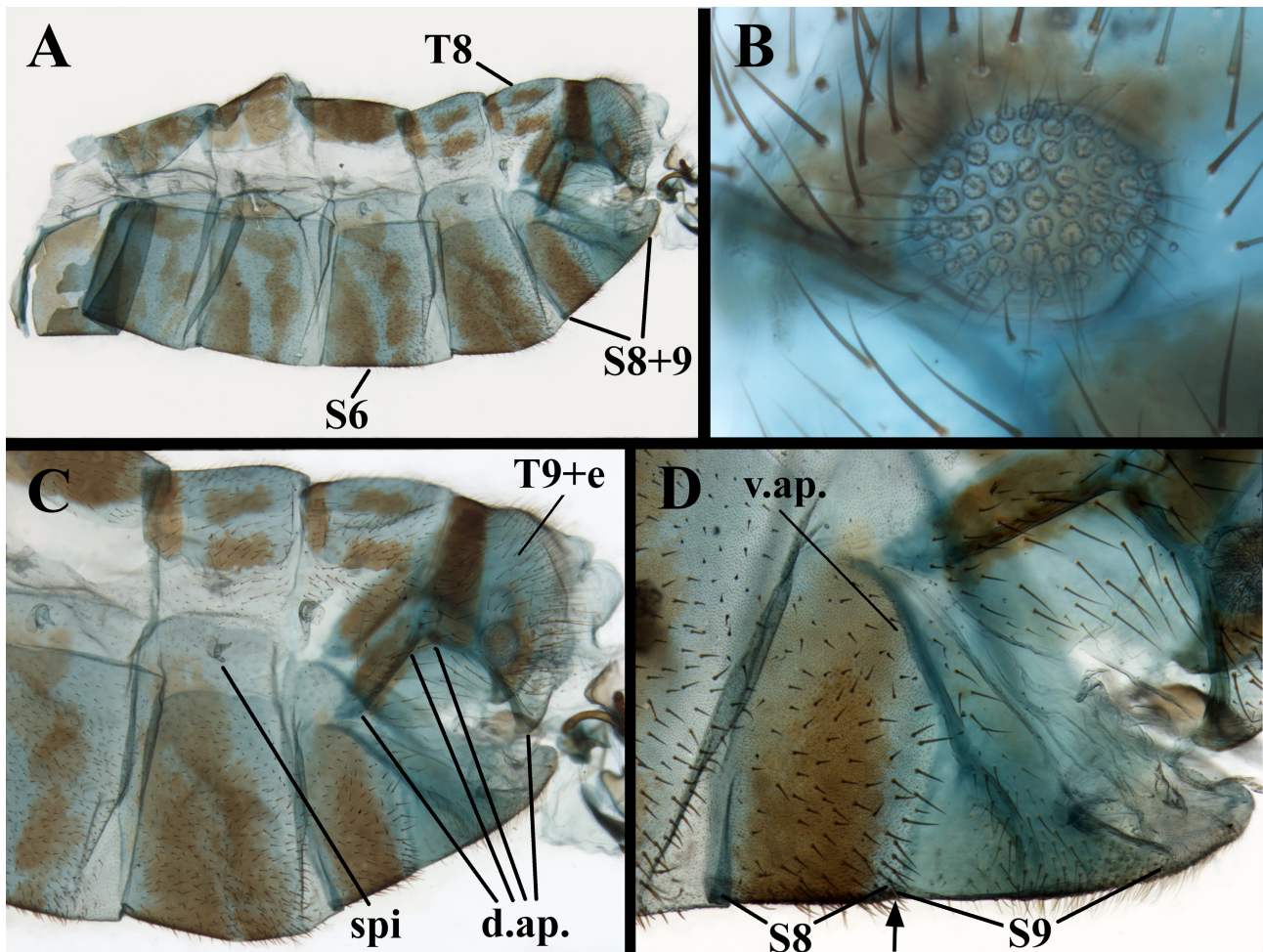


FIGURE 16. *Abachrysa eureka* Banks. Male abdomen. A. Segments A4 to terminus, lateral. B. Callus cerci. C. Segments A6 to terminus, lateral; Note the two sections of the inverted V-shaped dorsal apodeme. D. Eighth and ninth sternites, lateral; arrow indicates fused suture line between S8 and S9; two sections of dorsal apodeme visible. Abbreviations: **d.ap.**, dorsal apodeme; **spi**, spiracle; **S6**, **S8**, **S9**, sixth, eighth, and ninth sternites; **S8+9**, fused eighth and ninth sternites; **T8**, eighth abdominal tergite; **T9+e**, fused ninth tergite and ectoproct; **v.ap.**, ventral apodeme. [All: Alabama, TRC].

Abdomen—Male. (n=2; Figs 16–18). *Exterior:* Texture of integument soft, flexible, with tendency to fold or tear. All tergites, all sternites, pleural region of A8 (only) with short to medium-length, sturdy setae; T9+e with longer, more dense setae. Microtholi present at least on S6–S8. Pleural regions proximal to A8 mostly without setae; spiracles medium-sized, round, simple, with two atria. Tergites (dorsal view) roughly quadrate with rounded corners, almost twice as wide as long; dorsum of T9 short, fully fused with ectoproct, moderately bilobed distally (dorsal view), with dorsal surface entire, slight suggestion of mesal suture; lower margin of T9+e (lateral view) fully lined by slender dorsal apodeme with inverted V-shape; distal leg of V with small hook at terminus, then curving slightly upward, extending along entire ventral surface of T9+ectoproct, below callus cerci, to junction near T8; proximal leg of dorsal apodeme extending anteroventrally well into basal section of A8, ending near proximal peak of S8. Surface between legs of apodeme with long, robust setae similar to those on T9+e. Callus cerci circular (height 0.25 mm, width ~0.29 mm), with ~53–54 slender trichobothria. Basal sternites tall, e.g., for S4–S6, ratio of length to height (lateral view) = ~0.82 : 1; S7 shorter, ratio of length to height = ~0.75 : 1.

Sternites 8 and 9 fully fused, but marked by prominent line of fusion (suture); S8 with short, stout setae, proximal apex slightly lower than adjoining distal margin of S7; S9 with surface smooth, unmarked, bearing longer, finer setae than S8; ventral apodeme visible below dorsal margin of S8&9, sloping through upper region of distal S8, terminating in ventral region of mid-S9. Terminus of S9 relatively broad, straight, smooth, with robust, scabrous membrane folded internally; gonapsis absent, parameres present. *Coloration:* Cream with dark markings as in Figs 16 and 19. Callus cerci cream with black slash distoventrally.

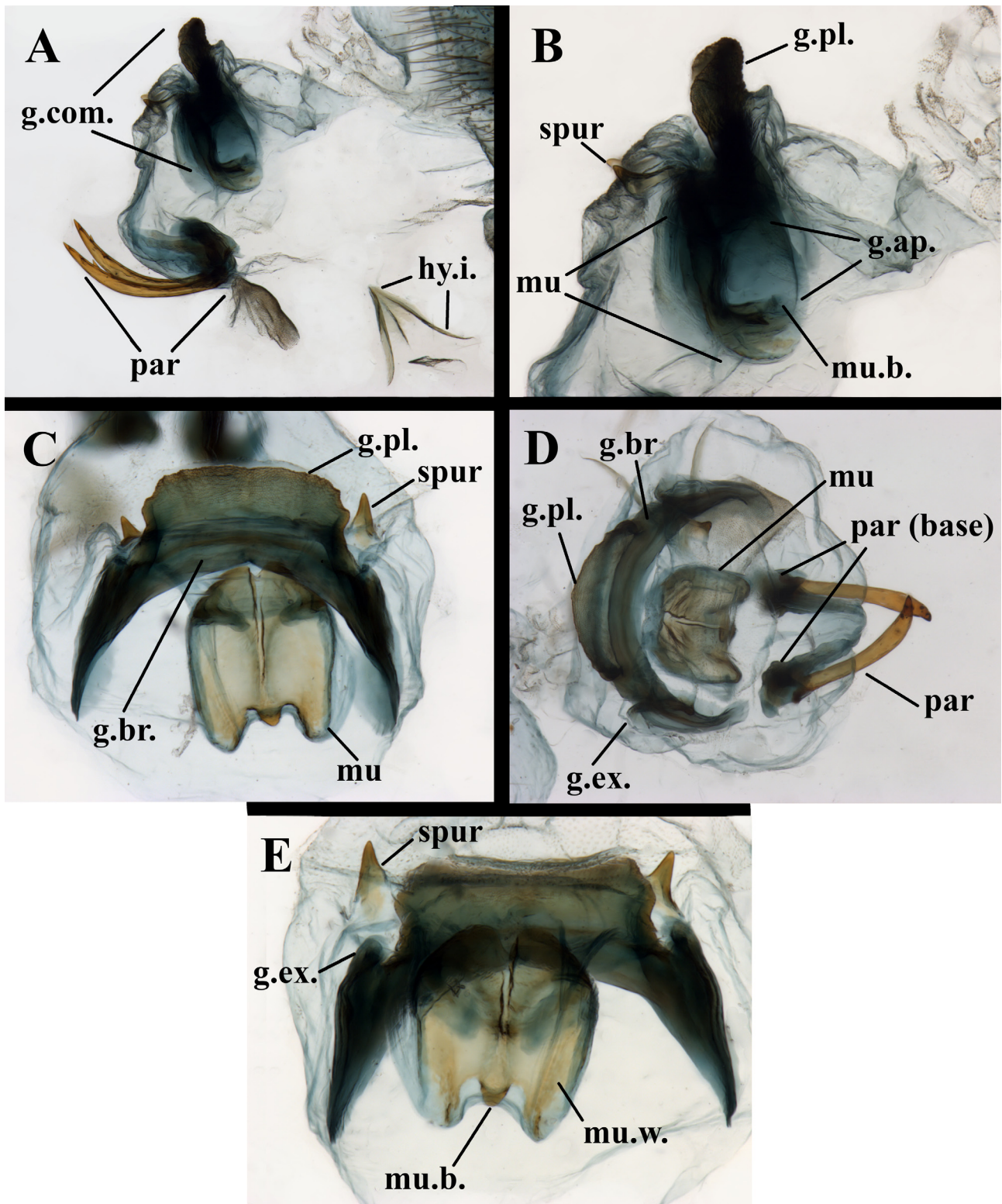


FIGURE 17. *Abachrysa eureka* Banks. Gonarcus complex. A. Lateral, with all genitalic parts for size comparison. B. Gonarcus, lateral, with mediuncus visible beneath gonarcapodeme. C. Gonarcus, dorsal, showing full extent of gonarcaplate. D. Gonarcus, posterodorsal, showing separation between gonarcal bridge and gonarcaplate. E. Gonarcus, frontodorsal, showing full view of gonarcal spur. Abbreviations: **g.ap.**, gonarcapodeme; **g.br.**, gonarcal bridge; **g.com.**, gonarcus complex; **g.ex.**, dorsolateral extension of gonarcapodeme; **g.pl.**, gonarcaplate; **hy.i.**, hypandrium internum; **mu.**, mediuncus; **mu.b.**, mediuncal beak; **mu.w.**, mediuncal wing; **par.**, paramere; **par (base)** base of paramere; **spur**, gonarcal process that is neither fused nor articulated with the gonarcus. [All: Alabama, TRC].

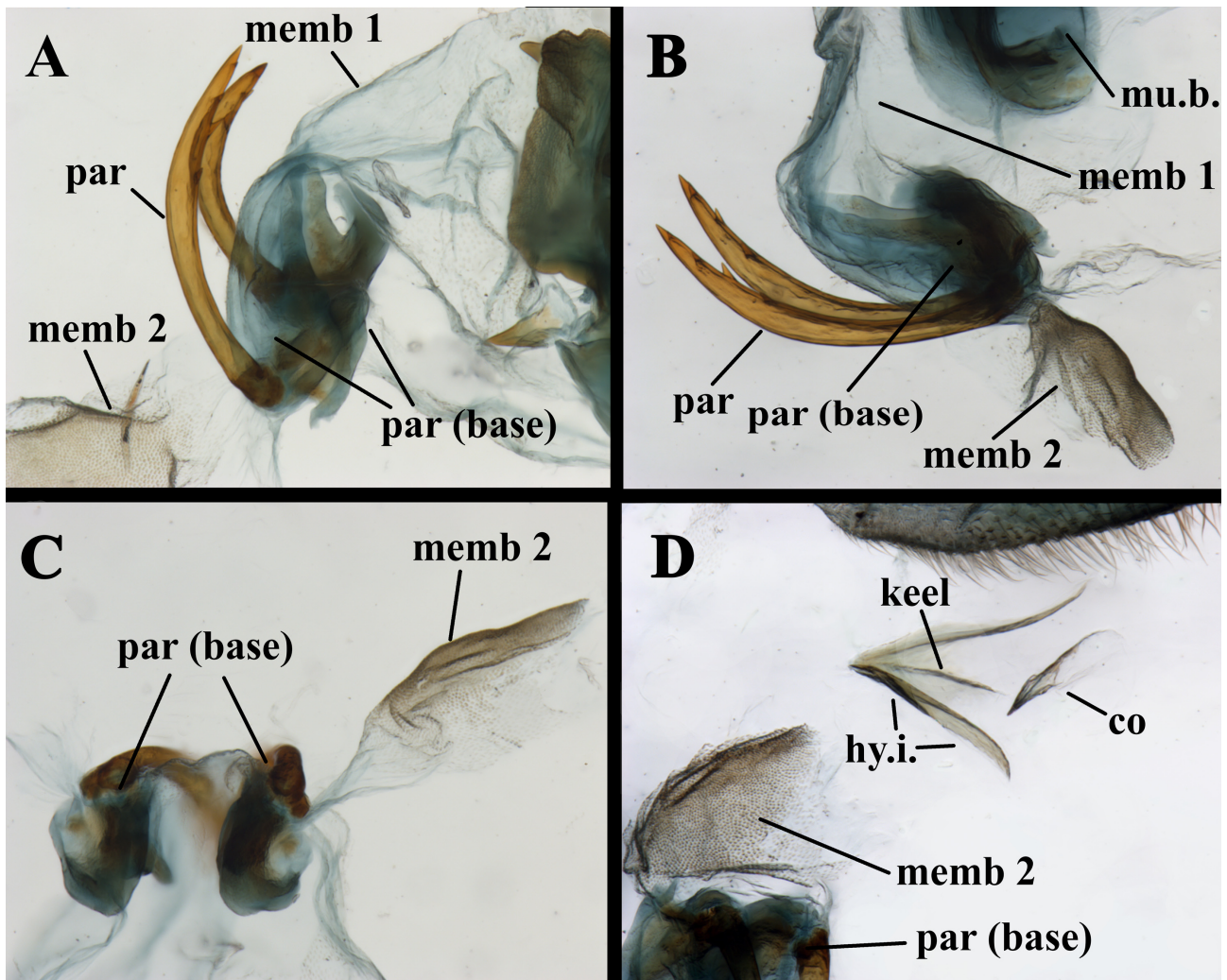


FIGURE 18. *Abachrysa eureka* Banks. A–C. Parameres with winged base and membrane, posterolateral (A), lateral (B), ventral (C). D. Hypandrium internum with paramere base near memb 2. Note basal separation of parameres in C. Abbreviations: **co**, comes; **hy.i.**, hypandrium internum; **memb 1**, clear membrane that connects memb 2 to gonarcus; **memb 2**, scabrous membrane (torn) that connects base of paramere to tip of S9; **mu.b.**, mediuncal beak; **par**, paramere; **par (base)** base of paramere. [All: Alabama, TRC].

Genitalia: Parameres elongate, slender, curved, acute tipped, with ~three acute thorns along inner margin, with bases remaining separate in heavy membranous sockets embedded in sturdy, darkened, scabrous membrane extending forward beneath each paramere, attached to robust, clear membrane via pair of brownish, scabrous membranes on tip of S9. Gonarcus rounded, arcuate; gonarcular bridge with quadrate, slightly fluted plate extending from dorsal surface; gonarcular apodemes elongate, broad, rounded distally, each bearing small dorsal protrusion near gonarcular plate; mediuncus attached below gonarcular bridge via heavy membrane; pair of spurs* lateral to gonarcular bridge, not attached directly to gonarcular bridge, but via membranous connection; long, robust, clear membrane holding parameres attached to ventral surface of mediuncus. Mediuncus flat, basally with two rounded wings hollow below; distal margin with small, sclerotized, rounded beak; proximal section bifurcated, with each wing separate. Hypandrium internum relatively large, V-shaped; arms straight, distally curved; dorsal keel slender, shallow; comes spear-shaped, about size of keel. Gonosaccus, gonosetae absent.

*The spurs (Figs 17B, 17C, 17E) mentioned in the lines above are not fused with the gonarcus, nor do they “articulate” with the gonarcus; rather, they are attached to the gonarcus via a membrane. Thus, they do not fall within the definition of either a gonocornu or an entoprocessus (Brooks & Barnard 1990: 124, Sosa & Tauber 2021). Here we use the descriptive term “spur” to identify them.

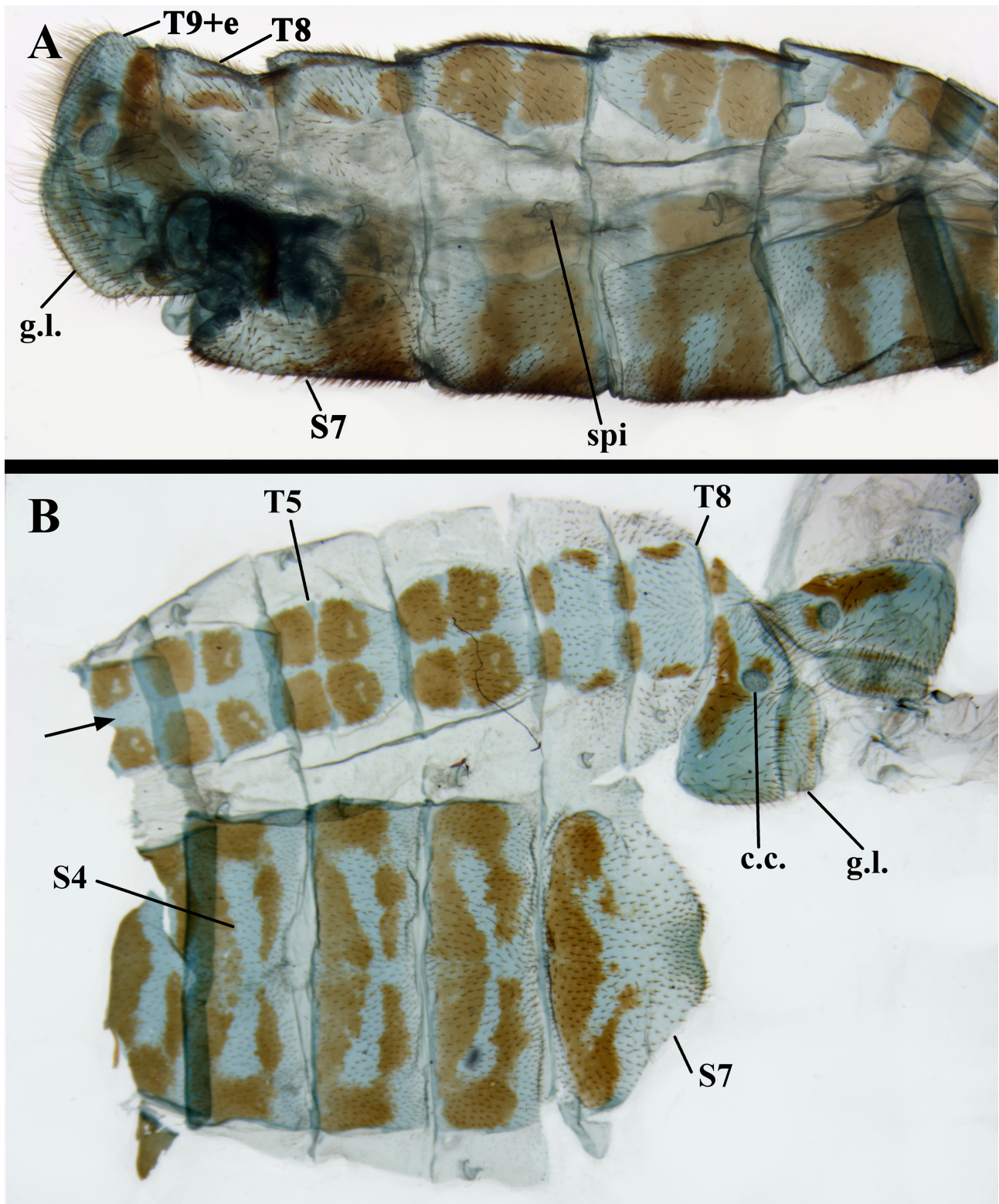


FIGURE 19. *Abachrysa eureka* Banks. Female abdomen. A. Abdominal segments A4-terminus, lateral. B. Abdominal integument, exterior (T4 to T9+e, S4–S7). The arrow in 19B points toward the dorsal mesal suture line. The hint of a ventral mesal suture line is also visible in this image. Note the patches of coloration on tergites, width of sternites. Abbreviations: **c.c.**, callus cerci; **g.l.**, gonapophysis lateralis; **spi**, spiracle; **S4**, **S7**, fourth and seventh abdominal sternite; **T5**, **T8**, fifth and eighth abdominal tergites; **T9+e**, ninth abdominal tergite and ectoproct. [All: Alabama, TRC].

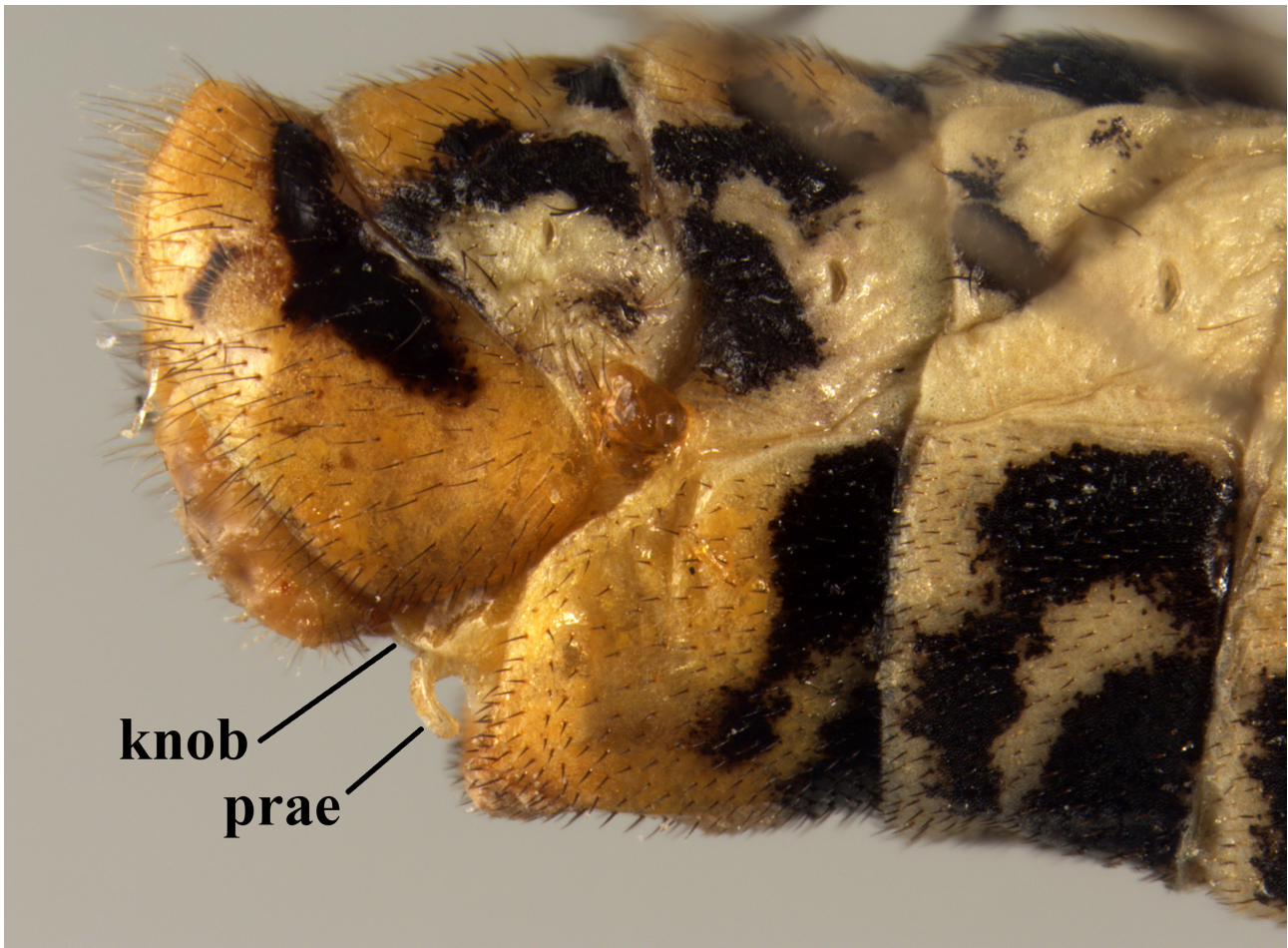


FIGURE 20. *Abachrysa eureka* Banks. Detail of female abdomen (lateral). Abbreviation: **knob**, knob of subgenitale; **prae**, praegenitale (*sensu* Tjeder 1966). [Alabama, TRC].

Abdomen—Female. (n=2; Figs 19–22). *Exterior:* Texture of integument soft, flexible, with tendency to fold or tear. Tergites (including T9+e) closely aligned but not completely fused dorsally; mesal line of fusion visible. Sternites (S3–S7) with relatively dense, evenly spaced, short setae throughout, becoming slightly longer, more robust posteriorly. Tergites (A3–A8) with longer, less dense, evenly spaced setae, also becoming denser and longer distally. Pleural regions of A3–A6 with few setae; pleural regions of A7, A8 with sparse covering of small setae, becoming larger distally; T9+e, gonapophyses laterales with dense, long setae throughout. Spiracles oblong, large on A5, A6 (length ~0.13–0.14 mm, width 0.05–0.06 mm), smaller distally (length ~0.08–0.09 mm, width 0.03–0.04 mm), with simple atrium, single small lobe. Tergites, sternites quadrate, with sides curved (flat view), rounded corners. Sternites S4–S6 (lateral view) with length about $\frac{3}{4}$ times height; S7 (lateral view) with height and length about equal, dorsal margin straight over basal ~one third, sloped to slightly angled over distal two thirds; distal margin of terminus with small mesal indentation. Ninth tergite + ectoproct (lateral view) narrow, with fairly straight, parallel lateral margins dorsally, diverging somewhat throughout; distal margin slightly concave; ventral margin gently rounded; proximal margin sloping slightly (width along ventral margin ~0.5x entire length of T9+e). Callus cerci ~round (height 0.23–0.25 mm, width 0.20 mm), with approximately ~47–51 trichobothria. Gonapophyses laterales slender, slightly crescent shaped in lateral view, curved, forming a circular doughnut shape in ventral view (height ~0.95–0.97 mm, width ~0.36–0.37 mm). *Coloration:* Exterior cream to tan, terminal sternites gold; all segments with tergites, sternites, pleural regions marked with bold black bands, spots; callus cerci gold, encircled with fine, dark line.

Genitalia: Internal female genitalia not especially large, contained within abdominal cavity of lower half of T9+e, pleural region of A8. Spermatheca robust, heavily sclerotized, doughnut-shaped structure with moderately deep invagination; spermathecal diameter (maximum) ~0.41 mm, height ~0.25 mm; invagination depth ~0.14 mm; invagination width at mouth ~0.12 mm. Dorsal surface of spermatheca with large, well sclerotized, sail-shaped

velum extending proximally toward bursa copulatrix; length of spermatheca and velum ~0.80 mm; velum distally giving rise to spermathecal duct; basal section of spermathecal duct heavily sclerotized, U-shaped, extending directly into subgenitale, with distal end of U-shaped curve attached to membranous base of subgenitale; distal end of spermathecal duct exiting subgenitale, forming broad curves; sclerotized section of spermathecal duct ~1.9 mm long, ending abruptly, leading immediately to narrower, lightly sclerotized, brushy terminal section of spermathecal duct. Brushy, distal section of spermathecal duct forming ~half length (~1.7 mm) of entire duct. Dorsal surface of spermatheca, velum, and sclerotized section of spermathecal duct with broad, elongate slit opening into bursa copulatrix above. Bursa copulatrix consisting of robust membrane with fluted, coiled section basally, large, clear, sac-like distally; base of sac-like section with pair of elongate, narrow, ribbon-like bursal glands. Subgenitale with (i) broad basal arms reaching across distal section of abdominal terminus, (ii) broad elongate neck terminating distally as bilobed knob, (iii) single, elongate, recurved lobe (praegenitale, *sensu* Tjeder 1966) extending from base of subgenitale, protruding distally from below, then recurving toward base of S7 (Fig. 20). Colleterial gland delicate, with clear membrane, with broad duct leading to colleterial reservoir; colleterial reservoir bulbous, with narrow duct leading to transverse sclerite. Transverse sclerite with comb-like rows of setae.

Specimens examined. **USA. AL:** Baldwin Co., Bon Secour NWR, 30°15'09"N, 87°48'50"W, 11–15 May 1994, T. L. Schnieffer, Mercury vapor and blacklight trap, William H. Cross Expedition (1♂, TRC); Weeks Bay NER Reserve, 30°25'03"N, 87°49'50"W, 4–6 Aug 2000, J. A. MacGowen, blacklight & M.V. lamp in mixed forest near estuary, W. H. Cross Expedition (2♀, TRC). **FL:** Dixie County, nr. Old Town, 7 Sept 1978, E. R. Hoebeke, M. E. Carter (1♀, TRC); Highlands Co., Archbold Biol. Station, 8 mi. S. Lake Placid, 11 Apr 1974, G. C. Eickwort (1♀, TRC).

Known geographic distribution. Southern USA: AL, AR, FL, GA, MS, TX.

Part 3. Comparisons among New World belonopterygine genera and possible phylogenetic and systematic implications

Generic diagnoses. To help facilitate comparative studies among belonopterygine genera, below are brief diagnoses of each New World genus now included in the tribe and a table (Table 1) of the characteristics used in differentiating the genera. The sources for the comparative information are few; they are listed for each genus.

Abachrysa (Brooks & Barnard 1990: 165, Figs 125–132; Breitkreuz 2018: 254–258; here, Figs 12–22). A monotypic genus. Size: Body stout, relatively large; wing length 12.6–18.5 mm; males and females of similar size. Coloration: Cream to gold with bold black markings on thorax, abdomen, and legs; antennal flagellum dark basally. Wings: Slender, tips rounded; ratio of forewing length to width = ~3.2 : 1; forewing and hindwing without splayed crossveins or dark markings, with most veins dark, interrupted by pale areas basally and within some longitudinal veins and crossveins. Tarsal claws: Basal dilation present. Abdomen: Setae numerous short, stout. Male: Ectoproct extending proximally as far as mid A8; dorsal apodeme of T9+e with a right-angled bend mesally, with basal section extending downward through at least half the length of A8; S8+9 fused with prominent suture visible; S6–S8 with microtholi; gonarcus without gonocornu, with frontal plate; parameres large, with membranous fusion basally. Female: Abdominal tergites with distinct mesal suture; dorsum of T9+e with deep mesal invagination; praegenitale present, visible externally.

In summary, *Abachrysa* is the only New World belonopterygine genus having a robust, pale body with bold markings, no wing markings or splayed costal veins, with males having large paired parameres joined in a V-shape, and females having the abdominal tergites mesally divided or very lightly fused and a praegenitale present externally.

Belonopteryx (Brooks & Barnard 1990: 165–167, Figs 133–135; Breitkreuz 2018: 258–262, Fig. 45; here, Fig. 23). A monotypic genus. Size: Body stout, relatively large; wing length 20–22 mm; males and females of similar size. Coloration: Cream with bold reddish-black body markings in longitudinal pattern (Fig. 23); color of antennal flagellum unknown. Wings: Narrow, tapered, acute at tips; ratio of forewing length to width = 5 : 1; costal area of forewing without splayed crossveins or dark markings; forewing with *im1* cell missing; forewing and hindwing with streak of reddish suffusion surrounding RP, PsM, and outer gradates; veins in reddish patches dark, other veins mostly pale. Tarsal claws: Simple. Abdomen: Setae short, dense. Male: Dorsal apodeme of T9+e short; S8+9 not fused (Brooks & Barnard 1990), fused (Breitkreuz 2018); S9 small; microtholi dense on all sternites except S9; gonarcus probably without frontal plate, probably without gonocornua; mediuncus with setae; parameres absent. Female: Praegenitale absent.

In summary, the rarely encountered *Belonopteryx* is the most distinct of the New World belonopterygine genera. It is recognized by its long, tapered wings, each with streaks of reddish suffusion along the RP and PsM+outer gradates; the lack of an *im1* cell in the forewing; and a robust, pale body with longitudinal dorsal markings. Males have very dense microtholi and females are without a praegenitale.

Nacarina (Brooks & Barnard 1990: 175–177, Figs 179–186; Freitas & Penny 2001: 252–256, Figs 1–7; Penny 2002: 206–208, Figs 132–140; Breitkreuz 2018: 286–290). Size: Body usually large and stout, but some species from Brazil relatively small and delicate; wing length 16–31 mm; males smaller than females. Coloration: Yellow to cream, with or without markings on thorax, abdomen, or legs; antennal flagellum often dark basally. Wings: Not narrowed, with rounded tips; ratio of forewing length to width = 2.8–3.4 : 1, without splayed crossveins; forewing and hindwing without markings, veins mostly pale. Tarsal claws: Basal dilation absent or small. Abdomen: Setae numerous, short, stout. Male: Dorsal apodeme of T9+e with basal section extending anteroventrally from behind callus cerci to or almost to end of T9+e (See Freitas & Penny 2001: Figs 4D, 5D, 7A); S8+9 fused with prominent suture or no suture; microtholi present or absent; gonarcus usually broad, with mediuncus having lateral arms; parameres rarely absent, with two arms fused. Female: No report of mesal suture dividing abdominal tergites; spermatheca with deep or shallow invagination; praegenitale present or absent; elongate, slender bursal ducts [shown for two species in Freitas & Penny 2001: *N. lavrasana* Freitas & Penny and *N. panchlora* (Gerstaecker)]. [Note: Figs 1 and 10 in Freitas & Penny are switched—the images on Fig. 10 should have the caption and placement of Fig. 1, *N. panchlora*; vice versa for the images on Fig. 1—they belong with the caption of Fig. 10, *Ceraeochrysa cincta* (Schneider)].

In summary, *Nacarina* species (and the sexes) are variable in size, body form, and many genital traits (see Table 1). The claim that parameres are absent from *Nacarina* (Brooks & Barnard 1990: 177) appears to have been premature. Apparently, they are present and associated with the gonosaccus in many species (Freitas & Penny 2001), but the structure of the parameres has not been well defined or illustrated. Indeed, it is safe to say that this relatively large genus is in great need of morphologically based revisionary work.

Vieira (Penny 2002: 205–206, Figs 129–131; Tauber 2006, 2007; Tauber *et al.* 2006; Sosa & Tauber 2017; here Fig. 23). Size: Body large and stout to relatively small and slender; forewing length 11.6–26.0 mm; males and females of similar size. Coloration: Cream with bold, black body markings; antennal flagellum dark basally. Wings: Not narrowed; ratio of forewing length to width = 2.5–2.6 : 1; costal area of forewing with patch of splayed crossveins, with dark markings (splaying very moderate in *V. elegans* (Guérin Méneville)); forewing and hindwing with dark patches; veins in dark patches also dark, other veins mostly pale. Tarsal claws: Basal dilation present. Abdomen: Setae relatively long, moderate density. Male: Dorsal apodeme of T9+e sinuous, with proximal section extending downward and well into A8; S8+9 fused with prominent suture; microtholi on S3–S8; gonarcus without gonocornu or frontal plate; mediuncus with or without frontal setae; parameres large, quadrate, closely attached to gonarcus via stiff membrane. Female: Abdominal tergites without mesal suture; dorsum of T9+e with or without deep mesal invagination; praegenitale absent.

In summary, *Vieira* is the only New World belonopterygine genus having the following suite of features: a robust, pale body with bold, black markings, wings with large dark markings, costal area of forewing with a series of splayed costal crossveins within a dark marking; males with quadrate parameres that are closely associated with the gonarcus, and females lacking a praegenitale.

Pantaleonius. Size: Body moderately small, delicate; forewing length 12.0–13.1 mm; males and females of similar size, but with sexual dimorphism in abdominal markings (see below in this paragraph). Coloration: Head and thoracic markings in linear pattern not spotty; prothorax and dorsum of head with pair of dark, longitudinal stripes that extend onto dorsum of scapes; females, but not males, with abdominal sternites S4 and S5 dark brown to black; antennal flagellum mostly pale, with only basal ¼ to 1/5 black. Wings: Slender; forewing broad, ratio of length to width = 2.6 : 1; costal area without splayed crossveins or dark markings; forewing and hindwing without dark patches. Tarsal claws: Basal dilation present, large. Abdomen: Setae relatively long, moderate density. Male: Dorsal apodeme of T9+e straight, with ventral spur; S8+9 fused, with suture present, not conspicuous; sparse microtholi present on S8 and distally on S7; gonarcus without gonocornu or frontal plate, with mediuncus winged, bearing one or two pairs of frontal setae; parameres absent. Female: Abdominal tergites without mesal suture; dorsum of T9+e without deep mesal invagination; praegenitale present, transversely elongate.

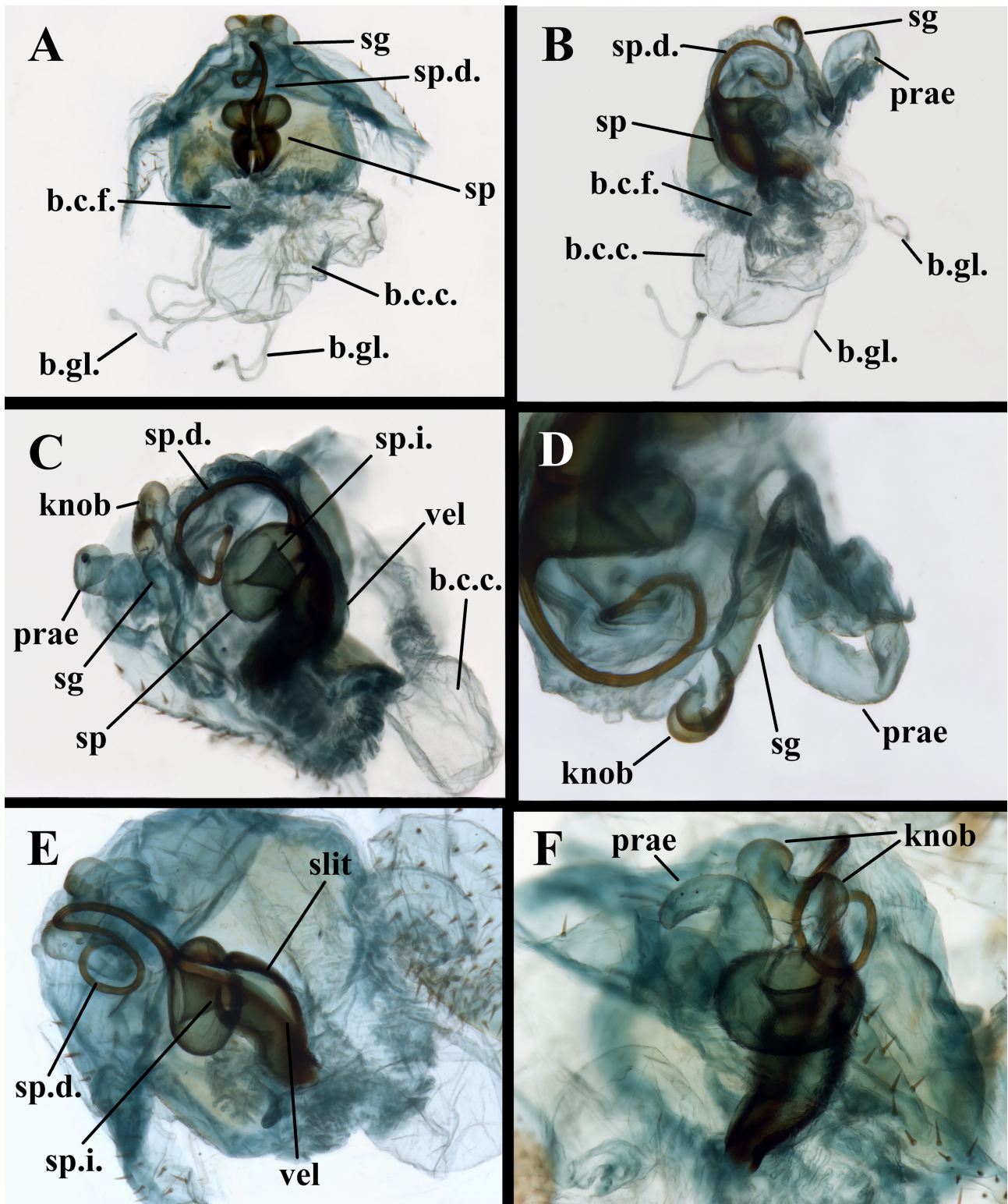


FIGURE 21. *Abachrysa eureka* Banks. Female genitalia. A, B. Genital complex, ventral (A), lateral (B). C. Spermathecal complex and subgenitale, lateral. D. Subgenitale, lateral. E. Spermathecal complex *in situ*, dorsal. F. Subgenitale knob and praegenitale (*sensu* Tjeder 1966), lateral, with spermatheca behind. Abbreviations: **b.c.c.**, clear membranous section of bursa copulatrix; **b.c.f.**, fluted section of bursa copulatrix; **b.gl.**, bursal gland; **knob**, distal knob at tip of subgenitale; **prae**, praegenitale; **sg**, subgenitale; **slit**, longitudinal opening along dorsal margin of spermatheca and spermathecal duct; **sp**, spermatheca; **sp.d.**, spermathecal duct; **sp.i.**, spermathecal invagination; **vel**, velum. [All: Alabama, TRC].

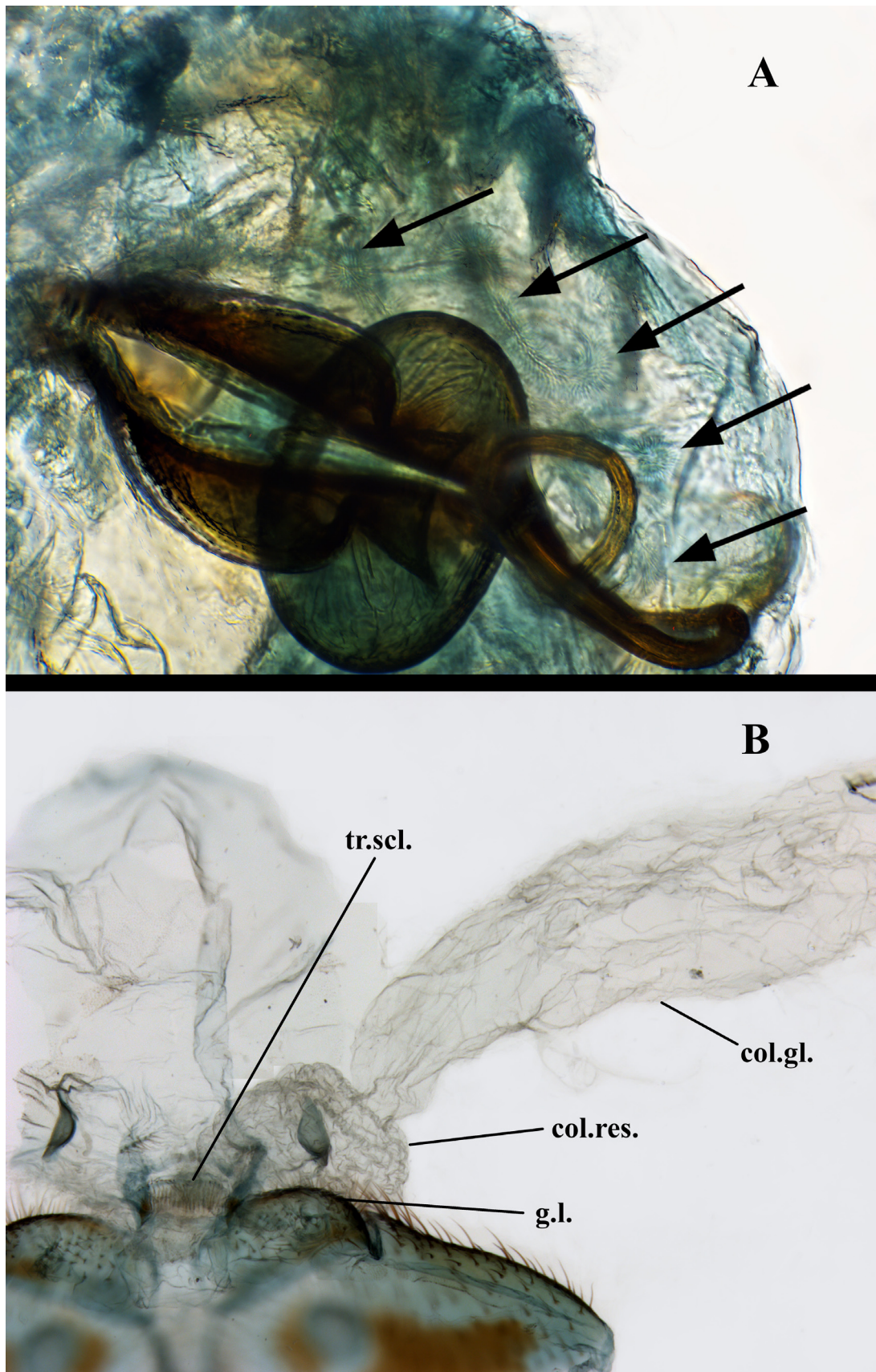


FIGURE 22. *Abachrysa eureka* Banks. Female genitalia. A. Spermathecal complex, dorsal; image made with compound microscope to show brushy section of spermathecal duct (arrows) and slit along dorsal margin of sclerotized section of spermathecal duct. To view: enlarge and follow arrows. B. Colleterial complex. Abbreviations: **col.gl.**, colleterial gland; **col.res.**, colleterial reservoir; **g.l.**, gonapophysis laterales; **tr.scl.**, transverse sclerite. [All: Alabama, TRC].

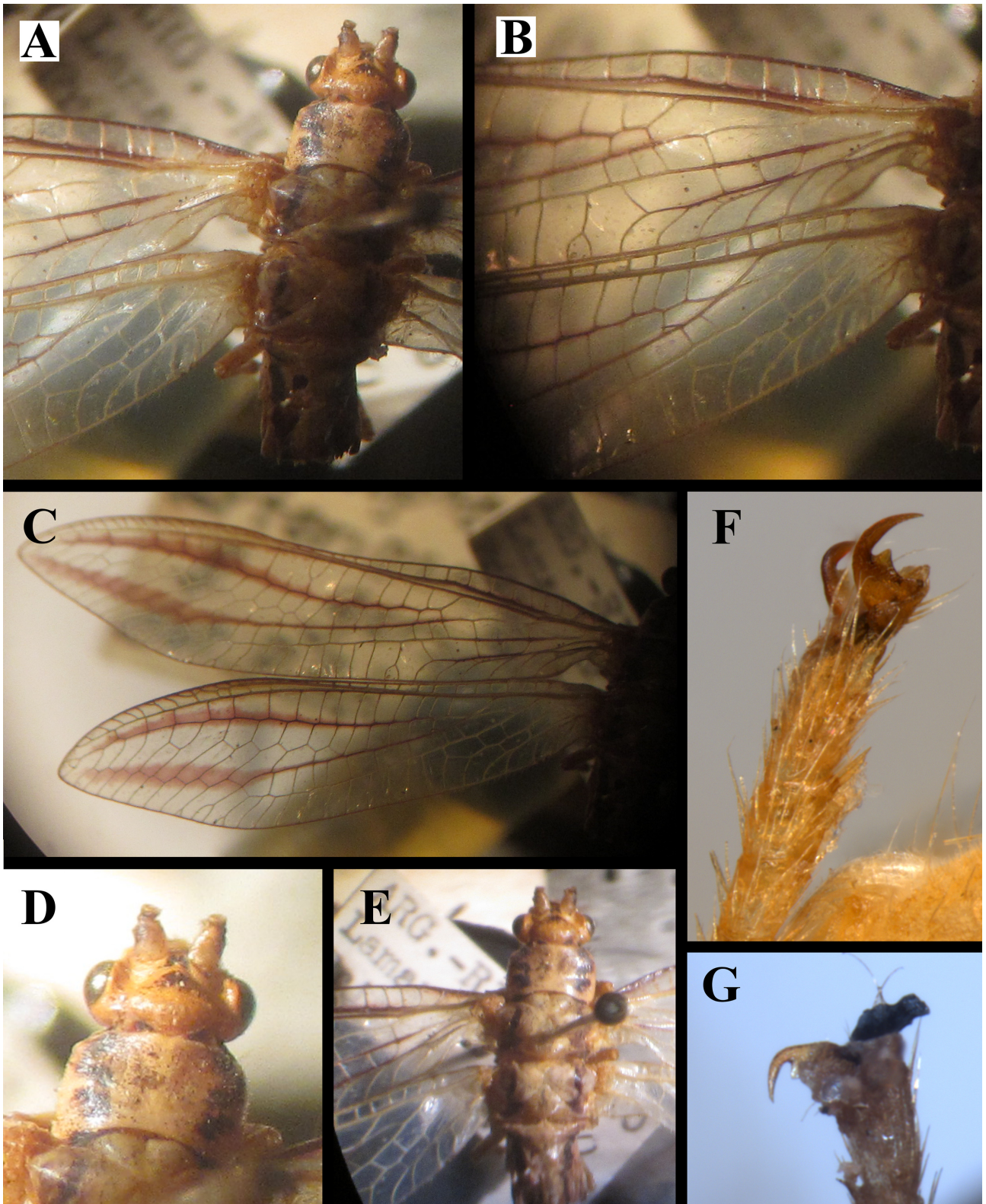


FIGURE 23. New World Belonopterygini. A–E. *Belonopteryx arteriosa* Gerstaecker: A. Head, thorax, base of wings, dorsal. B. Bases of forewing, hindwing. C. Forewing and hindwing. Note the reddish suffusion on the RP and M veins. D, E. Head, thorax, base of abdomen, dorsal. F, G. Tarsal claw (dilated) and distal tarsomeres, lateral; F. *Vieira leschenaulti* Navás; G. *Vieira brooksi* Tauber. [A–E: Argentina, MACN, photos by G.S. Albuquerque; F: Costa Rica, Cartago, LACM; G: Bolivia, Sara Province, CMNH].

In summary, *Pantaleonius* is the only genus among the New World Belonopterygini to have a yellow to tan body with prominent (but not large) dark spots; wings without markings or splayed venation, but with dark veins; terminal segments of male abdomen with dorsal apodeme having a ventral spur that articulates with a robust, somewhat sclerotized membrane extending from the ventral spur of the dorsal apodeme to the dorsum of the mediuncus. In addition, the male has a broad, U-shaped gonarcus, winged mediuncus, and no parameres. In the female, a praegenitale is present; the subgenitale is elongate; and the spermatheca is tubular, bent with a large velum.

Systematic implications. The adult morphology of the fifth New World belonopterygine genus described here appears to be consistent with earlier phylogenetic hypotheses that place the New World genera *Vieira*, *Nacarina*, and now *Pantaleonius* as basal to *Abachrysa*, and thus also basal to the Old World Belonopterygines. Moreover, as described below and shown on Table 1, it appears that *P. toschiorum* shares more features with the *Vieira* species than with those in the other New World genera.

Body size and form. In all body traits measured (head and facial width, antennal and wing length), *P. toschiorum* is among the smallest of the New World belonopterygines (e.g., wing length of only 12–13 mm). Similarly, most species of *Vieira*, with the exception of *V. leschenaulti* (Navás), also have small bodies (wing lengths of 11–16 mm). In comparison, *Abachrysa*, *Nacarina*, *Belonopteryx*, and *V. leschenaulti* adults are considerably larger and more stout (see forewing and head width data, Table 1), as are most of the Old World belonopterygines (recorded wing lengths of 15–27 mm, with rare exceptions).

Although the sample size is small, adult body size seems to be positively correlated with egg size. In turn, large egg size appears to be an essential component in a large suite of larval morphological, behavioral, and developmental traits that underlie the belonopterygine myrmecophilic lifestyle (Tauber *et al.* 2020). Thus, a better understanding of the pattern of variation in adult body size may help elucidate the evolutionary history and diversification of belonopterygine myrmecophily. In this regard, the monophyletic Old World genus *Turnerochrysa* Kimmins is particularly intriguing; the lone species in this genus is small-bodied (wing length of ~10 mm), and it has dark spots similar to the *Vieira* species. Its lifestyle and immatures are unknown, as are those of the *Vieira* species [with one exception—the *V. elegans* first instar (Tauber *et al.* 2006)].

Antennal characters. Two antennal characters have been used to differentiate adults of Belonopterygini from those in its sister tribe Leucochrysinini. First, in Belonopterygini, with few exceptions, the antenna is shorter than the forewings; in the sister tribe Leucochrysinini, the antenna typically is ~1.5 times longer than the forewing (Brooks & Barnard 1990: 243). Current data from the basal members of Belonopterygini (*Abachrysa*, *Pantaleonius*, and *Vieira*) indicate that this character holds well (Table 1) and is consistent with current phylogenies. Although antennal length itself varies considerably among the basal members of the tribe, it is consistently and markedly (0.51–0.87 times) shorter than the length of the forewing.

The second antennal character that traditionally has differentiated belonopterygine adults has been the length to width proportions of the midantennal flagellomeres, which were reported to be *at most* twice as long as broad (Brooks & Barnard 1990: 163). In comparison, flagellomere length in Chrysopini was reported to be 2 to 3 times flagellomere width, and in Leucochrysinini at least 3 times the width (Brooks & Barnard 1990: 185, 243). As seen on Table 1, the basal Belonopterygine taxa of the New World, especially *Pantaleonius*, exhibit considerable variation that is not consistent with the traditionally proposed taxonomic characters, but that is consistent with current hypotheses concerning the phylogeny of Belonopterygini. In *Abachrysa* (the most derived of the New World genera), the flagellomere length to width ratio = 1.2–1.4 : 1, which places it within the traditional range and illustrates its closer relationship with the Old World clade. At the other extreme is *Pantaleonius*, in which the flagellomere length to width ratio = 2.3–2.5 : 1; these values place it closer to the belonopterygine sister-taxon Leucochrysinini. In the genus *Vieira*, the flagellomere length to width ratio ranges from 1.4–2.4 : 1. Accurate data are needed for *Belonopteryx* and a variety of *Nacarina* species. From the current pattern of variation, it appears that the basal New World belonopterygines *Pantaleonius* and *Vieira* may depict an evolutionary transition from the presumably ancestral condition of elongate flagellomeres to the shortened state observed in *Abachrysa*, and that is typical of the derived, Old World belonopterygine genera. The presumed ancestral, long flagellomere condition is retained in the belonopterygine sister taxon, the current Leucochrysinini.

Legs. One of the key characters Brooks and Barnard (1990: 165) used in their diagnosis of *Abachrysa* was “claws without basal dilation”. Indeed, this character state correctly distinguishes *A. eureka* from all but one of the 26 belonopterygine species reported from South Africa (Tjeder 1966: 340). It is noteworthy that the *P. toschiorum* tarsal claw has a basal dilation, giving support to its relationship with the more basal New World genera *Vieira* or perhaps *Nacarina*, rather than the more derived *Abachrysa*.

TABLE 1. Distinctive features of New World Belonopterygine genera.

Feature	<i>Abachrysa</i> monotypic	<i>Belonopteryx</i> * monotypic	<i>Nacarina</i> ** many species	<i>Pantaleonius</i> monotypic	<i>Vieira</i> *** four species
Body form	Stout	Stout	Very stout to moderate	Moderate	Moderate to stout
Coloration	Cream	Cream	Yellow to cream	Cream	Cream
Body markings	Black, bold, large marks In irregular pattern	Red-black, bold lateral spots or stripes	With or without marks	Black spots in mod. bold, irregular pattern	Black, bold spots & stripes, variable
Size dimorphism	No	No	Yes	No	No
Head width	2.3-2.4 mm	?	?	1.4-1.7 mm	1.5-2.7 mm
Ratio midantennal flagellomere l : w	1.2-1.4 : 1	0.5-1.0 : 1	~1.0 : 1.0	2.3-2.5 : 1	1.4-2.4 : 1
Wing length	12.6-18.5 mm	20-22 mm	16-31 mm	12.0-13.1 mm	11.6-26.0 mm
Antennal length	12.9-13.6 mm			8.4-9.2 mm	10.0 mm <i>V. brooksi</i> 10.6-10.8 mm <i>V. elegans</i> 8.8-9.0 mm <i>V. flinti</i> 12.9-14.2 mm <i>V. leschenaulti</i>
Ratio antenna length : wing length	0.86 : 1			0.70 : 1	0.87 : 1 <i>V. brooksi</i> 0.74 : 1 <i>V. elegans</i> 0.57 : 1 <i>V. flinti</i> 0.51 : 1 <i>V. leschenaulti</i>
Wing shape	Not narrow	Narrow	Not narrow	Not narrow	Not narrow
Distal margin of wing	Round	Lanceolate	Round	Round	Round
Ratio wing l : w	3.2 : 1	5.0 : 1	~2.8-3.4 : 1	~2.6 : 1	~2.6 : 1
Costal veins splayed	No	No	No	No	Yes
Fore & hindwing markings	No	Yes, reddish	No	No	Yes, blackish
Tarsal claws	Simple	Simple	Usually with dilation	Large dilation	With dilation
MALE					
Ectoproct length	To mid A8	Short	To mid A8	To mid A8	Well into mid A8
Dorsal apodeme	Broken mesally, no spur	Short, no spur	Sinuuous, no spur	Straight, with ventral spur	Sinuuous, no spur
S8+9	Fused, with suture	Fused, apparently no suture	Fused, apparently no suture	Fused, with suture	Fused, without suture
Microtholi****	Present on S6-S8	Dense	Present or absent	Sparse on S8 and distal S7; none on S5, S6	Present, fairly dense on S6-S8
Gonarcular plate	Present	Prob. absent	Prob. absent	Absent	Absent
Parameres	Present	Absent	Present or absent	Absent	Present
Shape & place	Two arms connected in V-shape below gonarcus		Two arms connected with gonosaccus or mediuncus		Two arms with bar between, connected above or below mediuncus

...continued on the next page

TABLE 1. (continued)

Feature	<i>Abachrysa</i> monotypic	<i>Belonopteryx</i> * monotypic	<i>Nacarina</i> ** many species	<i>Pantaleonius</i> monotypic	<i>Vieira</i> *** four species
Articulating membrane between ventral spur and mediuncus	Absent	Absent	Absent	Present	Absent
FEMALE					
Abdominal tergites divided longitudinally	Yes	Unknown	No	No	Known from <i>V. flinti</i> , but not reported for other species
Dorsal invagination of T9+E	Deep	Unknown	Shallow to moderate	Absent	Deep or shallow
Praegenitale	Present, visible externally	Absent	Present or absent	Present	Absent

* Information largely from Brooks & Barnard (1990) and Breitung (2018).

** Information largely from Brooks & Barnard (1990) and Breitung (2018). This genus contains many undescribed species; the various character states indicated may not be fully representative of the group.

*** Information from Tauber (2006), Tauber *et al.* (2006, 2007), Sosa & Tauber (2017).

**** Microtholi are not known to occur on S9; for segments not reported, assume no information is available.

Abdominal characters. Several male and female abdominal features are useful in distinguishing belonopterygine genera and some warrant discussion here.

1. *Male: Suture between S8 and S9.* Brooks & Barnard (1990: 165) stated that “Males of *Abachrysa* can be distinguished from other belonopterygine genera by the suture between sternites 8 and 9 (these sternites are fused in all other genera in the tribe except *Belonopteryx*)”. However, in the specimen of *A. eureka* studied here the suture between S8 and S9 is fused, although the line of demarcation is present and visible. Also, in most specimens of *P. toschorum*, S8 and S9 are fused and often a line of fusion is discernable. In some specimens (those that are mature and well sclerotized), the fusion appears complete and only a subtle depression on the dorsal margin of the fused sclerites and/or a difference in the density of coloration or stain retention marks the line of fusion (see Figs 5A, 5B). It is noteworthy that interspecific variation in this feature also seems to be present within a number of genera, notably *Italochrysa* (see illustrations by Tjeder 1966), *Vieira* [see Tauber *et al.* 2006 (as *Berchmansus*), 2020; Tauber 2006 (as *Berchmansus*), 2007; Sosa & Tauber 2017], and perhaps *Nacarina* species [see illustrations by Brooks and Barnard (1990)]. As a result of the apparent intraspecific variation and the apparent interspecific variation within genera, the phylogenetic value of this character needs comparative study that includes both mature and teneral adult specimens across a range of genera and species.

2. *Female: Bursal complex.* In both *A. eureka* and *P. toschorum*, the bursa copulatrix presents as a large, clear, sac-like structure with two sections enclosing either: rounded tubules (*P. toschorum*) or fluted tubules and folds (*A. eureka*). A pair of thin, elongate bursal glands extend from the ventrolateral surface. In *P. toschorum*, the glands appear roundish, and in *A. eureka*, they are flat, narrower, and longer. Thin, flat bursal glands also were reported from *Vieira flinti* Sosa & Tauber; however, none were found in *V. elegans*, *V. brooksi* Tauber, or *V. leschenaulti* (Tauber 2006, as *Berchmansus*; Tauber 2007; Sosa & Tauber 2017). It is possible that they were overlooked. In any case, further examination should focus on the variation among belonopterygine taxa with regard both to the morphology of the bursa copulatrix and to the presence/absence and structure of bursal glands.

3. *Female: Praegenitale.* Praegenitale are considered common but not universal among belonopterygine taxa. However, given both the diversity of the structures that have been identified as “praegenitale” and the use of the term in the literature, this character should be reexamined. Tjeder (1966) applied the term extensively to taxa that today are considered Old World belonopterygines, and in these taxa the praegenitale consistently appeared as a knob-like structure at the tip of S7, immediately below the subgenitale. Tjeder’s drawings and text do not give the impression that these structures are heavily sclerotized, and it is not clear how closely these structures are associated with surrounding structures. They might or might not be fused with the subgenitale and/or the tip of S7. Based on

Tjeder's (1966) use of the term, Tuxen (1970: 316) defined the praegenitale as a "Paired or unpaired, plate- or tooth-like structure between apex of stern VII and subgenitale". He did not specify whether "between" meant "located between and separate from" or simply "located between". Later, Brooks & Barnard (1990), in their discussion of the various chrysopid taxa, appeared to accept the narrower application of the term, and they restricted its use to structures that are "... Not fused with subgenitale." (Brooks & Barnard 1990: 124). Thus, if we take the term with its original intent, it would readily apply to the structure in *A. eureka*, which appears very similar to praegenitale studied by Tjeder, and the term would also apply to the praegenitale of *P. toschorum*. In contrast, if we apply the term literally, as later restricted by Brooks & Barnard, the structure on *P. toschorum* would be included as a praegenitale, but Tjeder's foundational use of the term "praegenitale" for the numerous species he studied might be rejected. Rejection of Tjeder's usage would be especially problematic if these structures were shown to be secondarily fused with the subgenitale, as may be the case in *A. eureka* and perhaps even in the fully matured *P. toschorum*. Consequently, the homology of the fairly numerous structures identified as "praegenitale" in diverse chrysopid taxa is in need of reassessment (also see, Breitzkreuz 2018: 31). This reassessment should include interspecific comparisons and developmental studies of teneral and fully sclerotized individuals.

Part 4. Key to New World Genera of Belonopterygini

1.	Forewings and hindwings with distinct (red, black, or brown) markings	2
1'	Forewings and hindwings without markings	3
2.	Wings narrow, with lanceolate tips, membrane marked with red tinge; venation without splayed pattern	<i>Belonopteryx arteriosa</i> (Gertstaecker)
2'	Wings moderately broad, with round tips; alar membrane marked with black or brown, not red; at least some parts of forewing with venation in splayed pattern	<i>Vieira</i> Navás*
3.	Body without bold, dark markings, usually stout	<i>Nacarina</i> Navás**
3'	Body with dark, bold markings, stout or delicate	4
4.	Prothorax heavy, shield-like, with four pairs of black spots dorsally; body stout	<i>Abachrysa eureka</i> Banks
4'	Prothorax broad, but not particularly heavy, with two pairs of elongate black lines (one lateral, one sublateral), no spots; body delicate	<i>Pantaleonius toschorum</i> Tauber, n.sp.

* For a key to the species of *Vieria*, see Sosa & Tauber (2017).

** *Nacarina* is a large, diverse, poorly studied genus; there is no comprehensive key to the known species, and many species are undescribed. Regional keys are found in Freitas & Penny (2001: 252) and Penny (2002: 206).

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