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A new species of *Diolcus* Mayr (Hemiptera: Heteroptera: Scutelleridae: Pachycorinae) with a reexamination of the subfamily and generic placement of *Nesogenes boscii* (Fabricius) (Hemiptera: Heteroptera: Scutelleridae: Elvisurinae or Pachycorinae)

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A new species of *Diolcus* Mayr
(Hemiptera: Heteroptera: Scutelleridae: Pachycorinae)
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Abstract. *Diolcus thomasi* Eger **new species** (Hemiptera: Heteroptera: Scutelleridae: Pachycorinae), is described from Cayman Brac and Little Cayman Island and compared to *D. chrysorrhoeus* (Fabricius), its closest congener. *Nesogenes boscii* (Fabricius) is removed from the Elvisurinae and placed in the Pachycorinae. The relationship of *N. boscii* to *D. thomasi* and *D. chrysorrhoeus* is discussed.

Key words. Shield bug, Caribbean, Western Hemisphere, subfamily placement, systematics.

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Introduction

Diolcus Mayr (Hemiptera: Heteroptera: Scutelleridae: Pachycorinae) currently contains six valid species: *D. cassidoides* (Walker) from Hispaniola, *D. chrysorrhoeus* (Fabricius) from the southeastern US and Texas, *D. disjunctus* Barber from Puerto Rico, *D. irroratus* (Fabricius) from Florida and many of the Caribbean Islands, *D. pusillus* Berg from Argentina and Uruguay, and *D. variegatus* (Herrich-Schaeffer) from Cuba, Hispaniola, Jamaica and adventive in Florida (Eger and Baranowski 2002). There has been little work on this genus recently and it is in need of revision.

Horváth (1921) removed *Diolcus boscii* (Fabricius) from *Diolcus* and placed it in a new genus, *Nesogenes* Horváth. He also placed the new genus in Elvisurinae based on the expanded lateral carinae of the thoracic sterna. The placement of *N. boscii* in the Elvisurinae has been challenged in recent years. Cassis and Vanags (2006) considered the genus *incertae sedis* and excluded it from the Elvisurinae. Eger et al. (2015) suggested that *Nesogenes* is more closely related to genera of Pachycorinae than to those of Elvisurinae. However, the subfamily placement of the genus remains unsettled.

The purpose of this study is to describe a single new species of *Diolcus* and clarify the subfamily placement of *Nesogenes*. This paper is dedicated to the memory of Mike Thomas, a good friend and avid collector of insects, particularly on Caribbean Islands.

Materials and Methods

Repositories for types and other specimens are as follows: American Museum of Natural History, New York, NY, USA (AMNH); D. A. Rider Collection, Fargo, ND, USA (DARC); D. B. Thomas Collection, Kerrville, TX, USA (DBTC); Florida State Collection of Arthropods, Gainesville, FL, USA (FSCA); University of Georgia Collection of Arthropods, Athens, GA, USA (UGCA), National Museum of Natural History, Smithsonian Institution, Washington, DC, USA (USNM); and the collection of the senior author, Tampa, FL, USA (JEEC). Label data were transcribed as they appear on the labels. If there was more than one label, the label closest to the insect is indicated by 1), the second by 2), etc.

Genitalia were cleared in a nearly boiling 15% solution of KOH. Photographs were taken with a Leica DMC6200 digital camera attached to a Leica Z16 APO Macroscope and stacked using Leica software. Terminology follows Tsai et al. (2011). Measurements are presented as means followed by range in parenthesis. All measurements are given in mm.

Results

Diolcus thomasi Eger, new species

Description. Body narrowly ovate, medium sized (Fig. 1–2). Dorsum stramineous with uniformly dense dark brown punctation, this sometimes with green or purple iridescence. Venter stramineous, punctures on head and propleura large, sometimes with green or purple iridescence; punctures becoming smaller and less iridescent posteriorly on meso- and metapleura; abdominal punctation small and relatively dense laterally, much less dense mesially.

Apex of head narrowly rounded, mandibular plates shorter than clypeus and relatively acute apically. Lateral margins of mandibular plates slightly sinuous, straight to shallowly concave basally, slightly convex anteriorly. Clypeus elevated above mandibular plates. Antennae stramineous, somewhat darker basally; relative length of segments: $V > IV > II > III > I$. Rostrum stramineous, darker toward apex, reaching onto third abdominal sternite; relative length of segments: $II > III > I > IV$.



Figures 1–2. *Diolcus thomasi*, habitus. 1) Dorsal view. 2) Ventral view. Scale line = 1.0 mm.

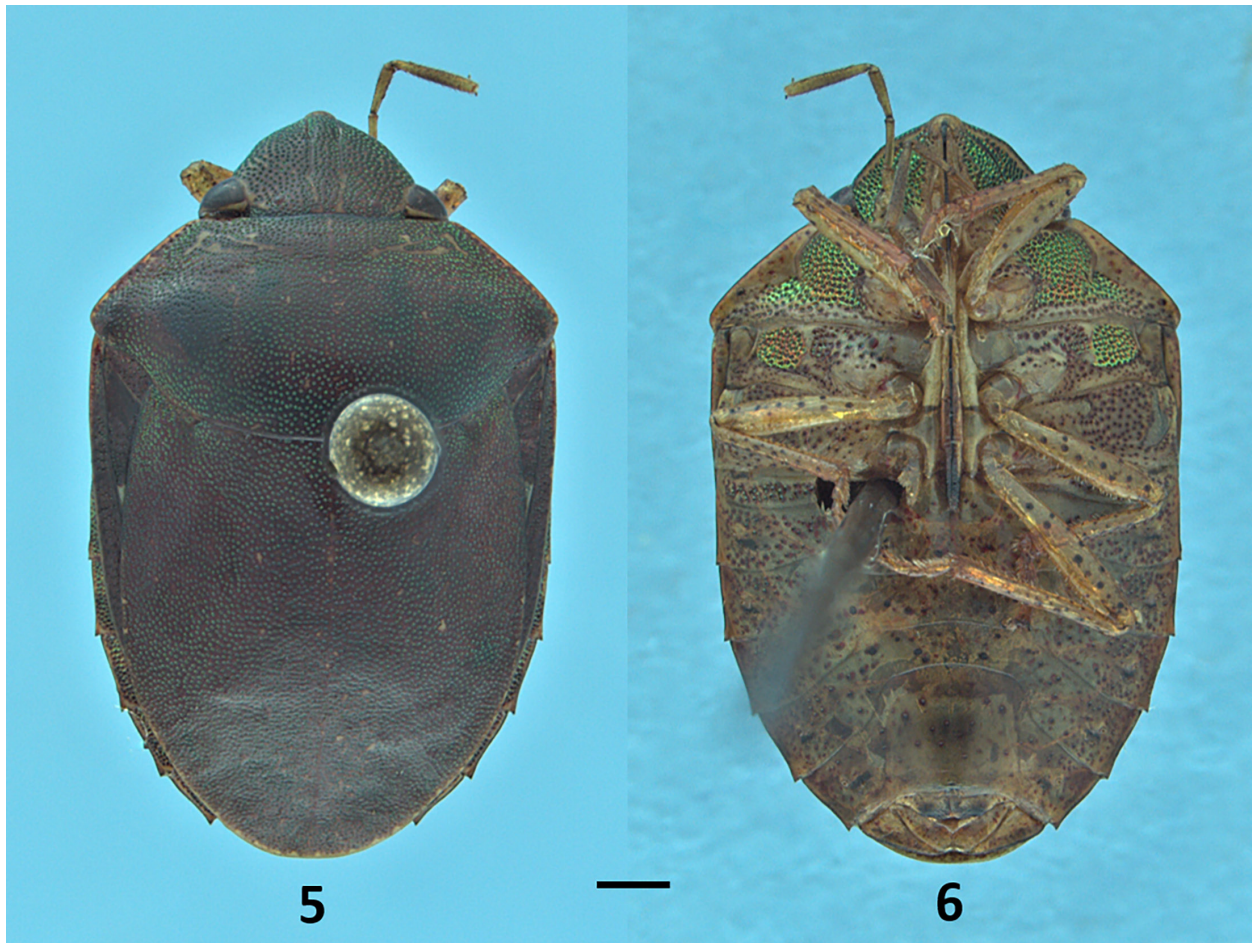


Figures 3–4. *Diolcus chrysorrhoeus*, habitus. 3) Dorsal view. 4) Ventral view. Scale line = 1.0 mm.

Anterior margin of pronotum triconcave, shallowly concave behind eyes, broadly and shallowly concave mesially, anterolateral margins straight or slightly convex, posterolateral margins sinuous, posterior margin straight to slightly concave. Punctuation relatively uniform, dark; iridescence, if present, usually confined to anterior $\frac{1}{3}$ to $\frac{1}{2}$ of pronotum. Scutellum and exposed portion of coria with punctuation similar to that of pronotum, vague pale mesial line usually present on scutellum. Ostiole located slightly closer to metacoxae than to lateral margin of metapleuron; ostiolar peritreme short, just outlining ostiole. Legs stramineous, maculate, macules somewhat lighter in color than on thoracic venter, those on superior surface of tibiae larger and darker.

Coloration on venter of abdomen uniform and similar to that of thorax, except punctuation generally smaller, stridulatory areas and meson of abdomen with relatively few punctures. Seventh sternite of males not excavated posteriorly, reaching end of body and covering pygophore (Fig. 10). Second and third sternites shallowly impressed mesially.

Posterior margin of pygophore broadly excavated mesially, forming a very open 'v', convex laterally (Fig. 7–8). Parameres located near lateral margin of genital cup, uncinat and curving laterad (Fig. 7, 9, 19). Proctiger weakly sclerotized. Phallosome short, not strongly sclerotized (Fig. 22–23); phallus with three pairs of conjunctival processes; first pair elongate, mostly membranous, with short, sclerotized, acute hook at apex; second pair elongate, curved toward acute apex; third pair thin, elongate, sclerotized, acute apically. Aedeagal conducting tube thin, sclerotized.



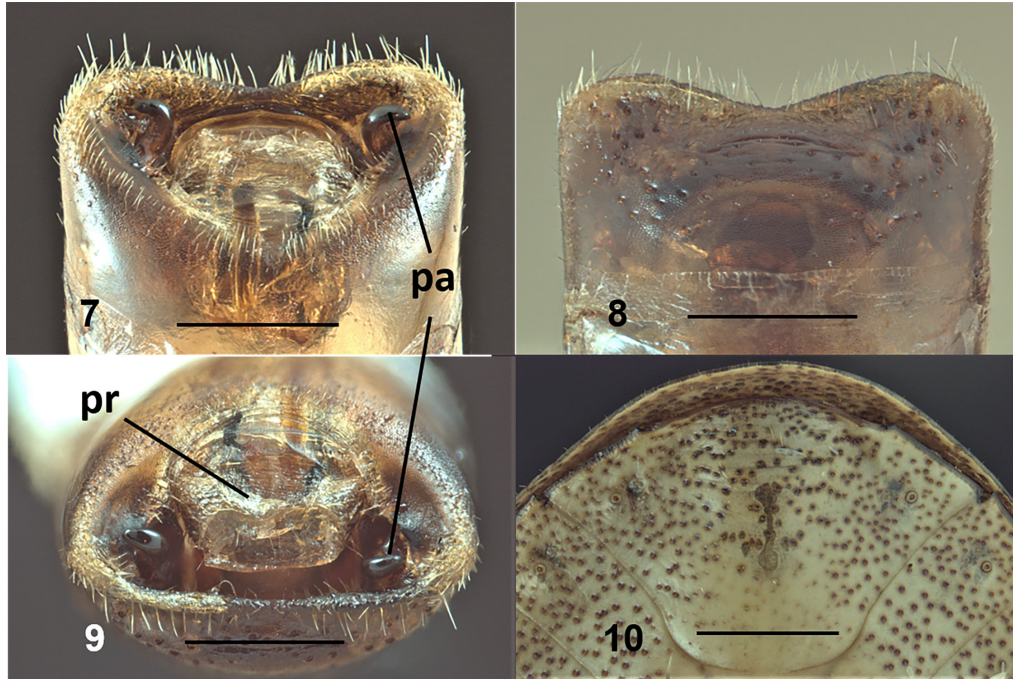
Figures 5–6. *Nesogenes boscii*, habitus. 5) Dorsal view. 6) Ventral view. Scale line = 1.0 mm.

Posterior margin of eighth valvifers produced posterad into rounded angle, slightly longer mesad of angle than laterad of angle (Fig. 28). Ninth valvifers strongly exposed. Ninth laterotergites not surpassing posterior margin of abdomen, contiguous mesially. Fecundation canal thin, elongate (Fig. 32). Spermathecal duct simple, spermathecal dilation present, oval shaped; intermediate part of spermatheca with proximal and distal flanges developed; apical receptacle digitoid, slightly constricted prior to apex (Fig. 33).

Male measurements (mm) (N = 10). Total length 8.69 (8.30–9.20); head: length 2.09 (1.90–2.20), width 2.93 (2.75–3.05); preocular length 1.15 (1.10–1.25); interocular width 1.81 (1.65–1.90); interocellar width 0.98 (0.90–1.05); pronotum: length 2.64 (2.40–2.80), width 5.60 (5.30–5.90); scutellum: length 5.59 (5.10–5.90), width 4.59 (4.20–4.80); mesial length of sternites: III 0.53 (0.50–0.55), IV 0.54 (0.50–0.60), V 0.56 (0.50–0.60), VI 0.57 (0.50–0.65), VII 1.88 (1.80–2.00).

Female measurements (mm) (N = 10). Total length 8.80 (8.40–9.05); head: length 2.10 (1.85–2.20), width 2.92 (2.75–3.10); preocular length 1.14 (1.10–1.20); interocular width 1.83 (1.65–2.05); interocellar width 0.98 (0.90–1.10); pronotum: length 2.58 (2.40–2.70), width 5.56 (5.15–5.85); scutellum: length 5.65 (5.50–5.90), width 4.72 (4.40–5.00); mesial length of sternites: III 0.50 (0.50–0.50), IV 0.54 (0.50–0.60), V 0.54 (0.50–0.70), VI 0.54 (0.50–0.80), VII 1.29 (1.20–1.40).

Type specimens. Holotype: male, labeled 1) CAYMAN ISLANDS: Cayman Brac, Brac Paradise Subdivision, 6-VI-2008, M. C. Thomas, R. H. Turnbow, & B. K. Dozier. 2) Black Light Trap, N19°44.688' W79°44.359' (FSCA). Paratypes: 65 males, 75 females. 60 males, 63 females labeled as holotype (2 males, 2 females to each of AMNH, DARC, DBTC, UGCA, USNM; 10 males, 10 females JEEC; 41 males, 43 females FSCA); 2 males labeled



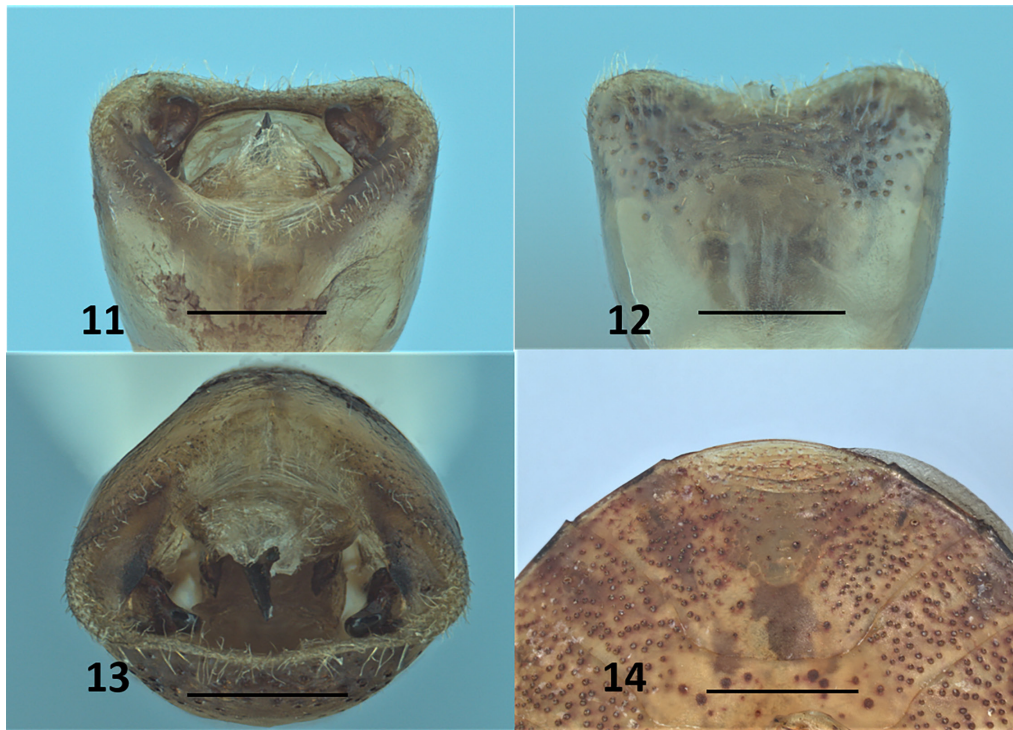
Figures 7–10. *Diolcus thomasi*. 7–9) Male pygophore. 7) Dorsal view. 8) Ventral view. 9) Posterior view. Scale lines = 0.5 mm. 10) Male seventh sternite. Scale line = 1.0 mm. (pa = paramere, pr = proctiger).

CAYMAN: Cayman Brac, N19°43.188' W79°47.579', 7 June 2008, Thomas & Turnbow (FSCA); 1 male, 7 females labeled CAYMAN: Cayman Brac, N19°43.688' W79°44.359', 5 June 2008, R. Turnbow (FSCA); 1 female labeled CAYMAN: Cayman Brac, N19°44.688' W79°44.359', bl trap, 5 June 2008, Thomas & Turnbow (FSCA); 1 male labeled CAYMAN: Cayman Brac, 9 km E Brac Parrot Res., 3-4-VII-2013, M. Thomas, Black Light Trap (FSCA); 1 male, 3 females labeled CAYMAN: Little Cayman, 3 km S of Spot Bay, 8-VII-2013, M. Thomas, Black Light Trap (FSCA); 1 female labeled CAYMAN: Little Cayman, 3.6 mi west of Coot Marsh, black light trap, 6.vii.2013, Col: M. C. Thomas (FSCA).

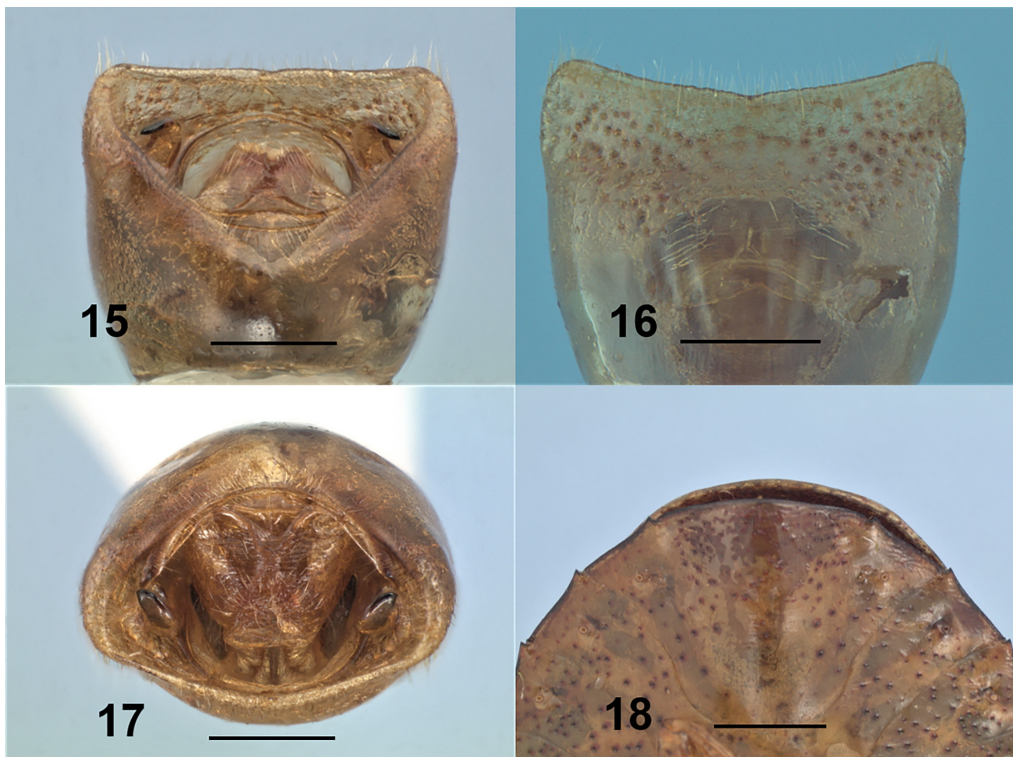
Distribution. Known only from the types which were collected on Cayman Brac and Little Cayman Island.

Etymology. The species is named for Mike Thomas who, with his colleagues, collected all of the types of this species and whose efforts in collecting insects, in systematic studies of beetles, and in contributions to the publication of this journal, contributed immensely to our entomological knowledge. He will be missed.

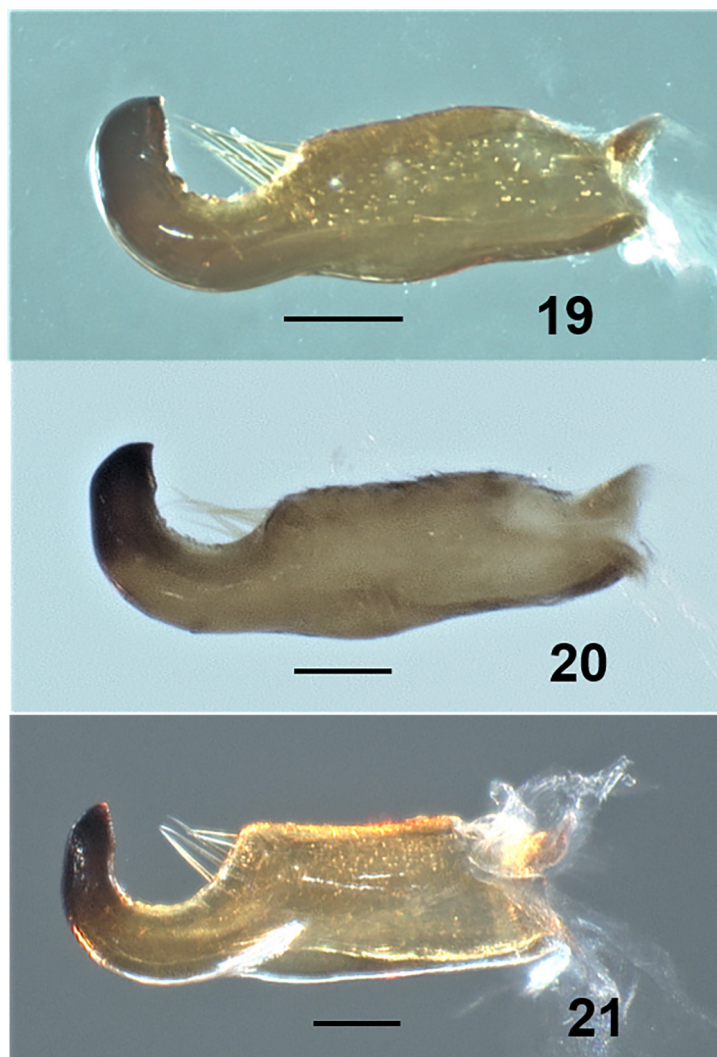
Comments. *Diolcus thomasi* resembles *D. chrysorrhoeus* in a number of characters. Both species are similar in size and shape and in the presence of iridescent punctures (Fig. 1–4) although these are sometimes lacking in *D. thomasi*. *Diolcus chrysorrhoeus* is a little wider than *D. thomasi*, the coloration of *D. chrysorrhoeus* is darker and the latter almost always has two dark sublateral macules on the scutellum (Fig. 3). The lack of an emargination on the posterior margin of the seventh sternite, hiding the male genitalia in both species (Fig. 10, 14), is distinctive and not found in other described species of *Diolcus*. The parameres and male pygophore of *D. chrysorrhoeus* (Fig. 11–13, 20) are similar to those of *D. thomasi*. The phallus in *D. chrysorrhoeus* (Fig. 24–25) is similar to that of *D. thomasi* in shape, in the presence of three pairs of conjunctival appendages and in the aedeagal conducting tube thin, elongate, and sclerotized. The differences lie particularly in the conjunctival processes. The sclerotized apex of each first conjunctival process is narrowed more abruptly in *D. chrysorrhoeus*, that of *D. thomasi* gradually narrowing to an acute apex. In *D. chrysorrhoeus*, each second conjunctival process is broader apically, narrowing to an acute apex in *D. thomasi*. The orientation of the third conjunctival processes in *D. thomasi* is toward the apex of the phallus while in *D. chrysorrhoeus*, they are oriented toward the base (this may be an artifact of expansion of the phallus). In addition, those of *D. thomasi* are narrow and elongate with an acute apex, while those of *D. chrysorrhoeus* are broader, shorter and less acute at the apex.



Figures 11–14. *Diolcus chrysorrhoeus*. 11–13) Male pygophore. 11) Dorsal view. 12) Ventral view. 13) Posterior view. Scale lines = 0.5 mm. 14) male seventh sternite. Scale line = 1.0 mm.



Figures 15–18. *Nesogenes boscii*. 15–17) Male pygophore. 15) Dorsal view. 16) Ventral view. 17) Posterior view. Scale lines = 0.5 mm. 18) male seventh sternite. Scale line = 1.0 mm.



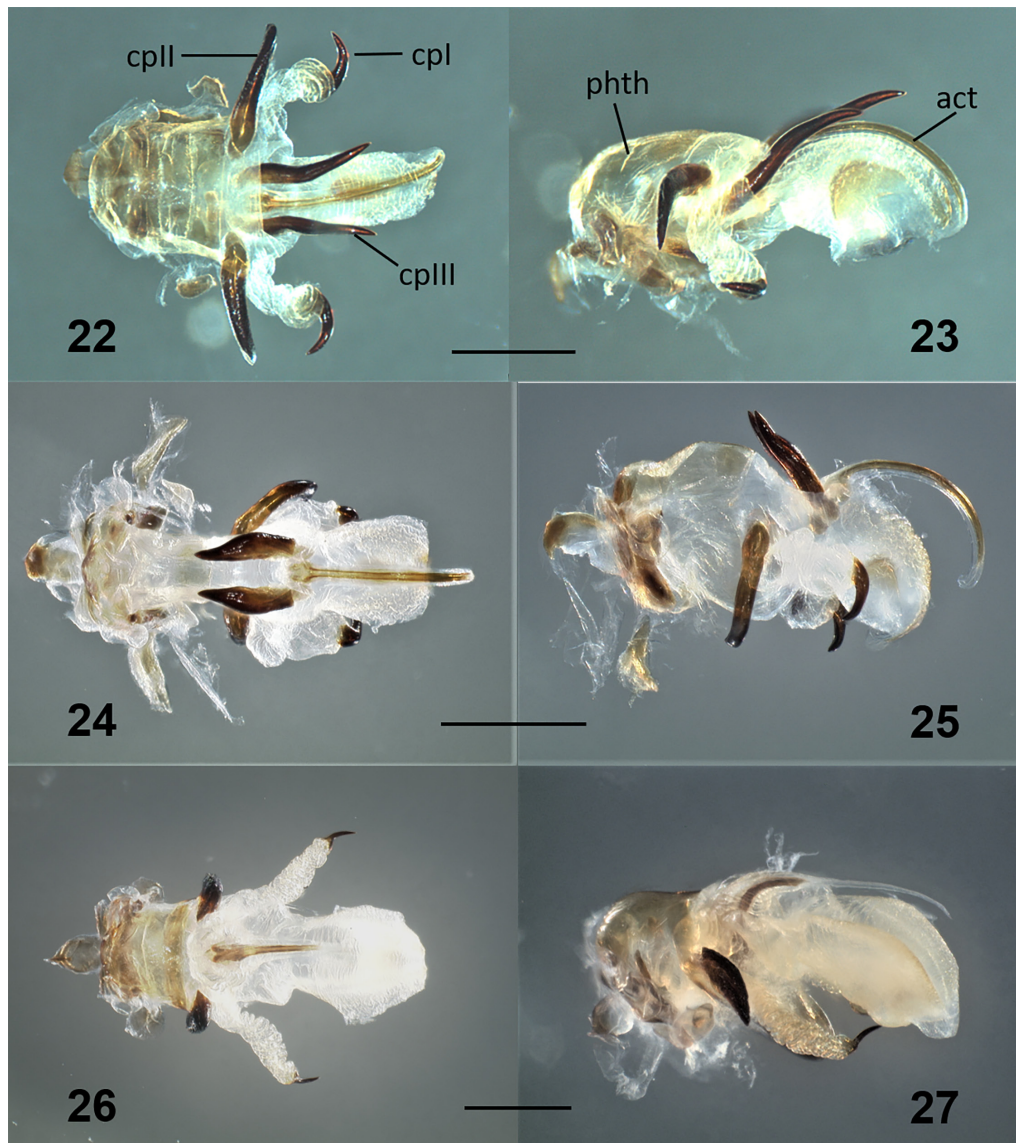
Figures 19–21. Left paramere, ental view. **19)** *Diolcus thomasi*. **20)** *Diolcus chrysorrhoeus*. **21)** *Nesogenes boscii*. Scale lines = 0.5 mm.

Nothing is known of the biology of this species except that most of the specimens were collected in black light traps.

Subfamily placement of *Nesogenes*. The subfamily Elvisurinae Stål currently contains six genera, five of these are found only in the Eastern Hemisphere: *Austrotichus* Gross and *Solenotichus* Martin from Australia; *Coleotichus* White from Australia and the Pacific Islands, *Elvisura* Spinola from Africa and India, and *Solenosthedium* Spinola from Asia, Africa and Europe. The single elvisurine genus in the Western Hemisphere is *Nesogenes* Horváth, with a single species, *N. boscii* (Fabricius) from the Caribbean area. As indicated in the introduction, the placement of this genus in the Elvisurinae is questionable.

Nesogenes boscii resembles elvisurine taxa in having the thoracic sterna deeply sulcate and bordered by strongly elevated carinae (Fig. 6). This character is generally used to characterize the Elvisurinae (Cassis and Vanags 2006; Tsai et al. 2011). It resembles some of the Elvisurinae, particularly some species of *Coleotichus* in having a convex posterior margin of the pronotum and in the presence of iridescent punctures (Fig. 5) but the latter are also found in species of *Diolcus*.

Nesogenes boscii differs from other Elvisurinae and resembles Pachycorinae, particularly some species of *Diolcus* in a number of characters. The abdominal sternites of Pachycorinae possess sublateral striated stridulatory

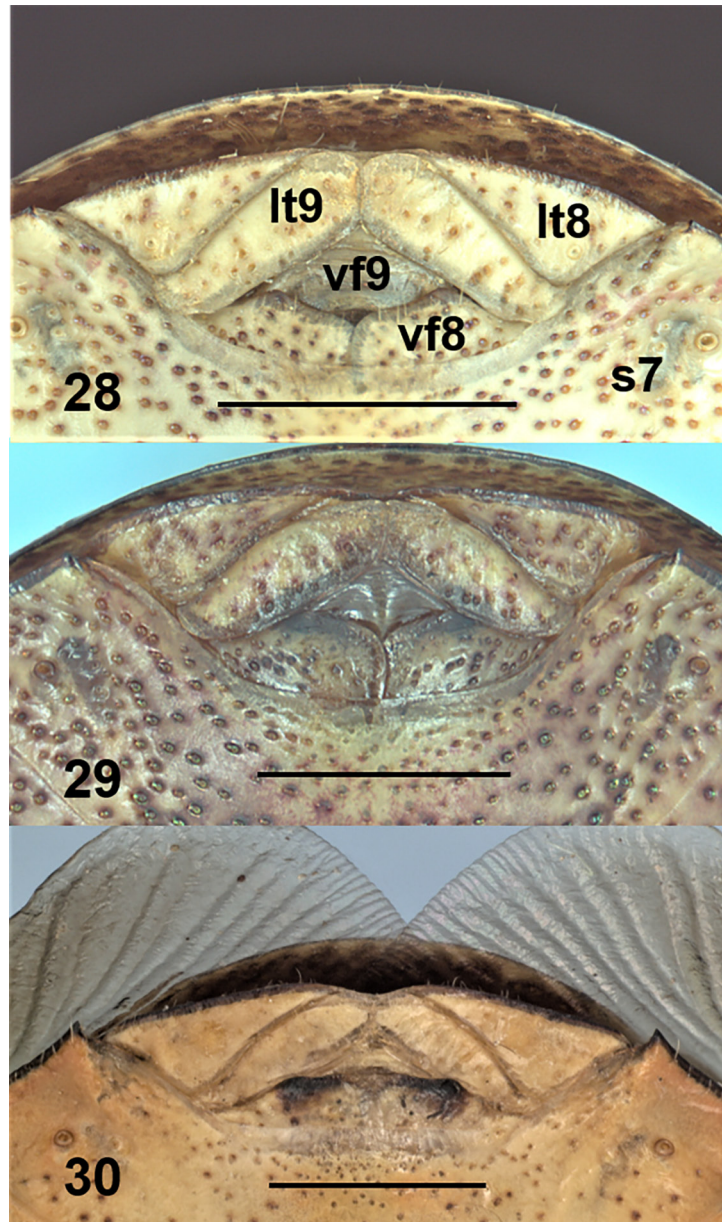


Figures 22–27. Phallus. 22–23) *Diolcus thomasi*. 24–25) *Diolcus chrysorrhoeus*. 26–27) *Nesogenes boscii*. 22, 24, 26) Dorsal view. 23, 25, 27) Lateral view. Scale lines = 0.5 mm. (act = aedeagal conducting tube, cpI = first conjunctival processes, cpII = second conjunctival processes, cpIII = third conjunctival processes, phth = phallosome).

patches on at least abdominal sternites 5 and 6 which are present in *N. boscii*. These are lacking in the Elvisurinae although the latter do possess setose glandular patches in the same area. The proepisternal keel is usually strongly developed in Elvisurinae, but not in *N. boscii*. Czaja (2016) indicated that the distal flange of the spermatheca is well developed in Elvisurinae, but is reduced or absent in the Pachycorinae; it is reduced in *N. boscii* (Fig. 36–37).

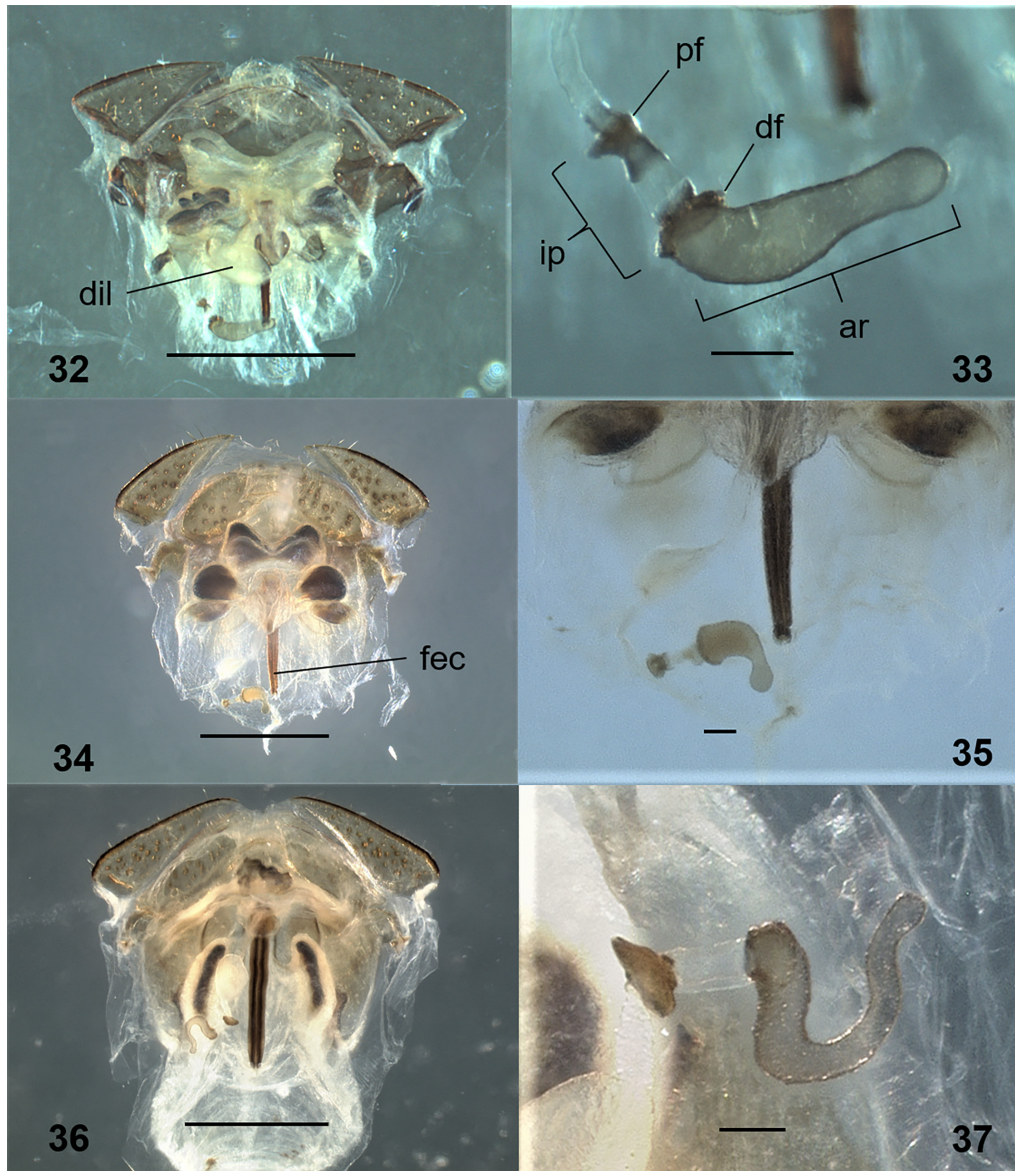
In summary, the placement of *N. boscii* in the Elvisurinae was based primarily on a single character. The geographic distribution of this species and the preponderance of characters suggest that it belongs in the Pachycorinae. I therefore remove *N. boscii* from the Elvisurinae and place it in the Pachycorinae.

The generic placement of *N. boscii* also warrants some scrutiny. It resembles *D. chrysorrhoeus* and *D. thomasi* in having a greatly reduced ostiolar peritreme; seventh urosternite not concave posteriorly, reaching the posterior margin of the abdomen and concealing the genital cup (Fig. 18); and in the presence of iridescent punctures, at least on the head and pronotum although *N. boscii* sometimes has yellow calloused areas on the dorsum. The



Figures 28–30. Female genital plates. **28)** *Diolcus thomasi*. **29)** *Diolcus chrysorrhoeus*. **30)** *Nesogenes boscii*. (lt8 = eighth laterotergites, lt9 = ninth laterotergites, s7 = seventh sternite, vf8 = eighth valvifers). Scale lines = 1.0 mm.

male pygophore (Fig. 15–17) and parameres (Fig. 21) of *N. boscii* are similar to those of *D. chrysorrhoeus* and *D. thomasi*. The phallus of *N. boscii* (Fig. 26–27) is similar to that of the above *Diolcus* species in general structure although the aedeagal conducting tube is only sclerotized basally and the third conjunctival appendages are lacking. The female genital plates of *N. boscii* (Fig. 30) and internal female genitalia (Fig. 35–36) are similar to *Diolcus* spp. except that the distal flange of the spermatheca is more reduced in *N. boscii* than in the two *Diolcus* species and the apical receptacle of the spermatheca is much more elongate in *N. boscii*. *Nesogenes boscii* appears to be very closely related to the two species of *Diolcus* treated in this paper, but there are enough differences in the male and female genitalia to retain its placement in a separate genus pending revision of *Diolcus*.



Figures 32–37. Female genitalia. **32–33)** *Diolcus thomasi*. **34–35)** *Diolcus chrysorrhoeus*. **36–37)** *Nesogenes boscii*. **32, 34, 36)** Genital and postgenital segments. Scale lines = 1.0 mm. **33, 35, 37)** Apex of distal spermathecal duct. Scale lines = 0.1 mm. (ar = apical receptacle, df = distal flange, dil = spermathecal dilation, fec = fecundation canal, ip = intermediate part of the spermatheca, pf = proximal flange).

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