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***Cardiophorus carinatus* (Coleoptera: Elateridae), an unusual new species from the Lake Wales Ridge (Florida, USA) and rediscovery of *Cardiophorus robustus* LeConte, 1853**

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The genus *Cardiophorus* Eschscholtz (Coleoptera: Elateridae), contains 61 species in North America (Douglas 2003, 2017). The first revision of this genus for North America was by Blanchard (1889). Lanchester (1971) later treated the species of northwestern USA and British Columbia, describing 45 species. Douglas (2003) revised the 11 species of Canada and USA (east of the Rocky Mountains). We present additional knowledge that has become available on the *Cardiophorus* species of eastern USA.

B. A. M. and Vince Golia discovered 2 unusual specimens of *Cardiophorus* from the Archbold Biological Station Collection as part of a treatise on the Elateridae of southeastern USA. Both specimens were collected from the Lake Wales Ridge in Polk County, Florida, USA, and are unlike any other New World species of *Cardiophorus*. We believe these 2 beetles are a new species and that they belong to this genus given their ventrally displaced pronotal lateral carinae (separate from pronotal hind-angle carina), anteriorly emarginate scutellum, closed mesocoxal cavities simple tarsi, and tarsal claws.

In addition, Douglas (2003), in his revision of eastern North American *Cardiophorus*, indicated that there were no known collection records of *C. robustus* since 1965, and that the species might be at risk of extinction. Through public online participation on the insect photograph BugGuide discussion site (<http://bugguide.net>), BAM obtained 3 specimens of this species from amateur photographers. In this paper, we present those new records where *C. robustus* were collected from 3 eastern seaboard states.

Materials and Methods

Specimens described here have been deposited in the Blaine A. Mathison Insect Collection (BAMC), Salt Lake City, Utah, USA, and the Florida State Collection of Arthropods (FSCA), Department of Plant In-

dustry, Gainesville, Florida, USA. Specimens were examined and photographed using a Leica M205 dissecting microscope and camera.

Results

Cardiophorus carinatus Mathison and Douglas **sp. nov.** (Figs. 1–3)

TYPE MATERIAL

HOLOTYPE male: Labelled “Lake Wales / Polk Co. FL / 12 Jan 1988 / J. Cronin,” “Scout Camp Scrub,” and with the authors’ red designation label “HOLOTYPE / *Cardiophorus / carinatus* / Mathison & Douglas 2017.” Paratype male: labelled “Lake Wales / Polk Co. FL / 19 Jan 1988 / J. Cronin,” “Scout Camp Scrub,” and with the authors’ yellow label “PARATYPE / *Cardiophorus / carinatus* / Mathison & Douglas 2017.” Both types deposited in the Florida State Collection of Arthropods, Gainesville, Florida. Type locality: United States of America, Florida, Polk Co., Lake Wales 27.9000°N, 81.4500°W

DESCRIPTION

Diagnosis: Males of this species are distinguished by the combination of the medially depressed supra-antennal carinae and costate elytral intervals.

Body: Length 4.9 mm. Integument with strong reticulate microsculpture throughout; head, prothorax, metaventrite brown-black; pronotal hind angles, elytra, and ventrites red-brown; pronotum convex, elytra narrowed from anterior third (Fig. 1). Vestiture yellow-white throughout, longest setae about 1.5 times longer than width of antennomere 2.

Head: Antennae with sensory elements beginning on antennomere 3; antennomere 3 is 2.3 times longer than antennomere 2; antennae extending to metacoxae; mandibles with apices bidentate. Labrum

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Figs. 1–3. *Cardiophorus carinatus* sp. nov. holotype male. 1, 2, habitus; 3, aedeagus, dorsal view. Scale bar = 1 mm.

convex; area between antennal fossa and eye without carinae or pits. Frons with supra-antennal carinae (frontal carina of Douglas [2003]) lowered toward labrum mesad, undivided at juncture with compound eye; frons with supra-orbital groove present.

Prothorax: Pronotum with hind angles abruptly divergent, not truncate dorsally; length of sublateral longitudinal carinae 0.5 times distance from base of carinae to side margin. Hypomeron with obtuse notch on hind margin (Fig. 2); pronotal lateral carina (submarginal carina of Douglas [2003]) restricted to posterior half, and not reaching hind angle carina; smaller pronotal punctures separated by 0.5 to 2.0 diam on disc, with intermixed punctures 2 times larger than smaller ones. Prosternum with anterior lobe short, directed ventrad; prosternal process with ventral surface directed dorsad at 45°, not carinate laterally.

Metathorax: Coxal plates small, covering 1/4 of femora when retracted. Elytra immaculate, with interval 8 carinate on apical half, in-

tervals 3 to 7 somewhat carinate on apical 4th. Upper edge of elytral epipleuron and ventrite edges not minutely serrate. Hind wings apparently capable of flight.

Abdomen: Urosternites 3 to 6 without lateral bulges; punctures difficult to measure accurately due to strong microsculpture; pubescence similar in density to and somewhat shorter than on elytra.

Genitalia: Aedeagus with parameres narrowed somewhat evenly from articulation to point, each with 2 setae; lateral expansions tiny, apical (Fig. 3).

Female: unknown.

ETYMOLOGY

The species epithet *carinatus* is in reference to the strongly costate elytral intervals 3 to 6.

REMARKS

The costate elytral intervals and long antennae both distinguish this from all other New World *Cardiophorus*. The key to species of eastern USA and Canada by Douglas (2003) directs this species to couplet 6, where the users may find that aedeagal and habitus characters direct them down diverging paths. Here users can separate *C. carinatus* from all other New World *Cardiophorus* by its carinate elytra and long antennae. This species somewhat resembles the cardiophorine *Horistonotus uhlerii* Horn (Coleoptera: Elateridae) (also present in southeastern USA), but the scutellum of that species is not anteriorly emarginate. On a world basis, the carinate elytral intervals, medially depressed supra-antennal sutures, ascendant prosternal process, reduced metacoxal plates, small apically positioned paramere expansions make *C. carinatus* species similar to *Cardiophorus (Perrinellus) reitteri* (Schwarz) (Coleoptera: Elateridae) from Israel and Syria. However, the present species differs from *C. reitteri* in its shorter body length, wider and rounder prothorax, smaller eyes (ocular index 74 vs. 61), visible pronotal lateral carina, non-serrate epipleura and ventrites, and narrower aedeagus.

Specimens were collected in the Lake Wales Ridge ecosystem, a low ridge extending 241 kilometers south to north in central Florida in Highlands, Polk, Osceola, and Lake counties (with the majority of the ridge in the former 2). The ridge originated as a series of Pleistocene epoch sand islands, later uplifted by isostatic rebound of the crust beneath the Florida Platform (Florida Forest Service 2005). Remaining native vegetation areas of the Lake Wales Ridge mainly are scrub, and are habitat for endemic vertebrates, including the Florida scrub jay and the sand skink (FNAI 2010). Arthropods endemic to the Lake Wales Ridge (Deyrup 1989) include: *Floridobolus penneri* Causey (Spiribolidae: Floridobolidae); *Zelotes florodes* Platnick & Shadab (Araneae: Gnaphosidae); *Sosippus placidus* Brady (Araneae: Lycosidae); *Geolycosa xera archboldi* McCrone (Araneae: Lycosidae); *Cicindela highlandensis* Choate (Coleoptera: Carabidae); *Phyllophaga panorpa* Sanderson (Coleoptera: Melolonthidae); *Serica frosti* Dawson (Coleoptera: Melolonthidae); *Anomala eximia* Potts (Coleoptera: Rutellidae); *Dasymutilla archboldi* Schmidt & Mickel (Hymenoptera: Mutillidae); and *Dorymyrmex elegans* (Trager) (Hymenoptera: Formicidae). In addition, Deyrup (1989) listed 24 other arthropods that are endemic to multiple ridges in Florida, including the Lake Wales Ridge ecosystem. We hypothesize that *C. carinatus* is endemic to the Lake Wales Ridge area because it has not been detected elsewhere despite Douglas' (2003) examination of over 6,000 *Cardiophorus* specimens from all states of eastern USA.

Little is known about the biology of *C. carinatus*, including the habits of the female or larva. The hind wings appear capable of flight in the male, but the female (although currently unknown) may be flightless and display the reduced morphologic features observed in some psammophilous elaterids from Florida (e.g., *Selonodon* spp. and *Floridelater americanus* [Horn]). The holotype was collected in a protected area for the sand skink, so pitfall trapping was not permitted (Mark Deyrup, personal communication 2013). These collecting restrictions may add to the rarity of this species in collections. Discovery of more specimens from this site may require ultraviolet light trapping or visual nocturnal searching of the soil surface with a headlamp.

REDISCOVERY OF *CARDIOPHORUS ROBUSTUS* LECONTE, 1853

Recently, 3 specimens of *C. robustus* have been discovered from Maine, Massachusetts, and Rhode Island. All records are voucher-identified specimens originally posted by participants of the Bug-Guide website. Specimens have label data as follows: "ME: York

Co., Kennebunk-Parson's Beach, 23-III-2012, B. Woo (BG622804)" [BAMC], approximate locality 43.3420°N, 70.5200°W; "MA: Middlesex Co., Shirley, 6-V-2012, T. Murray (BG638283)," approximate locality 42.5400°N, 71.6500°W [BAMC]; "USA: RI, Washington County, Block Island, sandy path along coastal bluff, A. Hunt," approximate locality 41.2070°N, 71.5580°W. These new records suggest that this species did not become extinct as suspected. The conservation status of this species remains unknown.

REMARKS

Finding a new species of *Cardiophorus* with no morphological affinities to other North American species was surprising given that Douglas (2003) examined over 6,000 specimens from the region. The present find suggests that further collecting is needed in other ecosystems within the eastern USA. It is encouraging to recognize that *C. robustus* continues to persist in rare sandy habitats in highly populated northeastern USA. This suggests that habitat conservation measures have had a positive effect on this species. However, it is unknown whether sufficient habitat exists for long-term survival of *C. carinatus* and *C. robustus*.

Summary

Cardiophorus carinatus Mathison and Douglas **sp. nov.** (Coleoptera: Elateridae) is described from the Lake Wales Ridge ecosystem of Florida, USA. In addition, *C. robustus* LeConte, 1853, is rediscovered in North America from Massachusetts, Maine, and Rhode Island.

Key Words: Insect conservation; psammophilous; sand

Summario

Se describe *Cardiophorus carinatus* Mathison and Douglas **sp. nov.** (Coleoptera: Elateridae) del ecosistema de la banda de Lake Wales Ridge, Florida, EE. UU. Además, se redescubrió el *C. robustus* LeConte, 1853, en América del Norte en los estados de Massachusetts, Maine, y Rhode Island.

Palabras clave: Conservación de insectos; psammófilo; arena

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