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INSECTA MUNDI

1116

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Date of issue: April 25, 2025

Center for Systematic Entomology, Inc., Gainesville, FL

Johnson PJ. 2025. *Cleidecosta hallwachsae* Johnson, new species, the first of the genus from North America (Coleoptera: Elateridae: Euplinthini). Insecta Mundi 1116: 1–8.

Published on April 25, 2025 by
Center for Systematic Entomology, Inc.
P.O. Box 141874
Gainesville, FL 32614-1874 USA
http://centerforsystematicentomology.org/

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Cleidecosta hallwachsae Johnson, new species, the first of the genus from North America (Coleoptera: Elateridae: Euplinthini)

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Abstract. *Cleidecosta hallwachsae* **new species** (Coleoptera: Elateridae: Euplinthini) is described from Costa Rica, Mexico, and Nicaragua. This is the first *Cleidecosta* Johnson species reported from North America, is known only from tropical dry broadleaf forest areas, and is probably nocturnal. Within the regional click beetle fauna *C. hallwachsae* **new species** is distinctive with a shallowly convex body, pectinate antennae of 12 antennomeres in the male and a strongly serrate antenna of 11 antennomeres in the female, and setose claws. Congeneric species are known from French Guiana, Argentina, southern Brazil, Bolivia and Paraguay.

Key words. Costa Rica, Nicaragua, taxonomy, Mesoamerica, Central America, biodiversity, Neotropical, tropical dry forest.

Resumen. Se describe *Cleidecosta hallwachsae* una **nueva especie** (Coleoptera: Elateridae: Euplinthini) de Costa Rica, México y Nicaragua. Esta es la primera especie de *Cleidecosta* Johnson reportada en América del Norte. Este escarabajo se conoce solo en áreas de bosques latifoliados secos tropicales y es probable que sea nocturno. Dentro de la fauna regional de escarabajos elatéridos *C. hallwachsae* **nueva especie** se distingue por un cuerpo ligeramente convexo, antenas pectinadas de 12 antenómeros en el macho y una antena fuertemente aserrada de 11 antenómeros en la hembra, y garras setosas. Se conocen especies congéneres de la Guayana Francesa, Argentina, sur de Brasil, Bolivia y Paraguay.

Palabras clave. Costa Rica, Nicaragua, taxonomía, Mesoamérica, Centroamérica, biodiversidad, Neotropical, bosque seco tropical.

ZooBank registration. urn:lsid:zoobank.org:pub:CC5E3289-636B-466A-9359-8CF8A84095FA

Introduction

Cleidecosta Johnson, 2002 (Coleoptera: Elateridae) is a genus of neotropical click beetles with three described species. All three species were formerly assigned to *Heligmus* Candèze, 1865, with *H. glyphoderus* Candèze from southern Brazil as the type species. A second species, *H. obscurus* Costa, 1975, was described from southwestern Brazil and adjacent Bolivia, followed by a third, *H. guyanensis* Chassain, 2010 from Guyane, or French Guiana. The genus and included species are largely unfamiliar to most people as specimens are rarely seen in collections and publicly available images are few.

The genus name *Cleidecosta* was proposed to replace *Heligmus* Candèze as it is a homonym of *Heligmus* Dujardin, 1845 in Nematoda. Costa (1975) established the tribe Heligmini and subtribe Heligmina, within Pyrophorinae, along with three subtribes Alampina, Compsoplinthina, and Euplinthina. Heligmina contained three genera from South America, *Heligmus*, *Meroplinthus* Candèze, and *Pyrischius* Hyslop. *Heligmus* at that time included only *H. glyphoderus* and *H. obscurus*. Since *Heligmus* is masculine in grammatical gender and *Cleidecosta* is feminine, *H. glyphoderus* and *H. obscurus* are now *C. glyphodera* and *C. obscura*, respectively. Due to *Heligmus* being replaced by *Cleidecosta* it was necessary to replace the family-group name Heligmini with Cleidecostini (Johnson 2002). Presently, Kundrata et al. (2019) have the group as the subtribe Cleidecostina within Agrypninae, Euplinthini. During the interim Chassain (2010) described *H. guyanensis*. Chassain and Touroult (2010) provided additional specimen information and a color image of *H. guyanensis*, but it appears that the transfer of this species to *Cleidecosta* was made online at TaxRef (2012). To date, no species of *Cleidecosta* is reported from outside of South America. The first from neotropical North America is presented below.

Materials and Methods

Descriptions include observations and measurements on both male and female specimens. Morphological terms and concepts generally follow Calder (1996) and Lawrence et al. (2010). Measurements were made with an ocular micrometer at 0.1 and 0.01 mm increments between 7–90× magnifications. Body length was measured from the anterior margin of the frons to the elytral apices, and width was measured across the elytral humeri, unless specified otherwise. The ocular index, a ratio of frons width and head width inclusive of the eyes, was calculated to two decimal places. Antennomere length ratios are given for the dimorphic sexes and given as ratio strings. The ratios were calculated for antennomeres 2–11 as measured along the lateral midline from antennomere base to apex at moderate magnifications, and values were rounded to one decimal place. Antennomere ramus length ratios are given relative to their antennomere length. Pronotal length is along the midline from anterior margin to the ante-scutellar emargination and width is at the widest point at midlength or base of the hind angles. Tarsomere lengths are measured at medium-high magnifications from base to apex along the dorsum, with values rounded to two decimal places and given as a ratio string.

Dissections were made as needed by soaking each specimen in ammonia for 1.0–2.0 hr, removing the abdomen, determining the sex, and either extracting the aedeagus or the sclerotized bursal structures of females. Structures were rinsed in distilled water and treated in 10% KOH as needed for organ resolution. Abdominal ventrites and aedeagi were neutralized and glued to a small card below the specimen. Dissected female genitalia and lightly sclerotized terminal abdominal sclerites were neutralized and preserved in plastic microvials with a drop of glycerine and attached below each specimen. Aedeagus total lengths were measured from the median lobe (penis) apex to the anterior margin of the basal piece (phallobase); paramere length from apex to the anteriormost point of the basal lobe; paramere tip along midline from apex to lateral spine; and basal piece length from basal lateral angle to apex of shoulder junction with paramere. Aedeagal ratios of taxonomic value measured at higher magnifications and calculated to two decimal places are basal piece length/total length, paramere length/total length, paramere apex/paramere length.

Label data are presented verbatim. Information from separate labels is separated by a slash bracketed by single spaces. Interpolated information is given within brackets as needed for clarity or supplementation. Each of the CRI labels with the database numbers given below are preceded by "Costa Rica, [a barcode], INBio." As used on these specimens the Costa Rican locality is represented by the Lambert Coordinate System (L-N or L-S) when indicated, followed by the collector(s), the INBio acronym, and the bar code number unique to each specimen. Latitude and longitude equivalent coordinates are inserted within brackets.

Specimens studied came from these individuals and institutions also cited in the acknowledgements as either loans or gifts:

JMMC = Jean-Michel Maes collection, León, Nicaragua

MNCR = Museo Nacional de Costa Rica, San José, Costa Rica (includes former Instituto Nacional de Biodiversidad collection)

MUCR = Museo de Insectos, Universidad de Costa Rica, San Pedro, Costa Rica

Taxonomy

Subfamily Agrypninae
Tribe Euplinthini
Subtribe Cleidecostina

Genus *Cleidecosta* Johnson, 2002

Heligmus Candèze 1865: 52. Not available due to homonymy with *Heligmus* Dujardin 1845: 147 (Nematoda).
Type species: *Heligmus glyphoderus* Candèze 1865: 52. Monotypy.
Cleidecosta Johnson 2002: 16. Replacement name for *Heligmus* Candèze 1865: 52.

Diagnosis. The presence of strong setae set on the lateral cusp of the basal angle of the pretarsal claw, with additional setae on the lateral and dorsal surfaces, and the apically subparallel elytral striae immediately place this insect in the Agrypninae. The pectinate 12 antennomeres of the male, absence of bioluminescence organs, the lack of deep pronotosternal or hypomeral grooves, fossae, or depressions, presence of apical tibial spurs, and multiple setae of the claws provide direct placement to Cleidecostina, or Heligmina of Costa (1975). The ecarinate frontal margin, antennae shorter than the pronotum in both sexes, the pronotum with a complete lateral margin carina, the aedeagal parameres articulating and not fused ventrally, and the bursa copulatrix lacking spines in combination provide assignment to *Cleidecosta* (as *Heligmus*) in Costa's keys and descriptions.

Cleidecosta hallwachsae Johnson, new species

(Fig. 1–8)

Description. Body (Fig. 1) elongate and subparallel at sides in dorsal silhouette, to shallowly arcuate at and broadest across elytral midlength, gradually attenuate in posterior third. Length 11.4–16.3 mm, width 3.8–5.0 mm. Integument medium to dark red-brown, with punctures dense, umbilicate, setiferous, with dull golden hair-like setae.

Head shallowly convex on vertex, upper frons with shallowly lunulate concavity between eyes; mid to lower frons with shallow medial depression to frontal margin; sculpture of dense umbilicate punctures; frontal margin impressed medially, subangulate laterally. Mandible stout, incisor tooth obtuse; base with outer face excavate. Eyes bulging, hemispherical, finely faceted; ocular index 66–68. Male antenna (Fig. 2) with 12 antennomeres; antennomere 2 short, transverse; antennomeres 3-10 thickly pectinate, each ramus subparallel, rounded at apex; antennomere 11 elongate, shallowly constricted before apex; antennomere 2–12 length ratio 1.0:1.3:1.6:1.6:1.6:1.6:1.5:1.5:2.3:3.7, antennomere 3–11 rami ratio 3.3:3.5:3.8:4.5:4.8:4.8:4.3:2.0; female antenna (Fig. 3) strongly serrate, antennomere 2–11 length ratio 1.0:1.8:1.3:1.3:1.3:1.0:1.0:1.0:2.0, antennomere 11 appendiculate.

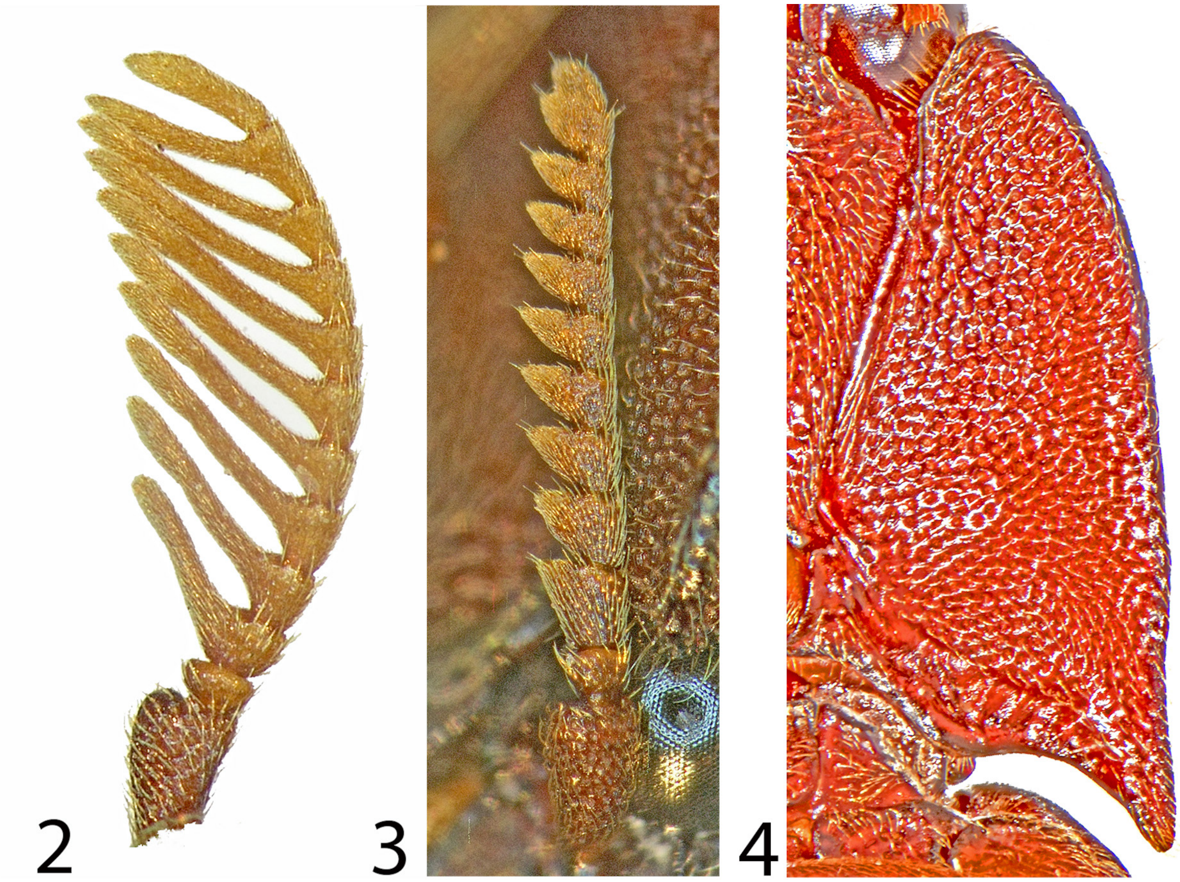
Pronotum wider than long, median length 0.8 times width at midlength, 0.3 times elytral length, moderately convex dorsally, sides slightly sinuate (male) to shallowly arcuate (female) in dorsal silhouette, hind angles slightly divergent. Pubescence of dull golden setae. Disc integument shining, with moderately-dense shallow, slightly ovoid, umbilicate setiferous punctures separated by 1.0–1.5 times own diameters, becoming deeper, rounder, and adjacent laterally; puncture setae long, 2.5 times puncture diameter. Lateral margin of polished carina, narrowly explanate, from anterior margin to hind angle apex. Posterior moderately declivous, moderately punctured, basal margin finely carinate; ante-scutellar sclerite reduced medially, obtusely dentate laterally. Hind angles shallowly convex at base, moderately divergent, narrowing to obtuse apex; dorsally evanescently unicarinate. Hypomeron (Fig. 4) subtriangular, narrowing and broadly rounded anteriorly, broad posteriorly; mesal margin carinate posteriorly, polished, impunctate, shallowly and narrowly excavate anteriorly, conjoined with lateral margin; posterior margin with broad, rounded lobe, then shallow emargination before hind angle apex.

Scutellar shield 1.2 times longer than wide, subpentagonal, broadly rounded anteriorly, subparallel sides in basal half, attenuate to obtuse apex; moderately punctured.

Elytra shallowly convex laterally to depressed discally, length about 3 times median length of pronotum, apices separately rounded; striae subparallel to apices, serially punctured, each deep, elongate, asetose; intervals shallowly convex to flattened apically, with four ranks of setiferous small shallow punctures, recurved hair-like setae shorter than pronotal setae.

Prosternum with disc strongly convex, densely punctured; chin piece shallowly deflexed; intercoxal process subhorizontal, attenuate, with strongly carinate coxal margins. Pronotosternal sutures slightly sinuate, closed anteriorly. Mesoventrite anterior portion horizontal, median fossa deep, walls arcuately V-shaped; posterior portion shallowly angled, grooved, planar with metaventrite at suture. Metaventrite 1.4 times wider than long, shallowly, densely, setiferously punctured. Legs with femora and tibiae slender, densely punctured, setose; tibia

Figure 1. *Cleidecosta hallwachsae* n.sp., dorsal habitus.



Figures 2–4. *Cleidecosta hallwachsae* n.sp. **2)** Male antenna, lateral aspect. **3)** Female antenna, lateral aspect. **4)** Hypomeron, ventral aspect.

with apical spurs short; tarsus subfiliform, densely pubescent, tarsomeres 1–4 sequentially shorter, length ratio 1.0:0.6:0.5:0.4:1.6 (male), 1.0:0.6:0.4:0.4:1.3 (female); claw (Fig. 5) long, slender, acute, basal expansion with 1–2 large ventrolateral setae, 2–3 lateral setae, 8–10 dorsal setae.

Abdominal ventrites 5, moderately-densely, shallowly setiferously punctured; ventrite 5 broadly rounded apically. Aedeagus (Fig. 6) length 1.9-2.0 mm; basal piece length 0.24 times total length, broadly rounded basally, broadly emarginate apically; median lobe attenuate from base to narrowly rounded apex, length 0.66 times total length; paramere deeply excavate mesally, length 0.76 times total length, lateral margin sparsely setose in apical third, membranous apex subangulate laterally, 0.2 times paramere dorsal length, with 12–18 setae dorsally, 8–10 setae ventrally.

Females are similar to males externally, slightly larger, pronotal margins shallowly arcuate in dorsal aspect, antennae serrate with 11 antennomeres, apical antennomere appendiculate. Ovipositor (Fig. 7) sclerites lightly to moderately sclerotized. Median tube with 3 membranous digits apically. Coxite with sclerotized ectal areas mid-length and basally; apical third membranous, constricted, obtuse apically, lacking styli; laterally densely setose in basal half. Baculus each side, short, 2.0 times length of coxite.

Etymology. The species epithet "*hallwachsae*", with consent, is in honor of Winifred `Winnie' Hallwachs, an eminent tropical ecologist and inspiration for biodiversity researchers in Costa Rica and around the world. She co-collected some of the earliest known specimens and is a strong advocate for conserving and protecting tropical dry forest biota and ecosystems.

Figures 5–7. *Cleidecosta hallwachsae* n.sp. **5)** Tarsal claw, dorsal oblique aspect. **6)** Aedeagus dorsal aspect. **7)** Ovipositor, dorsal aspect.

Type material. Holotype, male. COSTA RICA, Santa Rosa National Park, Guanacaste Prov., April 1983, 300 m, DH Janzen & W. Hallwachs [10.83641, -85.61548] / CRI001121960. Specimen will be returned to the Museo Nacional de Costa Rica, San José.

Paratypes. COSTA RICA, Santa Rosa National Park, Guanacaste Prov., April 1983, 300 m, DH Janzen & W. Hallwachs [10.83641, -85.61548] / CRI001121960; same, CRI001121961; same, May 1984 / CRI001121962; same, June 1991, L-N -313000, 359800 / CRI000590320. Fca. Jenny, 30 km N de Liberia, P.N. Guanacaste, Prov. Guan., Tp Malaise, 1990, L-N-316200, 864400 [10.8655069, -85.57353] / CRI000665681; same, may 1991, L-N-316200, 364400 / CRI000339906; same, R. Espinoza, abr 1991 / CRI000675313; same, 20 mar – 12 abr 1992, E. Araya / CRI000892637, CRI000892739, CRI000892647, CRI000892651, CRI000892664, CRI000892666; same, 18–25 abr 1993 / CRI001167693, CRI001167697, CRI001167706; same, Finca Jenny, 240 m, 8-10 Abr 1994, L N 317150–363700 [10.874071, -85.57998], #2833 / CRI001788356, CRI001788357, CRI001788358. 3 km NO de Nacaome, 100 m, P.N. Barra Honda, Prov. Guan., Abr 1993, M. Reyes, L-N-239000, 3860000 [10.168217, -85.37366] / CRI001324870; same, CRI001324871; same, 3 a 30 may 1993 / CRI0014011499; same, CRI001401538. Est. Palo Verde, 10 m, P.N. Palo Verde, Prov. Guanacaste, M. Ortiz, 25 mar a 21 abr 1992, L-N259000, 388400 / CRI000805687. Los Alemandros, P.N. Guanacaste, Prov. Guan., Prov. Guanacaste, 28 mar a 24 abr 1992, G. Gallardo, L-N 334800, 369800 [11.033856, -85.52478] / CRI000432194; same, M. Reyes / CRI000756429. Agua Buena, P.N. Guanacaste, Prov. Guan., 200 m, 8–23 abr 1993, E. López, L N 334800_364100 [11.0336569, -85.57694], #1954 / CRI001695677. Sector Murciélago, P.N. Santa Rosa, Prov. Guan., 80 m, 25 Mar–3 May 1994, E. Araya, Malaise, L N 320300_347200 [10.901925, -85.73102], #3068 / CRI001982953 (28, INBio-MNCR, all specimens listed above this count). Guanacaste, Parque Nacional Sta Rosa, 300 msm, 1-8 MAY-1995, H.J. Lezama & J.E. Arias (2, MUCR); Parque Nal. Santa Rosa, 300 msm, 1-5-JUL-1995, H.J. Lezama & J.E. Arias (1, UCRC). NICARAGUA: Masaya, Las Flores, iv.1993, Col. C. Lecoq & I. Cantamessa (2, JMMC).

Additional specimens. One image of a *Cleidecosta* from Quebrachalt, Zihuatanejo, Guerrero, Mexico, was seen on iNaturalist (2020) and it appears to be *C. hallwachsae*.

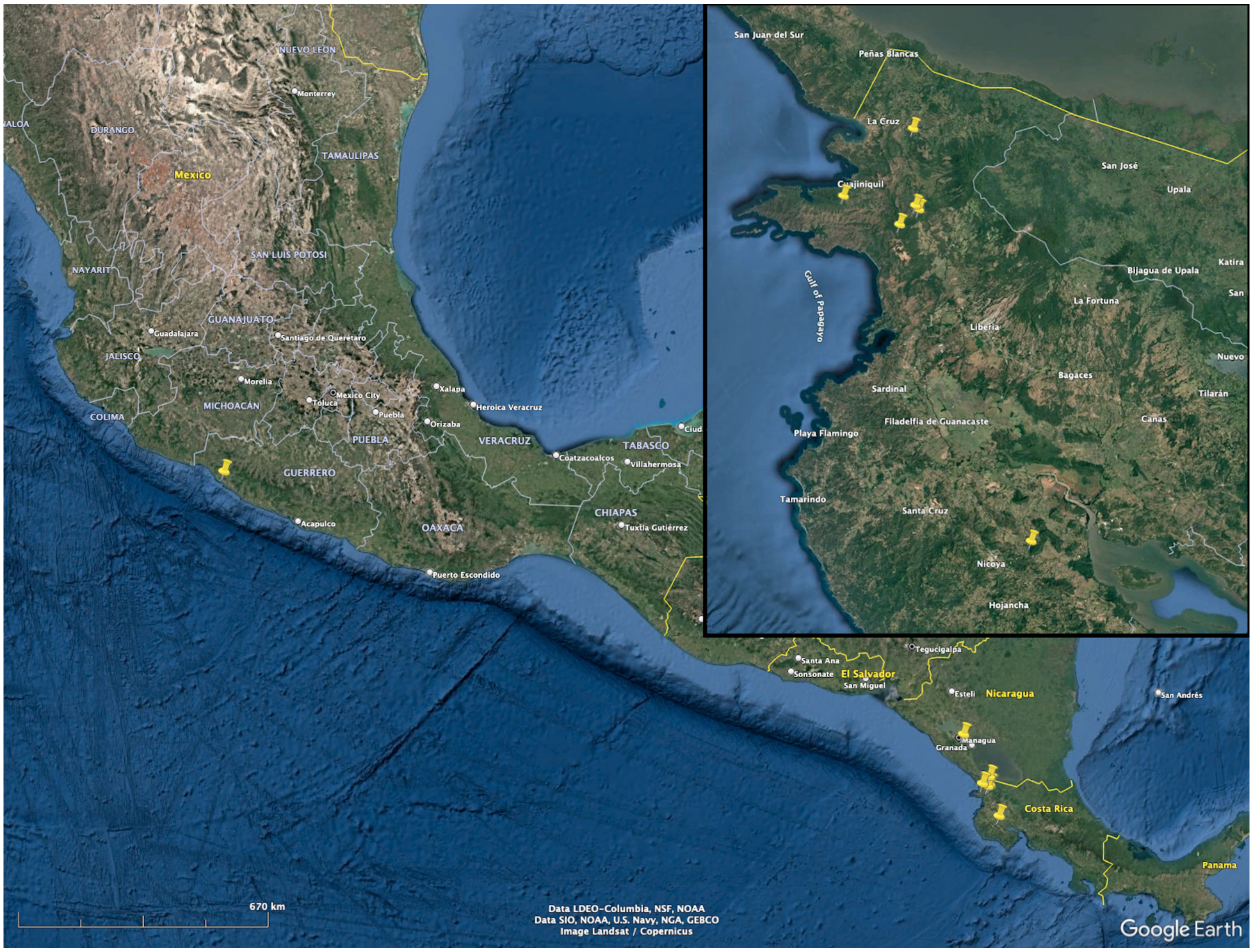


Figure 8. Google Earth image of *C. hallwachsae* distribution from Costa Rica to Mexico as indicated by yellow pins. Inset is northwestern Costa Rica showing separation of sampling sites.

Notes

Known collection sites of *C. hallwachsae* are within tropical dry broadleaf forest or transition zones with tropical moist broadleaf forest. Most specimens were captured with Malaise traps and this species is most likely nocturnal as indicated by the large and finely faceted compound eyes.

The North American distribution (Fig. 8) is disjunct from the other three *Cleidecosta* species, with *C. glyphodera* from southern Brazil, *C. obscura* from northern Argentina, southwestern Brazil and adjacent Bolivia, and Paraguay, and *C. guyanensis* from French Guiana. Morphologically, *C. hallwachsae* is readily distinguished by its medium to dark red-brown color, concavities on the frons, evenly convex pronotum lacking median groove or lateral pits, less divergent and narrower hind angles, the aedeagus with median lobe narrow and attenuate, and parameres with subangulate membranous and setose apices.

Costa (1975) described the bursa copulatrix as a simple tube without sclerites. Accessory glands were not characterized. The internal genitalia of females for this study were difficult to obtain as informative preparations beyond noting that the bursa copulatrix is a simple, unarmed, bulbous sac. Three dissected females, respectively, possessed 17, 36 and 42 near-mature to mature eggs from the ovaries through the oviducts and vaginal positions.

Acknowledgments

My thanks to Dan Janzen and Winnie Hallwachs for encouraging my interests in neotropical click beetles so many decades ago, support for the original Instituto Nacional de Biodiversidad (INBio) in Costa Rica, and the present Guanacaste Dry Forest Conservation Fund (GDFCF) for continuing studies in a fascinating ecosystem. Ángel Solis, GDFCF, Paul Hanson and Humberto Lezama, University of Costa Rica, and Jean-Michel Maes, León, Nicaragua, for loans and gifts of specimens. Simone P. Rosa is thanked for her advice on identity and relationships of South American click beetles. Gratitude is extended to Abigail P. Martens and Ángel Solis (also corrected the resumen and provided latitude and longitude equivalents for Lambert coordinates), for providing reviews and significant improvements to the draft manuscript.

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Received February 28, 2025; accepted March 10, 2025.
Review editor Oliver Keller.