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An unusual new species of *Canthidium* (Coleoptera: Scarabaeidae: Scarabaeinae) from Oaxaca, Mexico

BERT KOHLMANN[1], ALFONSINA ARRIAGA-JIMÉNEZ[2] & MATTHIAS RÖS[3]

[1]*Universidad EARTH, Apartado Postal 4442-1000, San José, Costa Rica. E-mail: bkohlman@earth.ac.cr*

[2]*Centro Interdisciplinario de Investigación para el Desarrollo Integral Regional-Oaxaca, Instituto Politécnico Nacional, Hornos No. 1003, Santa Cruz Xoxocotlán C.P. 71230, Mexico*

[3]*Consejo Nacional de Ciencia y Tecnología, Centro Interdisciplinario de Investigación para el Desarrollo Integral Regional-Oaxaca, Instituto Politécnico Nacional, Hornos No. 1003, Santa Cruz Xoxocotlán C.P. 71230, Mexico*

In this paper we describe *Canthidium quercetorum* **new species** (Coleoptera: Scarabaeidae: Scarabaeinae), a species that inhabits dry oak forest in the Mexican state of Oaxaca, between 2100 and 2300 m above sea level. Photographs and an illustration of the habitus and a distribution map are provided. The unusual distribution and ecology of this species are discussed. An updated key for the genus in Mexico and the United States of America is also presented.

The total number of *Canthidium* Erichson in Mexico has increased significantly since Kohlmann (2003) listed six species in the country. Kohlmann and Solís (2006a, 2006b) described eight new species from Mexico bringing the total up to 14. This new species brings the total number of Mexican *Canthidium* species to 15. As a comparison, Costa Rica has 25 species and Panama has 19 species of *Canthidium* (Solís & Kohlmann 2004, 2012).

Harold (1867) made the very pertinent observation that *Canthidium* substitutes *Onthophagus* Latreille ecologically in South America. Although this is partially true in Mexico, where many *Canthidium* species are found in humid tropical conditions along the Gulf of Mexico coast, *Canthidium* has been able to colonize environments in the mountains, like cloud forests and even dry tropical forest. However, the new species we are describing occurs in typical *Onthophagus*-related environments, such as the dry oak forest within the mountains of the Oaxaca Valley.

Measurements were made to the nearest 0.1 mm using an ocular micrometer with a Stemi DV4 stereoscope. The holotype, allotype, and paratypes of *C. quercetorum* are deposited in the Colección Entomológica, Instituto de Ecología Xalapa, Mexico (IEXA). Paratypes in the Muséum National d'Histoire Naturelle, Paris, France (MNHN); the Canadian Museum of Nature, Ottawa, Ontario, Canada (CMNC); and the Coleção de Entomologia of the Universidade Federal de Mato Grosso, Cuiabá (CEMT).

Canthidium quercetorum Kohlmann, Arriaga-Jiménez & Rös, new species (Figs. 1–3.)

Diagnosis. This species is distinguished by the following combination of characters: body sub-globose and dorsally dark green in colour; head and pronotum uniformly and strongly punctate; frons swollen; frontoclypeal region with a small, smooth swelling medial to each eye; eye dorsally at posterior end of gena two facets wide, interocular distance separated by approximately 14–16 times maximal eye width; antennal lamellae black and sericeous; pronotal surface smooth with sparse micropunctures, basal pronotal border not margined; elytra with eight clearly punctate striae, surface shagreen; pygidium shagreen and lightly punctate; the inner apical margin of the female protibia is not projected at all.

Type locality. Mexico: Oaxaca: Reserva Comunitaria San Pablo Etla.

Description of holotype. Length: 5.1 mm, humeral width: 3.5 mm. Body form sub-globose (Figs. 1, 2A–C). Head and pronotum dark green and shiny, elytra brownish black with green reflections (Fig. 2A). Head and pronotum strongly punctate and devoid of setae.

Clypeus rugosely punctate, apex strongly bidentate, median emargination broadly V-shaped; eye dorsally narrow 8–9 facets at widest portion, at posterior end of gena very narrow, two facets wide, eyes separated approximately 14–16 times maximum eye width (Fig. 2A). Head, frons, and vertex strongly punctate; frons swollen; two small, black, smooth swellings between the eyes (Fig. 2A). On either side of the vertex midline a small impunctate, shagreen area is present. Head surface lightly shagreen at base. Antennae blackish sericeous.

Pronotum with smooth surface, sparse micropunctures, shiny, and strongly and uniformly punctate (Fig. 2A); lateral fovea inconspicuous and simple; posterior margin lacking elongate punctures or groove.

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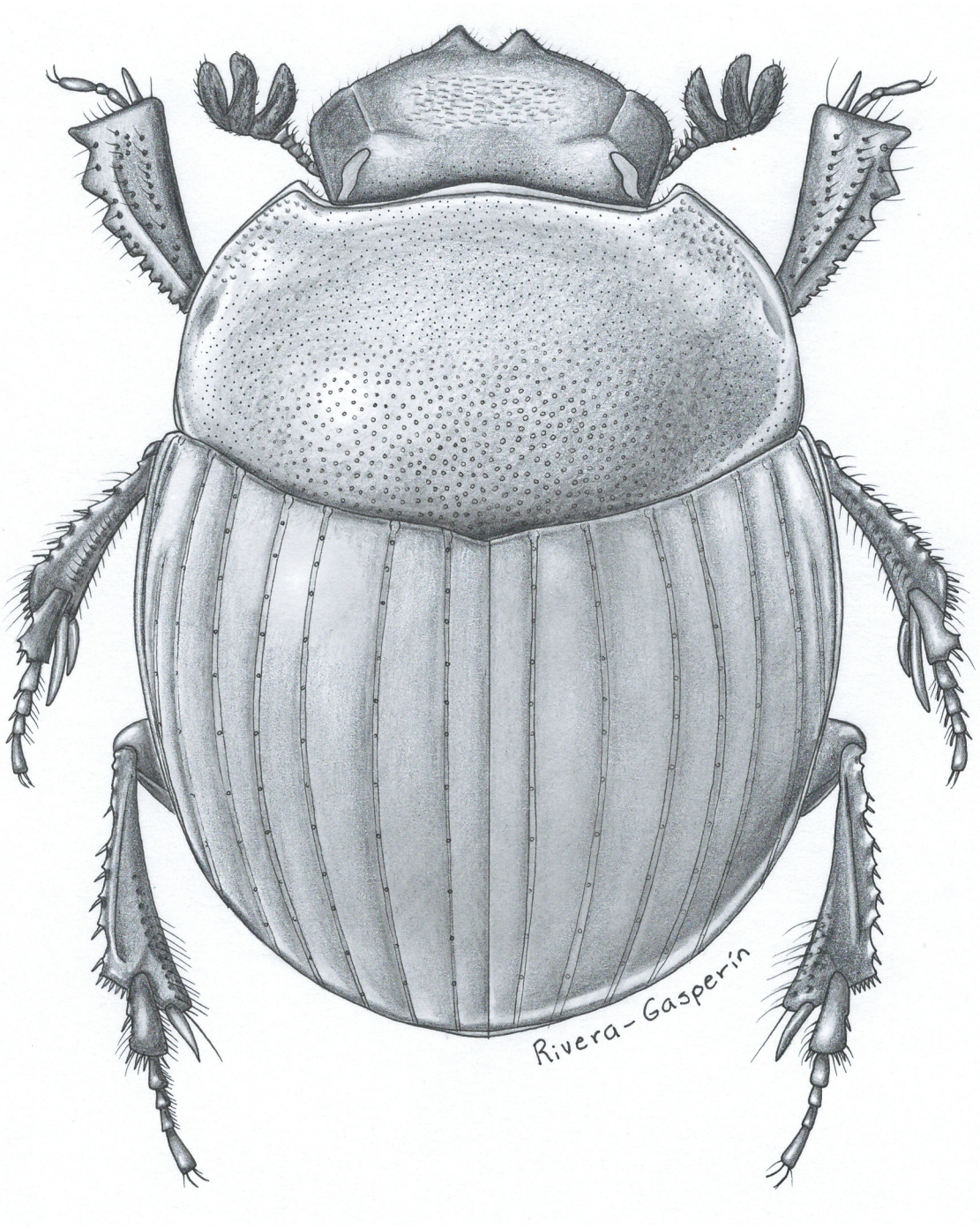

FIGURE 1. Illustration of the dorsal habitus of a female *Canthidium quercetorum* **new species**.

Elytral striae consisting of clear shallow, thin lines, interrupted by fairly evenly spaced oval punctures (spacing approximately at 3–5 the maximum length of one puncture); intervals finely punctate; surface shagreen (Fig. 2A).

Proepisternum excavate anteriorly, surface shagreen and finely punctate. Sternellum shagreen and with a line of setiferous punctures along base. Mesosternum shagreen and finely punctate. Metasternum punctate, less so at the midline (Fig. 2B), lateral-lobe punctures forming coarse rugulae.

Sternites 3–6 shagreen, sternites 3–5 with a row of small punctures along front border (Fig. 2B).

Protibia with three teeth on external border, inner apical margin of protibia produced into a triangular anterior projection and slightly bent downwards; apical spur simple and straight (Fig. 2D). Profemora, mesofemora, and metafemora with ventral surface finely punctate and finely shagreen.

Pygidium slightly convex, shagreen, and shiny with very fine and shallow punctures (Fig. 2F). Aedeagus as in Fig. 2G.

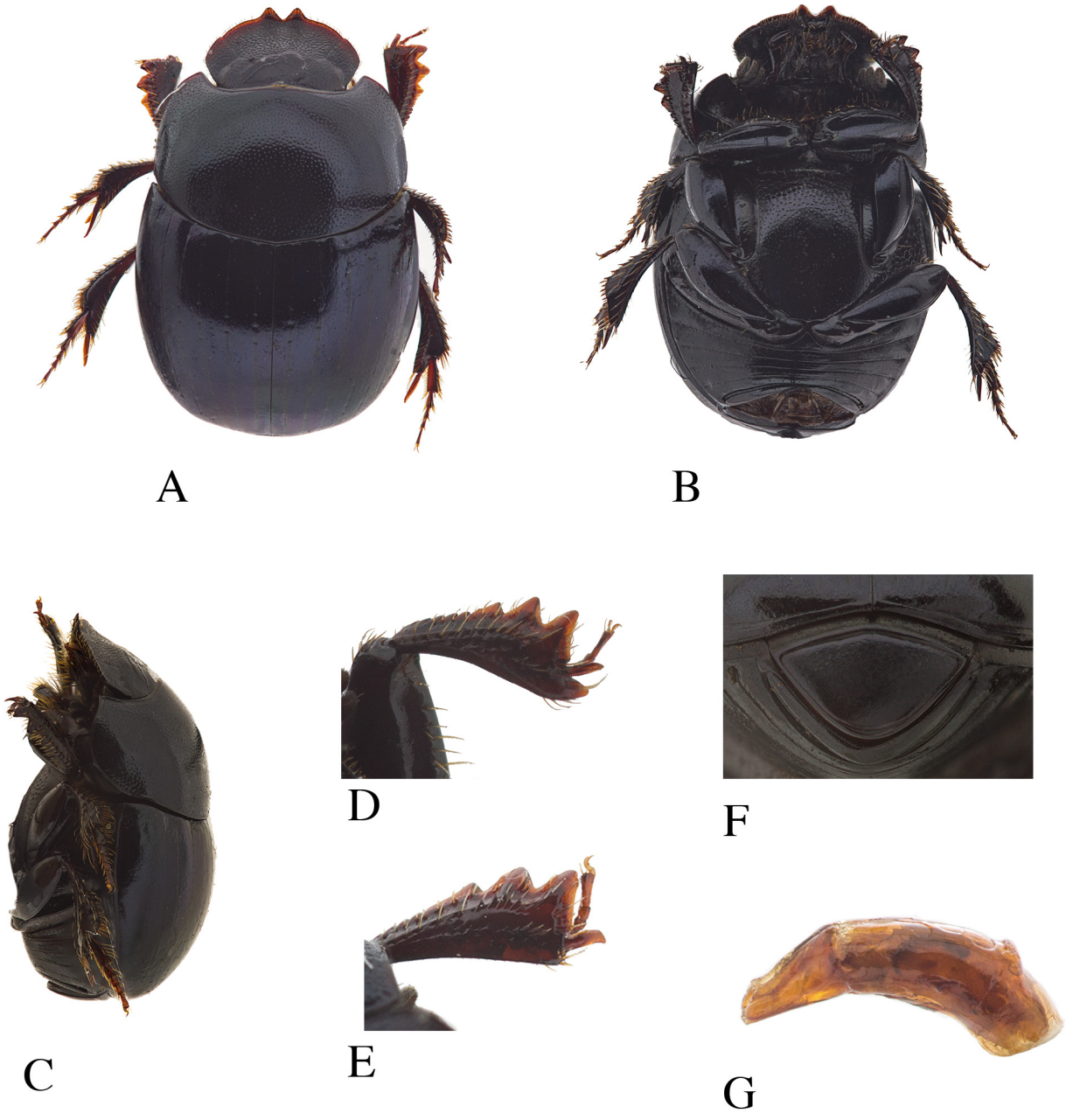

FIGURE 2. *Canthidium quercetorum* **new species**. **A**, the dorsal habitus; **B**, ventral habitus; **C**, lateral habitus; **D**, male protibia; **E**, female protibia; **F**, pygidium; and **G**, aedeagus.

Allotype. Female. Length: 4.6 mm, humeral width: 3.4 mm. Differing from the male in the following major characters: shorter pygidium, last abdominal segment broader, inner apex of protibia not forming a triangular projection, and tip of apical spur slightly bent inwards (Fig. 2E).

Variation. Length: 3.9–5.4 mm, humeral width: 2.4–3.7 mm. Dorsal surface reflexions varies from green to coppery. Antennal lamella varies from black to dark brown. Elytral intervals vary from flat to slightly convex.

Material examined (110 specimens). **Holotype.** Male: **"**México. Oaxaca: Reserva Comunitaria San Pablo Etla. 20-IX-2016. Coprotrampa. x- 96.732348' W, y- 17.170968' N. Bosque de Encino, 2155 m. Arriaga, J.A., Col." **Allotype.** Female. **"**México. Oaxaca: Reserva Comunitaria San Pablo Etla. 20-IX-2016. Coprotrampa. x- 96.732348' W, y- 17.170968' N. Bosque de Encino, 2155 m. Arriaga, J.A., Col." Paratypes: **"**México. Oaxaca: Reserva Comunitaria San Pablo Etla. 20-IX-2016. Coprotrampa. x- 96.732348' W, y- 17.170968' N. Bosque de Encino, 2155 m. Arriaga, J.A., Col." (102 specimens, IEXA (50), MNHN (12), CMNC (20), CEMT (20)); **"**México. Oaxaca: Reserva Comunitaria San

Pablo Etla. 20-IX-2016. Coprotrampa. x- 96.732386' W, y- 17.170454' N. Bosque de Encino, 2151 m. Arriaga, J.A., Col." (3 specimens, IEXA); "México. Oaxaca: Reserva Comunitaria San Pablo Etla. 20-IX-2016. Coprotrampa. x- 96.733014' W, y- 17.170797' N. Bosque de Encino, 2133 m. Arriaga, J.A., Col." (1 specimen, IEXA); "México. Oaxaca: Reserva Comunitaria San Pablo Etla. 20-IX-2016. Coprotrampa. 23-IX-16, x- 96.725987' W, y- 17.174158' N. Bosque de Encino, 2271 m. Arriaga, J.A., Col." (2 specimens, IEXA).

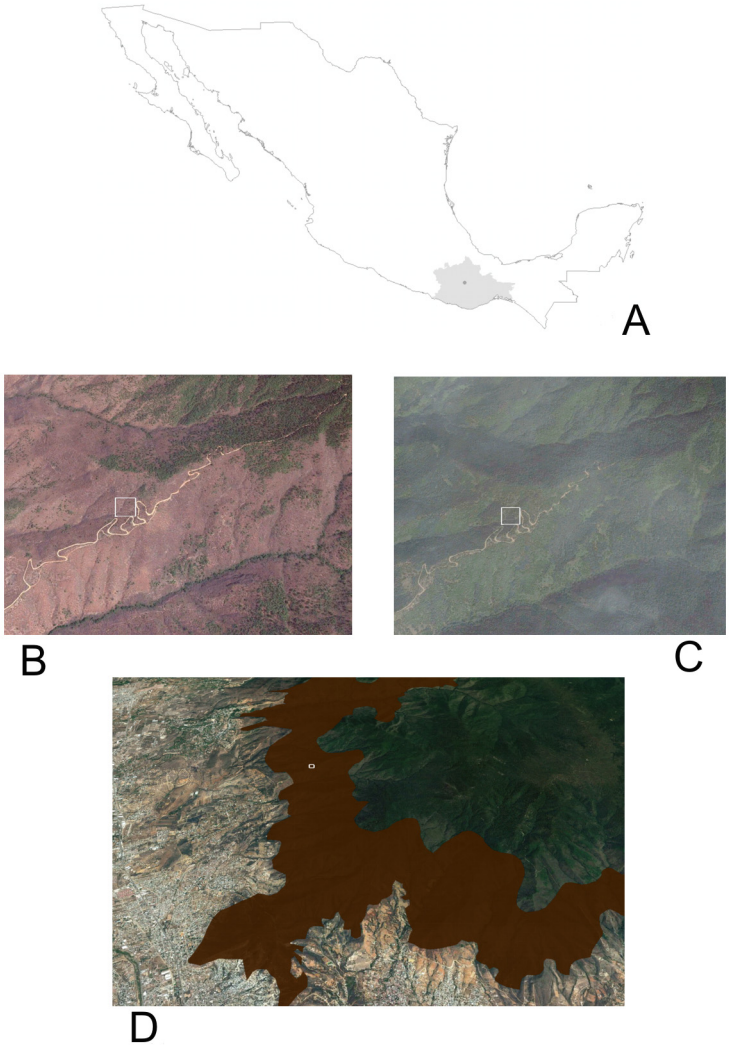

FIGURE 3. Sampling site, **A**, (grey point) of *Canthidium quercetorum* **new species** in Oaxaca (grey area), Mexico (white area). Satellite images of *Canthidium quercetorum* sampling sites in a deciduous oak forest **B**, at the dry season (left) and **C**, at the end of the rainy season (right) (March 2017, November 2014). Bright colours on the left image indicate a forest with trees that have lost their leaves; whereas green vegetation on the same image shows pine-oak forest at higher altitudes, where *Canthidium quercetorum* has not been collected. On the right image, oak forest appears with nearly maximum leaf density at the end of the rainy season. Distribution of **D**, dry oak forest (dark brown area), situated between approximately 1800 and 2400 m. Sampling site of *Canthidium quercetorum* is represented by the white rectangle. On the left lower side of the image the urban area of the Oaxaca Metropolitan Region can be seen. The dark green area on the right upper side of the image represents pine-oak and pine forest (highest elevation is around 3100 m). Satellite image was provided by GoogleEarth, and oak forest distribution by the Instituto Nacional de Estadística, Geografía e Informática.

Geographical distribution. The species is so far only known from Etla in the Sierra Norte in Oaxaca (Fig. 3A), along the internal dry slope facing the Oaxaca Valley. The dry deciduous oak forest where *Canthidium quercetorum* was found is characterized by trees between 5–10 m in height, and with around 12 cm diameter at breast height (Figs. 3B–C). Abundant oak species limited to this vegetation type are *Quercus laeta* Liebm. and *Q. laurina* Humb. & Bonpl. (Fagaceae), which in this region is distributed principally between 1800–2400 m. Other species dominating this forest in the sampling site are *Q. glaucoides* Mart. & Gal., *Q. liebmannii* Oersted., *Q. rugosa* Née, and *Q. castanea* Née, which are also found at higher or lower altitudes (John Williams, Centro Interdisciplinario de Investigación para el Desarrollo Integral Regional, Oaxaca, personal communication; Valencia-Ávalos & Nixon 2004). This dry deciduous oak forest

shows a strong seasonality, where most trees lose their leaves for around four to five months between December and May (Figs. 3B–C). As can be seen (Fig. 3D), the inferred area of distribution of this new species is adjacent to the Oaxaca Metropolitan Area. Thankfully, the area is under protection as the San Pablo Community Reserve.

This species has been collected in the forest in association with *Canthon humectus* (Say), *Copris klugi* Harold, *Deltochilum mexicanum* Burmeister, *Dichotomius colonicus* (Say), *Onthophagus anthracinus* Harold (or near), *O. aureofuscus* Bates, *O. chevrolati retusus* Harold, *O. mexicanus* Bates, *O. zapotecus* Zunino & Halffter, and *Phanaeus damocles* Harold.

Chorological affinities. The known collection locality of *C. quercetorum* is widely separated from that of a similar species, *C. delgadoi* Kohlmann & Solís, which is distributed in cloud forests on the Pacific slope of the Sierra Madre del Sur from Western Guerrero to Jalisco, Mexico, from 1350–2200 m.

Taxonomic relationships. *Canthidium quercetorum* is postulated to be the sister species of *C. delgadoi*. They are both sub-globose in body shape; they also have a swollen frons, narrow eyes, punctate pronotum, shagreen elytra, and shagreen and lightly punctate pygidium.

The two species are very similiar, but *C. quercetorum* can be easily separated from *C. delgadoi* using these characteristics: antennal lamellae black (versus pale yellow); pronotum is lightly shagreen; punctures of the elytral striae well defined; aedeagus with a fine, transparent keel running smoothly without forming a step along the dorsal, central midline of the parameres (keel absent in *C. delgadoi*); larger than average size (3.9–5.4 mm versus 3.5–4.4 mm); and inhabits a dry oak forest and not a cloud-forest.

Etymology. The name *quercetorum* is a latin word in genitive plural, meaning "of the oak woods".

Key to the *Canthidium* of Mexico and the United States of America

(modified from Kohlmann & Solís 2006a)

1 Posterior border of the pronotum with a line of simple or ocellate punctures; elytra with nine striae, the eighth adjoined to the ninth; length 6.5–10.5 mm (subgenus *Canthidium*) ..... *C. centrale* Boucomont
- Posterior border of pronotum without a line of punctures; elytra with 8 striae; length 3–6 mm (subgenus *Eucanthidium*) 1
1 Brachypterous wings; globose body 2
- Functional wings; non-globose body 4
2 Head and pronotum with distinct, fine punctures; elytral striae shallowly impressed except the first stria ..... *C. howdeni* Kohlmann & Solís
- Head and pronotum with distinct coarse punctures; elytral striae deeply impressed 3
3 Eyes at posterior end of gena 2–3 facets; metatibia apically obliquely truncate; parameres with a small hump at apical two-thirds ..... *C. riverai* Kohlmann & Solís
- Eyes at posterior end of gena 8–10 facets; metatibial internal apical angle projected into a tapering rectangle; parameres taper evenly towards apex ..... *C. margaritae* Kohlmann & Solís
4 Clypeofrontal region with three conical tubercles (sometimes with a carina between), anterior tubercle usually glossy and acute, surface sometimes with a carina between the tubercles 5
- Clypeofrontal region with two or without any tubercles, or with one to three low and rounded swellings; tubercles never acute 6
5 Pygidium distinctly punctate (at least in basal half), punctures separated by about a puncture diameter; pronotum with moderate to coarse punctures; head with three clear and small teeth on the frons ..... *C. pseudopuncticolle* Solís & Kohlmann
- Pygidium impunctate or very lightly or minutely punctate; pronotom with microscopic to very light punctures; elytral striae finely and shallowly impressed ..... *C. ardens* Bates
6 Eyes at posterior end of gena 10 or 20 facets wide 7
- Eyes at posterior end of gena 2–6 facets wide 9
7 Eyes at posterior end of gena 20 facets wide; elytra distinctly shagreen ..... *C. moroni* Kohlmann & Solís
- Eyes at posterior end of gena 10 facets wide; elytra lightly shagreen 8
8 Dorsal surface black-green, sometimes with green or red-coppery metallic reflections; clypeus wrinkled; pronotal punctures fine, red; elytra with micropunctures ..... *C. macclevei* Kohlmann & Solís
- Dorsal surface dark reddish brown; clypeus with dense and distinct punctures; pronotal punctures distinct, black; elytra with clear, regular and dense punctures ..... *C. andersoni* Kohlmann & Solís
9 Pronotum finely punctate; length 2.6–3.2 mm ..... *C. hespenheidei* Howden & Young
- Pronotum clearly punctate; length 3.7–5.9 mm 10
10 Frons with two well-developed swellings, frontal tubercle absent; dorsal surface green or green and wine ..... *C. smithi* Bates
- Frons without swellings or with three barely visible swellings; dorsal surface blue, green, or coppery brown 11
11 Entire dorsal surface or only head and elytra shagreen 12
- Only the elytra shagreen 13
12 Entire dorsal surface shagreen; antennal lamellae pale yellow ..... *C. delgadoi* Kohlmann & Solís
- Only head and elytra shagreen; antennal lamellae black ..... *C. quercetorum* Kohlmann, Arriaga-Jiménez, & Rös, **new species**
13 Central head tubercle forming a black swelling or sometimes a keel ..... *C. laetum* Harold
- Central head tubercle atrophied, not forming a black swelling or keel ..... *C. pseudoperceptibile* Kohlmann & Solís

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