A New Species of Canthidium Erichson (Coleoptera: Scarabaeidae: Scarabaeinae) from the Endemic Biota of Chimalapas, Oaxaca, Mexico

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A New Species of *Canthidium* Erichson (Coleoptera: Scarabaeidae: Scarabaeinae) from the Endemic Biota of Los Chimalapas, Oaxaca, Mexico

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Abstract

A **new species** of the genus *Canthidium* Erichson from the Los Chimalapas region of Oaxaca, Mexico is described and illustrated. *Canthidium kohlmanni* Mora-Aguilar and Delgado is diagnosed, and modifications to the key of the North American species of this genus are included. A non-exhaustive list of the endemic fauna and flora from Los Chimalapas region is presented.

Resumen

Se describe e ilustra a una **nueva especie** del género *Canthidium* Erichson colectada en la región de Los Chimalapas, Oaxaca, Mexico. La nueva especie es diagnosticada y se adicionan modificaciones a la clave de las especies de este género de Norteamérica. Se presenta una lista no exhaustiva de los taxones endémicos de fauna y flora que se han descrito de la región de Los Chimalapas.

Key Words: taxonomy, dung beetle, endemism, key to species, fauna, flora

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The genus *Canthidium* Erichson is one of the most diverse dung beetle genera of the New World, with the inclusion of 173 species distributed from southwestern USA to Argentina (Cupello 2018; Génier and Cupello 2018; Moctezuma *et al.* 2019). For South America, 138 species (80%) are recognized, of which 83 are located in Brazil, and of these 58 species are endemic. The North American fauna has 17 species, 10 of them endemic to Mexico (Solís and Kohlmann 2004; Kohlmann and Solís 2006a, b; Kohlmann *et al.* 2018; Moctezuma *et al.* 2019). After the revision by Harold (1867), only the North American, Costa Rican, and Panamanian species have been reasonably well studied (Howden and Young 1981; Solís and Kohlmann 2004; Kohlmann and Solís 2006a). We herein describe a new Mexican species from the Los Chimalapas region in the state of Oaxaca and modify the key to the species from USA and Mexico.

The region of Los Chimalapas is part of a terrestrial priority region of Mexico for biological conservation, known as "Selva Zoque-La Sepultura", due to its large expanse of forests, high richness of plants and vertebrates, and a high potential for endemism (Arriaga *et al.* 2000; Navarro-Sigüenza *et al.* 2008). This region is little known biologically. However, several species have been described from this region. For some years, collections have been carried out on several groups of animal and plants. Since 2012, expeditions have been undertaken to this region by the staff of the Instituto de Ecología, A. C. (Mexico) to obtain samples of Coleoptera and other insect groups. These collections have harvested a high number of unknown species of Scarabaeoidea that have been recently described. We present here, for the first time, a non-exhaustive list of the species of fauna and flora currently considered endemic from this region.

Material and Methods

Morphological structures were studied using a Zeiss Stemi SV-6 stereomicroscope. Photographs and measurements were taken with a Nikon SMZ25 stereomicroscope and DS-Fi2 camera, and image processing used NIS-Elements software. Measurements were taken with an ocular micrometer; length was measured from the apex of the clypeus to the apex of the pygidium, and width was measured across the humeri. Morphological terminology follows Howden and Young (1981) and Kohlmann and Solís (2006a). We use the phylogenetic species concept, which defines species as the smallest aggregation of populations diagnosable by a unique combination of character states (Wheeler and Platnick 2000).

We restricted the region of Los Chimalapas to two municipalities: Santa María Chimalapa and San Miguel Chimalapa. The first is basically a tropical lowland region, and the second one is mountainous with cloud forest and oak-pine forest at its higher elevation (2,250 m). A bibliographic search was

conducted, as complete as possible, on the taxa of fauna and flora described and restricted to this region.

Results

Canthidium kohlmanni Mora-Aguilar and Delgado, new species

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(Figs. 1–7)

Type Material. Holotype male labeled "MEXICO: Oaxaca, San Miguel Chimalapa, Benito Juárez, El Puerto, 8-VII-2013, 16.7159° N, 94.1076° W, 1,250 m, *Pinus-Quercus-Liquidambar* forest, Coprotrampa, E. Mora-A. y L. Delgado cols". Holotype is deposited in the Colección Entomológica del Instituto de Ecología A. C., Xalapa, Mexico.

Description. Holotype male. Length 3.9 mm, width across humeri 2.7 mm. Body form moderately convex and glabrous dorsally. Head and pronotum dark green and shiny, elytra darker, striae with green reflections, legs reddish brown; clypeus and frons slightly microreticulated (Fig. 1). **Head:** Clypeus slightly concave, apex bidentate, median emargination V-shaped, rugose-punctate anteriorly, transversally reticulated posteriorly; frons almost flat with 2 barely visible swellings, punctures confluent, sparser and shallower toward vertex; vertex slightly convex, almost impunctate on each side of midline. Eyes very narrow, with 2 facets at posterior end of genae; eyes separated by about 9–10 times maximum width of eye (Fig. 3). Antennae reddish brown, sericeous. **Pronotum:** Surface shiny, uniformly punctate; punctures sparse, shallow, minute to small at sides, like those on vertex (Fig. 1); lateral fovea semicircular and slightly marked; posterior margin lacking elongate punctures or groove. **Elytra:** Striae moderately impressed, interrupted by annulated punctures separated by about 2–3 diameters of 1 puncture; intervals very finely punctate, surface shiny (Fig. 1). **Wings:** Macropterous, wings functional. **Venter:** Proepisternum excavate anteriorly, surface microreticulated; sternellum smooth and with a line of setiferous punctures along base; mesosternum microreticulated with minute punctures; metasternum with minute punctures denser than mesosternum (Fig. 2). **Abdomen:** Sternites 1–6 microreticulated, with minute punctures; pygidium convex, shiny, with minute, shallow punctures (Fig. 2). **Legs:** Protibia with 3 large teeth on external border, apical and middle teeth separated by 2 denticles, inner apical margin of protibia produced into triangular anterior projection and slightly bent downwards; apical spur simple and slightly curved inward (Fig. 4); profemora microreticulated; meso- and metafemora densely punctate, punctures minute, shallow, denser apically. **Aedeagus:** Parameres moderately short, apices truncated to slightly rounded, inner margins slightly concave (Figs. 5–7).

Etymology. We dedicate this species to Bert Kohlmann, friend and specialist of the subfamily Scarabaeinae, and author of the works on the species of *Canthidium* from North America and Costa Rica.

Taxonomic Remarks. This species is distinguished by the following combination of characters: body moderately convex; dorsally dark green in color, pronotum and head with a light cast green and reddish; head with rounded swellings, not tuberculate; vertex slightly punctate; eye dorsally with two facets wide at the posterior end of gena, interocular distance separated by about 9–10 times the width of an eye; antennal club reddish brown and sericeous; pronotal surface with shallow and minute punctures on disc, at sides with punctures moderate in size; basal pronotal border not margined; elytra with eight clearly punctate striae; mesosternum with minute punctures; abdominal sternites shagreened, pygidium smooth and with minute, shallow punctures; macropterous; and the shape of the parameres (Figs. 5–7).

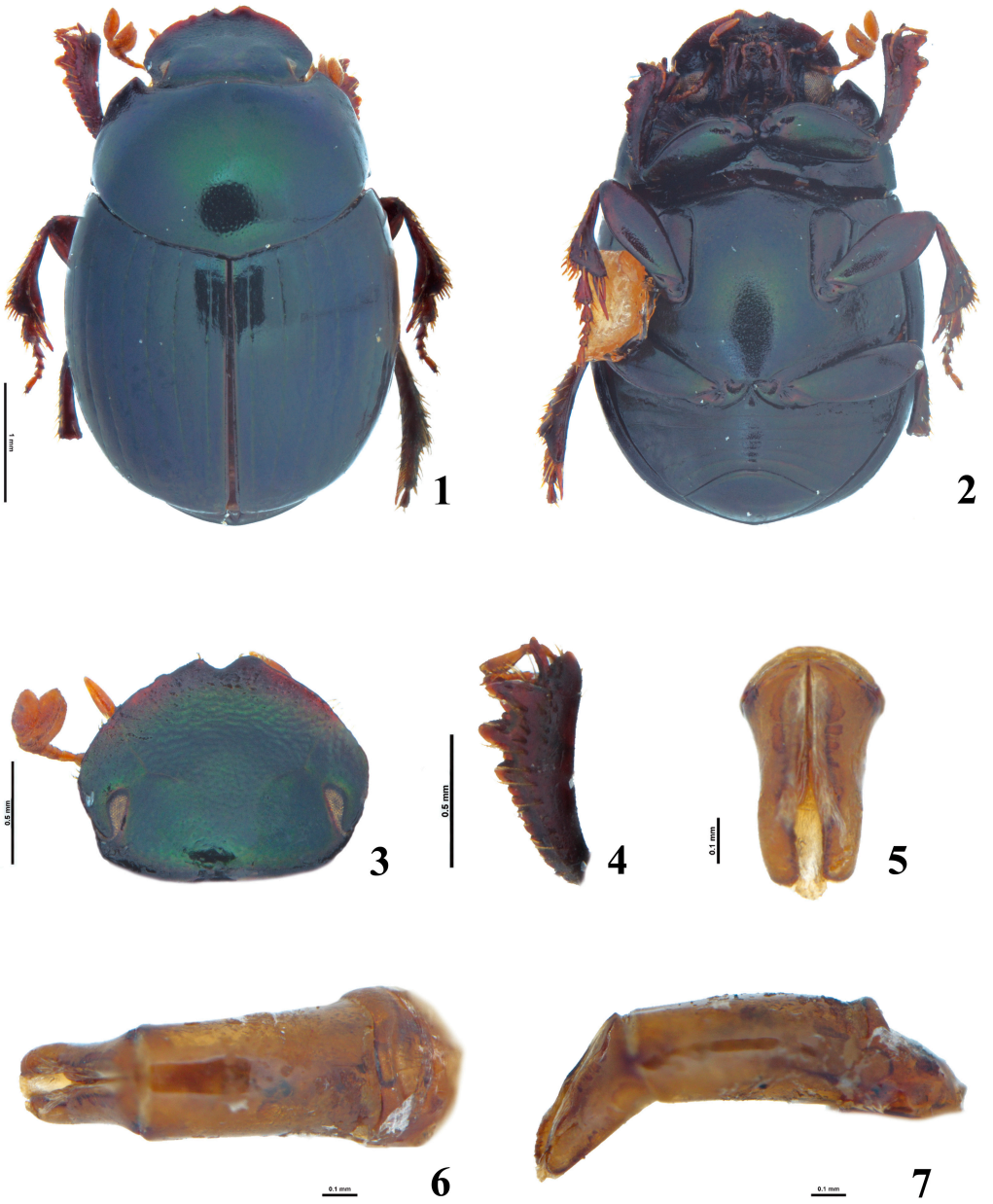
Canthidium kohlmanni is similar to *Canthidium pseudoperceptibile* Kohlmann and Solís (the new species was compared with paratypes of this species), but it is distinguished from *C. pseudoperceptibile* by the frons and vertex with denser and shallower punctures (Fig. 3 *versus* Fig. 9), the pronotum with finer and shallower punctation (Fig. 1 *versus* Fig. 8), the protibia with the apical and middle teeth separated by denticles (Fig. 4 *versus* Fig. 10), and the shape of the parameres of the male genitalia (Figs. 5–7 versus Figs. 11–12).

To include *C. kohlmanni*, we propose the following modifications in Moctezuma *et al.*'s (2019) key to the species of *Canthidium* of North America.

13. Head and pronotum weakly punctate, appearing smooth ..... 13′
- Head and pronotum coarsely punctate, appearing roughened 14

13′. Punctures on pronotal disc small, moderately deep (Fig. 8); apical and middle protibial teeth without denticles between them (Fig. 10); left paramere with projection on inner edge (Fig. 11) ..... ***C. pseudoperceptibile* Kohlmann and Solís**
- Punctures on pronotal disc minute, shallow (Fig. 1); apical and middle protibial teeth with denticles between them (Fig. 4); parameres without projection on inner edge (Fig. 5) ..... ***C. kohlmanni* Mora-Aguilar and Delgado, new species**

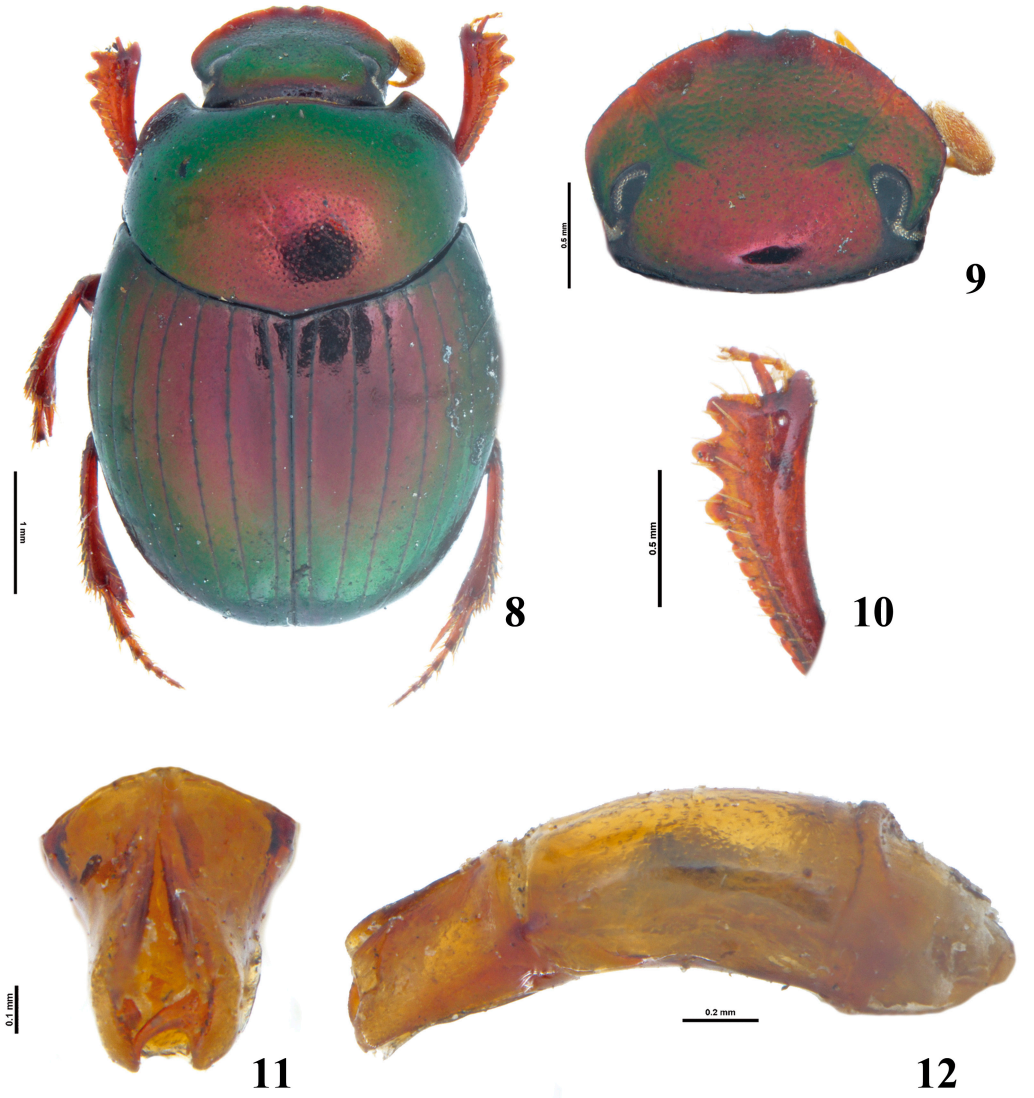
Distribution. *Canthidium kohlmanni* is only known from the type locality, in the undisturbed forests of the mountainous areas of Benito Juárez in the



Figs. 1–7. *Canthidium kohlmanni*, holotype. **1–2)** Habitus, dorsal and ventral views, respectively; **3)** Head; **4)** Protibia; **5–7)** Parameres, caudal, dorsal, and lateral views, respectively.

Los Chimalapas region of Oaxaca, Mexico. The locality and surrounding areas have a rugged topography with ravines and hills with mixed pine-oak forest and tropical deciduous forests at 1,250 m elevation. The distribution of *C. pseudoperceptibile* is allopatric with *C. kohlmanni*, since the former species inhabits tropical forests in the lowlands of the states of Veracruz and Chiapas in Mexico and Guatemala and Belize but on the Gulf of Mexico and Atlantic slopes.

Los Chimalapas has remained as a biologically unexplored region in Mexico, principally at elevations above 1,000 m. However, since the last



Figs. 8–12. *Canthidium pseudoperceptibile*, male paratype. **8)** Habitus, dorsal view; **9)** Head; **10)** Protibia; **11–12)** Parameres, caudal and lateral views, respectively.

decade of the last century to present, many species from this region have been described. Currently, one genus and 23 species of animals and 20 species of plants are endemic in the region (Appendix 1). Two groups stand out by the greater number of endemic species in this region, plants and beetles. Coleoptera is the most diverse group yet less studied. In Los Chimalapas, there are currently known one genus and one species of rove beetles, one species of zopherid beetle, 11 species of scarab beetles, and two species of passalid beetles that are endemic in this region (Appendix 1). Most of the species endemic species to this region are restricted to cloud and mixed forests with conifers located above 1,000 m elevation.

It is remarkable that this region conserves endemic species of large size, such as sturdy trees, *e.g.*, *Persea obscura* Lorea-Hern. (Lauraceae), or a robust beetle species, *e.g.*, *Proculus reyescastilloi* Delgado and Mora-Aguilar (Passalidae). The area of Los Chimalapas has remained as a little-disturbed region due to its mountainous and steep topography, which make accessibility difficult. Priority efforts to conserve this region must be given to maintain not

only particular species, but its huge composite biodiversity of species and landscapes (Navarro-Sigüenza *et al.* 2008).

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Appendix 1

Species of fauna and flora endemic to the region of Los Chimalapas, Oaxaca, Mexico.

Taxa	References
Pteridophyta: Polypodiopsida	Mickel and Smith (2000)
Polypodiales: Athyriaceae	
1. *Diplazium wendtii* Mickel and A. R. Sm.	
Spermatophyta: Cycadopsida	Vovides *et al.* (2008)
Cycadales: Zamiaceae	
2. *Ceratozamia chimalapensis* Pérez-Farr. and Vovides	
Magnoliophyta: Liliopsida	Hernández-Sandoval (2001)
Asparagales: Asparagaceae	
3. *Beaucarnea sanctomariana* L. Hern.	
Asparagales: Orchidaceae	
4. *Mexipedium xerophyticum* (Soto-Arenas, Salazar, and Hagsater) V. A. Albert and M. W. Chase	Pérez-García (2010)
Magnoliophyta: Magnoliopsida:	Turner (1989)
Asterales: Asteraceae	
5. *Ageratina chimalapana* B.L. Turner	
6. *Bartlettina serboana* B. L. Turner	Turner (2010)
Gentianales: Rubiacecae	Borhidi (2004)
7. *Arachnothryx atravesadensis* (Lorence) Borh.	
8. *Arachnothryx chimalaparum* Lorence ex Borh.	Borhidi (2006)
9. *Arachnothryx scoti* (Lorence) Borh.	Lorence (1991)
10. *Bouvardia nivea* Bohr.	Borhidi *et al.* (2008)
11. *Deppea chimalaparum* Bohr. and E. Martínez	Borhidi and Martínez-Salas (2012)
12. *Faramaea oaxacensis* Bohr.	Borhidi (2006)
13. *Martensianthus macdougallii* (Laurence)	Borhidi and Lozada-Pérez (2011)
Lamiales: Acanthaceae	Daniel (1999)
14. *Justicia chimalapensis* T. F. Daniel	
Laurales: Lauraceae	Rohde *et al.* (2017)
15. *Aiouea elegans* (Van der Werff) Rohwer	
16. *Ocotea corrugata* Van der Werff	Van der Weff (1999)
17. *Ocotea zoque* Lorea-Hern.	Lorea-Hernández (2008)
18. *Persea obscura* Lorea-Hern.	Lorea-Hernández (2008)
Rosales: Rhamnaceae	Pool (2013)
19. *Frangula chimalapensis* (R. Fernández) A. Pool	
20. *Frangula wendtii* (Ishiki) A. Pool	Pool (2013)
Acanthocephala: Eoacanthocephala	Salgado *et al.* (2010)
Neoechinorhynchida: Neoechinorhynchidae	
21. *Neoechinorhynchus chimalapensis* Salgado-Maldonado and Caspeta-Mandujano	
Arthropoda: Arachnida	Crews (2011)
Araneae: Selenopidae	
22. *Selenops makimaki* Crews	
Schizomida: Hubbardiidae	Monjaráz-Ruedas and Francke (2018)
23. *Stenochrus chimalapas* Monjaráz-Ruedas and Francke	
Arthropoda: Insecta	Delgado and Mora-Aguilar (2014)
Coleoptera: Passalidae	
24. *Proculus reyescastilloi* Delgado and Mora-Aguilar	
25. *Vindex chimalapensis* Ariza-Marín, Reyes-Castillo, Moctezuma, and Sánchez-Huerta	Ariza-Marín *et al.* (2019)
Coleoptera: Scarabaeidae	Morón and Vaz-de-Mello (2007)
26. *Archedinus howdeni* Morón and Vaz-de-Mello	
27. *Ateuchus colossus* Moctezuma, Sánchez-Huerta, and Halffter	Moctezuma *et al.* (2018)
28. *Canthidium chimalapense* Moctezuma and Halffter	Moctezuma *et al.* (2019)
29. *Canthidium kohlmanni* Mora-Aguilar and Delgado	This work
30. *Canthidium nebularum* Moctezuma, Sánchez-Huerta, and Halffter	Moctezuma *et al.* (2019)

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Appendix 1. continued.

Taxa	References
31. *Onthophagus chimalapensis* Delgado and Mora-Aguilar	Delgado and Mora-Aguilar (in press)
32. *Chrysina chimalapensis* Mora-Aguilar, Curoe, Delgado, and Ramírez-Ponce	Mora-Aguilar *et al.* (2018)
33. *Copris chimalapensis* Mora-Aguilar and Delgado	Mora-Aguilar and Delgado (2015)
34. *Cryptocanthon chimalapensis* Mora-Aguilar and Delgado	Mora-Aguilar and Delgado (2018)
35. *Phanaeus zoque* Moctezuma and Halffter	Moctezuma and Halffter (2017)
36. *Rhyparus chimalapensis* Mora-Aguilar and Delgado	Mora-Aguilar and Delgado (2019)
Coleoptera: Staphylinidae	Santiago-Jiménez (2016)
37. *Macrozoque hoplandrioides* Santiago-Jiménez	
Coleoptera: Zopheridae	Delgado and Mora-Aguilar (2019)
38. *Verodes chimalapensis* Delgado and Mora-Aguilar	
Diptera: Scatopsidae	Huerta (2013)
39. *Colobostema lupitae* Huerta	
Psocodea: Epipsocidae	García-Aldrete (2019)
40. *Epipsocus reyesi* García-Aldrete	
Chordata: Amphibia	Lynch (1967)
Anura: Craugastoridae	
41. *Craugastor silvicola* (Lynch)	
Chordata: Sauropsida	Campbell (1984)
Squamata: Anguidae	
42. *Abronia ornelasi* Campbell	
Squamata: Dipsadidae	Canseco-Márquez *et al.* (2018)
43. *Chersodromus australis* Canseco-Márquez, Ramírez-González, and Campbell	