

THE NEOTROPICAL SPECIES OF SMALL CARPENTER BEES OF THE SUBGENUS *CERATINA* (*ZADONTOMERUS*) ASHMEAD, 1899 (HYMENOPTERA: APIDAE)

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Abstract

The Neotropical species of the subgenus *Ceratina* (*Zadontomerus*) Ashmead are revised. We recognize seven new species, giving a total of 10 species for the region: *Ceratina* (*Zadontomerus*) *capitosa* Smith, *C. (Z.) ignara* Cresson, *C. (Z.) nautlana* Cockerell, *C. (Z.) kopili* new species, *C. (Z.) basaltica* new species, *C. sapphira* new species, *C. (Z.) indigovirens* new species, *C. (Z.) rehanae* new species, *C. (Z.) raquelitae* new species, and *C. (Z.) tepetlana* new species. We propose the following synonymies: *C. abdominalis* Smith, *C. tehuacana* Strand, and *C. parignara* Cockerell under *C. (Z.) ignara*; and *C. bakeri* Smith and *C. nigriventris* Friese under *C. (Z.) nautlana*. Also, we describe the previously unknown male of *C. capitosa*, and provide a key to the species, diagnoses, descriptions and illustrations of the new species.

Key words: small carpenter bees, new species, new synonymies, taxonomy., Xyllocopinae

Introduction

Bees of the genus *Ceratina* Latreille, 1802 are commonly known as small carpenter bees because they construct their nests in dead and broken twigs (Rehan 2020). Despite being typically recognized as solitary, subsocial behavior has been described for some species, which makes them an important group to study the evolution of sociality in bees (Shell & Rehan 2018).

Ceratina comprises 375 currently described species (Ascher & Pickering 2020), classified in 23 subgenera (Michener 2007; Roig Alsina 2013; Terzo *et al.* 2007). *Ceratina* are widespread and well-represented globally, but are rare in Australia and absent in Antarctica (Michener 2007). In the Americas there are six endemic subgenera: *Calloceratina* Cockerell, occurring from Mexico to Bolivia and Brazil; *Ceratinula* Moure, distributed from southern USA to Argentina; *Crewella* Cockerell, ranging from Costa Rica to Argentina; *Neoclavicera* Roig-Alsina, found from Peru to Argentina; *Rhysoceratina* Michener, distributed from Colombia to Argentina; and *Zadontomerus* Ashmead, occurring from southern Canada to Colombia and Venezuela (Flórez-Gómez & Griswold 2020; Michener 2007; Roig Alsina 2013). For the Neotropical region, four revisions have been made: Genaro (1998) revised the species from Cuba and La Española, Roig-Alsina (2013, 2016) revised *Neoclavicera* and *Rhysoceratina*, and de Oliveira *et al.* (2020) revised *Ceratinula* species occurring in Brazil.

The subgenus *C. (Zadontomerus)* comprises 30 currently described species, with 19 Nearctic species (Daly 1973; Rehan *et al.* 2010; Rehan & Sheffield 2011), and 11 Neotropical species (Moure 2012). Taxonomic revisions are limited and have mainly focused on the Nearctic species (Michener 1936; Rehan & Richards 2008; Rehan &

Sheffield 2011). Neotropical species of *Ceratina* (*Zadontomerus*) have not been previously revised. In this study, we describe seven new species for the region, establish new synonyms and provide diagnoses for the previously described ones. We also present an identification key for the species and updated maps of their geographic distributions.

Material and methods

We examined 3526 specimens deposited in the following collections: Museo de Zoología “Alfonso L. Herrera”, Facultad de Ciencias, UNAM, Mexico (MZFC); Colección Nacional de Insectos, Departamento de Zoología, Instituto de Biología, UNAM, Mexico (CNIN); Colección de la Estación de Biología Chamela, IBUNAM, Mexico (EBCh); Colección Entomológica de Abejas y Polinizadores, El Colegio de la Frontera Sur, San Cristóbal de las Casas, Chiapas, Mexico (ECOAB); American Museum of Natural History, New York, USA (AMNH); and USDA-ARS Pollinating Insects Research Unit, Utah State University, Logan, Utah, USA (BBSL). We examined type material from eight species obtained on loan from the National Museum of Natural History, Smithsonian Institution (USNM) and the Museum of Comparative Zoology, Harvard University (MCZ). We could not examine the types of *C. capitosa* and *C. abdominalis*, however, available descriptions and photos served to discriminate them from other species.

Morphological terminology used in this study follows Michener (2007) and Daly (1973), with the following abbreviations: metasomal tergum (T) and metasomal sternum (S). We dissected the male genitalia, sixth sternum (S6) and seventh tergum (T7), which were cleared with a 10% KOH solution to clearly observe the details of morphology (Ayala 1999), and then stored in vials with glycerin attached to the corresponding specimen. Descriptions were made based on the holotype and a paratype, further annotations in the comments section were made using all available specimens. Measurements in the descriptions were made using a Leica MZ6 microscope and are expressed in millimeters. Habitus photographs were taken with a Cannon EOS 70D DSLR camera and a Canon EF-S 60 mm macro lens. Photographs of structures were taken using a Zeiss AXIO Zoom V16 microscope with an AxioCam MRC5 5 megapixel camera. All images were processed in Adobe Photoshop CS5® and Affinity Photo®. Holotypes and paratypes are deposited at MZFC, CNIN, ECOAB and AMNH. Finally, we constructed distribution maps with collection data obtained from specimen labels using QGIS software and layers from the CONABIO geoinformation portal.

Systematics

Genus *Ceratina* Latreille

Subgenus *Zadontomerus* Ashmead

Zadontomerus Ashmead, W. H. (1899). Classification of the bees, or the superfamily Apoidea. Trans. Amer. Entomol. Soc. 26: 49–00 [69]. Type species: *Ceratina tejonensis* Cresson, 1864 by original designation.

Ceratina (*Zadontomerus*) Cockerell, T. D. A. & Porter, W. (1899). Contributions from the New Mexico Biological Station - VII. Observations on bees, with descriptions of new genera and species. Ann. Mag. Nat. Hist. 4 (7): 403–421 [404]. Unjustified emendation.

Diagnosis. Presence of two impunctate swellings on the frons of males and females, one on each side; pronotum with lateral carina extending to the forecoxa, but not continuing dorsally; gradulus on T4 and T5; dark metallic coloration, paraocular marks absent except in males of a few species; forecoxa with straight posterior margin; preoccipital margin carinate, weakly so in some species; fore and medial tibiae with one apical spiniform projection; base of hind tibia with a spine-like projection; wax plates on S2 and S3; males with medial tuft of hairs on T6, weakly evident in some species; males with more punctures than females, and generally, smaller; females with inner margin of eyes subparallel to slightly convergent below, males with eyes convergent to strongly convergent below; and clypeal marks and preoccipital carina more conspicuous in males.

***Ceratina (Zadontomerus) capitosa* Smith, 1879**

(Figures 1, 2, 22A, 23A, 24A, 25)

Ceratina capitosa Smith, F., 1879 (syntype: Natural History Museum, United Kingdom: ♀, Mexico, Oaxaca)

Diagnosis. Head, scutum, scutellum and metanotum black with olive green tones, propodeum and metasoma olive green and wings brownish with lighter stigma; males and females with posterior margin of T4, T5 and T6 with dense yellow pubescence; large bees: females from 9.0–12.0 mm and males from 7.0–10.0 mm. Females, gena wider than eye width, with sparse punctures, area adjacent to eye impunctate, reaching $\frac{1}{4}$ of genal area; disc of scutum impunctate and polished. Males with hind femur with ventral medial projection forming an angle and sparse white hairs (Fig. 22A); and T7 of males with medial rounded projection (Fig. 23A).



FIGURE 1. *Ceratina capitosa*. A: Male lateral habitus, B: male frontal view, C: Holotype, female lateral habitus, D: Holotype, female frontal view, E: Holotype, female dorsal view (from Natural History Museum (2021))

Male. Length 7.8 mm. *Head.* Black with olive green tones. Mandibles bidentate. Labrum with yellow spot at the middle area, pubescence short, sparse. Clypeus with T-shaped yellow mark, coarse punctation. Supraclypeal area and lower paraocular area densely punctate, punctures separated by less than a puncture diameter. Ocellocular area with punctures separated by a distance equal to 1.5 times puncture diameter. Frons with paired impunctate swellings, surrounding area with punctures separated by a distance up to twice puncture diameter. Vertex densely punctate, with yellowish pubescence, long, sparse. Gena with punctures separated by a distance at least 1.5 times puncture diameter. Preoccipital carina well developed. Scape and pedicel dark brown, flagellum brown. Head length 1.9 mm; head width 2.3 mm; lower interocular distance 1.17 mm; upper interocular distance 1.43 mm; ocellocular distance 0.52 mm.

Mesosoma. Black with olive green tones. Pronotum with lateral carina, dorsolateral angle of pronotum carinate. Mesepisternum with white and scattered plumose pubescence, upper area densely punctate, separated by less than a puncture diameter, lower area with punctures separated by a distance equal to twice puncture diameter; hypoepimeral area with close punctures becoming sparser in the lower area. Metepisternum with fine and close punctures, punctures smaller than ones at the mesepisternum. Anterior area of scutum with punctures separated by a distance of 3 times puncture diameter; disc of scutum with few punctures, line of dispersed punctures surrounding the anteromedial line; posterior area with fine and densely distributed punctures. Scutellum with dense punctation separated by a distance equal or less than a puncture diameter. Metanotum with fine and close punctures, punctures smaller than ones on the scutellum. Propodeum, basal area with striae, finely and densely punctate, with white scattered pubescence, integument olive green contrasting with the rest of mesosoma. Tegula brown and impunctate. Length of forewing 6.2 mm. Wings brownish, submarginal cell dark brown, venation brown and pterostigma light brown to yellowish. Scutum length 1.3 mm; scutum width 1.69 mm. *Legs.* Integument black. Base of tibia with yellow spot. Tarsi dark brown, distitarsus and tarsal claw brown. Spurs whitish. Hind femur medially dilated forming an angle (Fig. 22A); ventral surface with short, sparse hairs.

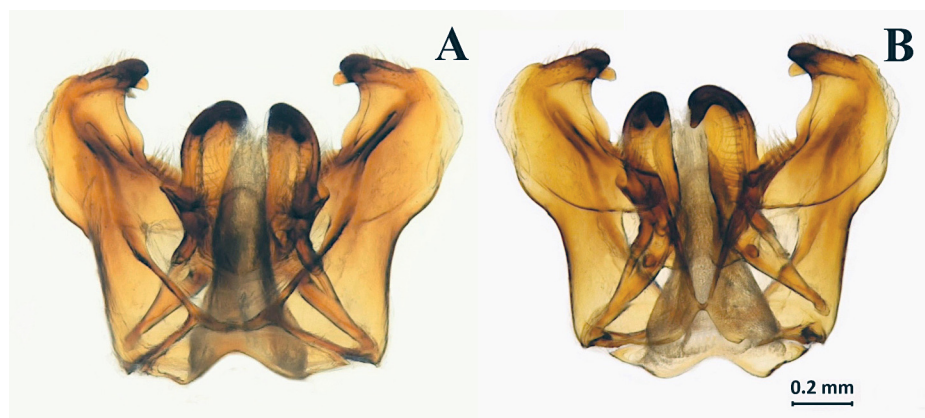


FIGURE 2. Genital capsule of *Ceratina capitosa* male. A: Dorsal view, B: ventral view.

Metasoma. Integument olive metallic green. T1 polished, disc with small area with fine and close punctures. T2-T3 with dense punctation laterally, separated by a distance less than or equal to puncture diameter, becoming more separated on the disc. T4 densely punctate; posterior margin with short and yellowish hairs, densely distributed. T5-T7 rugose, with dense, short and yellowish hairs; T6 apex with tuft of dense yellowish hairs. T7, apical margin delimitating a medial projection (Fig. 23A). S6 as shown in the Fig. 24A. Genital capsule as in Figure 2.

Material examined: MEXICO. Jalisco: Ciudad Guzmán, 16 km SW, 2000 m, 18-VII-1989, T. Griswold (BBSL: 4 ♀, 9 ♂. EBCh: 2 ♂). Ciudad Guzmán, Camino Volcán Colima, 16.6253, 103.54713, 5 -IX- 2014, R. Ayala (EBCh: 3 ♂). El Terrero, 1-IX-2018, R. Ayala (EBCh: 1 ♀). La Manzanilla, 25 km N, 30 -IV- 1990, C. M. Estrada (EBCh: 1 ♂). Las Cuevas, 10 km SE La Manzanilla, 16-VIII-1990, C. M. Estrada (EBCh: 2 ♀). Mazamitla, 10 km SE El Terrero, 5-XI-1990, R. Ayala (EBCh: 1 ♂). Talpa de Allende, Sierra Occidental, 1803 m, 20.345, -104.959, 9-IX-2012, J. Mérida (ECOAB: 1 ♂). **Michoacán:** Dr. Miguel Silva, 9 km S de Ario de Rosales, 1450 m, 29-X-1987, T. Griswold (BBSL: 1 ♀, 4 ♂). Las Cañas, 21 km de Ario de Rosales, 1390 m, 29-X-1987, T. Griswold (BBSL: 1 ♀, 1 ♂). Tzintzuntzan, N de Pátzcuaro, 2100 m, 16 -X- 1987, T. Griswold (BBSL: 3 ♀). **Morelos:** Cuernavaca, 5-XII-1987, F. Parker. Tepoztlán, km 12 Autopista México–Cuautla, 18.973 N, -99.0825 W, 1650 m (BBSL: 15 ♀, 5 ♂); 17-III-1996, I. Hinojosa (MZFC: 1 ♀: 2130); 14-IV-1996, O. Yáñez (MZFC: 3 ♀: 2161, 2160, 2159); 30-VI-1996,

O. Yáñez (MZFC: 1 ♀: 2289, 1 ♂: 2266); 13-VII-1996, O. Yáñez (MZFC: 3 ♀: 2303, 2301, 2300); 14-VII-1996, O. Yáñez (MZFC: 2 ♀: 2360, 2372, 1 ♂: 2355); 4-VIII-1996, I. Hinojosa (MZFC: 2 ♀: 2404, 2384); 10-VIII-1996, O. Yáñez (MZFC: 2 ♀: 2409, 2457, 1 ♂: 2410); 30-XI-1996, I. Hinojosa (MZFC: 7 ♀: 2828, 2827, 2825, 2759, 2747, 2741, 2826); 22-XII-1996, O. Yáñez (MZFC: 1 ♀: 2879); 25-I-1997, I. Hinojosa (MZFC: 2 ♀: 2968, 2943); 16-II-1997, I. Hinojosa (MZFC: 2 ♂: 3060, 3371). Tepoztlán, km 4. 5 Autopista México–Cuautla, 1940 m, 19.00416, -99.1294; 16-XII-1995, I. Hinojosa (MZFC: 5 ♀: 3653, 3654, 3673, 3674, 3685); 26-V-1996, I. Hinojosa (MZFC: 1 ♀: 3956); 9-VI-1996, I. Hinojosa (MZFC: 1 ♀: 3986); 3-VIII-1996, I. Hinojosa (MZFC: 2 ♀: 4091, 4062); 5-X-1996, I. Hinojosa (MZFC: 1 ♀: 4274, 1 ♂: 4283); 27-X-1996, I. Hinojosa (MZFC: 5 ♀: 4328, 4346, 4345, 4349, 4301, 1 ♂: 4344); 23-XI-1996, O. Yáñez (MZFC: 3 ♀: 4421, 4471, 4432); 15-XII-1996, I. Hinojosa (MZFC: 1 ♀: 4567); 9-III-1997, I. Hinojosa (MZFC: 1 ♀: 4730); 17-V-1997, I. Hinojosa (MZFC: 1 ♀: 4769); 14-VI-1997, O. Yáñez (MZFC: 3 ♀: 4797, 4798, 4849); 9-VIII-1997, I. Hinojosa (MZFC: 1 ♀: 4932). **Nayarit:** Santa Isabella, 10-III-1972, F. Parker (BBSL: 2 ♀, 4 ♂). Tepic, Reserva de la Biosfera Sierra de San Juan, 1080 m, 21.518, -104.972, 20-X-2013, J. Mérida (ECOAB: 1 ♂).

Distribution. *Ceratina* (*Z.*) *capitosa* only known from Mexico, in the Trans-Mexican Volcanic Belt, Pacific Lowlands and Sierra Madre del Sur biogeographic provinces (Morrone, 2019), with records from Jalisco, Michoacan, Morelos, Nayarit and Oaxaca. The distribution ranges from 0–2000 m in elevation.

Comments. Very similar in color and size to an undescribed species of *Ceratina* (*Calloceratina*). For this reason, in some collections both species tend to be identified as *C. capitosa*; however, they can be differentiated by the impunctate swollen areas on the frons of *C. capitosa* (diagnostic character for *Zadontomerus*), spine-like projection in the base of hind tibia, and males with a tuft of dense hairs in the apex of T6.

Ceratina (*Zadontomerus*) *ignara* Cresson, 1878

(Figures 3, 4, 22B, 23B, 24B, 25)

Ceratina ignara Cresson, E. T., 1878 (lectotype: ANSP: ♀ 2471. Mexico).

Ceratina townsendi Cockerell, T. D. A., 1903 (syntype: USNM: ♀ 8307. Mexico, Veracruz, San Rafael, Río Nautla).

Ceratina abdominalis Smith, H. S., 1907 (syntype: USNM: ♀, ♂ 55731. Costa Rica, San José, Monte Redondo), **n. syn.**

Ceratina cuprea Friese, H., 1916 (syntype: Museum für Naturkunde Berlin: ♀, ♂. Costa Rica, San José).

Ceratina nara Strand, E., 1919 (holotype: AMNH: ♂. Guatemala, Amatitlán).

Ceratina tehucana Strand, E., 1919 (syntype: Museum für Naturkunde Berlin: ♀, ♂. Mexico, Puebla, Tehuacán, 1650 m), **n. syn.**

Ceratina parignara Cockerell, T. D. A., 1931 (holotype: MCZ: ♂ 16262. Mexico, Yucatán, Chichén Itzá), **n. syn.**

Diagnosis. Medium to large in size: females from 7.0–9.0 mm and males from 6.5–8.0 mm in length. Bluish head and mesosoma, and dark green to olive green metasoma; males recognizable by the lower paraocular yellow marks; hind trochanter and ventral surface of basal half of hind femur with dense, long whitish hairs, as long as width of hind trochanter; hind femur medially dilated, but not forming an angle (Fig. 22B); T7 with concave lateral margins, distal margin truncate (Fig. 23B); females with lower paraocular area punctate, punctures separated by a distance up to a puncture diameter; disc of scutum predominantly impunctate, but some punctures along the anteromedial and parapsidal lines; metasoma twice as long as width; and both sexes with subhyaline to lightly smoked wings. Similar in color to *C. indigovirens* sp. n. (see below), but males can be easily recognized by the paraocular yellow marks and distal margin of T7 truncated.

Material examined: **BELIZE.** Cayo District: Pine Ridge, Cooma Cairn, 30-IV-2009, J. S. Ascher (AMNH: 1 ♀). **COSTA RICA.** Alajuela: Bijagua, 20 km S Upala, 1-10-IV-1991, F. Parker (BBSL: 1 ♀). **Guanacaste:** Estación Biológica Volcán Cacao, 13-II-1995, F. Parker (BBSL: 1 ♀, 4 ♂). Estación Maritza, W del Volcán Orosí, 600 m, 12-II-1995, T. Griswold (BBSL: 1 ♂). Finca Montezuma, 3 km del Río Naranjo, F. Parker (BBSL: 3 ♂); 30-I-1992 (BBSL: 1 ♂); 5/7-II-1992 (BBSL: 46 ♀, 42 ♂); 15-II-1992 (BBSL: 25 ♂); 15-IV-1992 (BBSL: 2 ♂). 15-IV-1992 (BBSL: 2 ♂); 20-V-1992 (BBSL: 1 ♂); 18-IX-1992 (BBSL: 1 ♂); 10-XI-1992 (BBSL: 2 ♂); 8/18-I-1993 (BBSL: 8 ♀); 24/29-I-1993 (BBSL: 3 ♂). **Puntarenas:** San Vito, Estación Biológica Las Alturas, 1500 m, 1-III-1992, P. Hanson (BBSL: 3 ♂). **San José:** Escazu, F. Parker; 8-II-1987 (BBSL: 2 ♀); 9/10-I-1988 (BBSL: 9 ♀, 5 ♂); 7/14-II-1988 (BBSL: 6 ♀, 14 ♂); 26-III-1988 (BBSL: 4 ♂); 16-I-1989 (BBSL: 42 ♀); 5-II-1989 (BBSL: 3 ♀, 5 ♂). San José, 30-III-1966, C. Michener (BBSL: 1 ♀, 1 ♂). **MEXICO.** Colima: El Mixcuate, 19.322104, -103.93541, 541 m, 3-XI-2014, R. Ayala (EBCh: 1 ♀). **Hidalgo:** Tlanchinol-Apantlázol km 4, 20.984, -98.63694, 1600 m, 13-

IX-1993, L. Godínez (MZFC: 8♀: 26944, 26946, 26947, 26948, 26949, 26951, 26950, 26945. 7♂: 26943, 26939, 26928, 26933, 26941, 26942, 26940). Tenango de Doria, El Damo, 2155 m, 20.325, -98.2272, 5-VIII-1993, L. Godínez (MZFC: 1♂: 26893). Tulancingo de Bravo, El Paraíso, 2185 m, 20.15, -98.4, 7-VI-1992, M. Díaz (MZFC: 3♀: 12089, 12090, 12086). **Jalisco:** Ciudad Guzmán, 16 km NW, 1800-2000 m, 17-VII-1989, T. Griswold (BBSL: 13♀, 1♂). Ciudad Guzmán, L1 Camino Volcán Colima, 19.62579, -103.5713, 29-VII-2015, R. Ayala (EBCh: 10♀). Zapotitlán de Vadillo, 19.57733, -103.81786, 1075 m, 4-XI-2014, R. Ayala (EBCh: 1♀). **Michoacán:** El Cangrejo, 20 km N La Huacana, 090 m, 30-X-1987, T. Griswold (BBSL: 1♀). El Descansadero, 80 km N Arteaga, 28-X-1987, T. Griswold (BBSL: 1♀). Huetamo, 7-III-1972, F. Parker (BBSL: 19♀, 1♂). Presa Zucuiran, 600 m, 28-X-1987, T. Griswold (BBSL: 1♀). Santa Clara, 15 km Santa Clara S Pátzcuaro, 2200 m, 28-X-1987, T. Griswold (BBSL: 4♀). Tzintzuntzan, N de Pátzcuaro, 2100 m, 16-X-1987, T. Griswold (BBSL: 3♀). **Morelos:** Cuernavaca, 21-XI-1987, F. Parker (BBSL: 6♀, 5♂). Yautepec, km 21, Autopista Cd. México-Cuautla, 3-17-VIII-1997, O. Yáñez (MZFC: 7♀: 1103, 1035, 722, 570, 1597, 1662, 1578). Tepoztlán, km 12 Autopista Cd. México-Cuautla, 18.973, -99.0825, 1650 m, 18-XI-1995, I. Hinojosa (MZFC: 1♀: 1947); 18-II-1996, O. Yáñez (MZFC: 11♀: 2375, 2359, 2438, 2338, 2312, 2830, 2760, 2100, 2096, 2271, 2110. 4♂: 2089, 2083, 2112, 2076); 25-I/16-II-1997, I. Hinojosa (MZFC: 3♀: 3046, 2931, 3233. 2♂: 2969, 3131); km 19.5, Autopista México-Cuautla, 18.938, -99.0383, 1350 m, 5-XI-1995, O. Yáñez (MZFC: 3♀: 113, 120, 119); 20-21-VIII-1996, I. Hinojosa (MZFC: 15♀: 1116, 853, 830, 384, 378, 441, 531, 705, 695, 390, 526, 509, 443, 442, 682); 9-II-1997, I. Hinojosa (MZFC: 3♀: 1487, 1484, 1765. 4♂: 1171, 1216, 1176, 1215). **Nayarit:** San Blas, La Bajada, 18-III-1983, G. Bohart (BBSL: 1♀, 2♂). **Puebla:** Cholula, UDLA, 13-IX-1998, T. Griswold (BBSL: 4♀). Izucar de Matamoros, 3-IX-1974, F. Parker (BBSL: 3♀). **Quintana Roo:** Felipe Carrillo Puerto, 19.35, -88.03, 13-X-1986, T. Griswold (BBSL: 1♂). **San Luis Potosí:** Río Axtla, La Griega Vieja, 2-III-1986, S. Weller (AMNH: 1♀). **NICARAGUA:** **Rivas:** Isla Ometepe, Camino a Cascadas San Ramón, 11.4243, -85.52936, 23-II-2013, E. S. Wyman (AMNH: 5♀, 2♂). **PANAMÁ.** **Chiriquí:** Boquete, 8.6986, -82.4505, 13-I-2012, F. Parker (BBSL: 26♀, 7♂). **Coclé:** Valle de Anton, 5-VI-1945, C. Michener (AMNH: 1♀, 1♂).

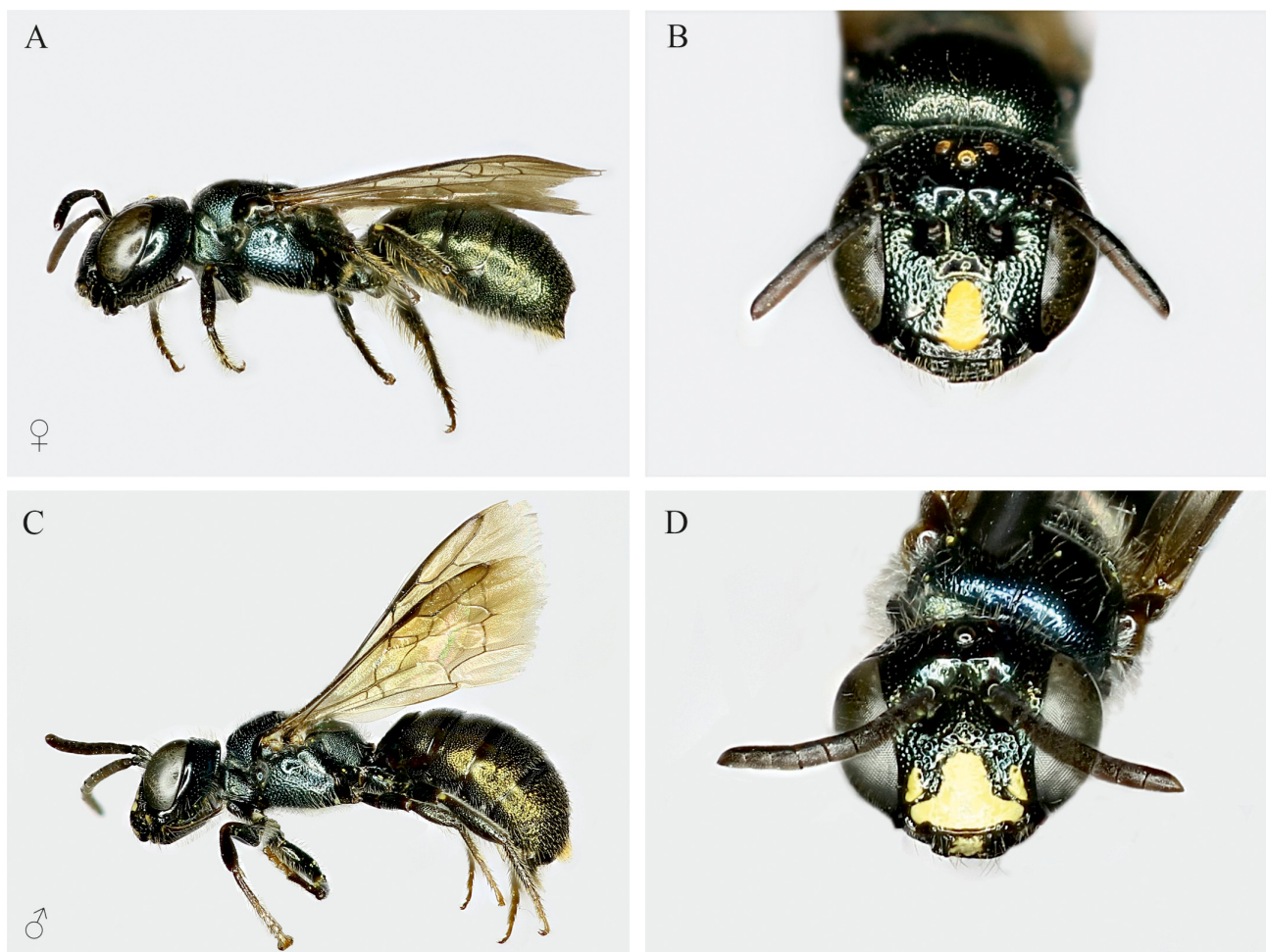


FIGURE 3. *Ceratina ignara*. A: Female lateral habitus, B: female frontal view, C: male lateral habitus, D: male frontal view.

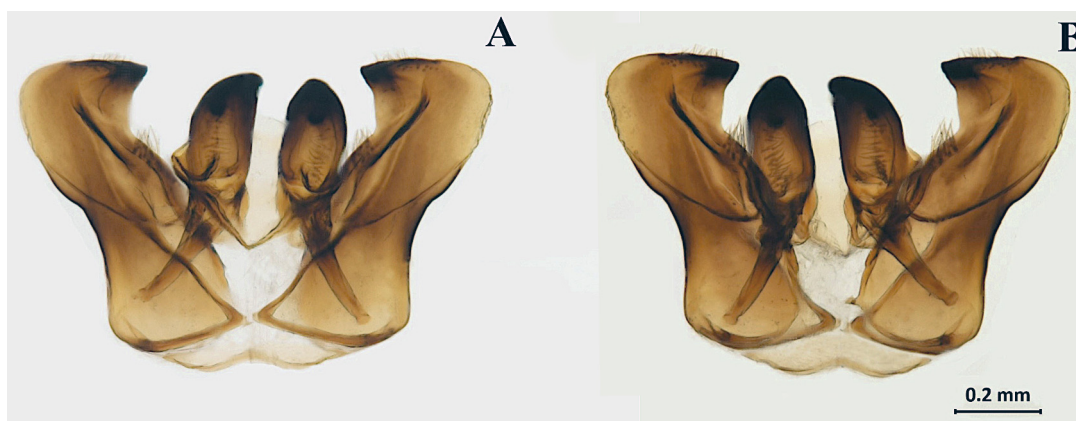


FIGURE 4. Genital capsule of *Ceratina ignara* male. A: Dorsal view, B: ventral view.

Distribution. *Ceratina* (Z.) *ignara* ranges from Nayarit, Mexico to northern Panama. This species occurs from the sea level to 2200 m elevation and seems to be associated to tropical deciduous forests, tropical rainforests, and pine and cloud forests.

Comments: We propose *Ceratina abdominalis* as synonym of *C. ignara* based on the species description, where Smith (1907) mentioned the following characters in the male holotype: “head and thorax dark bluish green, abdomen coppery hue, apical plate truncate, almost twice as broad as long, corners well rounded. Small lateral face marks present”. These key characters are diagnostic to *Ceratina ignara*. *Ceratina tehuacana* and *Ceratina parignara* males show the same characters: yellow paraocular marks, head and mesosoma bluish and metasoma olive green, besides the shape of T7 and hind femur. These characters support that these species are synonymies.

Ceratina (*Zadontomerus*) *nautlana* Cockerell, 1897

(Figures 5, 6, 21A, 22C, 23C-D, 24C, 26)

Ceratina nautlana Cockerell T. D. A., 1897: 160 (syntype: USNM: ♀, ♂ 3352. Mexico, Veracruz, San Rafael, Río Nautla)

Ceratina bakeri Smith, H. S., 1907 (holotype: USNM ♂ 63513. Mexico, Guerrero, Acapulco), **n. syn.**

Ceratina nigriventris Friese, H., 1916 (holotype: Museum für Naturkunde Berlin: ♂, ♀. Costa Rica, San José), **n. syn.**

Diagnosis: Small to medium in size: females from 4.0–6.2 mm and males from 3.5–4.5 mm in length. Both sexes with yellow markings on the pronotal lobe; body dark green to dark bluish, with metallic tints; subhyaline wings; females upper paraocular area and frons, around the impunctate swellings, with sparse punctures, surface mostly polished; supraclypeal area impunctate or with sparse punctures. Similar to *C. kopili* n. sp. but can be recognized by the presence of a longitudinal yellow mark on the foretibia; females with disc of the scutum almost entirely impunctate (Fig. 21A); males with yellow marks on the lower paraocular area, sometimes diluted or absent; T7 with two laminar projections forming a middle notch, which can be less evident in some individuals (Fig. 23 C-D); mandibles sometimes with yellow marks on the inner margin; hind femur with slight rounded dilation (Fig. 22C).

Material examined: BELIZE. Belize Botanical Garden, 17.0975, -89.071667, 27-II-2007, J. S. Ascher (AMNH: 4♀, 3♂). **Cayo District:** Las Cuevas Research Station, 465 m, 16.733056, -88.9863, 29-IV-2004, S. K. Javorek (AMNH: 4♀). Hidden Valley Inn, 17.065032, -88.855, 23-II-2007, J. S. Ascher (AMNH: 1♀, 1♂). Cooma Cairn, 16.99893, -88.8478, 30-IV-2009, J. S. Ascher (AMNH: 8♀, 3♂). Hidden Valley Inn, 17.06503, -88.8559, 25-XI-2007, J. S. Ascher (AMNH: 3♀, 1♂). Mahogany, 16.95694, -88.97973, 24-II-2007, J. S. Ascher (AMNH: 1♂). **Stann Creek:** Rd NW of Placencia, 16.68472, -88.3377, 09-V-2007, S. K. Javorek (AMNH: 4♀). **COLOMBIA.** **Antioquia:** Porce, 24-IV-1997, A. Smith-Pardo (BBSL: 1♂). **César:** César, Valledupar, 11-VI-1968, B. Malkin (AMNH: 11♀, 2♂). Sierra de Perijá, 1500 m, 20-VIII-1968, B. Malkin (AMNH: 2♂). **Magdalena:** Santa Marta, 29-III-1933, F. E. Lutz (AMNH: 1♀). **COSTA RICA.** **Cartago:** Orosi, 1-VII-1981, N. Krauss (AMNH: 3♂). **Guanacaste:** Cañas, 80-100 m, 1-VII-1981, N. Krauss (AMNH: 2♀). Cañas, 19-30-III-1990, F. Parker (BBSL: 4♂); 27-II-1987, F. Parker (BBSL: 3♀). Estación Maritza, 600 m, 12-II-1995, T. Griswold (BBSL: 1♂). Finca Montezuma, 5-30-IV-1992, F. Parker (BBSL: 25♀, 24♂). **Heredia:** La Selva Estación Biológica, 17-VI-1986, W.

Hanson (BBSL: 1♂). **Limón:** Guapiles, 13-XII-1987, F. D. Parker (BBSL: 1♀). **San José:** Escazu, 16-I-1989, F. D. Parker (BBSL: 18♀, 10♂). San José, 9.9351, - 84.1787, 16-II-2002, E. Schlinger (BBSL: 1♀, 1♂). **GUATEMALA. Escuintla:** Tiquisate, 60 m, 27-VI-1947, F. Johnson (AMNH: 2♂). **Sacatepéquez:** Antigua, 1550 m, 1-VII-1980, N. Krauss (AMNH: 2♀, 2♂). **HONDURAS. Atlántida:** La Ceiba, 0-100 m, VII-1981, N. Krauss (AMNH: 3♀). La Ceiba, 24-II-1979, G. Bohart (BBSL: 2♀). Lago de Yojoa, 600-650 m, VII-1981, N. Krauss (AMNH: 1♀); VII-1981, N. Krauss (AMNH: 1♀). **Cortés:** San Pedro Sula, 23-II-1979, G. Bohart (BBSL: 3♂). Isla Roatan, 24-II-1979, G. Bohart (BBSL: 2♀, 1♂). **MEXICO. Mexico City:** Ciudad Universitaria, 2329 m, 19.31306, -99.1919, 09-V-2015, C. Martínez (CNIN: 3♂); 2328 m, 19.31457, -99.1919, 28-VI-2016, C. Martínez (CNIN: 1♀, 1♂). **Chiapas:** Tuxtla Gutiérrez, 26-VII-1987, F. Parker (BBSL: 4♀). **Colima:** Armeria, 1-VIII-1954, M. Cazier (AMNH: 1♀). 33 km de Colima, 800 m, 19-VII-1989, T. Griswold (BBSL: 4♀). San Antonio, 1 Km W Río la Lumbra, 19.62579, -103.71458, 5-V-2015, R. Ayala (EBCh: 2♂). El Mixcuate, 541 m, 19.32104, -103.93541, 03-XI-2014, R. Ayala (EBCh: 11♀). **Jalisco:** Carretera Barra de Navidad-Puerto Vallarta, Río San Nicolás, 27-IV-1986, M. Sánchez (EBCh: 1♀). Estación de Biología Chamela, 17- XI-1983, S. Bullock (EBCh: 3♀); 13-IV-1985, R. Ayala (EBCh: 6♀, 3♂); 26-VIII-1985, R. Ayala (EBCh: 6♀); 6-8-X-1985, F. Parker y T. Griswold (AMNH: 1♀. BBSL: 28♀, 23♂, EBCh: 6♀, 15♂); 4-XII-1985, R. Ayala (EBCh: 17♀); 19-IV-1986, R. Ayala (EBCh: 4♀); 19.511985, -105.036569, 26-IX-2016, G. Medina y P. Ortega (EBCh: 25♀). Ciudad Guzmán, Camino Volcán Colima, 19.62579, -103. 5713, 29-VII-2015, R. Ayala (EBCh: 2♀); 1500 m, 17-VII-1989, T. Griswold (BBSL: 17♂). Cuitzmala, Playa 8 km S Careyes, 4-X-1985, F. Parker y T. Griswold (EBCh: 3♀). Río San Nicolás, 20 km NW Chamela, 5-X-1985, J. Rozen (EBCh: 1♂). El Grullo, 1200 m, 17-VII-1989, T. Griswold (BBSL: 2♀). Purificación, 300 m, 16-VII-1989, T. Griswold (BBSL: 3♀). **Morelos:** Reserva de la Biosfera Sierra de Huatla, 18.4587, -99.0072, 24-IV-2000, R. Westcott (BBSL: 24♀). Miguel Colorado, 2 Km al SE, 195 m, 18.7652, -90.6558, 26-III-1997, O. Yáñez (MZFC: 3♀: 6369, 6393, 6356). Hopelchen, Dzibalchén, casa de C. Cocom, 200 m, 19.4619, -89.72638, 25-X-1997, O. Yáñez (MZFC: 3♀: 6375, 6371, 6360). Huitzilac, Derrame del Chichinautzin, km 86. 3, 2470 m, 19.02416, -99.145, 8-II-1997, I. Hinojosa (MZFC: 3♀: 5920, 6054, 5597, 2♂: 5264, 5286). Tepoztlán, km 12, Autopista México-Cuautla, 1650 m, 18.9733, -99.0825, 2-III-1997, O. Yáñez (MZFC: 6♀: 3143, 3166, 3167, 3165, 3169, 2958, 3♂: 3168, 3187, 3177); 11-V-1997, J. Salinas (MZFC: 3♀: 3274, 3258, 3257); 5-VII-1997, I. Hinojosa (MZFC: 3♀: 3338, 3323, 3322, 5♂: 2287, 2281, 2279, 2276, 2251); 10-VIII-1997, O. Yáñez (MZFC: 4♀: 3392, 3370, 3369, 3368); 22-XII- 1996, I. Hinojosa (MZFC: 2♀: 2914, 2915). km 19.5 Autopista México-Cuautla, 1350 m, 18.93805, -99.03833, 15-III-1997, I. Hinojosa (MZFC: 2♀: 1317, 1318); 18-V-1997, I. Hinojosa (MZFC: 1♀: 1415, 2♂: 313, 312). km 4.5 Autopista México-Cuautla, 1940 m, 19.0041, -99.129444, 26-V-1996, O. Yáñez (MZFC: 4♀: 3953, 3920, 4778, 4772, 1♂: 4771); 9-VI-1996, I. Hinojosa (MZFC: 4♀: 3990, 3980, 3969, 3988); 3-VIII-1996, I. Hinojosa (MZFC: 1♂: 4069); 27-X-1996, I. Hinojosa (MZFC: 2♀: 4370, 4386). **Nayarit:** San Blas, 21-III-1983, F. Parker y T. Griswold (BBSL: 3♂). **Oaxaca:** Cuyoyepiji, 3-III-1972, F. Parker (BBSL: 12♀, 3♂). Tehuantepec, 11-XI-1964, J. C Pallister (AMNH: 53♀). **Quintana Roo:** Akumal, Puerto Morelos, 20.22, -87.20, 5-X-1986, T. Griswold (BBSL: 2♀). Puerto Felipe Carrillo, 19.35, -88.03, 13-X-1986, T. Griswold (BBSL: 42♀, 10♂). Vallarta, 17 km Puerto Morelos, 20.50, -87.00, 08-X-1986, T. Griswold (BBSL: 3♂). **Veracruz:** Catemaco, 6-IX-1974, G. Bohart (BBSL: 1♀). **NICARAGUA.** Chinandega, 12 km de El Viejo, 23-V-2013, A. Payne (AMNH: 33♀, 7♂). Río San Juan, 2.5 km N de San Carlos, 44 m, 11.1483, -84.76, 31-V-2013, A. Payne (AMNH: 10♀, 4♂). Río San Juan Refugia, Bartola, 7.6243, - 81.2420, 3-VI-2008, J. Wilson (BBSL: 2♀). **PANAMA. Chiriquí:** Boquete, 8.6986, - 82.4505, 13-I-2012, F. Parker (BBSL: 19♀, 2♂). **VENEZUELA. Mérida:** Mérida, 1950 m, 11-IX-1973, G. Bohart (BBSL: 1♂). **Zulia:** La Mesa, Trujillo, 11-IX-1973, G. Bohart (BBSL: 1♀, 2♂). Rosario, 14-VI-1976, A. Menke (BBSL: 1♀).

Distribution. *Ceratina* (Z.) *nautilana* has a wide geographic range, from Nayarit, Mexico to Antioquia, Colombia, ranging from sea level to ~2000 m elevation. It is associated with tropical forests, especially dry forests.

Comments. Along its distributional range this species shows color variation, from dark olive green to dark bluish. In some females the yellow marks on the foretibia are less evident. Some males from Nicaragua, Costa Rica, Panama, Colombia and the Pacific Coast of Mexico, do not have paraocular yellow marks, besides, there is variation in the shape of the apex of T7. This is possibly a species complex; we could not find discrete and constant characters to delimit more than one species, but additional studies using methods such as DNA barcoding may reveal cryptic diversity (Gibbs 2009). Morphology of the genital capsules is constant across the geographic range. We propose *Ceratina bakeri* and *Ceratina nigriventris* as synonymies of *Ceratina nautilana* based on the observation of type

material, male holotype of *C. bakeri* presents the characteristic longitudinal yellow mark on the foretibia, shape of hind femur and T7 of *C. nautlana*. *Ceratina nigriventris* male and female types have a longitudinal yellow mark on the foretibia. Female has the scutum disc impunctate, and male share with *C. nautlana* the shape of T7 and foretibia.

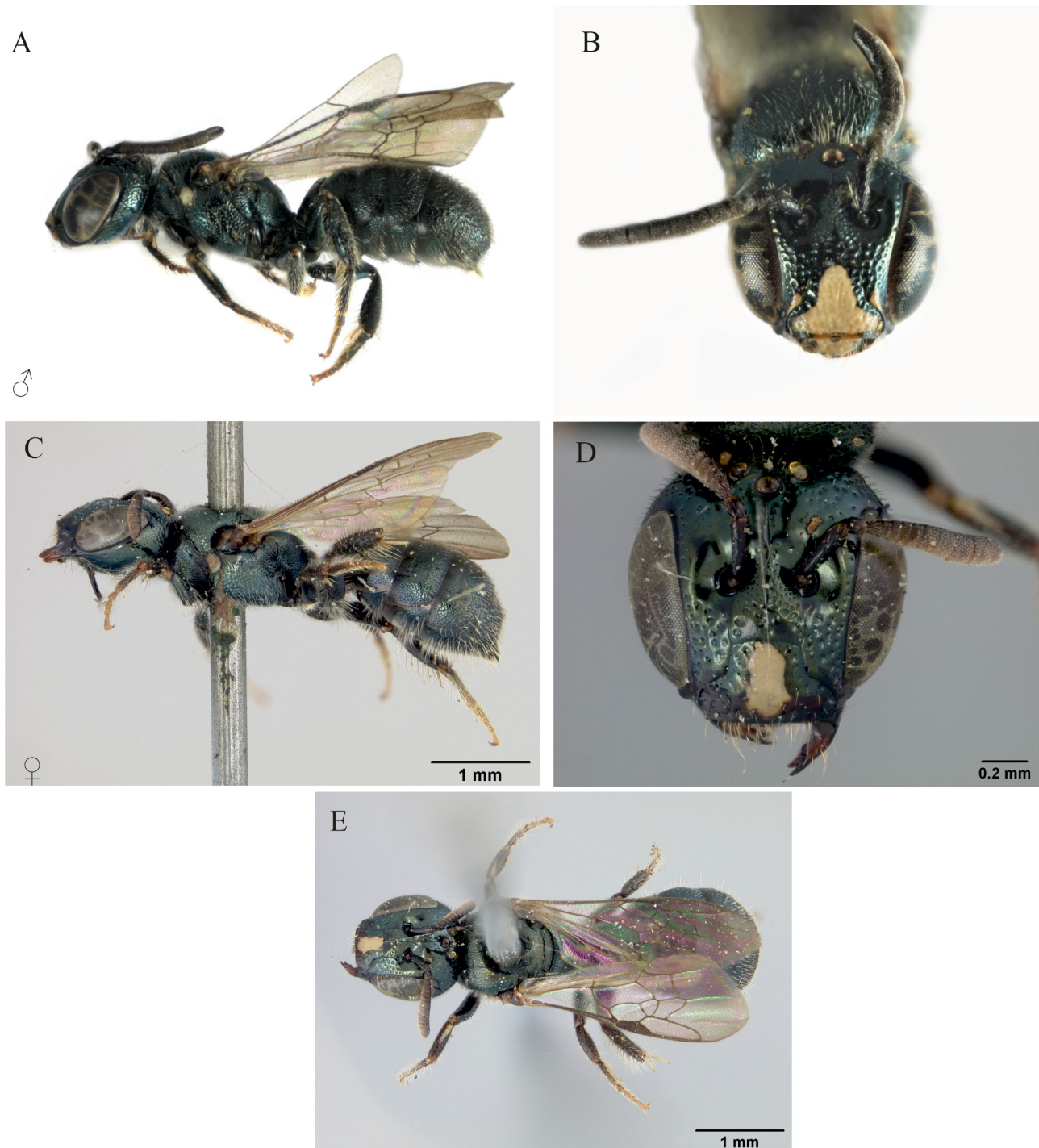


FIGURE 5. *Ceratina nautlana*. A: Male lateral habitus, B: male frontal view, C: Holotype, female lateral habitus, D: Holotype, female frontal view, E. Holotype, female dorsal view (from Smithsonian National Museum of Natural History (2021))

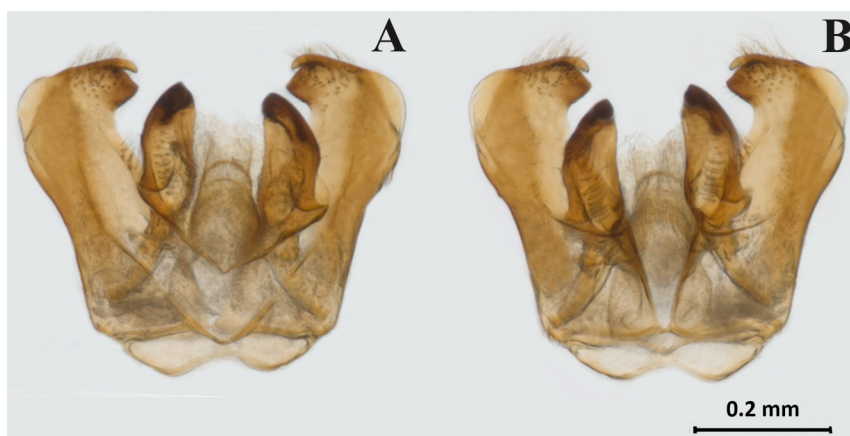


FIGURE 6. Genital capsule of *Ceratina nautlana* male. A: Dorsal view, B: ventral view.

***Ceratina (Zadontomerus) kopili* Flórez-Gómez, Ayala & Hinojosa-Díaz new species**

(Figures 7, 8, 21B, 22D, 23E, 24D, 27)

Diagnosis. Small to medium-sized bees: females from 4.8–6.0 mm, males from 4.0–5.5 mm in length. Pronotal lobe with yellow mark, highly conspicuous preoccipital foveate carina, beginning in the upper third of the occiput, forming a strong depression, being more developed in males (Fig. 7E); body dark green with metallic tones; female frons with punctures separated by a distance 0.5–2.0 times puncture diameter; disc of scutum with punctures along the anteromedial line and punctures densely distributed around the parapsidal lines; males with hind femur strongly dilated medially, forming an angle (Fig. 22D); and T7, posterior margin concave, forming a medial, narrowly rounded projection (Fig. 23E). Females similar in appearance to those of *C. nautlana*; however, *C. kopili* can be easily recognized by the presence of a well-developed preoccipital carina, the absence of a longitudinal yellow mark on the foretibia (present in *C. nautlana*), as well as punctuation in the scutum disc (almost entirely impunctate in *C. nautlana*).

Description. Holotype female. Length 5.68 mm. Body dark green with metallic tones, metasoma olive green.

Head. Round. Mandibles with three teeth, black and middle area brownish; outer margin with scattered short whitish hairs. Hypostomal carina rounded. Clypeus with yellow medial oval mark; area around the mark with dense punctures separated by a distance less than 0.5 times a puncture diameter. Supraclypeal area with dense and fine punctation between antennal sockets, medial area with punctures irregularly distributed, separated by more than a puncture diameter. Lower and upper paraocular area densely punctate, distance equal to or less than a puncture diameter. Antennocular area (area between antennal bases and inner margins of compound eyes) with punctures separated by a distance equal or less than 0.5 times a puncture diameter. Frons with impunctate swellings, surrounding area with punctures separated by a distance 0.5–1.5 times puncture diameter. Vertex densely punctate, with whitish pubescence, short and scattered. Gena with upper and medial area densely punctate, becoming sparse below; with whitish and short hairs. Preoccipital margin with well-developed carina, beginning in the upper third of the occiput, forming a strong depression. Antennae dark brown. Head length 1.46 mm; head width 1.36 mm; lower interocular distance 0.76 mm; upper interocular distance 0.90 mm; ocellocular distance 0.33 mm.

Mesosoma. Pronotum with lateral carina; dorsolateral angle with transverse carina; pronotal lobe with yellow mark. Mesepisternum densely punctate, punctures separated by less than a puncture diameter; hypoepimeral area with dense punctures covering almost all the area, lower area impunctate. Metepisternum with fine, closely spaced punctures, puncture size less than those on mesepisternum. Scutum anterior area between notauli and anteromedial line, with close punctures; disc with punctures along anteromedial line, punctures reaching posterior margin; area around parapsidal lines densely punctate; posterior area with close punctures. Scutellum similar in punctation to scutum, medial area with sparser punctures. Propodeum, basal area with striae, one in the middle longer than the lateral striae; the rest of propodeum finely and densely punctate, with whitish plumose hairs. Length of forewing 3.52 mm. Tegula brown and impunctate. Wings subhyaline, pterostigma dark brown, venation light brown. Scutum length 0.8 mm; scutum width 1.15 mm. **Legs.** Dark brown with greenish metallic tones. Base of tibia with yellow

spot. Tibial spurs whitish. Tarsi light brown. *Metasoma*. T1 polished, disc with small area with fine and close punctures. T2 and T3 with dense punctation laterally, separated by a distance less than equal to a puncture diameter, becoming more separated on the disc. T4 densely punctate, as T2 and T3; posterior margin of T4 with short and yellowish hairs, densely distributed. T5 and T6 rugose, with short and scattered yellowish hairs.

Paratype male. Length 4.66 mm. Same color as female.

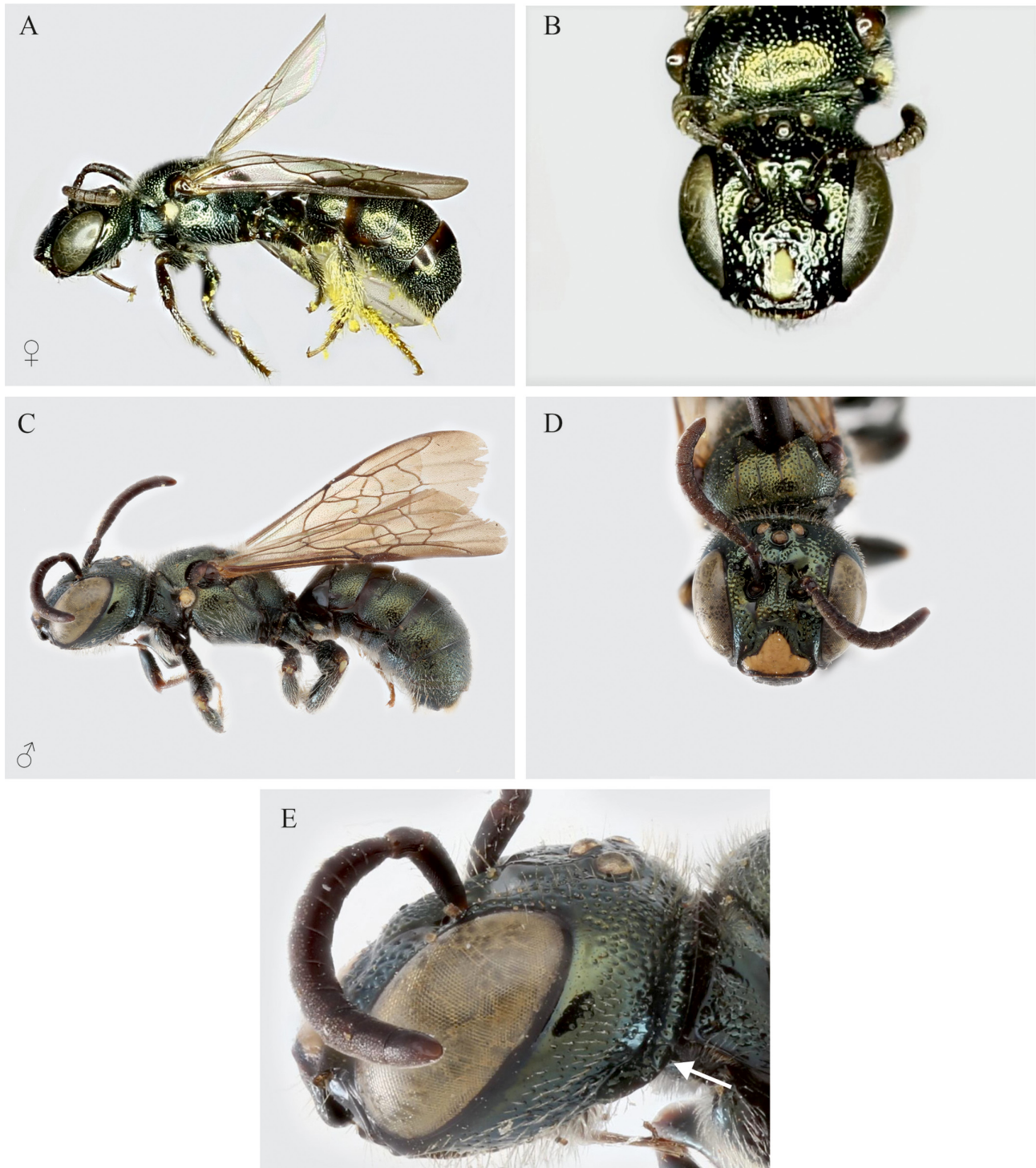


FIGURE 7. *Ceratina kopili* sp. n. A: Holotype, female lateral habitus, B: Holotype, female frontal view, C: Paratype, male lateral habitus, D: Paratype, male frontal view, E. Paratype, male preoccipital carina.

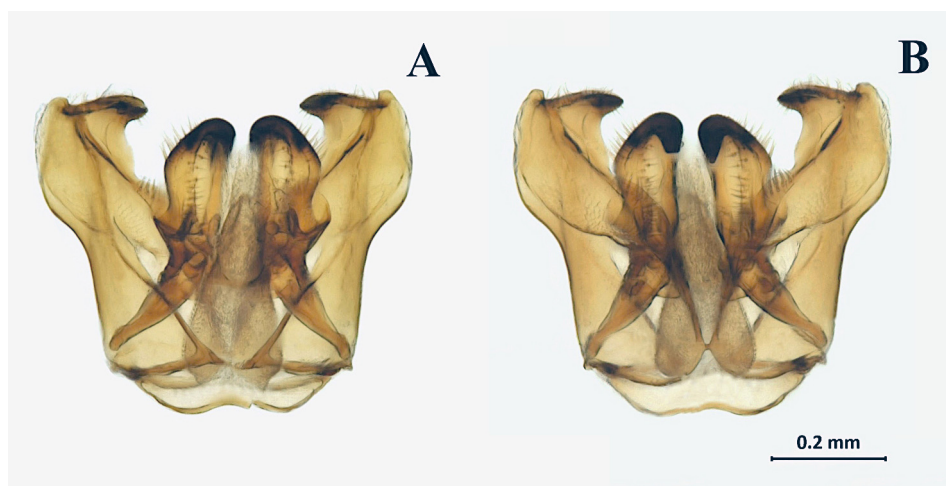


FIGURE 8. Genital capsule of *Ceratina kopili* sp. n. male. A: Dorsal view, B: ventral view.

Head. Mandibles with two teeth, color and pubescence as in female. Labrum with yellow rounded mark in the middle area. Clypeus, with inverted T-shaped yellow mark. Supraclypeal and paraocular area densely punctate, separated by a distance of less than one puncture diameter. Frons as in female. Vertex densely punctated, with long and scattered whitish hairs. Gena with dense punctation and short, whitish hairs. Preoccipital carina well developed, more so than in females, beginning in the upper third of the occiput, forming a strong depression. Antennae as in female. Head length 1.27 mm; head width 1.37 mm; lower interocular distance 0.65 mm; upper interocular distance 0.89 mm; ocellocular distance 0.27 mm.

Mesosoma. Generally, as in female, but with longer and more conspicuous whitish hairs. Length of forewing 3.27 mm. Scutum length 0.72 mm; scutum width 0.97 mm. **Legs.** Hind trochanter ventral margin forming a right angle, with short whitish hairs. Hind femur strongly dilated forming an acute angle in the middle area; ventral margin almost hairless (Fig. 22D).

Metasoma. Punctures as in the female. T6, middle area with tuft of whitish pubescence. T7, apex with concave lateral margins, forming a medial acute projection; posterior margin with long sparse hairs (Fig. 23E). S6, as shown in Fig. 24D. Genital capsule as shown in Figure 8.

Type material: Holotype (♀ MZFC: 03274): MEXICO: Morelos: Tepoztlán, Km 12, Autopista México-Cuautla, 1650 m, 18. 973, - 99. 0825, 11-V-1997, J. Salinas. Described paratype (1♂: 2196): same locality as holotype. Other paratypes: same locality as holotype (MZFC: 2♀: 2942, 2197). Mexico City: Ciudad Universitaria, 2328 m, 19.31449, -99.19178, 18 -VII- 2015, C. Martínez (CNIN: 1♂). 19.31418, -99.19189, 5-IX-2015 (CNIN: 1♂). 19.31457, -99.1919, 28-VI-2016 (CNIN: 2♀). 19.31402, -99.19172, 1-VIII-2015 (CNIN: 3♂). Jalisco: Mazamitla, 20 km SW, 5 km S, 18 km SE, 18-29-III-1990, C. M. Estrada (EBCh: 6♀, 2♂). Morelos: Cuernavaca, 20-XI-1987, F. Parker (BBSL: 2♀, 4♂). Tepoztlán, km 4.5, Autopista México-Cuautla, 1940 m, 19.00416, -99.12944, 9-VI-1996, I. Hinojosa, O. Yáñez (MZFC: 2♀: 4229, 3962. 5♂: 3961, 3981, 3983, 3984, 3982). Oaxaca: Cuyotepeji, 3-10-III-1972, F. Parker (BBSL: 5♀, 29♂). Puebla: Tehuacán, 1-III-1972, F. Parker (BBSL: 1♂). Cholula, UDLA, 13-IX-1998, T. Griswold (BBSL: 3♀, 7♂). Acatepec, 5 km N, 18.212778, -97.62833, 15-IX-1998, T. Griswold (BBSL: 1♂).

Distribution: *Ceratina* (Z.) *kopili* is endemic to Mexico. It is known for the Transmexican Volcanic Belt, in Morelos, Jalisco, Oaxaca, Puebla and Mexico City. It ranges from 1500 m to 2400 m elevation.

Etymology: Kopili in Náhuatl means crown, referring to the conspicuous preoccipital carina which resembles a crown. It is a noun in apposition.

***Ceratina* (*Zadontomerus*) *basaltica* Flórez-Gómez, Hinojosa-Díaz & Ayala new species**

(Figures 9, 10, 22E, 23F, 24E, 28)

Diagnosis: Females from 7.0–9.0 mm, males from 6.0–7.5 mm in length. Both sexes with preoccipital foveate carina, more evident in males, pronotal lobe with yellow mark, body dark greenish to olive green with metallic

tones, subhyaline wings with brown venation. Female genal area wider than eye width in lateral view; disc of scutum with sparse punctures along the median line, separated by a distance up to 5 times a puncture diameter. Male ventral surface of hind femur with an acute dilation (Fig. 22E); T6 with medial swollen area strongly evident and yellowish tuft of pubescence; and T7 with concave lateral margins, forming a medial rounded projection (Fig. 23F). Similar to *C. rehanae*, this species is recognizable by the color of the wings, which are lighter; females can be distinguished by the polished and impunctate genal area adjacent to the compound eye, disc of scutum with fewer punctures in contrast to *C. rehanae*, in which the punctures are more conspicuous. Males can be easily recognized by the swollen area in the middle of T6.

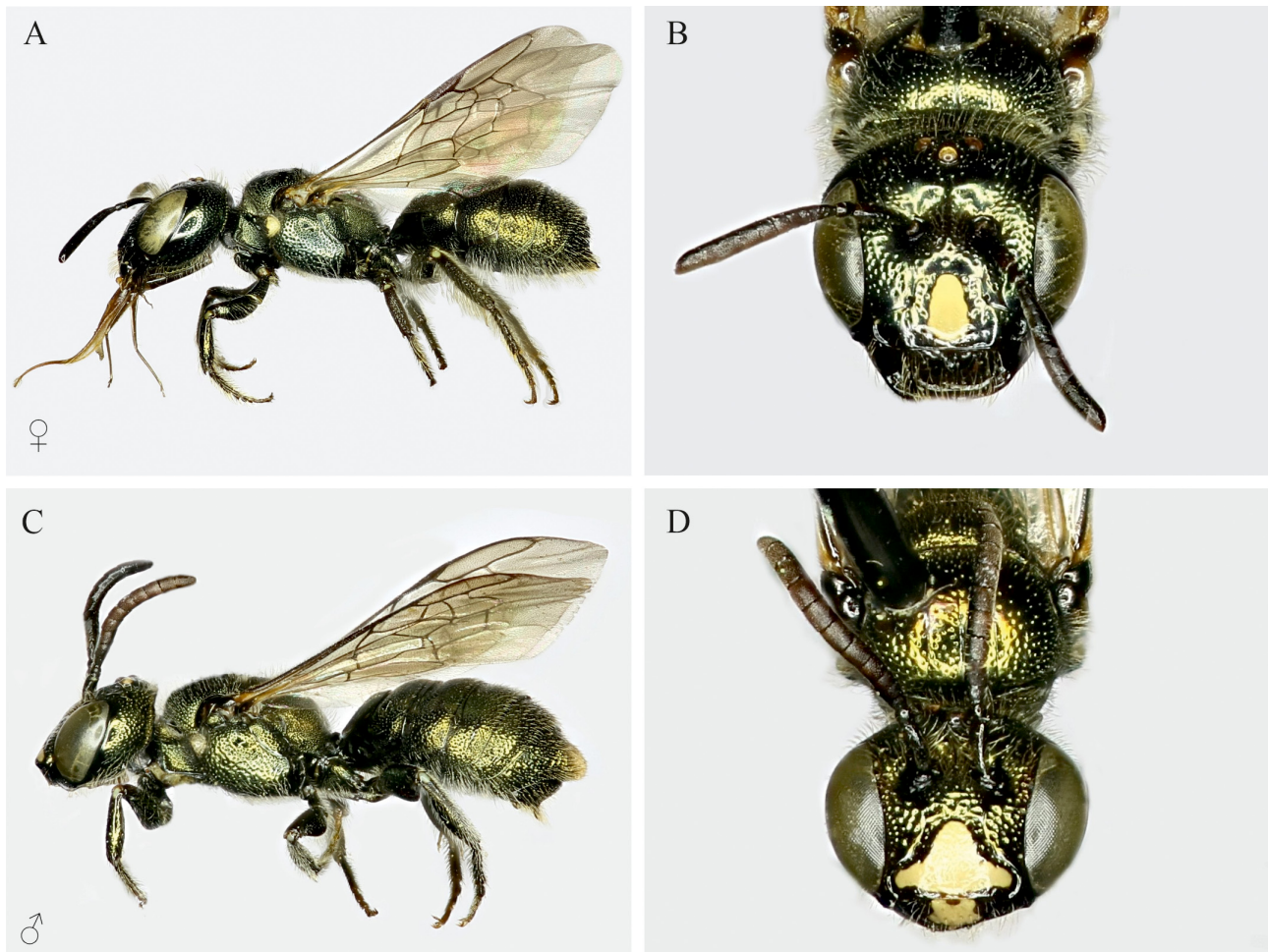


FIGURE 9. *Ceratina basaltica* sp. n. A: Paratype, female lateral habitus, B: Paratype, female frontal view, C: Holotype, male lateral habitus, D: Holotype, male frontal view.



FIGURE 10. Genital capsule of *Ceratina basaltica* sp. n male. A: Dorsal view, B: ventral view.

Description. Holotype male. Length 7.4 mm. Body olivaceous greenish with metallic tones.

Head. Mandibles with two teeth, dark brownish, outer margin with scattered whitish hairs. Labrum with square-shaped yellow mark in the middle. Clypeus with inverted T-shaped yellow mark. Supraclypeal and paraocular area densely punctate. Frons, area surrounding frontal lobes, and vertex with punctures densely distributed and scattered yellowish hairs. Eyes convergent below. Gena densely punctate, with whitish, long, scattered pubescence in the lower area. Preoccipital carina well developed with foveae, more evident than females. Scape with yellowish and scattered hairs, scape, pedicel and flagellum black to dark brown. Head length 1.6 mm; head width 1.92 mm; lower interocular distance 1.01 mm; upper interocular distance 1.25 mm; ocellocular distance 0.38 mm.

Mesosoma. Pronotum with lateral carina; pronotal lobe with yellow mark. Mesepisternum with scattered short and whitish pubescence and dense punctation, punctures separated by a distance 0.5–2.0 times their diameter; hypoepimeral area with fine and close punctures becoming more widely separated in the lower area. Scutum, anterior area between notauli with punctures separated by distance of one puncture diameter, disc with punctures dispersed along the anteromedian line, separated by a distance greater than a puncture diameter, posterior area densely punctured. Scutellum densely punctured, becoming sparser on the disc, punctures separated by up to four times a puncture diameter. Propodeum basal area striate, lateral area with close, fine punctures and whitish plumose pubescence. Tegula dark brown. Wings subhyaline, pterostigma and venation brown. Length of forewing 4.81 mm. Scutum length 0.91 mm; scutum width 1.3 mm. *Legs.* Hind trochanter, with short sparse pubescence, ventral margin slightly rounded. Hind femur medially dilated forming an acute projection, ventral margin almost hairless (Fig. 22E).

Metasoma. T1 impunctate and polished but disc finely punctured. T2 and T3 with punctures densely distributed, becoming sparser on the disc, with a distance between punctures equal to or less than one puncture diameter. T4 with sparse punctures. T5 and rugose, with short and scattered pubescence. T6 integument as in T5, strongly projecting medially, tuft of yellow hairs on this projection. T7 with concave lateral margins, forming a medial rounded projection (Fig. 23F). S6, as shown in figure 24E. Genital capsule as shown in Figure 10.

Paratype female. Length 7.04 mm. Body dark green with metallic and olivaceous tones.

Head. Mandibles with three teeth, color and pubescence as in male. Hypostomal carina with anterior tooth. Labrum black with scattered white pubescence. Clypeus with yellowish medial oval-shaped mark, surface with sparse punctures. Supraclypeal area with fine punctures between antennal sockets, medial area almost polished. Lower paraocular area densely punctate, upper area with punctures more widely separated than lower area, distance equal to or greater than one puncture diameter. Frons, area surrounding the impunctate swellings with punctures distributed heterogeneously, some areas with punctures separated by less than a puncture diameter, other areas with separation greater than a puncture diameter. Vertex with punctures densely distributed, distance between each one equal or less than puncture diameter, with sparse yellowish pubescence. Genal area wider than eye width in lateral view. Gena with punctures densely distributed in the upper area, distance between punctures less than or equal to a puncture diameter, becoming sparse below, area adjacent to eye polished and impunctate, reaching 1/3 of the gena. Preoccipital margin carinate. Antennae, color as in males. Head length 1.74 mm; head width 2.12 mm; lower interocular distance 1.10 mm; upper interocular distance 1.39 mm; ocellocular distance 0.45 mm.

Mesosoma. Pronotum as in males. Scutum, anterior area as in males, disc of scutum with sparse punctures and polished areas, posterior area as in male. Mesepisternum, scutellum, propodeum and wings as in male. Length of forewing 5.68 mm. Scutum length 1.1 mm; scutum width 1.57 mm. *Legs.* Dark with metallic green tones. Base of tibia with yellow spot. Tarsi dark brown. Spurs whitish.

Metasoma. T1–T4 punctures as in male. T4 with sparse punctures, posterior margin with short, dense pubescence, thick and thin hairs intercalated. T5 and T6 rugose, with short and scattered pubescence, with thick and thin hairs intercalated. Sternites with whitish, scattered and long pubescence.

Type material: Holotype (CNIN: 1♂): MEXICO: Distrito Federal: Ciudad Universitaria, REPSA, 2328m, 19.31402, -99.19172, 19-IX-2015, A. Cervantes. Described paratype (♀ MZFC: 30923): Mexico City: Pedregal de San Ángel, 2250 m, 3-IX-1989, A. Escalante y R. Delgadillo. Other paratypes: same locality as holotype (MZFC: 2♀: 30229, 30230).

Other material examined: MEXICO. Mexico City: Pedregal de San Ángel, 2250 m 18-VII-1989, R. Ayala (MZFC: 6♀: 30222, 30225, 30226, 30236, 30224, 30215); 6-X-1989, M. Arteaga (MZFC: 1♀: 30228); 2-9-VI-1990, R. Delgadillo (MZFC: 5♀: 30232, 30234, 30235, 30220, 30227); 13-22-XI-1990, L. Pérez (MZFC: 5♀: 30221, 30214, 30216, 30218, 30223). Ciudad Universitaria, 2328 m, 19.31457, -99.1919, 28-VI-2016, C. Martínez

(CNIN: 6♀); 19.31402 N, -99.19172 W, 10-16-IV-2015, C. Martínez (CNIN: 3♀); 20-VI-2015, C. Martínez (CNIN: 3♀); 25-IX-2015, C. Martínez (CNIN: 1♀, 4♂); 10-X-2015, C. Martínez (CNIN: 2♀). **Guanajuato:** Atarjea, 2149 m, 21.21, -99.83, 24-X-2012, J. Mérida (ECOAB: 1♂). **Hidalgo:** Tulancingo de Bravo, El Paraíso, 2185 m, 20.15, -98.4161, 12-IV-1993 (MZFC: 5♂: 12101, 12105, 12104, 12102, 12103). **Michoacán:** Zitácuaro, 25-X-1987, T. Griswold (BBSL: 2♀).

Distribution: *Ceratina* (*Z.*) *basaltica* is distributed in central Mexico, along the Trans-Mexican Volcanic Belt and the Sierra Madre Oriental, above 2000 m. It is known for Mexico City, Guanajuato, Hidalgo and Michoacán.

Etymology: The specific name refers to basalt, volcanic rock that forms the Ecological Reserve Pedregal de San Ángel, in Mexico City, the type locality. It is an adjective in the nominative singular.

***Ceratina* (*Zadontomerus*) *tepetlana* Flórez-Gómez, Ayala & Hinojosa-Díaz new species**

(Figures 11, 12, 22F, 23G, 24F, 27)

Diagnosis: Medium sized bees, females from 7.0–9.0 mm, males from 6.8–8.0 mm in length; dark olivaceous green color, vertex in both sexes with conspicuous long and yellowish pubescence, more evident in males; smoked wings. Females with gena wider than eye width in lateral view, area adjacent to eye polished and impunctate; scutum disc in impunctate. Hind trochanter in males, with long and densely packed pubescence, hind femur medially dilated (Fig. 22F); and T7 with posterior margin concave, forming a medial rounded projection (Fig. 23G). Some females can be similar in size and wing color to those of *C. ignara*, but *C. tepetlana* can be distinguished by the long, conspicuous pubescence on the vertex, and the overall integument color, showing little contrast among head, mesosoma and metasoma (in *C. ignara* head and mesosomal color is bluish, contrasting the metasomal color).

Description. Holotype male. Length 7.91 mm. Body dark olivaceous green with metallic tones.

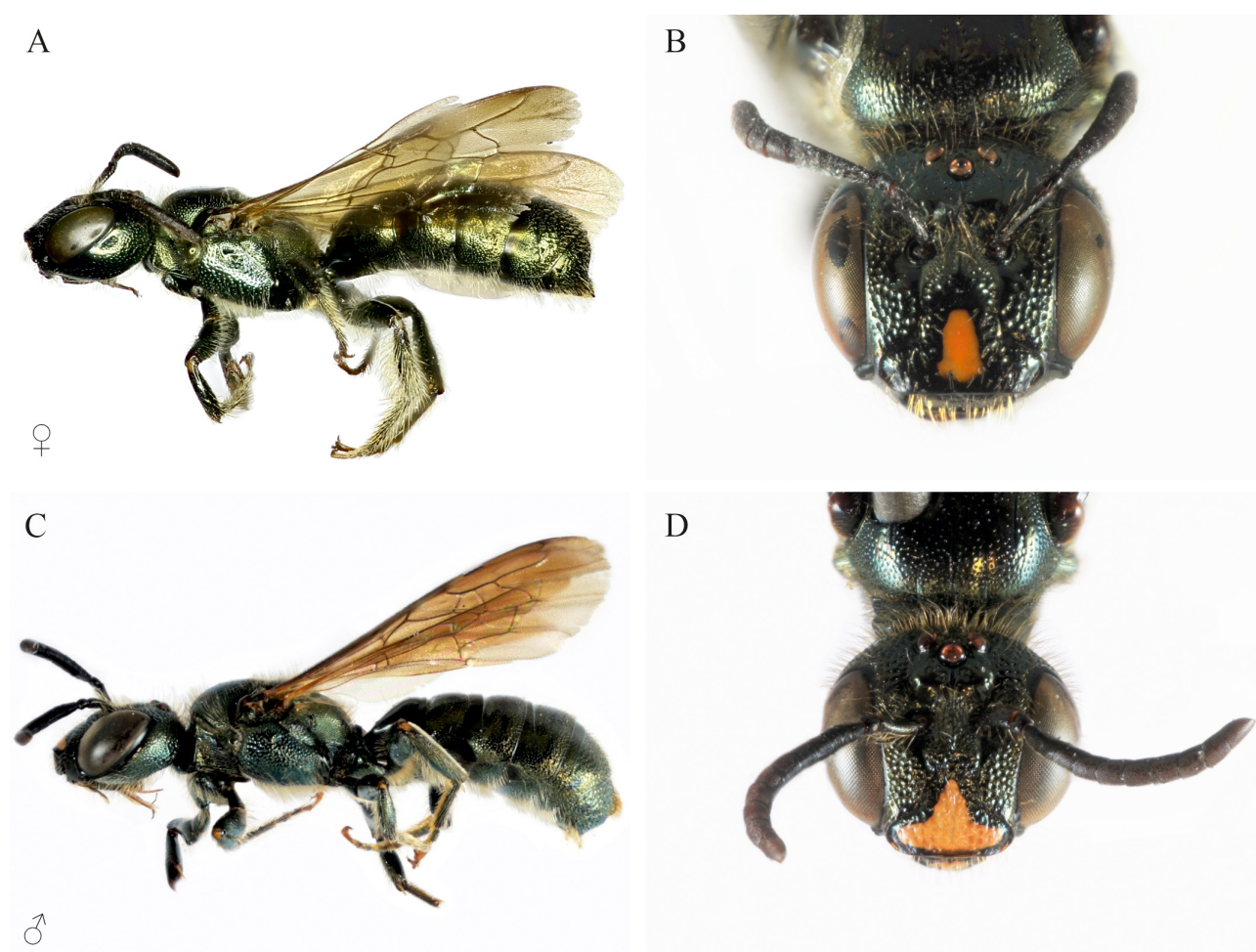


FIGURE 11. *Ceratina tepetlana* sp. n. A: Paratype, female lateral habitus, B: Paratype, female frontal view, C: Holotype, male lateral habitus, D: Holotype, male frontal view.

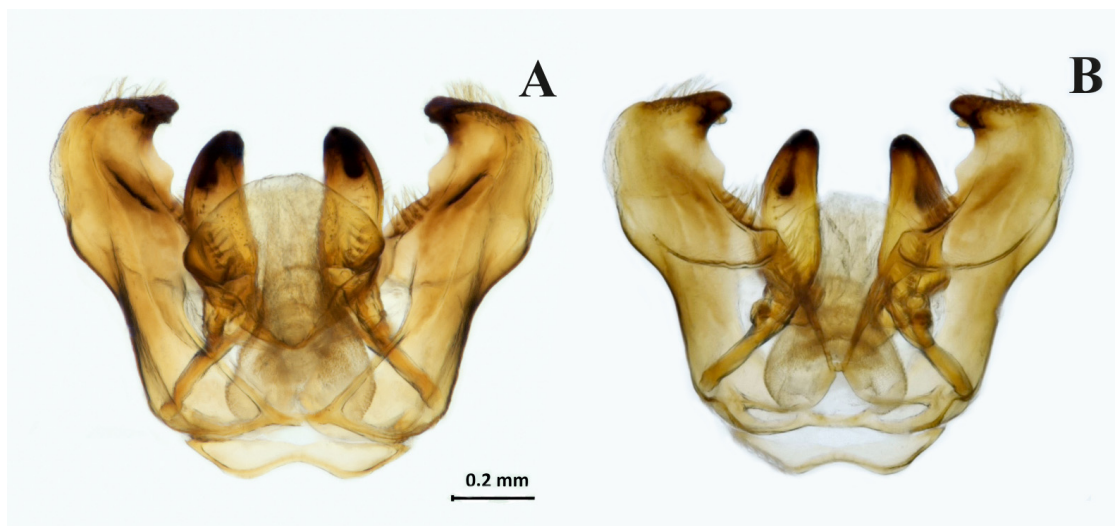


FIGURE 12. Genital capsule of *Ceratina tepetlana* sp. n male A: Dorsal view, B: Ventral view.

Head. Mandibles with two teeth, dark brown. Labrum with yellow mark in the middle area. Eyes convergent below. Clypeus with inverted T-shaped yellow mark, filling almost all the surface; closely punctured and rugose surface. Lower paraocular area and supraclypeal area closely punctate, punctures adjacent to each other. Upper paraocular area and frons with punctures separated by a puncture diameter distance. Vertex densely punctate, with long and yellowish pubescence. Gena densely punctate, with long yellowish pubescence more conspicuous in the lower area. Preoccipital carina more evident than in female. Antennae dark brown. Head length 1.82 mm; head width 2.04 mm; lower interocular distance 1.11 mm; upper interocular distance 1.38 mm; ocellocular distance 0.47 mm.

Mesosoma. Pronotum with lateral carina reaching the coxae; dorsolateral angle with transverse carina; pronotal lobe with short pubescence on the edge. Mesepisternum densely punctate, punctures separated by a puncture diameter or less distance; hypopimeral area with dense punctures on upper area, impunctate area towards the scrobal groove. Scutum, anterior area with yellowish pubescence as on vertex and with punctures separated by a distance up to twice puncture diameter; disc with punctures surrounding the parapsidal and anteromedial lines. Scutellum with close punctures, becoming sparser in the disc. Propodeal triangle striate. Propodeum, lateral area finely and densely punctate, with whitish plumose hairs. Tegula dark brown and impunctate. Smoked wings, pterostigma and venation brown. Length of forewing 5.47 mm. Scutum length 1.17 mm; scutum width 1.52 mm. **Legs.** Hind trochanter, ventral margin rounded with long and densely distributed pubescence. Hind femur medially dilated, basal half with yellowish, long and scattered plumose hairs (Fig. 22F).

Metasoma. T1 polished and impunctate, disc with small area finely and closely punctured. T2 and T3 with close punctation separated by a distance up to a puncture diameter, disc with sparse punctures. T4 with punctures separated by three times a puncture diameter; posterior margin with short scattered pubescence. T5 rugose. T6, medial area slightly projected and with hair tuft of copper pubescence. T7, posterior margin concave, forming a medial rounded projection (Fig. 23G). S6, as shown in Figure 24F. Genital capsule as shown in Figure 12.

Paratype female Length 8.26 mm. Same color as male.

Head. Round. Mandibles dark brown with three teeth. Labrum black with yellowish scattered pubescence. Clypeus with medial subtriangular-oval yellow mark, area surrounding the mark rugose. Supraclypeal area with dense and fine punctation between antennal sockets, area adjacent to clypeus impunctate. Lower paraocular area densely punctate, punctures reaching the epistomal suture, separated by a distance of less than a puncture diameter. Upper paraocular area with punctures slightly more separated than lower area, distance among punctures up to twice the diameter of a puncture. Frons with impunctate swellings, surrounding area with punctures as on upper paraocular area. Vertex with long, yellowish pubescence. Gena wider than eye width in lateral view; area adjacent to eye polished and impunctate reaching 1/3 of the gena; upper and medial area with sparse punctures, becoming sparser below. Preoccipital margin carinate, becoming more evident in dorsal view. Antennae as in males. Head length 2.08 mm; head width 2.39 mm; lower interocular distance 1.47 mm; upper interocular distance 1.52 mm; ocellocular distance 0.56 mm.

Mesosoma. Pronotum, mesepisternum and metepisternum as in male. Anterior area of scutum with punctures separated by a distance up to three times a puncture diameter, pubescence yellowish and long as in vertex; disc impunctate and polished; posterior area with close punctures. Scutellum disc with sparse punctures. Propodeal triangle striate. Propodeum and wings as in male. Length of forewing 6.08 mm. Scutum length 1.21 mm; scutum width 1.73 mm. *Legs*. Dark brown with green metallic tones. Base of tibia with yellow spot. Tarsi brown. Spurs whitish.

Metasoma. T1-T4 as in male. T5 and T6 rugose, with short and scattered whitish pubescence over the whole surface.

Type material: Holotype (♂ MZFC: 5895): MEXICO: Morelos: Huitzilac, Derrame del Chichinautzin, km 86.6, 2450 m, 19.0258, -99.14333, 26-X-1996, I. Hinojosa. Described paratype (♀ MZFC: 5607): Huitzilac, Derrame del Chichinautzin, km 85.8, 2470 m, 19.0233, -99.14944, 8-II-1997, I. Hinojosa. Other paratypes: same locality as described paratype (MZFC: 2 ♀: 5885, 5664, 2 ♂: 5894, 6017).

Other material examined: GUATEMALA: Huehuetenango: La Democracia, Cajuil, 1026 m, 15.637, -91.787, 6-IV-2010, J. Mérida (ECOAB: 1 ♀: 18361). **MEXICO. Chiapas:** Ocosingo, Ocosingo, 1290 m, 16.861, -92.106, 9-11-IV-2010, M. Cigarroa (ECOAB: 2 ♀: 17197, 17193); 1110 m, 16.916, -92.132, 12-IV-2010, M. Cigarroa (ECOAB: 1 ♀: 17192); 880 m, 16.892, -92.084, 13-IV-2010, J. Mérida (ECOAB: 1 ♀: 17198). Ocosingo, Sibaca, 1107 m, 16.945, -92.184, 11-IV-2010, M. Cigarroa (ECOAB: 5 ♀: 17199, 17200, 17201, 17195, 17196). San Juan Cancuc, Chicja, 1170 m, 16.902, -92.360, 8-IV-2010, C. López (ECOAB: 1 ♀: 17194). Hidalgo: Mineral del Chico, Mineral del Chico, 2356 m, 20.219, -98.740, 10-VII-2013, J. Mérida (ECOAB: 2 ♀: 18606, 18607). Tulancingo de Bravo, El Paraíso, 2185 m, 20.15, -98.4, 30-X-1992, O. Yáñez (MZFC: 1 ♀: 12087, 2 ♂: 12092, 12095). **Morelos:** Tepoztlán, km 4.5, Autopista México-Cuautla, 1940 m, 19.00416, -99.12944, 28-X-1995, O. Yáñez Ordóñez (MZFC: 2 ♀: 3551, 4457). Tepoztlán, km 12, Autopista México-Cuautla, 1650 m, 18.9733, -99.0825, 10-30-XI-1996, O. Yáñez (MZFC: 2 ♀: 2772, 2725); 18-II-1996, I. Hinojosa (MZFC: 2 ♀: 2093, 1955). Huitzilac, Derrame del Chichinautzin, km 79, 2670 m, 19.0355, -99.2055, 11-XI-1995, O. Yáñez (MZFC: 2 ♀: 5117, 5116); km 85.8, 2470 m, 19.0233, -99.14944, 8-II-1997, I. Hinojosa (MZFC: 6 ♀: 5635, 5588, 5800, 5799, 5491, 5490. 7 ♂: 5894, 6017, 6016, 5549, 5836, 5665, 5542); km 80.8, 2620 m, 19.0283, -99.19194, 11-XI-1995, O. Yáñez (MZFC: 1 ♀: 5128); km 81, 2620 m, 19.02861, -99.19027, 21-I-1996, I. Hinojosa (MZFC: 1 ♀: 5210); km 85, 2500 m, 19.02527, -99.1561, 15-X-1995, I. Hinojosa (MZFC: 1 ♀: 5319. 1 ♂: 5009); km 85.3, 2475-2480 m, 19.0238, -99.15194, 1-XII-1996, I. Hinojosa (MZFC 4 ♀: 5030, 5031, 5032, 5331. 5 ♂: 5719, 5011, 5028, 5255, 5253); km 85.6 - km 85.7, 2465-2470 m, 19.0233, -99.1511, 4-V-1996, O. Yáñez, I. Hinojosa (MZFC: 15 ♀: 5934, 5942, 5684, 6122, 6127, 6125, 6162, 5014, 5012, 5400, 5430, 5375, 5373, 5527, 5510. 7 ♂: 5685, 6187, 5401, 5399, 5374, 5513, 5512); km 86, 2470 m, 19.0233, -99.1463, 1-8-II-1997, I. Hinojosa, O. Yáñez (MZFC: 12 ♀: 5807, 5855, 5732, 6137, 6136, 5020, 5171, 5159, 5263, 5243, 5272, 5289. 13 ♂: 5901, 5900, 5856, 6136, 5049, 5017, 4998, 4997, 4996, 4994, 5238, 5237, 5276); km 86.5, 2450 m, 19.0255, -99.1441, 26-X-1996, I. Hinojosa, J. Márquez (MZFC: 9 ♀: 5596, 5607, 5703, 5179, 5197, 5196, 5195, 5181, 5310. 9 ♂: 5600, 5578, 5571, 6194, 5194, 5193, 5175, 5308, 5305); km 87, 2430 m, 19.02361, -99.1347, 7-VI-1997, I. Hinojosa (MZFC: 3 ♀: 6142, 5058, 5361. 4 ♂: 6113, 6108, 6107, 5362). **Oaxaca:** Santa María Yavesía, 2013 m, 17.264, -96.436, 15-XII-2015, N. Arnold (ECOAB: 5 ♀: 72095, 72100, 72104, 72108, 72114); 2016 m, 17.247, -96.435, 14-XII-2015, N. Arnold (ECOAB: 1 ♀: 72062); 2001 m, 17.235, -96.430, 15-XII-2015, K. Pérez (ECOAB: 1 ♀: 72090). Santiago Comaltepec, 1997 m, 17.565, -96.549, 15-XII-2015, K. Pérez (ECOAB: 1 ♀: 72126). San Pablo Macuiltianguis, 2011 m, 17.523, -96.540, 15-XII-2015, K. Pérez (ECOAB: 1 ♀: 72148). **Querétaro:** Colón, Cerro El Zamorano, 2678 m, 20.911, -100.201, 23-X-2012, J. Mérida (ECOAB: 1 ♀: 18592). **San Luis Potosí:** Zaragoza, Sierra de Álvarez, 2344 m, 22.088, -100.650, 20-X-2012, J. Mérida (ECOAB: 2 ♀: 18584, 18587); 2366 m, 22.064, -100.623, 21-X-2012, E. Pineda (ECOAB: 2 ♀: 18585, 18586).

Distribution: *Ceratina* (*Z.*) *tepetlana* is found from central Mexico to northern Guatemala, from 800 m to 2700 m in elevation. Its distribution corresponds to the Transmexican Volcanic Belt, Sierra Madre del Sur and Chiapas Highlands.

Etymology: The specific name refers to the Náhuatl word *tépetl*, which means mountain, indicating that this species can be found in mountain regions. It is an adjective in the nominative singular.

***Ceratina (Zadontomerus) sapphira* Flórez-Gómez & Ayala new species**

(Figures 13, 14, 22G, 23H, 24G, 28)

Diagnosis: Body size of females from 7.0–9.0 mm, males from 6.0–6.5 mm; this species is clearly distinguishable by its dark bluish color, smoked wings and polished propodeal triangle with distinct middle stria. Females with clypeus completely bluish, sometimes with reduced medial yellow mark; preoccipital carina slightly developed; disc of scutum polished, but with line of sparse punctures along the medial line. Male clypeus with distal and transverse yellow mark, sometimes forming two contiguous triangles; hind femur with rounded medial dilation (Fig. 22G); and posterior margin of T7 with truncated median projection (Fig. 23H).

Description. Holotype female. Length 7.4 mm. Body dark blue with metallic tones.

Head. Round shaped. Mandible with three teeth, black and middle area brownish. Labrum black with dispersed yellowish pubescence. Hypostomal carina with apical tooth. Clypeus dark bluish, same color as the rest of the head, some paratypes with thin middle yellow mark; dispersed punctures but middle area polished. Supraclypeal area with close and fine punctures between antennal sockets, medial area polished but with vertical line of punctures, separated by more than a puncture diameter. Lower paraocular area with dense punctation, but area adjacent to epistomal sutures impunctate. Upper paraocular area and frons, area surrounding the impunctate swellings, with dispersed punctures, separated by a distance from one to four times a puncture diameter. Vertex densely punctate, with scarce, short and whitish pubescence. Preoccipital carina slightly evident, being less conspicuous in dorsal view. Gena with upper area densely punctate, becoming sparser below; lower area with whitish, sparse and short hairs; area adjacent to the eye impunctate. Scape, flagellum and pedicel black. Head length 1.71 mm; head width 1.92 mm; lower interocular distance 1.15 mm; upper interocular distance 1.22 mm; ocellocular distance 0.45 mm.

Mesosoma. Pronotum with lateral carina; pronotal lobe dark with whitish short pubescence on the edge. Mesepisternum with sparse and long pubescence, with dense punctures separated by less than a puncture diameter; hypoepimeral area, with dense punctures becoming sparser below. Scutum, anterior area between notauli with punctures densely distributed, separated by a distance of up to a puncture diameter; disc polished but with line of sparse punctures along the medial line reaching the posterior margin; posterior area with fine and contiguous punctures. Scutellum with dense punctures becoming sparser in the disc. Propodeal triangle polished but with medial stria, lateral striae slightly evident. Propodeum, lateral areas with fine and close punctures, with whitish, scattered and long pubescence. Tegula dark brown and impunctate. Wings moderately smoked, stigma and venation dark brown. Length of forewing 5.1 mm. Scutum length 1.08 mm; scutum width 1.11 mm. *Legs.* Dark blue with metallic tones. Tibia base with yellow spot. Tarsi dark brown. Spurs light brown.

Metasoma. T1 polished, disc with small area with dispersed punctures. Lateral areas of T2 and T3 punctate, disc with sparse punctures and large impunctate areas. T4 with dense punctation, becoming more disperse on the disc. T5 and T6 rugose, with short and scattered whitish hairs. Sterna with long and scattered pubescence.

Paratype male. Length 6.25 mm. Length of forewing 4.77 mm. Same color as female.

Head. Mandibles with two teeth, black, with dispersed whitish pubescence on the distal margin. Labrum with small yellow mark in the middle. Clypeus, lower area with yellow transversal mark, punctation similar to female. Area above antennal sockets impunctate. Frons, area surrounding frontal swellings, densely punctate. Paraocular area, punctation as in female. Eyes convergent towards mandibles. Vertex densely punctate, punctures separated by a distance equal to or less than a puncture diameter, scarce long and whitish hairs over the surface. Gena densely punctate, as vertex, lower area with long, dispersed whitish pubescence. Preoccipital carina slightly more conspicuous than female. Antennae as female. Head length 1.43 mm; head width 1.67 mm; lower interocular distance 0.31 mm; upper interocular distance 0.97 mm; ocellocular distance 0.31 mm.

Mesosoma. Generally as in female, but anterior area of scutum densely punctate between notauli, disc with dispersed punctures. Scutum length 1.08 mm; scutum width 1.11 mm. *Legs.* Hind trochanter, ventral margin straight, with long, dispersed plumose hairs. Hind femur with rounded medial dilation; ventral margin, basal half with long, scattered pubescence (Fig. 22G).

Metasoma. Punctures as in the female. T6, middle area with tuft of brownish pubescence. T7, posterior margin straight, but with medial truncate projection (Fig. 23H). S6, as shown in figure 24G. Genital capsule as shown in the Fig. 14.

Type material: Holotype (♀ ECOAB: 18694): MEXICO: Chiapas: Oxchuc-Ch'enhawuk, 2057 m, 16. 798, - 92. 316, 15-VI-2013, M. Santiz. Described paratype (♂ ECOAB: 16932): same locality as holotype. Other paratypes:

same locality as holotype (ECOAB 3♀: 18692, 18687, 18682). GUATEMALA: Cunén, 1830 m, 11-VIII-1947, F. Johnson (AMNH: 1♀). Chichicastenango, 7-VIII-1947, F. Johnson (AMNH: 1♀). Nebaj, 09-VIII-1947, F. Johnson (AMNH: 1♂).

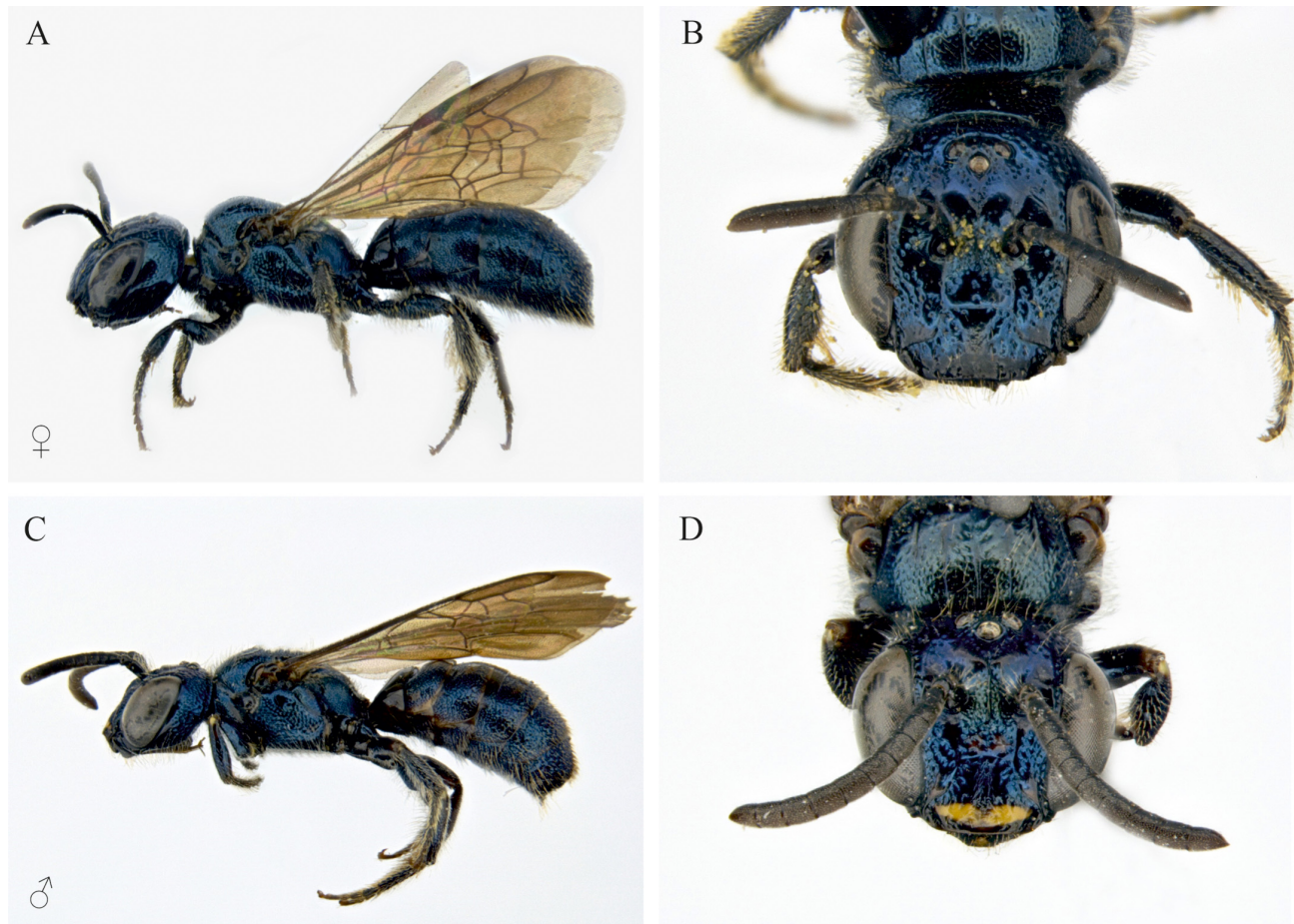


FIGURE 13. *Ceratina sapphira* sp. n. A: Holotype, female lateral habitus, B: Holotype, female frontal view, C: Paratype, male lateral habitus, D: Paratype, male frontal view.

Other material examined: MEXICO. Chiapas: El Porvenir, 1.26 km SW, 2724 m, 15.445, 92.281, 1-XII-2014, J. Mérida (ECOAB: 1♀: 18959). Huixtán, Carretera a Chana, 2087 m, 16.637, -92.331, 13-VI-2012, P. Sagot y J. Mérida (ECOAB: 2♀: 18582, 53004). Jitotol, El Ocotal, 1692 m, 17.059 N, -92.857 W, 13-14-III-2009, J. Mérida (ECOAB: 13♀: 18850, 18910, 18886, 18921, 18926, 18928, 18929, 18930, 18931, 18932, 18933, 16786, 16903). Motozintla de Mendoza, 2092 m, 15.240, -92.200, 16-II-2014, P. Sagot (ECOAB: 1♀: 52951). Oxchuc, 1962 m, 16.781, -92.334, 22-II-2013, M. Santiz (ECOAB: 2♀: 18517, 18669). Oxchuc, 1971 m, 16.805, -92.361, 24-VII-2012, J. Mérida (ECOAB: 1♀: 53024). Oxchuc-Mukulwitz, 1972 m, 16.802, -92.322, 23-IV-2013, M. Santiz (ECOAB: 7♀: 18476, 18494, 18495, 18661, 18711, 18576, 18725). Oxchuc-El Calvario, 1980 m, 16.791, -92.345, 27-II-2013, J. López (ECOAB: 4♀: 18536, 18704, 18548, 18569); 30-VI-2013, M. Santiz (ECOAB: 2♀: 18699, 18701). Oxchuc-Zona Urbana, 2000 m, 16.774, -92.342, 21-II-2013, J. López (ECOAB: 7♀: 18508, 18509, 18511, 18513, 18514, 18515, 18516, 1♂: 16933); 23-III-2013, J. López (ECOAB: 19♀: 18658, 18577, 18579, 18580, 18496, 18490, 18552, 18558, 18562, 18489, 18502, 18493, 18466, 18560, 18567, 18570, 18565, 18564, 18568, 1♂: 16937); 17-IV-2013, J. López (ECOAB: 8♀: 18532, 18533, 18546, 18520, 18524, 18526, 18681, 18676). Oxchuc-Ch'enchwuk, 2057 m, 16.798, -92.316, 15-VI-2013, M. Santiz (ECOAB: 11♀: 18693, 18688, 18683, 18679, 18673, 16952, 16953, 16954, 16955, 16951, 16946, 2♂: 16976, 16947). Oxchuc-Tzopilja, 2211 m, 16.729, -92.310, 11-VI-2013, M. Santiz (ECOAB: 5♀: 16957, 18670, 16959, 18685, 18663). Oxchuc-Retiro, 2231 m, 16.786, -92.367, 31-III-2013, J. López (ECOAB: 8♀: 18556, 18481, 18482, 18486, 18487, 18497, 16964, 18675). Oxchuc-Ka'ket curus, 2251 m, 16.789, -92.372, 2-IV-2013, J. López (ECOAB: 3♀: 18518, 18519, 18528). Pueblo Nuevo Solistahuacán, 1792 m, 17.174, -92.916, 11-VII-2012, J. Mérida (ECOAB: 1♂: 53003). San Cristóbal de Las Casas, 2138 m, 16.734, -92.618, 16-IV-2015, L. Marin (ECOAB: 3♀: 66570, 66572, 66573, 2♂: 66578, 66579);

2168 m, 16.748, -92.643, 17-II-2015, M. Robles (ECOAB: 9♀: 66564, 66565, 66566, 66567, 66568, 66569, 66571, 66574, 66575, 4♂: 66577, 66580, 66581, 66582); 2261m, 16.752, -92.676, 16-VI-2012, P. Sagot (ECOAB: 1♀: 18422). Zinacantán, 2139 m, 16.768, -92.736, 14-VI-2012, P. Sagot (ECOAB: 5♀: 18426, 18427, 18428, 18420, 52992, 2♂: 52994, 52995). **Hidalgo:** Tenango de Doria, 2180 m, 9-III- 1993, L. Godínez (MZFC: 1♀: 26894, 2♂: 26896, 26892). Tenango de Doria-Cerro el Cirio, 2155 m, 20.3233, -98.197778, 9-V-1993, L. Godínez (MZFC: 3♀: 26895, 26882, 26885, 5♂: 26897, 26899, 26898, 26903, 26902); 20.325, -98.2272, 3-XI-1993, L. Godínez (MZFC: 3♀: 26877, 26880, 26881). La Misión, Cerro Prieto, 1654 m, 21.077, - 99.104, 19-VIII-2013, J. Mérida (ECOAB: 1♀: 18616). **Oaxaca:** Totontepec Villa de Morelos, 2537 m, 17.143, -96.031, 25-XI-2013, J. Mérida (ECOAB: 1♂: 52974). San Jerónimo Tecóatl, 1204 m, 18.152, -96.853, 18-V-2015, L. M. Reyes (ECOAB: 1♀: 74886). San Mateo Yolochochitlán, 1564 m, 18.143, -96.870, 19-V-2015, L. Reyes (ECOAB: 1♀: 74919). Eloxochitlán de Flores Magón, 1377 m, 18.190, -96.886, 20-V-2015, L. Reyes (ECOAB: 1♀: 75015).

Distribution: *Ceratina* (*Z.*) *sapphira* is found in the mountains of Guatemala and Mexico, in the Sierra Madre del Sur, Chiapas Highlands and Sierra de Juárez in Oaxaca. Records range from 1200–2800 m above sea level. This species reaches the highest elevation of any of the Neotropical *Zadontomerus*. In Mexico it is reported from the states of Chiapas, Hidalgo and Oaxaca, and in Guatemala in the department Quiché.

Comments: This species shows variation in color associated with geographic distribution. Specimens from Hidalgo have an opaque blue-dark green coloration. In contrast, specimens from Chiapas, Oaxaca (both in Mexico) and Guatemala have a more intense bluish coloration, this is the most common color of this species.

Etymology: The specific name refers to sapphire, as the color of this bee resembles this blue precious gem.

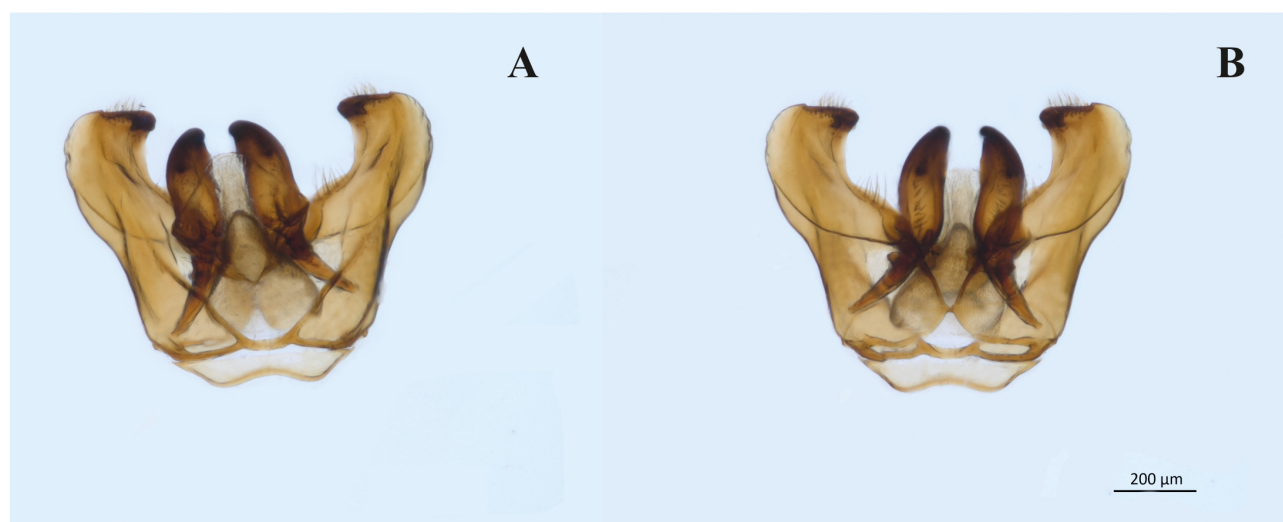


FIGURE 14. Genital capsule of *Ceratina sapphira* sp. n male. A: Dorsal view, B: ventral view.

Ceratina (*Zadontomerus*) *raquelitae* Flórez-Gómez & Ayala new species

(Figures 15, 16, 22H, 23I, 24H, 28)

Diagnosis: Medium sized bees, females range from 6.0–7.8 mm in length and males from 5.5–6.3 mm in length; dark green-olivaceous with metallic tints. Females recognizable by the combination of the following characters: thick pubescence with rounded apex on the posterior margin of T4 and disperse in T5 (Fig. 15E); clypeus with thin yellow mark. Disc of scutum impunctate or with line of scarce punctures along the medial line that do not reach the posterior margin in both sexes. Males with eyes strongly convergent below; hind trochanter ventral margin rounded with long and dense whitish pubescence, extending to the basal half of the femur; hind femur slightly dilated (Fig. 22H); and T7 forming two laminar projections delimitating a medial notch (Fig. 23I).

Description. Holotype male. Length 5.9 mm. Body dark green olivaceous with metallic tones.

Head. Mandibles with two teeth, black and medial area light brown, outer margin with scattered whitish and short pubescence. Labrum, middle area with yellow squared-shaped mark. Clypeus with an inverted T-shaped yellow mark; densely punctate. Supraclypeal area and lower paraocular area densely punctate, surface rather rugose. Upper paraocular area and frons surrounding the swellings, with punctures separated by a distance as 1–3 times a

puncture diameter. Eyes strongly convergent below. Vertex densely punctate and with sparse yellowish pubescence. Gena with upper area densely punctate, becoming sparser below, punctures do not reach the preoccipital margin, long and whitish scattered pubescence. Preoccipital margin carinate, carina more developed than female. Antennae dark brown, distal flagellomeres lighter. Head length 1.39 mm; head width 1.57 mm; lower interocular distance 0.69 mm; upper interocular distance 1.01 mm; ocellocular distance 0.32 mm.

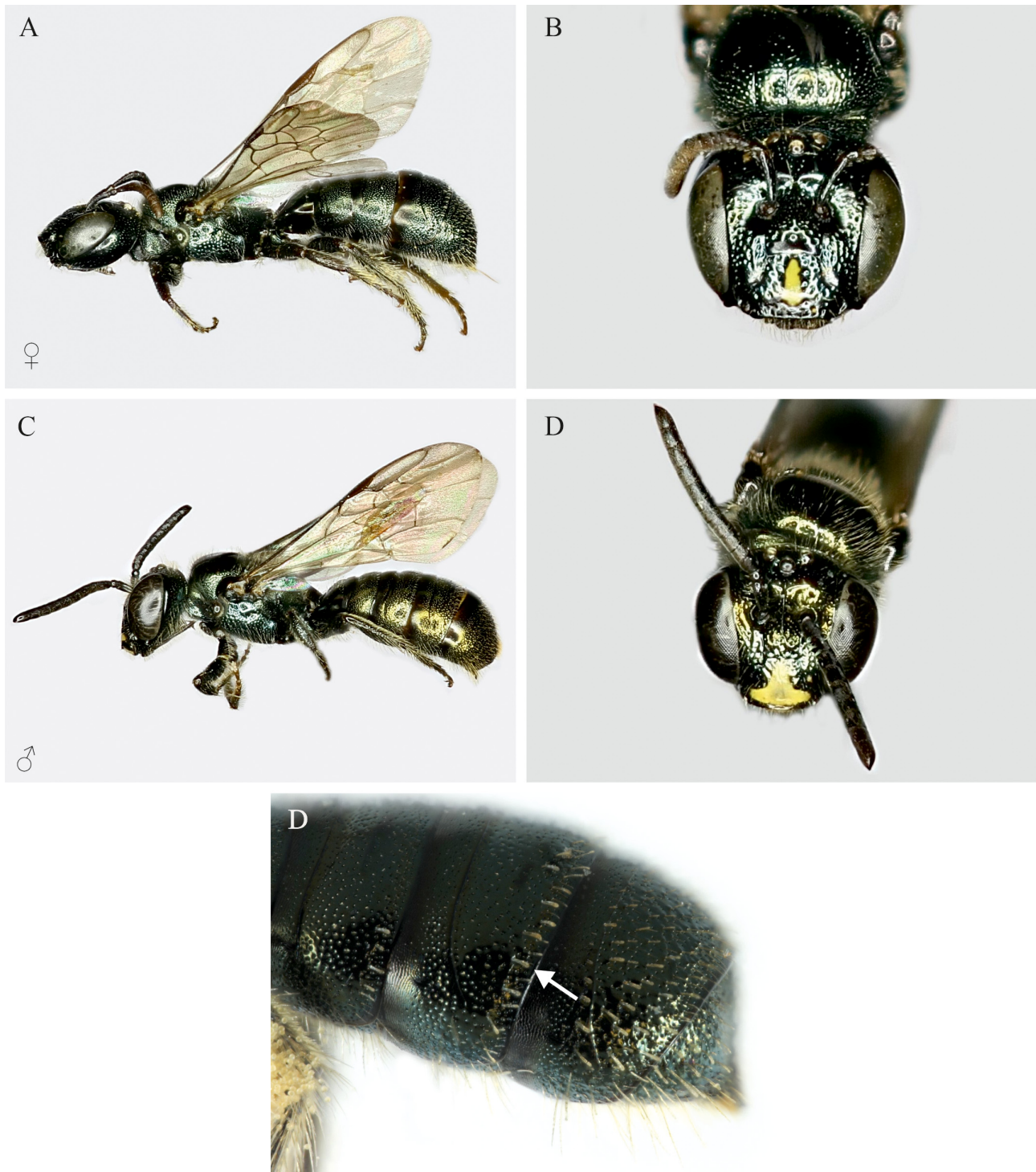


FIGURE 15. *Ceratina raquelitae* sp. n. A: Paratype, female lateral habitus, B: Paratype, female frontal view, C: Holotype, male lateral habitus, D: Holotype, male frontal view, E: Paratype, female metasoma, thick pubescence on T4-T6.

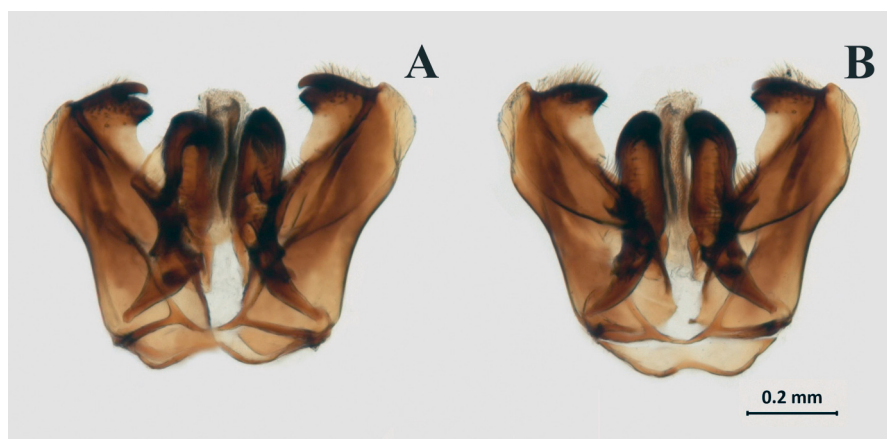


FIGURE 16. Genital capsule of *Ceratina raquelitae* sp. n male A: Dorsal view, B: Ventral view.

Mesosoma. Pronotum with lateral carina, dorsolateral angle rounded. Mesepisternum with punctures separated by a distance up to twice a puncture diameter, lower area with sparser punctures and whitish scattered pubescence. Hypoepimeral area with dispersed punctures, as the rest of the mesepisternum, lower area towards the scrobal groove impunctate. Anterior area of scutum with punctures separated by a distance of 1.0–2.5 times the diameter of a puncture; disc of scutum almost impunctate but with dispersed punctures surrounding the medial line; posterior area with close punctures. Scutellum with dense punctation but disc with more separated punctures, distance between punctures up to 3 times a puncture diameter. Propodeal triangle striate, medial striae much longer than lateral ones. Tegula dark brown and polished. Wings slightly smoked, venation dark brown. Length of forewing 4.31 mm. Scutum length 0.8 mm; scutum width 1.11 mm. **Legs.** Hind trochanter, ventral margin rounded with long and dense whitish pubescence. Hind femur, slightly dilated, basal half with dense, long and white pubescence (Fig. 22H).

Metasoma. T1 polished, disc with fine and dense punctures. T2 with dispersed punctation, separated by a distance of up to twice puncture diameter. T3 with dense punctures becoming sparser in the disc. T4–T5 with punctures separated by a distance of twice a puncture diameter. T6, middle area with tuft of yellowish pubescence. T7 forming two laminar projections delimitating a medial notch (Fig. 23I). S6, as shown in the Figure 24H. Genital capsule as shown in the Figure 16.

Paratype female. Length 7.42 mm. Same color as male

Body dark green olivaceous with metallic tones.

Head. Round. Mandibles with three teeth, color as male. Labrum black, with long yellowish pubescence. Clypeus, middle area with thin longitudinal yellow mark, with punctures separated by a distance of 0.5–1.0 times puncture diameter, middle area impunctate. Inner margins of compound eyes slightly converging below. Supraclypeal area with dense punctation between antennal sockets, medial area polished and impunctate. Lower paraocular area and antennocular area densely punctate, distance among punctures less than a puncture diameter. Area below antennal sockets polished. Upper paraocular area with scarce punctures. Frons, area surrounding the impunctate swellings, with dispersed punctures, separated by a distance as three times a puncture diameter. Vertex with dispersed punctures, with large areas polished; scattered whitish long hairs. Gena narrower than eye width, areas adjacent to eye and preoccipital margin polished and impunctate reaching 1/3 of the gena; upper area with dispersed punctures separated by a distance as twice a puncture diameter; lower area with scarce punctures almost impunctate. Preoccipital margin with slightly evident carina. Antennae as male. Head length 1.56 mm; head width 1.73 mm; lower interocular distance 0.97 mm; upper interocular distance 1.11 mm; ocellocular distance 0.38 mm.

Mesosoma. Generally, as in male but with shorter pubescence. Anterior area of scutum with punctures separated by a distance of 1.0–2.5 times the diameter of a puncture; disc impunctate; posterior area with close punctures. Tegula and wings as male. Length of forewing 4.64 mm. Scutum length 0.89 mm; scutum width 1.32 mm. **Legs.** Dark with green metallic tones. Tibia base with yellow spot. Tarsi dark brown, apical tarsi lighter. Spurs yellowish.

Metasoma. T1–T4 Punctures as in male. T4 posterior margin with long, thick and round, pointed whitish hairs (Fig 15E), separated by 2–4 punctures. T5 and T6 rugose, with long thick hairs intercalated with short and thin hairs.

Type material: Holotype (♂ MZFC: 05530): MEXICO: Morelos: Huitzilac, Derrame del Chichinautzin, km 87, 2440 m, 19.025; -99.13972, 4-VII-1997, O. Yáñez. Described paratype (♀ MZFC: 05541): same locality as holotype. Other paratypes: same locality as holotype (♀ MZFC: 03479, 02829, ♂ MZFC: 04839, 06140, 05529, 06121).

Other material examined: MEXICO. Michoacán: Dr. Miguel Silva, 9 km S Ario de Rosales, 1450 m, 29-X-1987, T. Griswold (BBSL: 1♂). **Morelos:** Tepoztlán, km 3.5, Autopista México-Cuautla, 2000 m, 19.00694; -99.13861, 12-18-XI-1995, J. L. Salinas (MZFC: 3♀: 3613, 3550, 1989); km 12, Autopista México-Cuautla, 1650 m, 18.9733; -99.0825, 4-VIII-1996, I. Hinojosa (MZFC: 4♀: 3256, 2829, 1989, 2126, 1♂: 2402); km 4.5, Autopista México-Cuautla, 1940 m, 19.0041; -99.12944, 17-II-1996, I. Hinojosa (MZFC: 2♀: 3855, 3762); 9-VI-1996, O. Yáñez (MZFC: 2♂: 3958, 3923); 3-VIII-1996, I. Hinojosa (MZFC: 1♀: 4085, 6♂: 4030, 4080, 4079, 4078, 4067, 4057); 22-IX-1996, I. Hinojosa (MZFC: 1♀: 4133, 3♂: 4470, 4228, 4330); 27-VII-1997, I. Hinojosa y O. Yáñez (MZFC: 2♀: 4794, 4900, 8♂: 4901, 4838, 4905, 4839, 4902, 4864, 4863, 4862). Huitzilac, Derrame del Chichinautzin, km 87, 2440 m, 19.025; -99.13972, 4-VII-1997, O. Yáñez (MZFC: 3♂: 6141, 6140, 5363); km 86.5, 2450 m, 19.0255, -99.14416, 26-X-1996, I. Hinojosa (MZFC: 2♀: 5595, 5598, 1♂: 5250); km 85.6, 2470 m, 19.0241, -99.1450, 15-X-1995, I. Hinojosa y O. Yáñez (MZFC: 8♀: 6087, 5781, 5013, 5545, 5541, 5535, 5543, 5252, 7♂: 6121, 6126, 4993, 5532, 5531, 5529, 5530); km 85, 2500 m, 19.0252, -99.15611, 15-X-1995, I. Hinojosa (MZFC: 1♂: 5008); km 79.4, 2660 m, 19.0352, -99.20194, 11-XI-1995, O. Yáñez (MZFC: 2♀: 5080, 5127). **Jalisco:** Ciudad Guzmán, 40 km W, 2000 m, 17-VII-1989, T. Griswold (BBSL: 4♂). Camino Volcán Colima, 19.6253; -103.54713, 05-IX-2014, R. Ayala (EBCh: 2♂). Mazamitla, 5 km S, 18-III-1990, C. M. Estrada (EBCh: 7♀, 4♂).

Distribution: *Ceratina* (*Z.*) *raquelitae* is endemic to Mexico. This species is distributed in the Transmexican Volcanic Belt, between 1400–2600 m above sea level, in the states of Jalisco, Michoacán and Morelos.

Comments: In some cases, females are similar to *C. ignara*, but can be recognized by the long, thick hairs on the apical terga. In addition, the clypeal mark is thinner and metasoma is more elongated.

Etymology: This species is dedicated to Raquel Gómez, mother of the first author.

Ceratina (*Zadontomerus*) *rehanae* Flórez-Gómez & Ayala new species

(Figures 17, 18, 21C, 22I, 23J, 24I, 27)

Diagnosis: Body size of females from 6.6–8.0 mm and males from 6.0–8.0 mm; yellow maculation on the pronotal lobe, dark green bees, sometimes with golden metallic tones; smoked wings and marginal cell slightly darker. Females with frons, paraocular area and gena densely punctate, disk of scutum with dispersed punctures along the medial line and surrounding the parapsidal lines; scutellum densely punctate. Males with hind trochanter with ventral margin forming a right angle; hind femur with strong medial dilation forming an angle, ventral margin glabrous (Fig. 22I); and posterior margin of T7 concave, forming medial projection (Fig. 23J). This species is similar to *C. basaltica*; but females can be distinguished by a more conspicuous punctation on disc of scutum, around the parapsidal lines. Males can be recognized because, in contrast to those of *C. basaltica*, they do not have a swollen area on the medial area of T6.

Description. Holotype male. Length 6.5 mm. Body dark green with golden metallic tones.

Head. Mandibles with two black teeth. Labrum with medial yellow mark. Clypeus with inverted T-shaped yellow mark, covering almost all the clypeus; area without mark with dense punctures. Eyes with inner margin convergent below. Paraocular area, supraclypeal area and frons with densely distributed punctures, separated by a distance up to a puncture diameter. Vertex punctation as the rest of the head, with scattered yellowish hairs. Gena with dense punctures, lower area with long scarce pubescence. Preoccipital carina foveate, slightly more evident than female. Antennae dark brown., pedicel and scape with long and scattered yellowish pubescence. Head length 1.60 mm; head width 1.84 mm; lower interocular distance 0.85 mm; upper interocular distance 1.2 mm; ocellular distance 0.375 mm.

Mesosoma. Pronotum with lateral carina, dorsolateral angle rounded, pronotal lobe with yellow mark covering all the surface. Mesepisternum densely punctate; punctures separated by a distance of up to a puncture diameter, becoming sparser below; hypoepimeral area with punctures densely distributed, as the rest of mesepisternum, with small impunctate region next to the episternal scrobe. Metepisternum with punctures as mesepisternum. Scutum, anterior region with dense punctures, separated by a distance of up to a puncture diameter, disc with disperse

punctures separated by a distance up to 3 times a puncture diameter, posterior area with close punctures. Scutellum with dense punctures, but disc with slightly more separated punctures. Metanotum rugose. Propodeal triangle striate, medial striae longer than lateral ones. Propodeum, lateral sides with fine and close punctures, with dispersed and whitish pubescence. Tegula brown. Wings smoked, marginal cell slightly darker, venation dark brown. Length of forewing 4.7 mm. Scutum length 0.96 mm; scutum width 1.40 mm. *Legs*. Hind trochanter with ventral margin forming a right angle, with scarce short pubescence. Hind femur with strong medial dilation forming an angle, ventral margin glabrous (Fig. 22I).

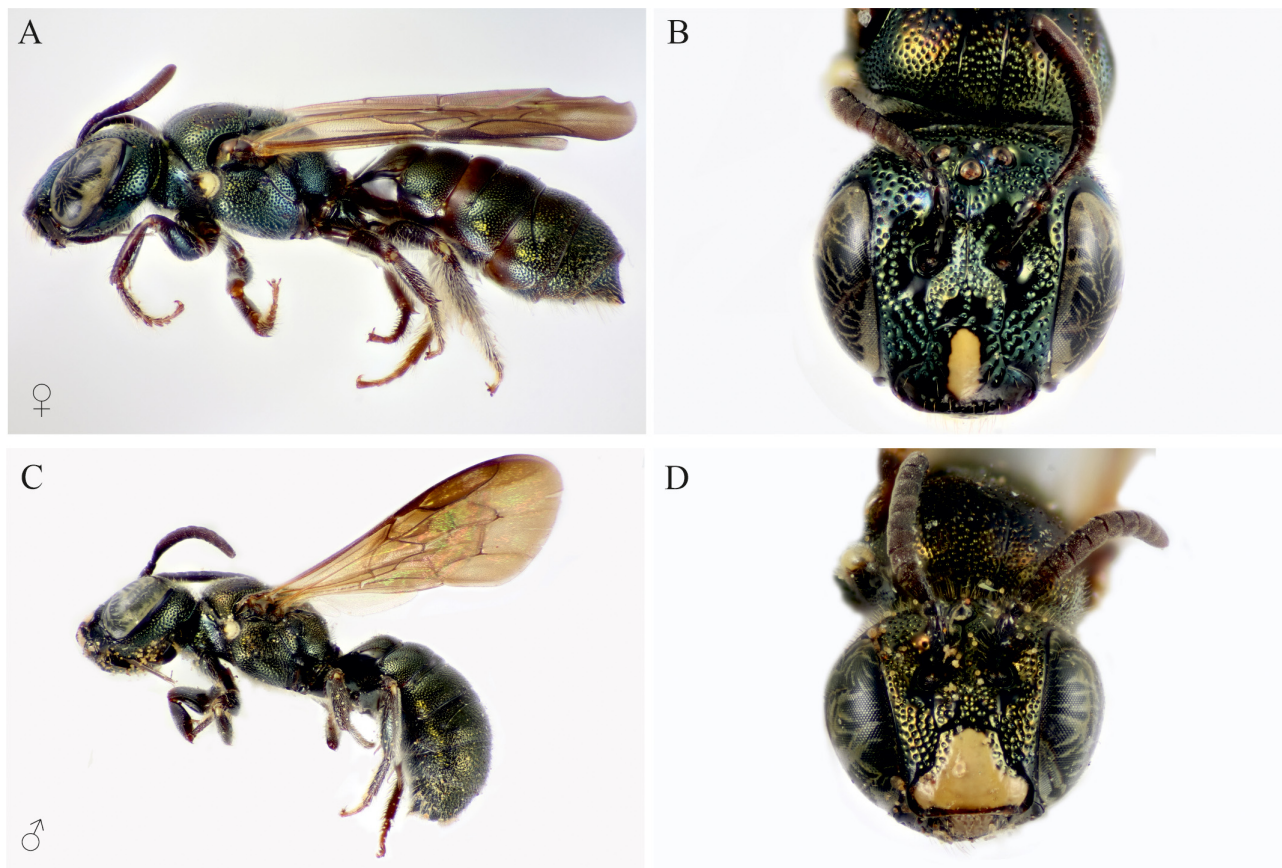


FIGURE 17. *Ceratina rehanae* sp. n. A: Paratype, female lateral habitus, B: Paratype, female frontal view, C: Holotype, male lateral habitus, D: Holotype, male frontal view.

Metasoma. T1 polished and impunctate, but with dense punctures on the posterior margin and disc. T2 and T3 densely punctate, punctures separated by a distance less or as a puncture diameter, disc with polished, almost impunctate transversal region. T4 with dense punctures, posterior margin with scattered short pubescence. T5 rugose. T6, medial area with tuft of yellowish pubescence. T7, posterior margin concave, forming medial projection (Fig. 23J). S6, as shown in Figure 24I. Genital capsule as shown in the Fig. 18.

Paratype female. Length 7.6 mm. Body dark green with golden metallic tones.

Head. Mandibles with three teeth, dark brown, outer margin with short and scarce pubescence. Maxillary palps with 6 segments. Hypostomal carina rounded. Labrum, dark brown with scattered yellowish pubescence. Clypeus, medial area impunctate and with oval yellow mark; upper area with dense punctures. Supraclypeal area with fine and dense punctures between antennal sockets, medial area impunctate but with longitudinal line of punctures. Eyes with inner margins subparallel. Paraocular area with punctures densely distributed, separated by a distance up to 1.5 times puncture diameter, punctures reaching the epistomal suture. Frons, area surrounding the impunctate swellings and vertex with punctures densely distributed, as in the paraocular area. Gena narrower than compound eye width; upper area with dense punctures separated by a distance up to a puncture diameter, becoming sparser below, distanced by 0.5–2.0 times a puncture diameter, reaching the preoccipital margin. Preoccipital margin carinate. Antennae as in males. Head length 1.8 mm; head width 2.09 mm; lower interocular distance 1.15 mm; upper interocular distance 1.36 mm; ocellocular distance 0.48 mm.

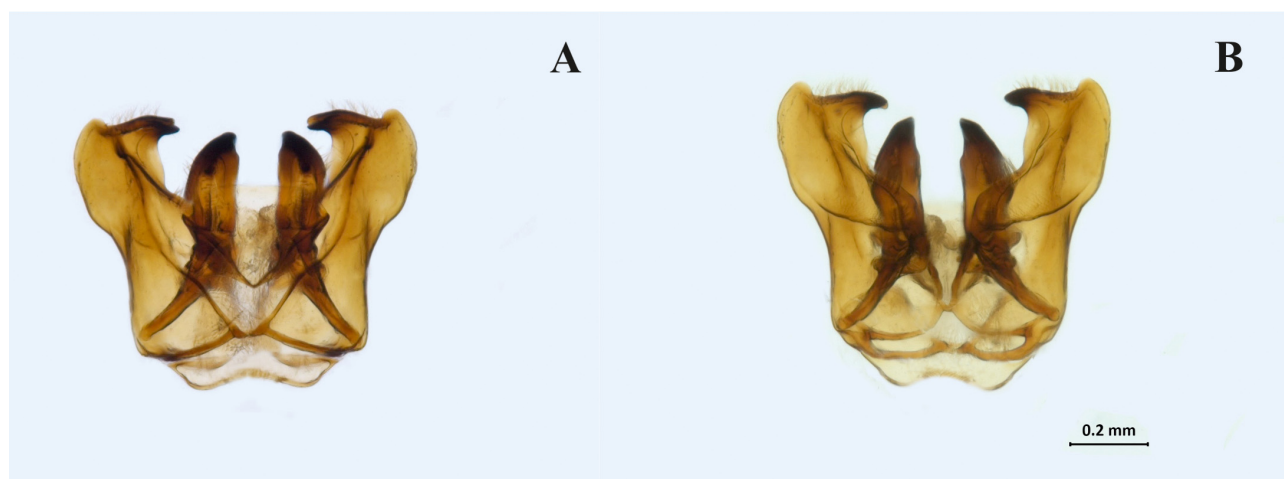


FIGURE 18. Genital capsule of *Ceratina rehanae* sp. n male A: Dorsal view, B: Ventral view.

Mesosoma. Pronotum, mesepisternum, metepisternum, scutellum, and propodeum as in males. Scutum, anterior region with dense punctures, separated by a distance of up to a puncture diameter, disc with dispersed punctures along the anteromedian line and around parapsidial lines, posterior area with close punctures. Tegula and wings as in male. Length of forewing 4.7 mm. Scutum length 1.05 mm; scutum width 1.6 mm. **Legs.** Dark brown with green metallic tones. Tibia base with yellow spot. Tarsi light brown. Spurs light brown.

Metasoma. T1-T4 punctures as in male. T5 and T6 rugose, with scattered whitish pubescence.

Type material. Holotype (♂ AMNH): MEXICO: Jalisco: Zapotillo, 3 km N, 15-VII-1989, J. Rozen. Described paratype (♀ AMNH): same locality as holotype. Other paratypes: Chiapas: Motozintla, 1200 m, 15.30, - 92.23, 7-XI-2011, P. Sagot (♂ ECOAB: 56053, ♀ ECOAB: 122317).

Material examined: **MEXICO.** **Chiapas:** Las Cruces, 15-IX-1974, G. Bohart (BBSL: 1♀). **Colima:** Colima, 16 km NW, 800 m, 19-XII-1989, T. Griswold (BBSL: 1♀). **Guerrero:** Zihuatanejo, km 55 I. M. Altamirano, 19-III-1989, R. Ayala (EBCh: 5♀). **Jalisco:** Puerto Vallarta, 07-XII-1986, G. Bohart (BBSL: 13, 21♂). El Grullo, 1200 m, 17-VII-1989, T. Griswold (BBSL: 2♀). Purificación 20 km S, 300 m, 16-VII-1989 (BBSL: 4♀, 9♂). Autlán de Navarro 30 km, 500 m, 16-VII-1989, T. Griswold (BBSL: 1♀). Barra de Navidad, 18-IV-1986, F. Parker (BBSL: 2♀). Ciudad Guzmán 22 km N, 1800 m, 17-VII-1989, T. Griswold (EBCh: 3♀). San Clemente, 20.085269, -104.253856, 16-VII-1989, J. Rozen (AMNH: 3♀). Zapotillo, 21.147776, -102.80108, 15-VII-1989, J. Rozen (AMNH: 2♂). **Morelos:** Reserva de la Biosfera Sierra de Huautla, 18.4587, -99.0072, 24-IV-2000, R. Westcott (BBSL: 3♀). Ajuchitlán, 2.5 km O. Ajuchitlán, 950 m, 18.46775, -98.99243, 07-VIII-1996, M. E Guardado (EBCh: 1♂). Huautla, 2.5 km N 4 km O Huautla, Estación CEAMISH, 940 m, 18.46118, -99.0412, 07-VIII-1996, C. A Uribe (EBCh: 1♂). **Nayarit:** San Blas, 150 m, 1-IX-1963, H. Weems (BBSL: 1♀). Tepic, 25-VII-1954, M. Cazier (AMNH: 2♀). **Puebla:** Zapotitlán, 2-III-1972, F. Parker (BBSL: 1♂). **Veracruz:** Huatusco, 19. 17337, -96. 9724, 11-I-2007, S. W. Droege (EBCh: 8♀, 5♂).

Distribution: *Ceratina* (*Z.*) *rehanae* is found mainly in the Mexican lowlands, although some specimens can be found in mountainous regions up to 1000 m above sea level. It is associated to the Pacific Lowlands, Balsas Basin, southern slope of the Transmexican Volcanic Belt, Sierra Madre Oriental and Sierra Madre del Sur. Presumably endemic to Mexico, it is found in the states of Chiapas, Colima, Guerrero, Jalisco, Morelos, Nayarit, Puebla and Veracruz.

Etymology: The name of this species is dedicated to Sandra Rehan, a bee scientist who has dedicated much of her research to the biology, systematics, and evolution of *Ceratina*.

Ceratina (*Zadontomerus*) *indigovirens* Flórez-Gómez, Ayala & Hinojosa-Díaz new species

(Figures 19, 20, 22J, 23K, 24J, 27)

Diagnosis: Body size of females and males from 5.5–7.0 mm; dark blue head and mesosoma with metallic tints, contrasting the metasoma, which is green metallic or sometimes copper metallic, wings smoked with dark brown

venation. Females with lower paraocular area with dense punctures, upper paraocular area and frons with dispersed punctures separated by a distance up to twice a puncture diameter; disc of scutum polished and impunctate. Male hind trochanter with dense and long pubescence, reaching the basal half of the hind femur; hind femur medially dilated (Fig. 22J); and posterior margin of T7 with two laminar projections forming a medial notch (Fig. 23K).

Females can be similar to *C. ignara*; however, this species can be recognized by the shape of the metasoma, that generally its length is less than twice the width, while in *C. ignara* the metasoma is longer. Males of both species are easily distinguishable because *C. indigovirens* do not have paraocular marks, while *C. ignara* do.

Description. Holotype male. Length 6.13 mm. Head and mesosoma dark metallic blue, mesosoma green with metallic tints, copper in some paratypes.

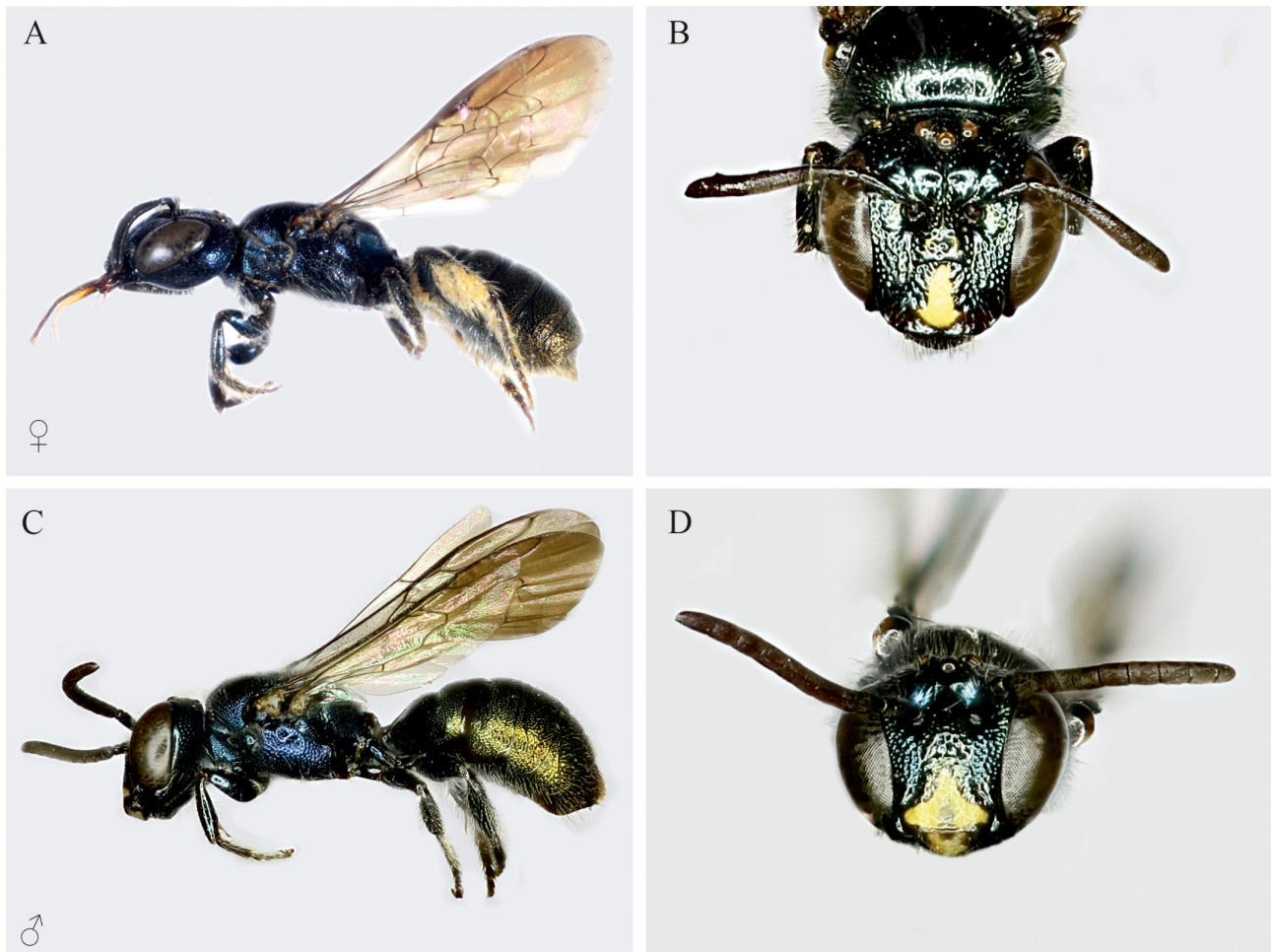


FIGURE 19. *Ceratina indigovirens* sp. n. A: Paratype, female lateral habitus, B: Paratype, female frontal view, C: Holotype, male lateral habitus, D: Holotype, male frontal view.

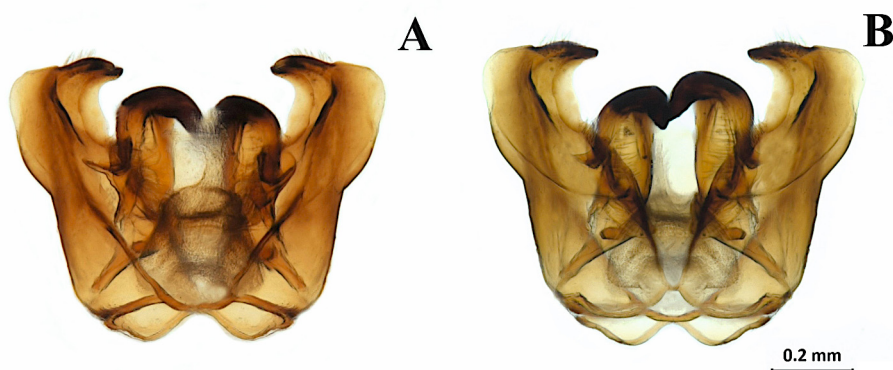


FIGURE 20. Genital capsule of *Ceratina indigovirens* sp. n male A: Dorsal view, B: Ventral view.



FIGURE 21. Scutum of females A: *Ceratina nautlana*, B: *Ceratina kopili* sp. n., C: *Ceratina rehanae* sp. n.

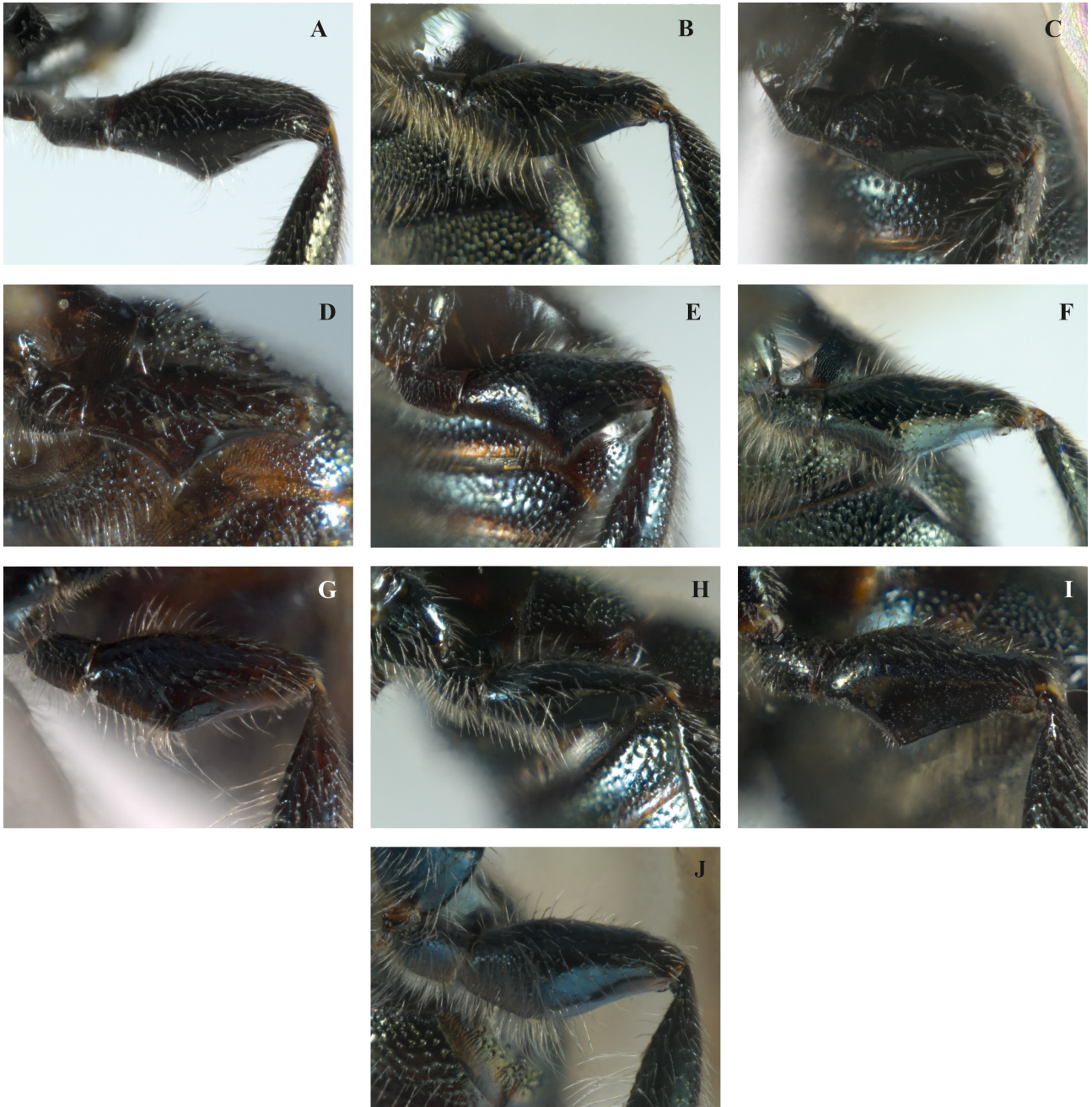


FIGURE 22. Hind trochanter and femur from males of the *Ceratina* (*Zadontomerus*) species: A. *C. capitosa*, B. *C. ignara*, C. *C. nautlana*, D. *C. kopili* sp. n., E. *C. basaltica* sp. n., F. *C. tepetlana* sp. n., G. *C. sapphira* sp. n., H. *C. raquelitae* sp. n., I. *C. rehanae* sp. n., J. *C. indigovirens* sp. n.

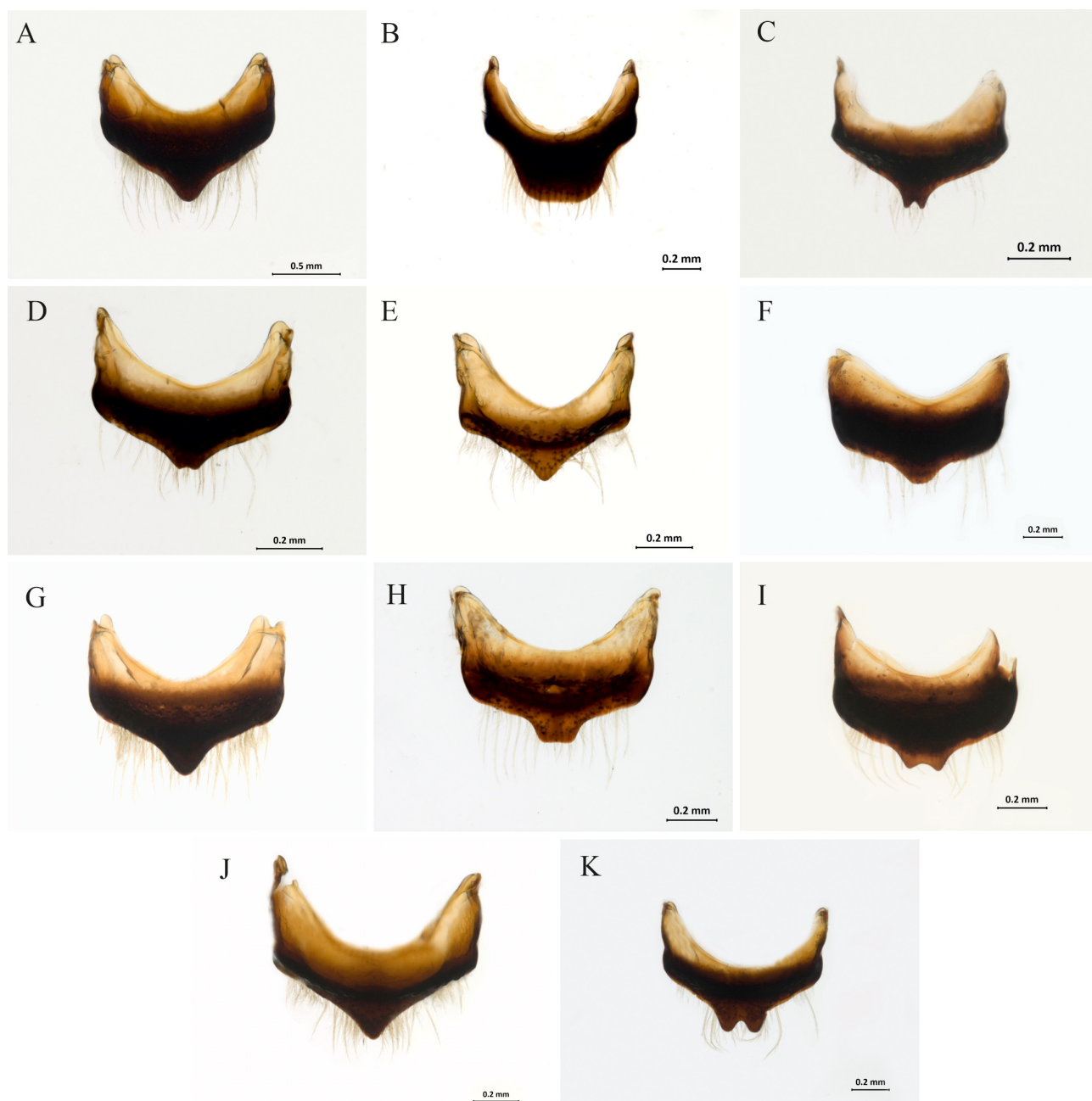


FIGURE 23. Tergite 7 from males of the *Ceratina* (*Zadontomerus*) species: A. *C. capitosa*, B. *C. ignara*, C-D *C. nautlana*, E. *C. kopili* sp. n., F. *C. basaltica* sp. n., G. *C. tepetlana* sp. n., H. *C. sapphira* sp. n., I. *C. raquelitae* sp. n., J. *C. rehanae* sp. n., K. *C. indigovirens* sp. n.

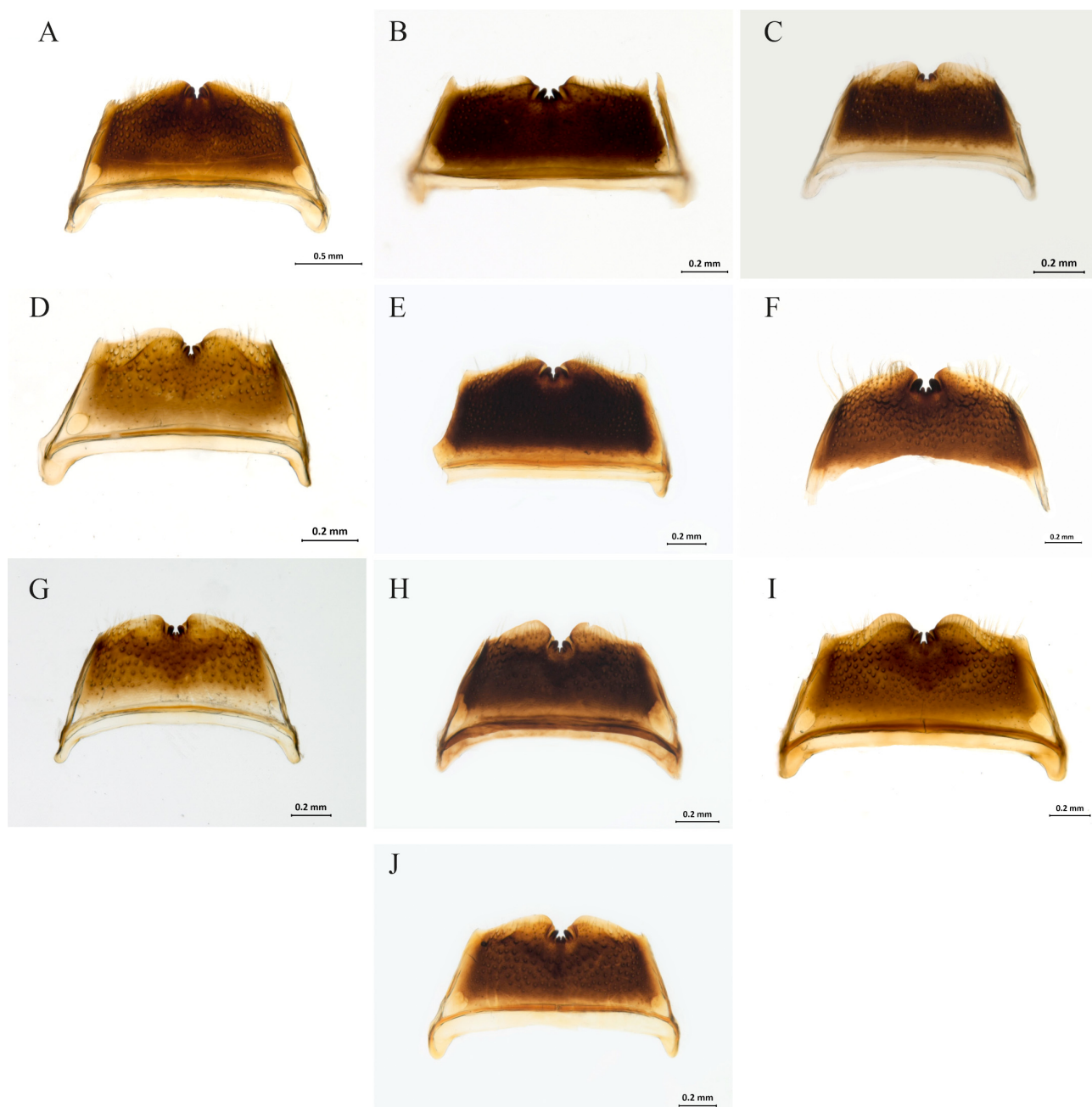


FIGURE 24. Sternite 6 from males of the *Ceratina* (*Zadontomerus*) species: A. *C. capitosa*, B. *C. ignara*, C. *C. nautlana*, D. *C. kopili* sp. n., E. *C. basaltica* sp. n., F. *C. tepetlana* sp. n., G. *C. sapphira* sp. n., H. *C. raquelitae* sp. n., I. *C. rehanae* sp. n., J. *C. indigovirens* sp. n.

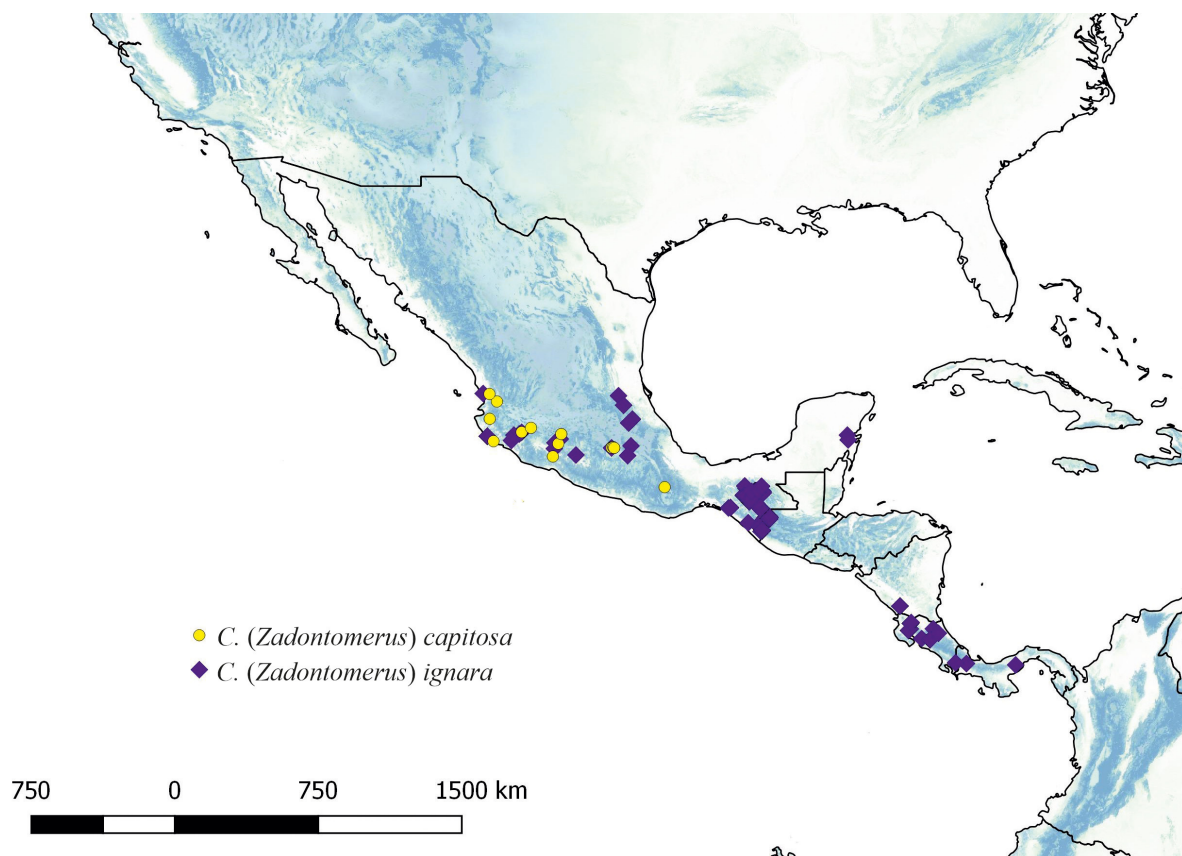


FIGURE 25. Distribution map of *Ceratina (Zadontomerus) capitosa* and *Ceratina (Zadontomerus) ignara*.

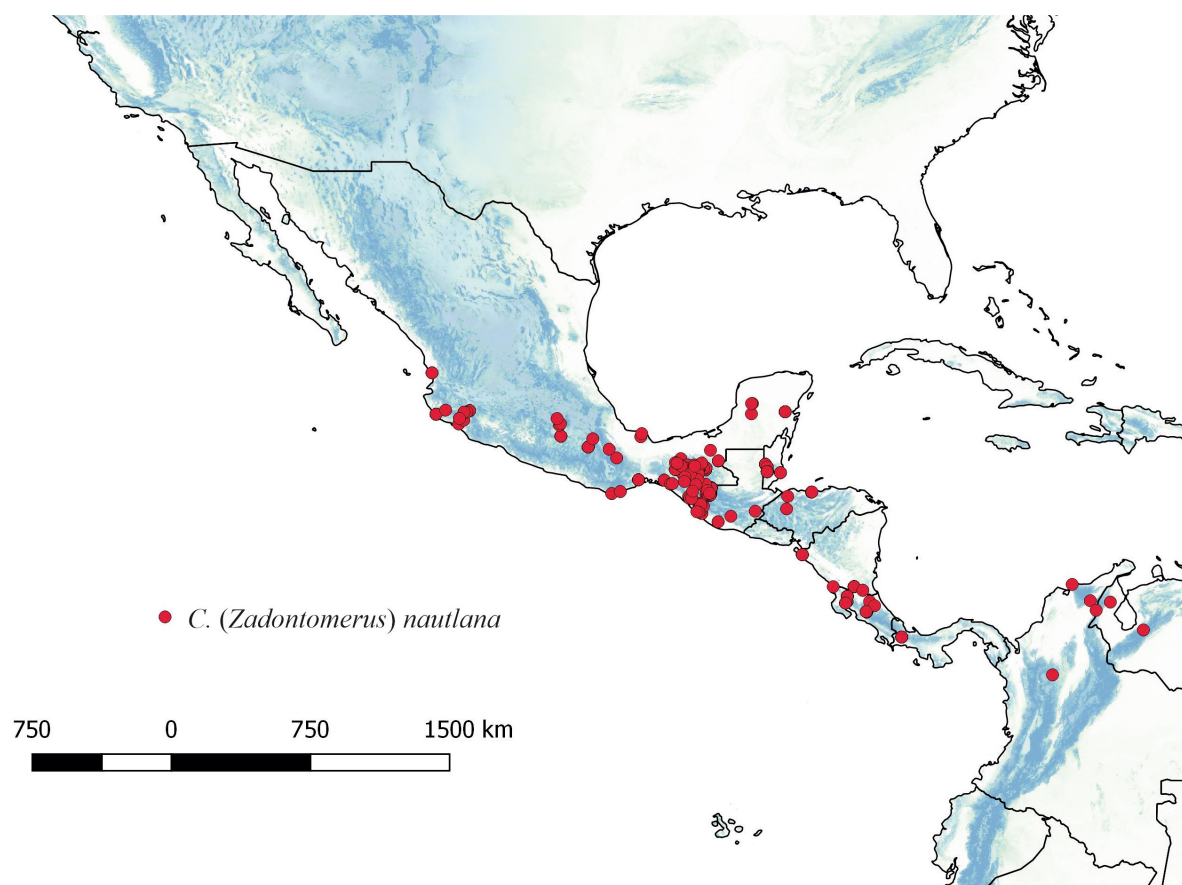


FIGURE 26. Distribution map of *Ceratina (Zadontomerus) nautlana*.

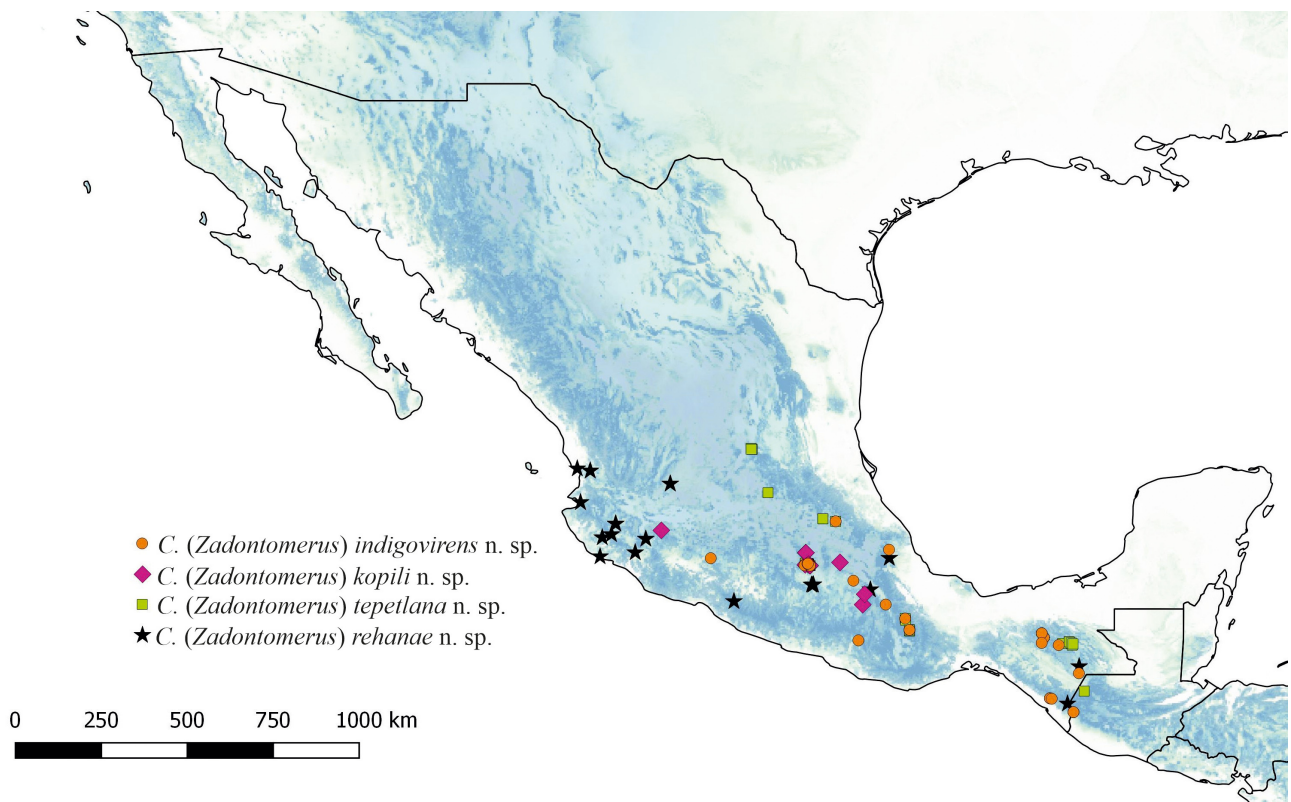


FIGURE 27. Distribution map of *Ceratina (Zadontomerus) indigovirens* sp. n., *Ceratina (Zadontomerus) kopili* sp. n., *Ceratina (Zadontomerus) tepetlana* sp.n. and *Ceratina (Zadontomerus) rehanae* sp. n.

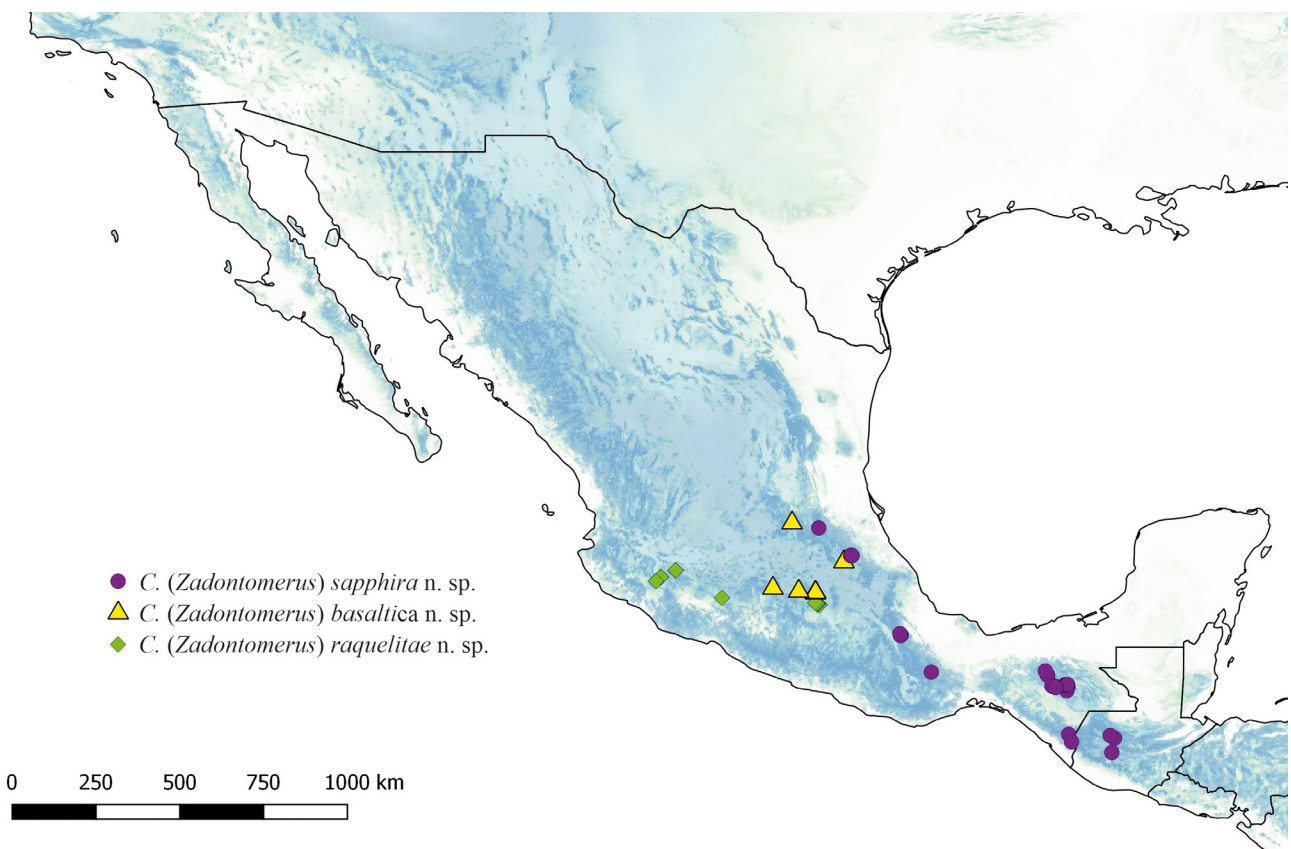


FIGURE 28. Distribution map of *Ceratina (Zadontomerus) raquelitae* sp. n., *Ceratina (Zadontomerus) sapphira* sp. n. and *Ceratina (Zadontomerus) basaltica* sp.n.

Head. Mandibles black with two teeth, dark brown and medial area lighter, outer margin with whitish scattered hairs. Labrum with medial yellow mark, reaching upper and lower margins. Clypeus with an inverted T-shaped yellow mark, coarse punctures surrounding this mark. Eyes strongly convergent below. Paraocular area and frons, with dense punctures, separated by a distance up to a puncture diameter. Vertex densely punctate, with long, whitish, scattered pubescence. Gena with punctures as vertex, lower area with long and scattered pubescence. Preoccipital margin carinate, slightly more evident than in female. Antennae dark brown. Head length 1.53 mm; head width 1.67 mm; lower interocular distance 0.83 mm; upper interocular distance 1.08 mm; ocellocular distance 0.31 mm.

Mesosoma. Pronotum with lateral carina, dorsolateral angle rounded, pronotal lobe with scattered whitish pubescence. Mesepisternum with long dispersed whitish hairs, densely punctate, separated by a distance equal to the diameter of one puncture, becoming sparser below; hypoepimeral area, upper region with fine and dense punctures, lower area next to the episternal scrobe impunctate. Scutum, anterior area, between notauli, with dense punctures, separated by up to a puncture diameter, disc impunctate and polished. Scutellum with dense punctures, becoming more widely separated on the disc. Propodeal triangle striate. Propodeum, lateral areas with fine and close punctures, long and scattered white pubescence. Tegula dark brown. Wings smoked, darker at the apex. Length of forewing 4.88 mm. Scutum length 1.01 mm; scutum width 1.15 mm. *Legs.* Hind trochanter, ventral margin with long and dense whitish pubescence. Hind femur with rounded medial dilation; ventral margin, basal half with long and dense whitish pubescence (Fig. 22J).

Metasoma. T1 polished, disc with small area of fine and closely spaced punctures. T2 and T3 with dense punctation on lateral areas, disc with few punctures and large impunctate areas. T4 densely punctate, becoming more dispersed on the disc; posterior margin with short and whitish hairs, thick and thin hairs intercalated. T6, middle area with tuft of brownish pubescence. T7, apex with two laminar projections forming a medial notch (Fig. 23K). S6, as shown in Figure 24J. Genital capsule as shown in the Fig. 20.

Paratype female. Length 6.82 mm. Color as male.

Head. Mandibles with three teeth, color as males. Labrum black covered by sparse whitish pubescence. Hypostomal carina with an anterior tooth. Clypeus with medial yellow mark, punctures as male. Supraclypeal area with dense punctures between antennal sockets, medial area with dispersed, irregularly distributed punctures. Eyes with inner margin slightly convergent below. Lower paraocular and antennocular areas densely punctate, separated by a distance less than puncture diameter. Upper paraocular area, vertex and frons, around the impunctate swellings, separated by a distance of up to twice a puncture diameter. Preoccipital margin carinate. Gena with area adjacent to eye polished and impunctate, reaching 1/3 of genal area; upper area densely punctate, punctures becoming sparser below; with sparse, short, whitish hairs. Antennae as in male. Head length 1.7 mm; head width 1.86 mm; lower interocular distance 1.06 mm; upper interocular distance 1.16 mm; ocellocular distance 0.34 mm.

Mesosoma. Pronotum and mesepisternum as male. Scutum, anterior area between notauli with disperse punctures, separated by a distance of two to three times puncture diameter, disc of scutum impunctate, posterior area with close punctures. Scutellum, propodeum and tegula as males. Wings smoked. Length of forewing 5.1 mm. Scutum length 1.03 mm; scutum width 1.26 mm. *Legs.* Dark blue metallic tones. Tibia base with yellow spot. Tarsi dark brown. Spurs whitish. *Metasoma.* T1-T4 as males. T5 and T6 rugose, with scattered yellowish pubescence.

Type material: Holotype (♂ ECOAB: 16902): MEXICO: Chiapas: Jitotol, El Ocotal, 1692 m, 17.059, -92.857, 13-III/4-IV-2009, J. Mérida, P. Sagot. Described paratype (♀ ECOAB: 18893): same locality as holotype. Other paratypes: same locality as holotype (♀ ECOAB: 18901, ♂ ECOAB, 16901).

Material examined: MEXICO. Chiapas: Acacoyagua, 596 m, 15.445, -92.700, 2-10-XI-2005, M. Guzmán (ECOAB: 3♀: 18449, 53008, 53010). Bochilla Yerbabuena, 1653 m, 16.918, -92.917, 4-XII-2016, P. Sagot (ECOAB: 1♀: 66987). Jitotol, El Ocotal, 1692 m, 17.059, -92.857, 13/III-4/IV-2009, J. Mérida & P. Sagot (ECOAB: 22♀: 17642, 18821, 18822, 18831, 18842, 18844, 18846, 18847, 18851, 18853, 18854, 18855, 18856, 18858, 18911, 18913, 18915, 18923, 18891, 18892, 18893, 18901. 6♂: 18837, 18914, 18909, 18884, 16904). La Trinitaria, Unión Juárez, 1695 m, 16.110, -91.927, 6-VII-2012 (ECOAB: 1♂: 56117). Pueblo Nuevo Solistahuacán, Pueblo Nuevo Sol, 1792 m, 17.174, -92.916, 11-VII-2012, J. Mérida (ECOAB: 4♀: 52997, 52998, 53000, 53001). Tenejapa, Tzaquiviljok, 1483 m, 16.861, -92.464, 5-IV-2009, J. Mérida (ECOAB: 1♀: 16816). Unión Juárez, Carretera Finca Muxbal, 1444 m, 15.077, -92.071, 18-XII-2009, J. Mérida (ECOAB: 2♂: 16835, 16837). Hidalgo: Tulancingo de Bravo, El Paraíso, 2185 m, 20.15, -98.4, 12-IV-1993, M. Díaz Batalla (MZFC: 1♀: 12091). Michoacán: Dr. Miguel Silva, 9 km S Ario de Rosales, 1450 m, 29-X-1987, T. Griswold (BBSL: 1♀, 1♂). Morelos: Tepoztlán, km 4.5 Autopista México-Cuautla, 1940 m, 19.0041, -99.1294, 16-III-1996, O. Yáñez (MZFC: 2♀: 3826, 4331); km

12 Autopista México-Cuautla, 1650 m, 18.973, -99.0825, 8-VIII-1997, I. Hinojosa (MZFC: 4♀: 3327, 2079, 2292, 2127). Huitzilac, Derrame del Chichinautzin km 85.8, 2440 m, 19.023, -99.1494, 6-IV-1997, I. Hinojosa (MZFC: 2♀: 6035, 6139). Cuernavaca, 20-XI-1987, F. Parker (BBSL: 5♀, 1♂). **Oaxaca:** Santa María Yavesía, 2013 m, 17.264, -96.436, 15-XII-2015, N. Arnold (ECOAB: 2♂: 72093, 72106). Santa María Yucuhiti, San José Zaragoza, 1512 m, 16.985, -97.795, 5-XI-2015, N. Arnold (ECOAB: 1♂: 75375). Santiago Comaltepec, 1997 m, 17.565, -96.549, 16-XII-2015, J. Mérida (ECOAB: 1♂: 72125). Cuyotepeji, 3-III-1972, F. Parker (BBSL: 18♀, 2♂). **Puebla:** Tepexi de Rodríguez, 18-I-1991, R. Ayala (MZFC: 1♀: 26969). **Veracruz:** Teocelo, 26-VIII-1989, M. Tloltzin (MZFC: 1♀: 26968).

Distribution: *Ceratina* (*Z.*) *indigovirens* is found in the mountain areas of Mexico in the Transmexican Volcanic Belt, Sierra Madre del Sur, Sierra Madre Oriental and Chiapas Highlands, ranging from 550 to 2500 m elevation. It is found in the states of Chiapas, Hidalgo, Michoacán, Morelos, Oaxaca, Puebla and Veracruz, presumably associated to pine-oak and mountain cloud forests.

Etymology: The specific name refers to the contrasting blue and green coloration on this bee.

Key to the Neotropical species of *Ceratina* (*Zadontomerus*)

Females

1. Pronotal lobe with yellow mark 2
- Pronotal lobe without yellow mark, same color as the rest of mesosoma 5
2. Anterior tibia with a longitudinal yellow mark, scutum disc almost entirely impunctate (Fig x) . *C. nautlana* Cockerell, 1897
- Anterior tibia with yellow spot at the base, scutum disc with punctures along the medial line. 3
3. Preoccipital carina well pronounced, foveate and forming a strong depression; total length no greater than 6 mm *C. kopili* sp. n.
- Preoccipital carina foveate, not forming a strong depression; total length from 6.5–9 mm 4
4. Gena impunctate, polished area adjacent to eye broad, 1/3 genal width; disc of scutum with sparse, fine punctures along the median line, separated by a distance up to 5 times a puncture diameter; wings subhyaline *C. basaltica* sp. n.
- Gena impunctate, polished area adjacent to eye narrow, gena punctures covering almost all surface; disc of scutum with coarse punctures dispersed along median line, separated by a distance up to 3 times a puncture diameter (Fig. 21C); wings moderately dark brownish *C. rehanae* sp. n.
5. Clypeus yellow mark small and narrow (length 3 times middle width) or absent 6
- Clypeus with oval and wide yellow mark (length up to 2.5 times middle width) 7
6. Propodeal triangle striate throughout, with conspicuous lateral striae; body green olivaceous with metallic tints; clypeus with narrow yellow mark, T4 posterior margin with thick and long hairs (Fig 15E) *C. raquelitae* sp. n.
- Propodeal triangle polished with single medial stria; body dark metallic blue, sometimes dark green; clypeus with or without reduced yellow mark; T4 posterior margin with thin hairs, scarce thick hairs *C. sapphira* sp. n.
7. Stigma yellowish or light brown; posterior margin of T4, T5 and T6 with dense yellowish pubescence; olive green propodeum contrasting with black scutum and scutellum *C. capitosa* Smith, 1879
- Stigma brown to dark brown; posterior margin of T4, T5 and T6 with dispersed pubescence; mesosoma entirely green olivaceous or blue 8
8. Head and mesosoma metallic blue, metasoma green or copper with metallic tints; vertex with short and sparse pubescence .. 9
- Head, mesosoma and metasoma green olivaceous with metallic tints; vertex with long, yellowish and scattered pubescence .. *C. tepetlana* sp. n.
9. Metasoma length about twice or more the width; total length from 7.0 to 9.0 mm *C. ignara* Cresson, 1878
- Metasoma short, length less than twice the width; total length from 5.5 to 7.0 mm *C. indigovirens* sp. n.

Males

1. Pronotal lobe with yellow mark 2
- Pronotal lobe without a yellow mark, same color as the rest of mesosoma 5
2. T7 with two laminar projections forming a middle notch, slightly evident in some specimens (Fig. 22C-D); anterior tibia with longitudinal yellow mark *C. nautlana* Cockerell, 1897
- T7 with posterior margin concave, forming a medial narrowly rounded projection (Fig. 22E, F, J); anterior tibia with a yellow spot at the base 3
3. Preoccipital carina well pronounced, foveate and beginning in the upper third of occiput, forming strong depression (Fig 7E); hind femur with strong ventral dilation forming an angle as in Figure 21D; total length from 4.0–5.5 mm *C. kopili* sp. n.
- Preoccipital carina foveate not forming strong depression; hind femur with strong ventral dilation forming an angle as in Figures 21E, 21I; total length from 6.0–8.0 mm 4
4. T6 with swollen area strongly evident under a yellowish tuft of pubescence; wings subhyaline; hind trochanter ventrally rounded; hind femur with ventral dilation forming an angle as in the figure 21E *C. basaltica* sp. n.

- T6 surface without swollen area, middle area with a yellowish tuft of pubescence; wings brownish, marginal cell darker than the rest of the forewing; hind trochanter ventral surface forming a right angle; hind femur with ventral dilation forming an angle (Fig. 21I) *C. rehanae* **sp. n.**
- 5. Lower paraocular area with yellow marks; T7 with concave lateral margins, distal margin truncate (Fig. 22B) *C. ignara* Cresson, 1878
- Lower paraocular area without yellow marks; T7 with two posterior projections forming middle notch or with concave lateral margins forming a medial projection ... 6
- 6. T7 with two posterior projections forming middle notch 7
- T7 with concave lateral margins forming medial projection 8
- 7. Head and mesosoma metallic blue, metasoma metallic green; hind femur with strong rounded ventral dilation (Fig. 21J); outer margin of gonocoxite rounded (Fig. 20) *C. indigovirens* **sp. n.**
- Body entirely dark metallic green; hind femur with ventral slight dilation round shaped (Fig. 21H); outer margin of gonocoxite apex forming an acute angle (Fig. 16) *C. raquelitae* **sp. n.**
- 8. Clypeus with transversal yellow mark in the lower area; propodeal triangle polished, with a middle stria; body entirely metallic dark blue (dark green in some cases) *C. sapphira* **sp. n.**
- Clypeus with T-shaped yellow mark; propodeal triangle striate; body entirely olivaceous green or head and metasoma black and mesosoma olivaceous green ... 9
- 9. Stigma light brown; hind trochanter and femur with scarce pubescence (Fig. 21A); head and mesosoma except propodeum black with metallic tints, propodeum and metasoma olivaceous green (...) *C. capitosa* Smith, 1879
- Stigma dark brown; hind trochanter with dense long pubescence; hind femur basal half with disperse long pubescence (Fig. 21F); body entirely olivaceous green (...) *C. tepellana* **sp. n.**

Discussion

In the Neotropical region, Mexico is the country with the highest representation of *Ceratina* (*Zadontomerus*), with 10 of the 12 known species. Most species can be found in the Trans-Mexican Volcanic Belt. Two species have a wide distribution, *C. ignara* from central Mexico to Panama, and *C. nautlana* from central Mexico to Venezuela and the Cordillera Occidental in Colombia. There are two *C. (Zadontomerus)* species that we did not include in this study and that have an isolated distribution: *C. cyaniventris* Cresson, 1865, endemic to Cuba, and *C. crewi* Cockerell, 1903, known from one specimen collected in Guyana.

In the Neotropics, *C. (Zadontomerus)* has predominantly a montane Mesoamerican distribution pattern (Halffter & Morrone 2017), and where humidity and altitude play an important role shaping their distribution patterns. Nonetheless, some species that can be found mainly in lower altitudes, have a typical Neotropical pattern, where species are distributed by the coasts (Reyes-Castillo, 2003).

In this study we found that two species previously assigned to *Zadontomerus* (*Ceratina marginata* Baker and *C. quinquemaculata* Cockerell) do not have the diagnostic characters for the subgenus or any described subgenus, for this reason we consider both species as part of undescribed subgenera. This study supports the necessity of more studies of Neotropical *Ceratina* as they are poorly understood.

The recognition of the females in this subgenus is especially challenging, so misidentification is common in faunistic studies (Rehan & Sheffield, 2011). We found that patterns of punctation were the most helpful characters for female identification. These kinds of characters have been useful in similar studies of this subgenus in North America (Rehan & Richards, 2008). In addition to the difficulty in the identification of females, we found variation in male characters in *C. nautlana*, including the shape of T7 and paraocular marks. This is common in *C. (Zadontomerus)*. For example, in *C. nanula*, a species from western North America, males show variation in the shape of the hind femur and T7 (Daly, 1973). The use of molecular tools, such as DNA barcoding, may be needed to fully understand the species limits in certain, closely-related species groups (Gibbs 2009; Rehan & Sheffield 2011). We suggest that *C. nautlana* might be a species complex, and future studies should use molecular data to determine if it is a species with broad morphological variation or a group of cryptic species.

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