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ARTICLE

A new species of *Dilophochila* Bates, 1888 with comments on natural history and distribution of the genus (Coleoptera: Melolonthidae: Rutelinae)

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Abstract. A new species, *Dilophochila glabra* **sp. nov.** is described from the Sierra Norte, Oaxaca, Mexico. Diagnosis and images (dorsal, lateral and ventral habitus, and genitalia) of the taxonomic characters are provided. Affinities with their closest congeners and the general distribution pattern of the genus are discussed, considering that it presents a typical Mountain Paleoamerican sub-pattern. The modifications in the mouthparts of this genus due to the specialization in the intake of pine needles are commented, as well as in two other different taxa within Anomalini.

Keywords. Anomalini; Shining leaf chafer; Needle intake; Distribution pattern.

INTRODUCTION

The ruteline genus *Dilophochila* Bates includes six species distributed in southeastern Mexico, as well as one species in Guatemala and another in Honduras (Morón & Howden, 2001). In Mexico, they are distributed in the states of Chiapas (2 species), Oaxaca (1 species) and Veracruz (1 species).

All the species have a very restricted distribution and a marked preference for high humidity areas, such as coniferous forests established between 1,800 and 2,600 masl, in the Sierra Madre Oriental, Sierra Madre del Sur, Mexican Transvolcanic Belt, and the Chiapas Central Massifs in México (Morón & Howden, 2001), as well as in the Central America Nucleus in Guatemala and Honduras (*sensu* Halffter, 1987).

Within the American fauna, *Dilophochila* is a genus remarkably distinct in the morphology of its mouthparts, robust protibiae, claws and genitalia, which form a combination of characters that makes it difficult to recognize any affinity with other New World genera based on morphological criteria. Bates (1888) commented that it presented more resemblance to the genus *Bolax* Fischer von Waldheim (Geniatini), while Morón & Nogueira (1998) indicated that various structures are unique among the taxa of the neotropical region, the reason why some consider it as an isolated subtribe (Ohaus, 1918; Blackwelder, 1944; Morón *et al.,* 1997).

An additional characteristic of this genus is its close association with coniferous forests and the modifications in the oral appendages as a specialization to the feeding of pine needles, with the labrum widely sinuate and the incisive area of the mandibles and denticles of the lacinia reduced (Morón & Nogueira, 1998); such habits and mouthpart modifications also occur in other taxa of Anomalini such as *Bucaphallanus* Ramírez-Ponce & Morón (2012) and *Chelilabia* Morón & Nogueira (1998) (Ramírez-Ponce & Morón, 2012), but with different morphological expressions.

In this contribution a new species from the state of Oaxaca is described. We comment on the general distribution pattern of the genus and provide new records in other biogeographical provinces, plates with diagnostic characters for the genus and species, a taxonomic key, and a distribution map.

MATERIAL AND METHODS

Specimens

Specimens from the following collections were studied: Andrés Ramírez-Ponce Collection, Xalapa, Mexico (ARPC); Daniel J. Curoe Collection, Mexico City, Mexico (DJCC); Colección Miguel Ángel Morón, Instituto de Ecología, A.C. Xalapa,

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Veracruz, Mexico (IEXA); Miguel Ángel Morón Ríos Collection, Xalapa, Mexico (MXAL).

Type specimens are destined for the following collections: Andrés Ramírez-Ponce Collection, Xalapa, Mexico (ARPC); Carsten Zorn Collection, Gnoien, Rostock, Germany (CCZ); Colección Nacional de Insectos, Universidad Nacional Autónoma de México, Mexico City, Mexico (CNIN); Colección Entomológica Miguel Ángel Morón Ríos, Instituto de Ecología, A.C. Xalapa, Veracruz, Mexico (IEXA); Daniel J. Curoe Collection, Mexico City, Mexico (DJCC); Fernando Zagury Vaz de Mello, Universidade Federal de Mato Grosso, Cuiabá, Brazil (CEMT); Matthias Seidel Collection, Vienna, Austria (MSPC); Muséum National d'Histoire Naturelle, Paris, France (MNHN); Museum für Naturkunde, Berlin, Germany (MFN); Naturhistorisches Museum Basel, Basel, Switzerland (NMB); National Museum in Prague, Czech Republic (NMPC); Oscar Galindo Collection Texcoco, Mexico (GALC) and United States National Museum, Washington, D.C., USA (USNM).

Morphological analysis and taxonomy

The morphological and taxonomic criteria are based on Morón & Howden (2001), except for the ventral plate of the aedeagus, which follows D'Hotman & Scholtz (1990). Specimens were analyzed with a Leica MZ8 stereomicroscope equipped with a P|10x/21B ocular lenses.

We use the phylogenetic species concept, which defines a species as: "the smallest aggregation of (sexual) populations or (asexual) lineages diagnosable by a unique combination of character states" (Wheeler & Platnick, 2000).

Plates and map

Multifocal photographs were taken with a Nikon SMZ25 stereomicroscope with the Nikon NIS-Elements Imaging software. The images were processed and edited in Adobe Photoshop CS6 (Adobe Systems Inc, San José California). The distribution map was created in ArcGIS Desktop v10.8 (1999-2019 Esri Inc).

RESULTS

Family Scarabaeidae Latreille, 1802
Subfamily Rutelinae MacLeay, 1819
Tribe Anomalini Peringuey, 1902
Dilophochila Bates, 1888
Dilophochila glabra sp. nov.
Figs. 1A, B, C, E, G, 2A, B

Type material

Holotype (♂; IEXA): a) "México, Oaxaca, Sierra Juárez, San Felipe Usila, Santa Cruz Tepetotutla. 17°43'16"N, 96°32'56"O", b) "Bosque mesófilo/*Pinus.* Trampa luz 22-26/jun/17, 1330 m. Ramírez-Ponce & Curoe", c) "*Dilophochila glabra* Ramírez-Ponce *et al.,* 2023 Holotype" (red label). **Paratypes** (146♂♂, 1♀): Same data as holotype except by: c) "*Dilophochila glabra* Ramírez-Ponce *et al.,* 2023 Paratype" (yellow label): ARPC (29♂♂, 1♀), CCZ (3♂♂), CNIN (15♂♂), DJCC (28♂♂), IEXA (10♂♂), CEMT (3♂♂), MSPC (3♂♂), MNHN (5♂♂), MFN (5♂♂), NMB (5♂♂), NMPC (5♂♂), GALC (4♂♂), USNM (5♂♂); a) México, Oaxaca, Sierra Juárez, San Felipe Usila, camino a Sta Cruz Tepetotutla. Bosque mesófilo, b) Trampa de luz, aditivos met. 11-16/junio/2018, 1010 m 17°43'16.9"N, 96°32'56.5"O Ramírez-Ponce & Curoe col., c) "*Dilophochila glabra* Ramírez-Ponce *et al.,* 2023 Paratype" (yellow label): DJCC (4♂♂); a) México, Oaxaca, Sierra Juárez, San Felipe Usila, camino a Sta Cruz Tepetotutla. Bosque mesófilo b) Trampa de luz, aditivos met. 11-16/junio/2018, 1400 m. 17°42'40.01"N, 96°33'5.49"O Ramírez-Ponce & Curoe col., c) "*Dilophochila glabra* Ramírez-Ponce *et al.,* 2023 Paratype" (yellow label): ARPC (11♂♂), DJCC (11♂♂).

Description: Holotype (♂; IEXA). Male, length 9.9 mm, greatest width 3.9 mm. ***Color:*** Ground color ocher; frons and pronotal discal vittae deep metallic green; elytral intervals IV, VII and IX slightly darker (Fig. 1A). ***Head:*** Clypeal margin with v-shaped notch; noticeably reflexed anteriorly; clypeal surface densely rugose, with scattered, moderately short, slightly curved setae; frontoclypeal suture complete (Fig. 1B). Frons with depression widening anteriorly; surface of depression as on clypeus except without setae; rest of surface of frons punctate; punctures dense, large, contiguous anteriorly, moderately dense and shallow posterior to eyes; supraocular area with 6-7 long, decumbent setae. ***Pronotum:*** Anterior angles acute and projected anteriorly, lateral margins sinuate, posterior angles slightly obtuse; surface irregularly, not densely punctate; punctures large; each side with 2 long, decumbent setae; anterior and lateral margins with long, irregularly spaced setae; lateral and posterior margins beaded. ***Scutelar shield:*** Surface irregularly, densely punctate; punctures moderate in size. ***Elytron:*** Glabrous, with 10 striae between suture and humeral umbone; striae slightly impressed by rows of large, round punctures separated approximately by their own diameter; intervals IV, VII and IX wider, clearly more elevated and darker than adjacent intervals (Fig. 1A); epipleuron not expanded in basal half (Fig. 2A). ***Venter:*** Surface completely covered by long, scattered setae (Fig. 2B). ***Pygidium:*** In lateral view, uniformly convex; surface moderately densely setose. ***Legs:*** Protibia (Fig. 1C) with margins mostly subparallel; external margin with 2 distinct teeth; subapical projection small, obtuse, weakly broadened; protarsomeres 1-4 moderately wide; protarsomere 5 with 2 basal, acute denticles; inner protarsal claw angulate and narrowly cleft. ***Male Genitalia:*** Base of parameres broadly and evenly curved; in caudal view, parameres elongate subtriangular, external margins weakly sinuate before preapical constriction; apices markedly broadened, rounded; in lateral view, ventral margin not folded (arrow) (Fig. 1G).

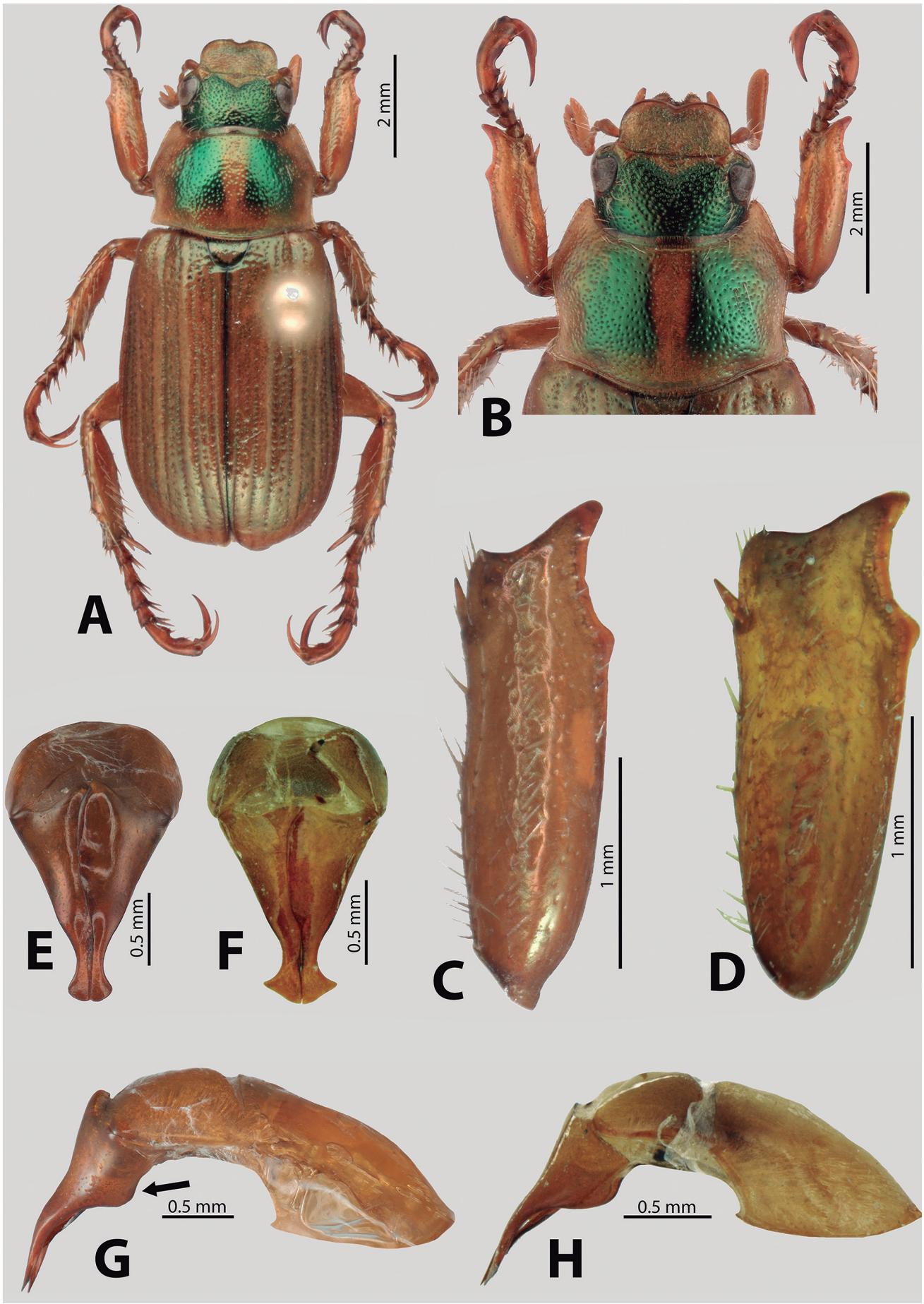

Figure 1. Diagnostic characters of *Dilophochila glabra* **sp. nov.** (A, B, C, E, G) and *D. miahuatleca* Morón & Howden (D, F, H). (A) Dorsal habitus; (B) Head, pronotum and anterior legs; (C, D) Protibia; (E, F) Parameres (caudal view); (G, H) Aedeagus (lateral view).

Sexual dimorphism: Males are always dorsally darker than females on the pronotum, the pronotal discal vittae of the females present a different intensity of coppery brown color and metallic green reflections. There is frequent variation in the elytral intervals IV, VII and IX, which are often darker, as well as in the abundance of ventral setae. Female, length 10.5 mm, greatest width 5.0 mm. Similar to male except as follows: dorsally ochre except frons and pronotum bright coppery, and elytral intervals IV, VII and IX light brown; clypeal margin less reflexed; epipleuron thickened and expanded in basal half; metatibia with distal denticle much more elongate and curved; preapical spur longer; tarsi more slender; inner protarsal claw narrow, not angulate and finely cleft; abdomen much less setose.

Variation: In males, length varies from 8.5 to 9.8 mm, and greatest width varies from 3.6 to 4.1 mm. In one male, the color of the pronotal vittae is not green but similar to the female's.

Remarks: *Dilophochila glabra* **sp. nov.** is one of the two species in the genus that have the pronotum almost glabrous and is also characterized by two long

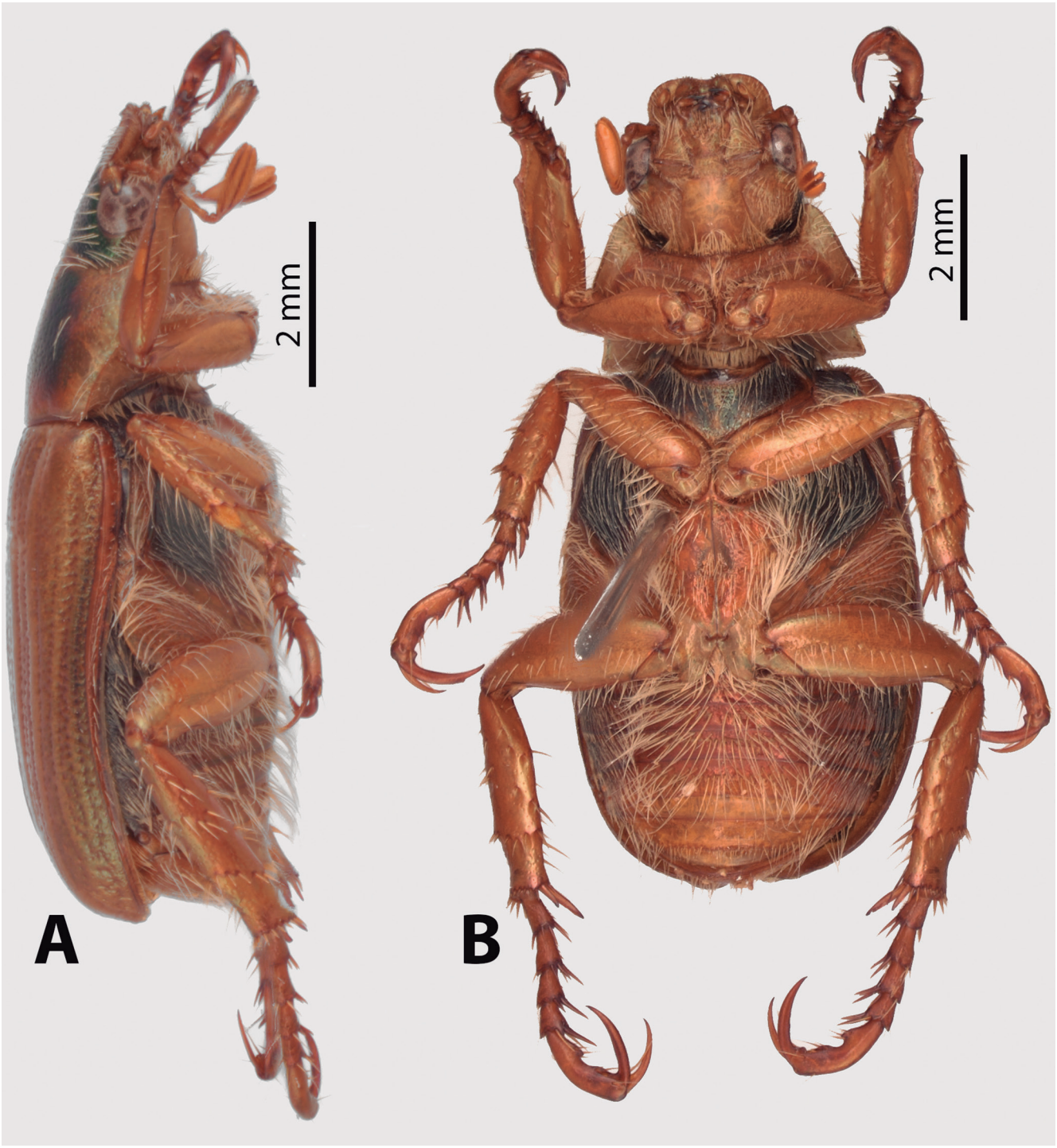

Figure 2. *Dilophochila glabra* **sp. nov.** (A) Lateral habitus; (B) Ventral habitus.

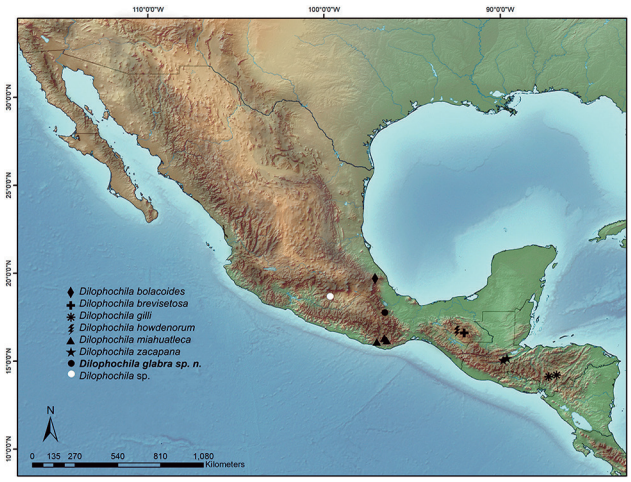

Figure 3. Distribution of the species of the genus *Dilophochila* Bates.

and decumbent setae on each side of the pronotal disc, whereas *D. gilli* Morón & Howden, 2001 (Honduras) presents only one setae on the right side near the middle of the disc; however, the genital differences, in addition to its widely disjunct distribution, allows them to be separated easily. On the other hand, *D. glabra* **sp. nov.** presents genital similarity with *D. miahuatleca* Morón & Howden, 2001; however, the rounded parameral apices differ from those of *D. miahuatleca,* which are remarkably acute and expanded externally, and the base of parameres not folded (folded in *D. miahuatleca*). In addition, they are distributed in two mountainous systems separated by the central valleys of the state of Oaxaca (Fig. 3)

Etymology: The Latin name *"glabra"* ("smooth; bald, hairless") alludes to the near absence of pronotal setae, which easily distinguishes this *Dilophochila glabra* sp. nov. from the rest of the species of Mexico.

Distribution: *D. glabra* is known only from the type locality, in the Sierra Norte of the state of Oaxaca, characterized by coniferous and cloud forests located between 900 and 1,300 masl. This area is part of a priority terrestrial region for conservation (RTP-130; Arriaga *et al.,* 2000), with high functional ecological integrity, as well as high diversity and endemism.

Natural history: The specimens were collected with a metal additive light trap in an ecotone between cloud and pine forests in two collection events in successive years in the month of June, which coincided with a massive emergence of specimens. It should be noted that of the total sample (n = 148) only one female was collected.

DISCUSSION

Various American genera of Anomalini are morphologically atypical for the fauna of the continent; their characteristics are more similar to those of other genera with distribution in tropical Asia, like *Mazahuapertha* Morón & Nogueira, 1998, *Callirhinus* Blanchard or *Nayarita* Morón & Nogueira, 1998. The genus *Dilophochila* stands out among all American genera because its diagnostic somatic and sexual characters are not shared with any other American genus, and it exhibits only some traits in common with certain species of the Asiatic genus *Adoretosoma* Blanchard, such as body elongate and dorsoventrally compressed, pronotum with broadly sinuate lateral margins, protibiae wide, inner protarsal claw notably long, with a medial denticle and greatly reduced superior ramus. However, the lack of phylogenetic evidence and their widely disjunct distributions make it difficult to formulate a congruent explanation that correlates biogeographical affinity, time of divergence and geological theory.

The genus *Dilophochila* is endemic to the Mexican Transition Zone. It is present in the principal mountain systems of central and southern Mexico, as well as in the mountains of Guatemala and Honduras. Given that mountain systems play an important role as biological corridors and barriers (Rahbek *et al.,* 2019), promoting dispersion and speciation by vicariant processes, the Sierra Madre Oriental and Sierra Madre Occidental of Mexico have also been very important corridors as northward and southward faunal dispersion routes. Therefore, it is very likely that the distribution of the genus extends beyond the limits of the Transmexican Volcanic Axis.

The ingestion of pine needles is infrequent due to the amount of resins they contain; this supposes a high degree of specialization of the digestive metabolism, as well as morphological adaptations. Two subgenera of *Paranomala, P. (Bucaphallanus)* and *P. (Chelilabia),* also exhibit the same pattern of mouthpart modifications: bilobulate or widely sinuate mentum and labrum, reduction in the number of maxillary teeth and modifications in the molar area. However, their shape and arrangement, as an adaptive response to a specialized diet, are remarkably different, as a convergent adaptive response to a specialized diet (Ramírez-Ponce & Morón, 2012).

At this time, without phylogenetic evidence that allows to recognize the real affinities of this enigmatic genus, or its biogeographical affinity, we recognize that its distribution conforms to the Paleoamerican Mountain sub-pattern, which characterizes lineages that have successfully colonized the mountain systems of the Mexican Transition Zone, whose southern limit is in Central America. (Halffter & Morrone, 2017).

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