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The genus *Heilipus* Germar, 1824, (Molytinae: Hylobiini).in Mexico, Key to Separate Species

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ABSTRACT: One of the limitations for the study of curculionids in Mexico is the lack of taxonomic keys at different hierarchies; therefore, in the present work, a key is provided to separate species of *Heilipus* German present in the country; a genus that includes species associated with Lauraceae. *H. albopictus* (Champion 1902) and *H. lauri* (Boheman 1845) are considered economically important pests, since the immature stage bores and feeds inside the trunks or fruits of *Persea americana* Mill.

KEYWORDS: *Heilipus* German, *Persea Americana*, Molytinae: Hylobiini, Mexico

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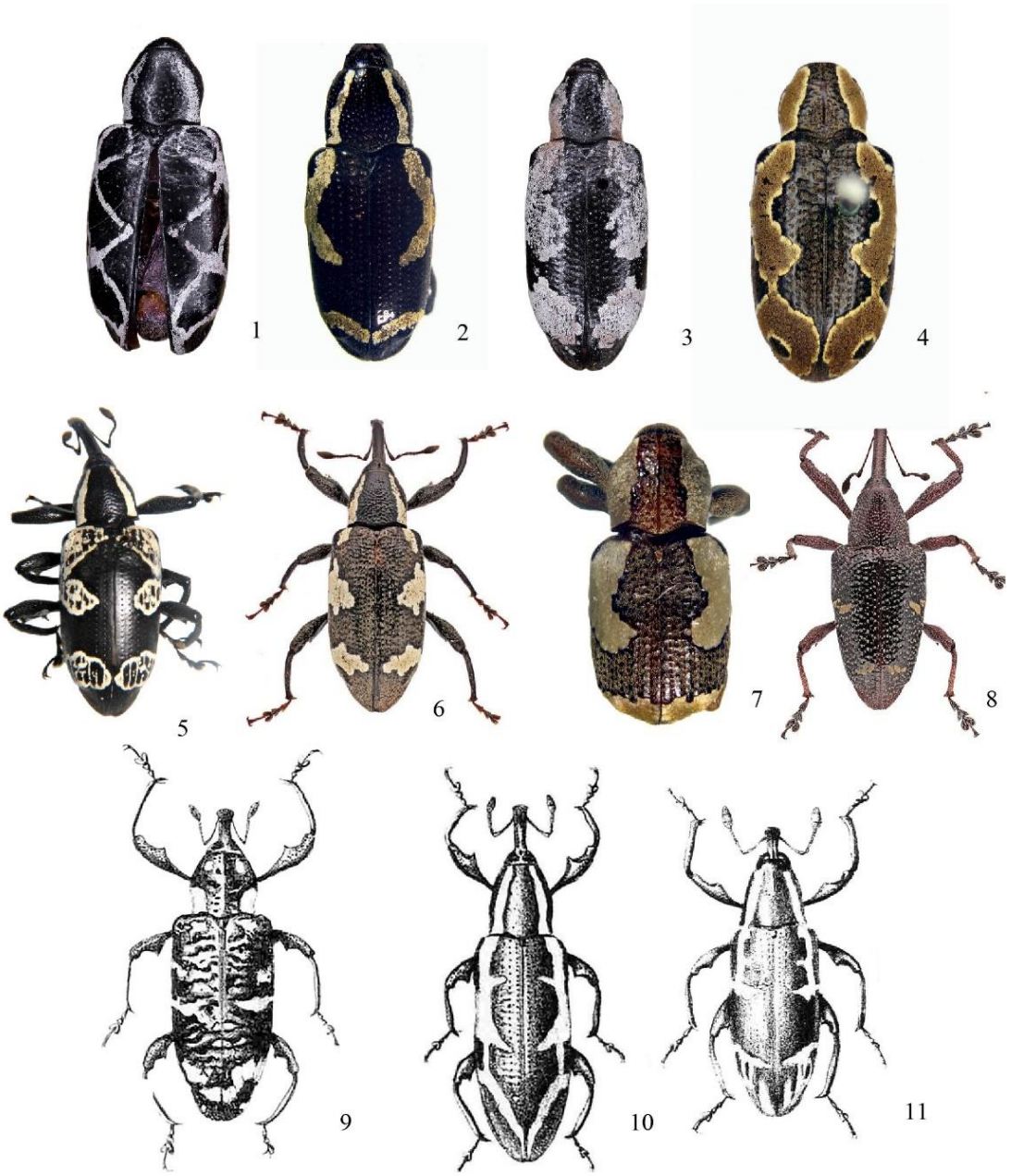
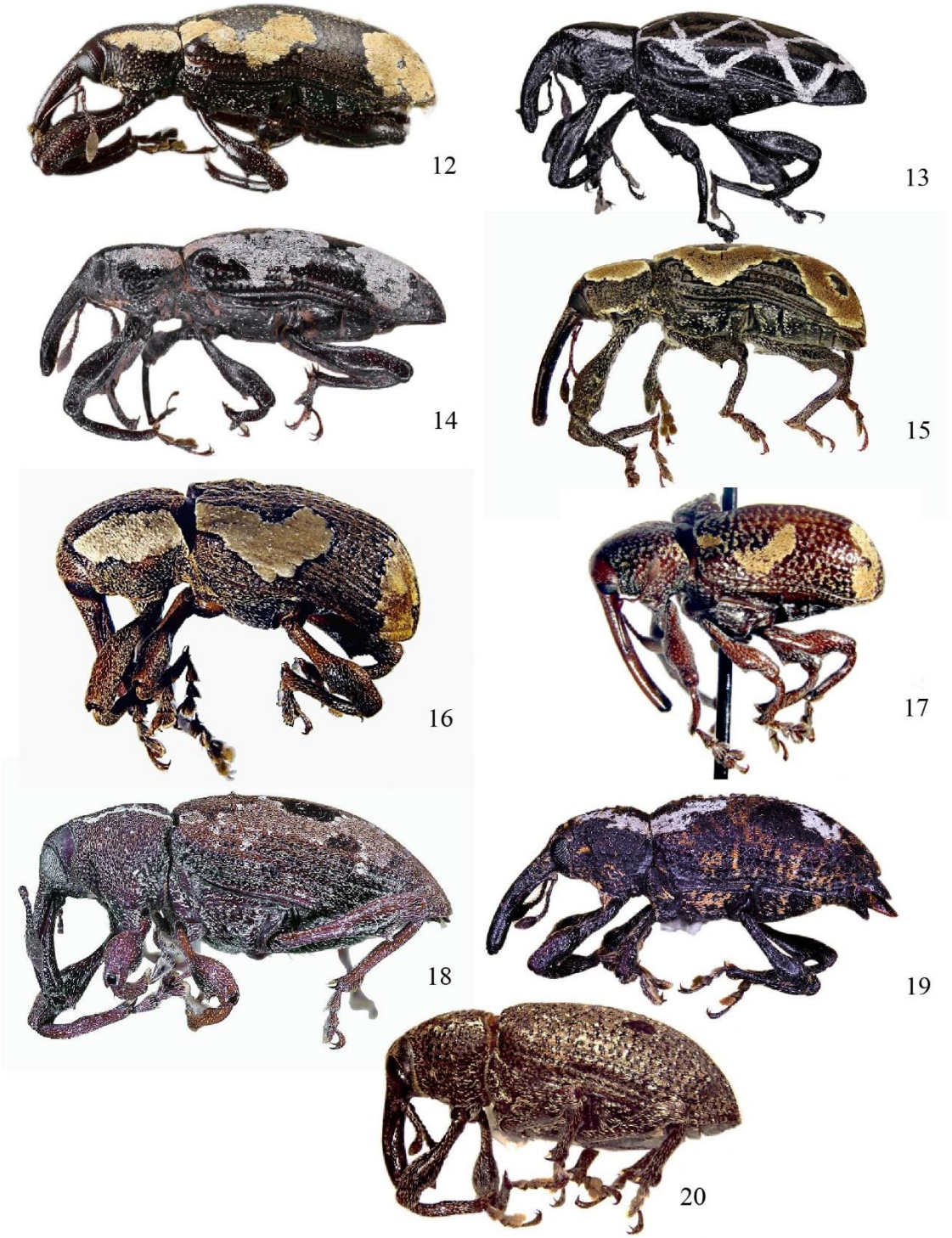
Characters recognition. *Heilipus* is characterized by having large-sized species (9-16 mm in length) with the body elongated-oval or oblong-oval (Figs. 1-11); long eyes with intraocular space narrower than the width of the rostrum base (Fig. 24); moderately large scutellum; clavate femur with a sharp tooth; tibia with two tufts of bristles projecting towards the uncus at the internal apical angle (Figs. 21-22), tibia with a simple dorso-apical comb (with a single line of ascending bristles), long and separated claws; left mandible with a distal lobe and a small tooth; glabrous prementum; metatibia with uncus strongly curved towards the internal angle, without mucro; mesosternum with a tuberous process (Fig. 29) (Kuschel 1955).

Intergeneric relationship. *Heilipus* can superficially be confused with members of the species of *Heilipodus* (Kuschel, 1955) (Fig. 19), *Heilus* (Fig. 20), or *Hilipinus* (Champion 1902) (Fig. 18); however, it differs from those by the mucronate tibiae and combs with tufts of setae. On the other hand, *Heilus* presents folds just behind the metacoxae on the first abdominal ventrite (Fig. 24); *Hilipinus* with the upper margin of the scrobe abruptly ends at 1/3 apical of the lower margin of the eye (Fig. 23) and *Heilipodus* with the eyes wider and slightly subcircular, likewise, most species have tuberous granules on the thorax and elytra (Kuschel 1955, Champion 1903).

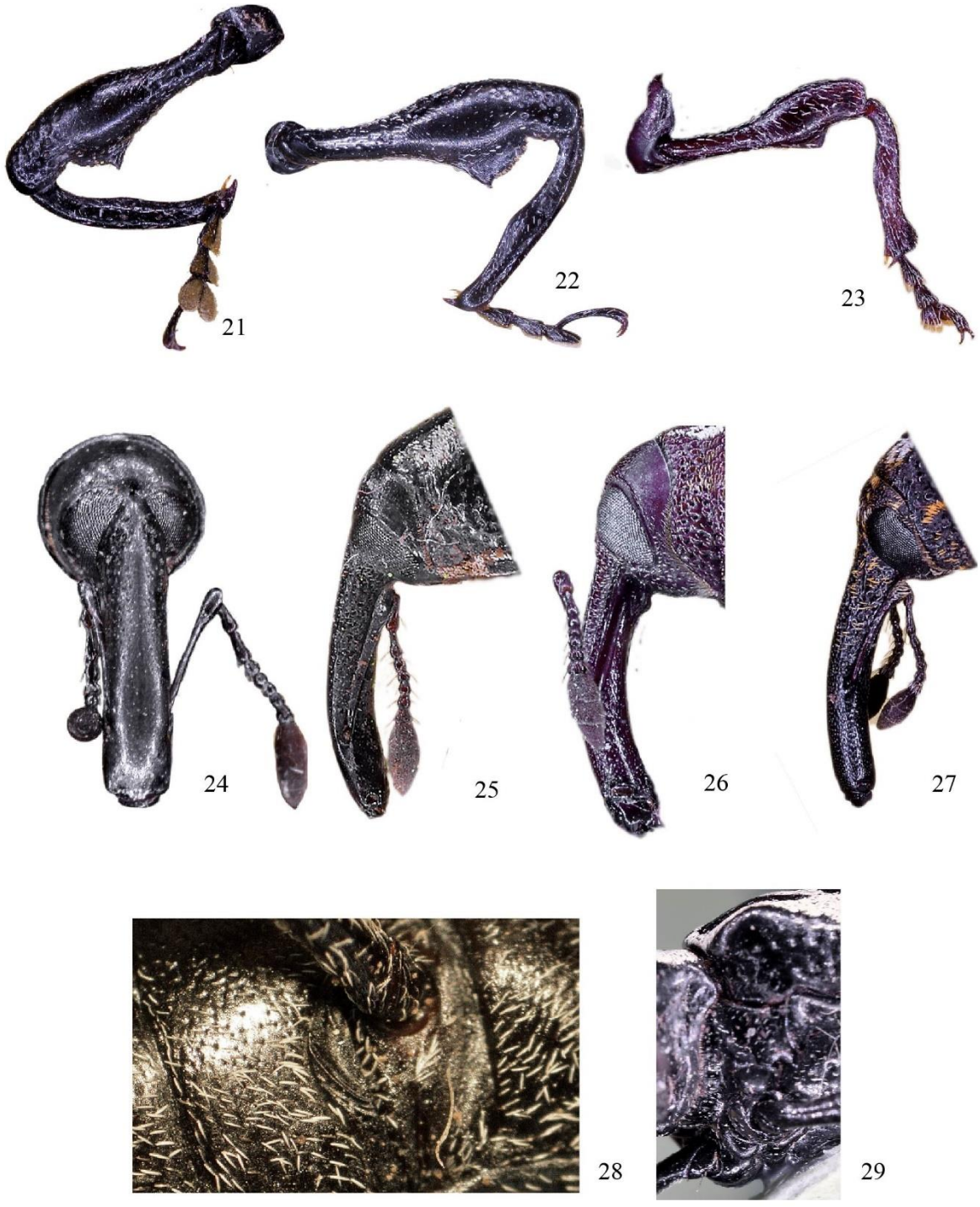
Host plants: *Heilipus* is closely associated with plants of the Lauraceae family, with most known species being associated with fruits or trunks of *Persea*: *P. americana, P. schiedeana; Damburneya: D. ambigens, D. gentlei, D. salicifolia; Nectandra: N. turbacensis, N. cissiflora, N. lineata; Beilschmiedia pendula; Ocotea cernua, O. oblonga, O. puberula,* and *O. veraguensis* (Rodríguez et al. 2022). However, for most species, their host plant is unknown.



Figs. 1-11. Dorsal view of representative specimens of Heilipus present in Mexico. 1) *H. albovenosus*, 2) *H. albomaculatus*, 3) *H. cruciatus*, 4) *H. limbatus*, 5) *H. fenestratus*, 6) *H. albopictus*, 7) *H. draco*, 8) *H. lauri*, 9) *H. ahrensi*, 10) *H. furcatus*, 11) *H. hyeroglyphicus*.



Figs. 12-17. Representative species of *Heilipus* present in Mexico, lateral view. 12) *H. elegans,* 13) *H. albovenosus,* 14) *H. cruciatus,* 15) *H. limbatus,* 16) *H. draco,* 17) *H. guttiger.* Figs. 18-20. Genera superficially similar to *Heilipus,* in lateral view: 18) *Hilipinus* sp., 19) *Heilipodus* sp., 20) *Heilus* sp.



Figs. 21-29. Taxonomically significant characters for distinguishing *Heilipus* from other genera. 21) Protibia with two tufts of setae and uncus, lateral view; 22) Metatibia with a single line of ascending setae, 23) Metatibia with mucro and a tuft of setae, 24) Frontal region, intraocular region, 25) Scrobe directed towards the ventral margin of the eye, 26) Scrobe does not reach the ventral margin of the eye, 27) Wide subcircular eyes, 28) Abdominal ventrite 1 with folds just behind the metacoxae, 29) Mesocoxae with an intercoxal tubercle.

Key to separate *Heilipus* species present in Mexico:

1. Pronotum with continuous stripes of setae on each side (Figs. 1-7) ……..…….....3

1´. Pronotum without continuous stripes of setae (Figs. 8-9)..……...…….2

2. Pronotum constricted at the base and rounded in the middle, surface with rugose and carinated punctures, lateral-basal margin with a semi-rectangular patch of setae on each side, other smaller and circular ones near the apex; elytra with transverse, rough wrinkles and several narrow, transverse and irregular stripes of setae (Fig. 9)……..…….. *H. ahrensi*

2´. Conical pronotum, punctuated, slightly rough; elytra with transverse punctate-striae, slightly more carinate at the base, with two pairs of narrow, transverse and irregular stripes, the first near the middle between striae 4-8, the second near the elytral declivity between striae 1-4, reddish-dark body; rostrum almost twice the size of the thorax (Fig. 8)……..*H. lauri*

3. Rostrum almost 2x longer than pronotum (Figs. 15 and 17)…..…….……..….4

3´. Rostrum equal to or not more than 1.3x the length of the pronotum (Figs. 12–14) ……..…..…5

4. Elytral stripes connected through a narrow line of setae with the declivity patch; circular patch with a large inner circle surrounding the elytral callus; antenna with segment 1 almost 1.5x longer than segment 2; size 10 mm (Fig. 15)....*H. limbatus*

4´. Elytral stripes do not connect with the declivity patch; circular or semicircular patch with a narrow inner circle surrounding the elytral callus; antenna with segment 1 almost 2x longer than segment 2; size 8-9 mm (Fig. 17).....*H. guttiger*

5. Elytra with wide stripes, the basal ones interconnected, forming a "V"; elytral declivity with a transverse stripe. All stripes on the inside divided with vertical lines and/or small patches of setae, interstices glabrous (Fig. 5)....……....*H. fenestratus*

5´. Elytra with dense patches of setae without interlines on the inside……..…..…..6

6.- Rostrum slightly straight and robust, 1.2 x longer than pronotum; pronotum wider than long, elytra slightly concave behind the scutellum; with granules, carinated and transverse, wide and curved stripes extending to the middle; elytral declivity with a patch of setae surrounding the callus; size 7 to 9 mm (Fig. 16)…... *H. draco*

6´. Rostrum slightly robust and curved; pronotum longer than wide or almost as long as wide, large size of 12 to 16 mm……...……..……..……7

7. Elytra with narrow stripes of whitish setae, the stripes unite, forming geometric figures, glabrous on the inside; pronotum constricted at the base; body with shallow punctures (Figs. 1-13)…….....……....*H. albovenosus*

7´. Elytra with wide or narrow stripes of whitish or yellowish setae, not forming geometric patterns; variable pronotum and elytra……..……8

8. Pronotum with narrow stripes extending slightly beyond the middle of the elytra and with transverse or oblique ramifications (Figs. 10-11)….…….…….…..…… 9

8´. Pronotum with wide stripes continuing on the elytra, curved, with sinuous and irregular margins without transverse ramifications (Figs. 2-3)….……..…..……..10

9. Elytral stripes with three transverse ramifications, progressively smaller towards the base of the elytra, elytral declivity with a transverse stripe and with vertical stripes reaching the apex (Fig. 11)……..……..…..*H. hieroglyphicus*

9´. Elytral stripes with three ramifications, the first one at the basal 1/3, transverse reaching stria 2, the second oblique and acute in the middle part of elytra, the third vertical joining a narrow oblique stripe that goes from the external margin of stria 8 to the apex of stria 1 (Fig. 10)…….…….... *H. furcatus*

10. Pronotum and elytra with continuous, homogeneous, oblique stripes slightly wider near the middle region of the elytra; elytral declivity with narrow, transverse stripes above the elytral callus (Fig. 2)…….……*H. albomaculatus*

10´. Pronotum and elytra with wide stripes until the middle part of the elytra, those on the elytral declivity transverse, all with highly irregular and sinuous margins...…..11

11. Elytral callus glabrous, surrounded by a large patch of setae covering almost completely the elytral declivity (Fig. 12)……...…….……*H. elegans*

11´. Elytral callus partially surrounded or not by setae…….……..……..12

12. Pronotum tubulate; elytral stripes, narrow at the base, wider and transverse in the middle region of the elytra, with highly irregular and sinuous margins; elytral declivity stripes widely separated from the apical margin of the elytra; pronotum and elytra granulated, reddish-dark integument (Fig. 6)…….…….*H. albopictus*

12´. Pronotum constricted at base with rounded sides near middle; elytral stripes wide from the base to the middle region, arched in shape, with sinuous and irregular margins; elytral declivity with a wide, transverse, sinuous and irregular stripe, may reach the apex of the elytra; thorax and elytra punctuated, black-reddish color (Figs. 3 and 14) ……...*H. cruciatus*

Synopsis of *Heilipus* species present in Mexico:

H. albomaculatus: Described by Champion (1903: 16); associated with fruits of *Damburneya ambigens* and *D. gentlei* (Lauraceae), the larva does not completely consume the seed, completing its development by pupating and subsequently emerging as an adult. Distribution: Belize, Guatemala, and Mexico (Veracruz).

H. ahrensi: Endemic species of Mexico, only known from the descriptions of Boheman (1843: 80) and Champion (1903: 21); no data on its biology. Distribution: Mexico (Oaxaca and Guerrero).

H. albopictus: Endemic species of Mexico, described by Champion (1903: 9), is known as a trunk borer in *Persea americana* (Muñiz, 2001), the female drills the base of the tree at a height of 40 cm, deposits her eggs, upon hatching the larvae feed under the bark, hence their presence is evidenced by observing reddish exudates and excrement at the base of the trunk, completes its cycle

inside the same trunk (Castañeda et al. 2010). Distribution: Mexico (Hidalgo, Estado de México, Morelos, and Nayarit (Jones et al. 2019)).

H. albovenosus: Endemic species of Mexico, described by Champion (1903: 10); no data on its biology. Distribution: Mexico (Veracruz and Chiapas (Ontiveros et al., 2019)).

H. cruciatus: Species described by Chevrolat (1833:15); with very little information, its biology is unknown (Champion 1903: 9). Distribution: Mexico (Chiapas, Hidalgo and Veracruz (Obregon, 2013; Ontiveros et al. 2019)).

H. draco (*H. rectirostris*) Kuschel (1955), O´Brien and Wibmer (1982), species with wide distribution in the American continent and Caribbean islands; in Mexico, known from the state of Veracruz. Records of causing damage to *Beilschmiedia pendula, Ocotea cernua, O. oblonga, O. puberula, O. veraguensis*; *Nectandra cissiflora* and *N. lineata* (Lauraceae) (Fleck et al. 2021, Rodríguez et al. 2022).

H. fenestratus: Species described by Champion (1903:10), no data on its biology. Distribution: Guatemala and Mexico (Veracruz) (Ontiveros et al. 2019).

H. furcatus: Endemic species of Mexico, described by Champion (1903:13); no data on its biology. Distribution: Mexico (Veracruz).

H. guttiger: Species described by Champion (1903:20); associated with fruits of *Damburneya* and *Nectandra* (Lauraceae), one larva develops per seed, where it also pupates and emerges as an adult. Rodríguez et al. (2022) report its presence in Colombia (Díaz et al. 2021), Guatemala, Mexico (Veracruz), and Panama.

H. hieroglyphicus: Species described by Champion (1902:11), who indicates that the species is known from Guatemala; likewise, Blackwelder (1945), O´Brien and Wibmer (1982) mention its distribution in Mexico; however, there is no record of locality, possibly distributed in the southeast, confirmation is required.

H. lauri: Species described by Boheman (1854: 443) is closely associated with *Persea schiedeana* (Nees 1836) and *P. americana*: it causes severe damage to the Hass, Fuerte, Colin, V-33, Choquette, and Criolla varieties (Castañeda et al. 2007, 2009, 2013; Díaz et al. 2017); due to its feeding habit, it is considered a quarantine pest, its presence limits the production and commercialization of avocado fruit: this makes it the best-known and studied curculionid in Mexico. *H. lauri* is distributed in the states of México, Guerrero, Hidalgo, Morelos, Oaxaca, Puebla, and Veracruz (Jones et al. 2019).

H. elegans: Described by Guérin (1844:148); however, Champion (1903: 9) mentions that it presents morphological variations in the size of specimens, mainly in the arrangement of scales on the elytra, which can be continuous or not, among other characters. Distribution: Central and South America; in Mexico, there is no record of collection locality; possibly distributed in the southeast, confirmation is required.

H. limbatus: Described by Champion (1903:11); superficially similar to one of the smaller varieties of *H. elegans*, host plant and distribution are unknown.

CONCLUSIONS

Heilipus is an American genus, with species of endemic and quarantine importance. Due to indirect collection methods, the host plants for many of the species are unknown. In some specimens, precise collection data is lacking, highlighting the need for a more comprehensive and systematic effort to obtain more precise details about the species.

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