

THREE NEW SPECIES OF *PHYLLOPHAGA* HARRIS  
(COLEOPTERA: SCARABAEIDAE: MELOLONTHINAE) FROM THE  
STATE OF PUEBLA, MEXICO

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ABSTRACT

Three species of *Phyllophaga s. str.* Harris from the Mexican state of Puebla are described: *Phyllophaga aragoni* Morón, **new species**, from pine-oak forest on the southwestern slope of Popocatepetl volcano; *Phyllophaga buapae* Morón, **new species**, from mixed temperate forest near Zacatlán; and *Phyllophaga cazahuata* Morón, **new species**, from mixed forests of Sierra del Tentzo. Drawings of diagnostic structures and comments about the similarities of each species with other species in the subgenus are provided.

Key Words: scarab beetles, taxonomy, morphology, *blanchardi* species-group, *scissa* species-group

RESUMEN

Se describen tres especies de *Phyllophaga s. str.* Harris colectadas en tres localidades del estado de Puebla, México: *Phyllophaga aragoni* Morón, **nueva especie**, de un bosque de pino y encino situado en la ladera suroeste del volcán Popocatepetl; *Phyllophaga buapae* Morón, **nueva especie**, de un bosque templado mixto en la región de Zacatlán; y *Phyllophaga cazahuata* Morón, **nueva especie**, de los bosques mixtos de la Sierra del Tentzo. Se incluyen dibujos de las estructuras diagnósticas y comentarios sobre las semejanzas de cada una de estas especies con otras especies del subgénero.

During field work carried out from 1996 to 2006 in diverse localities of the state of Puebla, more than 4,200 specimens of 72 species of the genus *Phyllophaga* Harris were collected (Aragón and Morón 2013). Most of these species were represented by dozens or hundreds of specimens, while others were represented by 10 or fewer specimens. At least 12 undescribed species of the subgenera *Phyllophaga*, *Phytalus* Erichson, *Chlaenobia* Blanchard, and *Listrochelus* Blanchard were identified (Morón 2010; 2012; Morón and Aragón 2012). In this paper, males of three new species of the subgenus *Phyllophaga* are described and figured.

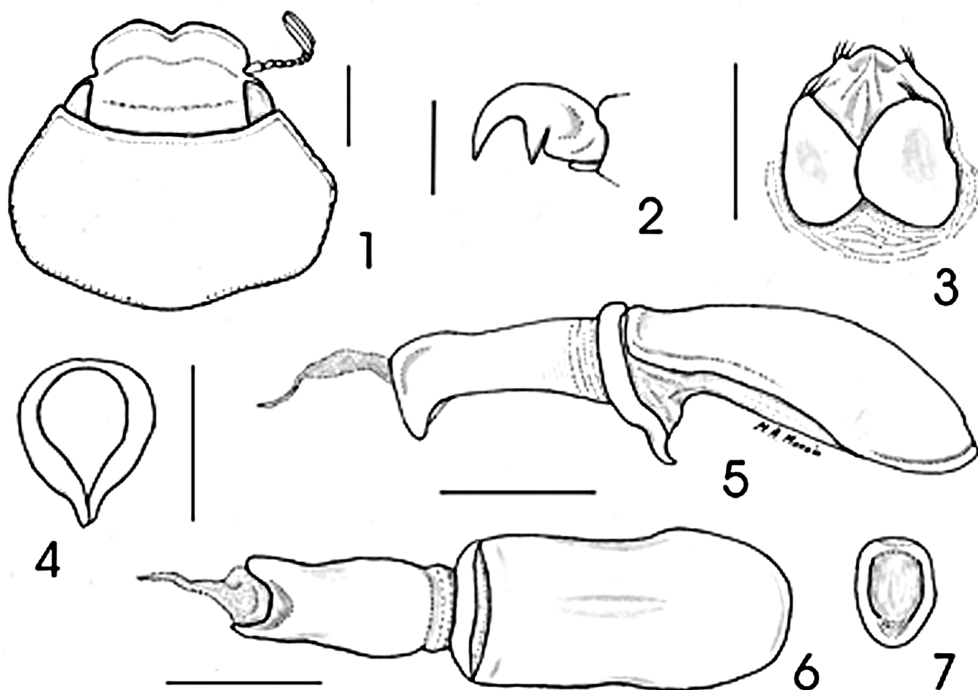
MATERIAL AND METHODS

In this work, the phylogenetic species concept of Wheeler and Platnick (2000) is applied, while the characters and terms used in the descriptions are those of Morón (1986, 2003). Drawings were made with the aid of a Leica MZ8 stereomicroscope provided with a camera lucida. Measurements were obtained with an ocular micrometer or caliper. Specimens described in this study are deposited in the collection of Instituto de Ecología, A. C. (IEXA), Xalapa, Veracruz, Mexico.

TAXONOMY

*Phyllophaga (Phyllophaga) aragoni* Morón,  
**new species**  
(Figs. 1–7, 18–19)

**Holotype.** Male. Length: 20.6 mm. Humeral width: 8.7 mm. **Color:** Head and pronotum shiny, dark brown; elytra shiny, reddish brown; abdomen and legs shiny, yellowish brown. **Head:** Clypeus with scattered erect setae, 3.1X wider than long, anterior border moderately elevated, anterior margin widely notched, disk surface wide and deeply concave at sides, raised at middle, with moderately dense, deep, round punctures. Frontoclypeal suture clearly impressed, sinuate at middle. Frons 2.9X wider than long, widely convex, coarsely rugopunctate with sparse medium-sized erect setae on disk. Antenna 10-segmented, with 3-segmented club, lamellae 1.3X longer than length of preceding 6 segments combined; segments 3 and 4 of equal length, segments 5 and 6 shorter than preceding segments, with weak, rounded prominences on anterior margins; segment 7 wider than long, with acute prominence on anterior margin. Frons 4.7X wider than dorsal diameter of eye. Canthus long and narrow, with 10 setae (Fig. 1). Labrum reniform, deeply concave, with slender, long setae



**Figs. 1–7.** *Phyllophaga aragoni*. 1) Head and pronotum; 2) Male protarsal claw; 3) Female genital plates, ventral view; 4) Parameres, distal view; 5) Complete genital capsule, lateral view; 6) Complete genital capsule, dorsal view; 7) Detail of apex of inner sac, distal view. Scale bars = 2 mm, except in Fig. 2 = 0.5 mm.

along borders. Mentum widely concave, longitudinally furrowed, with sparse punctures and slender setae at sides, anterior border deeply notched.

**Thorax:** Pronotum 1.7X wider than long and 2.1X wider than frons. Pronotal disk glabrous, with deep, round punctures irregularly separated by 1–5 diameters; anterior bead complete, with long, curved setae; lateral borders widely angled, lateral marginal bead weakly crenulate, with slender, long setae; basal bead indicated by irregular punctures mainly on middle third and curved, long setae; anterior angles briefly obtuse, rounded; posterior angles widely obtuse, weakly prominent (Fig. 1). Scutellum 1.8X wider than long, with 10 punctures irregularly distributed near borders, and anterior border widely sinuate. Elytron 2.9X longer than wide, glabrous, densely and irregularly punctate; epipleural border progressively narrowed toward apex, with scattered short setae; humeral callus rounded, prominent; apical callus rounded (Fig. 18). Metathoracic wings completely developed. Pterosternum with many long, yellowish setae.

**Abdomen:** Visible abdominal sternites 2–4 glabrous, shallowly depressed at middle (Fig. 19); sternite 5 convex, with ovate granulose area at middle, with scattered short setae near posterior border; anal plate large, shiny, irregularly con-

cave, smooth and furrowed at middle, granulose at sides, with slender long setae toward sides and posterior border. Propygidium mostly dull, densely punctate, with many short setae. Pygidium shiny, widely convex, with scattered, shallow punctures, and short setae, irregularly distributed; apical margin with 12 slender setae; basal margin narrow but distinct at middle. **Legs:** Protibia as long as protarsus (1:1), with 2 large teeth and a basal small tooth on external border, preapical spur acute, straight, shorter than 2nd protarsomere. Mesotibia with an oblique, well marked, setiferous carina and small setiferous tooth on external side; upper apical spur with rounded apex, 1.2X longer than lower spur. Metatibia slightly shorter than metatarsus (0.9:1.0), with an oblique setiferous carina and small setiferous tooth on external side; upper apical spur articulated, curved, round pointed, longer than basal metatarsomere (1.6:1.0), and 1.4X longer than lower spur; lower apical spur articulated, curved, apex rounded. Protarsomeres 1–2 semicylindrical, elongate, with subapical, inner projection and tuft of setae; protarsomeres 3–4 with scattered ventral setae and crown of apical setae. Meso- and metatarsomeres semicylindrical, elongate, each with enlarged apex, crown of apical setae, and sparse setae along

ventral side. Tarsal claws dentate, with ventral tooth narrow, acute, located toward base (Fig. 2). **Genital capsule:** With short, narrowed, curved parameres dorsally fused, apex narrowed, acute, and curved backward (Figs. 4–5). Aedeagus with sclerotized, tubular support apically curved downward; inner sac with preapical sclerotized, rounded, small plate (Figs. 5–7). Tectum wide, uniformly convex. Length of genital capsule from apex of parameres to border of basal piece 3.8 mm.

**Paratype.** Female. Similar to male except as follows: antennal club as long as preceding 4 segments combined; head and pronotal punctation deeper. Visible abdominal sternites 2–4 nearly convex, with scattered, short setae near midline; sternite 5 with many punctures and long setae; anal plate large, widely convex, with shallow punctures and scattered slender setae. Both apical spurs of metatibia widened, curved, with rounded apices. Ventral genital plates well-sclerotized, nearly symmetrical, widely convex with some apical setae; dorsal genital plates fused at midline, with 3 apical lobes and some short setae on distal borders (Fig. 3). Body length: 20.8 mm. Humeral width: 8.8 mm.

**Type Material.** Holotype male and paratype female: MEXICO: Puebla, Tochimilco, San Antonio Alpanocan, 21-IX-2000, 2114 m, A. Aragón (IEXA).

**Type Locality.** San Antonio Alpanocan, Tochimilco municipality, state of Puebla, Mexico (18°52'42"N, 98°42'32"W).

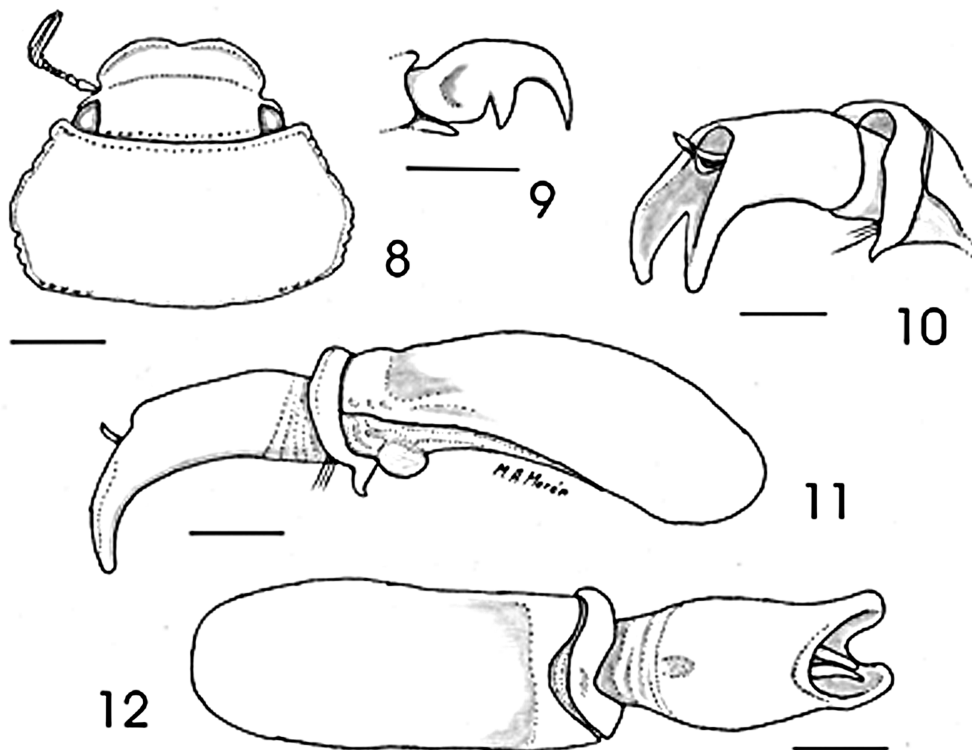
**Biological Data.** This species inhabits the disturbed pine-oak forest located at 2,114 m elevation on the southwestern slope of Popocatepetl volcano. Both specimens were attracted to a mercury vapor light trap in September. The date of their capture is very late in the season for *Phyllophaga* in comparison with the usual phenology of the genus in central Mexico (May–July).

**Remarks.** *Phyllophaga aragoni* belongs to the *scissa* species-group as defined by Morón (2003) and is similar externally to *Phyllophaga plairi* Saylor and *Phyllophaga scissa* (Bates). However, the pronotal and elytral punctation of *P. plairi* is denser than that of *P. aragoni*, while the clypeal shape of *P. aragoni* is also less bilobed than in *P. scissa*. The distal half of the parameres of *P. aragoni* is much shorter and narrower than in the other two species, and the apex of the sclerotized aedeagal support is very different between the three species: narrowed and briefly curved in *P. scissa* (Fig. 24); truncate with lateral spurs in *P. plairi* (Fig. 25); and broad and curved in *P. aragoni* (Fig. 5). The *scissa* species-group is currently under study by the author, including a number of undescribed species represented by few individuals from Mexican mountains.

**Etymology.** The new species is named after my friend Agustín Aragón García, professor of the Benemérita Universidad Autónoma de Puebla, an enthusiastic promoter of basic and applied studies of scarab beetles in the state of Puebla, who has obtained many important records of new and rare Scarabaeoidea.

*Phyllophaga (Phyllophaga) buapae* Morón,  
new species  
(Figs. 8–12, 20–21)

**Holotype.** Male. Length: 17.5 mm. Humeral width: 7.3 mm. **Color:** Head and pronotum shiny, dark brown; elytra, abdomen, and legs shiny, yellowish brown. **Head:** Clypeus with scattered erect setae, 2.9X wider than long, anterior border scarcely elevated, anterior margin widely notched, disk surface wide and moderately concave at sides, raised at middle, with dense, deep, round punctures. Frontoclypeal suture clearly impressed, nearly straight at middle. Frons 3X wider than long, widely convex, coarsely rugopunctate with sparse, medium size, erect setae on disk. Antenna 10-segmented, with 3-segmented club, lamellae 1.2X longer than length of preceding 6 segments combined; segments 3 and 4 of equal length, segment 5 shorter than preceding, with weak, rounded prominence on anterior margin; segments 6 and 7 wider than long, with acute prominences on anterior margins. Frons 3.7X wider than dorsal diameter of eye. Canthus long and narrow, with 10 setae (Fig. 8). Labrum reniform, deeply notched, with slender, long setae along borders. Mentum widely concave, with sparse punctures and slender setae at sides, anterior border narrowly notched. **Thorax:** Pronotum 1.8X wider than long and 2.0X wider than frons. Pronotal disk with sparse, long slender setae on basal half, with deep, round punctures irregularly separated by 1–6 diameters; anterior bead complete, with long, curved setae; lateral borders widely angled, lateral marginal bead irregularly crenulate, with slender, long setae; basal bead indicated by irregular row of punctures and scattered, curved setae; anterior angles straight, prominent; posterior angles widely obtuse, not prominent (Fig. 8). Scutellum 1.5X wider than long, without punctures, and anterior border nearly straight. Elytron 2.8X longer than wide, denselt, irregularly punctuate, nearly glabrous, only a few erect setae located between scutellum and humeral callus; epipleural border progressively narrowed toward apex, with scattered short setae; humeral callus rounded, prominent; apical callus rounded (Fig. 21). Metathoracic wings completely developed. Pterosternum with many yellowish, long setae. **Abdomen:** Visible abdominal sternites 2–4 convex, with scattered minute



**Figs. 8–12.** *Phyllophaga buapae*. **8)** Head and pronotum; **9)** Male protarsal claw; **10)** Aedeagus and parameres, latero-distal view; **11)** Complete genital capsule, lateral view; **12)** Complete genital capsule, dorsal view. Scale bars = 2 mm, except in Fig. 9 = 0.5 mm.

setae; sternite 3 with a pair of asymmetrical, flattened teeth near midline; sternite 4 with a pair of small teeth; sternite 5 with irregularly granulose area at middle and scattered short setae toward lateral margins; anal plate shiny, deeply and widely furrowed along midline, finely granulose at sides, with slender, long setae toward sides and posterior border. Propygidium shiny, weakly rugopunctate, with many minute setae. Pygidium shiny, glabrous, convex, prominent basally (Fig. 20), with scattered shallow punctures irregularly distributed; apical margin with 12 slender setae; basal margin narrowed, weakly distinct at middle. **Legs:** Protibia shorter than protarsus (1.0:1.2), with 2 large teeth and a small basal tooth on external border, preapical spur acute, straight, as long as 2nd protarsomere. Mesotibia with an oblique, well-marked, setiferous carina and small setiferous tooth on external side; upper apical spur with rounded apex, 1.2X longer than lower spur. Metatibia with an oblique, setiferous carina and small, setiferous tooth on external side; upper apical spur articulated, slightly curved, rounded apically, and 1.3X longer than lower spur; lower

apical spur articulated, curved, apex rounded. Protarsomeres 1–2 semicylindrical, elongate, with subapical, inner projection and sparse tuft of short setae; protarsomeres 3–4 with scattered ventral setae and crown of apical setae. Meso- and metatarsomeres semicylindrical, elongate, each with enlarged apex, crown of apical setae, and a row of scattered setae along ventral side. Tarsal claws dentate, with ventral tooth narrow, acute, located toward base (Fig. 9). **Genital capsule:** With short, narrowed, curved parameres dorsally fused, apex narrowed, acute, and briefly curved backward, with 3 slender setae on preapical inner border (Figs. 10–11). Aedeagus with large, strongly sclerotized, tubular support apically bifurcate and curved downward; inner sac with 2 preapical spines (Figs. 10–12). Tectum wide, uniformly convex. Length of genital capsule from apex of parameres to border of basal piece 5.0 mm.

**Female.** Unknown.

**Type Material.** Holotype male: MEXICO: Puebla, Zacatlán, San Miguel Tenango, 14-V-2000, bosque de coníferas, trampa luz Hg, 2,100 m, S. M. Percino (IEXA).

**Type Locality.** San Miguel Tenango, Zacatlan municipality, state of Puebla, Mexico (19°55'N, 97°55'W).

**Biological Data.** This species inhabits disturbed forest with species of *Pinus* L. (Pinaceae) and *Juniperus* L. (Cupressaceae) located near 2,100 m of altitude. The single known specimen was collected in a light trap during May.

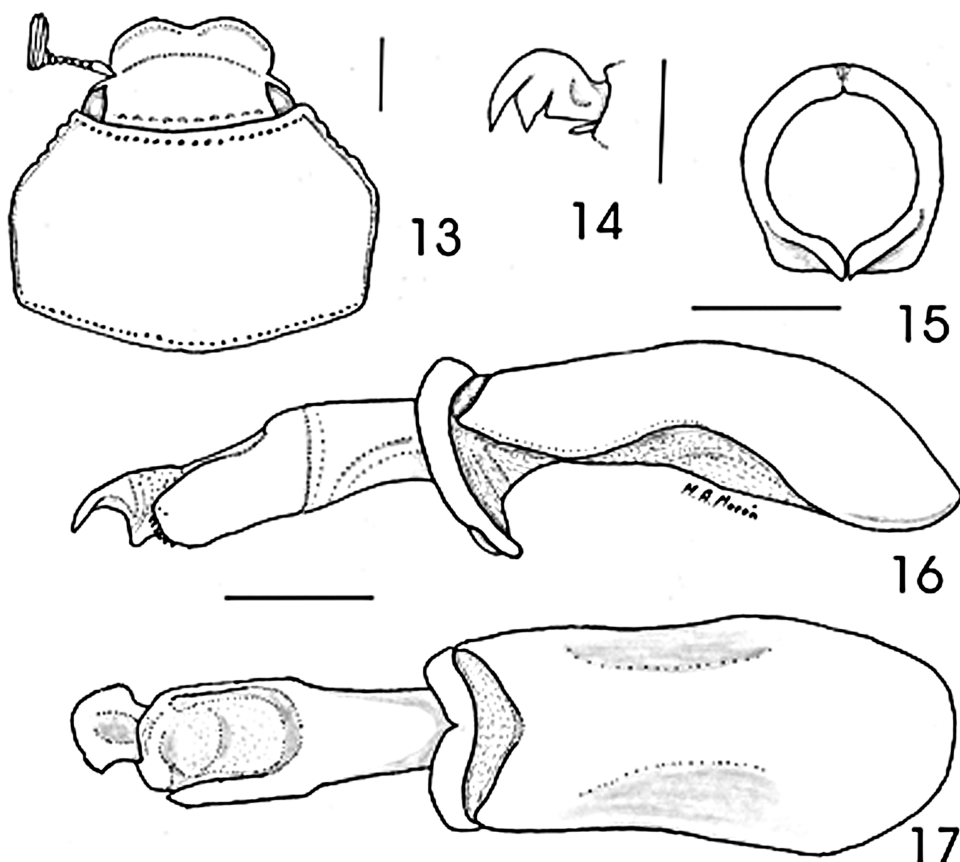
**Remarks.** *Phyllophaga buapae* is placed in the *scissa* species-group (*sensu* Morón 2003) and is similar externally to *P. scissa*. However, the pronotum and basal third of the elytra in *P. buapae* bear erect setae. The male genital capsule of *P. buapae* (Fig. 11) is distinguished from that of *P. scissa* (Fig. 24) by its short parameres with preapical setae, and the very stout and apically bifurcate, sclerotized support of the aedeagus. Furthermore, there are tooth-like projections on visible sternites 3 and 4 associated with asymmetrical

intersegmental sutures. The holotype is missing the last three tarsomeres of the right foreleg. Both metatarsi and left metatibia are partially deformed (Fig. 20), not completely extended, probably as a result of difficulties during the emergence of the young adult.

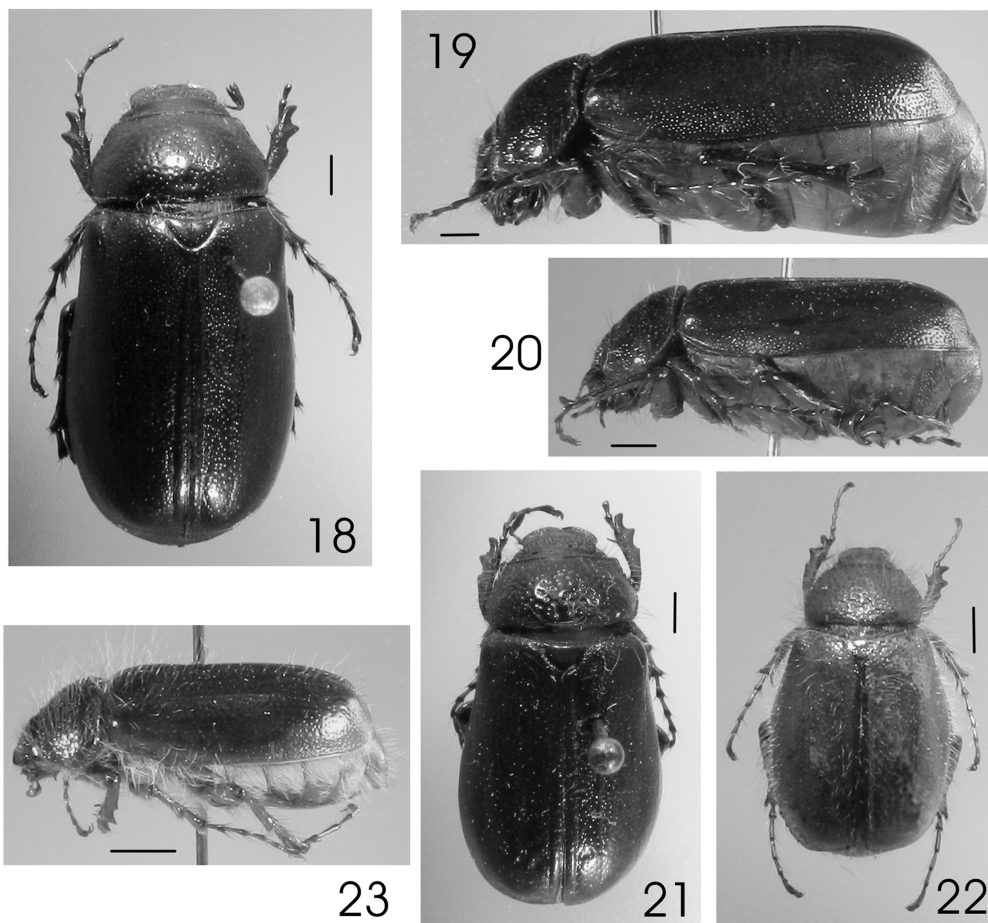
**Etymology.** The specific epithet *buapae* is derived from the acronym of Benemérita Universidad Autónoma de Puebla, BUAP, an institution that has supported various aspects of scarab beetle studies in the region over the past 16 years.

*Phyllophaga (Phyllophaga) cazahuata* Morón,  
new species  
(Figs. 13–17, 22–23)

**Holotype.** Male. Length: 11.8 mm. Humeral width: 5.1 mm. **Color:** Head, pronotum, and legs shiny, reddish brown; elytra and abdomen shiny,



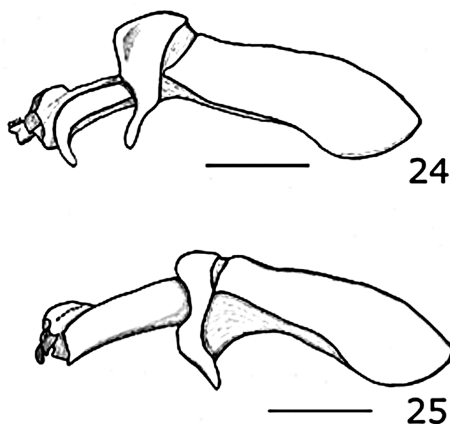
**Figs. 13–17.** *Phyllophaga cazahuata*. 13) Head and pronotum; 14) Male protarsal claw; 15) Parameres, distal view; 16) Complete genital capsule, lateral view; 17) Complete genital capsule, dorsal view. Scale bars = 1 mm, except in Fig. 14 = 0.5 mm.



**Figs. 18–23.** Habitus of *Phyllophaga* species from Puebla. **18)** *P. aragoni*, dorsal view; **19)** *P. aragoni*, lateral view; **20)** *P. buapae*, lateral view; **21)** *P. buapae*, dorsal view; **22)** *P. cazahuata*, dorsal view; **23)** *P. cazahuata*, lateral view. Scale bars = 1 mm.

yellowish brown. **Head:** Clypeus with few erect setae, 3.9 wider than long, anterior border clearly elevated, anterior margin widely notched, disk surface deeply concave at sides, raised at middle, rugopunctate. Frontoclypeal suture clearly impressed, nearly straight. Frons 2.5X wider than long, widely convex, coarsely rugopunctate with abundant medium size, erect setae on disk. Antenna 10-segmented, with 3-segmented club, lamellae 1.2X longer than length of preceding 6 segments combined; segments 3 and 4 of equal length, segments 5 and 6 each shorter than preceding, with weak rounded prominences on anterior margins; segment 7 wider than long, with acute prominence on anterior margin. Frons 5.0X wider than dorsal diameter of eye. Canthus long and narrow, with 10–11 setae (Fig. 13). Labrum reniform, widely concave, with slender, long setae along borders.

Mentum widely concave, with sparse slender setae at sides, anterior border deeply notched. **Thorax:** Pronotum 1.7X wider than long, 2.4X wider than frons. Pronotal disk with abundant erect setae (1.0–1.5 mm long), and deep, round, wide punctures irregularly separated by 1–4 diameters; anterior bead complete, coarsely rugopunctate, with erect setae; lateral borders widely angled, lateral marginal bead irregularly crenulate, with slender setae; basal bead indicated by regular row of setiferous punctures with erect setae; anterior angles briefly acute, projected; posterior angles widely obtuse, rounded (Fig. 13). Scutellum 1.3X wider than long, with many small punctures irregularly distributed, and anterior border nearly straight. Elytron 2.3X longer than wide; setae short and scattered on disk, more abundant on sides, and long and erect around scutellum,



Figs. 24–25. Lateral view of the genital capsule of *Phyllophaga* species. 24) *P. scissa*. 25) *P. plairi*. Scale bars = 1 mm.

densely and regularly punctate; epipleural border progressively narrowed toward apex, with dense row of slender setae; humeral callus rounded, prominent; apical callus rounded (Figs. 22–23). Metathoracic wings completely developed. Pterosternum with many long, yellowish setae. **Abdomen:** Visible abdominal sternites 2–4 glabrous, shiny, convex at middle; sternite 5 convex, with scattered erect setae and punctures; all sternites laterally with abundant long setae; anal plate shiny, irregularly concave, granulose, with slender, long setae on the entire surface. Propygidium moderately dull, densely punctate, with many short setae. Pygidium shiny, widely convex, with regularly distributed, shallow, wide punctures, and long setae on disk and borders; apical margin with 14 slender setae; basal margin much narrowed, weakly distinct at middle. **Legs:** Protibia shorter than protarsus (1.0:1.2), with 2 large teeth and a basal small tooth on external border, preapical spur acute, straight, as long as 2nd protarsomere. Mesotibia with an oblique, well-marked, long setiferous carina and short setiferous carina on external side; upper apical spur with rounded apex, 1.3X longer than lower spur. Metatibia shorter than metatarsus (0.8:1.0), with an oblique setiferous carina and small setiferous tooth on external side; upper apical spur articulated, curved, acutely pointed, longer than basal metatarsomere (1.0:0.8), and 1.5X longer than lower spur; lower apical spur articulated, curved, apex rounded. Protarsomeres 1–4 semicylindrical, elongate, with subapical, inner projection and some short setae; protarsomeres 1–4 with few ventral setae and crown of apical setae. Meso- and metatarsomeres semicylindrical, elongate,

each with enlarged apex, crown of apical setae, and 2 rows of setae along ventral side, such rows of setae are better developed in hind tarsi. Tarsal claws dentate, with ventral tooth wider than apical tooth, and prominent basal process, all narrowly separated by deep notches (Fig. 14). **Genital capsule:** With short, narrowed, curved parameres dorsally fused, distally not fused, widely truncate, with preapical border acutely projecting (Figs. 15–17). Aedeagus with sclerotized, tubular support with lateral preapical rounded lobes; inner sac with preapical sclerotized, curved, rounded, small plate (Figs. 16–17). Tectum wide, uniformly convex. Length of genital capsule from apex of parameres to border of basal piece 3.1 mm.

**Female.** Unknown.

**Type Material.** Holotype male: MEXICO: Puebla, Tzicatlacoyan, Cantera, 16-VII-1996, s/cazahuate, 21 hrs. 2000 m, M. A. Morón (IEXA).

**Type Locality.** La Cantera, km 3 carr. Tepenene a Huehuetlán, Tzicatlacoyan municipality, state of Puebla, Mexico (18°51'N, 98°04'W).

**Biological Data.** This species inhabits a mixed transitional forest with species of *Quercus* L. (Fagaceae), *Taxodium* Rich. (Cupressaceae), *Juniperus*, *Ipomoea* L. (Convolvulaceae), and *Yucca* L. (Agavaceae) located at 2,000 m elevation in the Sierra del Tentzo. The single known specimen was collected at 21:00 h directly on leaves of “cazahuate” (*Ipomoea murucoides* Roem. & Schult.) in July. Another species, *Phyllophaga martinezpalaciosi* Morón, was collected at the same time and on the same plant.

**Remarks.** *Phyllophaga cazahuata* is placed in the *blanchardi* species-group (*sensu* Morón 1986) and is similar externally to the small, hairy species of the “*leonina*” complex. The male genital capsule of *P. cazahuata* differs from these species by the pointed apical keel on the preapical border of the parameres. Its body shape is slightly depressed, not cylindrical as is typical of the species in the “*leonina*” complex. The head of *P. cazahuata* is also smaller than other species in the “*leonina*” complex.

**Etymology.** The specific epithet is derived from the ancient nahuatl word “cazahuate” applied to the tree species *I. murucoides*, from which the holotype was collected.

#### ACKNOWLEDGMENTS

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