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New species of *Orizabus* Fairmaire (Coleoptera: Scarabaeidae: Dynastinae: Pentodontini) from Mexico and Guatemala, with a revised key and checklist of the species in the genus

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Dynastinae: Pentodontini) from Mexico and Guatemala,
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Abstract. Five **new species** of *Orizabus* Fairmaire from Mexico and Guatemala are described, illustrated, and compared with other *Orizabus* species: *O. amalgamatus* Ratcliffe and Cave, *O. delgadoi* Ratcliffe and Cave, *O. epithecus* Ratcliffe and Cave, *O. mezclus* Ratcliffe and Cave, and *O. thomasi* Ratcliffe and Cave. An identification key and a checklist of the species in the genus *Orizabus* are provided.

*The way you see things depends a great deal
on where you look at them from.*
— N. Juster, *The Phantom Tollbooth*

Introduction

The genus *Orizabus* Fairmaire, 1878 (Coleoptera: Scarabaeidae: Dynastinae) presently contains 20 species, and five new species are described here. With the exception of four species known only from Honduras and El Salvador, all of the remaining species are found in Mexico and Guatemala, with three of them extending northwards into the United States: *O. clunalis* (LeConte), *O. ligyroides* Horn, and *O. pyriformis* (LeConte). Because of the patchy distribution of *Orizabus* species in space and time, we believe that additional species will be found in Mexico and Guatemala in highland areas (above 1,600 m elevation) that have never been sampled. The five new species described here bear this out. The considerable variation in body morphology of the “*O. clunalis*” form suggests that additional cryptic species will also be recognized from within this complex in the future as more specimens from different localities become available.

Orizabus species are recognized by the presence of a transverse, straight or bilobed clypeal carina immediately *behind* the clypeal apex (*O. ligyroides* is the only exception; its clypeal carina is *at* the apex), protibia with apex rounded (not obliquely truncate as in *Aphonus* LeConte species), and pronotum with or without an anterior tubercle and fovea. The number of spinules (within a range, not the absolute number) at the apex of the metatibia is sometimes helpful in separating some species. The subapical clypeal carina, the tubercle and/or carina on the frontoclypeal region on the head, the protibial teeth, and the spinules at the apex of the metatibia are subject to considerable wear since these beetles dig in the soil, and so these structures may be missing, worn, or broken; accordingly, some caution is necessary when using these characters to delineate species. Delgado (2008) provided the most recent key to species.

The adults usually inhabit pine/oak woodlands above 1,600 m elevation and are nocturnal. Apparently not all species are attracted to lights at night. Morón et al. (2003) observed that *O. vulcanicus* Morón, Tapia, and Aragón and *O. rubricollis* Prell were either not or only rarely attracted to lights. This, no doubt, contributes to the apparent rarity of some specimens in collections.

We herein describe five new species of *Orizabus* resulting from our project to survey and inventory the Dynastinae of Mexico, Guatemala, and Belize. Given the number of new species described, a new key to *Orizabus* species is included. All of the biotic survey results for the entire subfamily will appear in our forthcoming volume that documents the biodiversity of this study area (Ratcliffe and Cave, in preparation).

Methods

Label data are quoted *verbatim*; different lines of a label are separated by a diagonal slash (/); different labels are distinguished from one another by a double slash (//). We use our red labels to designate holotypes and allotypes and our yellow label to designate paratypes.

Orizabus is a difficult genus, because many of the species are morphologically similar. This, combined with varying degrees of intraspecific variation, can lead to great uncertainty about species delineations. We must confront, then, the dilemma of deciding whether we are seeing morphological variation within a species or differences in character states that actually reflect differences between species. A reference collection of authoritatively identified specimens that includes many exemplars of specimens within species as well as many species is, therefore, essential. As with most other dynastine scarabs, the parameres of male *Orizabus* species are diagnostic. Accordingly, we use differences in the form of the male parameres to distinguish species. In this paper, the presence of dots on a figure of the parameres indicates non-sclerotized tissue; this is especially evident in lateral views. A dashed line indicates a weak ridge or carina.

We adhere to the phylogenetic species concept as outlined by Wheeler and Platnick (2000). This concept defines species as the smallest aggregation of populations diagnosable by a unique combination of character states. Not all species are equally diagnosable. Some are easily recognized by examining one individual with a unique set of characters (*e.g.*, one of the new species described herein), and some must be proposed only after several individuals from different populations are examined.

Orizabus amalgamatus Ratcliffe and Cave, new species

(Fig. 1-3, 26-27)

Type Material. Holotype male labeled "MEXICO: Sonora; 7029' el./ Hwy 16, 9.1 mi. E. + 1.8 mi./ SW Yecora, 8/Aug./2004// 28°22'13" N, 109°01'53" W/ R. Cunningham + B. Streit lgt/ Near Radio Tower, BL + MV". Allotype female and five paratypes with same data; one paratype with same data but 2003. One male paratype labeled "MEXICO: Edo Mexico, @ 1980 m/ Sierra de Nanchitichitla, 27.2-27.7 km/ SW Luvianos 26-28/July/ 2006/ Vicinity: 18°52'34"N 100°24'02"W/ R. A. Cunningham & G. Nogueira L." Holotype and allotype deposited at the Instituto de Ecología (Xalapa, Mexico), two paratypes in the R. Cunningham collection (Chino, CA), one paratype in U. S. National Collection, one paratype in the William Warner collection (Chandler, AZ), and two paratypes in the B. C. Ratcliffe collection (Lincoln, NE).

Holotype. Male. Length 16.9 mm; width 9.6 mm. Color black. *Head:* Surface completely, transversely rugose. Frontoclypeal region with slender, transverse, arcuate carina, central tubercle absent. Clypeus with subapical carina weakly bilobed, reflexed. Interocular width equals 4.0 transverse eye diameters. Antenna with 10 segments, club distinctly longer than segments 2-7. *Pronotum:* Surface on anterior half and posterior angles with moderately dense, small punctures; posterior half with sparse, small punctures; anterior angles and sides near margins densely punctate. Fovea absent. Base lacking marginal bead. *Elytra:* Surface with 5 punctate, furrowed striae between suture and median edge of humerus; punctures moderately large. Intervals 2 with incomplete row of similar punctures. Sides with similar, but less distinct, rows of punctures. *Pygidium:* Surface completely, densely rugulopunctate. Apex with complete marginal bead. In lateral view, surface regularly convex. *Legs:* Protibia tridentate. Metatibia at apex with 13 spinules on left leg and 14 spinules on right. *Venter:* Prosternal process long, columnar, covered with long, reddish brown setae. *Parameres:* Apex with thickened, lobe-like swelling mesad of sclerotized, needle-like apex (Fig. 2-3).

Allotype. Female. Length 18.3 mm; width 10.3 mm. As holotype except in the following respects: *Head*: Frontoclypeal carina with small, transverse tubercle at center. Interocular width equals 5.2 transverse eye diameters. *Elytra*: Interval 2 with long row of punctures. *Pygidium*: Surface moderately punctate, punctures small. *Legs*: Metatibia at apex with 15 spinules.

Variation. Male paratypes (6). Length 17.1-17.5 mm; width 10.0-10.2 mm. As holotype except in the following respects: Color black (5 specimens) to reddish brown (1 specimen). *Head*: Reddish brown specimen with small, transverse tubercle at center of frontoclypeal carina. *Legs*: Metatibia at apex with 14-18 spinules.

Female paratype (1): Length 18.3 mm; width 10.5 mm. The single female paratype does not differ significantly from the allotype.

Etymology. The species name is derived from the Middle English *amalgame* and Medieval Latin *amalgama*, meaning a mixture or combination. Used here to refer to the mixture of character states seen in other species of *Orizabus* that delineate this species *e.g.*, the pronotal and pygidial punctation and the form of the male parameres.

Distribution. *Orizabus amalgamatus* is known only from near Luvianos in the Sierra de Nanchichitla, Mexico and from Yécora, Sonora, Mexico (Fig. 26-27). The wide separation in localities may be indicative of isolation and/or little or no collecting between the two points.

Temporal Distribution. August (8).

Diagnosis. *Orizabus amalgamatus* resembles closely *O. batesi* Prell, especially the males. The pronotum of *O. amalgamatus* is distinctly punctate everywhere, whereas in *O. batesi* it is smooth and impunctate except for a few punctures in the anterior angles. In the males, the pygidium of *O. amalgamatus* is densely rugulopunctate, but in *O. batesi* the surface has only small, sparse punctures; the punctation on the pygidium of the females is similar between both species. Each paramere of *O. amalgamatus* has a thickened, lobe-like swelling mesad of the sclerotized, needle-like apex (Fig. 2), while this structure is small and slender in *O. batesi* (Fig. 17).

Biology. The type series was taken at lights at an elevation of 2,142 m. The type series of *O. amalgamatus* was collected at the same time and place as specimens of *O. ratcliffei* Delgado. Nothing else is known of the life history of this species.

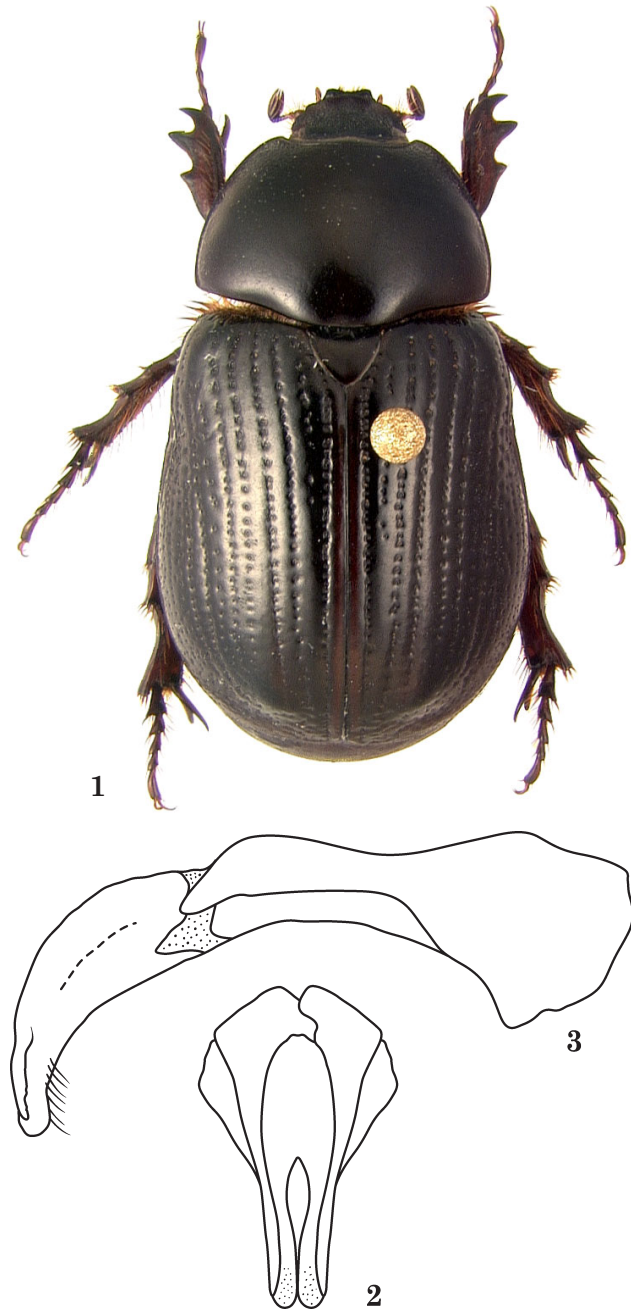


Figure 1-3. *Orizabus amalgamatus*. 1) Dorsal view. 2-3) Parameres, caudal and lateral views.

***Orizabus delgadoi* Ratcliffe and Cave,
new species**
(Fig. 4-6, 26, 28)

Type Material. Holotype male labeled "MEX: Oaxaca/ Cerro Zempoaltepetl/ 3000 m, 20-22 vii 09/ Curoe, Ramirez col". Two paratypes with same data. Holotype deposited at the University of Nebraska State Museum (Lincoln, NE), one paratype in the Leonardo Delgado collection (Xalapa, Mexico), and one paratype in the B.C. Ratcliffe collection (Lincoln, NE).

Holotype. Male. Length 22.1 mm; width 13.0 mm. Color dark reddish brown, almost black. *Head:* Surface completely, coarsely, transversely rugose. Frontoclypeal region with transverse, arcuate carina with low tubercle at middle. Clypeus with subapical carina bilobed, reflexed. Interocular width equals 7.5 transverse eye diameters. Antenna 10-segmented, club distinctly longer than segments 2-7. *Pronotum:* Surface on anterior half with dense, moderately large punctures, becoming rugopunctate on sides and angles; posterior half sparsely punctate, punctures small. Fovea and tubercle absent. Posterior border lacking marginal bead. *Elytra:* Surface with 5 furrowed, punctate striae between suture and median edge of humerus, punctures moderately large, ocellate. Interval 2 with short row of similar punctures at base. Sides with similar, but less distinct, rows of punctures. *Pygidium:* Surface punctate; punctures moderate in density and size, shallow. Apex with marginal bead and short, transverse, preapical depression at center. In lateral view, surface regularly convex. *Legs:* Protibia lacking teeth on external margin. Metatibiae at apex with 23 and 26 spinules. *Venter:* Prosternal process long, columnar, apex rounded, densely covered with long, reddish brown setae. *Parameres:* Each paramere with small, subapical notch on lateral edge, apices, in lateral view, not concave (Fig. 5-6).

Variation. Male paratypes (2). Length 19.9-20.5 mm; width 12.2-12.5 mm. The paratypes do not differ significantly from the holotype. The punctation on the pygidium is reduced in one specimen (punctures are more shallow) and nearly obsolete in the other specimen.

Etymology. We take great pleasure in dedicating this species to Leonardo Delgado (Instituto de Ecología, Xalapa, Mexico) in recognition of his fine work documenting the dynastine fauna of Mexico.

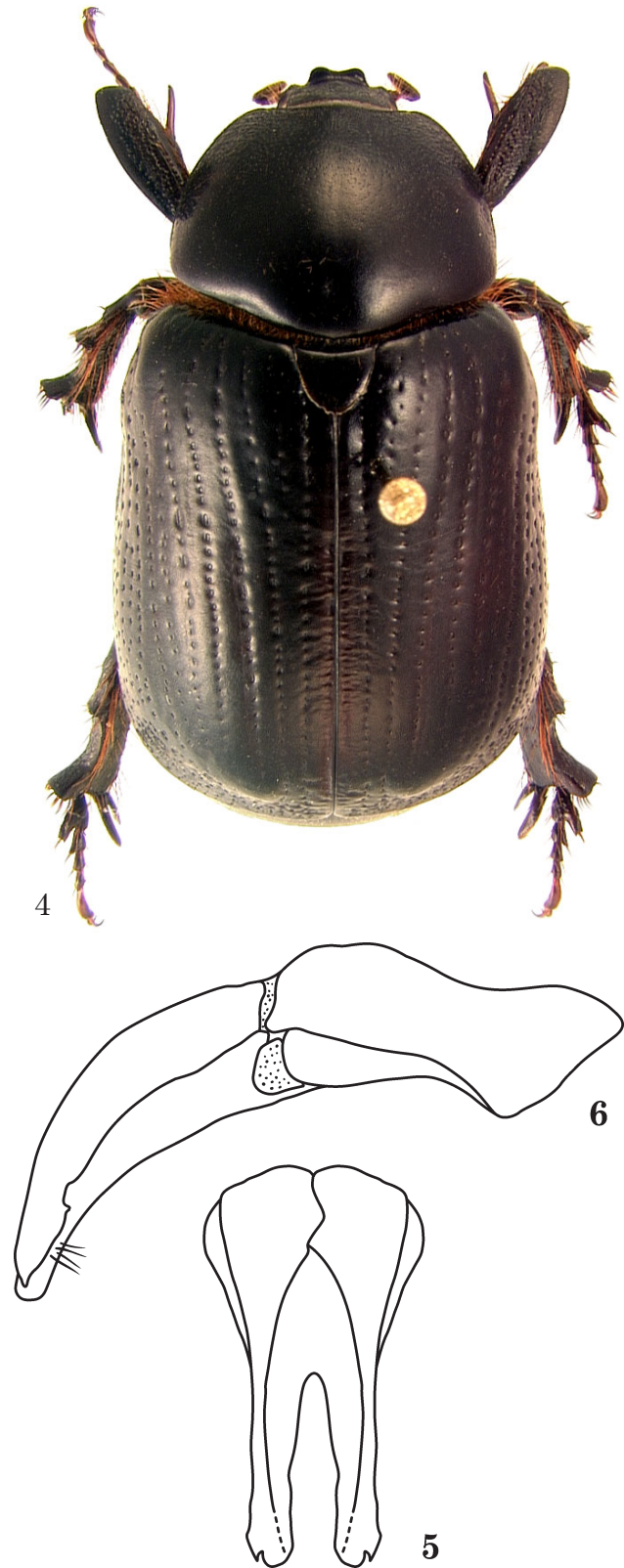


Figure 4-6. *Orizabus delgadoi*. 4) Dorsal view. 5-6) Parameres, caudal and lateral views.

Distribution. *Orizabus delgadoi* is known only from Cerro Zempoaltepetl, Oaxaca, Mexico (Fig. 26, 28).

Temporal Distribution. July (3).

Diagnosis. *Orizabus delgadoi* has distinctly punctate-striate elytra, edentate protibia, no fovea or tubercle on the pronotum, and distinctive parameres (Fig. 5-6). The parameres resemble those of *O. rubricollis* Prell (Fig. 23), but that species has a strong lateral tooth on the shaft of the paramere, whereas this tooth is absent in *O. delgadoi*. In addition, the apex of the paramere in lateral view is not concave in *O. delgadoi*, while it is deeply concave in *O. rubricollis*. The eyes of *O. delgadoi* are smaller than those of *O. rubricollis*, thus giving a slightly wider interocular distance.

Biology. As with most species of *Orizabus*, the life history is unknown. The specimens in the short type series were collected at lights at an elevation of 3,000 m.

***Orizabus epithecus* Ratcliffe and Cave,
new species**
(Fig. 7-9, 26)

Type Material. Holotype male labeled "Mexico Gue/Tasco/22 Sept 1944/W F Foshag". Holotype deposited at the University of Nebraska State Museum (Lincoln, NE).

Holotype. Male. Length 21.5 mm; width 12.1 mm. Color black. **Head:** Surface completely, transversely rugose to rugopunctate. Frontoclypeal region with arcuate, transverse carina with tubercle at center. Clypeus with subapical carina weakly bilobed, reflexed. Interocular width equals 4.0 transverse eye diameters. Antenna 10-segmented, club distinctly longer than segments 2-7. **Pronotum:** Surface punctate; punctures small, sparse, almost evenly distributed, becoming moderately large and denser in anterior angles and along lateral margin. Fovea and tubercle absent. Posterior border lacking marginal bead. **Elytra:** Surface with 5 furrowed, punctate striae between suture and median edge of humerus, punctures moderately large, ocellate; sutural row with punctures shallow and greatly reduced in size in basal fifth; second row with punctures nearly obsolete in basal fourth. First large interval with short row of 3-4 small, shallow punctures at base; remaining intervals smooth, shining. Sides with similar, but less distinct, rows of larger punctures. **Pygidium:** Surface completely covered with moderately dense, small punctures;

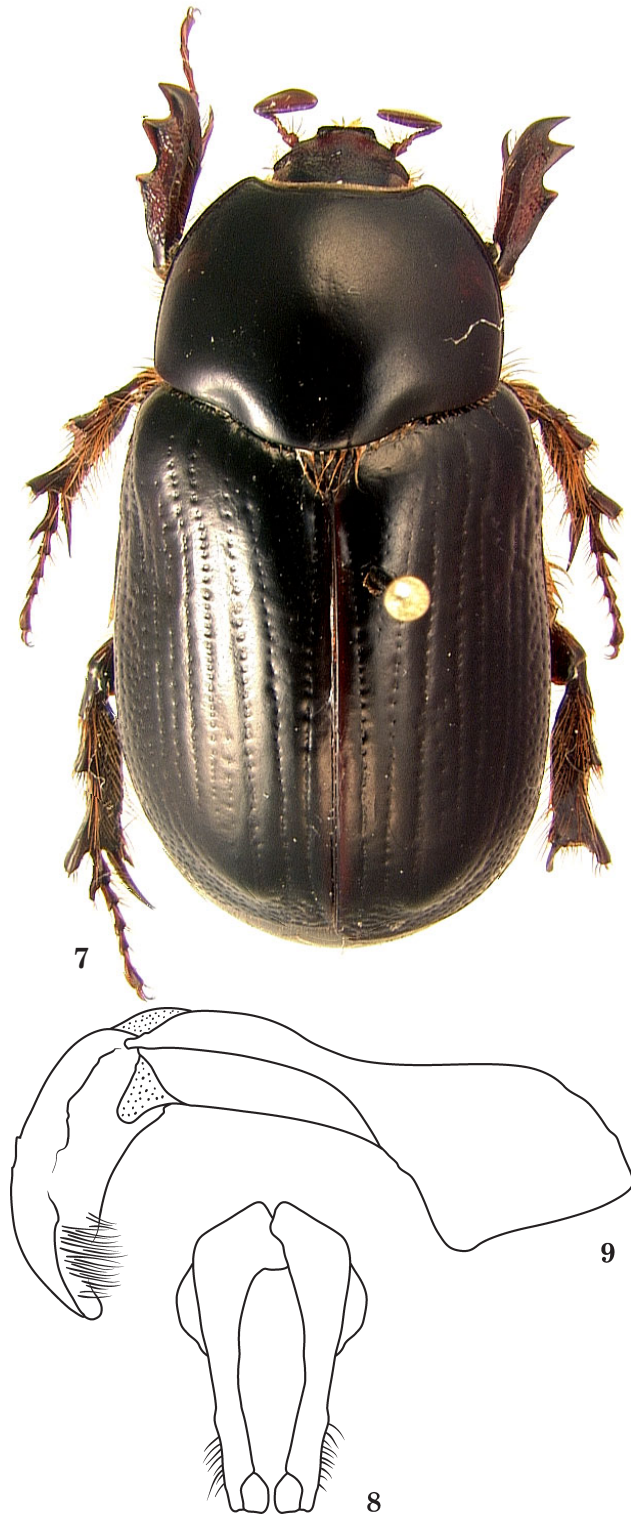


Figure 7-9. *Orizabus epithecus*. 7) Dorsal view. 8-9) Parameres, caudal and lateral views.

disc with several small, longitudinal rugae; base and lateral margins rugulopunctate. Posterior margin with complete bead. In lateral view, surface regularly convex. *Legs*: Protibia tridentate. Metatibia at apex on right leg with 17 spinules; apex of left leg damaged, spinules not evident. *Venter*: Prosternal process long, columnar, slender, apex narrowly rounded, covered with reddish brown setae. *Parameres*: Each with large, less sclerotized “lobe” on notched, inner apex (Fig. 8-9).

Etymology. The species name is derived from the Greek word *epitheke*, meaning an addition or increase; hence, one more species of *Orizabus*.

Distribution. *Orizabus epithecus* is known only from Tasco (Taxco) in Guerrero, Mexico (Fig. 26).

Temporal Distribution. September (1).

Diagnosis. *Orizabus epithecus* is unique in its body shape and form of the parameres (Fig. 8). Unlike other species in the genus, its body form is noticeably elongate (best seen in comparison with other species), and the dorsum is a lustrous, shining black due to the smooth surface of the elytral intervals and between the punctures of the pronotum. In addition, the parameres are remarkable for the large, less sclerotized “lobe” on the notched, inner apex of each paramere (Fig. 8). The female remains unknown.

Biology. Nothing is known of the life history of this species.

***Orizabus mezclus* Ratcliffe and Cave,
new species**
(Fig. 10-13, 26)

Type Material. Holotype male labeled “GUATEMALA: Suchitepequez/Dept. Finca El Vesubio ca 12 km/N of Patulul. 7 June 2005/14°32.841'N 91°09.729'W/1399m BL/MV traps. RS Zack”. Holotype deposited at the University of Nebraska State Museum (Lincoln NE).

Holotype. Male. Length 19.6 mm; width 12.1 mm. Color dark reddish brown. *Head*: Surface vaguely, coarsely, transversely rugose to rugopunctate (surface appears worn). Frontoclypeal region with transverse carina, carina becoming tuberculiform at middle. Clypeus with subapical carina weakly bilobed, reflexed. Interocular width equals 5.0 transverse eye diameters. Antenna 10-segmented, club slightly longer than segments 2-7. *Pronotum*: Surface with moderately dense, moderately large punctures except along midline on basal half of center of disc where punctures sparse, small; anterior angles coarsely rugopunctate; broad band along lateral margins with dense, moderately large punctures. Fovea absent.

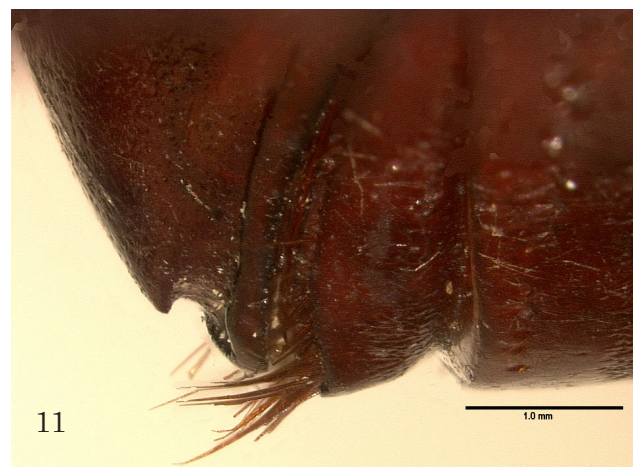


Figure 10-11. *Orizabus mezclus*. 10) Dorsal habitus. 11) Oblique view of left pygidial apex.

Anterior marginal bead expanded at center into prominent tubercle, anterior face of tubercle smooth like marginal bead. Posterior border with partial marginal bead, bead absent in front of scutellum. *Elytra*: Surface with 5 furrowed, punctate striae between suture and median edge of humerus, punctures large, ocellate. First large interval with partial, irregular row of punctures. Sides with similar, but less distinct rows of punctures. *Pygidium*: Surface shagreened, nearly completely, densely rugulopunctate except at center apex where punctures become small and moderately dense. Apex at center before margin with short, distinct, transverse groove (Fig. 11). Posterior margin with complete bead. In lateral view, surface regularly convex. *Legs*: Protibia lacking teeth. Metatibia at apex with spinules worn away; right leg with 20 sockets for spinules; sockets not clearly visible on left leg. *Venter*: Prosternal process moderately long, columnar, apex rounded, covered with long, reddish brown setae. *Parameres*: Each paramere with small tooth on ventrolateral edge (Fig. 12-13).

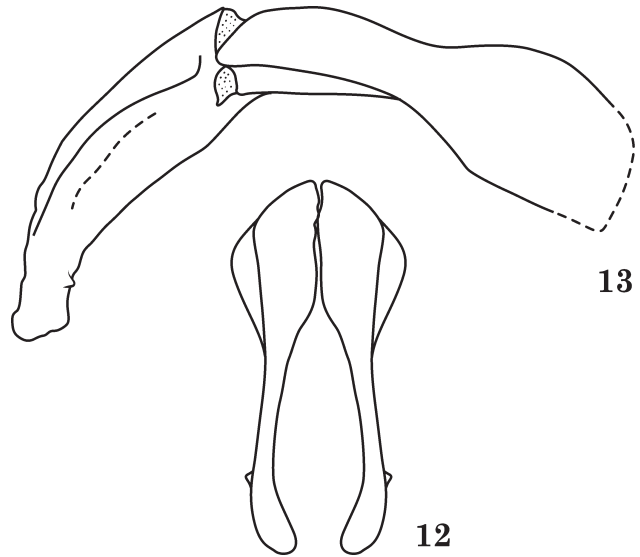


Figure 12-13. *Orizabus mezclus*, Parameres, caudal and lateral views. .

Etymology. The specific epithet for this species is derived from the Spanish word *mezcla*, meaning a mixture or medley. This species is so named in reference to its mixture of character states seen in species of *Orizabus*.

Distribution. *Orizabus mezclus* is known from a single specimen from the Guatemalan department of Suchitepéquez, near Patulul (Fig. 26).

Temporal Distribution. June (1).

Diagnosis. *Orizabus mezclus* superficially resembles *O. clunalis* and *O. cuernavacensis* Delgado and Deloya in the form of the edentate protibia, sculpturing of the pronotum, and parameres. Unlike *O. clunalis*, however, it does not have a fovea on the pronotum, and each paramere has a small tooth on the ventrolateral edge (Fig. 12), whereas there is only an angular swelling in *O. clunalis* (Fig. 19). It differs from *O. cuernavacensis* because it is larger (nearly 20 mm versus 17 mm), and it has a distinctive, transverse groove just before the marginal bead of the pygidium (Fig. 11), whereas there is no groove in *O. cuernavacensis*.

Biology. Nothing is known of the life history of this species. It was collected at lights at an elevation of 1,399 m.

***Orizabus thomasi* Ratcliffe and Cave, new species**

(Fig. 14-16, 26, 29-30)

Type Material. Holotype male labeled: "MEXICO: Veracruz/ Excola, el. 9310'/ 19°06.46'N, 97°12.77'W/ 23-IV-09, D. B. Thomas". Allotype female and one female paratype labeled "MEXICO: Veracruz, 5 Km W/ Excola, El 9026 ft, 7 May 2008/19°06.60'N; 97°12.77'W/ 19°06.46'N, 97°12.77'W/ D. Thomas & D. Robacker". Two male paratypes labeled "MEXICO/Veracruz/Cofre de Perote/Mateu-leg./Coll. Martínez/Sept.974". Holotype and allotype deposited at the University of Nebraska State Museum (Lincoln, NE). Two paratypes deposited in the Canadian Museum of Nature (Ottawa, Canada) and one paratype in the B. C. Ratcliffe collection (Lincoln, NE).

Holotype. Male. Length 16.3 mm; width 9.7 mm. Color black. *Head:* Surface completely, transversely rugose to rugopunctate. Frontoclypeal region with weak, transverse carina. Clypeus with subapical carina weakly bilobed, reflexed. Interocular width equals 4.5 transverse eye diameters. Antenna 10-segmented, club distinctly longer than segments 2-7. *Pronotum:* Surface shagreened, punctate; punctures small, shallow (almost obsolete), moderate in density and almost evenly distributed. Fovea and tubercle absent. Posterior border lacking marginal bead. *Elytra:* Surface with 5 furrowed, punctate striae between suture and median edge of humerus, punctures moderate in size, ocellate. First large interval with only 3-4 punctures at base. Sides with similar, but less distinct rows of slightly larger punctures. *Pygidium:* Surface shagreened, completely covered with dense, small punctures; base and lateral margins rugulopunctate. Posterior margin with complete bead. In lateral view, surface regularly convex. *Legs:* Protibia tridentate. Metatibiae at apex with 19 spinules. *Venter:* Prosternal process long, columnar, slender, apex narrowly rounded, densely covered with reddish brown setae. *Parameres:* Each with tooth on lateral edge at about midpoint of shaft (Fig. 15-16).

Allotype. Female. Length 16.7 mm; width 10.0 mm. As holotype except in the following respects: *Head:* Interocular width equals 5.5 transverse eye diameters. *Pronotum:* Surface with punctures moderate in size and density in anterior half and along lateral margins; punctures small and sparse in basal half. *Pygidium:* Disc with dense, small punctures except at center apex where punctures sparse. In lateral view, surface weakly convex.

Variation. Male paratypes (2). Length 18.2-18.4 mm; width 10.9-11.0 mm. The male paratypes do not differ significantly from the holotype.

Female paratype (1). Length 18.0 mm; width 10.7 mm. As allotype except pronotum like that of male holotype: punctures small, shallow (almost obsolete), moderate in density and almost evenly distributed.

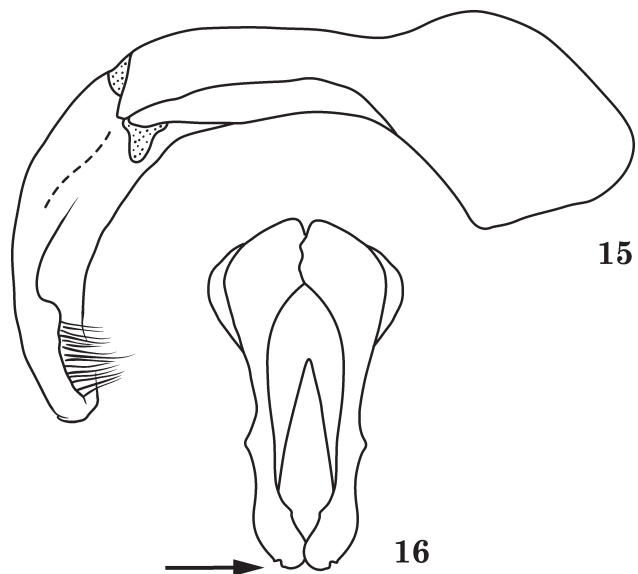


Figure 14-16. *Orizabus thomasi*. 14) Dorsal view. 15-16) Parameres, caudal and lateral views.

Etymology. This species is named in honor of its collector, Donald Thomas (USDA, Weslaco, TX), and in recognition of Don's generous donations of specimens over the years for our projects.

Distribution. *Orizabus thomasi* is known only from the vicinity of the high elevation (2,751-2,838 m) pueblo of Excola in the Municipio de Calchualco in Veracruz, Mexico (Fig. 26, 29-30) and from Cofre de

Perote (possibly Parque Nacional Cofre de Perote), another high elevation locale in the same municipio.

Temporal Distribution. April (1), May (2), September (2).

Diagnosis. The male of *O. thomasi* is distinctive because of its small size (16-18 mm), vaguely punctate pronotal surface that lacks a fovea and tubercle, tridentate protibia, and completely punctate pygidium. The parameres of *O. thomasi*, *O. cuernavacensis*, and *O. teamscaraborum* Ratcliffe and Cave are somewhat similar (Fig. 15-16, 20, and 24-25, respectively). *Orizabus thomasi* has a tooth on the lateral edge at about the midpoint of the paramere, whereas *O. cuernavacensis* does not. *Orizabus teamscaraborum* has edentate protibiae and a large body size (23-30 mm), but *O. thomasi* has tridentate protibiae and a small body size (17-17 mm). The females of *O. thomasi* key out closest to *O. cuernavacensis* and *O. fairmairei* (Bates); *O. thomasi* has moderately dense punctures on the pygidium (except at the center apex), whereas the pygidium in *O. cuernavacensis* and *O. fairmairei* are both relatively smooth everywhere except at the base and angles.

Biology. Nothing is known of the life history of this species. The specimens were collected at lights from elevations of 2,751 and 2,838 m in pine/oak forest (Fig. 29-30). The female paratype had 18 developed eggs within her abdomen. The specimen was collected in May, suggesting that oviposition was imminent.

Key to Males of Adult *Orizabus* Species

(modified from Delgado 2008)

- | | | |
|-------|---|---|
| 1. | Elytra weakly striate, at most with feebly impressed rows of punctures | 2 |
| — | Elytra furrowed, distinctly impressed striae with rows of punctures | 3 |
| 2(1). | Pronotum with tubercle and fovea on anterior half. Protibia without teeth or lobes on external margin. Length 24-27 mm. Southern Mexico . | <i>O. dechambrei</i> Morón, Tapia and Aragón |
| — | Pronotum lacking fovea and tubercle on anterior half. Protibia tridentate on external margin. Honduras | <i>O. botox</i> Ratcliffe and Cave |
| 3(1). | Protibia lacking lobes or teeth on external margin | 4 |
| — | Protibia with lobes or teeth on external margin | 13 |
| 4(3). | Antenna 9-segmented. Length 15-18 mm. Central Mexico | <i>O. vulcanicus</i> Morón, Tapia and Aragón |
| — | Antenna 10-segmented | 5 |
| 5(4). | Subapical carina of clypeus straight | 6 |
| — | Subapical carina of clypeus bilobed | 7 |
| 6(5). | Pronotum with deep fovea and prominent tubercle on anterior half. Length 22-25 mm. Southeastern Mexico, Guatemala, Nicaragua | <i>O. tuberculatus</i> Prell |
| — | Pronotum with shallow depression and feeble tubercle on anterior third. Length 13-16 mm. Northwestern Mexico | <i>O. ratcliffei</i> Delgado |
| 7(5). | Pronotum with fovea and tubercle on anterior half | 8 |
| — | Pronotum without fovea or tubercle on anterior half | 10 |
| 8(7). | Metatibia at apex usually with more than 40 spinules. Parameres just before apex notched (Fig. 24-25). Length 23-30 mm. El Salvador, Honduras | <i>O. teamscaraborum</i> Ratcliffe and Cave |
| — | Metatibia at apex usually with less than 30 spinules. Parameres round, entire just before apex (Fig. 19) | 9 |

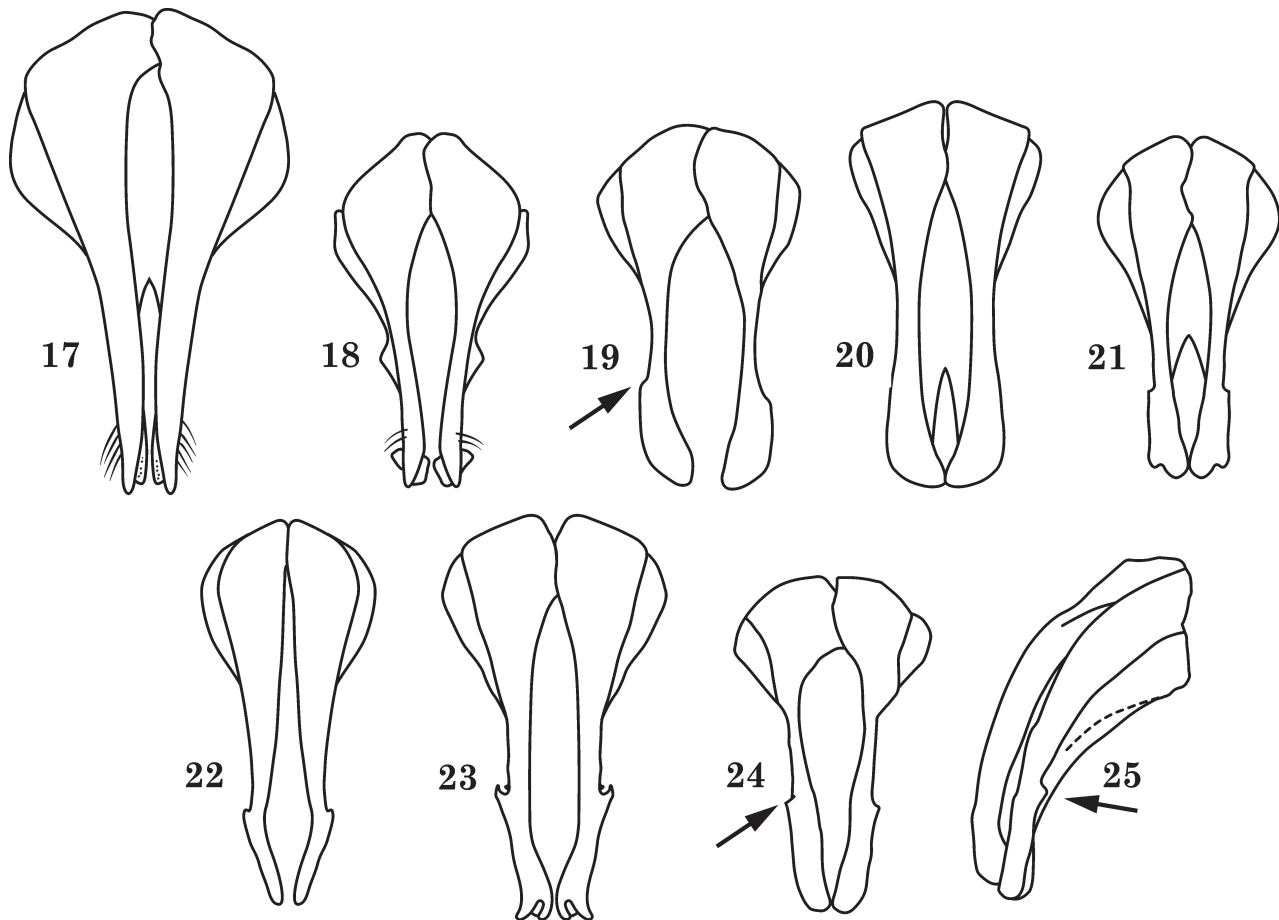


Figure 17-25. Parameres of *Orizabus* spp. 17) *O. batesi*. 18) *O. brevicollis*. 19) *O. clunalis*. 20) *O. cuernavacensis*. 21) *O. fairmairei*. 22) *O. pyriformis*. 23) *O. rubricollis*. 24-25) *O. teamscaraborum*.

- 9(8). Clypeus with apex extending beyond broadly bilobed subapical carina. Parameres as in Fig. 19. Length 20-27 mm. United States, Mexico, Guatemala, El Salvador, Honduras *O. clunalis* (LeConte)
- Clypeus with apex not extending beyond clypeal carina, carina with 2 contiguous teeth. Length 20-27 mm. Southwestern United States, northern Mexico *O. ligyroides* Horn
- 10(7). Elytra on second interval smooth. Parameres at apical third with lateral carina; apex notched and glabrous 11
- Elytra on second interval with row of punctures on basal half. Parameres without lateral carina at apical third; apex entire, setose or glabrous 12
- 11(10). Parameres with large tooth at middle on external margin (Fig. 23); apex in lateral view strongly concave. Length 21-26 mm. Central and northwestern Mexico *O. rubricollis* Prell
- Parameres lacking large tooth at middle on external margin; apex in lateral view not concave (Fig. 5-6). Length 19-22 mm. Oaxaca, Mexico *O. delgadoi* Ratcliffe and Cave
- 12(10). Anterior marginal bead of pronotum expanded at center into distinct tubercle. Pygidium completely, densely rugulopunctate; apex at center just before marginal bead with short, deep, transverse groove (Fig. 11). Length 20 mm. Southern Guatemala *O. mezclus* Ratcliffe and Cave
- Anterior marginal bead of pronotum without tubercle. Pygidium with sparse, minute punctures on disc; apex entire, lacking deep transverse groove, with long setae. Parameres as in Fig. 20.

- Length 15-17 mm. Central, western and southern Mexico
 ***O. cuernavacensis* Delgado and Deloya**
- 13(3). Apex of inner spur of hind tibia abruptly curved, hook shaped. Length 16-17 mm. Eastern Mexico
 ***O. endrodianus* Morón**
 — Apex of inner spur of hind tibia straight or slightly curved 14
- 14(13). Pronotum with tubercle and fovea or depression on anterior half 15
 — Pronotum without tubercle or depressions on anterior half 17
- 15(14). Frontoclypeal region with transverse line but lacking distinct tubercle or carina. Honduras
 ***O. puchicus* Ratcliffe and Cave**
 — Frontoclypeal region with tubercle and/or carina 16
- 16(15). Frontoclypeal region with straight, transverse carina. Length 15-21 mm. Central, western,
 northwestern Mexico ***O. isodonoides* Fairmaire**
 — Frontoclypeal region with strong tubercle. Length 23-27 mm. Oaxaca, Mexico
 ***O. subaziro* Ratcliffe**
- 17(14). Pygidium completely, densely punctate to rugopunctate 18
 — Pygidium rugopunctate only at base and basal angles, elsewhere variably sparsely to moderately
 punctate; *O. fairmairei* may occasionally be densely punctate but see form of parameres (Fig.
 21) 21
- 18(17). Frontoclypeal region with transverse line but lacking distinct carina or tubercle. Length 19-22
 mm. Honduras ***O. hondurensis* Ratcliffe and Cave**
 — Frontoclypeal region with transverse carina or tubercle at middle (both may be weak) 19
- 19(18). Parameres lacking a tooth on the lateral edge (Fig. 2). Length 16-19 mm. Sonora, Mexico
 ***O. amalgamatus* Ratcliffe and Cave**
 — Parameres with a tooth on lateral edge 20
- 20(19). Body form distinctly rounded or rotund. Parameres slender, with lateral tooth far below middle of
 shaft (Fig. 22), apex glabrous. Length 14-19 mm. United States, eastern Mexico
 ***O. pyriformis* (LeConte)**
 — Body form suparallel. Parameres robust, with lateral tooth just below middle of shaft, apex setose
 (Fig. 15-16). Length 16-17 mm. Veracruz, Mexico ***O. thomasi* Ratcliffe and Cave**
- 21(17). Posterolateral area of pronotal disc nearly smooth, at most with a few micropunctures 22
 — Posterolateral area with at least some small punctures 23
- 22(21). Pygidium with at least a few punctures on disc. Parameres without lateral tooth (Fig. 17). Length
 16-19 mm. Central, western, northwestern and southern Mexico ***O. batesi* Prell**
 — Pygidium without punctures on disc. Parameres with tooth at middle of lateral margin. Length
 18-20 mm. Southern Mexico ***O. rawlinsi* Dechambre**
- 23(21). Pronotum on anterior half with sparse, small punctures. Form elongate, surface black, strongly
 shining. Parameres as in Fig. 8-9. Length 20-22 mm. Guerrero, Mexico
 ***O. epithecus* Ratcliffe and Cave**
 — Pronotum on anterior half with dense, moderately large punctures. Form elongate or rotund,
 surface opaque black or reddish brown. Parameres different 24
- 24(23). Parameres (Fig. 18) with a tooth at middle of lateral margin, apex expanded and bifid. Length 23-
 26 mm. Mexico ***O. brevicollis* Prell**

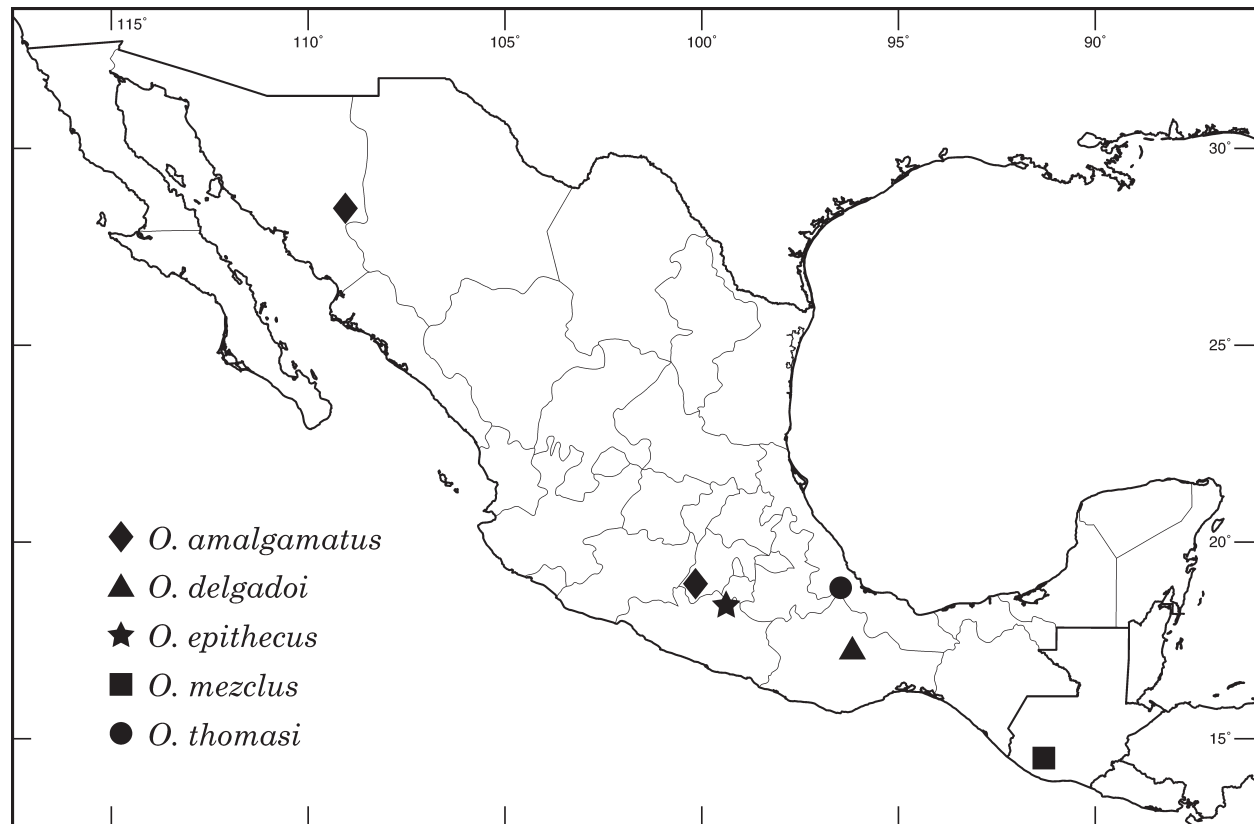


Figure 26. Distribution map for the new *Orizabus* species described in this paper.

- Parameres (Fig. 21) with subapical projection on lateral margin, extreme apex entire. Length 14-19 mm. Southern and eastern Mexico *O. fairmairei* (Bates)

Key to Females of Adult *Orizabus* Species

(modified from Delgado 2008)

(The females of *O. delgadoi*, *O. epithecus*, and *O. mezclus* remain unknown)

1. Elytra weakly striate, at most with feebly impressed rows of punctures 2
 — Elytra furrowed, with distinctly impressed, punctate striae 3
- 2(1). Pronotum with basal bead. Apical tooth of protibia narrowly rounded. Length 24-27 mm. Southern Mexico *O. dechambrei* Morón, Tapia and Aragón
 — Pronotum without basal bead. Apical tooth of protibia broadly rounded. Honduras
 *O. botox* Ratcliffe and Cave
- 3(1). Protibia entire, lacking lobes or teeth 4
 — Protibia with lobes or teeth on external margin 6
- 4(3). Subapical carina of clypeus straight or nearly so. Length 22-25 mm. Southeastern Mexico, Guatemala, Nicaragua *O. tuberculatus* Prell
 — Subapical carina of clypeus bilobed 5
- 5(4). Pronotum without tubercle. Metatibia at apex with less than 30 spinules. Length 21-26 mm. Central and northwestern Mexico *O. rubricollis* Prell

- Pronotum with strong tumescence on anterior margin. Metatibia at apex with more than 40 spinules. Length 23-30 mm. El Salvador and Honduras *O. teamscaraborum* Ratcliffe and Cave
- 6(3). Antenna 9-segmented. Length 15-18 mm. Central Mexico *O. vulcanicus* Morón, Tapia and Aragón
- Antenna 10-segmented 7
- 7(6). Pygidium with deep, preapical depression. Length 16-17 mm. Eastern Mexico *O. endrodianus* Morón
- Pygidium without preapical depression 8
- 8(7). Frontoclypeal region with weak line but lacking tubercle or carina 9
- Frontoclypeal region with tubercle (may be small) and/or carina (may be weak) 10
- 9(8). Metatibia at apex with about 24 spinules. Honduras *O. hondurensis* Ratcliffe and Cave
- Metatibia at apex with about 30-34 spinules. Honduras *O. puchicus* Ratcliffe and Cave
- 10(8). Pygidium completely, densely punctate to rugopunctate. Length 14-19 mm. United States, eastern Mexico *O. pyriformis* (LeConte)
- Pygidium rugopunctate only at base and basal angles, elsewhere variably sparsely to moderately punctate; *O. fairmairei* may occasionally be densely punctate 11
- 11(10). Posterolateral area of pronotal disc nearly smooth 12
- Posterolateral area of pronotal disc with at least some punctures 13
- 12(11). Pygidium with at least some small punctures on disc. Length 16-19 mm. Central, western, northwestern, and southern Mexico *O. batesi* Prell
- Pygidium without punctures on disc. Length 18-20 mm. Southern Mexico *O. rawlinsi* Dechambre
- 13(11). Subapical carina of clypeus straight 14
- Subapical carina of clypeus emarginate or bilobed 15
- 14(13). Frontoclypeal region with distinct, transverse carina. Length 15-21 mm. Central, western and northwestern Mexico *O. isodonoides* Fairmaire
- Frontoclypeal region with weak carina and small tubercle. Length 13-16 mm. Northwestern Mexico *O. ratcliffei* Delgado
- 15(13). Size small, length usually less than 20 mm 16
- Size larger, length usually more than 20 mm 19
- 16(15). Pygidium with dense, small punctures except at center apex. Length 16-19 mm. Veracruz, Mexico *O. thomasi* Ratcliffe and Cave
- Pygidium not densely punctate, instead with sparse, minute to small punctures 17
- 17(16). Pygidium with sparse, small punctures. Best identified by collecting in association with males. Length 16-19 mm. Sonora, Mexico *O. amalgamatus* Ratcliffe and Cave
- Pygidium with sparse, minute punctures 18
- 18(17). Body shape subparallel, lateral margins becoming slightly wider posteriorly. Pronotum at midline “short”, length:width ratio 3:5. Best identified by collecting in association with males. Length 15-19 mm. Central, western and southern Mexico *O. cuernavacensis* Delgado and Deloya

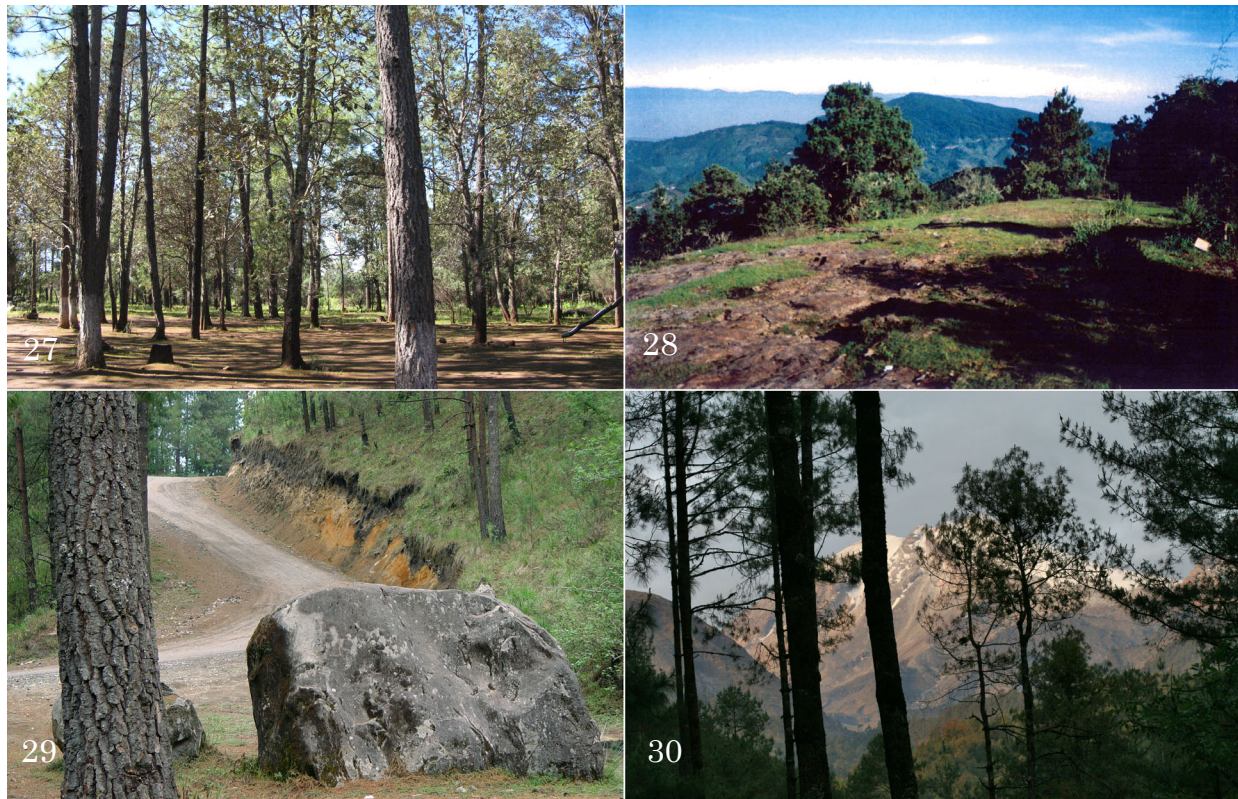


Figure 27-30. Habitats for some *Orizabus* species. **27)** Type locality of *O. amalgamatus* near Yécora in Sonora, Mexico. Photo courtesy of Ian Swift. **28)** Type locality of *O. delgadoi* at Cerro Zempoaltepetl in Oaxaca, Mexico. Photo courtesy of Daniel Curoe. **29-30)** Type locality of *O. thomasi* in the vicinity of Excola in the Municipio de Calchualco in Veracruz, Mexico. Photos courtesy of Karen Robacker.

- Body shape rotund, lateral margins becoming much wider posteriorly. Pronotum at midline “long”, length:width ratio 4:5. Best identified by collecting in association with males. Length 14-19 mm. Southern and eastern Mexico *O. fairmairei* (Bates)
- 19(15). Metatibia at apex with more than 30 spinules. Upper genital plates with basal projections and short setae. Length 23-27 mm. Central, eastern, western and northwestern Mexico *O. brevicollis* Prell
- Metatibia at apex with less than 30 spinules. Upper genital plates without basal projections and with long setae **20**
- 20 (19). Clypeus with apex not extending beyond clypeal carina, carina with 2 contiguous teeth. Length 20-27 mm. United States, northern Mexico *O. ligyroides* Horn
- Clypeus with apex extending beyond broadly bilobed supapical carina **21**
- 21(20). Protibial spur extending to about apex of first tarsomere, rarely longer. Length 20-27 mm. United States, Mexico, Guatemala, El Salvador, Honduras *O. clunalis* (LeConte)
- Protibial spur extending to apex of second tarsomere, rarely shorter. Length 23-27 mm. Oaxaca, Mexico *O. subaziro* Ratcliffe

Checklist of *Orizabus* species

- Orizabus amalgamatus* Ratcliffe and Cave, 2010: Mexico
Orizabus batesi Prell, 1914: Mexico
Orizabus botox Ratcliffe and Cave, 2006: Honduras
Orizabus brevicollis Prell, 1914: Mexico
Orizabus clunalis (LeConte, 1856): Mexico, Guatemala, Honduras, El Salvador, USA
 Aphonus clunalis LeConte, 1856
 Orizabus cultripipes Fairmaire, 1878
 Orizabus sallei Fairmaire, 1878
 Orizabus marginatus Fairmaire, 1878
 Orizabus snowii Horn, 1885
 Orizabus ponderosus Casey, 1915
 Orizabus fontinalis Casey, 1915
Orizabus cuernavacensis Delgado and Deloya, 1990: Mexico
Orizabus dechambrei Morón, Tapia, and Aragón, 2003: Mexico
Orizabus delgadoi Ratcliffe and Cave, 2010: Mexico
Orizabus endrodianus Morón, 1981: Mexico
Orizabus epithecus Ratcliffe and Cave, 2010: Mexico
Orizabus fairmairei (Bates, 1888): Mexico
 Cheiroplatys fairmairei Bates, 1888
Orizabus hondurensis Ratcliffe and Cave, 2006: Honduras
Orizabus isodonoides Fairmaire, 1878: Mexico
Orizabus ligyroides Horn, 1885: Mexico, USA
Orizabus mezclus Ratcliffe and Cave, 2010: Guatemala
Orizabus puchicus Ratcliffe and Cave, 2006: Honduras
Orizabus pyriformis (LeConte, 1847): Mexico, USA
 Bothynus pyriformis LeConte, 1847
 Pseudaphonus debiliceps Casey, 1915
 Pseudaphonus ovalis Casey, 1915
 Pseudaphonus repens Casey, 1915
 Pseudaphonus lucidus Casey, 1915
Orizabus ratcliffei Delgado, 2008: Mexico
Orizabus rawlinsi Dechambre, 2003: Mexico
Orizabus rubricollis Prell, 1914: Mexico
Orizabus subaziro Ratcliffe, 1994: Mexico
Orizabus teamscaraborum Ratcliffe and Cave, 2006: Honduras, El Salvador
Orizabus tuberculatus Prell, 1914: Mexico
Orizabus thomasi Ratcliffe and Cave, 2010: Mexico
Orizabus vulcanicus Morón, Tapia, and Aragón, 2003: Mexico

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