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THREE NEW SPECIES OF THE NEOTROPICAL WATER BEETLE GENUS *ELMOPARNUS* (COLEOPTERA: DRYOPIDAE)

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Members of the dryopid genus *Elmoparnus* are rare in collections and only three species have been described in the 84 years since the genus was described. The type of the genus, *E. brevicornis* Sharp (1882), was described from a single male collected in Panama. The second species known, *E. glaber* Grouvelle (1889), was described from a male and two female specimens from Venezuela. The third species, *E. mexicanus* Brown (1970b), was described from a single female from Mexico.

The early descriptions of *E. brevicornis* by Sharp and *E. glaber* by Grouvelle were brief and incomplete but these deficiencies were corrected in a synopsis of the genus by Hinton (1940) in which he redescribed both species, extended the generic diagnosis to make it comparable with modern generic descriptions, and discussed the distribution of the few specimens available to him at the time.

Since Hinton's synopsis appeared, only two articles referring to the genus have been published. The first reference was its inclusion in a key to the dryopid genera of the New World and a brief mention of its habitat by Brown (1970a). The second article was a description of the new species, *E. mexicanus* Brown (1970b) with comments on its habitat and a key to the three species known at that time.

During the past few years several additional collections of

Elmoparnus were made by M. E. and P. D. Perkins in Mexico and Central America, C. M. and O. S. Flint, Jr. in Venezuela, P. J. Spangler et al. in Ecuador, and A. Langley et al. in Ecuador. Among the 18 specimens included in this recently acquired material we recognize one previously described species, *E. glaber*, and three new species. Therefore, we have prepared this article to describe the new species and to present some new information regarding this poorly known but exceedingly interesting genus of beetles.

Elmoparnus pandus, new species
Figures 1, 3–5, 7–16, 19, 20

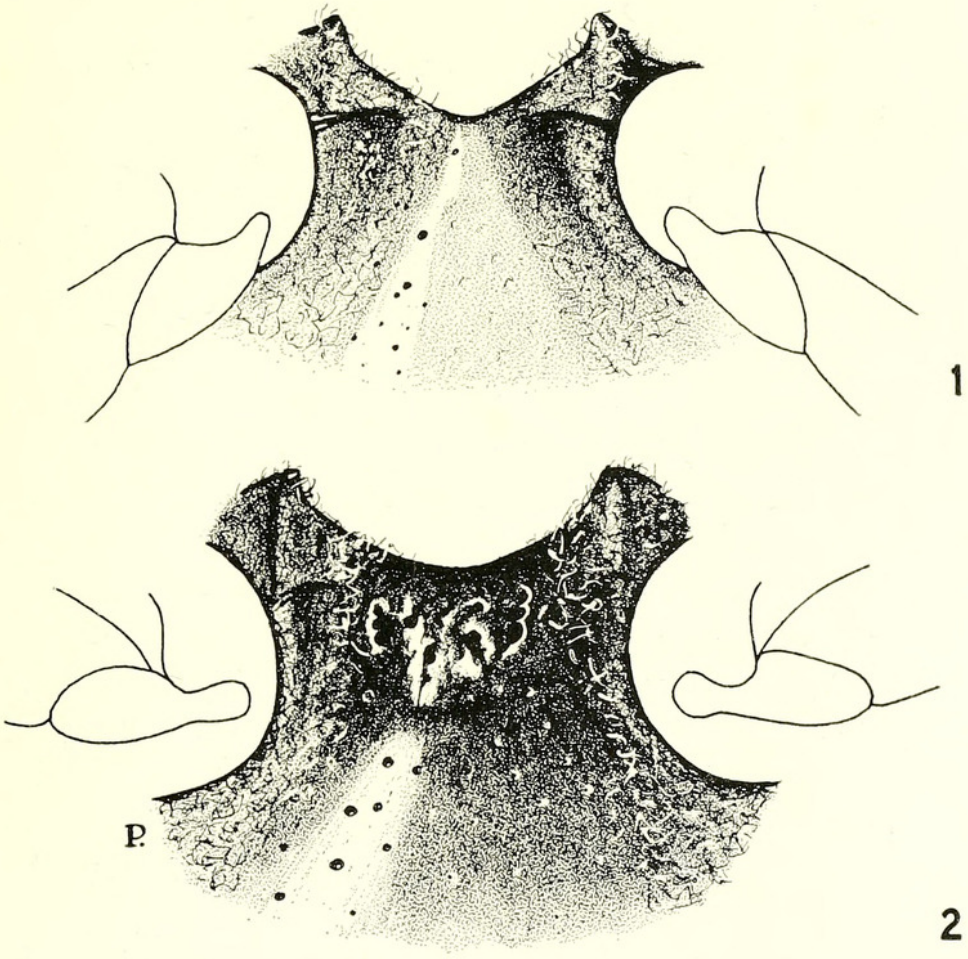
This new species is similar to *E. brevicornis* Sharp, *E. mexicanus* Brown, and *E. miltops*, new species, because all four species have 9-segmented antennae. However, *E. pandus*, new species, may be distinguished from *E. brevicornis* by the sublateral pronotal carina extending from base to apex instead of being restricted to the basal two-fifths. From *E. mexicanus*, *E. pandus* may de distinguished by the following characters: its smaller size, 3.5 mm vs. 5.6 mm; punctures on pronotal disc separated by one to two times their diameter instead of two to four times; first abdominal sternum not feebly rugose laterally; and labrum and clypeus light reddish brown.

From *E. miltops*, which it closely resembles, *E. pandus* may be distinguished by the form and sculpture of the anteromedial region of the metasternum, which is narrow, very slightly elevated, and possesses small widely separated punctures (Fig. 1) instead of being wide, distinctly elevated, and with coarse, sometimes confluent punctures (Fig. 2). In addition the posterior coxae of *E. pandus* are less densely and less coarsely punctate than the posterior coxae of *E. miltops*.

Holotype male: Length 3.5 mm; width 1.7 mm. Body form obovate, moderately strongly convex dorsally. Color dark reddish brown; pronotum darker than elytra; antennae, clypeus, and labrum light reddish brown. Venter dark reddish brown except all palpi, labium, apical margin of prosternum, tibiae, tarsi, and apex of last abdominal sternum lighter reddish brown.

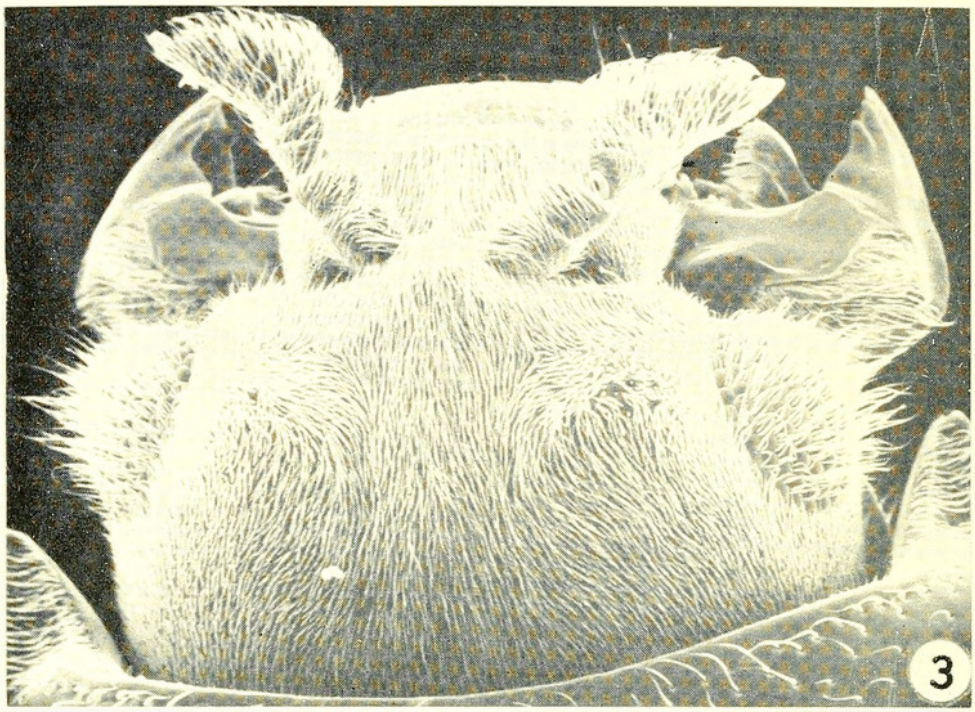
Head finely microreticulate, micropunctate, and densely pubescent (Figs. 3, 4) except anterior edge of clypeus glabrous. Eyes with large convex facets also pubescent. Antenna 9 segmented (Fig. 5). Labrum shallowly emarginate anteromedially; emargination bordered by a glabrous liplike area; upper edge of liplike area sharply, angularly demarcated; labral surface above liplike area densely microreticulate, with numerous long, golden, upswept setae dorsolaterally resembling a mustache; anterolateral angles broadly rounded.

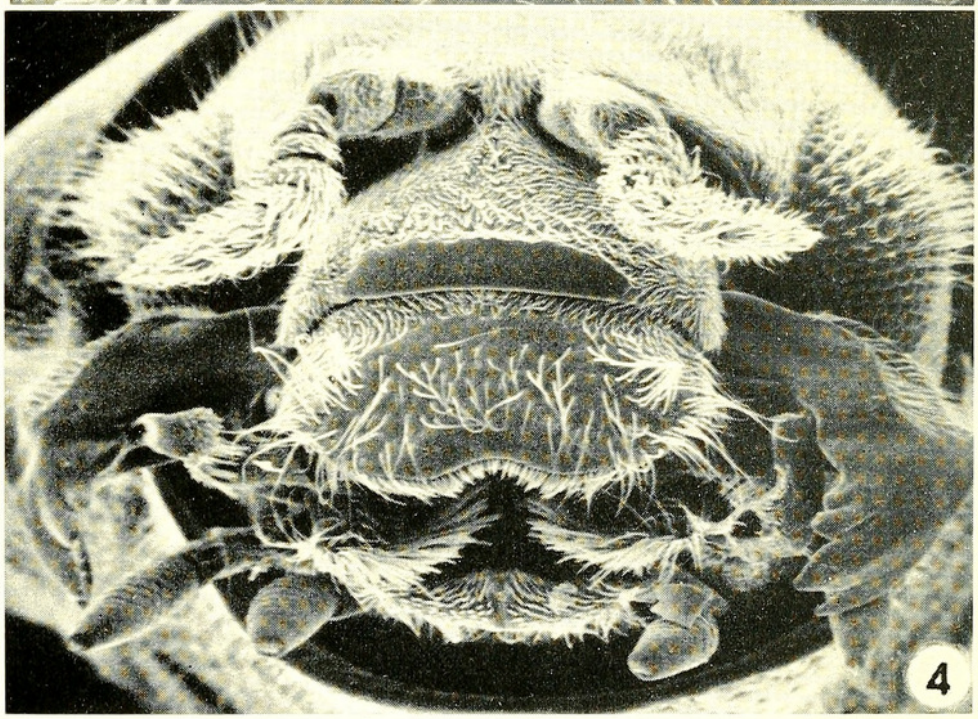
Pronotum 1.0 mm long; 1.5 mm wide, widest at base; sides arcuate; anterior side feebly margined; lateral sides strongly and distinctly mar-



FIGS. 1 & 2. Intercoxal area of metasternum: 1, *Elmoparnus pandus*, new species; 2, *E. miltops*, new species.

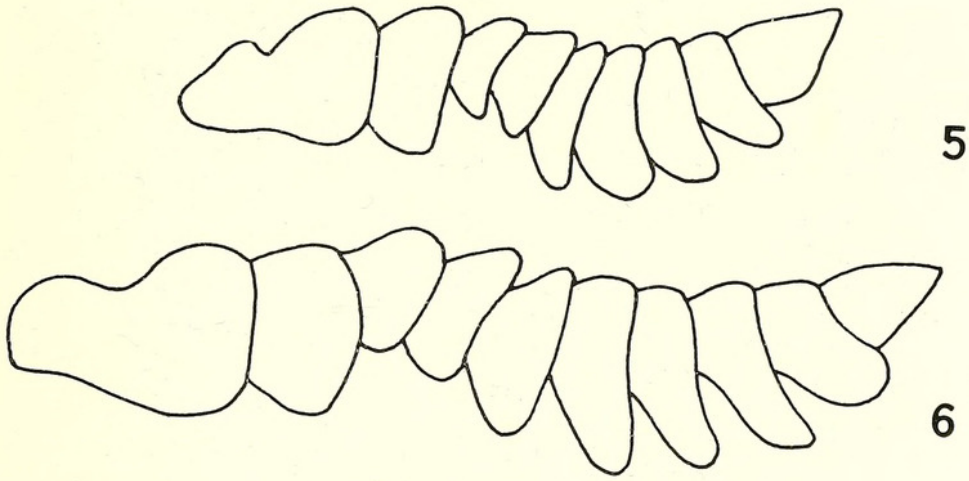
gined; posterior side not margined but strongly bisinuate; anterolateral angles strongly produced, apex acute; sublateral carinae distinct, extending from base almost to apex at each anterolateral angle; diverging so that each carina at apex is only about one-half as far from lateral margins as at base. Coarse and fine punctures intermixed and denser between sublateral carina and lateral margin. Disc with coarse (at 100×), moderately dense punctures; punctures separated by their diameter; punctures coarser and sparser adjacent to sublateral carina. Prosternum with inclined sides densely pubescent; medial surface flat, glabrous, and coarsely sparsely punctate; punctures denser along apical margin, separated by about one-half to one times their diameter. Prosternal process (Fig. 7) flat, broad, widening slightly between procoxae; sides feebly margined, arcuate, converging apically, and terminating in a slender protuberance (Fig. 8); surface glabrous, sparsely and moderately coarsely punctate; punctures separated by two to four times their diameter, denser and coarser laterally. Mesosternum deeply foveate (Fig. 9) for recep-





FIGS. 3 & 4. *Elmoparnus pandus*, new species, head: 3, Dorsal view, 110×; 4, Facial view, 100×.

tion of protuberance of prosternal process. Metasternum with antero-medial region narrow, slightly raised above plane of posterior region (Fig. 1); inclined sides densely pubescent; medial surface flat, almost glabrous, with shallow longitudinal furrow on midline, and punctate;



FIGS. 5 & 6. Antenna (pubescence omitted): 5, *Elmoparnus pandus*, new species; 6, *E. dasycheilus*, new species.

punctures moderately fine, sparse along furrow but slightly denser anteromedially between mesocoxae. Metacoxa sparsely and moderately coarsely punctate. Foreleg with tibia evenly arcuate from base to apex (Fig. 10) and a distinct notch at apical fourth (Fig. 11); foretibia bearing a dense, narrow tuft of moderately long golden setae along posteromedial edge, tuft extends distad about one-half length of tibia. Protarsal segments 1 to 3 expanded and bearing a large oblique row of dense, flat, golden setae on medial surface (Fig. 12).

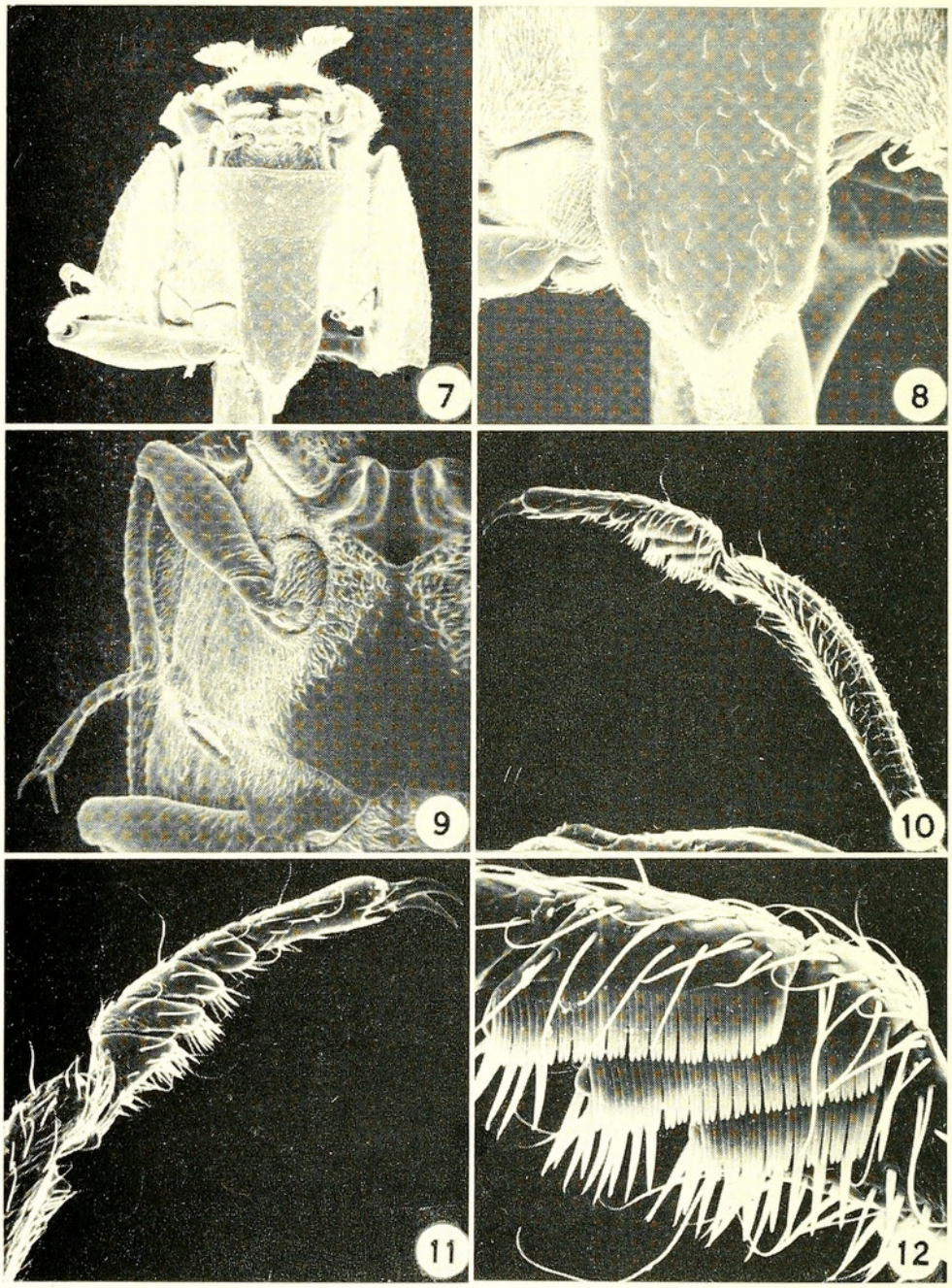
Scutellum flat, subtriangular, rounded laterally; surface finely, sparsely punctate, punctures separated by about three to four times their diameter.

Elytra punctate. Punctures coarser and denser than those on pronotal disc, and although mostly disarrayed, three poorly defined serial rows of smaller punctures are evident adjacent to suture; slightly coarser disarrayed punctures in intervals; punctures in serial rows separated by one-half to three times their diameter, those in intervals separated by one to six times their diameter. Lateral margin of each elytron with a densely pubescent respiratory fovea at about apical fourth (Figs. 13, 14). Sides of elytra rather evenly arcuate from base to apex; sides rather strongly margined.

Abdominal sterna 1 to 4 microreticulate and densely pubescent. Sternum 1 with moderately coarse, sparse punctures apicomedially; punctures separated by one to three times their diameter. Apical sternum pubescent along anterior and lateral margins, leaving a shiny, triangular, apicomedial area with only a few, fine, golden setae and a few moderately coarse punctures; punctures denser apically; distinctly notched apicomedially.

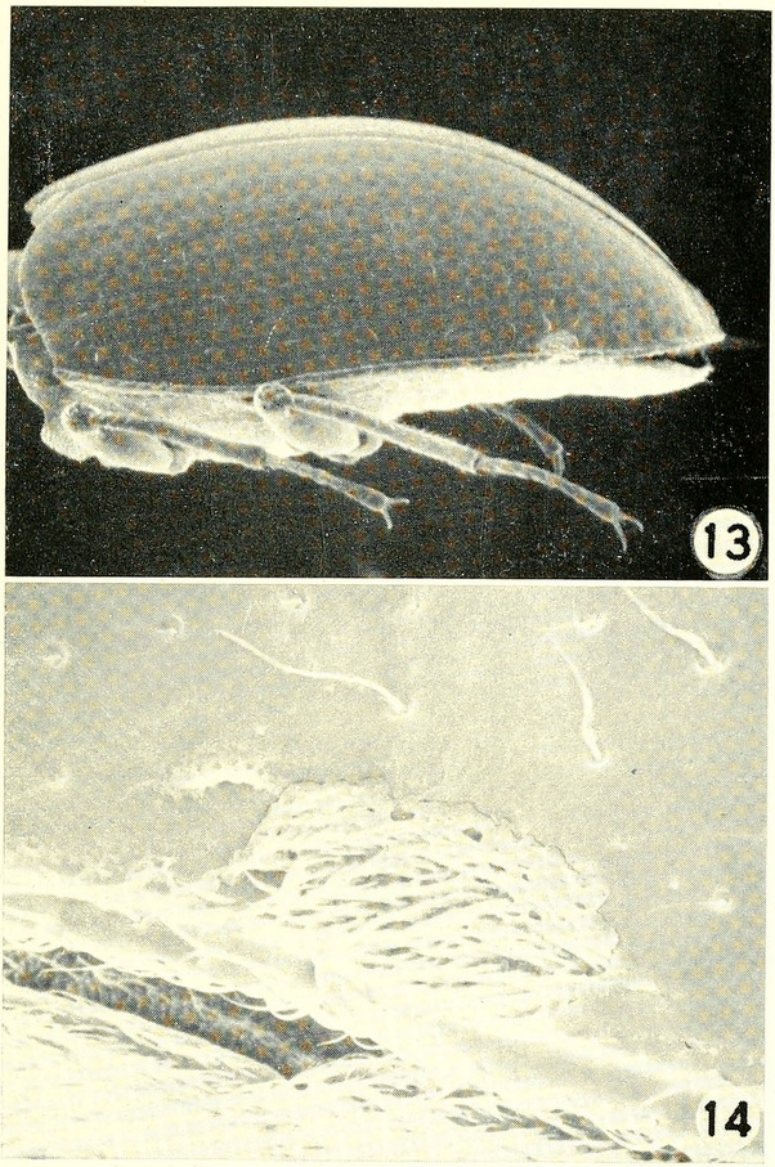
Male genitalia: As illustrated (Figs. 15, 16).

Female: Similar to male with the following exceptions: tibia of foreleg feebly arcuate and lacking the distinct notch on the inner margin at the apical fourth; first to third segments of foretarsi not expanded and



FIGS. 7–12. *Elmoparnus pandus*, new species: 7, Prosternal process, 50×; 8, Apex, prosternal process, 125×; 9, Mesosternal fovea, 70×; 10, Protibia and protarsus, ♂, 100×; 11, Foretibial notch, ♂, 160×; 12, Medial surface, protarsal segments 1–3, ♂, 495×. All figures reduced 50 percent.

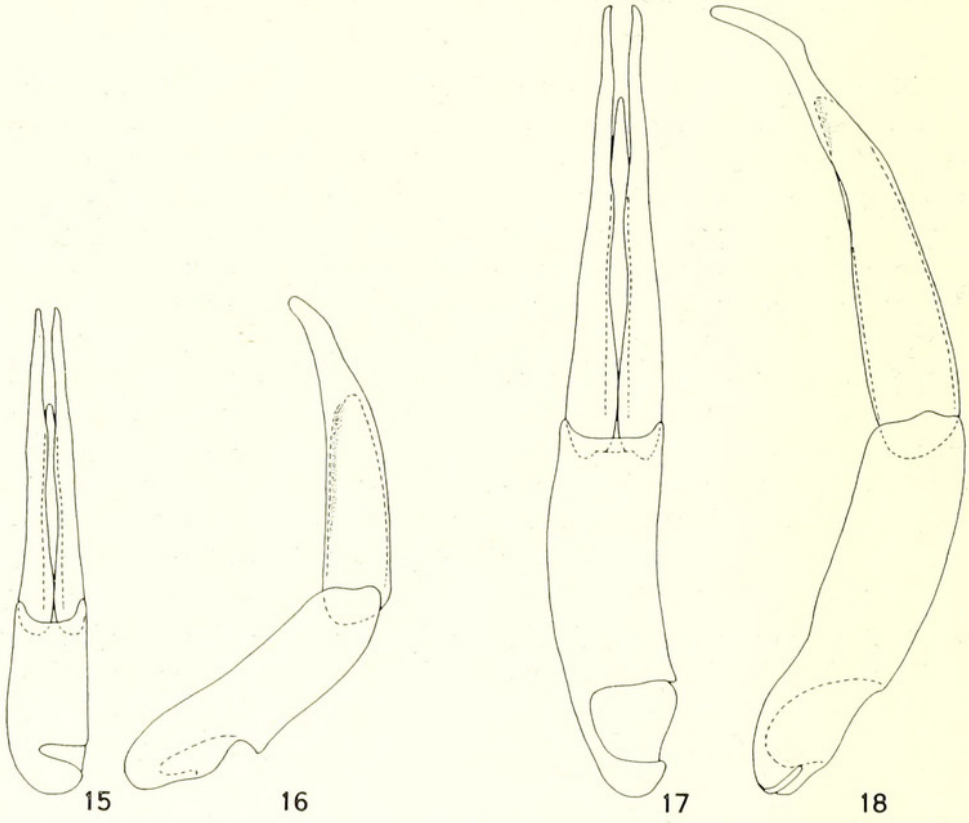
lack the large oblique row of dense, flat, golden setae on medial surface; golden setae above the glabrous liplike area of the labrum about half as long as on the males; upper edge of glabrous liplike area rounded onto the labrum instead of sharply angularly demarcated.



FIGS. 13 & 14. *Elmoparnus pandus*, new species, elytral respiratory fovea: 13, Fovea on elytron, 30×; 14, Fovea, 220×.

Type-data: Holotype male: MEXICO: Oaxaca: Valle Nacional (4 miles south), 6 July 1974, M. E. and P. D. Perkins; USNM Type No. 73943, deposited in the National Museum of Natural History, Smithsonian Institution. Allotype, same data as holotype. Paratypes: Same data as holotype, 2♂♂, 1♀. GUATEMALA: Alta Verapaz: La Tinta (5 miles west), small tropical brook, 6 June 1974, M. E. and P. D. Perkins, 3♀♀. HONDURAS: Cortes: Puerto Cortes (5 miles south), clear tropical stream, 19 June 1974, M. E. and P. D. Perkins, 1♀.

One pair of paratypes is deposited in the P. D. Perkins collection; all other specimens are deposited with the holotype.



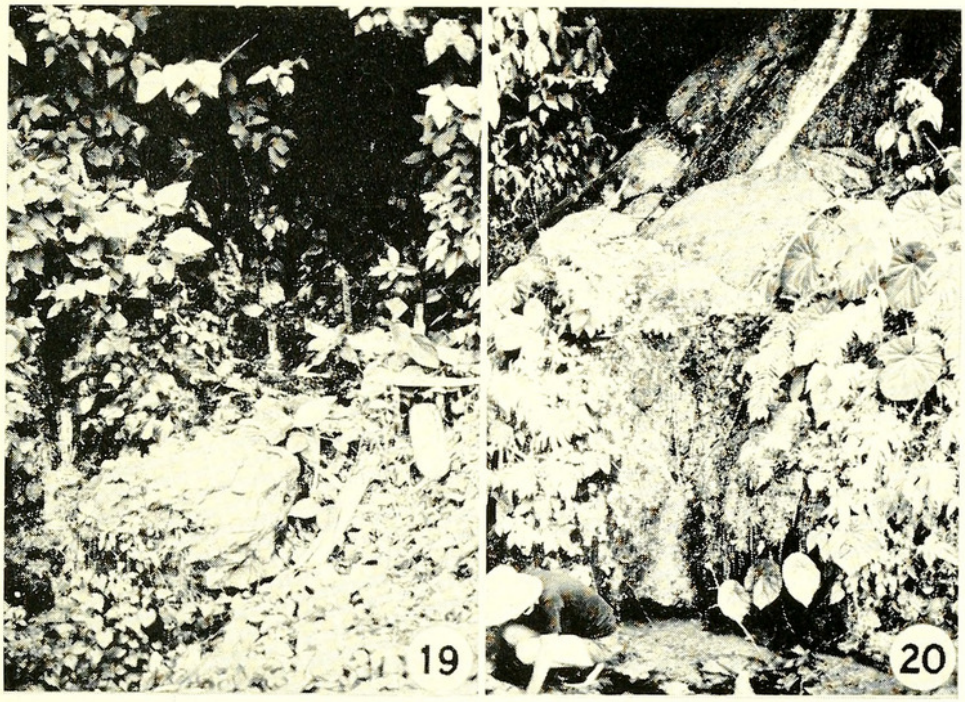
FIGS. 15–18. Male genitalia: 15–16, *Elmoparnus pandus*, new species; 15, Dorsal view; 16, Lateral view. 17–18, *Elmoparnus dasycheilus*, new species; 17, Dorsal view; 18, Lateral view.

Etymology: *pandus* from pandus, L.—curved, in reference to the moderately but distinctly curved foretibiae of the male and female of this species.

Habitat: Only two comments have been published concerning the habitat preference of this rare genus. Brown (1970a) mentioned that he had collected one specimen of *Elmoparnus* from a small cataract in southeastern Mexico. Later, Brown (1970b) added that this specimen, which he described as *E. mexicanus*, was found in the state of Chiapas at approximately 4,000 feet elevation.

In 1974, Perkins and his wife Maureen had the good fortune to collect this rare genus in three Central American countries: Mexico, Guatemala, and Honduras. The specimens proved to be members of the unnamed species described above as *E. pandus*.

The habitat at the type-locality, in the mountains of Oaxaca, Mexico, consisted of a small cataract flowing through the dense vegetation of a tropical rain forest (Fig. 19). The beetles were collected by removing debris, mainly twigs and leaves which had become trapped behind larger water-soaked branches, from the cataract. The debris was then placed



FIGS. 19 & 20. *Elmoparnus pandus*, new species, habitat: 19, Microhabitat at type-locality, Oaxaca, Mexico; 20, Biotope near La Tinta, Guatemala.

on a flat surface and spread out. The beetles were virtually impossible to find by inspecting each twig, but after a short wait to allow the debris to dry somewhat, specimens of *Elmoparnus* began to slowly emerge. Aquatic beetles collected in association included: Hydraenidae—*Hydraena* sp.; Hydrophilidae—*Anacaena* sp., *Enochrus* sp.; Elmidae—*Cylloepus* sp.

The biotope of *E. pandus* in Guatemala consisted of a small cataract, a portion of which was flowing over the exposed roots of a tree (Fig. 20). Although quite different in general appearance from the Oaxacan locality, the microhabitat in Guatemala was quite similar. Again, adults of *Elmoparnus* were found by removing water-soaked debris, mainly twigs, placing it on a nylon sheet, and allowing it to dry. Associated aquatic beetles included: Hydraenidae—*Hydraena* sp.; Hydrophilidae—*Notionotus* sp.

The third locality, consisting of a shallow, rapid tropical stream in Honduras, was quite different than the preceding two. A single specimen of *Elmoparnus pandus* was found while stirring up the margin of a gravel bar in midstream. The beetle, in contrast to the numerous hydrophilid specimens with which it was found, did not float to the surface when dislodged from the substratum. Other associated aquatic beetles included: Hydrophilidae—*Anacaena* sp., *Enochrus* sp.; Elmidae—*Heterelmis* sp.

Elmoparnus miltops, new species
Figure 2

This new species is similar to *E. brevicornis*, *E. pandus*, and *E. mexicanus* because all four species have 9-segmented antennae. However, the greater length (5.6 mm) of *E. mexicanus* will easily distinguish it from the other three species which are much shorter (3.1 to 3.5 mm). Both *E. miltops* and *E. pandus* may be distinguished readily from *E. brevicornis* by the sublateral carina extending from base to apex instead of being restricted to the basal two-fifths as it is in *E. brevicornis*. From *E. pandus*, which it most closely resembles, *E. miltops* may be distinguished by the form and sculpture of the anteromedial region of the metasternum which is wider, distinctly elevated, and possesses coarse, sometimes confluent punctures (Fig. 2) instead of being narrow, weakly elevated, and with small widely separated punctures (Fig. 1). In addition, the posterior coxae of *E. miltops* are more densely and coarsely punctate than the posterior coxae of *E. pandus*.

Holotype female: Length 3.4 mm; width 1.7 mm. Body form obovate, moderately strongly convex dorsally. Color black dorsally except antennae, clypeus, and labrum light reddish brown. Venter black with reddish tinge except all palpi, labium, apical margin of prosternum, tibiae, tarsi, and apex of last abdominal sternum lighter reddish brown.

Head finely microreticulate and densely pubescent except anterior edge of clypeus glabrous. Eyes with large convex facets also pubescent. Antenna 9 segmented. Labrum shallowly emarginate anteromedially; emargination bordered by a glabrous liplike area; upper edge of liplike area is rounded onto labrum instead of being sharply demarcated; labral surface above liplike area densely microreticulate, with numerous short, scattered, golden setae and a few long golden setae; anterolateral angles broadly rounded.

Pronotum 1.0 mm long; 1.5 mm wide, widest at base; sides arcuate; anterior side feebly margined; lateral sides strongly and distinctly margined; posterior side not margined but strongly bisinuate; anterolateral angles strongly produced, apex acute; sublateral carinae distinct, extending from base almost to apex at each anterolateral angle; diverging so that each carina is only about one-half as far from lateral margins as at base; coarse and fine punctures intermixed and denser between sublateral carina and lateral margin. Pronotal disc with coarse (at 100×) moderately dense punctures; punctures separated by their diameter; punctures coarser and sparser adjacent to sublateral carina. Prosternum with inclined sides densely pubescent; medial surface flat, glabrous, and coarsely sparsely punctate; punctures denser along apical margin and separated by one-half to one times their diameter. Prosternal process flat, broad, widening slightly between procoxae; sides feebly margined, arcuate, and converging apically; terminating in a slender protuberance; surface glabrous, sparsely and moderately coarsely punctate; punctures separated by two to three times their diameter, denser and coarser laterally. Meso-

sternum deeply foveate for reception of protuberance of prosternal process. Metasternum with anteromedial region broad, moderately but distinctly raised above plane of posterior region (Fig. 2); inclined sides densely pubescent; medial surface flat, almost glabrous, punctate, with fine shallow longitudinal furrow on midline; punctures moderately coarse and sparse along furow but some very coarse and some confluent punctures anteromedially (Fig. 2). Metacoxa densely, coarsely punctate. Foretibiae evenly arcuate from base to apex.

Scutellum flat, subtriangular, rounded laterally; surface finely sparsely punctate, punctures separated by a distance about three to four times their diameter.

Elytra punctate. Punctures coarser and denser than those on pronotal disc; disc with coarse punctures adjacent to suture in poorly defined rows, punctures separated by one-half to two times their diameter. Lateral margin of each elytron with a densely pubescent respiratory fovea at about apical fourth. Sides of elytra rather evenly arcuate from base to apex; sides rather strongly margined.

Abdominal sterna 1 to 4 densely pubescent. Sternum 1 with moderately fine, sparse punctures anteromedially; punctures separated by one to three times their diameter. Apical sternum densely pubescent along anterior and lateral margins leaving a shiny, triangular, apicomedial area with only a few, fine, golden setae and a few moderately coarse punctures; punctures denser apically; distinctly notched apicomedially.

Male: Unknown.

Type-data: Holotype female; ECUADOR: Zamora-Chinchipe: Zamora, 9 June 1976, Andrea Langley et al.; USNM Type No. 73944, deposited in the National Museum of Natural History, Smithsonian Institution.

Etymology: *miltops*, from miltos, G.—red, plus *ops*, G.—face, in reference to the reddish labrum and clypeus of the species.

Habitat: The single female specimen was collected about 1 km from Zamora on the Zamora-Gualaquiza road in a small pool in a roadside drainage ditch. The partially shaded ditch was fed by tiny rills flowing down from the mountainside. Trichoptera larvae were collected along with the holotype indicating a lotic habitat.

Elmoparnus dasycheilus, new species
Figures 6, 17, 18

This new species is similar to *Elmoparnus glaber* Grouvelle, the only other species in the genus with 10-segmented antennae. From *E. glaber*, this new species may be distinguished by the flat instead of deeply grooved prosternal process.

Holotype male: Length 4.9 mm; width 2.4 mm. Body form obovate, moderately strongly convex dorsally. Color black dorsally except antennae, eyes, and labrum reddish brown; pronotum and elytra virtually glabrous; head not shining black like pronotum and elytra because of dense golden setae and microreticulate surface. Venter black except all

palpi, labium, apical margin of pronotum, tibiae, tarsi, and apex of last abdominal sternum reddish brown.

Head finely microreticulate and densely pubescent except anterior edge of clypeus which is glabrous; eyes with large convex facets also pubescent. Antennae 10 segmented (Fig. 6). Labrum moderately emarginate anteromedially; emargination bordered by a glabrous liplike area; upper edge of liplike area sharply, angularly demarcated; labral surface above liplike area densely microreticulate and provided with long, golden upswept setae dorsolaterally resembling a mustache; anterolateral angles broadly rounded.

Pronotum 1.3 mm long, 1.8 mm wide; widest across basal fourth; side arcuate; anterior and lateral sides distinctly margined; posterior side not margined but strongly bisinuate; anterolateral angles strongly produced, apex blunt; sublateral carinae distinct, extending from base almost to apex at each anterolateral angle; diverging so that each carina is only about one-half as far from lateral margins as at base. Coarse and fine punctures intermixed and sparse between sublateral carina and lateral margin. Disc with coarse (at 100×), moderately dense punctures; punctures separated by a distance about twice their diameter; punctures coarse and fine intermixed and denser laterally. Prosternum with inclined sides densely pubescent; medial surface flat, glabrous, and rather finely sparsely punctate; punctures denser along anterior margin and separated by a distance one-half to one times their diameter. Prosternal process flat, widening slightly between procoxae; sides feebly margined, arcuate, converging apically and terminating in a slender protuberance; surface glabrous, and sparsely, moderately coarsely punctate; punctures separated by three to eight times their diameter. Mesosternum deeply foveate for reception of protuberance of prosternal process. Metasternum with inclined sides densely pubescent; medial surface flat, glabrous, with shallow longitudinal furrow on midline, and punctate; punctures moderately coarse, moderately sparse along furrow but dense, slightly rugose anteromedially between mesocoxae. Foreleg with tibia curved, abruptly bent at apical fourth; bearing a sparse, narrow tuft of moderately long golden setae along posteromedial edge; tuft extends distad about one-half length of tibia. Protarsal segments 1 to 3 expanded and bearing a large oblique row of dense, flat, golden setae on medial surface.

Scutellum flat, subtriangular, rounded laterally; surface finely, sparsely punctate; punctures separated by a distance almost four to six times their diameter.

Elytra punctate; punctures moderately coarse, slightly smaller and varying more in size than those on pronotal disc; punctures on disc separated by a distance two to six times their diameter; each puncture bearing a microseta; lateral margin of each elytron with a densely pubescent respiratory fovea at about apical fourth. Sides of elytra diverging to basal fifth then feebly angulate and thereafter arcuate and converging very gradually to apices; sides strongly margined.

Abdominal sterna 1 to 4 microreticulate and densely pubescent. Apical

sternum with dense pubescence along anterior and lateral margins leaving a shiny, triangular, apicomedial area with only a few, fine, golden setae and a few coarse punctures; punctures denser apically; distinctly notched apicomedially.

Male genitalia as illustrated (Figs. 17, 18).

Female: Similar to male with the following exceptions: tibia of foreleg feebly arcuate and lacking the moderately abrupt bend at the apical fourth; first to third segments of foretarsi are not expanded and lack the large oblique row of dense, flat, golden setae on medial surface; golden setae above the glabrous liplike area of the labrum are about one-half as long on both females of the type-series as on the male; upper edge of the glabrous liplike area rounded onto the labrum instead of sharply, angularly demarcated.

Type-data: Holotype male; ECUADOR: Pastaza: Tarqui, 10 February 1976, Spangler et al.; USNM Type No. 73954, deposited in the National Museum of Natural History, Smithsonian Institution. Allotype, same data as holotype. Paratype, same data as holotype, 1 ♀.

Etymology: *dasycheilus*, from dasy, G.—hairy, plus *cheilus* from cheilos, G.—lip, in reference to the very long golden fringe of setae on the labrum which is especially obvious on the male.

Habitat: Collected from leaves and twigs drifted against rocks in a very small stream, which was well shaded by dense overhanging vegetation.

Respiration

Perkins collected and observed specimens of *E. pandus* at the type-locality and his observations are given below along with a general discussion of the unique morphological adaptations for respiration in the genus *Elmoparnus*.

Specimens of *E. pandus*, collected at the type-locality, were placed in a vial containing water and a few small twigs. When viewed with a microscope, the beetles were seen to periodically crawl up the twigs to a position just below the surface of the water. The beetles then would bring their antennae forward so that the air layer surrounding one antenna became contiguous with the air layer surrounding the other. Each antenna was slightly arched, resulting in a small separation of the apical segments of one antenna from the apical segments of the other (Fig. 3). The beetles would then move toward the surface of the water and break the surface film with the antennae. After remaining in this position for a short time, the beetles would turn and crawl downward on the twig.

Apparently respiration in *Elmoparnus* is accomplished as follows. Contact is made with atmospheric air by the antennae which are covered with hydrofuge pubescence; thus a thin layer of air surrounds the antennal segments. Each antenna, when held next to the head, lies beneath a large tuft of hairs. These hairs plus others on the head also constitute hydrofuge pubescence and result in the head, with the exception of the

palpi and a portion of the labrum, being surrounded by a layer of air. Therefore, oxygen-rich atmospheric air is transmitted from the surface of the water by way of the hydrofuge pubescence on the antennae to the head and then to the ventral bubble where respiration takes place.

The function of the antennae in respiration in *Elmoparnus* is unique among the known Dryopidae. Most dryopids have dense hydrofuge hairs on the dorsal surface, but the antennae do not function to replenish the air supply as they do in *Elmoparnus*. The other known dryopids have a plastron which maintains a thin layer of air against a pressure differential (Thorpe, 1950). This allows the beetles to obtain oxygen directly from the water, thus obviating the necessity of contacting atmospheric air. As a result, these dryopids, although they cannot swim, are able to utilize habitats far beneath the surface of deep streams and rivers. However, *Elmoparnus*, which also cannot swim, must remain near the surface of the water to obtain atmospheric air, and this may partially explain why most specimens of *Elmoparnus* have been collected from cascades and small brooks where the water is relatively shallow.

Many aquatic beetles, most notably the Hydraenidae and Hydrophilidae, use the antennae to form an air funnel between the atmospheric air and the air reservoir which is held by hydrofuge pubescence to the venter. The antennae of hydraenids and hydrophilids are inserted on the lateral areas of the head and function independently for air replenishment. This lateral placement of the antennae allows the hydraenids and hydrophilids to obtain air when either side of the body or the dorsum of the head is close to the surface of the water.

In marked contrast, the antennae of *Elmoparnus* are inserted near the midregion of the head and do not function independently; therefore *Elmoparnus* apparently can use the antennae to obtain air only when the dorsum of the head is close to the surface of the water. If this is true, certain restrictions would be imposed on the activity of the beetles. Beetles which are feeding in a head downward position would have to periodically interrupt the feeding process to return to the surface to replenish the air supply. These supposed restrictions may explain the unusual, densely pubescent respiratory fovea on the lateral elytral margin of all known species of *Elmoparnus* (Figs. 13, 14). This respiratory fovea is not found on any other known Dryopidae (Hinton, 1940). Observations on living, submerged beetles have shown that the respiratory fovea holds a small bubble of air which is connected to the ventral bubble by a narrow, pubescent channel.

The respiratory foveae may have evolved to allow *Elmoparnus* to obtain atmospheric air when the beetle is oriented with its side close to the surface of the water and when in a head downward position. If this is the case, *Elmoparnus* would be capable of feeding in a head downward position without the necessity of periodically stopping to obtain air. Further observations are needed to confirm this hypothesis because such behavior was not witnessed. (The observation vials contained only twigs of small diameters and these were placed at approxi-

mately a 45 degree angle to the surface of the water. Further studies might involve horizontal twigs placed just below the surface.)

Discussion

Previous accounts of the morphology, habitats, and behavior of the species of *Elmoparnus* have been understandably brief and incomplete or lacking because of the rarity of specimens for study and observation. Our examination of both sexes and of a greater number of specimens than were previously available, as well as observations of living specimens of *E. pandus*, has added materially to our knowledge of the morphology and behavior of the species of *Elmoparnus*. However, the males of *mexicanus* and *miltops* are still unknown and further observations on living material are needed to confirm or refute some of the ideas we express regarding certain aspects of their respiratory behavior, e.g., firsthand observations on the use of the respiratory fovea on each elytron.

Hinton (1940), in his redescription of Sharp's type, mentions the presence of the long labral setae on the male holotype of *E. brevicornis*. This appears to be a characteristic of the males of all of the species of *Elmoparnus*. At least we now can confirm that males of *E. brevicornis*, *E. glaber*, *E. dasycheilus*, and *E. pandus* have the long labral setae. In addition the males of *E. glaber*, *E. dasycheilus*, and *E. pandus* have the following characters in common: protarsal segments 1 to 3 distinctly expanded and provided with oblique rows of flat, dense, golden setae; and a rather distinct bend or an obvious notch present at the apical fourth of the protibia. We believe these secondary sexual modifications of the males will be present on the males of *E. mexicanus* when they are found. No mention is made of a tuft of longer setae on the protibiae, expanded protarsi, or distinct bend or notch at the apical fourth of the protibia for *E. brevicornis* by Hinton (1940). If Hinton's habitus illustration of *E. brevicornis* was drawn from Sharp's male holotype, it apparently lacks the expanded protarsi and notch or obvious bend at apical fourth of the protibia mentioned above. We have not seen Sharp's unique male type.

The glabrous dorsal surface of the species of *Elmoparnus* may be an adaptation which decreases resistance to the flow of water, thereby allowing these insects to utilize habitats with fast currents such as cascades. However, the slick surface may present problems during copulation, because the male could be easily dislodged from the female by a fast current. Apparently the species of *Elmoparnus* have solved this problem in a manner similar to certain hydraenids and hydrophilids—by increasing the adhering abilities of the male protarsi. This is accomplished by an expansion of the first three protarsal segments and modification of the setae to form comblike structures (Figs. 10, 11, 12). In addition, the well-developed notch of the protibia (Fig. 11) of the male *E. pandus*, and the obvious bend of the protibia of males of other species at its apical fourth probably aids in firmly grasping the female. The pro-

tarsi of the males of the known species of *Elmoparnus* are quite unlike those of other described dryopids because the others lack the expanded protarsal segments and the modified setae.

In Hinton's (1940) redescription of Sharp's *E. brevicornis* he illustrated the prosternal process and showed it terminating in a slender protuberance. Later, when Brown (1970) described *E. mexicanus*, he also illustrated the prosternal process of his new species but he illustrated it as without an apical protuberance and used this as a character in his key to separate *E. mexicanus* from *E. glaber*. However, all specimens of all species we have examined have the apical protuberance on the prosternal process and we believe it is present on *E. mexicanus* too. The reason Brown probably overlooked the protuberance is easily explained because in its normal position the protuberance (Figs. 7, 8) fits compactly into a deep fovea (Fig. 9) in the mesosternum. In order to see the protuberance, the prosternal process must be disarticulated from the mesosternum.

The first species known, *E. brevicornis* described by Sharp in 1882, is still known only from the type-specimen and the one additional specimen from Panama reported by Hinton in 1940. The second species discovered, *E. glaber*, described by Grouvelle in 1889, was known only by the type-series until this year when Dr. Oliver S. Flint, Jr., and his wife Carol collected the following specimens. Venezuela: Merida: Merida (27 km W, on Rt. 4), 20 Feb. 1976, 2♂♂, 2♀♀. Venezuela: Aragua: Rancho Grande (4 km S), 5 Feb. 1976, 1♀. The third species known, *E. mexicanus* described by Brown in 1970, is known only from the type-specimen.

Obviously specimens of *Elmoparnus* are rare in collections and special efforts must be made by collectors to find them. Frequent lighttrap collections made over a 2-year period in Ecuador failed to attract a single specimen of *Elmoparnus*; therefore, we doubt that they will be collected by this method. Hand sorting through sticks, leaves, and similar debris caught against rocks and logs in small streams and cascades as discussed under the descriptions of the new species of *Elmoparnus* seems to be the most practical and productive way to collect these elusive beetles.

Of the six species of *Elmoparnus* now known, four have 9-segmented antennae. One of these species, *E. mexicanus*, is known only from Mexico; one species, *E. pandus*, is known from Mexico and Central America; the third species, *E. brevicornis*, is known from Central America; and the fourth species, *E. miltops*, is known from South America. The two known species with 10-segmented antennae, *E. glaber* and *E. dasycheilus*, are known only from South America. The six species of *Elmoparnus* may be distinguished by use of the following key.

Key to the Species of *Elmoparnus*

1. Sublateral carina confined to basal two-fifths of pronotum; antenna 9 segmented; Panama ..... *E. brevicornis* Sharp

Sublateral carina extending nearly entire length of pronotum; antennae 9 or 10 segmented 2

2. Antennae of 9 segments 3
   Antennae of 10 segments 5
3. Length about 5.6 mm; clypeus black; Mexico ..... *E. mexicanus* Brown
   Length 3.4 mm to 3.5 mm; clypeus reddish brown; Mexico, Central America, and South America 4
4. Anteromedial region of metasternum narrow, very slightly or not at all raised above plane of posterior portion of metasternum, and bearing small sparse punctures (Fig. 1); hind coxae sparsely and moderately coarsely punctate; Mexico and Central America ..... *E. pandus*, new species
   Anteromedial region of metasternum wide, raised above plane of posterior portion of metasternum, and bearing large, frequently confluent punctures (Fig. 2); hind coxae densely and coarsely punctate; Ecuador ..... *E. miltops*, new species
5. Middle of prosternal process rather deeply longitudinally grooved; Venezuela ..... *E. glaber* Grouvelle
   Middle of prosternal process flat; Ecuador ..... *E. dasycheilus*, new species

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