

UNUSUAL MORPHOLOGY IN A NEW GENUS AND SPECIES OF CERATOCANTHINAE
FROM NEW GUINEA (COLEOPTERA: SCARABAEOIDEA: HYBOSORIDAE)

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Abstract

Oxymorostes riedeli new genus and species is described from the Indonesian part of New Guinea. This new taxon is characterized by a number of unique characters: the presence of a deep excavation in the hypomeron and the unusually modified humeral area of the elytra. Its closest relationships seem to be within the newly defined “*Perignamptus* genus group”, characterized by mouthparts morphology, including the presence of a large pore on the mandibular surface. This group gathers at least the Oriental/Australasian genera *Madrasostes* Paulian, *Perignamptus* Harold, and *Macrophilharmostes* Paulian as well as a few species currently placed in other genera.

The Oriental/Australasian genus *Madrasostes* Paulian, 1975 (Coleoptera: Scarabaeoidea: Hybosoridae: Ceratocanthinae) displays an extensive morphological diversity, not only involving elytral, pronotal, and head morphology, but also sexual dimorphism and genitalia. After its description, several species have been ascribed to it, without paying particular attention to finding reliable characters for a definition of the genus. As a result, there exist a single, large composite genus and a series of smaller satellite genera, all of them poorly defined, but seeming to share many important characters with *Madrasostes*. It is possible that most of these genera (including *Madrasostes*) could be polyphyletic (or paraphyletic with respect to *Madrasostes*). In an attempt to cope with this extreme diversity I undertook a morphological exploration of all the species ascribed to *Madrasostes* and its allied genera. A series of synapomorphies (mainly in mouthparts morphology) suggests that *Madrasostes* and its allies could be a monophyletic group. Due to the extreme morphological diversity found in the group, given the current concept of genus in the subfamily, it seems quite clear that the current classification needs to be strongly modified, with the splitting of *Madrasostes* into a number of smaller genera and the erection of new genera, some of them monotypic. One such example is the new genus described below, which shows a number of unusual, often unique, character states, such as the presence of prothoracic cavities, the oddly shaped elytral humeri, the raised pronotal basal edge, and the single apical mesotibial spur. This combination of character states (the first two being autapomorphic) warrants the creation of a separate genus, although mouthparts morphology indicates close relationships with *Madrasostes*. This new genus is remarkable not only because of its unusual morphology but also because of its geographical distribution. The Ceratocanthinae (Coleoptera: Scarabaeoidea: Hybosoridae) fauna of New Guinea is still very poorly known. Published records would suggest that New Guinea is a marginal area, inhabited only by a few species belonging to widespread Oriental/Australasian genera, such as *Pterorthochaetes* Gestro, 1899, *Madrasostes*, and *Cyphopisthes* Gestro, 1899 (Ocampo and Ballerio 2006; Paulian 1978, 1981). Two

endemic genera (*Perignamptus* Harold, 1877 with three species and the monotypic *Macrophilharmostes* Paulian, 1978) are poorly differentiated from *Madrasostes*. However, the discovery of the present new genus, as well as of several other still undescribed taxa of Ceratocanthinae (mostly in the Staatliche Museum für Naturkunde Stuttgart collection) adds greatly to the known fauna, making New Guinea an important center of speciation and endemism for the subfamily.

Materials and Methods

I refer to Ballerio (2000*a, b*, 2001, 2004) for methods and terminological conventions. In giving label data, author's comments are in square brackets, while depository collection acronyms are in round brackets. Micrographs were obtained with a Zeiss EVO 40 XVP Scanning Electron Microscope at the Museo Tridentino di Scienze Naturali (Trento, Italy), after gold coating.

All Ceratocanthini have the labrum attached to a vertical wall perpendicular to the longitudinal axis of the head. This wall has been regarded as the true clypeus (Hesse 1948) or as a part of it (Ballerio 2000*a*). Up to now I have used the term vertical portion of the clypeus for that structure, which, in some genera such as *Cryptophilharmostes* Ballerio, 2000 or *Pseudosynarmostes* Ballerio, 2008, is conspicuous and diagnostic. From now on, following Krikken (2008), I will adopt the term "clypeopleuron" for that structure, which I find more appropriate.

- EL = maximum elytral length
- EW = maximum total elytral width
- HL = maximum head length
- HW = maximum head width
- L = length
- PL = maximum pronotal length at middle
- PW = maximum pronotal width at middle
- W = width

SMNS: Staatliche Museum für Naturkunde Stuttgart collection, Stuttgart, Germany;

ABCB: Alberto Ballerio collection, Brescia, Italy.

Oxymorostes Ballerio, new genus

Type species: *Oxymorostes riedeli* Ballerio, new species

Description. Small Ceratocanthinae, body shiny, setose; "rolling up" coaptations perfect; flightless. *Head:* wide (W/L ratio = 1.5), pentagonal, fore portion triangular, apex forming an obtuse angle (about 120°), both sides of the angle rectilinear, irregularly finely serrated, not reflexed upward, tip of triangle blunt; genae almost aligned with fore margin, slightly protruding outwards while forming a rounded acute angle, genal canthus indistinct, dorsal ocular area absent, ventral ocular area small, narrow, almost entirely visible from above; dorsal surface almost plane, with variable punctures, transversal striae and pubescence. Clypeopleuron short and transversely slightly grooved at each side. Labrum wide and short, hemispherical, distally fringed by long fine setae directed forward. Distal epipharynx (Fig. 5) semicircular, longitudinally divided by a strong anterior median process; pariae distinctly raised with respect to the haptolachus; median brush and corypha absent; apical fringe made of long, fine setae, absent in the middle. Mentum (Fig. 3) ventrally flat, widely emarginated in

the middle, emargination regularly wide-U-shaped; labial palpi (including palpiger) four-segmented, first segment short and transverse, segment two short, segment three longer and plumper than preceding one, segment four subconical, apically bearing some short sensilla, all segments, apart from the last one, fringed with long setae. Maxillae (Fig. 4) with an elongate single membranous lacinia, covered with fine long setae, monolobed galea proximally sclerotized and distally clothed with coarse long, fine setae with distinctive comb-like tip (galeal brush) (Fig. 6), maxillary palpi (including palpiger) four-segmented, palpiger small, segment two wide and short, segment three short, segment four long and subconical, about as long as preceding two together, apically bearing some short sensilla. Mandibles (Fig. 2) short, regularly curved, apicalis with pointed apical tooth very short and blunt, not protruding over mesal brush, lateral sclerite of apicalis bearing a distinct large pore (Figs. 2c and 9), conjunctive present, mesal brush wide and well developed, basalis with molar lobe strong. Antennae 10-segmented (Fig. 8), scape long (about half the total length of antenna), distally slightly clavate, pedicellus plump and rounded, flagellum short, made of short articles distinctly wider than long, antennal club three-segmented, uniformly hairy. *Thorax*: Pronotum subtrapezoidal, wider than long (W/L ratio = 1.7–1.8), distinctly wider than elytra; fore margin feebly bisinuate; fore angles slightly but distinctly protruding forward, broadly subtruncate at apex; fore edge continuously, finely margined, edges of sides and base without any visible margin (dorsal view); base at middle slightly protruding backwards, basal edge strongly swollen and raised (Fig. 7); pronotal surface regularly convex with one wide shallow depression at each side of disc (paradiscal depressions). Ventral areas of prothorax slightly alutaceous, setigerously punctured, with setae very fine and long; edge between pronotal borders and hypomeron swollen and densely covered by short, thick, clavate setae; hypomeron folded in with a wide, deep excavation about as long as two-thirds the length of prothorax, excavation with sparse, short, clavate setae (Fig. 11). Scutellum wider than long (W/L ratio = 1.4), sides proximally subparallel and distinctly notched by elytral articular process, then convergent to form a triangle with elongate acute apex and sides slightly curved inward. Surface slightly depressed in the middle. Procoxae transverse, apices nearly touching each other; fore trochanters relatively wide, with fore tips bearing a tuft of long setae; profemora slender, fore margin slightly curved inwards, surface almost smooth with few recumbent setae; protibiae straight, inner side sinuate, outer side finely irregularly serrate, ending apically with two distinct transverse teeth, apical spur relatively long, sharp, distally curved downward, protarsi with first article longer than the following three articles together, articles two to four relatively plump, article five slightly longer than the former, bearing two short curved claws, each tarsomere, except the last one, ventrally bearing a tuft of fine setae. Apical portion of mesepisterna not visible from above. Mesosternum narrow, short and plump, mesocoxae large, almost contiguous, transverse, trochanters narrow, with hind tip acute, mesofemora slender, surface smooth, with hind edge emarginated at distal third; mesotibiae slender, inner angle of apex with one straight apical spur, mesotarsi inserted near the inner angle of apical edge, slightly longer than apical edge of tibia, with first four articles plump and subequal, fifth slightly longer than the preceding one, bearing two small curved claws; each tarsomere, except the last one, ventrally bearing a tuft of coarse setae; trochanters of metafemora narrow, with hind tip acute, metafemora plumper than mesofemora, surface hairy, hind edge distally with a small emargination, metatibiae triangular, elongate, flat, inner side not sinuated, ending

with two straight and sharp fine spurs paired at the inner angle of the tibia, metatarsi almost as long as the apical edge of tibia, first article almost as long as the following two together, articles two to four short and plump, fifth longer than the fourth, which ends with two small, feebly curved claws; each tarsomere, with the exception of the last one, ventrally bearing a tuft of coarse setae. Outer face of meso- and metatibiae with longitudinal striae along inner margin and some short, sparse, clavate setae along outer margin, which is fringed by spaced out sharp, short setae. Elytra longer than wide (W/L ratio = 1.06–1.16), apical fourth regularly rounded (dorsal view), apex slightly re-entering inward (lateral view); elytra regularly convex, although slightly flattened at disc; elytral suture not or very finely raised; inferior sutural stria present, ending just before humeral area, delimiting a rather developed marginal elytral area; marginal area extremely developed, smooth, strongly incavated (Fig. 7), with a sharp dorsal border separating it from dorsal elytral surface, articular area lacking striation, large so to match the swollen posterior angles of pronotum when the beetle rolls up its body, visible in lateral view; humeral callus absent; elytral articular process small, smooth and shiny. Flightless (apterous). *Sexual dimorphism*: male apical protibial spur plumper than in female and with distal third more noticeably bent downwards, apical mesotibial spur straight, inner apical mesotibial angle acutely expanded (false spur) as compared to the hooked apical spur usually present in other ceratocanthine genera (Fig. 10) (Ballerio 2006). Females with apical protibial spur slender, gently bent downwards, apical mesotibial spur straight, lacking any false transverse spur.

Etymology. From the Ancient Greek *οξυμωρος* meaning “union of two opposites,” due to the beetle’s striking appearance with a very wide pronotum and narrow elytra. The suffix *-ostes*, is used, as done by Paulian for most of the genera of Ceratocanthinae he created. The suffix was taken (R. Paulian, pers. comm.) from two of the first genera to be established for the subfamily, *i.e.*, *Philharmostes* Kolbe, 1895 and *Synarmostes* Germar, 1843, and is a contraction of *-armostes* which derives from the Ancient Greek *αρμοζειν* meaning “to match together,” “to fit,” clearly referring to the coaptation capabilities of these weird beetles. The gender is masculine.

Diagnosis. *Oxymorostes* can be easily identified among all other Ceratocanthinae genera by the following combination of characters: (a) prothorax with a deep ventrolateral excavation; (b) basal edge of pronotum swollen and raised; (c) elytral humeri strongly modified; (d) single apical mesotibial spur.

Remarks. Finding the closest relationship of this genus requires a phylogenetic analysis which is not yet available. A preliminary analysis considering external morphology, mouthparts, and male and female genitalia suggests that *Oxymorostes* could fall within a group of Oriental/Australasian genera formed by *Perignamptus*, *Madrasostes* and *Macrophilharmostes*, as well as a few species currently placed in other genera, namely *Besuchetostes jaccoudi* Paulian, 1977, *Besuchetostes howdeni* Paulian, 1979, *Cyphopisthes inexpectatus* Paulian, 1981, and *Eusphaeropeltis sabah* Paulian, 1989. This group will be named hereafter as the “*Perignamptus* genus group” (since *Perignamptus* was the first genus belonging to it to be established). It is defined mainly on the basis of mouthparts morphology, which has already proven to be a source of important characters for reconstructing the phylogeny of Ceratocanthinae (Ballerio 2008). The combination of characters shared by these genera is: (a) labrum hemicircular with two shallow paradiscal depressions and a fringe of dense, long setae; (b) epipharynx as in Figure 5: hemicircular in shape, with a strongly raised median process; (c)

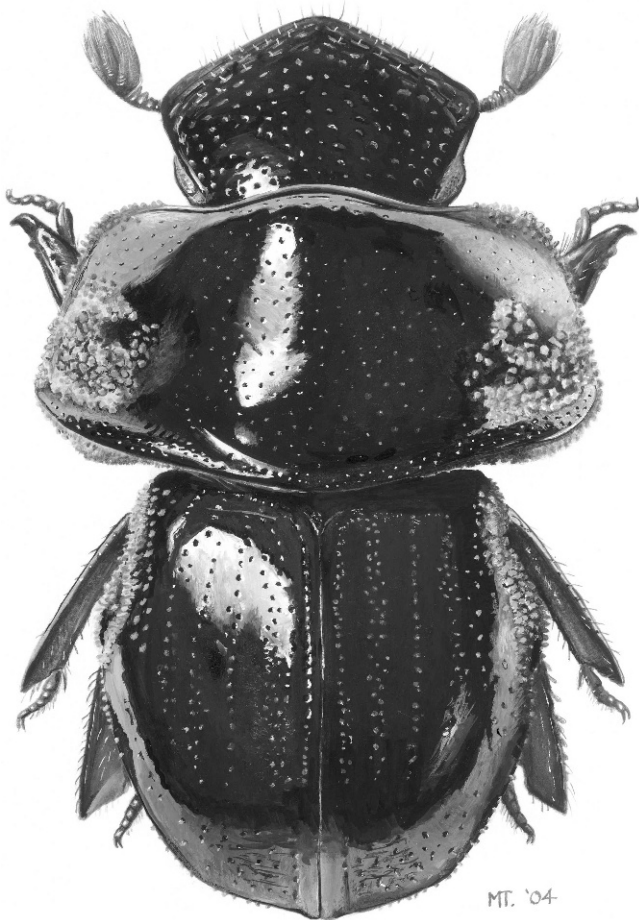


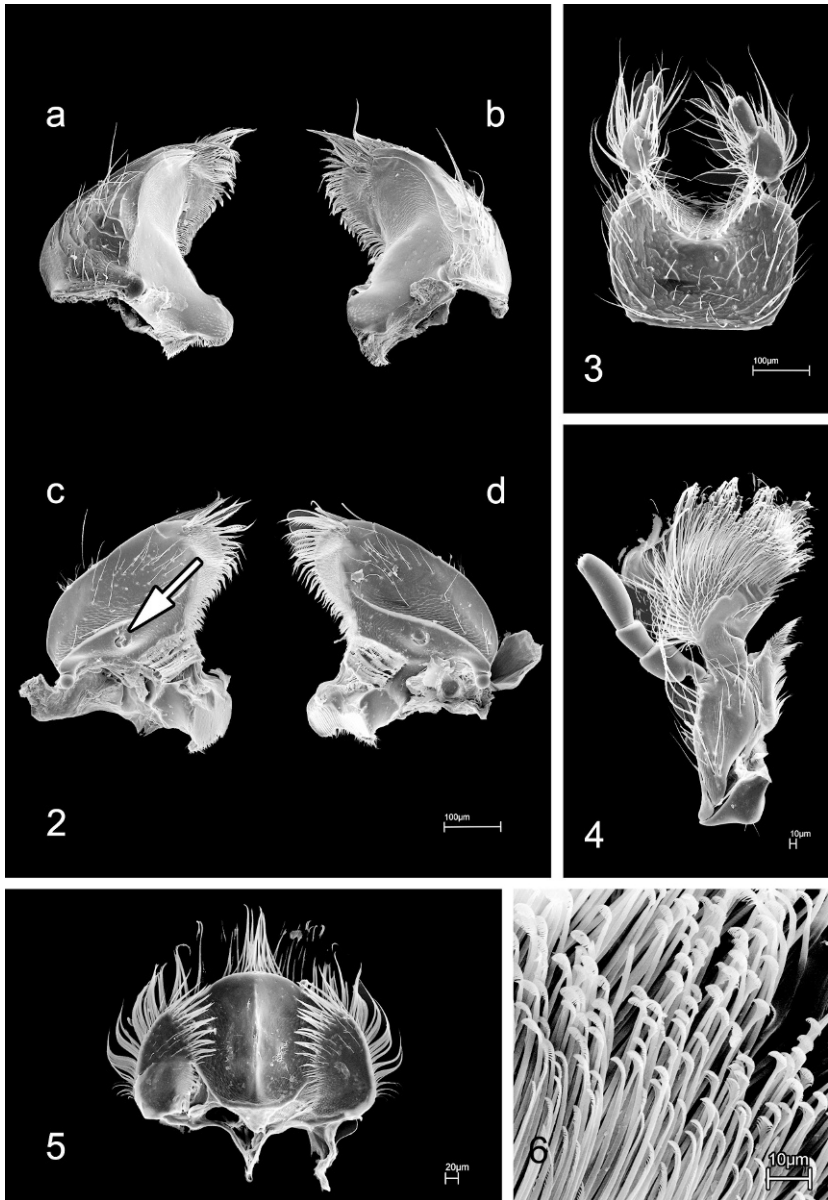
Fig. 1. *Oxymorostes riedeli*. Habitus, total length 3 mm (drawing by Mario Toledo).

labial palpi with segment three swollen and strongly widened compared to other segments; (d) apicalis of mandible with a very short and broad apical tooth, not protruding over the mesal brush; (e) mandible with strongly developed mesal brush; (f) mandibular basalis with a large ventral pore in the lateral sclerite of basalis. The last of these appears to be an autapomorphic character state whose fine morphology and function are worthy of further studies, which could shed light on the biology and feeding habits of these beetles.

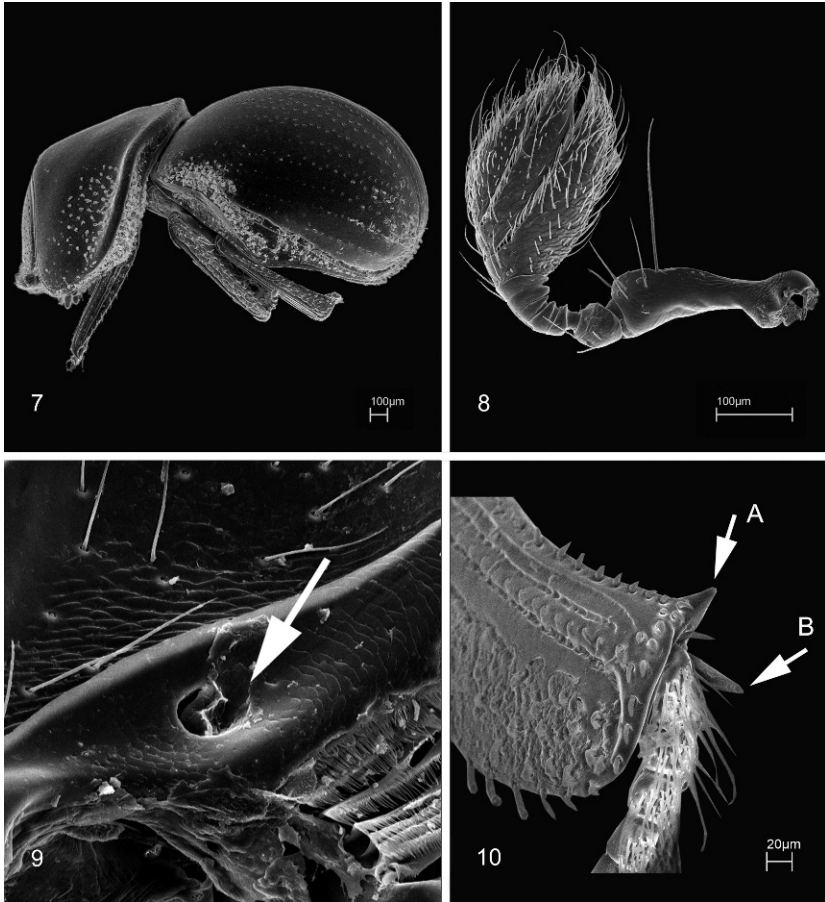
***Oxymorostes riedeli* Ballerio, new species**

(Fig. 1)

Holotype, male: Indonesia—Irian Jaya [now: Papua]: Sorong: Makbon, Malawor, 200–280 m., 28.I.2001, leg. A. Riedel (SMNS) [distended specimen, glued on a card, dissected: genitalia glued on a separate card, same pin].



Figs. 2–6. Mouthparts of *Oxymorostes riedeli*. **2)** mandibles, dorsal and ventral view, arrow indicates the pore; **3)** labium and labial palpi; **4)** maxilla; **5)** epipharynx; **6)** detail of galear brush.



Figs. 7–10. Details of morphology of *Oxymorostes riedeli*. **7)** habitus, lateral view; **8)** antenna; **9)** detail of the pore on lateral sclerite of mandible; **10)** apical portion of male mesotibia, arrow A indicates the false spur, arrow B indicates the true apical spur.

Paratypes: 6 males and 7 females (4 males and 6 females dissected) same data as holotype (4 males and 5 females in SMNS, 2 males and 2 females in ABCB).

Description. HL = 0.6–0.7 mm; HW = 0.9–1.1 mm; PL = 0.8–1.1 mm; PW = 1.6–2.0 mm; EL = 1.2–1.6 mm; EW = 1.4–1.7 mm. Overall morphology as in generic description. Dorsum black, sometimes with brownish shadings, setation yellow/whitish, sternum reddish/yellowish, antennae yellowish. *Head*: dorsal surface with sparse impressed fine, simple punctures proximally, becoming transversely comma-shaped towards fore edge, fore margin with a few fine, shallow, transverse striae, genal suture almost absent, barely visible; a few short, thick, small, clavate setae near fore margin. *Pronotum*: shiny, smooth, with sparse, fine, simple punctation, punctures much finer than on head, their distance apart more than five times their diameter, denser along borders; a paradiscal depression laterally, densely covered by short, thick, large clavate setae, sides and

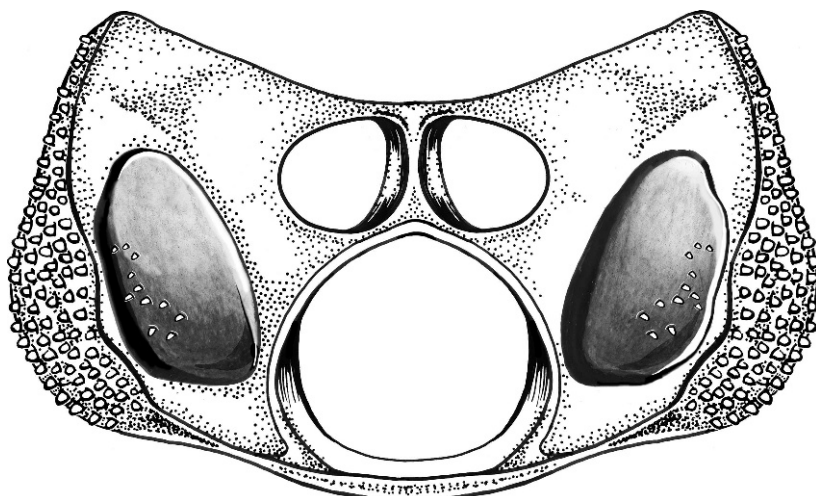


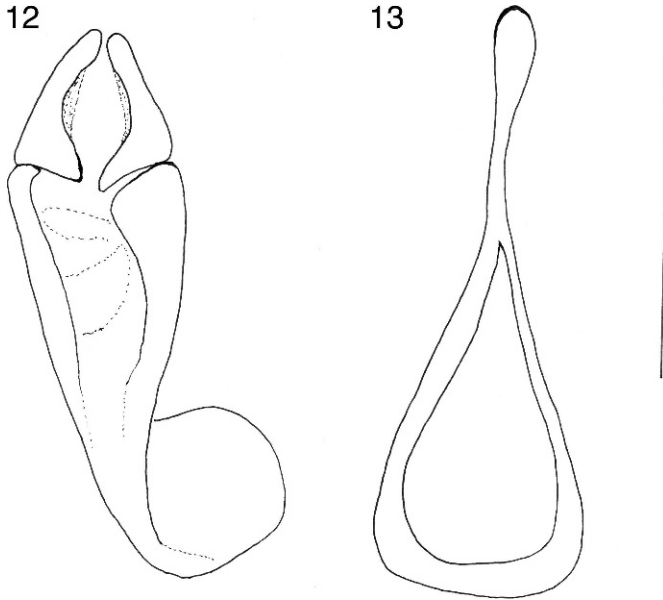
Fig. 11. *Oxymorostes riedeli*. Ventral view of prothorax showing the large deep cavity on each side (coxae removed) (drawing by Aura Paucar Cabrera).

base densely setose as on paradiscal depressions; swollen basal edge of pronotum covered ventrally by dense, thick, short, clavate setae. *Scutellum*: uniformly, sparsely punctate, punctures similar to those on head. *Elytra*: smooth, shiny, bearing short, small clavate setae apically and laterally, with some irregular (apart from sutural stria which is complete) longitudinal rows of small transverse comma-shaped punctures, shallowly impressed, sometimes having internally a fine puncture bearing an extremely short fine seta; humeral area above articular area densely covered by short thick clavate setae; sutural stria marked by a complete longitudinal row of transverse, short, comma-shaped punctures. *Aedeagus*: basal piece twisted, about three times longer than parameres; internal sac small; parameres slightly asymmetrical, dorsally flattened (Fig. 12). *Male genital segment*: moderately sclerotized, Y-shaped, with manubrium about as long as basal triangle (Fig. 13). *Female genitalia*: bursal sclerites absent and spermatheca U-shaped, moderately sclerotized; genital palpi weakly sclerotized, subcircular, relatively small and short.

Etymology. Named after its collector, Dr. Alexander Riedel (Staatliche Museum für Naturkunde Karlsruhe), student of Attelabidae and Curculionidae.

Distribution and habitat. The type locality is near the village of Makbon (approximately 00450S, 1313160E), near the town of Sorong on the northwestern coast of the Vogelkop Peninsula in the Indonesian part of New Guinea (then Irian Jaya, now Papua). The area belongs to the Vogelkop-Aru Lowland Rain Forest ecoregion (Wikramanayake *et al.* 2002), characterized by tropical moist broadleaf lowland forest. The type series was collected by sifting leaf litter from rainforest (A. Riedel, pers. comm.).

Bionomics. Three of the six dissected females had mature eggs. Two females had two eggs and one female had a single egg. In both cases eggs were large (about 0.3 mm diameter) compared to the size of the abdomen. In comparison to other ceratocanthine females I have dissected, eggs of this species were both larger in comparison to the abdomen and less numerous. Species living in leaf litter or



Figs. 12–13. Details of male genitalia of *Oxymorostes riedeli*. **12)** aedeagus in dorsal view; **13)** outline of male genital segment. (scale bar: 1 mm).

under bark typically have three-five eggs, whereas species living in the canopy generally have more than ten eggs (author's unpubl. data).

All examined specimens had an unknown substance of uncertain origin among the setae and inside the prothoracic cavities. An unsuccessful attempt was made to analyze that substance so as to determine if it was a secretion from the setae.

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