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Rhyparoclava pyrrhocoroides, a new genus and species of autapomorphic Rhyparochromidae with clavate antennae from Madagascar (Hemiptera: Heteroptera)

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Abstract. A new genus and species, *Rhyparoclava pyrrhocoroides* gen. & sp. nov. from the Montagne de Français in northern Madagascar is described and illustrated, including structures of the external scent efferent system of the metathoracic scent glands, pregenital abdomen and its trichobothrial pattern, and the genitalia of both sexes. This autapomorphic taxon is brachypterous, anocellate, and has the most strongly clavate antennae known in Rhyparochromidae (Hemiptera: Heteroptera: Lygaeoidea). The systematic placement of *Rhyparoclava pyrrhocoroides* is discussed and the taxon is placed in the subfamily Rhyparochrominae, and tentatively in the tribe Rhyparochromini, though examination of a larva is needed to confirm the tribal placement in the future. All known specimens of *Rhyparoclava pyrrhocoroides* were collected by sifting of leaf litter and other plant residues in woody parts of the Montagne de Français Reserve, characterized by strictly seasonal, dry deciduous forest. A preliminary check-list of the Rhyparochromidae of Madagascar is compiled based on literature, including 32 genera and 62 species (57 described, 5 so far undescribed) belonging to 9 different tribes, of which two genera and 41 species (i.e. 66%) are endemic to Madagascar (including its off-shore islands).

Key words. Hemiptera, Heteroptera, Lygaeoidea, Rhyparochromidae, biodiversity, endemism, taxonomy, new genus, new species, systematic placement, check-list, Madagascar

Introduction

Madagascar, the fourth largest island in the world with an area of 587,041 km^2, is well known for its exceptionally rich, endemic, and strongly endangered biota. This is true also for true bugs (Heteroptera). Although the regional true bug fauna has been receiving increasing attention in recent years (e.g., Bañař et al. 2014, 2015, 2016a,b; Chłond 2014, 2015, 2016; Chłond & Bugaj-Nawrocka 2015; Chłond et al. 2016; Forthman et al. 2016; Kment 2015; Kment & Baena 2015; Kment et al. 2014, 2016; Kóbor & Kondorosy 2016; Lis et al. 2015; Namyatova & Cassis 2016; Polhemus & Andersen 2015; Polhemus & Martiré 2014; Štys & Bañař 2016), there is still no catalogue of the Madagascan Heteroptera and monographs are available for only a few families or superfamilies: Enicocephalidae (Villiers 1958), Reduviidae (Villiers 1968, 1979; Forthman et al. 2016), Tingidae (Duarte Rodrigues 1992), Blissidae (Slater 1967), Pyrrhocoroidea (Cachan 1952a), Coreidae (Brailovsky 2011), and Pentatomoidea (excluding Cydnidae) (Cachan 1952b, Kment 2006).

Rhyparochromidae, the seed bugs, is the most species-rich family of Lygaeoidea with 14 tribes, about 400 genera and more than 2000 described species worldwide (Henry 2009, Henry et al. 2015). No monograph or check-list of this family has ever been published for Madagascar; therefore, the available information on the regional fauna must be extracted from world catalogues (Slater 1964, Slater & O'Donnell 1995) and individual publications (Signoret 1861; Reuter 1887; Bergroth 1894, 1905, 1906, 1907; Distant 1909; Horváth 1909, 1924; Poppius & Bergroth 1921; Scudder 1962, 1963, 1967, 1968, 1971, 1984; Eyles 1968, 1973; Slater & Sweet 1970; Villiers 1971; Slater 1972, 1989, 1994, 1998; O'Rourke 1974, 1975; Harrington 1980; Zheng & Slater 1984; Slater & Zheng 1985; Slater & O'Donnell 1999; Deckert & Eyles 2002; O'Donnell & Schaefer 2011; Kment et al. 2016). So far, 31 genera and 61 species of Rhyparochromidae (56 described ones and five so far undescribed species of *Lilliputocoris* Slater & Woodward, 1979, see O'Donnell & Schaefer 2011) have been recorded from Madagascar, belonging to 9 tribes (Cleradini, Drymini, Lethaeini, Lilliputocorini, Megalonotini, Myodochini, Ozophorini, Rhyparochromini, and Stygnocorini; see Table 1). The tribal placement of *Nesodromus* Bergroth, 1905 remains unknown, and also the generic placement of the species *Graptopeltus filicornis* (Bergroth, 1894), *Rhyparochromus geniculatus* (Signoret, 1861) and *Rhyparochromus raptorius* Signoret, 1861 requires reevaluation. Among the recorded taxa, only one genus, *Nesodromus*, is endemic to Madagascar and another, *Ectyphoscelus* Eyles, 1968, is restricted to Madagascar and Seychelles; the remaining genera are distributed in Madagascar as well as on the African continent or more widely in the (Old) World tropics. A peculiar case is the distribution of the genus *Perimeda* Reuter, 1887, represented by two species, *P. dimidiata* Reuter, 1887 in Madagascar and *P. scudderi* Kiritshenko, 1967 in Afghanistan (Reuter 1887, Kiritshenko 1967). On the other hand there is a considerable amount of endemism among the seed bug species, of which 40 (i.e. 66%) are known only from Madagascar (including its off-shore islands; Table 1). In this paper, we describe an additional new endemic genus and species of Rhyparochromidae from the island. Such a high proportion of endemics is not exceptional among the true bugs in Madagascar (compared with e.g. Pentatomidae – Kment 2013, 2015, and Reduviidae: Ectrichodiinae – Forthman et al. 2016).

Table 1. A provisional check-list of Rhyparochromidae recorded from Madagascar. Endemic species are marked with one asterisk, endemic genera with a double asterisk. The classification and nomenclature follow Slater (1964) and Slater & O'Donnell (1995). Only synonyms described from Madagascar are listed.

Cleradini	
Clerada apicicornis Signoret, 1863	Horváth (1909), Slater (1964)
Drymini	
**Salaciola acutangulata* J. A. Slater, 1994	Slater (1994)
**Salaciola caliginosa* J. A. Slater, 1989	Slater (1989, 1994)
Salaciola nana Bergroth, 1906	Bergroth (1906), Slater (1964, 1989)
Salaciola signaticornis Linnavuori, 1978	Slater (1989, 1994)
**Sinierus nudus* Scudder, 1984	Scudder (1984)
Lethaeini	
**Diniella marginata* (Signoret, 1861)	Signoret (1861), Slater (1964, 1998)
Diniella nitida (Reuter, 1882)	Distant (1909), Slater (1964)
**Lethaeus gigas* J. A. Slater & O'Donnell, 1999	Slater & O'Donnell (1999)
Lethaeus longirostris Reuter, 1887	Reuter (1887), Slater (1964)
**Lethaeus nodulinervis* Bergroth, 1905	Bergroth (1905), Slater (1964)
**Neolethaeus maculosus* J. A. Slater & O'Donnell, 1999	Slater & O'Donnell (1999)
**Neolethaeus madagascariensis* J. A. Slater & O'Donnell, 1999	Slater & O'Donnell (1999)
**Neolethaeus polhemi* J. A. Slater & O'Donnell, 1999	Slater & O'Donnell (1999)
Lilliputocorini	
**Lilliputocoris* sp. 1	O'Donnell & Schaefer (2011)
**Lilliputocoris* sp. 2	O'Donnell & Schaefer (2011)
**Lilliputocoris* sp. 3	O'Donnell & Schaefer (2011)
**Lilliputocoris* sp. 4	O'Donnell & Schaefer (2011)
**Lilliputocoris* sp. 5	O'Donnell & Schaefer (2011)
Megalonotini	
**Allocentrum impunctatum* Scudder, 1977	Scudder (1977)
**Polycrates crassicornis* Horváth, 1924	Horváth (1924), Slater (1964)
**Polycrates triguttulatus* Slater, 1964	Signoret (1861), Scudder (1962), Slater (1964)
= *Plociomerus triguttatus* Signoret, 1861 (preoccupied)	
**Polycrates tschitscherini* (Bergroth, 1907)	Bergroth (1907), Scudder (1962), Slater (1964)
**Serranegra brevirostris* Scudder, 1963	Scudder (1963), Slater (1964)
Myodochini	
**Aegyptocoris descarpentriesi* Villiers, 1971	Villiers (1971), Slater & O'Donnell (1995)
Horridipamera perlonga (Scudder, 1969)	Slater & Zheng (1985)
Horridipamera inconspicua (Dallas, 1852)	Reuter (1887), Slater (1964), Slater & Zheng (1985)
= *Pamera ebenaui* Reuter, 1887	
**Mimobius capito* Bergroth, 1921	Poppius & Bergroth (1921), Slater (1964), Harrington (1980)
Paromius gracilis (Rambur, 1839)	Signoret (1861), Slater (1964)
= *Plociomerus nabizoides* Signoret, 1861	
Pseudopachybrachius capicola (Stål, 1865)	Reuter (1887), Slater (1964), Zheng & Slater (1984)
Pseudopachybrachius reductus (Walker, 1872)	Zheng & Slater (1984)
Ozophorini	
**Migdilybs elegans* J. A. Slater, 1972	Slater (1972)
**Migdilybs nudus* Scudder, 1963	Scudder (1963), Slater (1972)
**Migdilybs pauliani* J. A. Slater, 1972	Slater (1972)
Rhyparochromini	
Dieuches annulatus (Signoret, 1861)	Signoret (1861), Reuter (1887), Frappa (1931), Slater (1964), Eyles (1973), Deckert & Eyles (2002)

(continues on the next page)

Table 1. (continued)

Dieuches coenosus (Stål, 1865)	Slater (1964), Eyles (1973), Deckert & Eyles (2002)
**Dieuches constrictus* Eyles, 1973	Eyles (1973), Deckert & Eyles (2002)
**Dieuches exsertus* Eyles, 1973	Eyles (1973)
**Dieuches fuscus* Reuter, 1887	Reuter (1887), Slater (1964), Eyles (1973)
Dieuches humilis Reuter, 1887	Reuter (1887), Eyles (1973), Slater (1964), Deckert & Eyles (2002)
Dieuches lateralis (Signoret, 1863)	Slater (1964), Eyles (1973)
Dieuches placidus (Stål, 1865)	Slater (1964), Eyles (1973), Deckert & Eyles (2002)
**Ectyphoscelus paxillus* Eyles, 1968	Eyles (1968)
Elasmolomus mendicus Stål, 1872	Reuter (1887), Slater (1964), Scudder (1967)
Elasmolomus transversus (Signoret, 1861)	Signoret (1861), Slater (1964), Scudder (1967)
**Graptopeltus filicornis* (Bergroth, 1894)	Bergroth (1894), Slater (1964)
Lanchnophorus guttulatus Reuter, 1887	Reuter (1887), Slater (1964), Kment et al. (2016)
Naphius apicalis (Dallas, 1852)	Slater (1964), Scudder (1968)
**Naphius rossi* Scudder, 1971	Scudder (1971)
Nocellochromus distinctus Scudder, 1963	Scudder (1963)
**Perimeda dimidiata* Reuter, 1887	Reuter (1887), Slater (1964)
**Poeantius unidentatus* Reuter, 1887	Reuter (1887), Slater (1964)
**Rhyparochromus geniculatus* (Signoret, 1861)	Signoret (1861), Slater (1964)
**Rhyparochromus raptorius* Signoret, 1861	Signoret (1861), Slater (1964)
***Rhyparoclava pyrrhocoroides* sp. nov.	this paper
Stygnocorini	
Lasiosomus lasiosomoides (Bergevin, 1930)	O'Rourke (1975)
**Lasiosomus madagascariensis* O'Rourke, 1975	O'Rourke (1975)
**Lasiosomus vittatus* O'Rourke, 1975	O'Rourke (1975)
**Notiocola madagascariensis* J. A. Slater & Sweet, 1970	Slater & Sweet (1970)
**Sweetocoris paraminutus* O'Rourke, 1974	O'Rourke (1974)
**Sweetocoris similis* O'Rourke, 1974	O'Rourke (1974)
Tribal placement uncertain	
***Nesodromus pleuriticus* Bergroth, 1905	Bergroth (1905), Slater (1964)

Considering the numbers of genera and species of Rhyparochromidae currently known from Madagascar we are sure that this is merely a fragment of the real diversity of this group on the island. Rhyparochromidae form an important part of the Heteroptera assemblages extracted from soil samples. During five Czech expeditions to Madagascar in 2010–2016, more than 10,000 specimens of rhyparochromid adults and larvae were collected using various sampling methods, of which more than 7,000 specimens were acquired by sifting of forest leaf litter and various plant debris and subsequent extraction in Winkler apparatus (the material is deposited in the Moravian Museum, Brno). While sorting sifted samples from the Montagne de Français Reserve, an exceptional locality situated in northern Madagascar, we found a peculiar bug with clavate antennae which, at first glance, resembled representatives of *Aderrhis* Bergroth, 1906 or its relatives (Pyrrhocoridae) in its body size, a uniformly brown colouration, brachyptery and the lack of ocelli. However, a more detailed examination revealed characters placing this taxon in the family Rhyparochromidae, subfamily Rhyparochrominae, but still leaving no doubt that it represents an extraordinary new genus and species which we describe and illustrate here.

Material and methods

In quoting the labels of type specimens, a slash (/) is used to divide data on different lines of one label, a double slash (//) to divide data on different labels, and authors' comments are given in square brackets [ ]. The labels are white with black print unless stated otherwise.

External observations and line drawings were made under a Leica MZ75 stereomicroscope provided with a camera lucida. For measurements we used the Olympus SZX12 stereomicroscope (with Olympus DF PLFL 0.5X PF objective) with attached Olympus SC50 digital camera (with Olympus U-TV0.5XC-3 low-magnification adaptor) and the Olympus Stream Motion 1.9.4 software for digital image analysis. The following dimensions were measured: body length (from apex of clypeus to apex of posterior margin of tergite VIII, in dorsal view), head length (from apex of clypeus to anterior margin of pronotum, in anterodorsal view with surface of the head parallel with the plane of focus), head width (maximum width across eyes, in anterodorsal view), interocular width (between inner margins of compound eyes, in anterodorsal view), length of each antennal segment (maximum length), pronotum length (medially, in most exposed, i.e. anterodorsal view), pronotum width (maximum width between posterolateral angles, in anterodorsal view), scutellum length (medially from base to apex, in dorsal view), scutellum width (maximum width at base, in dorsal view), and abdomen width (maximum width across posterolateral angles of abdominal segment V, in dorsal view). The term 'dorsal ocular index' refers to the ratio of the minimum width of the vertex to the maximum width of the eye; it is easiest to calculate if measured as twice the minimum interocular distance / maximum width across eyes minus minimum interocular distance (e.g., Trýzna & Baňař 2013, 2014). The measurements are given as median, with minimum and maximum values in parentheses.

Uncoated specimens (Figs 3–34, 39–64) were examined by a Hitachi S-3700N environmental scanning electron microscope at the Department of Palaeontology, National Museum, Prague. Scanning electron micrographs of gold-coated specimens (Figs 74–78) were taken using a JEOL 6380 LV scanning electron microscope. Habitus photographs were taken using a Canon MP-E 65 mm macro lens attached to a Canon EOS 550D camera and stacked from multiple layers using the Helicon Focus 5.1 Pro software. Colour photographs of various body parts of dissected specimens were taken using Olympus SZH 10.

Genitalia of the both sexes were prepared from a gently moistened specimen from which the whole abdomen was separated and placed in a small tube with 12% potassium hydroxide (KOH) solution and heated to the boiling point for several minutes until all soft tissues were adequately macerated. Genitalia were subsequently placed in distilled water for description and illustration. Finally, genitalia were stored in glycerol in a small vial mounted on the same pin with the corresponding specimen.

The general morphological terminology follows mostly Tsai et al. (2011) and Tsai & Rédei (2014, in press), the nomenclature of antennal segments follows Zrzavý (1990), the terms concerning pregenital abdomen morphology (i.e. tergite, sternite and hypopleurite) follow Sweet (1996) and those of the external scent efferent system of the metathoracic scent glands Kment & Vilímová (2010).

Specimens examined are deposited in the following collections:

BMNH Natural History Museum, London, United Kingdom;
EKKH Előd Kondorosy collection, Keszthely, Hungary;

HNHM Hungarian Natural History Museum, Budapest, Hungary;
MMBC Moravian Museum, Brno, Czech Republic;
MNHN Muséum national d'Histoire naturelle, Paris, France;
NMPC National Museum, Praha, Czech Republic.

Taxonomy

Rhyparoclava gen. nov.

Type species. *Rhyparoclava pyrrhocoroides* sp. nov., here designated.

Description. ***Structure.*** *Body* (Figs 1–3) drop-shaped, small, convex ventrally, quite flat dorsally.

Head (Figs 4–8) prognathous, ca. 1.5× longer than wide, preocular portion parallel-sided, outline W-shaped anteriorly. Eyes hemispherical, protruding from head outline by most of their width, narrowly separated from anterior margin of pronotum (Figs 4, 6), postgenae (= tempora) short (Figs 6, 8). Ocelli and cephalic trichobothria absent (Figs 4, 6, 8). Vertex and frons regularly gibbose, slightly elevated above level of eyes in lateral view (Fig. 8). Clypeus narrow, projecting forward, distinctly surpassing mandibular plates and apices of antenniferous tubercles (Fig. 6), in lateral view slightly gibbose and distinctly elevated above mandibular plates (Fig. 8). Antenniferous tubercles long, triangular, sharply and obliquely truncate apically, forming the lateral margin of head (Figs 4–7), with one small tooth on each dorsal and ventral side of anterior margin, visible in lateral view (Fig. 8), antennae inserted slightly anteroventrally. Antennae 4-segmented, as long as two thirds of body length, incrassate, clavate, widest across apical margin of basiflagellum (= antennal segment III) (Figs 1–2, 11, 35). Antennal segments from shortest to longest: basiflagellum (III) = distiflagellum (IV) < scape (I) < pedicel (II). Scape (Figs 9–10, 35) short, cylindrical, slightly narrowing in anterior third of its inner margin, its outline distinctly separated from segments II–IV, collectively forming a compact club. Pedicel (Figs 11, 35) longest, nearly twice as long as basiflagellum or distiflagellum, connected with scape only by very thin base and then gradually widened towards truncate apex. Basiflagellum (Figs 12, 35, 71) stout, cylindrical, only slightly widened basally, about half as long as pedicel and about the same length as distiflagellum. Distiflagellum (Figs 12, 35, 71) conically tapering towards pointed apex. Ventral side of head flat (Figs 5, 7), with a deep median depression starting from the posterior margin of bucculae and ending towards the apex of labial segment I (Fig. 7). Bucculae short, reaching half-length of labial segment I (Fig. 7), elongate, as high as labial segment I, their ventral margin only slightly rounded; bucculae hardly visible in lateral view (Fig. 8). Labium slender (Fig. 2); labial segment I (Figs 5, 7) as long as ca. 2/3 of head length, segment II (Figs 5, 21) longest, segment III (Fig. 21) short, reaching between procoxae, segment IV shortest, reaching between mesocoxae.

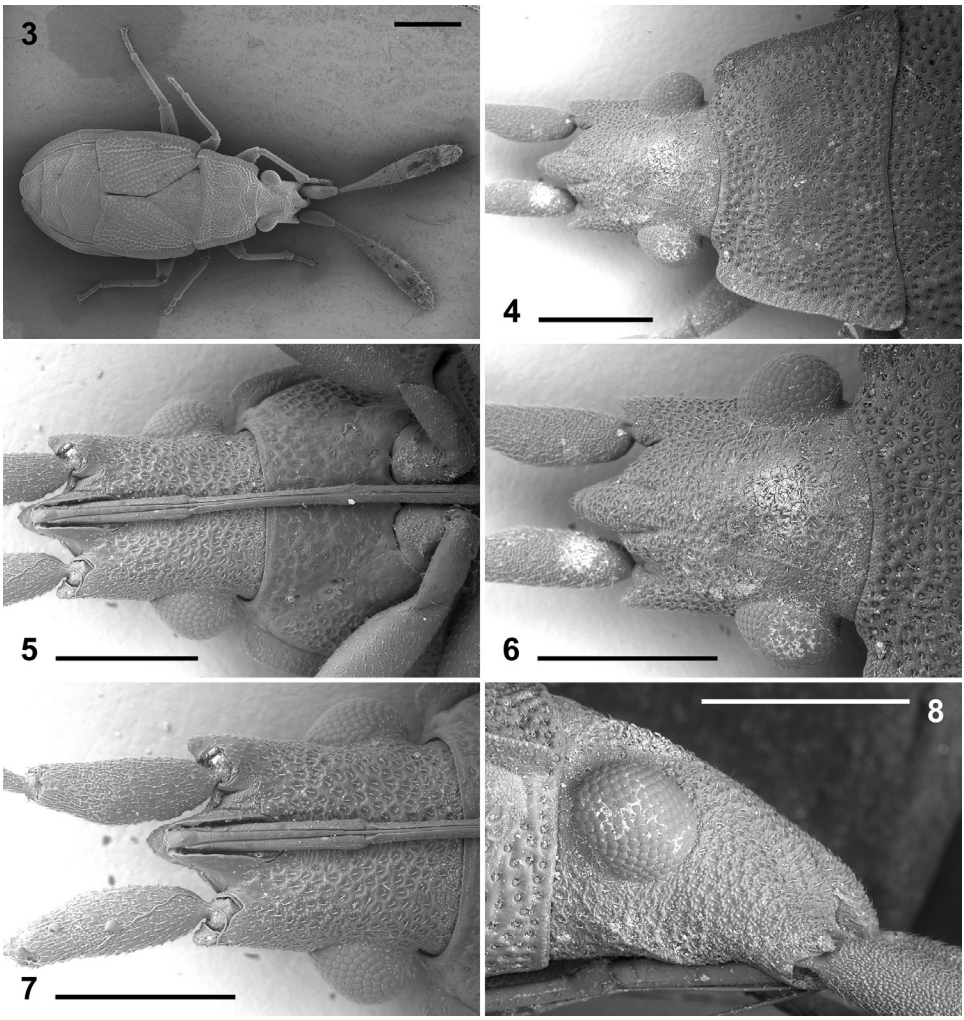
Thorax. Pronotum trapezoidal (Figs 4, 16), with anterolateral angle 106° and posterolateral angle 67°; anterior margin concave, pronotal collar not developed; lateral margins explanate, in the form of a wide lamella bearing a single row of punctures; disc of pronotum slightly convex, anterior and posterior lobes indistinctly delimited.

Scutellum (Figs 18–20) slightly convex, in shape of ca. equilateral triangle.

Figs 1–2. *Rhyparoclava pyrrhocoroides* gen. & sp. nov., habitus. 1 – female, dorsal view; 2 – male, ventral view. (Photographs by P. Kment).

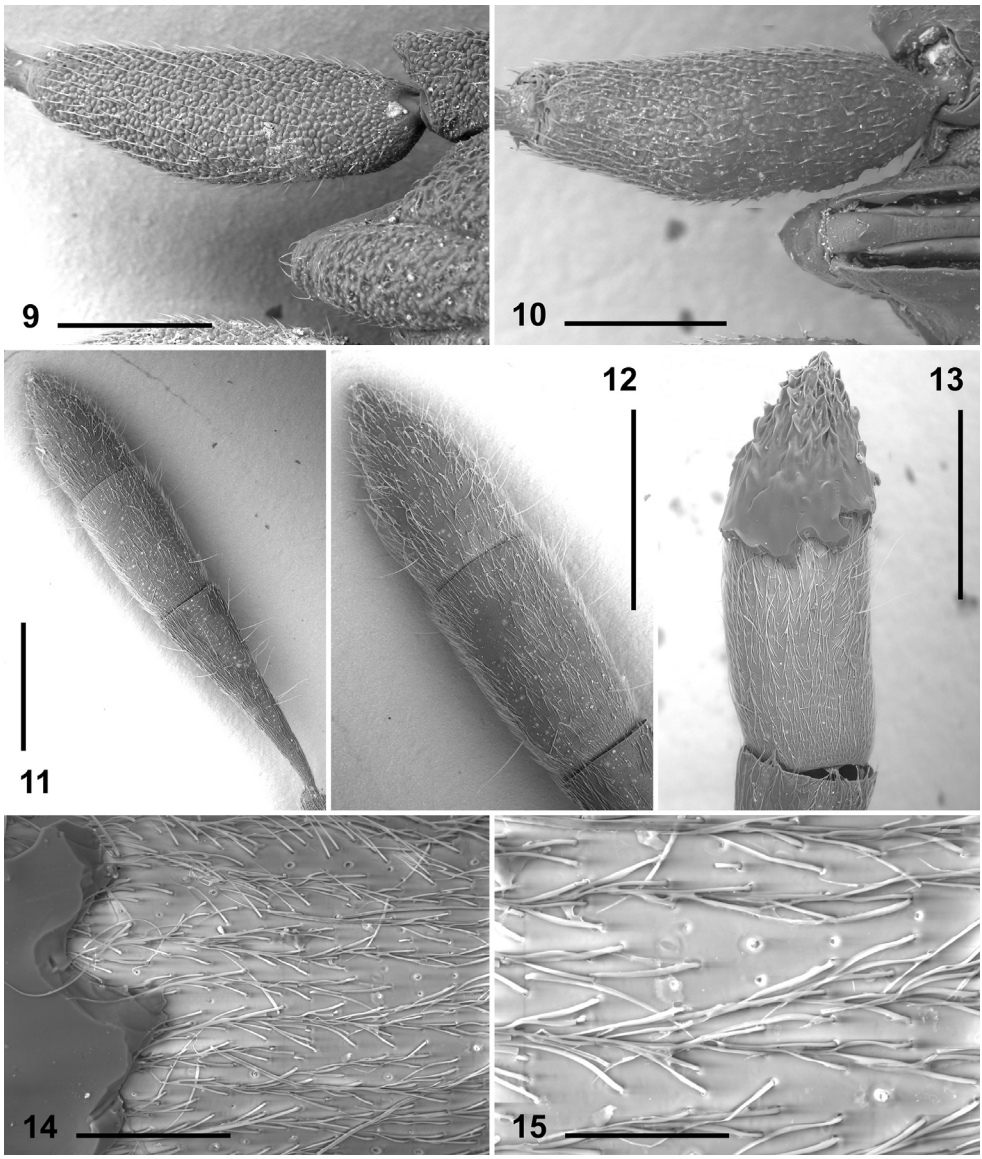
Pro-, meso- and metasterna (Figs 23–24) not keeled, with a very shallow groove medially. Vestibular scar well developed (Figs 25–27), laterally modified into a long, narrowly V-shaped ostiole (Figs 25–28). Peritreme (Figs 25–27) short, auricle-shaped, slightly shorter than half the distance between ostiole and lateral margin of metapleuron, narrowing laterad, apex narrowly rounded, peritremal furrow distinct throughout peritreme except its extreme apex (Figs 27–28). Peritremal surface oriented posteroventrally, elevated above surrounding pleuron. Evaporatorium surrounding ostiole and peritreme, occupying a large anteromedian portion of the metapleuron (Figs 25–26), projecting medially between meso- and metacoxae (Figs 25, 27); mesopleural evaporatorium small, occupying a narrow, subtriangular area between the mesopleural suture and the posterior margin of mesopleuron, narrowing laterad towards metathoracic spiracle (Fig. 26). Metepimeroid hardly demarcated from metepimeron (Fig. 25).

Fore wings brachypterous, fused together along claval commissure, membrane entirely absent (Figs 1, 3, 19–20). Exocorium expanded, lamellate, widest anteriorly and gradually

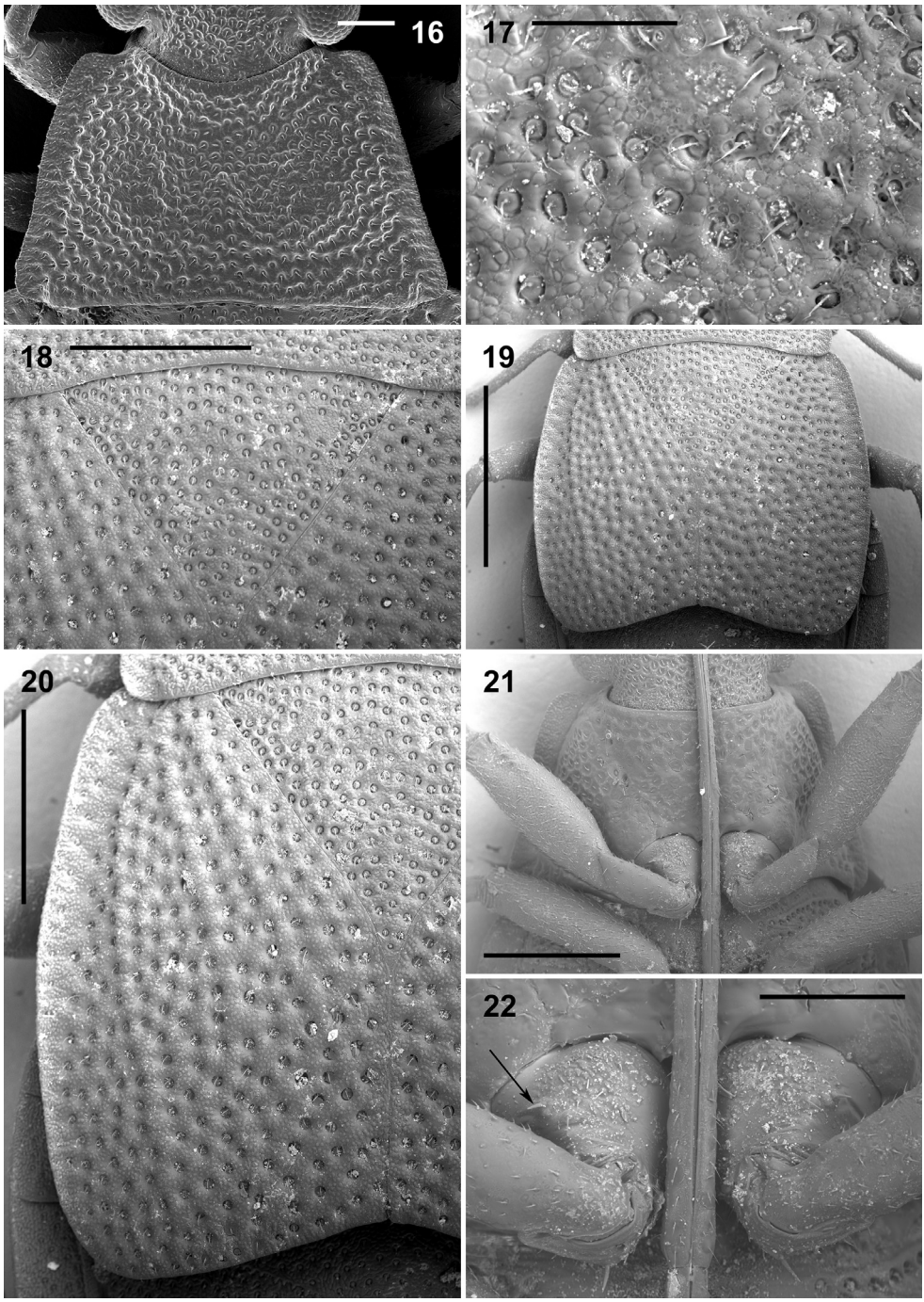


Figs 3–8. *Rhyparoclava pyrrhocoroides* gen. & sp. nov., SEM micrographs: 3 – habitus, dorsal view (18×); 4–5 – head and pronotum (4 – dorsal view, magnification 60×; 5 – ventral view, 75×); 6–8 – head (6 – dorsal view, 95×; 7 – ventral view, 95×; 8 – lateral view, 110×). Scale bars: 0.5 mm (Figs 4–8), 1 mm (Fig. 3). (SEM micrographs by P. Kment).

narrowing posteriad (Fig. 20), its proximal half bearing a single row of distinct punctures, distal half impunctate (punctuation apparent also on corresponding hypocostal lamina). Claval furrow obliterated, boundary of clavus and corium barely distinguishable (Figs 19–20). Veins (R+M, Cu, 1A+2A) slightly elevated, prominent among neighbouring rows of punctures (Fig. 20). Anterodistal angle of corium widely rounded, distal margin truncate, reaching ca. posterior margin of tergite IV or anterior margin of tergite V (Figs 1, 3, 39), posterior margins of both hemelytra enclosing an obtuse angle (ca. 143°; Fig. 19). Hind wings absent.



Figs 9–15. *Rhyparoclava pyrrhocoroides* gen. & sp. nov., SEM micrographs: 9–10 – scape (= antennal segment I) (9 – dorsal view, magnification 200×; 10 – ventral view, 210×); 11 – antennal segments II–IV, dorsal view (70×); 12–13 – basiflagellum (III) and distiflagellum (IV) (12 – dorsal view, 110×; 13 – ventral view, with film formed by slimy secretion, 130×); 14–15 – basiflagellum, dorsal view, microsculpture (14 – with slimy secretion, 400×; 15 – 850×). Scale bars: 50 μm (Fig. 15), 0.1 mm (Fig. 14), 0.2 mm (Figs 9–10), 0.4 mm (Fig. 13), 0.5 mm (Figs 11–12). (SEM micrographs by P. Kment).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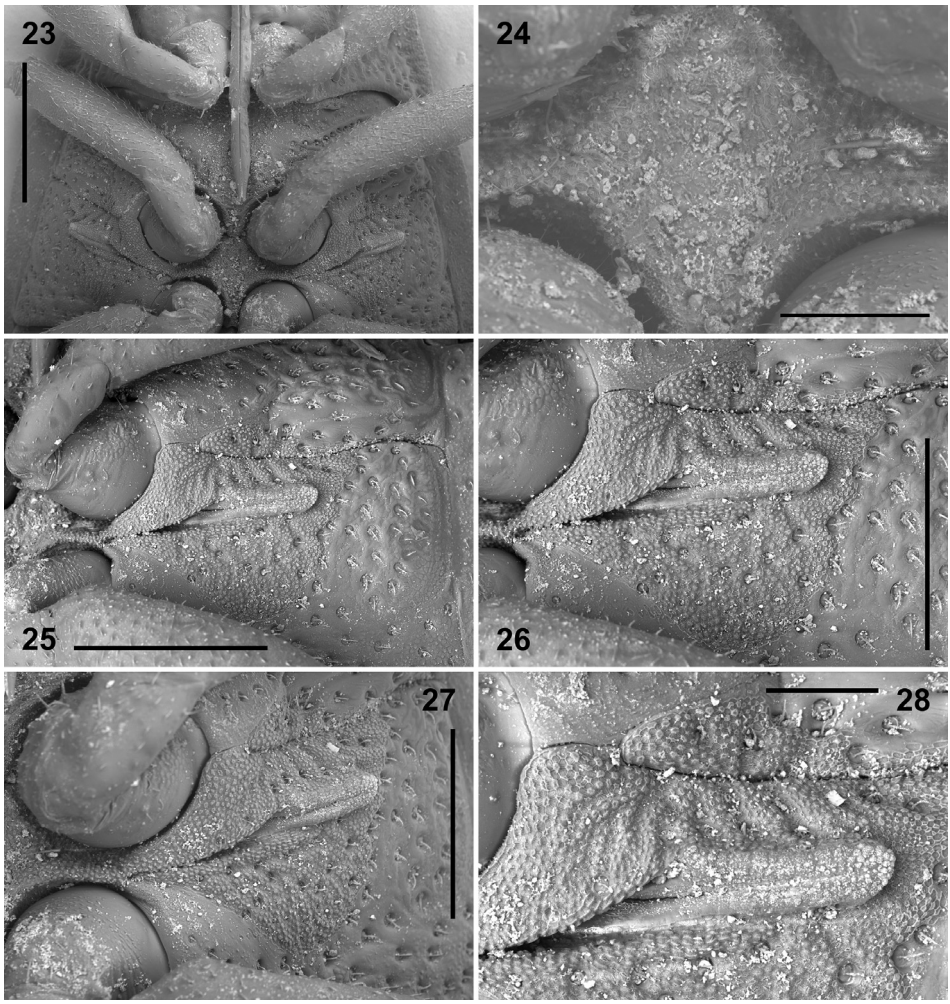
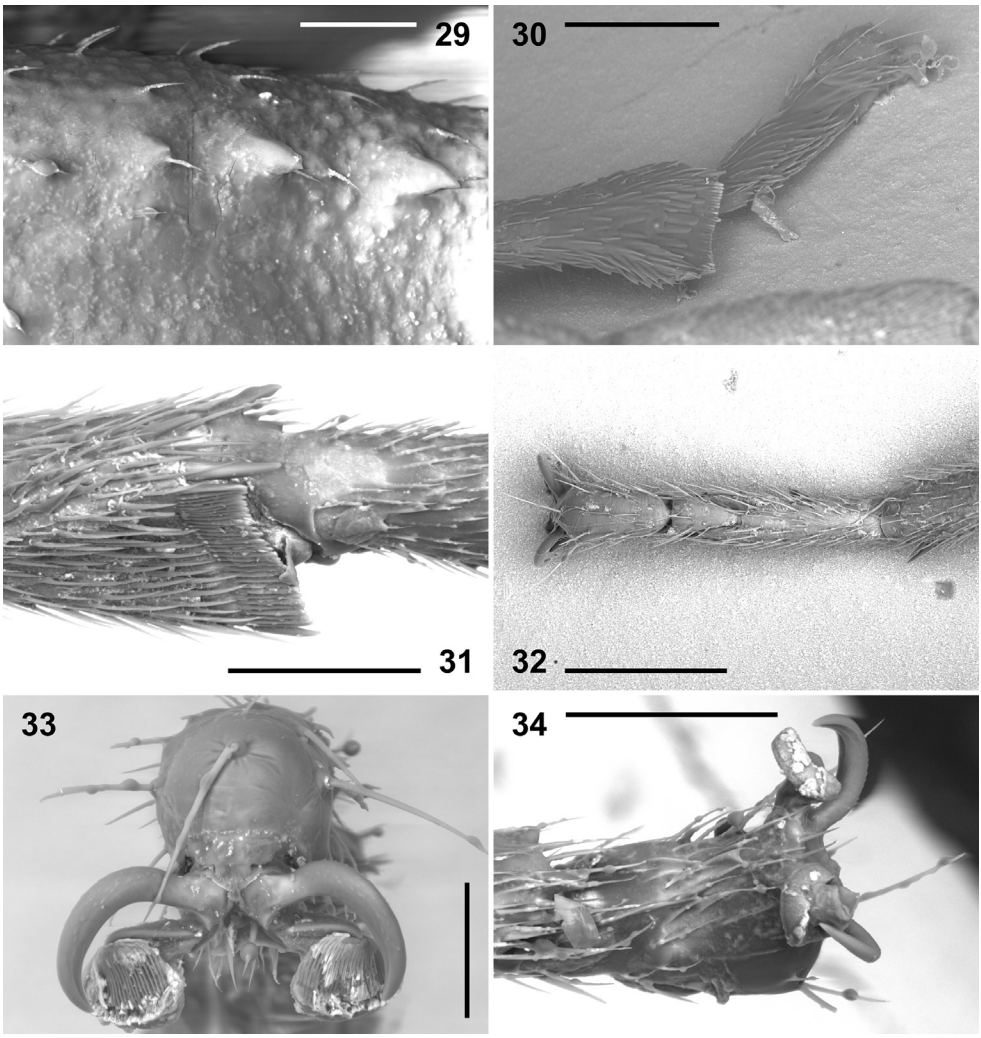


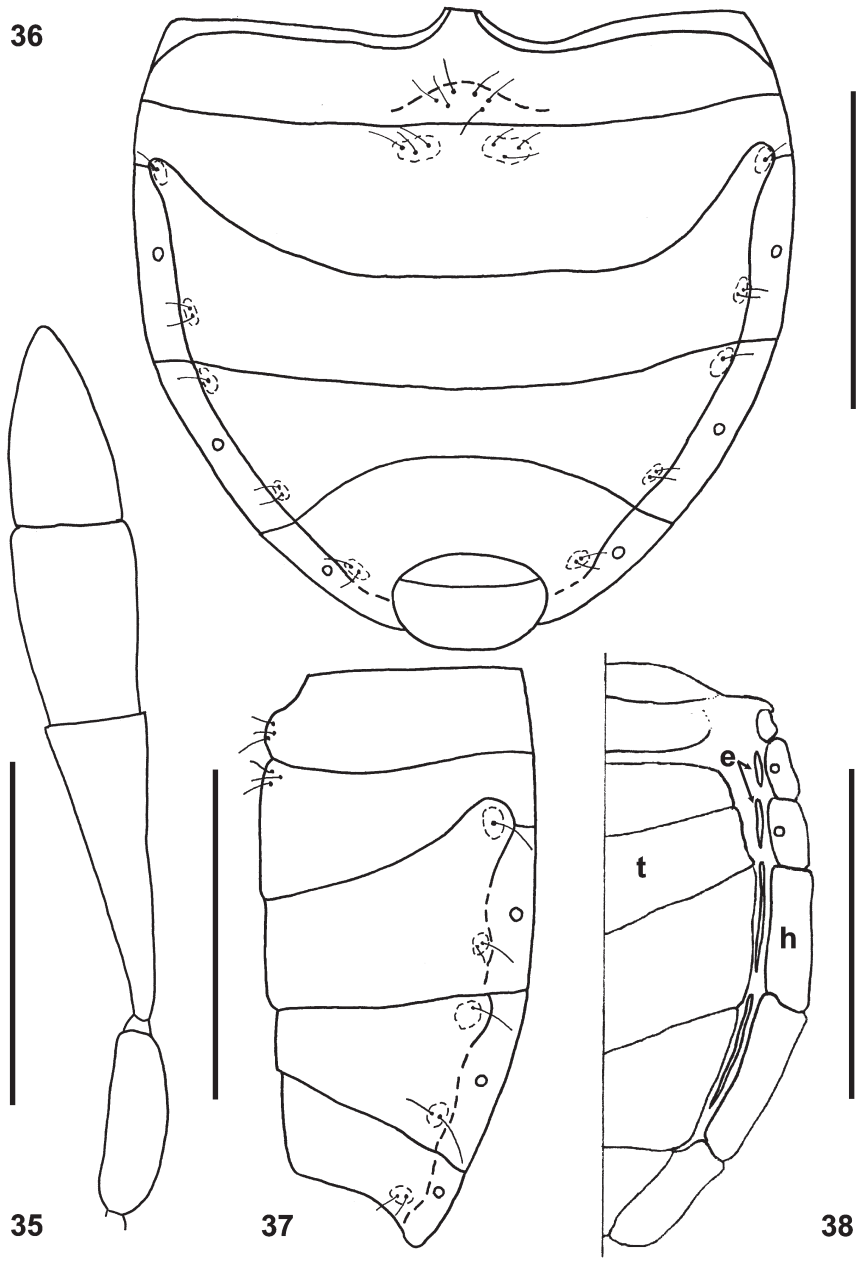
Figs 23–28. *Rhyparoclava pyrrhocoroides* gen. & sp. nov., SEM micrographs: 23 – meso- and metathorax, ventral view (magnification 75×); 24 – metasternum, ventral view (400×); 25–27 – external scent efferent system of the metathoracic scent gland (25 – ventrolateral view, 130×; 26 – ventrolateral view, 190×; 27 – ventral view, 170×); 28 – peritreme, ventral view (300×). Scale bars: 0.1 mm (Figs 24, 28), 0.3 mm (Figs 26, 27), 0.4 mm (Fig. 25), 0.5 mm (Fig. 23). (SEM micrographs by P. Kment).

Figs 16–22. *Rhyparoclava pyrrhocoroides* gen. & sp. nov., SEM micrographs: 16–17 – pronotum, dorsal view (16 – magnification 80×; 17 – detail of microsculpture, 400×); 18 – scutellum, dorsal view (100×); 19–20 – hemelytra, dorsal view (19 – 50×, 20 – 75×); 21 – prothorax, ventral view (75×); 22 – procoxae, ventral view (200×). Scale bars: 0.1 mm (Fig. 17), 0.2 mm (Figs 16, 22), 0.5 mm (Figs 18, 20, 21), 1 mm (Fig. 19). (SEM micrographs by P. Kment).



Figs 29–34. *Rhyparoclava pyrrhocoroides* gen. & sp. nov., SEM micrographs: 29 – profemur, ventral view, detail of anteroapical spines (magnification 600×); 30 – apex of protibia and protarsus (200×); 31 – apex of protibia, detail (500×); 32 – metatarsus, dorsal view (210×); 33–34 – propretarsus (33 – apical view, 700×; 34 – ventrolateral view, 550×). Scale bars: 50 μm (Figs 29, 33), 0.1 mm (Figs 31, 34), 0.2 mm (Figs 30, 32). (SEM micrographs by P. Kment).

Legs. Pro- and metacoxae inserted close to each other, distance between pro- and metacoxae as wide as labial width, distance between mesocoxae slightly wider (Figs 21–23). Anterior surface of procoxa with small granule-like tubercle bearing single seta (Figs 21, 22: black arrow). Femora incrassate (Figs 2, 21), oval in cross-section, apically attenuated, pro- and metafemora somewhat more incrassate than mesofemur; mesofemur shorter than profemur,



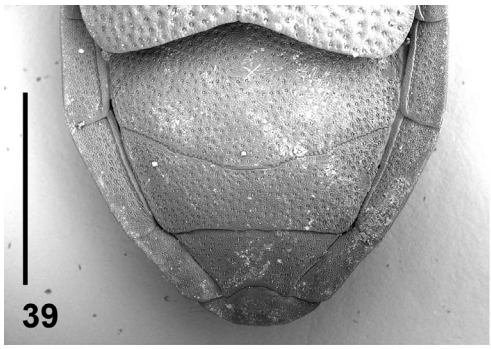
Figs 35–38. *Rhyparoclava pyrrhocoroides* gen. & sp. nov.: 35 – antenna; 36–38 – abdomen (36 – ventral view, 37 – lateral view, 38 – dorsal view). Scale bars: 1 mm. (Line drawings by V. Hemala). Abbreviations: e – epipleurite; h – hypopleurite; t – tergite.

metafemur longer than profemur. Ventral surface of femora flat in apical third, on profemora with three serially arranged denticles anteroapically (Figs 21, 29). Protibia rounded in cross-section, slender, widened and flattened only apically, bearing a row of small spines (Figs 30–31). Mesotibia shorter and metatibia longer than protibia; meso- and metatibia not widened apically, bearing two short spines on their apices ventrally. Tarsal segments from shortest to longest: II < III < I (Fig. 32). Pretarsus with two slender, sickle-shaped claws accompanied by large fleshy pulvilli (with lamellate microsculpture on their ventral surface) and two short parempodia (Figs 33–34).

Abdomen (Figs 36–46, 74–75) wide, almost rounded in outline posteriorly (connexival segments holding very wide obtuse angles), quite flat (Fig. 37), only slightly convex ventrally, without a median keel or furrow (Figs 36, 46). Abdomen widest across posterolateral angles of segment V, slightly wider than fore wings (Figs 1–2). Tergites II and III membranous, III slightly convex posteriorly (Figs 40–41). Tergites IV and V (Fig. 40) widely U-shaped; anterior margin of tergite VI concave, its posterior margin straight; posterior margin of tergite VII shallowly concave; tergite VIII widely rounded posteriorly. Vestiges of larval dorso-abdominal scent glands present between tergites III/IV (Fig. 49), IV/V (Fig. 50) and V/VI (Fig. 51). Y-shaped suture between tergites III and IV vestigial, apparent only medially (Figs 42–43). Abdominal spiracles II and V–VII situated ventrally (Figs 36–37), spiracles III and IV dorsally on the respective hypopleurites (Figs 38, 43: white arrows). Hypopleurites (= outer laterotergites) well developed, their lateral margins forming continual outline, their posterior margins slightly convex (Fig. 40). Separate, narrow epipleurites (= inner laterotergites) are present in segments III−VI (Fig. 38), invaginated in the fold between tergites (= mediotergites) and hypopleurites.

Sternite II narrow but completely developed (Figs 46–47). Sternite III triangularly produced anteromedially (Figs 36, 46–48), with one large rounded tubercle posteromedially, carrying 3+3 trichobothria approaching midline, one triad on each side (Figs 36–37, 46–48, 52); trichobothria on each side arranged triangularly, situated approximately at level of spiracles (Figs 36, 52). Sternites IV–VII with following arrangement of trichobothria on each side of body: Sternite IV with three trichobothria in one oval field submedially, in slightly prespiracular position, forming triangle (inner trichobothrium placed more posteriorly than lateral ones) (Figs 36, 52). Sternite V with three trichobothria laterally, anterior trichobothrium prespiracular, placed on large, rounded, prominent tubercle, two posterior ones postspiracular, placed on slightly elevated, oval field (Figs 37, 53). Sternite VI with three trichobothria laterally, anterior one prespiracular, placed on medium sized, apically excavated tubercle, two posterior ones postspiracular, placed on slightly elevated, oval field (Figs 37, 54). Sternite VII with two trichobothria laterally, both postspiracular (Figs 37, 55). Posterior portion of sternite VIII in male exposed below genital capsule (Figs 36, 57, 74–75). Sternites III–VII shallowly sulcate sublaterally (especially on V–VII), lateral margins forming ventral portion of connexivum (Figs 36–37, 44–46).

Figs 39–44. *Rhyparoclava pyrrhocoroides* gen. & sp. nov., SEM micrographs, abdomen. 39 – male, dorsal view (magnification 50×); 40–43 – female, dorsal view (40 – 42×; 41 – anteriorly, 55×; 42 – anterolaterally, 90×; 43 – detail of hypopleurites III and IV, 150×); 44 – female, lateral view (55×). Scale bars: 0.5 mm (Figs 41–43), 1 mm (Figs 39, 40, 44). (SEM micrographs by P. Kment).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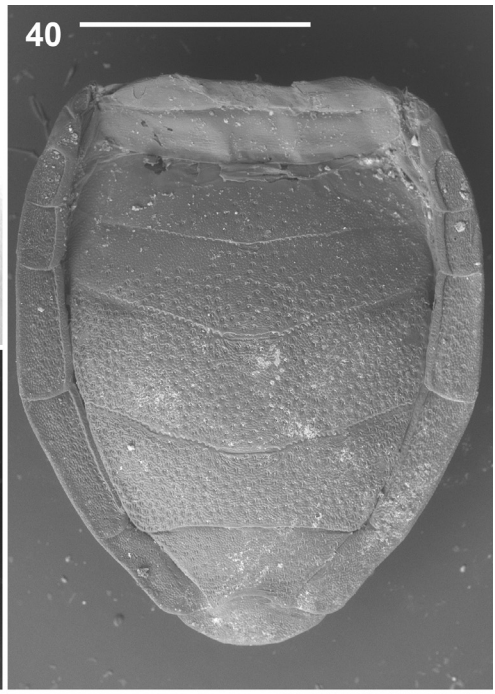
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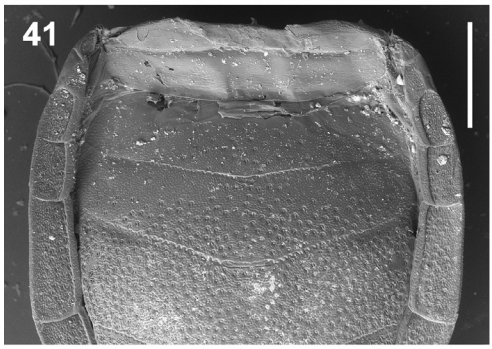
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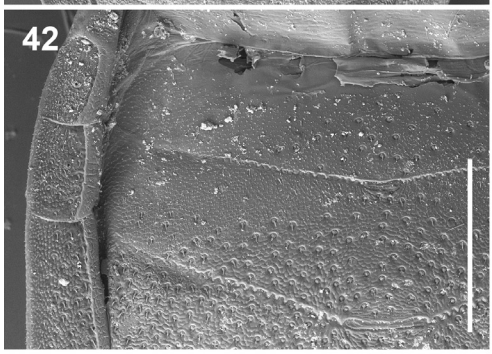
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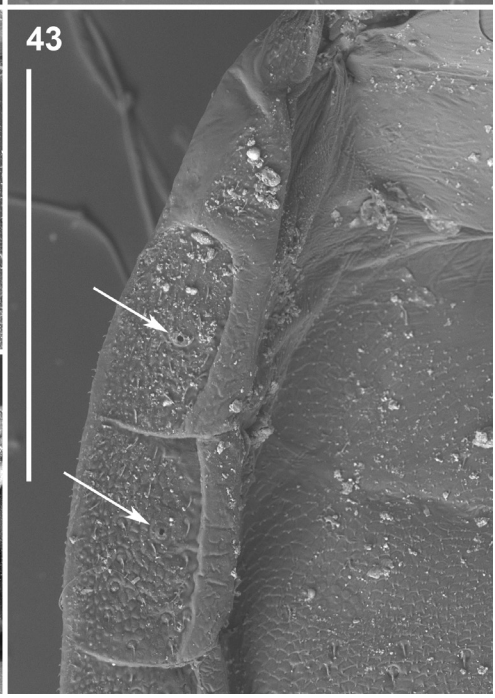
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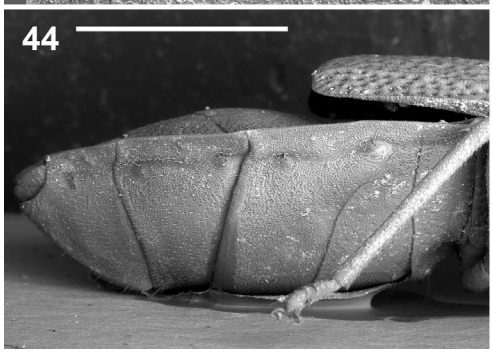
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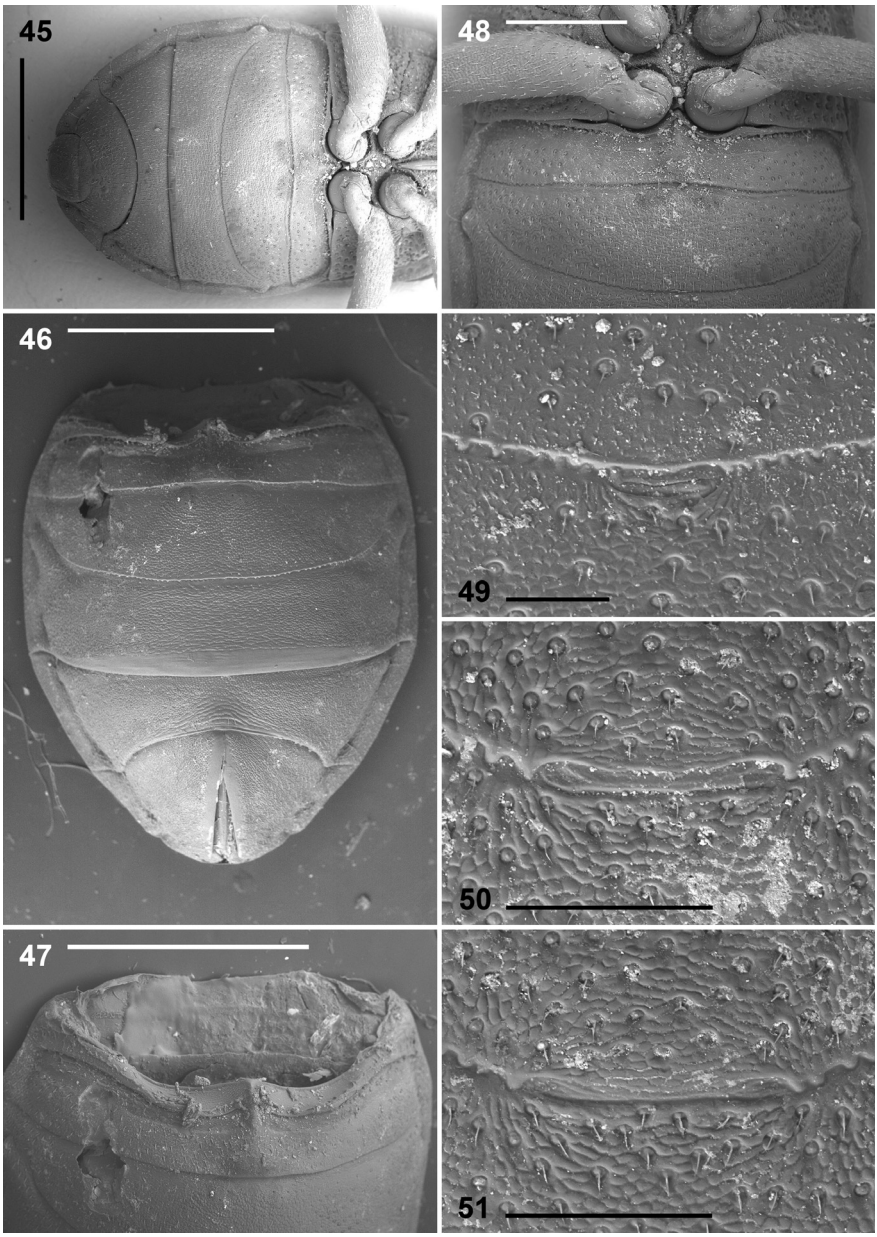
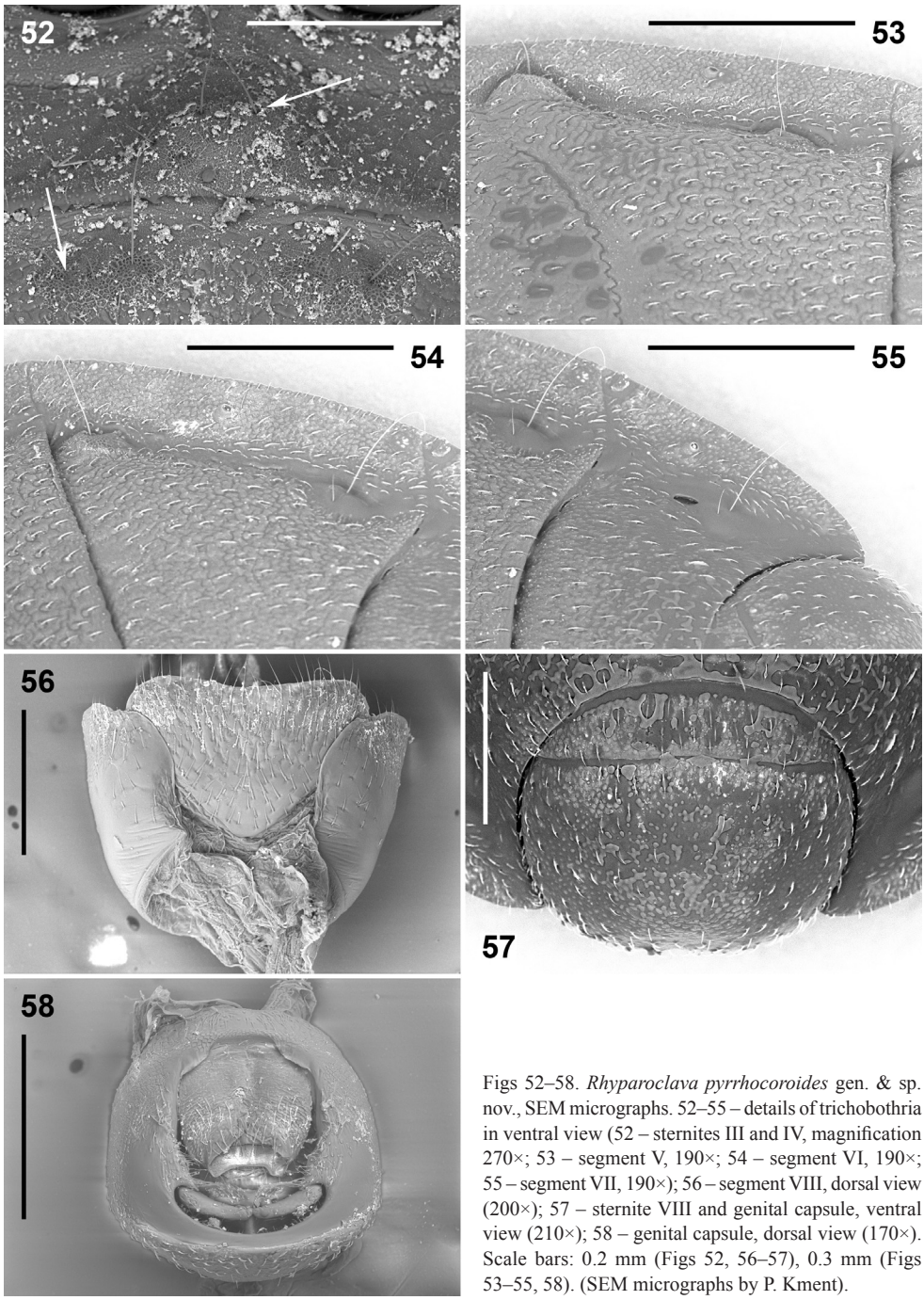
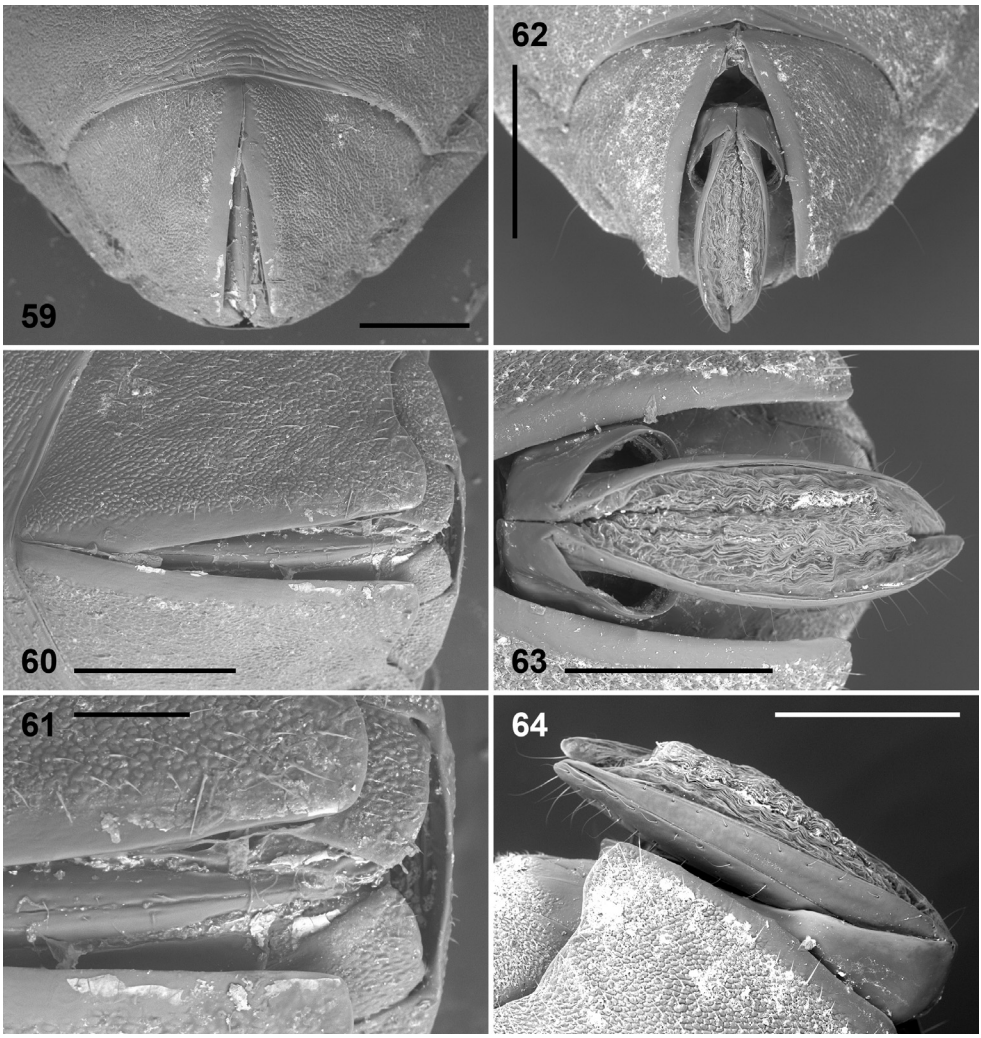


Figs 45–51. *Rhyparoclava pyrrhocoroides* gen. & sp. nov., SEM micrographs, abdomen: 45 – male, ventral view (magnification 47×); 46 – female, ventral view (42×); 47 – female, detail of anterior region (70×); 48 – male, details of sternites II–IV (70×). 49–51 – female, scars of larval dorso-abdominal scent glands, dorsal view: 49 – tergites III and IV; 50 – tergites IV and V (300×); 51 – tergites V and VI (300×). Scale bars: 0.1 mm (Fig. 49), 0.2 mm (Figs 50–51), 0.5 mm (Fig. 48), 1 mm (Figs 45–47). (SEM micrographs by P. Kment).



Figs 52–58. *Rhyparoclava pyrrhocoroides* gen. & sp. nov., SEM micrographs. 52–55 – details of trichobothria in ventral view (52 – sternites III and IV, magnification 270×; 53 – segment V, 190×; 54 – segment VI, 190×; 55 – segment VII, 190×); 56 – segment VIII, dorsal view (200×); 57 – sternite VIII and genital capsule, ventral view (210×); 58 – genital capsule, dorsal view (170×). Scale bars: 0.2 mm (Figs 52, 56–57), 0.3 mm (Figs 53–55, 58). (SEM micrographs by P. Kment).



Figs 59–64. *Rhyparoclava pyrrhocoroides* gen. & sp. nov., SEM micrographs. 59–61 – female terminalia, ventral view (59 – 95×, 60 – 140×, 61 – 300×). 62–64 – ovipositor (62 – ventral view, 90×, 63 – detail in ventral view, 180×, 64 – detail in lateral view, 160×). Scale bars: 0.1 mm (Fig. 61), 0.3 mm (Figs 59–60, 63–64), 0.5 mm (Fig. 62). (SEM micrographs by P. Kment).

Male genitalia. Genital capsule (Figs 57–58) small, subquadrate, widest subapically; posterior aperture (Fig. 58) large, divided by one narrowly triangular projection on each side into a broadly oval dorsal sinus and transverse, narrowly reniform ventral sinus. Paramere (Figs 65–66) narrowly rhombic. Phallus as in Figs 67–69 (not inflated), aedeagus composed by a basal vestibule (Tsai & Rédei in press; = distinconjunctiva sensu Bonhag & Wick 1953) untraceable in repose, a narrow, helicoid complex forming two coils, and a thin penisfilum protruding from the complex, forming five coils.

Female genitalia with ensiform but relatively short ovipositor (Figs 59–64); sternite VII completely bisected along midline, the two hemisternites broadly subtriangular, their posteromesal angles roundedly protruding, distal margins emarginate; valvifer IX nearly completely covered, only distalmost extremity exposed in rest (Fig. 60). Spermatheca helical, apically widened (Fig. 70).

Sexual dimorphism. Females somewhat wider and more robust than males (see the species description, measurements and calculated ratios), having wider abdomen compared with total body length, wider corium and pronotum compared with their lengths.

Differential diagnosis and systematic placement. *Rhyparoclava* gen. nov. is established here for a single species, *R. pyrrhocoroides* sp. nov., which is easy to distinguish from all known members of Rhyparochromidae due to its unique habitus, including anocellate head with prominent antenniferous tubercles, explanate lateral margins of pronotum and corium, brachyptery, and especially antennal segments II–IV forming a compact club, a condition unknown in any other member of the family. There are several genera with more or less incrassate antennal segments II to IV, e.g. *Appolonius* Distant, 1901 (Drymini) (Chopra & Singal 1982), *Lanchnophorus* Reuter, 1887 (Rhyparochromini) (Kment et al. 2016), *Longinischus* Brailovsky, 2009 (Ozophorini) (Brailovsky 2009, Brailovsky & Barrera 2016), and *Ptochiomera* Say, 1832 (Myodochini) (Henry et al. 2015), but all of them have antennal segments attenuated both basally and apically so the antenna keeps its moniliform structure.

Although *Rhyparoclava pyrrhocoroides* gen. & sp. nov. somewhat resembles some members of Pyrrhocoroidea in its general habitus and the lack of ocelli, it certainly does not belong to Pyrrhocoroidea because of the following characters: 1) presence of epipleurites (inner laterotergites), and 2) presence of a sclerotized holder and a multicoiled penisfilum (unknown in any Pyrrhocoroidea). These two characters are synapomorphies of Rhyparochromidae (both Plinthisini and Rhyparochromini), therefore the new genus is placed into this family. The lack of ocelli (a synapomorphy of Pyrrhocoroidea) in *Rhyparoclava* gen. nov. is therefore an autapomorphy evolved convergently and independently from the condition found in Pyrrhocoroidea, probably as a result of loss of the flight capacity in *Rhyparoclava*.

Based on the intersegmental suture between abdominal sternites IV and V curving anteriorly, terminating before attaining lateral abdominal margin (Figs 36–37, 44), the new genus is placed into the subfamily Rhyparochrominae (Sweet 1967, Henry 1997).

Following the keys to the tribes of Rhyparochrominae (Sweet 1967, Péricart 1999a), the combination of the abdominal spiracle II positioned ventrally and spiracles III and IV positioned dorsally on hypopleurites (Fig. 43), the posterior pair of trichobothria on sternite V being always with one above the other (Figs 37, 54), and the anterior dorso-abdominal scent gland present between terga III and IV (Fig. 49) unequivocally place *Rhyparoclava* to either Megalonotini or Rhyparochromini. Despite a superficial similarity of *Rhyparoclava* to some of the Gonianotini with explanate lateral margins of pronotum (especially *Emblethis* Fieber, 1860 – cf. Péricart 1999a,b), its placement in Gonianotini is excluded by the abdominal spiracle III positioned dorsally (it is positioned ventrally in Gonianotini). However, a placement of *Rhyparoclava* to either Megalonotini or Rhyparochromini is problematic due to the fact that both tribes are best distinguished based on larval characters, which are not available for *Rhyparoclava*. The tribe Megalonotini is defined by the absence of a Y-suture between tergites

III and IV in larva; the abdomen of the larva is black and heavily sclerotized; and anterior dorso-abdominal scent gland usually reduced, while in the larvae of Rhyparochromini, the Y-suture between tergites III and IV is present; the abdomen is usually light-pigmented, not black, and the anterior dorso-abdominal scent gland is always well developed (Sweet 1967, Péricart 1999a). Péricart (1999a) added one more character in the key for West Palaearctic genera: pronotum without or with only a narrow lateral keel in Megalonotini (e.g. *Sphragisticus* Stål, 1872), while lateral margins of pronotum are largely lamellate in all their length in Rhyparochromini. However, this is true only for West Palaearctic Rhyparochromini genera, e.g. in the Indian *Altomarus* Distant, 1903 or *Caridops* Bergroth, 1894, the lateral margin of pronotum is ecarinate, rounded (see Distant 1904). The presence of the vestiges of the anterior dorso-abdominal scent gland and the laterally explanate pronotal margin suggests an inclusion of *Rhyparoclava* into Rhyparochromini. However, a definitive tribal placement of the new genus requires either the discovery and description of a larva or the use of molecular phylogenetic methods in future studies.

The function of the peculiar clavate antennae (Figs 1–2, 11–12, 35, 71) of *Rhyparoclava* remains unknown. At first glance, they resemble antennae of some Clavigeritae (Coleoptera: Staphylinidae: Pselaphinae), e.g. *Colilodion* Besuchet, 1991 from Borneo and Sumatra (Besuchet 1991: 501), or the recently descibed *Squamiger elegans* Hlaváč & Baňař, 2016 from central Madagascar (Hlaváč & Baňař 2016: 394). The subtribe Clavigeritae contains strictly myrmecophilous genera (e.g. Hlaváč et al. 2013), having antennae strongly specialized for secretion of liquid compounds. However, we did not find any special morphological feature on antennae of *Rhyparoclava* such as gland openings (Figs 12–15, 71). The hard incrustation (slimy after softening in water) apparent on apical antennal segments in some specimens (Figs 13, 14) is interpreted as contamination, not a secretion of the antennal segments. Just speculatively, the antennae may be involved in visual communication (cf. also Wappler et al. 2015) or may serve as a fat storage organ helping to survive in adverse environmental conditions.

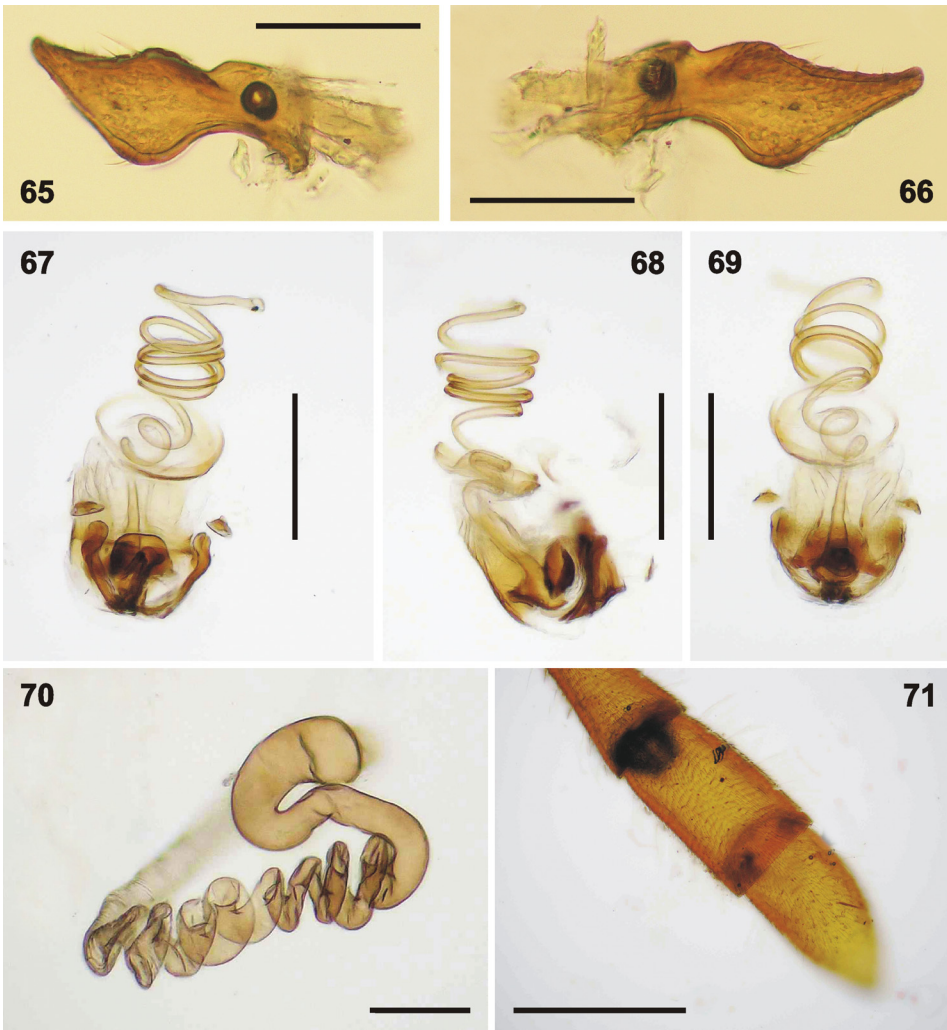
Etymology. The generic name is composed from the Latinized Greek word *rhyparo-* (originally ρυπαρός, meaning dirty or filthy), standing here for the family Rhyparochromidae, and the Latin noun *clava* (meaning maul, stick, cudgel or club), referring to the unusual clavate shape of antennae, unique within the family. The gender is feminine.

Rhyparoclava pyrrhocoroides sp. nov.

(Figs 1–71, 74–78)

Type locality. Northern Madagascar, Antsiranana Province, Antsiranana Prov., 8 km SW of Antsiranana (= Diego-Suárez), Montagne de Français hills, S 12°19′00.23″ E 49°33′92″.

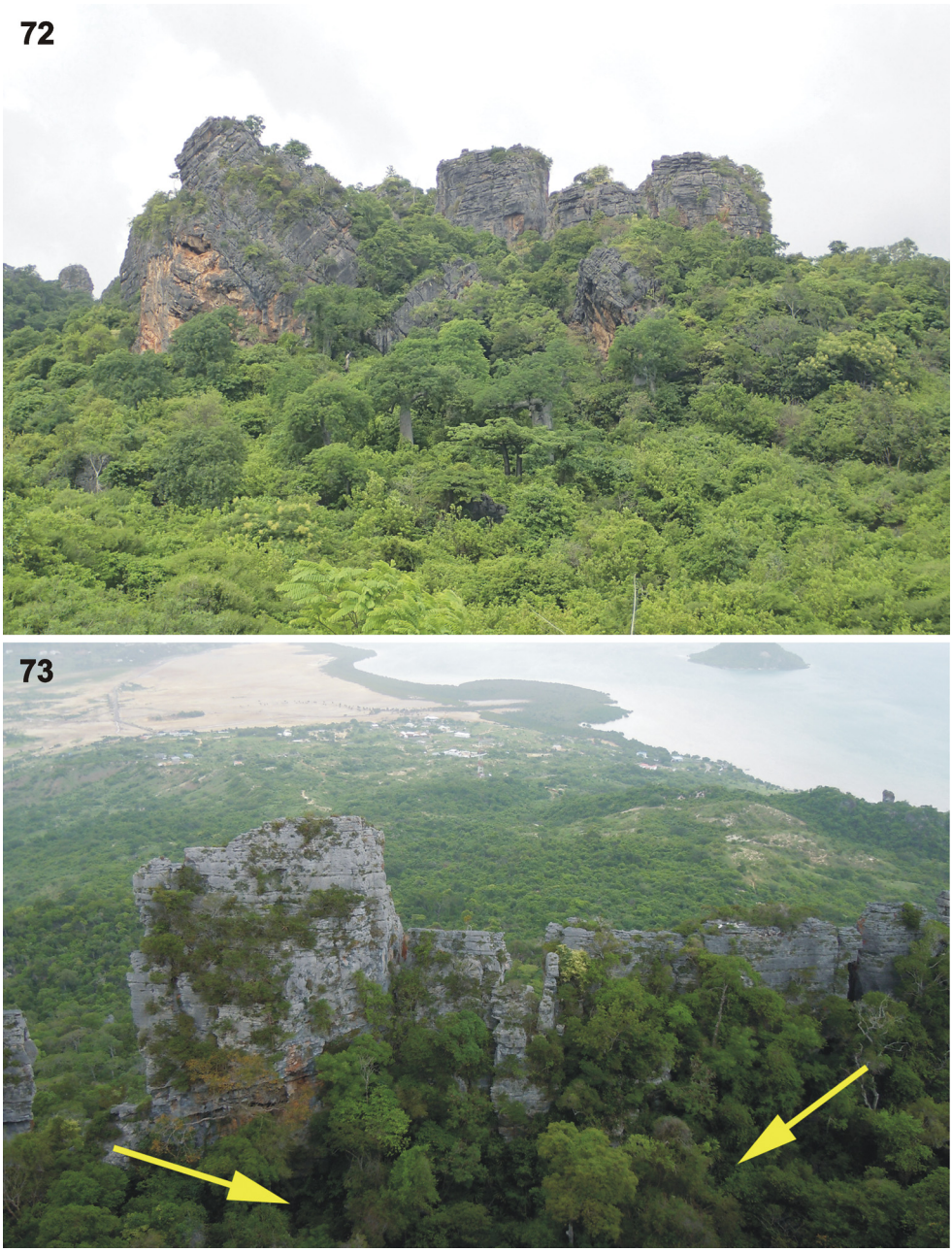
Type material. Holotype: ♂ (MMBC), 'MFR/Jan.2015/17 **N MADAGASCAR / Montagne de Français** ~250m / S12°19´00.23´´E49°33´92´´; 19.i.2015 / sifting litter by rock; Winkler app. extr. / P. Baňař & E.M. Rabotoson lgt. [printed, white label] // HOLOTYPE / *Rhyparoclava*/ pyrrhocoroides **gen. & sp. nov.** / P. Kment, V. Hemala & P. Baňař det. 2016 [printed, red label]'. Paratypes: 8 ♂♂ 8 ♀♀ (3 ♂♂ 2 ♀♀ MMBC; 3 ♂♂ 3 ♀♀ NMPC; 1 ♂ BMNH; 1 ♂ HNHM; 1 ♀ MNHN; 1 ♀ EKKH), the same data as holotype, 1 ♂ and 1 ♀ gold-coated for SEM photographing]; 1 ♀ (MMBC), 'MFR/Jan.2015/14 **N MADAGASCAR / Montagne de Français** ~320m / 18.i.2015; sifting litter by rock / Winkler apparatus extraction / P. Baňař & E.M. Rabotoson lgt.'; 2 ♂ 2 ♀♀ (MMBC), 1 ♂ 2 ♀ (NMPC), 'MFR/Jan.2015/15 **N MADAGASCAR / Montagne de Français** ~200m / 18.i.2015; sifting litter under big tree / Winkler apparatus extraction / P. Baňař & E.M. Rabotoson lgt.'; 1 ♂ 1 ♀ (MMBC), 1 ♀ (NMPC), 'MFR/Jan.2016/01 **N MA-**



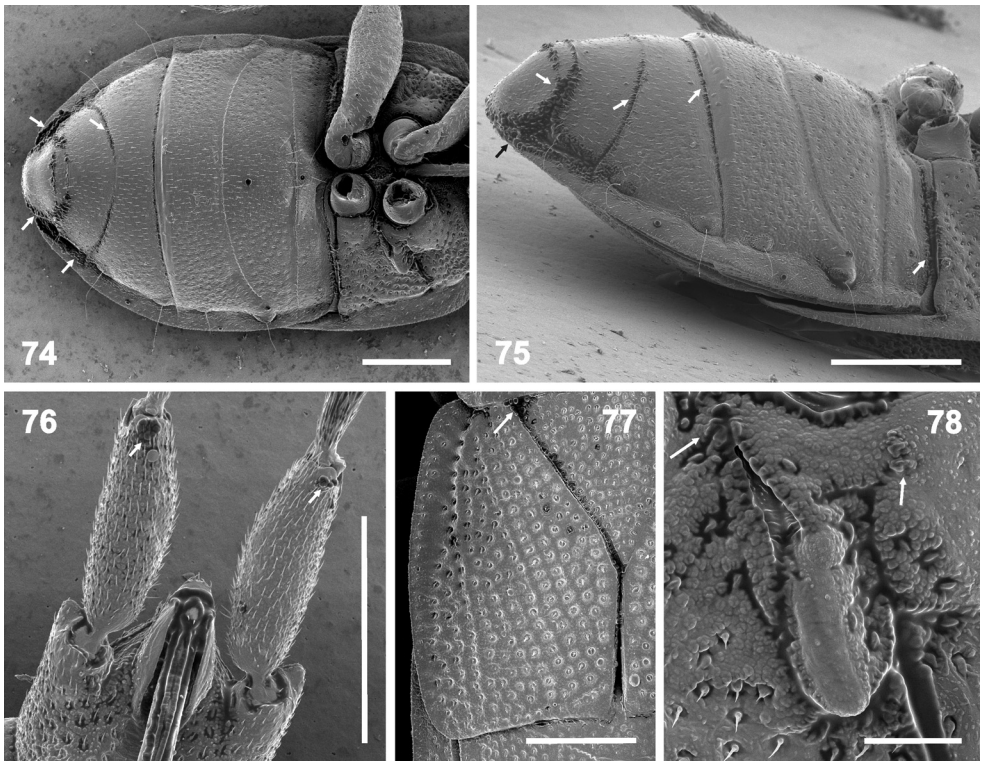
Figs 65–71. *Rhyparoclava pyrrhocoroides* gen. & sp. nov., male and female genitalia: 65–66 – paramere (two different views); 67–69 – phallus, not inflated (67 – ventral, 68 – lateral, 69 – dorsal view); 70 – spermatheca; 71 – basi- and distiflagellum after KOH treatment. Scale bars: 0.1 mm (65–70), 0.5 mm (71). (Photographs by P. Bařař).

DAGASCAR / Montagne de Français ~250m / 14.i.2016; sifting litter + rotten branches / Winkler apparatus extraction / P. Bařař & E.M. Rabotoson lgt.' Each paratype bears following printed red label: 'PARATYPE / *Rhyparoclava* / pyrrhocoroides **gen. & sp. nov.** / P. Kment, V. Hemala & P. Bařař det. 2016'.

Description. ***Coloration*** (Figs 1–2). Entire body dark brown, head blackish brown, the following parts being paler: antennal segments II–IV reddish brown, pedicel and basiflagellum with narrow black ring apically, apex of distiflagellum paler than rest of antenna; labium pale,



Figs 72–73. Montagne de Français, type locality of *Rhyparoclava pyrrhocoroides* gen. & sp. nov. 72 – view of the first table mountain from the main entrance; 73 – view from the top of the largest table mountain towards the coast. Yellow arrows indicate several places where sift samples were taken. (Photographs by P. Baňař).



Figs 74–78. *Rhyparoclava pyrrhocoroides* gen. & sp. nov., wart-like tubercles (marked by white arrows), SEM micrographs. 74 – thorax and abdomen, male, ventral view (45×); 75 – abdomen, male, lateral view (65×); 76 – scapes, ventral view (120×); 77 – scutellum and hemelytron, dorsal view (75×); 78 – metapleuron with ostiole and peritreme, ventrolateral view (250×). Scale bars: 0.5 mm (74–77), 0.1 mm (78). (SEM micrographs by P. Baňař).

only apex of the labial segment IV dark brown; coxae reddish brown, femora and tibiae pale brown, trochanter and tarsus paler than rest of leg; lateral margin of pronotum and costal margin/hypocostal lamina of hemelytron reddish brown because partly translucent due to deep punctures; small pale brown spots present around the callar lobe, a large one in the middle of scutellum, smaller one or two on veins in 2/3 of corium, a paler one in inner 1/3 of posterior margin of corium; sternites and hypopleurites III–VII each with one pale brown spot in posterolateral angle. Tergite VII reddish brown with a narrow blackish stripe distally.

Structure. See the generic description.

Vestiture. Head, thorax and abdomen glabrous macroscopically (e.g., Figs 1–2, 4, 19–20, 40, 46), with very short adpressed hairs visible only under high magnification (Figs 16–18, 25–28, 42, 48–51). Legs (Figs 21, 23), scape (Figs 9–10) and labium (Figs 5, 7, 21–22) with very short, adpressed pilosity; antennal segments II–IV covered with whitish adpressed setae and few intermingled long, fine, erect setae, most prominent on pedicel (Figs 9–15).

Punctation. Head (Figs 5–8) with dense, shallow punctures throughout, somewhat more prominent on vertex. Disc of pronotum (Figs 4, 16–17) with dense, irregularly dispersed, dark punctures, except of nearly smooth cicatrices, and explanate lateral margin bearing a single longitudinal row of dark brown punctures both dorsally and ventrally (Fig. 16). Scutellum (Figs 18, 20) with coarse, dense, irregular, dark punctures. Corium and clavus (Figs 19–20) with large and coarse, concolorous punctures forming longitudinal rows between veins. Thoracic pleura (Figs 23, 25–28) with large and deep punctures. Abdomen (Figs 39–42, 45–46, 48) with small to very small punctures both dorsally and ventrally, becoming smaller and denser posteriad; tergites III laterally and IV anterolaterally without punctures (Figs 41–42).

Measurements [median (minimum–maximum); in mm]. *Males* (n = 9; for antennal segments II–IV: n = 8, for labial segments: n = 1). Body length 4.26 (4.12–4.59); head: length 0.88 (0.66–0.96), width (including eyes) 0.87 (0.85–0.92), interocular width 0.47 (0.44–0.50); length of antennal segments: scape (I) – 0.54 (0.47–0.58), pedicel (II) – 0.88 (0.81–0.90), basiflagellum (III) – 0.48 (0.43–0.53), distiflagellum (IV) – 0.48 (0.45–0.51); lengths of labial segments: I – 0.57, II – 0.79, III – 0.46, IV – 0.34 mm; pronotum: length 0.77 (0.70–0.79), width 1.35 (1.26–1.45); scutellum: length 0.76 (0.67–0.79), width 0.89 (0.83–0.94); corium: length 1.43 (1.37–1.55), width 0.88 (0.82–0.92); abdomen: width (across segment IV) 1.79 (1.68–1.93).

Females (n = 9; for antennal segments II–IV: n = 8). Body length 4.99 (4.77–5.19); head: length 0.86 (0.74–0.93), width (including eyes) 0.95 (0.91–0.98), interocular width 0.51 (0.48–0.54); length of antennal segments: scape (I) – 0.56 (0.51–0.61), pedicel (II) – 0.96 (0.93–1.00), basiflagellum (III) – 0.55 (0.51–0.58), distiflagellum (IV) – 0.55 (0.50–0.58); pronotum: length 0.78 (0.76–0.85), width 1.52 (1.46–1.60); scutellum: length 0.85 (0.83–0.95), width 1.02 (0.97–1.11); corium: length 1.67 (1.59–1.75), width 0.98 (0.92–1.06); abdomen: width (across segment IV) 2.16 (2.07–2.26).

Ratios. Dorsal ocular index 2.35 (males), 2.31 (females); pronotum width / pronotum length 1.75 (males), 1.94 (females); corium length / corium width 1.63 (males), 1.70 (females); total body length / maximum abdomen width 2.38 (males), 2.31 (females).

Intraspecific variation. Besides sexual dimorphism, we noticed only slight variability in colouration, some specimens being slightly paler (probably teneral).

Teratology. In some of the specimens studied (sample 17 collected on 19.i.2015) we observed peculiar, small wart-like tubercles occurring isolated (e.g. apically on scape I – Fig. 76: white arrows) or in groups forming a 'rash' on certain body parts, especially around the peritreme (Fig. 78), in basal angles of the scutellum (Fig. 77), or along sutures between abdominal sternites (Figs 74–75). The presence of the 'rash' differed between the left and right side of the same specimen as well as between specimens, completely lacking in others. We consider this as a case of teratology or a symptom of some kind of disease.

Etymology. The species epithet is a compound adjective derived from the generic name of the fire bug, *Pyrrhocoris* Fallén, 1814, and the suffix *-oides* originating from the Ancient Greek ειδος (eidos, = form, likeness), meaning 'looking like a member of Pyrrhocoroidae'. In the Latinized form, the ending *-oides* is constant regardless the grammatic gender of the associated genus.

Habitat and biology. All known specimens of *Rhyparoclava pyrrhocoroides* gen. & sp. nov. were collected by sifting of leaf litter and other plant debris and subsequent extraction of the sifted material in a Winkler apparatus. The sifted samples were taken in woody parts of the Montagne de Français Reserve (Figs 72–73), a unique habitat formed on a calcareous massif eroded into a system of karstic formations and small table mountains, reaching maximally to 450 m a.s.l. The most interesting, densely forested parts covered with a strictly seasonal, dry deciduous forest, are situated between 150 and 450 m a.s.l. The sifted samples (containing many other groups of arthropods) were taken from microhabitats with maximum concentration of leaf litter, such as from small ravines, natural field depressions and near bases of high rocks (Fig. 73, yellow arrows). The sampled microhabitats situated in low canopy forest and shrubs were very dry, although the locality was visited during the height of the rainy season (January 2015 and 2016). The absence of larvae in the samples suggests a seasonal development of *R. pyrrhocoroides*.
Distribution. Endemic to northern Madagascar; known only from the Montagne de Français Reserve.

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