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Four new species of the genus *Rhyparus* Westwood, 1845 (Coleoptera: Scarabaeidae: Aphodiinae) with modified pygidium and last abdominal ventrite in females

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Authors described here four new species of the genus *Rhyparus* Westwood, 1845 with modified pygidium and last ventrite in females: *R. bacanensis* sp. nov. from Bacan Island, *R. buruensis* sp. nov. from Buru Island, *R. fijiensis* sp. nov. from Viti Levu Island and *R. stebnickae* sp. nov. from New Guinea Island. *R. paraphilippinensis* Ochi & Kakizoe, 2021 is identified as species consisting to mentioned group of species. Iconography of all known species with mentioned modifications is given. *R. approximans* Fairmaire, 1893, *R. loebli* Paulian, 1983 and *R. sepikensis* Stebnicka, 1998 are photographed in literature for the first time. *R. loebli* is recorded from Japan for the first time. Short discussion about relationships and evolution within the genus *Rhyparus* is given.

Key words. New species, Scarabaeoidea, Rhyparini, oriental region, australian region.

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INTRODUCTION

Stebnicka (1998) for the first time observed unusual sexual dimorphism in species identified by her as *Rhyparus striatus* Arrow, 1935 and in described then *Rhyparus sepikensis* Stebnicka, 1998. Males of both species has fifth abdominal ventrite and pygidium characteristic for the genus. Females has fifth abdominal ventrite transversely fossulate in anterior third and covered by deplanate, strongly elongate pygidium. Stebnicka examinate a large material of Rhyparini from Papua New Guinea, anyway never examinate type specimen of *R. striatus*. *R. striatus* was described on the basis of single specimen from Kokoda (Papua New Guinea). Stebnicka presumed that *R. striatus*

should be one of species from examinated by her material and choose most common, which was collected on type locality of *R. striatus* too. That was most probable in her thinking species. Authors have established that *R. striatus* is different species, which she never had a chance to study, much more similar to *R. henryi* Stebnicka, 1998. Species identified by her as *R. striatus* become indeed undescribed species named by us *Rhyparus stebnickae* sp. nov. Authors in their collections founded yet three species similar to *R. stebnickae* sp. nov. with similar sexual dimorphism, which are relatively easily distinguishable between each other and from all other known species of the genus *Rhyparus*. Although variability inside of that species need additional comments. Additionally, we identify that *R. paraphilippinensis* Ochi & Kakizoe, 2021 consist to discussed group of species. Similarity of *R. approximans* Fairmaire, 1893 and *R. loebli* Paulian, 1983 are discussed.

Interesting and discutable is similarity of all species to other Papuan species, especially to: *R. gracilis* Arrow, 1905 and *R. ediae* Stebnicka, 1998. Another interesting fact is that *R. stebnickae* sp. nov. and *R. sepikensis* – two species from the same evolutional group – may live together on the same locality.

MATERIAL AND METHODS

The specimen was observed with a Nikon SMZ-U stereoscopic microscope. The photos published here were taken by the use of the Canon EOS 5D Mark III connected with Canon MP-E 65mm macro lens. Photos were edited in the Helicon Focus 7 and Adobe Photoshop Elements 2018 programs.

For morphological terms used in the description of specimens we follow Krikken and Hujibregts (1987).

Specimens from type series of the new species are indicated by a red, printed label bearing the status of the specimen, its name, name of the authors, and year and month of the designation. In information about type material sign: "|" symbolized separate lines on labels; "||" symbolized the end of labels.

Our comments are added in square brackets "[…]"

Places of depository of specimens are given in round brackets "(…)".

We examined specimens from following private collections and institutions:

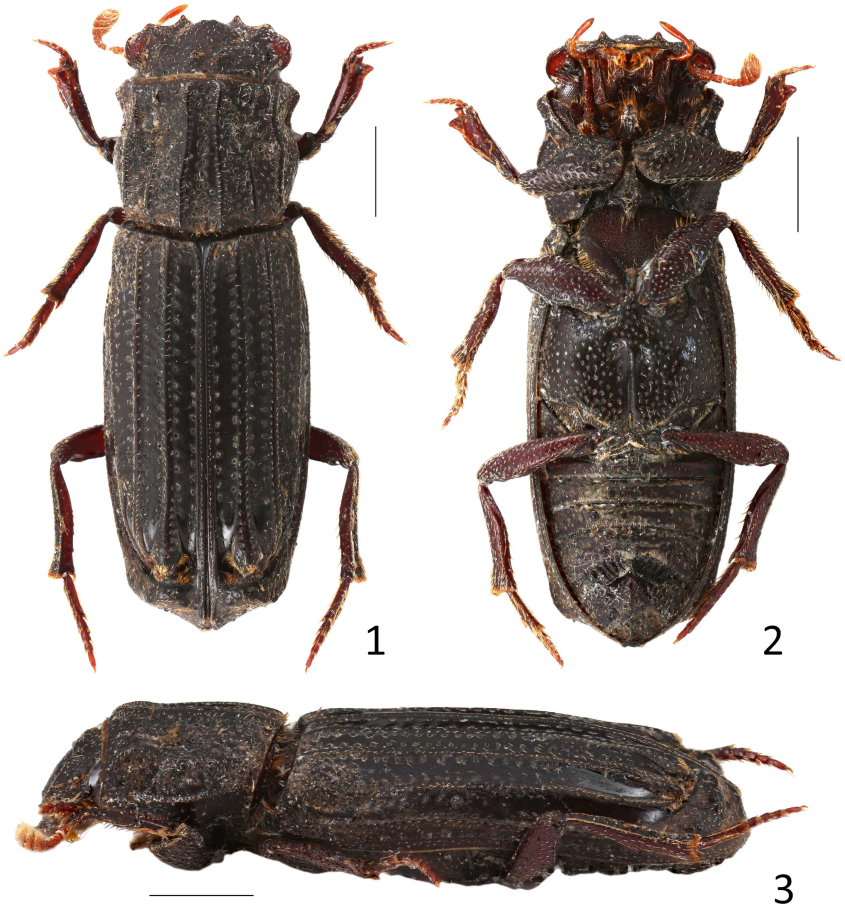
BPBM – Berince Pavahni Bishop Museum, Honolulu, USA (Jim Boone, Jeremy Frank)
CMNC – Canadian Museum of Nature, Ottawa, Canada (Francois Genier, Andrew Smith)
CNCW – Cezary Nowak, collection private, Włoszczowa, Poland
DUBC – Institute of Life Sciences and Technologies, Daugavpils University, Daugavpils, Latvia
FSCA – Florida State Collection of Arthropods, Gainesville, Florida, USA (Paul Skelley)
ISEA – Institute of Systematics and Evolution of Animals in Kraków, Poland (Daniel Kubisz, Łukasz Przybyłowicz)
ŁMCN – Łukasz Minkina, collection private, deposited in Institute of Systematics and Evolution of Animals in Kraków, Poland
MHNG – Museum of Natural History, Geneve, Switzerland (Giuluo Cuccodoro)
NMPC – National Museum, Praha, Czech Republic (Jiři Hájek)
NZAC – New Zealand Arthropod Collection, LandCare Research, Auckland, New Zealand (Richard Leschen)

TAXONOMY

Rhyparus bacanensis sp. nov.
(Figs. 1–3, 20, 26)

Type locality. Indonesia, Moluccas North, Bacan Island, Mount Sibela, 5 km SE of Makian vill.

Type material. Holotype (♀): Indonesia, N Moluccas | 500-750m., Bacan Island | SE slopes of Mt. Sibela | 5 km SE of Makian vill. |2-12.v.2008, leg. S. Jakl || (ŁMCN).



Figs. 1–3. *Rhyparus bacanensis* sp. nov., ♀, holotype: 1 – dorsal view; 2 – ventral view; 3 – lateral view. Scale lines: 1.0 mm.

Description of the holotype. Dorsum (Fig. 1). Length: 7.2 mm; maximum width: 2.25 mm. Body large-sized for members of this genus, elongate, not so distinctly convex, flattened in central part; weakly shiny; apparently almost glabrous, though partly clothed with very small yellowish macrosetae on head and all longitudinal costae on pronotum and elytra. Brownish to dark brown; antennae, tarsomeres and mouth parts pale brown.

Head (Fig. 20) moderately shiny, tops of costae distinctly shiny; transversely sub-hexagonal; clypeus trapezoidal in outline, anteriorly truncate, on sides weakly upturned as obtuse, weak tooth, and later sinuous on either side; genae distinctly more excavate than eyes; clypeal disc distinctly convex, ringed by a deep groove; convexity with a pair of quite distinct, very short, convergent ridges, nearly on whole surface with distinct, fine punctures bearing small macrosetae. Frons with four distinct, longitudinal ridges with similar structure as ridges on clypeal convexity. Head covered by quite regularly spaced, quite dense, moderately large punctures bearing small macrosetae.

Pronotum very weakly shiny, tops of costae distinctly shiny; with eight distinct costae and seven intercostae, with two lateral, rounded lobes on each side. Anterior lobes somewhat higher and distinctly narrower than posterior, on the top are the widest part of pronotum. Costae of middle, third and fourth pair not interrupted in basal part

of apical half, very gently convergent, distinctly convergent in the middle of apical third; second pair of costae distinctly interrupted in basal part of apical half; costae on each side with very small punctures bearing very small macrosetae. All intercostae in anterior part without additional short costae. Median intercostae with dense punctures, quite distinctly concentrated around median part into longitudinal line, all intercostae in basal part with distinct, dense punctation.

Scutellum almost imperceptible.

Elytra moderately shiny, tops of costae and preapical glandular area more distinctly shiny. Each elytron with six elevated costae, and five flat intercostae. Costae on sides with very small punctures bearing very small macrosetae. Preapical glandular area relatively small. Intercostae first to fourth with two distinct rows of punctures; on third intercostae there is very short additional costae with very short additional row of punctures here, however there are simple, sparsely located, much smaller punctures punctures almost until apex. Fifth intercosta with one row of punctures; in basal part of fourth intercosta there is region with extremely short additional costa, with some additional punctures. External caudal bulb distinctly reduced, area between external caudal bulb and sides of elytra not divided; external and medio-internal caudal bulbs not divided; medio-internal caudal bulb shortened, transversally rounded, internally stretched.

Pygidium (Fig. 26) with dense, irregularly spaced punctation, with weak longitudinal rib in the middle and deep excisionon its sides; with distinctly longitudinal apex in the shape of distinct triangle.

Venter (Fig. 2) moderately shiny. Meso-metaventral plate flattened in the middle, with distinct, narrow, quite deep longitudinal furrow; punctation of meso-metaventral plate dense, quite regularly spaced, irregular in size; all punctures bearing short macrosetae. Abdominal ventrites moderately shiny, on sides with rows of punctures; with an additional punctured furrow in basal part. Last abdominal ventrite with dense punctures, which are about one and half time larger than on last but one ventrite; in basal half in the middle part with dense, very deep, longitudinal rows; in apical part in the middle with very deep groove, clearly located much below apex of pygidium.

Meso- and metafemora with two very indistinct tubercles on lower border; all femora shiny, with regular, very distinct, rather small, very dense punctation; all punctures bearing small macrosetae.

Variation. Unknown.

Sexual dimorphism. Unknown. When we look at shape of meso-metaventral plate and apex of mesotibiae we can suppose that sexual dimorphism it is like typical for a whole genus (except pygidium and last ventrite).

Etymology. Toponymic; an adjective derived from the name of Bacan Island – where the holotype was collected.

Affinity. See discussion and tables 1 and 2.

Rhyparus buruensis sp. nov.
(Figs. 4–6, 21, 27)

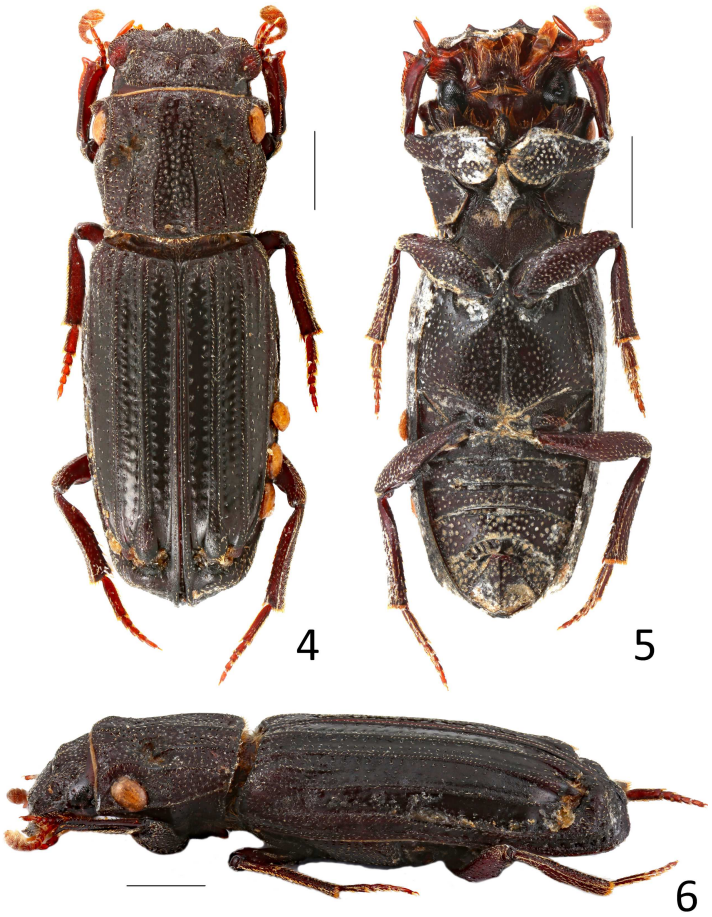
Type locality. Indonesia, Moluccas, Buru Island, Ilat vill., env., Ramaja Mount.

Type material. Holotype (♀): Indonesia | C Moluccas: see Buru Island | 200-350m. | Ilat vill., env., Ramaja Mt. | xii.2012 | leg. S. Jakl || (ŁMCN). Paratype (♀): Indonesia | C Moluccas: see Buru Island | 50-350m. | Ilat vill., env., Ramaja Mt. | vi.2013 | local coll. || (ŁMCN).

Description of the holotype. Dorsum (Fig. 4). Length: 7.3 mm; maximum width: 2.45 mm. Body large-sized for members of this genus, elongate, not so distinctly convex, flattened in central part; shiny; apparently almost glabrous, though partly clothed with very small yellowish macrosetae on head and all longitudinal costae on pronotum and elytra. Brownish to dark brown; antennae, tarsomeres and mouth parts pale brown.

Head (Fig. 21) weakly shiny; transversely subhexagonal; clypeus trapezoidal in outline, anteriorly weakly sinuate, on sides weakly upturned as obtuse, quite distinct tooth, and later sinuous on either side; genae distinctly more excavate than eyes; clypeal disc distinctly convex, ringed by a deep groove; convexity with a pair of quite distinct, very short, convergent ridges, on whole surface with distinct, fine punctures bearing small macrosetae. Frons with four distinct, longitudinal ridges with similar structure as ridges on clypeal convexity. Head covered by quite regularly spaced, quite dense, moderately large punctures bearing small macrosetae.

Pronotum quite distinctly shiny; with eight distinct costae and seven intercostae, with two lateral, rounded lobes on each side. Anterior lobes somewhat higherand distinctly narrower than posterior, on the top are the widest part of pronotum. Costae of third and fourth pair not interrupted in basal part of apical half, very gently convergent, distinctly convergent in the middle of apical third; median and second pair of costae distinctly interrupted in basal part of apical half; costae on each side with very small punctures bearing very small macrosetae. All intercostae in anterior part without additional short costae. Median intercostae with dense punctures, weakly concentrated around median part into longitudinal line, all intercostae in basal part with distinct, dense punctation.



Figs. 4–6. *Rhyparus buruensis* sp. nov., ♀, holotype: 4 – dorsal view; 5 – ventral view; 6 – lateral view. Scale lines: 1.0 mm.

Scutellum almost imperceptible.

Elytra shiny. Each elytron with six elevated costae, and five flat intercostae. Costae on sides with very small punctures bearing very small macrosetae. Preapical glandular area relatively small. Intercostae first to fourth with two distinct rows of punctures; on third intercostae there is short additional costae with additional row of punctures untill half of length of elytra. Fifth intercosta with one row of punctures; in basal part of fourth intercosta there is region with extremely short additional costa, with some additional punctures here. External caudal bulb distinctly reduced, area between external caudal bulb and sides of elytra not divided; external and medio-internal caudal bulbs not divided; medio-internal caudal bulb shortened, transversally rounded, internally stretched.

Pygidium (Fig. 27) with dense, irregularly spaced punctation, with weak longitudinal rib in the middle, and deep excision on its sides; with distinctly longitudinal apex in the shape of volcano with sinuate top.

Venter (Fig. 5) shiny. Meso-metaventral plate flattened in the middle, with distinct, narrow, quite deep longitudinal furrow; punctation of meso-metaventral plate dense, regularly spaced, irregular in size; all punctures bearing short macrosetae. Abdominal ventrites moderately shiny, on sides with rows of punctures; with an additional punctured furrow in basal part. Last abdominal ventrite with dense punctures, which are similar size as on last but one ventrite; in basal half in the middle part with dense, very deep, longitudinal rows; in apical part in the middle with very deep groove, clearly located much below apex of pygidium.

Mesofemora with two very indistinct tubercles on lower border; metafemora without any tubercles on lower border; all femora shiny, with regular, very distinct, rather small, very dense punctation; all punctures bearing small macrosetae.
Variation. Unknown.

Sexual dimorphism. Unknown. When we look at shape of meso-metaventral plate and apex of mesotibiae we can suppose that sexual dimorphism it is like typical for a whole genus (except pygidium and last ventrite).

Etymology. Toponymic; an adjective derived from the name of Buru Island – where the holotype was collected.

Affinity. See discussion and tables 1 and 2.

Rhyparus fijiensis sp. nov.
(Figs. 7–9, 22, 28)

Type locality. Fiji, Viti Levu Island, Navai.

Type material. Holotype (♀): Fiji | Viti Levu, Navai | vii.2016 || (ŁMCN). Paratypes (27exx.): 2exx.: Fiji | Viti Levu, Navai | xii.2016 || (ŁMCN); 6exx.: Fiji | Viti Levu, Navai | xii.2016 || (4exx. CNCW, 1ex. DUBC, 1ex. ISEA). 2exx.: Fiji | Viti Levu | Savura Creek, 31.vii.1975 | P.A. Maddison, M.V. light || (NZAC); 1ex.: Fiji | Viti Levu | Colo-i-Savu | 4.viii.1985 | T. Kepa, M.V. light || (NZAC); 2exx.: Fiji | Viti Levu | Colo-i-Savu | 18.i.1975 | P.A. Maddison, M.V. light || (NZAC); 4exx.: Fiji | Viti Levu | Nandrau | 750m, 19.x.1977 | G.Kuschel || (NZAC); 9exx.: Fiji | Viti Levu | Savu | 10.x.1977 | G. Kuschel [duplicate specimens in alcohol] || (6exx. FSCA; 3exx. NZAC); 1ex.: Fiji | Vanjua Levu | "forest nr. Niurudi Navonu" | 3-6.x.1975, P. S. Maddison, M.V. light || (NZAC).

Description of the holotype. Dorsum (Fig. 7). Length: 8.0 mm; maximum width: 2.3 mm. Body large-sized for members of this genus, elongate, not so distinctly convex, flattened in central part; shiny; apparently almost glabrous, though partly clothed with very small yellowish macrosetae on head and all longitudinal costae on pronotum and elytra. Brownish to dark brown; antennae, tarsomeres and mouth parts pale brown.

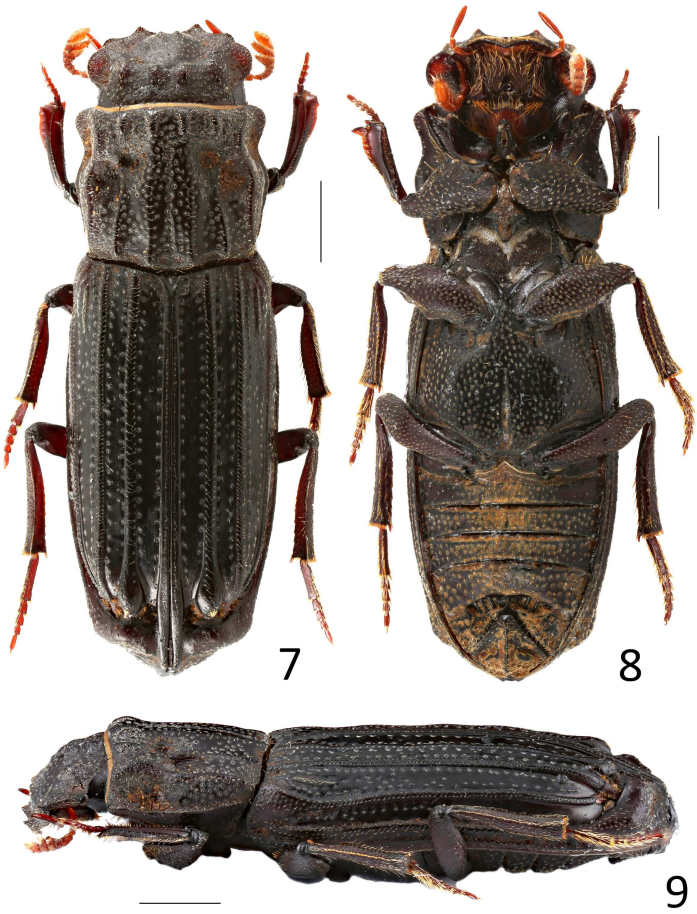
Head (Fig. 22) weakly shiny; transversely subhexagonal; clypeus trapezoidal in outline, anteriorly weakly sinuate, on sides weakly upturned as obtuse, quite distinct tooth, and later sinuous on either side; genae distinctly more excavate than eyes; clypeal disc distinctly convex, ringed by a deep groove; convexity with a pair of quite

distinct, very short, convergent ridges, nearly on whole surface with distinct, fine punctures bearing small macrosetae. Frons with four distinct, longitudinal ridges with similar structure as ridges on clypeal convexity. Head covered by quite regularly spaced, quite dense, moderately large punctures bearing small macrosetae.

Pronotum shiny; with eight distinct costae and seven intercostae, with two lateral, rounded lobes on each side. Anterior lobes very weakly higher and distinctly narrower than posterior, on the top are the widest part of pronotum. Costae of third and fourth pair not interrupted in basal part of apical half, very gently convergent, distinctly convergent in the middle of apical third; median and second pair of costae distinctly interrupted in basal part of apical half; costae on each side with very small punctures bearing very small macrosetae. All intercostae in anterior part without additional short costae. Median intercostae with dense punctures, distinctly concentrated around median part into longitudinal line, all intercostae in basal part with distinct, dense punctation.

Scutellum almost imperceptible.

Elytra shiny. Each elytron with six elevated costae, and five flat intercostae. Costae on sides with very small punctures bearing very small macrosetae. Preapical glandular area relatively small. Intercostae first to fourth with two distinct rows of



Figs. 7–9. *Rhyparus fijiensis* sp. nov., ♀, holotype: 7 – dorsal view; 8 – ventral view; 9 – lateral view. Scale lines: 1.0 mm.

punctures; on third intercostae there is short additional costae with additional row of punctures untill half of length of elytra. Fifth intercosta with one row of punctures; in basal part of fourth intercosta there is region with extremely short additional costa, with some additional punctures here. External caudal bulb distinctly reduced, area between external caudal bulb and sides of elytra not divided; external and medio-internal caudal bulbs not divided; medio-internal caudal bulb shortened, transversally rounded, internally stretched.

Pygidium (Fig. 28) with dense, irregularly spaced punctation, with distinct longitudinal rib in the middle and deep concavitieson its sides; with distinctly longitudinal apex in the shape of volcano with narrow, truncate top.

Venter (Fig. 8) shiny. Meso-metaventral plate flattened in the middle, with distinct, narrow, quite deep longitudinal furrow; punctation of meso-metaventral plate dense, regularly spaced, irregular in size; all punctures bearing short macrosetae. Abdominal ventrites moderately shiny, on sides with rows of punctures; with an additional punctured furrow in basal part. Last abdominal ventrite with dense punctures, which are slightly larger than on last but one ventrite; in basal half in the middle part with dense, very deep, longitudinal rows; in apical part in the middle with very deep groove, clearly located much below apex of pygidium.

Mesofemora with two distinct tubercles on lower border; metafemora without any tubercles on lower border; all femora shiny, with regular, very distinct, rather small, very dense punctation; all punctures bearing small macrosetae.

Variation. Length of body: 7.4–8.2 mm. Intercostae of pronotum and elytra usually are shiny, but sometimes less shiny – untill subopaque. Lateral lobes of pronotum may be more or less distinctly developed. Density of punctation of pronotal and elytral intercostae is quite distinctly variable. Degree of concentration of punctures in median intercostae of pronotum is quite variable. Usually elytral costae are convex and narrow, rarely may be flattened and quite wide. Additional rows of fine punctures observed usually on third elytral intercostae – between main rows, but there are specimens with some punctures on all rows.

Sexual dimorphism. Shape of meso-metaventral plate (in both sexes), apex of mesotibiae (in both sexes) and shape of last abdominal ventrite and pygidium of males are typical for sexual dimorphism in genus *Rhyparus*. Last abdominal ventrite and pygidium of females is distinctly elongate at apex (Fig. 28). Last abdominal ventrite and pygidium of males are not modified.

Etymology. Toponymic; an adjective derived from the name of Fiji Islands – where the type series was collected.

Affinity. See discussion and tables 1 and 2.

Rhyparus stebnickae sp. nov.
(Figs. 10–12, 23, 29)

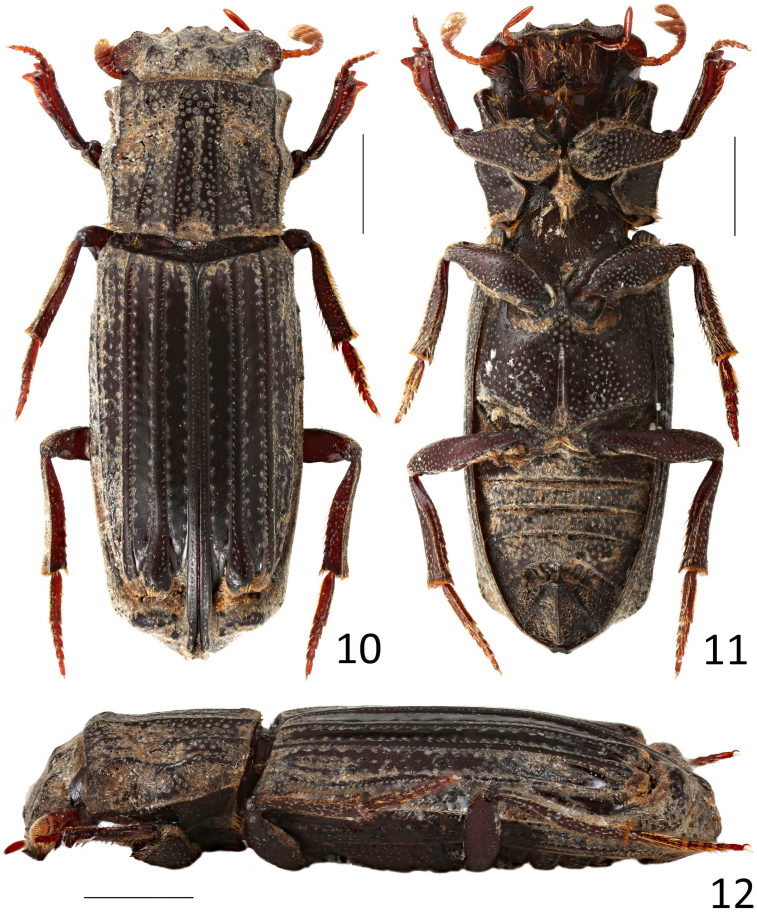
Type locality. Indonesia, West Papua prov., Arfak Mts, Manokwari distr., Dueibei env., cca 20 km S of Warmare, 1190m.

Type material. Holotype (♀): Indonesia, West Papua prov. | Arfak Mts, 1190m alt. | Dueibei env., 10.ii-28.ii.2008 | cca 20 km S of Warmare | Manokwari distr, St. Jakl lgt. || (ŁMCN). Paratypes (10exx.): 1ex.: Coll. I.R.Sc.N.B. | Papua New Guinea | Wau, Morobe prob., | Wau Ecology Institute, | 1200 m, at light | I.G.: 26373 | 18.vi.1981 | leg. J. Van Goethem || (DUBC); 1ex.: Coll.R.Isc.N.B. | Canopy mission P.N.G. | Madang province | Batteta 19-vi-1993 | light M1 | leg. Olivier Missa || (DUBC); 2ex.: Papua New Guinea: | Morobe Prov.: Wau; | 21.ii.1982 || light trap | R.T.Bell, Coll. || (1ex. CNCW; 1ex. NHNG); 1ex.: Papua Nlle Guinée | Morobe i.(19)80 | env de Gurakor | W.G.Ullrich || (ISEA); 1ex.: New Guinea: (NE) | Wau, Morobe distr. | 1200m, 2-10.xi.(19)61 || J. & M. Sedlacek | M.V. light trap || H.F. Howden, 1992 || (ŁMCN); 3exx.: Papua New Guinea | Wau, 4000 ft. | 24-30.VI.1974 | H.F. Howden || Rhyparus | striatus Ar. | dt. Stebnicka (2exx. CMNC; 1ex. FSCA); 1ex.: Papua – N. Guinea | Mainyanda i.1980 | 25km W Bulolo | W.G. Ullrich 600m || (ISEA).

Description of the holotype. Dorsum (Fig. 10). Length: 6.5 mm; maximum width: 1.9 mm. Body moderate- to large-sized for members of this genus, elongate, not so distinctly convex, flattened in central part; shiny; apparently almost glabrous, though partly clothed with very small yellowish macrosetae on head and all longitudinal costae on pronotum and elytra. Brownish to dark brown; antennae, tarsomeres and mouth parts pale brown.

Head (Fig. 23) shiny; transversely sub-hexagonal; clypeus trapezoidal in outline, anteriorly weakly sinuate, on sides weakly upturned as obtuse, quite distinct tooth, and later sinuous on either side; genae distinctly more excavate than eyes; clypeal disc distinctly convex, ringed by a deep groove; convexity with a pair of very indistinct, very short, convergent ridges, nearly on whole surface with distinct, fine punctures bearing small macrosetae. Frons with four distinct, longitudinal ridges with similar structure as ridges on clypeal convexity. Head covered by quite regularly spaced, quite dense, moderately large punctures bearing small macrosetae.

Pronotum shiny; with eight low but distinct costae and seven intercostae, with two lateral, rounded lobes on each side. Anterior lobes somewhat lower and distinctly narrower than posterior; posterior lobes on the top are the widest part of pronotum. Costae of third and fourth pair not interrupted in basal part of apical half, very gently convergent,



Figs. 10–12. *Rhyparus stebnickae* sp. nov., ♀, holotype: 10 – dorsal view; 11 – ventral view; 12 – lateral view. Scale lines: 1.0 mm.

distinctly convergent in the middle of apical third; median pair of costae in apical half become very low but without any cutpoint of interruption; second pair of costae distinctly interrupted in basal part of apical half; costae on each side with small punctures bearing very small macrosetae. All intercostae in anterior part without additional short costae. Median intercostae with dense punctures, very distinctly concentrated around median part, all intercostae in basal part with distinct, dense punctation.

Scutellum almost imperceptible.

Elytra shiny. Each elytron with six elevated but flattened on the top costae, and five flat intercostae. Costae on sides with very small punctures bearing very small macrosetae. Preapical glandular area relatively small. Intercostae first to fourth with two distinct rows of punctures; on third intercostae there is short additional costae with additional row of punctures untill half of length of elytra. Fifth intercosta with one row of punctures; in basal part of fourth intercosta there is region with extremely short additional costa, with some additional punctures here. External caudal bulb distinctly reduced, area between external caudal bulb and sides of elytra not divided; external and medio-internal caudal bulbs not divided; medio-internal caudal bulb shortened, transverse, internally stretched.

Pygidium (Fig. 29) with dense, irregularly spaced punctation, with very distinct longitudinal rib in the middle and deep excision on its sides; with distinctly longitudinal apex in the shape of volcano with sinuate top.

Venter (Fig. 11) shiny. Meso-metaventral plate flattened in the middle, with distinct, narrow, quite deep longitudinal furrow; punctation of meso-metaventral plate dense, regularly spaced, irregular in size; all punctures bearing short macrosetae. Abdominal ventrites moderately shiny, on sides with rows of punctures; with an additional punctured furrow in basal part. Last abdominal ventrite with dense punctures, which are slightly larger than on last but one ventrite; in basal half in the middle part with dense, very deep, longitudinal rows; in apical part in the middle with very deep groove, clearly located much below apex of pygidium.

Mesofemora with two distinct tubercles on lower border; metafemora with very weak tubercles on lower border; all femora shiny, with regular, very distinct, rather small, very dense punctation; all punctures bearing small macrosetae.

Variation. Length of body: 6.2-7.0 mm. Intercostae of pronotum and elytra usually are shiny, but sometimes may be somewhat less shiny. Lateral lobes of pronotum may be more or less weakly developed. Density of punctation of pronotal and elytral intercostae is quite distinctly variable. Degree of concentration of punctures in median intercostae of pronotum is very weakly variable. Usually elytral costae are flattened and wide, rarely may be somewhat more distinctly convex and quite narrow. Additional rows of fine punctures observed usually on third elytral intercostae – between main rows, but there are specimens with simple punctures on all rows.

Sexual dimorphism. Shape of meso-metaventral plate (in both sexes), apex of mesotibiae (in both sexes) and shape of last abdominal ventrite and pygidium of males are typical for sexual dimorphism in genus *Rhyparus*. Last abdominal ventrite and pygidium of females is distinctly elongate at apex (Fig. 29). Last abdominal ventrite and pygidium of males are not modified.

Etymology. Patronymic. Dedicated to Zdzisława Stebnicka who noticed unusual sexual dimorphism in the genus Rhyparus at the first time.

Affinity. See discussion and tables 1 and 2. Additional problem is that some specimens of *R. gracilis* Arrow, 1905 (which them *R. stebnickae* sp. nov. was collected on the same localities on Papua New Guinea) may have similar structure of elytral costae, identique structure of caudal bulbs and somewhat similar shape of lateral lobes of pronotum (posterior lateral lobes can be widely, regularly rounded, weakly developed, with very small sinuation between them and anterior lateral

lobes). Anyway females of *R. gracilis* have normally developed pygidium and last abdominal ventrite. Males of *R. gracilis* can be distinguished by: more distinctly convex body, posterior lateral lobes of pronotum never more distinctly developed than anterior, punctures in median intercostae of pronotum never so distinctly concentrated nearby the middle (never create so distinct longitudinal line) and elytral intercostae usually matt.

MATERIAL FOR COMPARISON

Rhyparus approximans Fairmaire, 1893
(Fig. 30, 34–36, 40)

Rhyparus approximans Fairmaire, 1893: 145. Type locality: "Bornéo occ., Sambas".
Rhyparus approximans: Balthasar, 1964: 610.
Rhyparus approximans: Dellacasa, 1988: 89 (catalogue).
Rhyparus approximans: Bordat, 1996: 92.
Rhyparus approximans: Mencl *et al.*, 2013: 493.

Additional material examined. (6exx.): 2exx.: Malaysia, Borneo,Trus Madi Mts, 14-20.vi.2014, local coll. (CNCW); 1ex.: Malaysia, N Borneo, Sabah, Keningau distr., Mt. Trus Madi, 4.iv.2013 (DUBC); 1ex.: Malaysia, N Borneo, Keningau distr., Trus Madi Mt., 1250 m, 5°26'35''N, 116°27'5''E, 17-27.iii.2012, leg. P. Romantsov (ŁMCN); 1ex.: Malaysia, N Borneo, Sabah, Keningau distr, Trus Madi Mt., 1160m, 24.viii.2012, leg. A. Klimenko (ŁMCN) [photographed specimen]; 1ex.: Malaysia, N Borneo, Sabah, Nabawan distr., 7 km N Pesianga v., 530m., 29.v.2012, leg. A Klimenko (ŁMCN).

Distribution. Known from Borneo Island.

Rhyparus loebli Paulian, 1983
(Fig. 31, 37–39, 41)

Rhyparus loebli Paulian, 1983: 618, fig. 1. Type locality: "Taiwan: Fenchihu, 1400m".
Rhyparus loebli: Dellacasa, 1988: 354 (catalogue).
Rhyparus azumai loebli: Ochi, 2001: 7.
Rhyparus azumai loebli: Dellacasa & Dellacasa, 2006: 149 (catalogue).
Rhyparus azumai loebli: Mencl *et al.*, 2013: 493.
Rhyparus azumai loebli: Dellacasa *et al.*, 2016: 165 (catalogue).
Rhyparus loebli: Ochi *et al.*, 2018: 19.

Type material examined. Holotype: Holotype || Rhyparus | löbli n. sp. || R. Paulian det. || Taiwan, iv-vi.(19)77 | Fenchihu, 1400m | J. & S. Klapperich || (MHNG); Paratypes (6 exx.): the same as holotype (3exx. MHNG; 3exx. ISEA without original type labels but confirmed by first author).

Additional material examined. (2exx.): 1ex.: Japan: Kagoshima-ken, Ôshima-gun, Tokunoshima-chô, Amami Oshima Island, Kametsu, Hagedake, 31.vii.2012, Keishke Narita, (LT) (CNCW); 1ex.: Japan, Kagoshima pref. Amami Oshima Island, 29.vii.2007, leg. Kazuo Ichikawa (ŁMCN) [photographed specimen: fig. 31].

Comment. *R. loebli* was known earlier only from Taiwan. Authors record the species from Japan (Amami Oshima Island) for the first time. Probably species earlier was overmissed with *R. azumai*.

Distribution. Known from Taiwan: Taiwan Island. Japan: Amami Oshima Island.

Rhyparus paraphilippinensis Ochi & Kakizoe, 2021
(Figs. 13–15, 24, 32)

Rhyparus paraphilippinensis Ochi & Kakizoe, 2021: 31, figs: 5, 18, 30, 38, 45. Type locality: "Philippines, Mindanao Island, Caraga Region, Agusan del sur, Sibagat".
Rhyparus gracilis Arrow, 1905: Anichtchenko *et al.*, 2021: 102, figs: 3a-c, 9, 15, 21, 27a-b.

Additional material examined. (22exx.): 8exx.: Philippines, Mindanao, Bagongsilang, 1996, leg. Bocak (NMPC); 3exx.: Philippines, Mindanao, Gingoog, Eureka Mt., 730m, 8°41.4970N, 125°14.2710E, 31.iii – 3.iv.2022, leg. A.Vasiljeva (DUBC); 1ex.: the same but: leg. A.Anicht-

chenko (DUBC); 1ex.: Philippines, Mindanao, Misamis or., Claveria rd., 1200m, 8.701522, 125.014624, 26-28.iii.2022, leg. A.Vasiljeva (DUBC); 1ex.: Philippines, Mindanao, Davao del Sur, Apo Mt. Rng, Mabanlas, 1200m, 7.120251, 125.317203, 23-24.iii.2022, leg. A. Vasiljeva (DUBC); 1ex.: the same but: Philippines, Mindanao, Davao del Sur, Apo Mt. Rng, Mabanlas, 1500m, 7°7.2810N, 125°18.7580E, 21-23.iii.2022 (DUBC); 7exx.: the same but: 21-24.iii.2022, leg. A. Vasiljeva (DUBC).

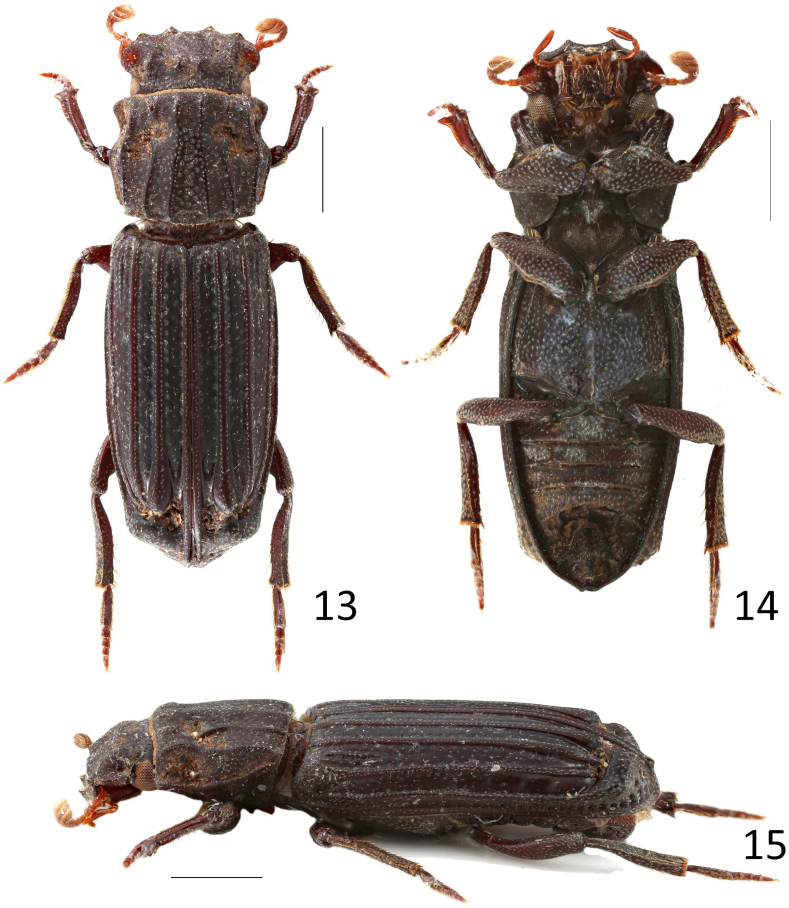
Comment. Specimens from paper of Anichtchenko *et al.*, 2021 identified by authors as *R. gracilis* indeed are *R. paraphilippinensis*. Additionally, see: discussion.

Distribution. Philippines: Mindanao Island.

Rhyparus sepikensis Stebnicka, 1998
(Figs. 16–19, 25, 33)

Rhyparus sepikensis Stebnicka, 1998: 844, fig. 7. Type locality: "Papua New Guinea, West Sepik Province, Torricelli Mtns, Mokai Village, 750m". *Rhyparus sepikensis*: Mencl *et al.*, 2013: 495.

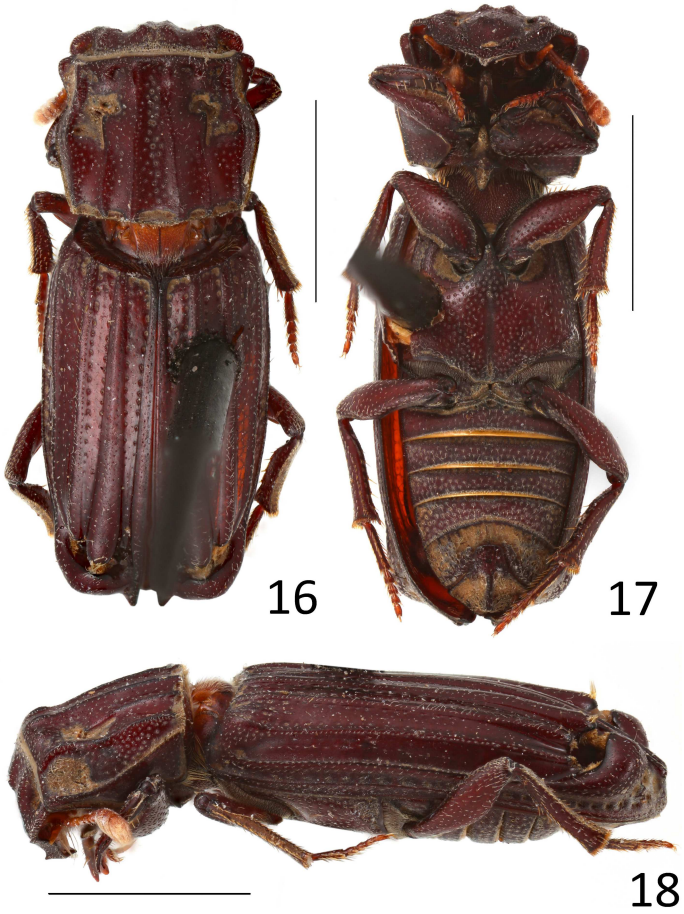
Type material examined. Paratype (♀): Holotype | *Rhyparus*|*sepikensis* sp. n. | det. Z.Stebnicka || New Guinea: NE. | Torricello Mts. | Mokai vill. 750m. | 1-23.i.1959 || W.W. Brandt | collector | Bishop ||.



Figs. 13–15. *Rhyparus paraphilippinensis* Ochi & Kakizoe, 2021., ♀: 13 – dorsal view; 14 – ventral view; 15 – lateral view. Scale lines: 1.0 mm.

Comment. Stebnicka designated holotype of *R. sepikensis* as male. Author loan from BPBM holotype which occur female. Probably labels are switched.

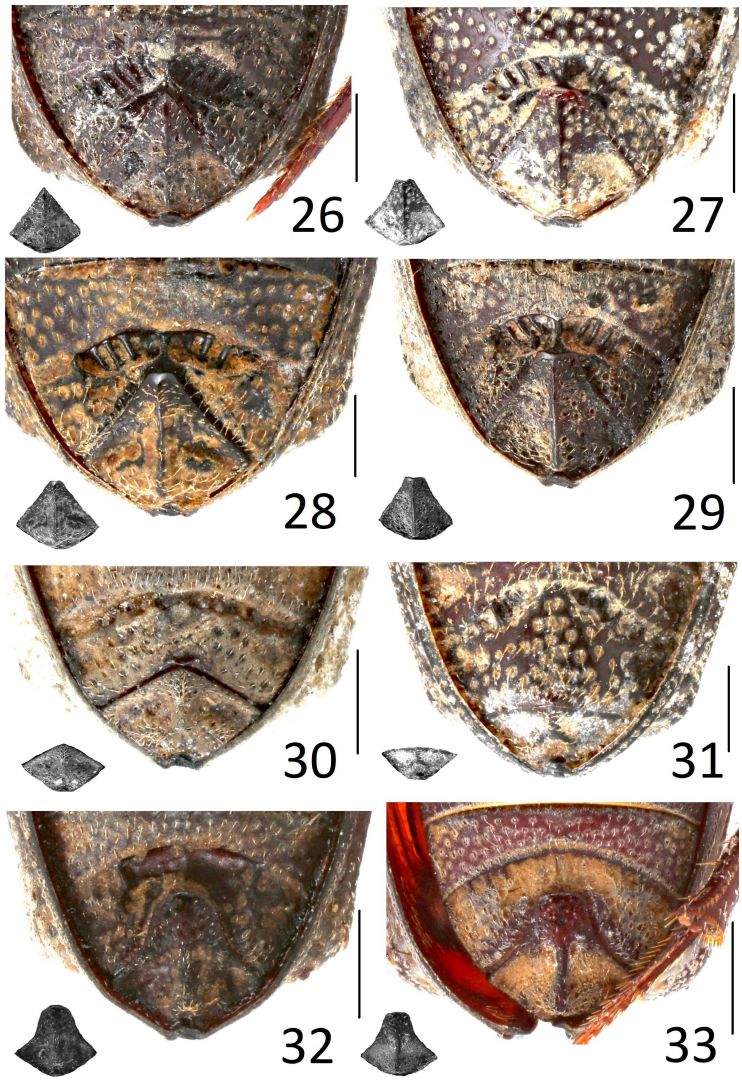
Distribution. Known from Papua New Guinea: West Sepik– only from type series.



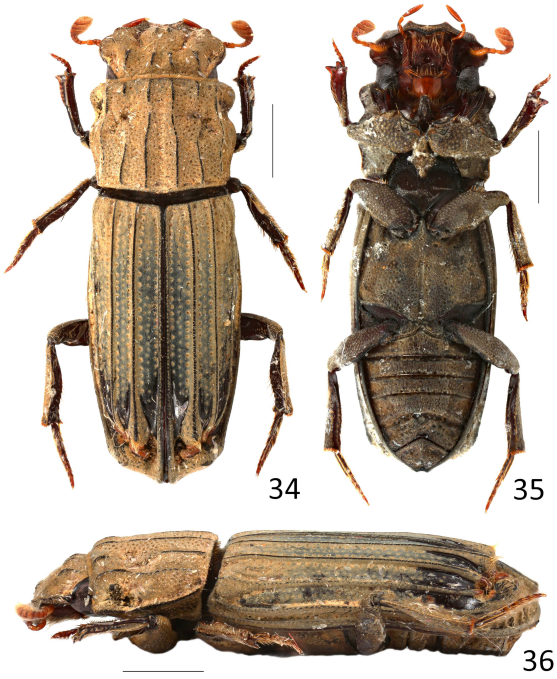
Figs. 16–18. *Rhyparus sepikensis* Stebnicka, 1998., ♀, paratype: 16 – dorsal view, direct projection on pronotum; 17 – ventral view; 18 – lateral view. Scale lines: 1.0 mm.

Fig. 19. *Rhyparus sepikensis* Stebnicka, 1998., ♀, paratype: dorsal view, direct projection on elytra. Scale line: 1.0 mm.

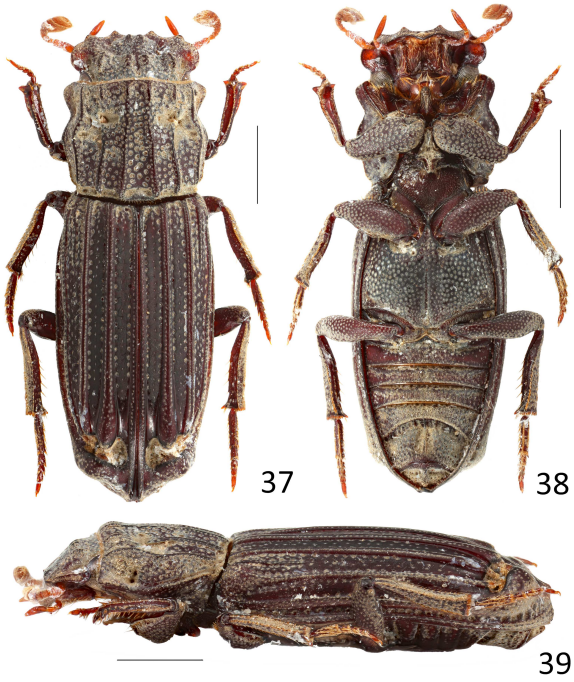
Figs. 20–25. Heads: 20 – *R. bacanensis* sp. nov., ♀, holotype; 21 – *R. buruensis* sp. nov., ♀, holotype; 22 – *R. fijiensis* sp. nov., ♀, holotype; 23 – *R. stebnickae* sp. nov., ♀, holotype; 24 – *R. paraphilippinensis* Ochi & Kakizoe, 2021, ♀; 25 – *R. sepikensis* Stebnicka, 1998, ♀, paratype. Scale lines: 1.0 mm.



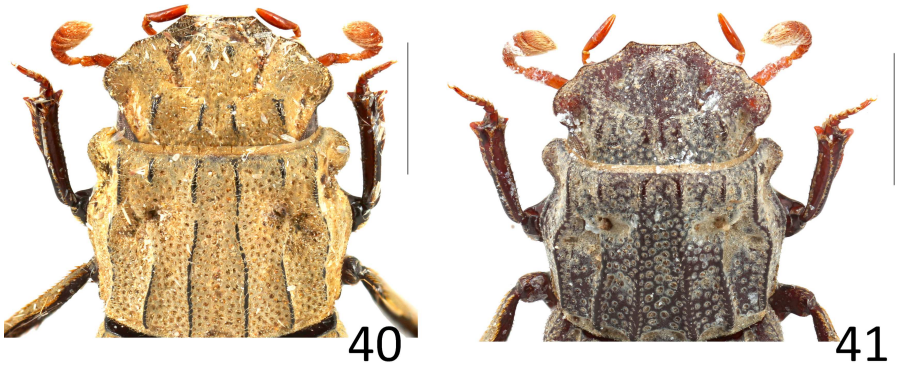
Figs. 26–33. Abdominal apexes with black-white miniatures of pygidium on left-down side: 26 – *R. bacanensis* sp. nov., ♀, holotype; 27 – *R. buruensis* sp. nov., ♀, holotype; 28 – *R. fijiensis* sp. nov., ♀, holotype; 29 – *R. stebnickae* sp. nov., ♀, holotype; 30 – *R. approximans* Fairmaire, 1893, ♀; 31 – *R. loebli* Paulian, 1983, ♀; 32 – *R. paraphilippinensis* Ochi & Kakizoe, 2021, ♀; 33 – *R. sepikensis* Stebnicka, 1998, ♀, paratype. Scale lines: 0.5 mm.



Figs. 34–36. *Rhyparus approximans* Fairmaire, 1893, ♀: 34 – dorsal view; 35 – ventral view; 36 – lateral view. Scale lines: 1.0 mm.



Figs. 37–39. *Rhyparus loebli* Paulian, 1983, ♂, holotype: 37 – dorsal view; 38 – ventral view; 39 – lateral view. Scale lines: 1.0 mm.



Figs. 40–41. Heads: 40 – *R. approximans*, ♀; 41 – *R. loebli*, ♂, holotype. Scale lines: 1.0 mm.

DISCUSSION

Unusual sexual dimorphism with modified pygidium and last ventrite was observed for the first time by Stebnicka (1998). Both examined by her species have quite characteristic, relatively wide and usual,very low elytral costae. That features help to distinguish them from other species not only from Papua New Guinea but from most of known species from genus *Rhyparus* from around the world. However not all specimens of *R. stebnickae* sp.nov. (identified by Stebnicka as *R. striatus*) and all other newly described species have elytral costae normally developed – i.e. relatively narrow and quite distinctly convex. Females of all undescribed species studied in that paper have modified pygidum and last abdominal ventrite. Thanks that feature can be easily distinguished from all others *Rhyparus* species. With males we have somewhat more difficulties. All of them have distinctly elongate and not so distinctly convex (quite deplanate) body, weakly (or very weakly) developed lateral lobes of pronotum, distinct and dense punctation of all pronotal intercostae (especially in basal part) and very weakly developed caudal bulbs. Combination of that features help to distinguish our group from a large part of species. Remaining species which agree with that combination are: *R. approximans* Fairmaire, 1893 and *R. loebli* Paulian, 1983. They outstanding from that group, but are still more closely corelate to species from the group than to other known because of still quite unique sexual dimorphism, i.e.: *R. approximans* have weakly modified pygidium in females, *R. loebli* have weakly modified last ventrite in females – with kind of modification similar to species from the group (in basal half, in the middle part there are dense, very deep, longitudinal rows). To identify easily all species mentioned in discussion above we propose list of the key features in the tables below.

Due to the unique shape of pygidium of females, all species of the group can be easily distinguished. Only *R. buruensis* sp. nov. and *R. stebnicka* sp. nov. have similar shape of that structure (anyway in *R. buruensis* sp. nov. median longitudinal rib of pygidium is distincly lower and less developed) – but they are much different and can be easily distinguishable thanks other features. Males are much more difficult to identification between species – because of very high variability. Additionally, there are some species (for example: *R. gracilis*) outside the group which may live together, with kind of variability superimposed on the variability of species from discussed group. It is necessary to notice, that shine of species is very variable: specimens usually totally shiny may have at least intercostae matt – and vice versa. Degree of development of lateral lobes of pronotum may be variable – from very weakly developed to weakly developed. Convexity of elytral costae is somewhat variable – and even in *R. stebnickae* sp.nov. costae may be somewhat convex, may looks as relatively normally developed. Generally size of *Rhyparus* species may be extremely variable (in *R. gracilis* smallest specimens can be even more than twice shorter than highest). It is problem,

species / character	*R. approximans* Fairmaire, 1893	*R. bacanensis* sp. nov.	*R. buruensis* sp. nov.	*R. fijiensis* sp. nov.
shine	all costae shiny; all intercostae matt, additionaly covered by dusty pattern	all costae shiny; intercostae of pronotum very weakly shiny, intercostae of elytra moderately shiny	all costae shiny; intercostae of pronotum quite distinctly shiny, intercostae of elytra shiny	all costae and intercostae shiny, however: sometimes intercostae of elytra less shiny (even subopaque)
the degree of elongation of the body	distinctly elongate	distinctly elongate	distinctly elongate, proportionally least elongated	distinctly elongate, proportionally most wydłużony
lateral lobes of pronotum	quite distinctly developed, sinuation between them distinct	weakly developed, sinuation between them not distinct	weakly developed, sinuation between them not distinct	weakly developed, sinuation between them not distinct
anterior lobes of pronotum	rounded, very slighly lower than posterior	almost triangular, slightly higher than posterior	almost triangular, slightly higher than posterior	rounded, slightly higher than posterior
posterior lobes of pronotum	widely, regularly rounded	widely, regularly rounded	widely, somewhat irregularly rounded	very widely, somewhat irregularly rounded
punctation median intercostae of pronotum	dense, distinctly concentrate in the middle into longitudinal line, punctures coarse	dense, distinctly concentrate in the middle into longitudinal line, punctures coarse	dense, weakly concentrate in the middle into longitudinal line, punctures coarse	dense, distinctly concentrate in the middle into longitudinal line, punctures coarse
convexity and width of elytral costae	distinctly convex, narrow	quite distinctly convex, relatively narrow	quite distinctly convex, relatively narrow	quite distinctly convex, relatively narrow, rarely flattened and widened
additional rows of fine punctures on elytral intercostae – between main rows	observed on all intercostae, additionaly on first and second intercostae punctures usually larger than fine	observed on third intercostae, additionaly some punctures present on all intercostae	observed on third intercostae, additionaly some punctures present on all intercostae	observed on third intercostae, additionaly some punctures present on all intercostae
median row of punctures on third elytral intercostae	very short about 1/5 of total lenghth; then sparsely distributed, much smaller punctures almost till apex	very short about 1/5 of total lenghth; then sparsely distributed, much smaller punctures almost till apex	till half of lenghth, then much smaller punctures almost till apex	till half of lenghth, thenvery sparsely distributed, much smaller punctures almost till apex
pygidium of females	weakly modified – in the shape of obtuse triangle Fig. 30	with apex in the shape of distinct triangle Fig. 26	with apex in the shape of volcano with sinuate top, with median rib somewhat lower than in *R. stebnickae* sp. nov. Fig. 27	with apex in the shape of volcano with narrow, truncate top Fig. 28
additional unique characters	–	–	fourth intercostae of pronotum is least steep in the group, and because of it seems to be widest	Proportionally longest species (against the bacground of the whole genus)
distribution	Malaysia: Borneo Island	Indonesia: Moluccas North: Bacan Island	Indonesia: Moluccas: Buru Island	Fiji: Viti Levu

Table 1. Differentiation of known *Rhyparus* species with modified pygidium and last ventrite in females – part 1.

species / character	*R. loebli* Paulian, 1983	*R. paraphilippinensis* Ochi & Kakizoe, 2021	*R. sepikensis* Stebnicka, 1998	*R. stebnickae* sp. nov.
shine	all costae moderately to distinctly shiny; all intercostae matt	all costae moderately shiny to shiny; all intercostae matt	all costae shiny; intercostae of pronotum moderately shiny, intercostae of elytra shiny	all costae and intercostae shiny
the degree of elongation of the body	distinctly elongate	distinctly elongate	distinctly elongate	distinctly elongate
lateral lobes of pronotum	quite weakly developed, sinuation between them quite distinct	relatively weakly developed, sinuation between them quite distinct	quite weakly developed, sinuation between them quite distinct	weakly developed, sinuation between them not distinct
anterior lobes of pronotum	almost triangular, slightly lower than posterior	almost triangular, slightly lower than posterior	almost triangular, slightly lower than posterior	almost triangular, slightly lower than posterior
posterior lobes of pronotum	widely, somewhat irregularly rounded	widely, regularly rounded	widely, regularly rounded	widely, somewhat irregularly rounded
punctation median intercostae of pronotum	dense, weakly concentrate in the middle but not into longitudinal line, punctures coarse	dense, weakly concentrate in the middle but not into longitudinal line, punctures coarse	dense, very weakly concentrate in the middle into longitudinal line, punctures relatively fine, not coarse	dense, very distinctly concentrate in the middle into longitudinal line, punctures coarse
convexity and width of elytral costae	distinctly convex, relatively narrow	distinctly convex, relatively narrow	quite distinctly convex, relatively wide	very low to quite distinctly convex, relatively wide
additional rows of fine punctures on elytral intercostae – between main rows	may be observed on all intercostae till apex, anyway specimens without no additional fine punctures was examined too	always observed on all intercostae	observed on all intercostae	sometimes observed on third intercostae, additionaly some punctures may be present on all intercostae
median row of punctures on third elytral intercostae	variable in length: from half of lentgh of elytra to whole of the length	very short about 1/5 of total lenghth; thendensely distributed, much smaller punctures almost till apex	very short about 1/5 of total lenghth; thendensely distributed, much smaller punctures almost till apex	till half of lenghth
pygidium of females	not modified Fig. 31	with apex in the shape of mountain with regularly rounded top Fig. 32	with apex in the shape of volcano with rounded top Fig. 33	with apex in the shape of volcano with sinuate top, with median rib somewhat higher than in *R. buruensis* sp. nov. Fig. 29
additional unique characters	–	last ventrite in basal half, in the middle part with very deep groove; elytral suture before apex of elytra always with distinct, elevated protuberance	as well very distinctly widened second costae of elytra in apical half as (delikatne) punctation of pronotal intercostae in basal half are characteristic (against the bacground of the whole genus)	Height and width of elytral costae against the bacground of the whole genus is similar only to *R. sepikensis*
distribution	Taiwan: Taiwan Island Japan: Amami Oshima Island	Philippines: Mindanao Island	Papua New Guinea: New Guinea Island: West Sepik province	Indonesia and Papua New Guinea: New Guinea Island

Table 2. Differentiation of known *Rhyparus* species with modified pygidium and last ventrite in females – part 2.

because in some specimens of *R. gracilis* (probably old specimens) elytral costae may be rubbed off. Because of that compared specimens may looks very similarly. Individual specimens of all species discussed in that work may be very similar. That indicate situation that, for example: some specimens of *R. loebli* may be very similar to some of *R. gracilis*. That make some problems in establishing species affiliation. Earlier we are thinking that better will be treat all that similar specimens as one species with extraordinary variability. Because of that in paper Anichtchenko *et al.*, 2021 we treat *R. paraphilippinensis* as *R. gracilis*. Now we found at least one clear feature thanks which we can identify all that species with no doubt.

Interesting and discutable is similarity of all species to *Rhyparus gracilis* Arrow, 1905. Another interesting fact is that *R. stebnickae* sp. nov. and *R. sepikensis* – two species from the same evolutional group – may live together on the same locality. What interesting too: *R. stebnickae* sp. nov. is relatively very widely distributed species – even if only on one, large Island. *R. gracilis* is in our opinion one of the most variable species of genus *Rhyparus* Westwood, 1845 and one of most variable species of Aphodiinae Leach, 1815 in general. Type of *R. gracilis* was described from Archipelag of Luisiades, from Sud-East Island. It is realtively far away from Papua New Guinea. Because of that – we suspect that *R. gracilis* from Papua New Guinea may be another species. Additionally, based on above, we suspect that *R. gracilis* from Papua New Guinea may be a complex of very similar species – anyhow at persent time we are not able to state it with sure and establish limits of species.

As a result of our study we are in opinion that epipharynx in genus *Rhyparus* Westwood, 1845 is very weakly variable and rather useless in identification of species. Similar situation we have with aedeagus – only in rare cases it is usefull. Apical structures (parameres and sides of median lobe) of aedeagusare very fragile, susceptible on external modifications. Additionally, median lobe is moveable and because of it proportions between them and parameres frequently will be interrupted. Degree of curvation of parameres and apical structures are somewhat variable but frequently they are not good feature for comparision between species (especially from the same regions). Pygidium of females if it is modified is very usefull tool which help in identification a lot. Additionally, we observed some that females are much more different between species than males when we compare abdominal ventrites. Because of it we suspect that establishing of females as holotypes of newly described species in the genus *Rhyparus* in some groups will be more usefull than males.

Large similarity between some species of the genus *Rhyparus* may suggest that they have common ancestor. It looks that all species with females with that unusual sexual dimorphism are closely related. What interesting – in Oceanian region, among of species from genus *Rhyparus* we can distinguish some leading types of morphology of body with more or less characteristics features – we are in opinion that group of species with modified pygidium in females is one of that, probably monophiletic groups. *R. loebli* and *R. approximans* because of intermediate characters between that group and other *Rhyparus* species probably are most primal species in discussed group. Additionally, they are the earliest described species. Because of it we propose name: “approximans” for discussed group of species – anyhow we don’t propose here any limits untill futher studies with examination and division of species into other groups. *R. gracilis* for example, because of large similarity of body, seems to be a member of another, probably most closely related group. Additionally, there is yet one very large problem: probably most of *Rhyparus* species untill now stay undescribed (Ochi *et al.* 2021 are agree with our opinion too).

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