

The *Scopaeus kokodanus* species group (Coleoptera: Staphylinidae: Paederinae) from New Guinea and the Solomon Islands, with description of three new species

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Abstract

The informal *Scopaeus kokodanus* species group (Coleoptera: Staphylinidae: Paederinae: Scopaeina) is defined using diagnostic primary and secondary sexual characters. It comprises *S. kokodanus* Cameron, 1938 (Papua New Guinea), *S. arfakmontium* spec. nov. (Indonesia: West Papua), *S. balkei* spec. nov. (Indonesia: Papua) and *S. potamides* spec. nov. (Solomon Islands). The species are diagnosed including distributional information and comparative notes.

Keywords Taxonomy | morphology | exoskeletal characters | genital characters | distribution

1. Introduction

Both diversity and biogeography of the species-rich rove beetle clade Scopaeina Mulsant & Rey, 1878 (Staphylinidae: Paederinae), which presently comprises more than 500 named species worldwide, are still largely unknown. According to type revisions for Australia, New Zealand and the islands east of the Wallace Line including Melanesia (Frisch 2016), only nineteen species of Scopaeina are hitherto described from Australia, one from New Zealand and eight species from the Australasian islands, respectively. In this contribution, *Scopaeus kokodanus* Cameron, 1938 from Papua New Guinea, which was not taken into account in Frisch (2016), is redescribed and three closely related species from New Guinea and the Solomon Islands are described. These species constitute the *S. kokodanus* species group, which is defined herein mainly by primary and secondary sexual characters.

2. Material and methods

Material. The specimens this contribution is based on are stored in the following institutions and private collections and were lent by the mentioned curators and collectors: **MHNG** – Muséum d'histoire naturelle, Geneva (Giulio Cuccodoro, Ivan Löbl); **MFNB** – Museum für Naturkunde Berlin; **NHML** – Natural History Museum, London (Max Barclay, Roger Booth, Dmitry Telnov); **TWCF** – Takashi Watanabe Private Collection, Fujisawa; **ZMBC** – Zoological Museum Bogor, Cibinong (Pramesa Narakusumo).

Methods. The habitus photographs were created with the montage software Helicon Focus based on digital images which were taken with the camera Leica DMC6200 attached to the stereoscopic microscope Leica M205 C. Transmitted-light microscopic images were made using the Leica imaging system (transmitted light microscope DM6 B, camera K3, LasX software) and the montage software Helicon Focus. The photographs

were made with the following magnifications: Aedeagi: 100× (Figures 5–7) or 200× (Figures 8–16); abdominal sclerites VII and VIII: 100× (Figures 17–22); sperm pumps (Figures 23, 24): 400×.

Specimens were measured magnified 140× using a stereoscopic microscope with an eye-piece linear micrometer. Measurements and ratios, means are given in brackets (Ø), include, if available, both sexes and the maximum range of variation in body size and form. Total length of specimens = interval from apical denticles of labrum to posterior end of abdomen, depending on degree of contraction of abdomen; forebody length = interval from apical denticles of labrum to posterior margin of elytra at suture; head length = interval along midline from anterior margin of clypeus to posterior margin of head anterior of neck constriction; elytral length = interval from posterior tip of scutellum to posterior end of elytra along suture; eye length = interval from anterior to posterior end of ocular suture; temporal length = interval from posterior end of ocular suture to neck constriction; both eye length and temporal length are measured in lateral view; length of penultimate antennomere is measured without the thin basal stalk; length of tibia of mesothoracic leg is measured from point of insertion at distal end of mesofemur to distal end of mesotibia excluding terminal spines; width of mesotibia is measured at point of greatest width.

The morphology of the primary and secondary sexual characters is termed following Frisch et al. (2002: 31–34).

Tobias Mainda, specialist of the staphylinid genus *Stenus* Latreille 1797, was invited to coauthor this contribution in the course of a citizen science project of the Museum für Naturkunde Berlin and Radio Berlin-Brandenburg (RBB) and proposed the species names *Scopaeus arfakmontium* and *S. potamides*.

3. Taxonomy

The *Scopaeus kokodanus* Cameron, 1938 species group

Diagnosis: Medium sized to large, macrophthalmous, alate *Scopaeus* with slender body and appendages (Figs 1–4). Body length 3.6–5.0 mm, forebody length 2.1–2.8 mm. Head slightly elongate to strongly pyriform with maximum width across eyes and tempora evenly narrowed from eyes to neck constriction, head 1.08–1.16 times as long as wide, head across eyes 1.17–1.42 times as wide as tempora at half of length from eyes to neck constriction. Median labral denticles acute, lateral labral denticles shorter and stouter, with about right-angled

apex. Antenna slender with elongate distal segments, penultimate segment 1.1–1.14 times as long as wide. Protarsomeres about twice as wide as long. Legs slender, tibia of mesothoracic leg 6.7–11.2 times as long as wide. Elytra with well developed shoulders, about 1.1–1.23 times as long as pronotum. Metathoracic wings fully developed and functional. Surface of forebody shiny with very fine and spacious setose punctation and without microreticulation. Abdomen finely microreticulate, matter than forebody.

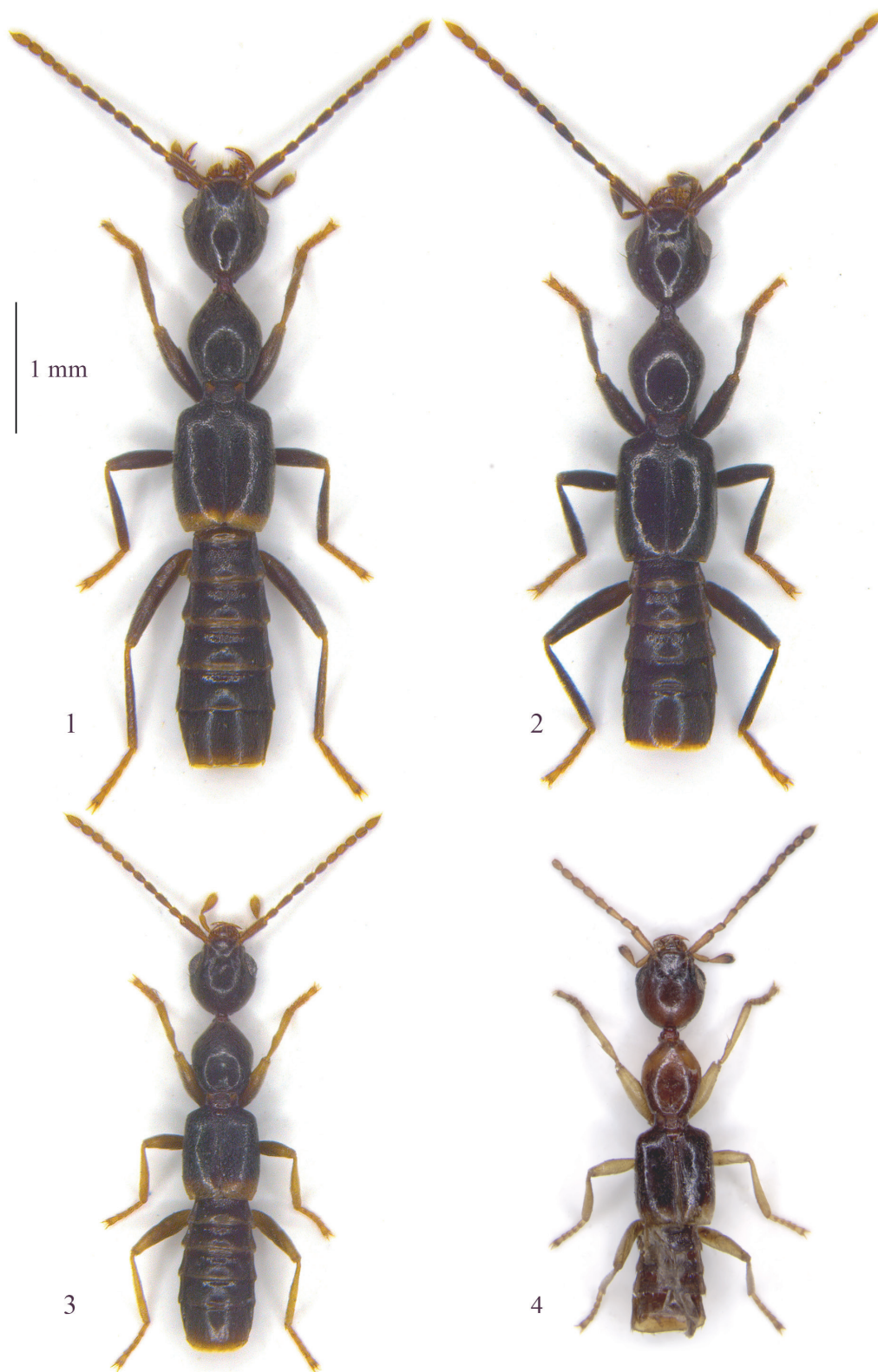
Male: Aedeagus with long phallobase and comparatively short distal lobes (Figs 5–7); in dorsal and ventral view (Figs 9, 10, 12, 13, 15, 16), lateral lobes strongly projecting, each bearing apical and ventral group of long setae; apical lobes short, almost semicircular at apex in dorsal and ventral view (Figs 9, 10, 12, 13, 15, 16), with somewhat emarginate ventrodistal margin (Figs 8, 11, 14); dorsal lobe evenly narrowed towards apex in lateral view (Figs 8, 11, 14), with subtriangular (Fig. 10) to round (Figs 13, 16) apex in dorsal view; flagellum short and without modifications (Figs 8, 11, 14). Abdominal sternite VII (Figs 17, 19, 21) slightly and broadly emarginate posteriorly and with strong, asetose, median depression covering more than median half of sternite width and all of sternite length, except for strongly sclerotized posterior margin, and being surrounded by a varying number of long, black, medioposteriad pointing setae. Posterior margin of abdominal sternite VIII (Figs 18, 20, 22) with two deep, lateral emarginations forming narrow median lobe with more or less shallow distal emargination.

Female: Sperm pump (Figs 23, 34) of characteristic shape of *Scopaeus* s. str. (Frisch et al. 2002: 30, 35, 44, Figs 24–29), but without species group and species specific features. Bursa copulatrix (see Frisch et al. 2002: 30, Fig. 27) hyaline, without sclerotizations.

Distribution: As far as known presently, the *Scopaeus kokodanus* species group is confined to the Australasian region and hitherto known from New Guinea and the Solomon Islands.

Bionomics: According to the sparse label information, members of the *Scopaeus kokodanus* species group were collected on banks of rain forest streams and rivers, which matches the major habitat preference of *Scopaeus* as described by Frisch et al. (2002: 28), at elevations between 200 and 750 m a.s.l.. The locality of *S. balkei* in the Foja Mountains (Fig. 25) is representative for this habitat type of *Scopaeus* in tropical rain forests. Specimens of *S. balkei* were flushed by the alluvial method from semi-shaded gravel banks of this stream and similar localities in the Cyclops Mountains.

Comparative notes: The *Scopaeus kokodanus* species group is well defined according to the apomorphic



Figures 1–4. Habitus of *Scopaeus kokodanus*, Papua New Guinea, Morobe, Waritaian (1), *S. arfakmontium*, paratype, Indonesia, West Papua, Arfak Mts (2), *S. balkei*, paratype, Indonesia, Papua, Cyclops Mts (3), *S. potamides*, paratype, Solomon Islands, Kolombangara (4).

characters of the primary and secondary sexual characters described above. The slender body shape of *S. kokodanus* and *S. arfakmontium* with the characteristic pyriform head is, however, widespread in the genus, found in various species groups and thus a convergency. An example is the Australian *S. ctenocryptus* Lea, 1923 (Frisch 2016: Fig. 4), which strongly resembles the habitus of these species, but has sexual characters notably different from those of the *S. kokodanus* species group (Frisch 2016: Figs 20–22, 60).

Scopaeus kokodanus Cameron, 1938

(Figs 1, 23)

Scopaeus kokodanus Cameron, 1938: 144, 155

Specimens examined (Papua New Guinea): Holotype ♀, Oro Prov., Kokoda, labelled as follows: ‘Type’ (round labeled in red), ‘PAPUA, Kokoda. 1,200ft. vi-vii. 1933. L. E. Cheesman. B. M. 1933-427.’, ‘*Scopaeus kokodanus* Cam TYPE’ (handwritten), ‘NHMUK014663049’ (with QR-code), ‘HOLOTYPE / by monotypy / *Scopaeus* Erichson, 1839 / *kokodanus* CAM., 1938 / label by J. FRISCH 2022’ (NHML) [Cameron (1938: 144, 145) described *S. kokodanus* after a ‘unique’ specimen. Thus, the type specimen is a holotype by monotypy (ICZN 1999: Article 73.1.1.)]; 1 ♀, Ehi Prov., Onerunka: Namu River, 01.12.1979, leg. Ullrich (MHNG); 1 ♀, same locality and collector, but 30.05.1979 (MFNB); 1 ♀, Morobe Prov., Morobe Mts: Waritaian (correct spelling?), 06.1979, leg. Ullrich (MHNG).

Diagnosis: Body shape and coloring as in Fig. 1. Total body length 4.6–4.7 mm; forebody length 2.8–2.9 mm. Head pyriform, 1.13–1.15 (Ø 1.14) times as long as wide, across eyes 1.31–1.35 (Ø 1.34) times as wide as across tempora at half of their length from eyes to neck constriction. Eyes 0.5–0.53 (Ø 0.52) times as long as tempora. Elytra about 1.1 times as long as pronotum. Penultimate segment of antenna about 1.1 times as long as wide. Tibia of mesothoracic leg 7.7–8.8 (Ø 8.5) times as long as wide. Body black-brown except for yellow margin in posterior seventh of elytra, dark brown maxillary palpi with light brown apical third of last segment, dark brown legs with medium brown tarsi, and antennae becoming evenly lighter from dark brown proximal segments towards light brown apical segments.

Male unknown.

Distribution: *Scopaeus kokodanus* is hitherto known from the Oro and Ehi provinces in southeastern Papua New Guinea only.

Comparative notes: Within the *Scopaeus kokodanus* species group, *S. kokodanus* (Fig. 1) agrees with

Scopaeus arfakmonium (Fig. 2) in the large body size and the pyriform head, but differs by the absence of a yellow posterior margin of the elytra. *Scopaeus balkei* (Fig. 3) and *S. potamides* (Fig. 4) are easily distinguished by smaller size and the non-pyriform head. *Scopaeus kokodanus* moreover has shorter distal antennomeres than the related species with the penultimate segment almost square.

Comment: According to Evenhuis (2003: 48), the ‘Annals and Magazine of Natural History, Volume III, Eleventh Series, 1939’ with the article in which Malcolm Cameron described *Scopaeus kokodanus* was published December 31, 1938, which is why the year of description of the species is 1938.

Scopaeus arfakmontium spec. nov.

(Figs 2, 5, 8–10, 17, 18)

Type specimens: Holotype ♂, Indonesia, West Papua: Arfak Mts, 500 m, 08.02.2011, leg. Watanabe (TWCF). Paratypes: 4 ♂, same data as holotype (MFNB, TWCF).

Diagnosis: Body shape and coloring as in Fig. 2. Total body length 4.7–5.0 mm; forebody length 2.7–2.8 mm. Head pyriform, 1.13–1.15 (Ø 1.14) times as long as wide, across eyes 1.34–1.42 (Ø 1.36) times as wide as across tempora at half of their length from eyes to neck constriction. Eyes 0.5–0.55 (Ø 0.52) times as long as tempora. Elytra about 1.14 times as long as pronotum. Penultimate segment of antenna about 1.3 times as long as wide. Tibia of mesothoracic leg 9.2–11.2 (Ø 9.7) times as long as wide. Body black except for dark brown maxillary palpi with light brown apex of last segment, dark brown legs with medium brown tarsi, and antennae becoming evenly lighter from dark brown proximal segments towards light brown apical segments.

Male: Aedeagus (Fig. 5) about 0.9 mm long; apical lobes parallel in lateral view (Fig. 8), in ventral and dorsal view (Figs 9, 10) convex laterally; lateral lobes notably longer than wide (Figs 9, 10); dorsal lobe triangular in dorsal view with subacute apex (Fig. 10). Asetose median depression of abdominal sternite VII (Fig. 17) with parallel lateral margins. Abdominal sternite VIII (Fig. 18) with median lobe of posterior margin notably longer than lateroposterior angles; end of median lobe notably emarginate.

Distribution: *Scopaeus arfakmontium* is hitherto known only from the type locality in the Arfak Mountains in the east of the Bird’s Head Peninsula, West Papua.

Comparative notes: Among the related species treated here, *Scopaeus arfakmontium* (Fig. 2) is readily distinguishable from *S. kokodanus* (Fig. 1) by the entirely black body without a light posterior margin of the elytra

and the more elongate distal antennal segments. It differs from both *S. balkei* (Fig. 3) and *S. potamides* (Fig. 4) by larger body size, the pyriform head, the larger aedeagus (Fig. 5) with elongate lateral lobes and the shape of the apical lobes, which are convexly widened laterally and parallel in lateral view (Figs 8–10), and by the posterior margin of abdominal sternite VIII with the median lobe longer than the lateroposterior angles (Fig. 18) and without four distinct, black macrosetae (see Figs 20, 22).

Etymology: The epithet '*arfakmontium*' (latin, noun, genitive: 'of the Arfak Mountains') refers to the type locality of the new species.

Scopaeus balkei spec. nov.

(Figs 3, 6, 11–13, 19, 20, 24)

Type specimens: Holotype ♂, Indonesia, Papua, Cyclops Mts (02°33'13"S, 140°34'34"E), vegetated sandbank of a small stream, 300 m, 11.06.2019, leg. Bretschneider (ZMBC). Paratypes (5 specimens): 4 ♂, same data as holotype (MFNB); 1 ♂, Indonesia, Papua,

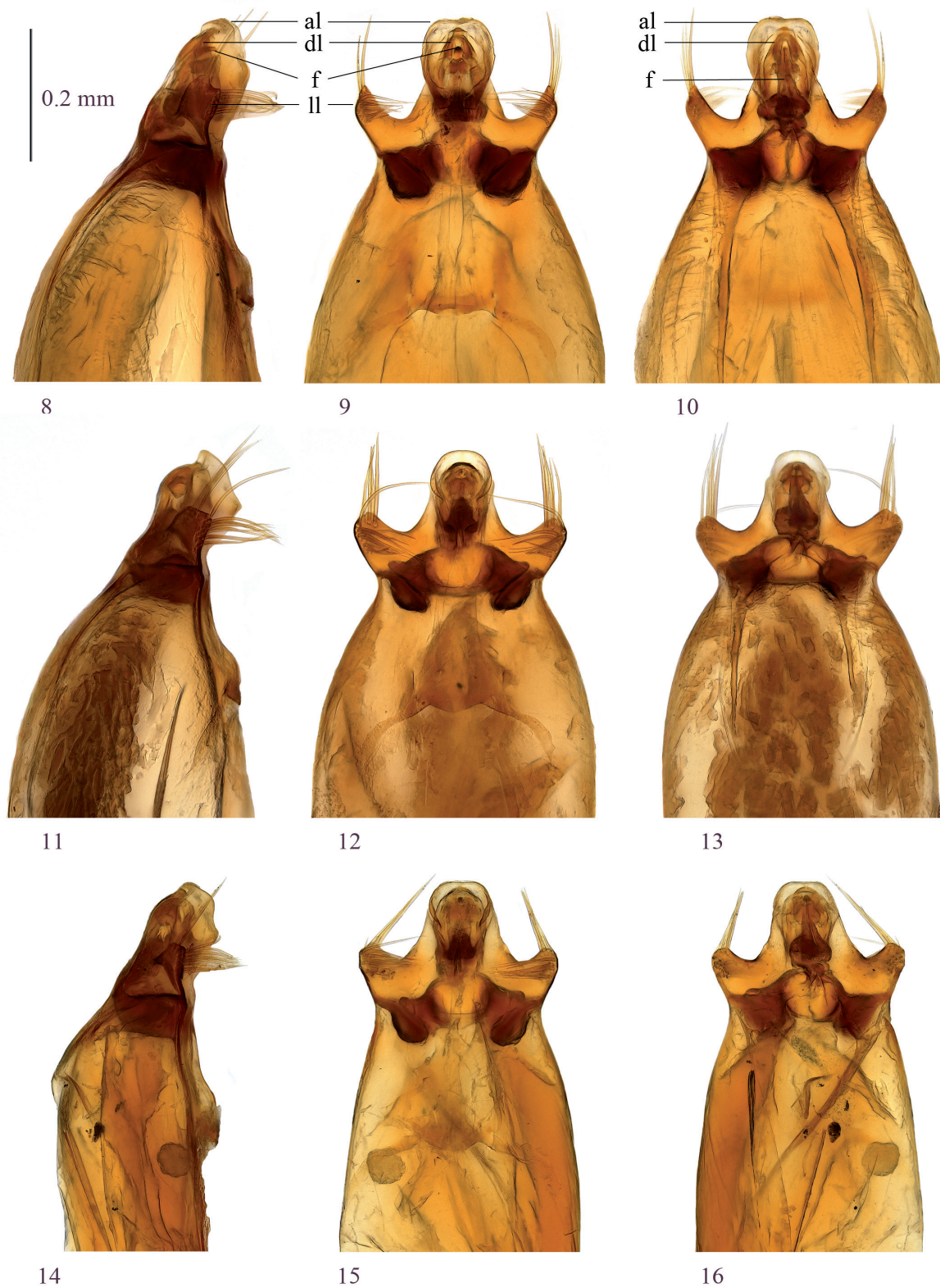
Foja Mts (02°27'32"S, 138°46'30"E), gravel bank of a small stream, 300 m, 28.05.2019, leg. Bretschneider (MFNB).

Diagnosis: Body shape and coloring as in Fig. 3. Total body length 3.6–3.9 mm; forebody length 2.1–2.3 mm. Head slightly elongate, non-pyriform but subcircular, 1.08–1.16 ($\bar{\text{O}}$ 1.12) times as long as wide, with convex tempora evenly narrowed towards round posterior margin, across eyes 1.27–1.33 ($\bar{\text{O}}$ 1.36) times as wide as across tempora at half of their length from eyes to neck constriction. Eyes 0.6–0.63 ($\bar{\text{O}}$ 0.61) times as long as tempora. Elytra about as long as pronotum. Penultimate segment of antenna about 1.2 times as long as wide. Tibia of mesothoracic leg 6.7–8.2 ($\bar{\text{O}}$ 7.6) times as long as wide. Body black-brown except for yellow distal fifth of elytra, medium brown maxillary palpi, yellow-brown legs with medium brown femora, and antennae with medium brown segments 1 and 2 followed by blackened segments 3–6, which are gradually lighter towards yellowish brown segments 7–11.

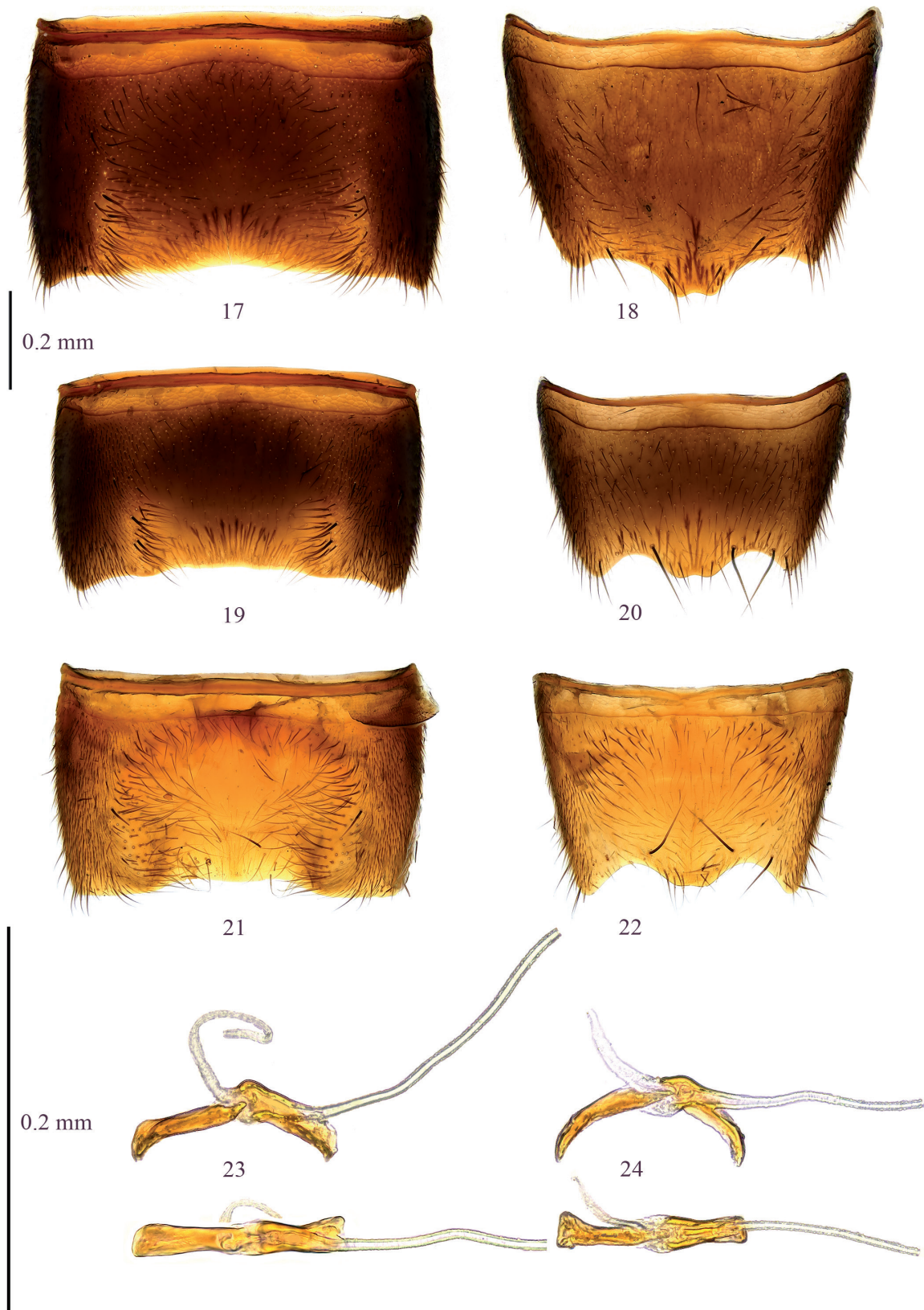
Male: Aedeagus (Fig. 6) about 0.7 mm long; apical lobes in lateral view with ventrally curved dorsal margin



Figures 5–7. Aedeagus (in lateral view) of *Scopaeus arfakmontium*, holotype, Indonesia, West Papua, Arfak Mts (5), *S. balkei*, holotype, Indonesia, Papua, Cyclops Mts (6), *S. potamides*, holotype, Solomon Islands, Kolombangara (7). **Abbreviations:** dl – distal lobes, pb – phallobase.



Figures 8–16. Apical portion of aedeagus in lateral (8, 11, 14), ventral (9, 12, 15), dorsal view (10, 13, 16) of *Scopaes arfakmontium*, holotype, Indonesia, West Papua, Arfak Mts (8–10), *S. balkei*, holotype, Indonesia, Papua, Cyclops Mts (11–13), *S. potamides*, holotype, Solomon Islands, Kolombangara (14–16). **Abbreviations:** al – apical lobes, dl – dorsal lobe, f – flagellum, ll – lateral lobe.



Figures 17–24. Abdominal sternite VII (17, 19, 21) and abdominal sternite VIII (18, 20, 22) of *Scopaeus arfakmontium*, holotype, Indonesia, West Papua, Arfak Mts (17, 18), *S. balkei*, holotype, Indonesia, Papua, Cyclops Mts (19, 20), *S. potamides*, paratype, Solomon Islands, Kolombangara (21, 22), *S. kokodanus* (23). Figs 23, 24: sperm pumps of (23) *S. kokodanus*, Papua New Guinea, Morobe, (24) *S. balkei*, paratype, Indonesia, Papua, Cyclops Mts.



Figure 25. Habitat of *Scopaeus balkei* in the Foja Mountains, Indonesia, Papua Province.

with longitudinally bent apex and almost right angled extended ventrally (Fig. 11), in dorsal view (Fig. 13) not widened laterally, but convex towards round apex, their distoventral margins circular in ventral view (Fig. 12); lateral lobes about as wide as long (Figs 12, 13); dorsal lobe stout with round apex in dorsal view (Fig. 13). Asetose median depression of abdominal sternite VII (Fig. 19) with parallel lateral margins. Abdominal sternite VIII (Fig. 20) with median lobe of posterior margin as long as lateroposterior angles; end of median lobe notably emarginate; four distinct, pigmented macrosetae situated close to posterior margin of sternite.

Distribution: *Scopaeus balkei* was collected in the Cyclops and Foja Mountains (Fig. 25) in the Indonesian province of Papua, western New Guinea.

Comparative notes: Among the members of the *Scopaeus kokodanus* species group, *S. balkei* (Fig. 3) differs from both *S. kokodanus* (Fig. 1) and *S. arfakmontium* (Fig. 2) by smaller body size and non-pyriform head. The species can moreover be separated from *S. arfakmontium* by the yellow apical margin of the elytra, the smaller aedeagus with stouter lateral lobes, laterally not widened, but ventrally angled extended apical lobes and round apex of the dorsal lobe (Figs 11–13), and by the posterior margin of abdominal sternite

VII with shorter median lobe and the presence of four distinct, dark macrosetae (Fig. 20). *Scopaeus balkei* differs from *S. potamides* by the darker body coloring and characters of the aedeagus and abdominal sternites VII and VIII described below.

Etymology: With the choice of the epithet ‘*balkei*’ (Latinized noun, derived from the surname ‘Balke’, genitive) we warmly dedicate the species to Michael Balke, coleopterist at the Zoologische Staatssammlung Munich, who actively supports the second author in his entomological activities.

Scopaeus potamides spec. nov.

(Figs 4, 7, 14–16, 21, 22)

Type specimens: Holotype ♂, Solomon Islands, Kolombangara, Kuzi, Camp 1, 07.09.1965, flood refuse between stones, banks of Kolombara River, leg. Royal Society Expedition, British Museum 1966-1 (NHML). Paratype 1 ♂, same data as holotype (MFNB).

Diagnosis: Body shape and coloring as in Fig. 4. Total body length 3.6–3.8 mm; forebody length 2.3–2.4 mm. Head slightly elongate, non-pyriform but subcircular, 1.1 times as long as wide, with convex tempora evenly narrowed towards round posterior margin, across eyes 1.17–1.28 (Ø 1.23) times as wide as across tempora at half of their length from eyes to neck constriction. Eyes 0.64–0.71 (Ø 0.68) times as long as tempora. Elytra 1.1 times as long as pronotum. Penultimate segment of antenna about 1.3 times as long as wide. Tibia of mesothoracic leg about seven times as long as wide. Head and pronotum reddish brown, elytra dark brown except for yellow posterior fifth, abdomen dark brown, appendages (maxillary palps, antennae, legs) unicolorous light yellow-brown.

Male: Aedeagus (Fig. 7) about 0.8 mm long; apical lobes in lateral view with strongly S-shaped ventroapical margin and obtusely extended ventrally (Fig. 14), in ventral and dorsal view (Fig. 15, 16) stout and somewhat narrowed towards clipped apex; lateral lobes about as wide as long (Figs 15, 16); dorsal lobe stout with round apex (Fig. 16). Abdominal sternite VII (Fig. 21) with asetose median depression notably narrowed towards posterior margin. Abdominal sternite VIII (Fig. 20) with median lobe of posterior margin as long as lateroposterior angles; end of median lobe slightly emarginate; four distinct, long, black macrosetae situated close to posterior sternite margin.

Distribution: *Scopaeus potamides* is hitherto known only from Kolombangara Island, Solomon Islands.

Comparative notes: Within the *Scopaeus kokodanus* species group, *S. potamides* (Fig. 4) is readily

distinguished by the lighter coloring with reddish brown head and pronotum and unicolorous yellowish brown appendages. The species differs from *S. kokodanus* (Fig. 1) and *S. arfakmontium* (Fig. 2) by the round, non-pyriform head. It moreover differs from *S. arfakmontium* by the smaller aedeagus (Fig. 7) with shorter lateral lobes, tapered apical lobes in dorsal view with characteristic shape in lateral view (Figs 14–16), round apex of the dorsal lobe and shorter median lobe of the posterior margin of abdominal sternite VIII, which is not longer than the lateroposterior angles of the sternite (Fig. 22) and lacks a clearly emarginate tip. In addition, *S. potamides* can be separated from both *S. arfakmontium* and *S. balkei* by the posteriorly narrowed asetose median depression of abdominal sternite VII (Fig. 21).

Etymology: With the epithet ‘*potamides*’ (greek noun Ποταμίδες, genitiv) reference is made to the potamids, the seductive river nymphs of the Greek mythology, because representatives of the genus *Scopaeus* are also inhabitants of streams. As every stream is said to have its own potamid according to the Greek mythology, we dedicate *S. potamides* to the nameless water nymph of the Kolombara River of Kolombaranga Island, the name of which moreover translates as ‘lord of the waters’.

4. Acknowledgements

Our thanks are due to the curators and collection managers mentioned in the material section above, who made this contribution possible by lending specimens from the collections under their care. We are also indebted to Takashi Watanabe for providing the series of *Scopaeus arfakmontium* from his private collection. Gil Bretschneider (Lichtenstein, Saxony, Germany) kindly provided specimens of *S. balkei* collected by him. We warmly thank Lee Herman, specialist of the Scopaeina at the American Museum of Natural History, for proof-reading the manuscript and linguistic and scientific advice.

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