

Amundsen Sea Mollusca from the BIOPEARL II expedition

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Abstract

Information regarding the molluscs in this dataset is based on the epibenthic sledge (EBS) samples collected during the cruise BIOPEARL II / JR179 RRS James Clark Ross in the austral summer 2008. A total of 35 epibenthic sledge deployments have been performed at five locations in the Amundsen Sea at Pine Island Bay (PIB) and the Amundsen Sea Embayment (ASE) at depths ranging from 476 to 3501m. This presents a unique and important collection for the Antarctic benthic biodiversity assessment as the Amundsen Sea remains one of the least known regions in Antarctica. Indeed the work presented in this dataset is based on the first benthic samples collected with an EBS in the Amundsen Sea. However we assume that the data represented are an underestimation of the real fauna present in the Amundsen Sea. In total 9261 specimens belonging to 6 classes 55 families and 97 morphospecies were collected. The species richness per station varied between 6 and 43. Gastropoda were most species rich 50 species followed by Bivalvia (37), Aplacophora (5), Scaphopoda (3) and one from each of Polyplacophora and Monoplacophora.

Keywords

Mollusca, Antarctica, Amundsen Sea, Bivalvia, Gastropoda, Scaphopoda, Aplacophora, Monoplacophora, Polyplacophora, BIOPEARL II

Project details

Project title: BIOPEARL II-JR 179 RRS James Clark Ross 2008

Personnel: Camille Moreau, Katrin Linse, Huw Griffiths, Peter Enderlein and David Barnes

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Study extent description: The study area of this dataset was set in the eastern Amundsen Sea and focused on the continental shelf, upper slope and over-deepened shelf basins of the Amundsen Sea Embayment (ASE) and Pine Island Bay (PIB). This dataset presents species occurrences and species richness of the individual epibenthic sledge (EBS) deployments. PIB appears to be the third largest drainage outlet of the West Antarctic Ice Sheet (Lowe and Anderson 2002). This area was chosen for the BIOPEARL II cruise as it has never been subject to benthic sampling before. Furthermore it shows a unique oceanography over its continental shelf defined by the Antarctic Circumpolar Deep Water (Jenkins et al. 2004). The presence of deep basins and troughs allows the trapping of warm Circumpolar deep Water (3.5°C above the in situ freezing point) on the continental shelf of the ASE and PIB (Jacobs et al. 2011). Vaughan (2008) assumed that these particularly warm waters are one of the reasons of the high melting rate reported at the base of the floating ice shelf in these regions. The seabed of the ASE, which is of particular interest in this benthic work, presents the marks of historic, glaciations and deglaciations, together with icebergs scouring and melt-water channels (Dowdeswell et al. 2006; Nitsche et al. 2007; Larter et al. 2009; Noormets et al. 2009). One of the other characteristics of the area is the perennial sea ice cover (Graham et al. 2010).

Design description: The Amundsen Sea is a very under sampled area on the Antarctic continental shelf, according to a recent gap analysis carried out by Griffiths et al. (2011). BIOPEARL (Biodiversity dynamics : phylogeography, evolution and radiation of life in Antarctica), a core project at the British Antarctic Survey, studied the southern Bellingshausen and eastern Amundsen seas to assess the biodiversity at local and regional scales (comparable to the BIOPEARL 2006 cruise to the Scotia Sea) and investigate the phylogenetic relationships of selected marine invertebrate taxa and their biogeography in reference to the climatological, oceanographical and geological history of the Bellingshausen/Amundsen Seas. The results are used to determine of the role of Antarctica and extreme environments in general in evolutionary innovation and generation of global biodiversity. The species presence data are added to SOMBASE (Southern Ocean Mollusc Database www.antarctica.ac.uk/sombase). SOMBASE generated initial core data system upon which SCAR's Marine Biodiversity Information Network (SCAR-MarBIN) was built. As SCAR-MarBIN is the Antarctic Node of the international OBIS network, the SOMBASE data system was designed to comply with the Darwin Core standards. Regarding the dataset, the existing Data Toolkit from SCAR-MarBIN was used (<http://www.scarmarbin.be/documents/SM-FATv1.zip>), following

the OBIS schema (<http://iobis.org/data/schema-and-metadata>). The dataset was uploaded in the ANTOBIS database (the geospatial component of SCAR-MarBIN), and the taxonomy was matched against the Register of Antarctic Marine Species, using the Taxon Match tool (<http://www.scarmarbin.be/rams.php?p=match>). The dataset meets the Darwin Core requirements and was designed around this data schema.

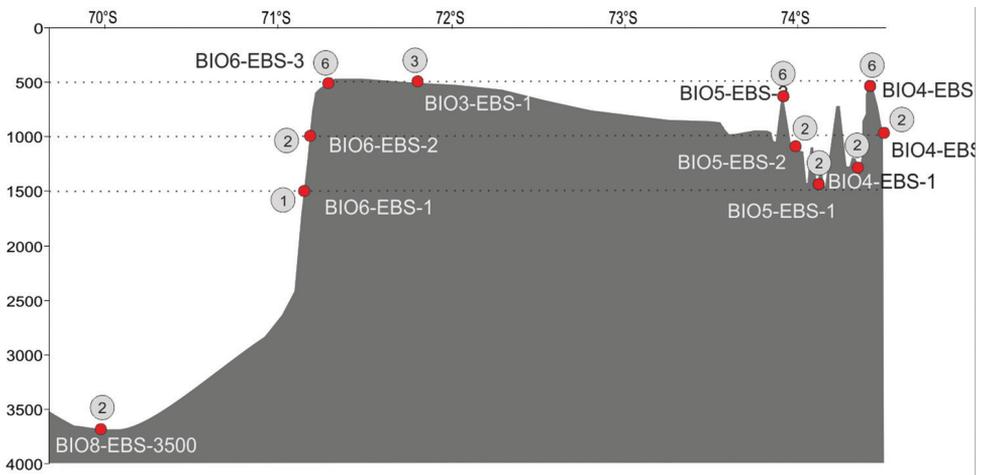
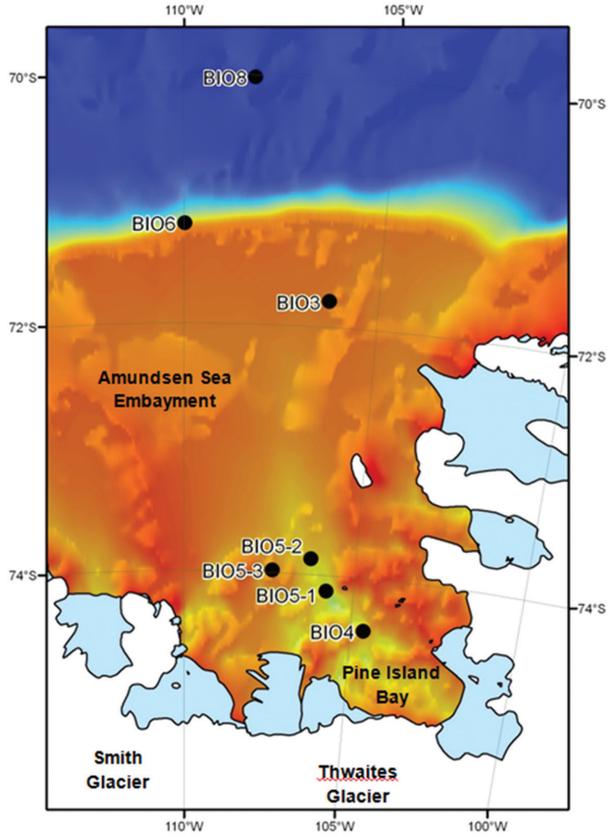
Sampling description: Five locations in the Pine Island Bay (PIB) and Amundsen Sea Embayment (ASE) at different depths ranging from 476 to 3501m have been sampled using an epibenthic sledge (EBS). Most deployments were made along depth transects from shallow to overdeepened continental shelf and to deeper slope (Figure 1 and 2). At three of the five locations samples were taken at ~500m, ~1000m and ~1500m depths, due to the particular geomorphology (presence of deep troughs close to the continent) of the ASE continental plateau. At each site, replicates (individual stations) were taken to assess habitat homogeneity and their number depended on water depth; three to six replicates were taken at 500m and two at 1000m, 1500m and 3500m depth. The BIOPEARL II cruise report is available from the British Oceanographic Data Centre (https://www.bodc.ac.uk/data/information_and_inventories/cruise_inventory/report/8277/).

This dataset presents 34 EBS deployments: 21 of which were performed at a depth of 500m at four different sites (BIO3-1, BIO4-3, BIO5-3 and BIO 6-3), six at a 1000m depth in three areas (BIO4-2, BIO5-2 and BIO6-2), five at a depth of 1500m at three different sites (BIO4-1, BIO5-1 and BIO6-1), and two replicates at site BIO8-3500 in 3500m depth. For three of the five locations, sites were positioned along vertical transects sampling at 500m, 1000m and 1500m with repeat deployments of the EBS. The sites BIO4-1, BIO4-2 and BIO4-3 and BIO6-1, BIO6-2 and BIO6-3 were situated in the same local area; while the sites BIO5-1, BIO5-2 and BIO5-3 were dispersed over a wider area because of ice cover. The EBS consist of on an epi-(below) and a supra-(above) net. Each of these nets has a mesh size of 500 μ m and an opening of 100x33cm. The cod end of both nets is equipped with net-buckets containing a 300 μ m mesh window (Brenke 2005). The EBS was trawled for 10 minutes on the sea bed at a 1 knot speed for deployments in 500m to 1500m and for 20 min in 3500m. Following Brenke (2005) that epi-and supra-nets are collecting the same fauna, these were pooled and treated as a single sample.

Quality control description: A species name was given to each specimen when it was possible. Individuals not corresponding to described species have been included in the analyses with the family or genus name and a letter or numerical code (e.g. Turbinidae sp.), however they represent a single morphospecies.

For these specimens, further morphological and genetic analyses are necessary to give them a species name but they can be included in this dataset as different species. Finally, specimens too badly damaged for species identification have not been taken in account here.

This dataset presents species occurrences and species richness of the individual EBS deployments.



Taxonomic coverage

General taxonomic coverage description: The present dataset focus on six molluscs classes (Mollusca: Aplacophora, Monoplacophora, Polyplacophora, Gastropoda, Bivalvia & Scaphopoda). It includes respectively for each class:

Class: Aplacophora

Species: *Aplacophora* sp. 1, *Aplacophora* sp. 2, *Aplacophora* sp. 3, *Aplacophora* sp. 4, *Aplacophora* sp. 5

Class: Polyplacophora

Family: Leptochitonidae

Genus: *Leptochiton*

Species: *Leptochiton* sp.

Class: Monoplacophora

Family: Micropilinidae

Genus: *Micropilina*

Species: *Micropilina* sp.

Class: Gastropoda

Family: Scissurellidae, Ataphridae, Mangeliidae, Capulidae, Calliotropidae, Seguenzioidea, Turbinidae, Turridae, Eulimidae, Limacinidae, Eatoniellidae, Cancellarioidea, Naticidae, Rissoidae, Diaphinidae, Fissurellidae, Raphitomidae, Cylichnidae, Lepetidae, Orbitestellidae, Buccinidae, Mathildidae, Newtoniellidae, Marginellidae, Cavoloniidae

Genus: *Anatoma*, *Trochaclis*, *Lorabela*, *Belalora*, *Torellia*, *Capulus*, *Calliotropis*, *Brookula*, *Brookula*, *Lisostesta*, *Liotella*, *Cirsonella*, *Balcis*, *Onoba*, *Hemiaclis*, *Limacina*, *Eatoniella*, Cancellaridae gen., *Falsilunatia*, *Pseudomauropsis*, *Sinuber*, *Powellisetia*, *Rissoid*, *Toledonia*, Fissurellidae gen., *Cornisepta*, *Zeidora*, *Pleurotomella*, *Cylichna*, *Iothia*, *Microdiscula*, *Pareuthria*, *Turritellopsis*, *Cerithiella*, *Eumetula*, *Marginella*, *Clio*

Species: *Anatoma euglypta*, *Trochaclis antarctica*, *Lorabela pelseneeri*, *Belalora* cf *striatula*, *Torellia insignis*, *Capulus* sp., *Calliotropis pelseneeri*, *Brookula* cf *charleena*, *Brookula* sp. b, *Lisostesta* sp., *Liotella* sp., *Liotella* cf *endeavourensis*, *Cirsonella extrema*, *Turbinid* sp. *Turrid* sp. 1, *Turrid* sp. 2, *Balcis* sp. *Onoba* cf *gelida*, *Hemiaclis incolorata*, *Limacina helicina*, *Eatoniella* cf *kerquelenensis regularis*, *Cancellarid* sp. *Falsilunatia* sp. *Pseudomauropsis anderssoni*, *Sinuber microstriatum*, *Powellisetia* cf *deserta*, *Rissoid* sp. *Toledonia* sp. 1, *Toledonia* sp. 2, *Toledonia* cf *elata*, Fissurellidae gen. sp. 1, Fisserulidae gen. sp. 2, *Cornisepta antarctica*, *Zeidora antarctica*, *Pleurotomella* cf *simillima*, *Cylichna* sp. *Iothia* sp. *Microdiscula* sp. *Pareuthria* cf *innocens*, *Turritellopsis gratissima*, *Cerithiella* cf *lineata*, *Cerithiella* cf *erecta*, *Eumetula* cf *strebli*, *Marginella ealesae*, *Clio antarctica*

Class: Bivalvia

Family: Nuculanidae, Nuculidae, Yoldiidae, Limopsidae, Philobryidae, Mytilidae, Limidae, Pectinidae, Propeamussiidae, Thyasiridae, Motacutidae, Lasaeidae, Cyamiidae, Carditidae, Thraciidae, Cuspidariidae, Lyonsiidae, Poromyidae, Neoleptonidae, Siliculidae, Arcidae, Vesicomysiidae, Tindariidae, Bathyspinulidae

Genus: *Propeleda*, *Ennucula*, *Yoldiella*, *Limopsis*, *Philobrya*, *Adacnarca*, *Dacrydium*, *Limatula*, *Adamussium*, *Hyalopecten*, *Cyclochlamys*, *Thyasira*, *Mysella*, *Waldo*, *Cyamiocardium*, *Cyclocardia*, *Thracia*, *Cuspidaria*, *Myonera*, *Lyonsia*, *Poromya*, *Neolepton*, *Silicula*, *Bathyarca*, *Vesicomya*, *Tindaria*, *Bathyspinula*

Species: *Propeleda longicaudata*, *Ennucula* sp. *Yoldiella ecaudata*, *Yoldiella sabrina*, *Yoldiella valettei*, *Yoldiella* cf. *profundorum*, *Yoldiella oblonga*, *Yoldiella* sp. *Limopsis longipilosa*, *Limopsis knudseni*, *Philobrya sublaevis*, *Philobrya quadrata*, *Adacnarca nitens*, *Dacrydium albidum*, *Limatula* *Limatula* sp. *Limatula Antarctolima* sp. *Adamussium colbecki*, *Hyalopecten pudicus*, *Cyclochlamys pteriola*, *Cyclochlamys gaussiana*, *Thyasira* sp. *Mysella antarctica*, *Waldo* sp. *Cyamiocardium denticulatum*, *Cyclocardia astartoides*, *Thracia meridionalis*, *Cuspidaria infelix*, *Cuspidaria minima*, *Myonera fragilissima*, *Lyonsia arcaeformis*, *Poromya antarctica*, *Neolepton* sp. *Silicula rouchi*, *Bathyarca sinuata*, *Vesicomya sirenkoi*, *Tindaria* sp. *Bathyspinula* sp.

Class: Scaphopoda

Family: Dentaliidae, Pulsellidae, Gadilidae

Genus: *Dentalium*, *Striopulsellum*, *Cadulus*

Species: *Dentalium majorinum*, *Striopulsellum minimum*, *Cadulus thielei*

Spatial coverage

General spatial coverage: Amundsen Sea, Antarctica

Coordinates: 74°29'24"S and 70°1'12"S; 110°5'24"W and 104°20'24"W

Temporal coverage: February 18, 2008–April 11, 2008

Natural collections description

Parent collection identifier: British Antarctic Survey

Collection name: BIOPEARL II EBS Molluscs

Collection identifier: Moreau/Linse

Specimen preservation method: Ethanol/Formaldehyde

Methods

Method step description:

- Epibenthic sledge sampling in the Amundsen Sea

- Once on the deck, the content of the samplers from the first deployment was immediately fixed in 96% undenaturated and pre-cooled (at -20°C) ethanol (Linse 2008) and kept for a minimum of 48 hours in a -20°C freezer and the samplers from the second deployment were fixed in 4 % buffered formalin. If six EBS deployments were carried out at a station, four were fixed in ethanol and two in formaldehyde. Afterwards, these samples were washed in cold sea water and transferred to 80 % ethanol. The treatment in formalin allows cytological studies.
- The taxonomic identification was performed in the British Antarctic Survey laboratory using a stereomicroscope.

Datasets

Dataset description

Object name: Darwin Core Archive amundsen_sea_molluscs

Character encoding: UTF-8

Format name: Darwin Core Archive format

Format version: 1.0

Distribution: http://ipt.biodiversity.aq/archive.do?r=amundsenseamolluscs_biopearl_ii

Publication date of data: 2013-01-09

Language: English

Metadata language: English

Date of metadata creation: 2013-01-09

Hierarchy level: Dataset

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Taxonomic revision of the genus *Callimerus* Gorham s. l. (Coleoptera, Cleridae). Part I. *latifrons* species-group

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Abstract

The *latifrons* species-group (= *Brachycallimerus sensu* Chapin 1924, Corporaal 1950; = *flavofasciatus*-group *sensu* Kolibáč 1998) of *Callimerus* Gorham is redefined and revised. Five species are recognized including one new species *Callimerus cacuminis* Yang & Yang **sp. n.** (type locality: Yunnan, China). *Callimerus flavofasciatus* Schenkling, 1902 is newly synonymized with *C. latifrons* Gorham, 1876. *Callimerus trifasciatus* Schenkling, 1899a is transferred to the genus *Corynommadius* Schenkling, 1899a. *Callimerus gorhami* Corporaal, 1949 and *C. pallidus* Gorham, 1892 are excluded from the *latifrons* species-group (their assignment to a species-group will be dealt with in a subsequent paper). A key to species of the *latifrons* species-group is given and habitus of each type specimen, male terminalia, and other diagnostic characters are illustrated.

Keywords

Cleridae, *Callimerus*, *Brachycallimerus*, Oriental region, systematics, new species, synonymy, species group

Introduction

The genus *Brachycallimerus* Chapin was erected by Chapin (1924) for *Callimerus latifrons* Gorham, 1876, *C. latesignatus* Gorham, 1892, *C. rusticus* Gorham, 1883, *C. pectoralis* Schenkling, 1899b and *C. trifasciatus* Schenkling, 1899a, which differed from typical *Callimerus* Gorham in having “broad and compact form, short and compact antennae, and the total absence of scales from the upper surface”. Later, two additional species, *Brachycallimerus doesburgi* Corporaal, 1937 and *B. gorhami* Corporaal, 1949, were described and another two species, *Callimerus pallidus* Gorham, 1892 and *C. flavofasciatus* Schenkling, 1902, were transferred to *Brachycallimerus* (Corporaal 1937; Chapin 1924). Hence, in the catalogue Corporaal (1950), a total of 9 valid species were included in this genus.

Kolibáč (1998) synonymized *Brachycallimerus* with *Callimerus* based on phylogenetic analysis of 38 morphological characters stating that “*Brachycallimerus* is derived from the major part of *Callimerus*” and that “*Callimerus* would be a paraphyletic taxon if *Brachycallimerus* were classified as a separate genus”. He treated members of *Brachycallimerus* as *flavofasciatus*-group infra *Callimerus*. Other three species groups were proposed within *Callimerus* in that paper: *dulcis*-group (major part of *Callimerus* Gorham, 1876), *coomani*-group (= *Cucujocallimerus* Pic, 1929) and *prasinatus*-group (= *Stenocallimerus* Corporaal & Pic, 1940). *Brachycallimerus doesburgi* Corporaal, 1937 was excluded from *flavofasciatus*-group, but assigned in *coomani*-group for the reason that its claw lacks a basal tooth (Fig. 77). The synonymy of *Brachycallimerus* under *Callimerus* is approved in Gerstmeier et al. (2012: 391), though they were treated as separate genera in Opitz (2010: 82).

In the present paper, we follow the classification system of Kolibáč (1998) and treat *Brachycallimerus* Chapin in a species-group rank, named it *latifrons* species-group (= *flavofasciatus*-group *sensu* Kolibáč 1998); the name of the species group is changed because *C. flavofasciatus* Schenkling, 1902 is synonymized with *C. latifrons* Gorham, 1876 herein, which is the oldest species of this species group. The purpose of this paper is to redefine *latifrons* species-group and revise its members. Five species are kept in the redefined *latifrons* species-group, with one new species from China (Yunnan) and Laos; one new synonym is proposed and three species that formally belong to this species group are excluded. The exclusion of *Callimerus doesburgi* (Corporaal, 1937) by Kolibáč (1998) is approved. All members of this species group are distributed in Southeast Asia.

Material and methods

Materials examined in the present paper are deposited in the following collections. Abbreviations are shown in the text as follows:

- CAU China Agricultural University, Beijing, China
- CCCC Collection of Mr. CHEN Changchin, Taiwan, China

- IZAS** Institute of Zoology, Chinese Academy of Sciences, Beijing, China
MCSN Museo Civico di Storia Naturale, Genova, Italy
MNHN Muséum National d'Histoire Naturelle, Paris, France
NHMB Naturhistorisches Museum, Basel, Switzerland
NHML The Natural History Museum, London, United Kingdom
NHRS Naturhistoriska Riksmuseet, Stockholm, Sweden
OUM Hope Department of Entomology, University Museum, Oxford, United Kingdom
RMNH Rijksmuseum van Natuurlijke Historie, Leiden, The Netherlands
USNM National Museum of Natural History, Smithsonian Institution, Washington, D. C., USA
ZMAN Zoölogisch Museum Amsterdam, Leiden, The Netherlands

Whole male abdomens were removed from the body with fine forceps and treated with 10% KOH solution at room temperature for 8–12 hours. Male terminalia were prised apart, rinsed and examined in 70% ethanol. Tegmina were photographed when totally dry in the air, while other parts of male terminalia were photographed in glycerol. All male terminalia components were permanently stored within glycerol in genital vial which was pinned below specimen. Habitus images were captured using a Nikon D7000 digital camera with Tamron SP 90mm lens, or Canon 450D digital camera with Canon Macro 100 mm lens. Terminalia images were captured by a Nikon digital Sight DS–SM camera fitted to a Nikon SMZ–1500 stereoscopic dissecting microscope controlled by ACT–2U software, or by a Canon 450D digital camera fitted to a Nikon SMZ–1500 stereoscopic dissecting microscope. Series of partially focused photographs were taken and then combined using Helicon Focus software, and finally processed with Adobe Photoshop software. Line drawings were made under Leica MZ125 stereoscopic dissecting microscope or created from color photographs using Adobe Illustrator software. Distribution maps, created in Adobe Illustrator software, are based on examined materials and published records.

Measurements were made under a stereomicroscope using an ocular micrometer. Body length is the linear distance from labrum to elytral apices. Body width is the maximum width across elytra. Abbreviations are shown in the text as follows: **AL**: antennal length; **AD**: distance between two antennae insertions. **EyD**: minimum distance between two eyes; **EyW**: maximum eye width in dorsal view (Fig. 71); **PL**: prothorax maximum length; **PW**: prothorax maximum width; **EL**: elytra maximum length; **EW**: elytra maximum width. Terminology mostly follows Ekis (1977). The male tegmen possesses three membranous semi-transparent regions, a pair of slit-like ones situated at both dorsal-lateral sides (Figs 59–60, 66–67) and the other, more or less cordiform, situated ventrally (Figs 60–61, 67–69); these membranous regions are more clear to see when tegmen is dry. The ventral membranous region is cordiform, surrounded by a pair of **outer margins** and a pair of **inner margins** (Figs 68, 69). Spicular forks are comprised of a spicular apodeme (*sensu* Opitz 2010) and a pair of spicular arms (Fig. 63; = lateral plates of the spicular fork *sensu* Opitz 2010). When describing male termi-

nalía, the following abbreviations are introduced: **TML**: length of ventral membranous region of the tegmen; **TMW**: width of ventral membranous region of the tegmen (Figs 61, 68–69); **TMaL**: vertical length of apical lobe of the ventral membranous region of tegmen; **SAPL**: length of spicular apodeme; **SFL**: length of spicular fork.

Original and later important taxonomic references are cited after taxon names. Full label data are provided for name-bearing type specimens: label data of each specimen are enclosed within a pair of double quotation marks, and individual labels are separated by a slash. All writings are cited in their original spelling, punctuation and language. Original italic or capital is ignored. Notes and elaborations relating to label data are enclosed in square brackets (including the writer, translation, etc). Red labels have been added to holotypes, paratypes, lectotypes and paralectotypes. Full label data or, in most cases, only locality data are provided for other specimens. When transcribing the label data, “**hw.**” is short for “handwritten”, and ellipsis are used if the original writing were illegible and unable to be transcribed. Authors of the handwriting on determination labels are identified with the clues given by Horn *et al.* (1990) and/or confirmed by present curators of correlative museums where the authors of those handwritings worked. Specimens marked with an asterisk are those whose male terminalia are figured in this paper.

Taxonomy

latifrons species-group

Brachycallimerus Chapin, 1924: 180, 190 (Type species: *Callimerus latifrons* Chapin, 1924; by original designation); –Kolibáč, 1998: 176 (synonymized with *Callimerus* Gorham).

Crassocallimerus Pic, 1929: 16 (Type species: *Callimerus latesignatus* Gorham, 1892; by monotypy; subgenus of *Callimerus* Gorham); –Corporaal, 1937: 60 (synonymized with *Brachycallimerus* Chapin).

flavofasciatus-group Kolibáč, 1998: 182.

Diagnosis. This species group is characteristic by its broad and compact body form. It differs from *dulcis* species-group (*sensu* Kolibáč 1998) and *prasinatus* species-group (*sensu* Kolibáč 1998) by pronotum wider than long (PL/PW < 1; Figs 4, 15, 17, 28, 30, 41, 44, 54); antenna short (AL/AD 1.0–1.2); antennomeres VII – XI or VIII – XI forming a more or less compact and oval club, width of antennomere VIII longer than or as long as its length (Figs 14, 27, 40, 53, 71); eyes large, posterior inner margins of eyes evidently convergent towards midline, EyD subequal to EyW (ratio 1.0–1.1) (Figs 4, 15, 17, 28, 30, 41, 44, 54); elytra without scales; integument with yellow and black coloration.

It differs from *coomani*-group (*sensu* Kolibáč 1998) by claws with a basal tooth (Fig. 57) and metatibiae with a subapical projection on the outer edge (Fig. 58).

In the integumental coloration (yellow and black), *C. pallidus* Gorham, 1892 (Carin Hills, Chebà; Figs 79), *C. gorhami* Corporaal, 1949 (Sumatra's East Coast; Fig. 81), *C. nigroapicalis* Pic, 1955 (Fujian; Fig. 84, 85), *C. terminalis* Chapin, 1919 (Sandakan, North Borneo; Fig. 86, 87), and some species related to *C. insolatus* Pascoe, 1860 might be similar to members of the *latifrons* species-group. The differences between *C. pallidus*, *C. gorhami* and this species group are provided in the text below. *C. nigroapicalis* is different from this species group in pronotum longer than wide. *C. terminalis* is different from this species group in claws without a basal tooth, subapical projection on outer edge of metatibia rudimental, pronotum longer than wide. Species related to *C. insolatus* differ from this species group in claws without a basal tooth.

Description. *Size:* length 7.5–11.7 mm, width 2.3–3.7 mm. *Integumental color:* yellow and black. *Vestiture:* body profusely vested with yellow pubescence; frons with dense white scales; thoracic pleuron sometimes with white scales. *Head:* including eyes wider than pronotum, vertex with sparse punctures. Labrum rectangular, apex straight or very slightly emarginated in the middle; mandibles stout; terminal segments of maxillary palpi digitiform, those of labial palpi elongate-triangular, both as long as their preceding segments. Eyes large, very slightly emarginated near antennal insertions, finely granulate; posterior inner margin of eyes evidently convergent towards midline, EyD subequal to EyW (ratio 1.0–1.1) (Figs 4, 15, 17, 28, 30, 41, 44, 54). Antenna short (AL/AD 1.0–1.2); antennomere I stout and bent, twice length as antennomere II; antennomere II globular; antennomere III longer than it is wide, slightly longer than antennomere II; antennomeres IV–X increasingly wider and shorter than their preceding segments, antennomeres VII or VIII to XI wider than or as long as their respective length, forming a more or less compact and oval club (Figs 14, 27, 40, 53, 71). Gula oblong, gular sutures parallel. *Prothorax:* wider than long (PL/PW 0.8–0.9), subapical impression of pronotum deep; pronotum constricted at base, evidently dilated before middle (Figs 4, 15, 17, 28, 30, 41, 44, 54); punctures on pronotum sparse and fine. *Elytra:* wider than head including eyes, EL/EW 1.7–2.3; sides parallel, sutural angle round, outer angle pointed (Fig. 70); punctures irregular and dense; without scales. *Legs:* tibiae without longitudinal ridge; metatibia with a subapical projection on outer edge (Fig. 58); tibial spur formula 0–1–1; tarsi formula 5–5–5, tarsomeres I–II evidently bilobed, III–IV more or less bilobed, V slender; tarsomere I of pro- and meso-tarsi as long as tarsomere II, meta-tarsomere I slightly longer than tarsomere II; tarsomere I–IV of all legs with evident pulvilli; claws with a basal tooth (Fig. 57). *Abdomen:* with six ventrites; male ventrite V–VI with posterior margin emarginated (Figs 13, 26, 39, 52, 65); female ventrite V with posterior margin straight, ventrite VI with posterior margin rounded. *Male terminalia:* tegmen tubular, sclerotized with three semi-transparent membranous regions: a pair of slit-like ones situated at dorsal-lateral sides (Figs 59–60, 66–67); the other one more or less cordiform, situated ventrally (Figs 60–61, 67–69). Outer margin of the ventral membranous region straight (Figs 9, 9a), slightly curved (Figs 22, 22a, 48, 48a, 61, 68, 69) or strongly curved (35, 35a); TML/TMW 0.9–1.3, TMaL/TML 0.2–0.6 (Figs 9, 9a, 22, 22a, 35, 35a, 48, 48a, 61, 68, 69). In some cases, an additional tiny membranous region presents at dorso-

central side of tegmen (Fig. 66). Parameres strongly sclerotized, apices divergent (Figs 7–9, 59–61) or convergent (Figs 20–22, 33–35, 46–48). Phallic plate sclerotized in midline (Figs 10, 36, 49). Spicular fork: SApL/SFL about 0.3 (Figs 11, 24, 37, 50, 63).

Distribution. Southeast Asia (Fig. 72).

Discussion. This species group is probably advanced groups within *Callimerus s. l.*, as Kolibáč (1998) suggested; but its sister group cannot be determined with certainty until the intra-taxonomy of the *dulcis* species-group (*sensu* Kolibáč 1998) has been resolved, which nearly contains two-thirds of species of this genus.

Key to species of *latifrons* species-group

- 1 Elytron with only one black spot at apex (Fig. 54); metasternum and metepisternum both yellow..... ***C. cacuminis* sp. n.**
- Elytron with two black spots, anterior spot just before middle, posterior spot at apex or near apex (Figs 1, 15, 28, 41); metasternum and metepisternum both black..... **2**
- 2 Head black; anterior black spot of elytron spanning from outer margin to suture or almost to suture (Figs 1, 2, 15, 17, 18)..... **3**
- Head yellow; anterior black spot of elytron clearly reaching neither outer margin or suture (Figs 28, 30, 31, 41, 42, 44)..... **4**
- 3 Pronotum totally black; mesepisternum black; anterior black spot of elytron extended to suture thus forming a complete black band across elytra (Figs 1, 2); EL/EW about 2.2; apices of parameres divergent (Figs 7–9), outer margin of ventral membranous region of tegmen straight (Figs, 9, 9a)..... ***C. latifrons* Gorham**
- Pronotum with major area yellow, only with a small transverse black patch on anterior margin (Fig. 15), in few cases such patch absent (Fig. 17); mesepisternum yellow; anterior black spot of elytron not exactly extended to suture, thus forming a incomplete black band across elytra interrupted at suture (Figs 15, 17, 18); EL/EW about 1.7; apices of paramere convergent (Figs 20–22), outer margin of ventral membranous region of tegmen slightly curved (Figs 22, 22a) ***C. latesignatus* Gorham**
- 4 Mesepisternum yellow; posterior black spot of elytron located vertical-apically, rounded rectangle, length to width ratio about 1.5:1 (Fig. 28); outer margin of ventral membranous region of tegmen strongly curved, TML/TMW about 0.9 (Figs 35, 35a); tergite VIII with posterior margin rounded, slightly notched in middle (Fig. 38) ***C. pectoralis* Schenkling**
- Mesepisternum black; posterior black spot of elytron located lateral-apically, bar-shaped, length to width ratio about 4:1 (Fig. 41); outer margin of ventral membranous region of tegmen slightly curved, TML/TMW about 1.3 (Figs 48, 48a); tergite VIII with posterior margin almost straight (Fig. 51)..... ***C. rusticus* Gorham**

***Callimerus latifrons* Gorham, 1876**

http://species-id.net/wiki/Callimerus_latifrons

Figs 1–14, 72

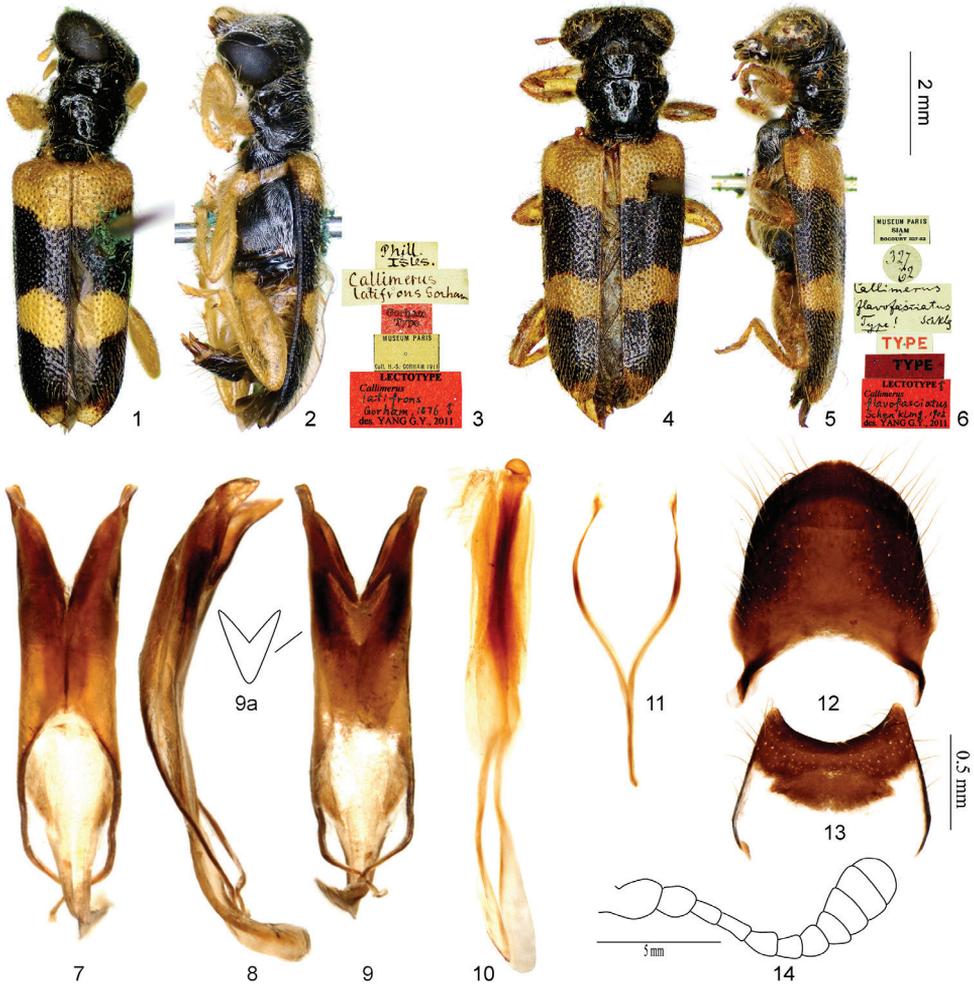
latifrons Gorham, 1876: 67 (*Callimerus*; type locality: “Philippines”); –Chapin, 1924: 190 (*Brachycallimerus*); –Kolibáč, 1998: 176 (*Callimerus*).

flavofasciatus Schenkling, 1902: 320 (*Callimerus*; type locality: “Siam”); –Schenkling, 1916: 220 (Singapore); –Chapin, 1924: 190 (synonymized with *latifrons* Gorham); –Corporaal, 1924: 196 (synonym of *latifrons* Gorham); –Corporaal, 1939: 193 (variety of *latifrons* Gorham); –Corporaal, 1948: 287 (raised to species rank). **Syn. n.**

Type material examined. **Lectotype** of *Callimerus latifrons* Gorham designated here: “Phill. Isles / *Callimerus latifrons* Gorham [hw. by Gorham] / ♂ / Gorham Type / Museum Paris, Coll. H.S. Gorham 1911 / Lectotype: *Callimerus latifrons* Gorham, 1876 ♂, des. Yang G. Y., 2011” (MNHN, ♂; Figs 1–3); **Lectotype** of *Callimerus flavofasciatus* Schenkling designated here: “327–62 / Museum Paris; Siam; Bocourt 327–62 / *Callimerus flavofasciatus* Schklg. Type! [hw. by Schenkling] / Type / ♂ / Type / Lectotype ♂: *Callimerus flavofasciatus* Schenkling, 1902, des. Yang G. Y., 2011” (MNHN, ♂; Figs 4–6).

Note on Type material. The name-bearing types of *latifrons* and *flavofasciatus* were not fixed in the original publications, so lectotypes of both species are designated here to express the taxonomic purpose of fixing the name to a single specimen and preventing further uncertainty regarding the taxon to which the names are applied. Only one specimen of each species was found in related museums.

Comment on synonymy. Gorham (1876: 67) described *C. latifrons* from Philippines as “Nigro-piceus, ..., elytrorum fasciâ basali, maculâque pone medium reniformi pallide testaceis” (with “a basal fascia (widest in centre) and two kidney-shaped spots, almost touching suture, yellow”). Schenkling (1902: 320) published *C. flavofasciatus* from Thailand, and stated that it differed from *C. latifrons* by having an additional yellow spot at apex of elytron. Chapin (1924: 190) synonymized *C. flavofasciatus* with *C. latifrons* and argued, *C. latifrons* having such a yellow spot at apex of elytron because all the Philippines specimens he examined having that (he also stated such a spot was mentioned in Gorham’s original description, which is not true though). Corporaal (1939: 193) found a specimen from Laos lacking a yellow spot at apex of elytron, which agrees well with Gorham’s description; so he regarded the specimen as a representative of the typical form of *C. latifrons*, and treated *flavofasciatus* as a variety of *C. latifrons* for having an additional yellow spot at elytral apex. Corporaal (1948: 287) re-treated *C. flavofasciatus* as a distinct species for presence of such a spot. However, after we located it from MNHN, we found that the type of *C. latifrons* actually having a yellow spot at apex of elytron, which was simply not mentioned in the original description. We compared the external morphology and male genital characters of type specimens of *C. latifrons* and *C. flavofasciatus* and found no significant differences; therefore, we



Figures 1–14. *Callimerus latifrons* Gorham, 1876. 1–3 lectotype of *C. latifrons* Gorham, 1876 (1 dorsal view 2 mirror image of right lateral view 3 labels) 4–6 lectotype of *C. flavofasciatus* Schenkling, 1902 (4 dorsal view 5 lateral view 6 labels) 7–13 male terminalia, specimen from Philippines (7 dorsal view 8 lateral view 9 ventral view 9a outline of ventral membranous region) 10 phallus 11 spicular fork 12 tergite VIII 13 sternite VIII 14 antenna, specimen from Yunnan.

synonymize *C. flavofasciatus* with *C. latifrons*. In addition, the specimen from Laos mentioned in Corporaal (1939: 193; 1948: 287) lacking the additional yellow spot is conspecific with *C. latifrons*; it is only the color variation of this species, as posterior black bands of elytra reach to the extreme apex and thus the apical yellow spot missing.

Diagnosis. *C. latifrons* can be rapidly distinguished from other species of this species group by its entirely black pronotum (Figs 1, 2).

There are 3 other species of this species group with two black spots on each elytron: *C. latesignatus*, *C. pectoralis* and *C. rusticus*. In addition to the difference in pronotal

coloration, *C. latifrons* can be differentiated from these three species by: (1) EL/EW about 2.2 (in other 3 species 1.7–1.8); (2) anterior black spot of elytron spanning from elytral outer margin to suture, thus forming a complete black band across elytra (Fig. 1); (3) apices of paramere divergent (Fig. 7–9).

Description. *Size:* length 7.5–8.9 mm, width 2.3–2.8 mm. *Color:* Head black, clypeus, labrum, palpi and antennae yellow; pronotum black; elytron yellow with two black spots, anterior spot just before middle, posterior spot near apex or at apex, both spots spanning from elytral outer margin to suture, thus forming two complete black bands across elytra; legs yellow with metacoxae black; prosternum black; mesepisternum black, mesepimeron yellow, mesosternum black with anterior and posterior areas more or less yellowish; metepisternum, metasternum and katapisternum black; abdominal ventrites I–III of male yellow, IV–VI black; abdominal ventrites I–V of female yellow, VI black. *Vestiture:* meso- and meta-pleuron more or less with thin white scales. *Head:* AL/AD about 1.0; EyD/EyW about 1.0. *Prothorax:* PL/PW about 0.9. *Elytra:* EL/EW about 2.2. *Male terminalia:* apices of paramere divergent (Figs 7–9); TML/TMW about 1.2, TMaL/TML about 0.4, outer margin of ventral membranous region straight (Figs 9, 9a); SaPL/SFL about 0.3 (Fig. 11); tergite VIII with posterior margin rounded and slightly pointed (Fig. 12); sternite VIII with posterior margin roundly concave (Fig. 13).

Variation. The posterior black spot on elytron in most cases doesn't reach to the extreme apex and thus a small region of elytron extreme apex is yellow. But in a few specimens the black spot reach to the extreme apex, so the yellow portion is missing. These two color forms could be found in the same locality (Yunnan, China for instance) and they are not correlated with sex.

Other material examined. **China: Yunnan:** Xishuangbanna Damenglong, 650 m, 1958.IV.9, WANG Shuyong, IOZ(E)1126312 (IZAS, 1♂); same data but 1958.V.5, PU Fuji, IOZ(E)1126311 (IZAS, 1♀); Xishuangbanna, Yunjinghong, 650 m, 1959.V.5, ZHANG Xuezhong, IOZ(E)1126310 (IZAS, 1♂); Xishuangbanna, Mengla, 620–650 m, 1959.V.13, PU Fuji, IOZ(E)1126319 (IZAS, 1♀); Xishuangbanna, Xiaomengyang, 850 m, 1958.VIII.18, ZHANG Yiran, IOZ(E)1126309 (IZAS, 1♀); same data but 1957.VI.10, WANG Shuyong, IOZ(E)1126306 (IZAS, 1♂); Jinping, Mengla, 420 m, 1956.IV.19, HUANG Keren et. al., IOZ(E)1126283 (IZAS, 1♀); Jinping, Mengla, 420 m, 1956.IV.27, HUANG Keren et. al., IOZ(E)1126284 (IZAS, 1♂); Jinping, Mengla, 370 m, 1956.IV.12, HUANG Keren et. al., IOZ(E)1126287 (IZAS, 1♂); **Vietnam:** Tonkin, Backan; Lemée, 1908; Musum Paris 1952, Coll. R. Oberthür (MNHN, 1♀); **Thailand:** nr. Chiangdao cave, 800 m, N. Thailand, 19-IV-1983, T. Shimomura leg. (MNHN, 1♀); **Philippines:** “L. Laglaize 1879; Dumalon Zamboanga; Mindanao / *Callimerus latifrons* Gorh., det. Corporaal 1923 / Musum Paris 1952, Coll. R. Oberthür / ♂” (MNHN, 1♂)*; **Malaysia:** “Doherty / Perak / Fry Coll. 1905. 100 / *C. latifrons* G. [hw. by Gorham] / *Callimerus latifrons* Gorham, Gorham det. [hw. by Gahan]” (NHML, 1♀); **Indonesia:** “J.B. Corporaal; Sumatra's O. K. Medan, 24.12.1917; 20 M / Musum Paris 1952, Coll. R. Oberthür / ♂” (MNHN, 1♂); “J.B. Corporaal; Sumatra's O. K. Medan, 24.12.1917; 20 M / Cal-

limerus flavofasciatus Schenkling; Corporaal det. 1923 / Musum Paris 1952, Coll. R. Oberthür / ♂” (MNHN, 1♂); “J.B. Corporaal; Sumatra’s O. K. Medan, 24.12.1917; 20 M / Callimerus flavofasciatus Schl. / [...] / [...] / Corporaal det. 1923 / Musum Paris 1952, Coll. R. Oberthür / ♀” (MNHN, 1♀); “J.B. Corporaal; Sumatra’s O. K. Pagar Marbau, 15 / 12.’18; 24 M / J.B. Corporaal det. 1922: Callimerus flavofasciatus Schl. / Musum Paris 1952, Coll. R. Oberthür / ♂” (MNHN, 1♂); “J.B. Corporaal; Sumatra’s O. K. Pagar Marbau, 15 / 12.’18; 24 M / B. flavofasciatus Schl. / Musum Paris, Coll. M. Pic / ♂” (MNHN, 1♂); “J.B. Corporaal; Sumatra’s O. K. Medan, 1.11. [19]21; 20 M / J.B. Corporaal det. 1922: Callimerus flavofasciatus Schl. / Musum Paris 1952, Coll. R. Oberthür / ♂” (MNHN, 1♂); “J.B. Corporaal; Sumatra’s O. K. Medan, 6.1921; 20 M / 1938 J.B. Corporaal det: Brachycallimerus latifrons Gorh. var. flavofasciatus Schenkling / Musum Paris 1939, Corporaal / ♂” (MNHN, 1♂); “J.B. Corporaal; Sumatra’s O. K. Medan, 22.1.[19]21; 20 M / 1938 J.B. Corporaal det: Brachycallimerus latifrons Gorh. var. flavofasciatus Schenkling / Musum Paris, Coll. M. Pic / ♂” (MNHN, 1♂); “J.B. Corporaal; Sumatra’s O. K. Pagar Marbau, 15 / 12.’18; 24 M / Musum Paris 1952, Coll. R. Oberthür / ♀” (MNHN, 1♀); “J.B. Corporaal; Sumatra’s O. K. Pagar Marbau, 15 / 12.’18[1918]; 24 M / [...] / Brachycallimerus flavofasciatus Schl. / Musum Paris, Coll. M. Pic / ♀” (MNHN, 1♀); “Sumatra, Si-Rambe, XII.90-III.91, E. Modigliani / 1941 Corporaal det. Brachycallimerus latifrons Gorh. var. flavofasciatus Schenkling” (MCSN, 1♀); “59192 / Doherty / Borneo, Pengaron / Fry Coll. 1905. 100 / C. latifrons G. [hw. by Gorham] / Callimerus latifrons Gorham, Borneo, Perak” (NHML, 1♀).

Distribution (Fig. 72). China (Yunnan), Vietnam, Thailand, Philippines (Mindanao), Malaysia, Indonesia (Sumatra, Borneo).

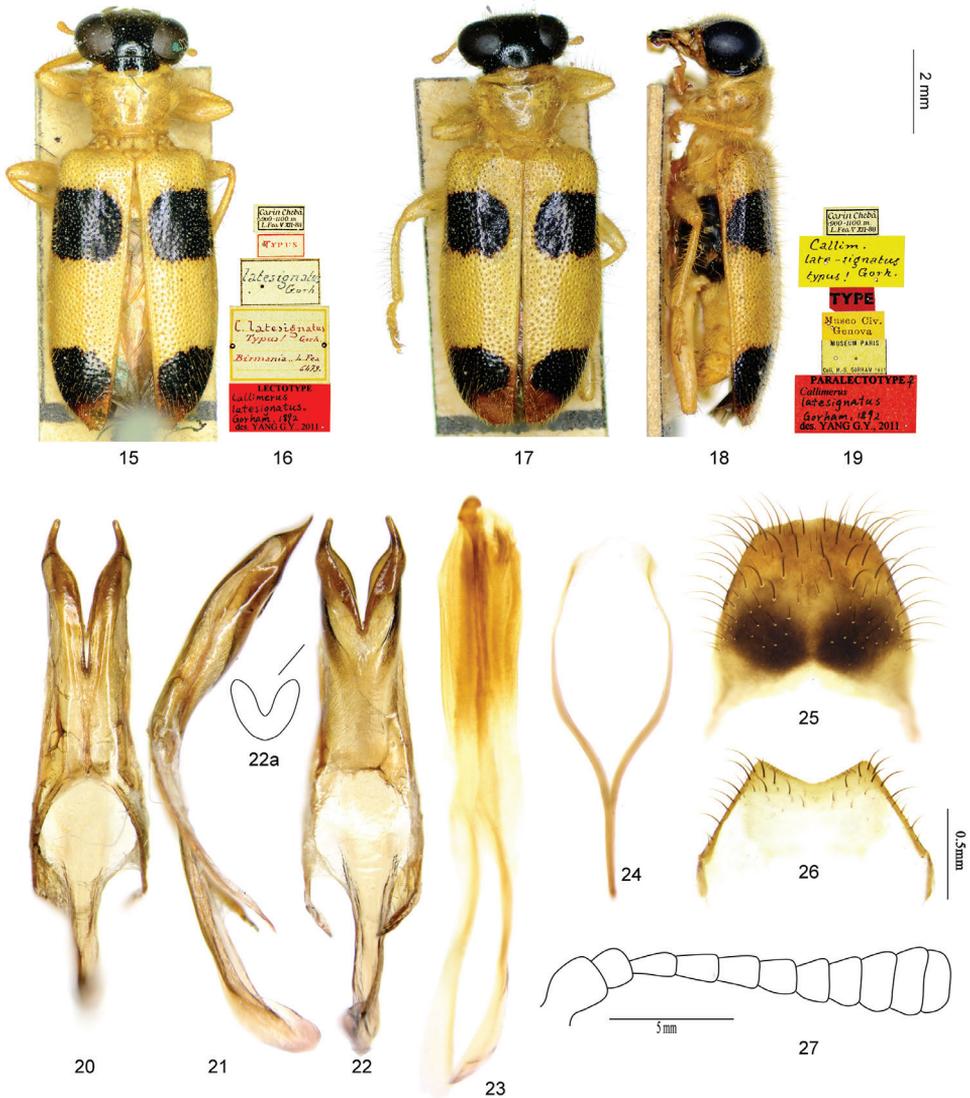
Callimerus latesignatus Gorham, 1892

http://species-id.net/wiki/Callimerus_latesignatus

Figs 15–27, 72

latesignatus Gorham, 1892: 728 (*Callimerus*; localities: “Carin Hills (Chebà)”, “Assam, Naga Hills”); –Chapin, 1924: 190 (*Brachycallimerus*); –Kolibáč, 1998: 176 (*Callimerus*).

Type material examined. **Lectotype** of *Callimerus latesignatus* Gorham designated here: “Carin Chebà, 900–1000 m; L. Fea, V XII-88 / Typus / latesignatus Gorh. [hw. by Raffaello Gestro] / Lectotype: Callimerus latesignatus Gorham, 1892, des. Yang G. Y., 2011” (MCSN, sex unknown; Figs 15–16); **Paralectotypes** of *Callimerus latesignatus* Gorham: “Carin Chebà, 900–1000 m; L. Fea, V XII-88 / Callim. late-signatus Gorh. typus! [hw. by Raffaello Gestro] / Type / Museo Civ. Genova / Museum Paris, Coll. H.S. Gorham, 1911 / Paralectotype ♀, Callimerus latesignatus Gorham, 1892, des. Yang G. Y., 2011” (MNHN, 1♀; Figs 17–19); “Doherty / Assam, Nagas / Fry Coll. 1905. 100. / C. latesignatus Gorh. [hw. by Gorham] / Callimerus latesignatus Gorham; Gorham det. [hw. by Gahan]” (NHML, 1 ex., sex unknown); “62022 / Do-



Figures 15–27. *Callimerus latesignatus* Gorham, 1892. **15–16** lectotype of *C. latesignatus* Gorham, 1892 (**15** dorsal view **16** labels) **17–19** Paralectotype of *C. latesignatus* Gorham, 1892 from MNHN (**17** dorsal view **18** lateral view **19** labels) **20–26** male terminalia, specimen from Yunnan **20–22** tegmen (**20** dorsal view **21** lateral view **22** ventral view **22a** outline of ventral membranous region) **23** phallus **24** spicular fork **25** tergite VIII **26** sternite VIII **27** antenna, specimen from Yunnan.

herty / Assam, Nagas / Fry Coll. 1905. 100. / *Callimerus latesignatus* Gorch., Assam, Type [“Type” with strikethrough; hw. by Frey] (NHML, 1 ex., sex unknown).

Note on Type material. The name-bearing type of *C. latesignatus* was not fixed in the original publication so the lectotype is designated here to express the taxonomic purpose of fixing the name to a single specimen and preventing further uncertainty regard-

ing the taxon to which the name is applied. The specimen deposited in MCSN is chosen as the lectotype because the type series were originally from that museum's expedition.

Diagnosis. *C. latesignatus* is most similar to *C. latifrons* and *C. pectoralis*. It differs from *C. latifrons* by: (1) pronotum with major area yellow, only with a small transverse black patch on anterior margin (Fig. 15), in few cases such patch absent (Fig. 17) (pronotum totally black in *C. latifrons*); (2) mesepisternum yellow (black in *C. latifrons*); (3) anterior black spot of elytron not exactly extended to suture, thus forming an incomplete black band across elytra interrupted at suture (Figs 15, 17, 18) (anterior black spot of elytron extended to suture in *C. latifrons*, thus forming a complete black band across elytra; Figs 1, 2); (4) EL/EW about 1.7 (*C. latifrons* with EL/EW about 2.2); (5) apices of paramere convergent (Figs 20–22) (*C. latifrons* with apices of paramere divergent; Figs 7–9); (6) outer margin of ventral membranous region of tegmen slightly curved, TMaL/TML about 0.6 (Figs 22, 22a) (*C. latifrons* with outer margin of ventral membranous region of tegmen straight, TMaL/TML about 0.4; Figs 9, 9a).

C. latesignatus differs from *C. pectoralis* by: (1) head black (*C. pectoralis* with head yellow); (2) pronotum with major area yellow, only with a small transverse black patch on anterior margin (Fig. 15), in few cases such patch absent (Fig. 17) (*C. pectoralis* with pronotum always totally yellow); (3) mesepisternum yellow (black in *C. pectoralis*); (4) anterior spot of elytron spanning from elytral outer margin to nearly suture (Figs 15, 17, 18) (*C. pectoralis* with anterior spot of elytron clearly neither reaching outer margin nor suture, such spot smaller; Figs 28, 30, 31); (5) outer margin of ventral membranous region of tegmen slightly curved, TMaL/TML about 0.6 (Figs 22, 22a) (*C. pectoralis* with outer margin of ventral membranous region of tegmen strongly curved; TMaL/TML about 0.3; Figs 35, 35a); (6) tergite VIII with posterior margin almost straight (Fig. 25) (tergite VIII of *C. pectoralis* with posterior margin notched in the middle; Fig. 38).

Description. *Size:* length 8.2–10.5 mm, width 2.8–3.8 mm. *Color:* Head black, clypeus, labrum, palpi and antennae yellow; pronotum with major area yellow, only with a small transverse black patch on anterior margin (Fig. 15), in a few cases such patch absent (Fig. 17); elytron yellow with two black spots, anterior spot just before middle, posterior spot near apex, both spots spanning from elytral outer margin almost to suture, thus forming two incomplete bands across elytra interrupted at the suture; legs yellow with metacoxae mostly black; prosternum, mesepisternum, mesepimeron and mesosternum yellow; metepisternum, metasternum and katepisternum black; abdominal ventrites usually yellow, in a few cases terminal ventrite darker. *Head:* AL/AD about 1.0; EyD/EyW about 1.0. *Prothorax:* PL/PW about 0.8. *Elytra:* EL/EW about 1.7. *Male terminalia:* apices of parameres convergent (Figs 20–22); TML/TMW about 0.9, TMaL/TML about 0.6, outer margin of ventral membranous region slightly curved (Figs 22, 22a); SApL/SFL about 0.3 (Fig. 24); tergite VIII with posterior margin almost straight (Fig. 25); sternite VIII with posterior margin shallowly triangularly concave (Fig. 26).

Variation. The pronotum of most specimens is yellow with a small transverse black patch on anterior margin, but two females examined don't have such a patch and thus the pronotum is totally yellow (one of which is the paralectotype in MNHN).

Other material examined. China: Guangxi: Daqingshan, Hengle, light trap, 1983.V.7, LIAO Subai (IZAS, 1♀); Pingxiang, YANG Jikun, 1963.V.10 (CAU, 3 ex.); same data but 1963.V.12 (CAU, 1 ex.); **Yunnan:** Mangshi, 900 m, 1955.V.16, Bustshik, IOZ(E)1126291 (IZAS, 1♂)*; Mangshi, 900 m, 1955.V.16, Kryzhanovskij, IOZ(E)1126292 (IZAS, 1♂); Mangshi, 900 m, 1955.V.16, Kryzhanovskij, IOZ(E)1126293 (IZAS, 1♀); Mangshi, 920 m, 1958.IX.1, LI Chuanlong, IOZ(E)1126325 (IZAS, 1♀); Gengma, 1955.V.2, HUANG Tianrong, IOZ(E)1126295 (IZAS, 1♀); eshan, 80.8, IOZ(E)1126959 (IZAS, 1♀); Baoshan, Diyidaoban, 1200 m, 1955.V.28, OU Bingrong, IOZ(E)1126305 (IZAS, 1♂); Baoshan to Yongping, 1955.V.28, B. Popov, IOZ(E)1126297 (IZAS, 1♀); Jingdong, Waidaba, 1250 m, 1956.V.26, YANG Xingchi, IOZ(E)1126289 (IZAS, 1♀); Jingdong, 1170 m, 1956.V.22, B. Popov, IOZ(E)1126300 (IZAS, 1♂); Jingdong, 1170 m, 1956.V.23, Kryzhanovskij, IOZ(E)1126301 (IZAS, 1♀); Jingdong, 1170 m, 1956.V.26, Kryzhanovskij, IOZ(E)1126302 (IZAS, 1 ex.); Jingdong, 1200 m, 1955.IV.27, Kryzhanovskij, IOZ(E)1126303 (IZAS, 1 ex.); Jinping, Mengla, 420 m, 1956.IV.19, HUANG Keren et. al., IOZ(E)1126282 (IZAS, 1 ex.); Jinping, Mengla, 400 m, 1956.IV.27, HUANG Keren et. al., IOZ(E)1126285; IOZ(E)1126286 (IZAS, 2 ex.); Jinping, Mengla, 370 m, 1956.IV.22, HUANG Keren et. al., IOZ(E)1126288 (IZAS, 1 ex.); Cheli, Shihuiyao, 750 m, 1957.IV.27, D. Panfilov, IOZ(E)1126296 (IZAS, 1 ex.); Damenglong, 640 m, 1957.IV.28, WANG Shuyong, IOZ(E)1126304 (IZAS, 1 ex.); Xishuangbanna, Xiaomengyang, 850 m, 1957.VI.25, ZANG Lingchao, IOZ(E)1126307 (IZAS, 1 ex.); same data but 1957.III.28, ZANG Lingchao, IOZ(E)1126294 (IZAS, 1 ex.); same data but 1958.IX.7, ZHANG Yiran, IOZ(E)1126308 (IZAS, 1 ex.); same data but 1957.IV.2, WANG Shuyong, IOZ(E)1126290 (IZAS, 1 ex.); same data but 1000 m, 1957.V.6, ZANG Lingchao, IOZ(E)1126298 (IZAS, 1 ex.); Xishuangbanna, Meng'a, 1050–1080 m, 1958.V.16, IOZ(E)1126323 (IZAS, 1 ex.); same data but 1958.V.25, PU Fuji, IOZ(E)1126314 (IZAS, 1 ex.); same data but 1958.V.12, IOZ(E)1126324 (IZAS, 1 ex.); same data but 1050 m, 1958.V.20 IOZ(E)1126313 (IZAS, 1 ex.); Xishuangbanna, Mengzhe, 870 m, 1958.VII.7, PU Fuji, IOZ(E)1126315 (IZAS, 1 ex.); Xishuangbanna, Mengzhe, 870 m, 1958.IX.3, WANG Shuyong, IOZ(E)1126316 (IZAS, 1 ex.); Xishuangbanna, Mengla, 620–650 m, 1959.V.13, ZHANG Fa-cai, IOZ(E)1126317 (IZAS, 1 ex.); same data but 1959.V.2, ZHANG Yiran, IOZ(E)1126318 (IZAS, 1 ex.); same data but 1959.VI.6, PU Fuji, IOZ(E)1126320 (IZAS, 1 ex.); same data but 1959.VI.6, ZHANG Yiran, IOZ(E)1126321 (IZAS, 1 ex.); same data but 1959.V.3, ZHANG Yiran, IOZ(E)1126322 (IZAS, 1 ex.); Hekou, Nanxi, Huayudong, 150 m, 2010.IV.27, ZHU Xiaoyu leg., under surface of leaves of *Ficus* (CCCC, 4 ex.); Honghe, Hekou, Nanxi, 150 m, 2009.V.21, LI Hu leg. (CAU, 1♀); **Vietnam:** “Museum Paris; Tonkin sept., Montagnes du Haut Song-Chai, Rabier 1895 / Museum Paris; Mes du Ht Song-Chai; Rabier 258-95 / *Callimerus latesignatus* Gorh., Schenkling vid. 1901” (MNHN, 1♂); “Museum Paris; Tonkin; Langue 1887 / *Callimerus latesignatus* Gorh., Schenkling vid 1901 / Compare au British Museum; P. Lesne 1907 / *Callimerus latesignatus* Gorh., P. Lesne vid.” (MNHN, 1♂); Tonkin occ., Env. de Hoa-Binh, R.P.A. de Cooman 1919 (MNHN, 4 ex.); Tonkin, P. Lemée, 1903–

1906 (MNHN, 3 ex.); **Laos**: Louang-Prabang, A Theng; A. Pavie 1888 (MNHN, 1 ex.); Laos (MNHN, 1 ex.); “Laos-NE, Xieng Khouang prov., 19°37–8'N 103°20–1'E, 30km NE Phonsavan: Ban Na Lam→Phou Sane Mt., 1300–1700 m, 10.-30.v.2009, M. Geiser leg. / NHMB Basel, NMPC Prague, Laos 2009 Expedition: M. Brancucci, M. Geiser, Z. Kraus, D. Hauck, V. Kuban” (NHMB, 1 ex.); “Laos-NE, Xieng Khouang prov., ~19°37–8'N 103°20'E, Phonsavan (30 km NE): Phou Sane Mt., ~1400–1500 m, 10.-30.v.2009, Z. Kraus leg. / NHMB Basel, NMPC Prague, Laos 2009 Expedition: M. Brancucci, M. Geiser, Z. Kraus, D. Hauck, V. Kuban” (NHMB, 1 ex.); **Thailand**: Siam, Lot 319, 3300 feet, 21 Jun 1936 (MNHN, 1 ex.); “Doi Suthep, 1100 m, Chiang Mai, N. Thailand, 15-IV-1983, T. Shimomura leg.” (MNHN, 1 ex.); “Mt. Doi Pui, 1400–1500 m, Chiang Mai, N. Thailand, 28-IV-1983, T. Shimomura leg.” (MNHN, 1 ex.); **India**: “Village 9th mile, nt. Rani Pul, 24.4 / Sikkim 77, Bhakta B.” (NHMB, 2 ex.); Khasia Hills, VI. 96 (MNHN, 1 ex.); “Mali 900 m, 28.4.1981 / Sikkim, Bhakta B.” (NHMB, 1 ex.); “Tista, 18.IV.1987 / Indien, Darjeeling D., Bhakta B.” (NHMB, 1 ex.); “Pudung, 24–25.V.87 / Indien, Darjeeling D., Bhakta B.” (NHMB, 1 ex.); “Pudung, 18.IV.1990 / Indien, Darjeeling D., Ch. J. Rai” (NHMB, 1 ex.); “Alghera, 2900 m, 25.IV.1982 / Darjeeling D., Ch. J. Rai” (NHMB, 1 ex.); “Umg. Kalimpong, Darjeeling Distr., 4.4.77” (NHMB, 1 ex.); “Kalimpong, Umg. Bhakta Bahadur, 10.5.77” (NHMB, 3 ex.); “Kalimpong 850 m, Nashay, 16.IV.1984 / Indien, Darjeeling D., Ch. J. Rai” (NHMB, 1 ex.); “Pudung, 24–25.V.87 / Indien, Darjeeling D., Bhakta B.” (NHMB, 1 ex.); **Bhutan**: British Bootang, L. Durel, 1899 (MNHN, 2 ex.); British Bootang, Maria Basti, 1900 (MNHN, 1 ex.); British Bootang, Maria Basti, 1899 (MNHN, 1 ex.); British Bootang, Padong, L. Durel 1913 (MNHN, 1 ex.); Pedong, A. Desgodins (MNHN, 2 ex.).

Distribution (Fig. 72). China (Guangxi, Yunnan), Vietnam, Laos, Thailand, Myanmar, India, Bhutan.

Callimerus pectoralis Schenkling, 1899b

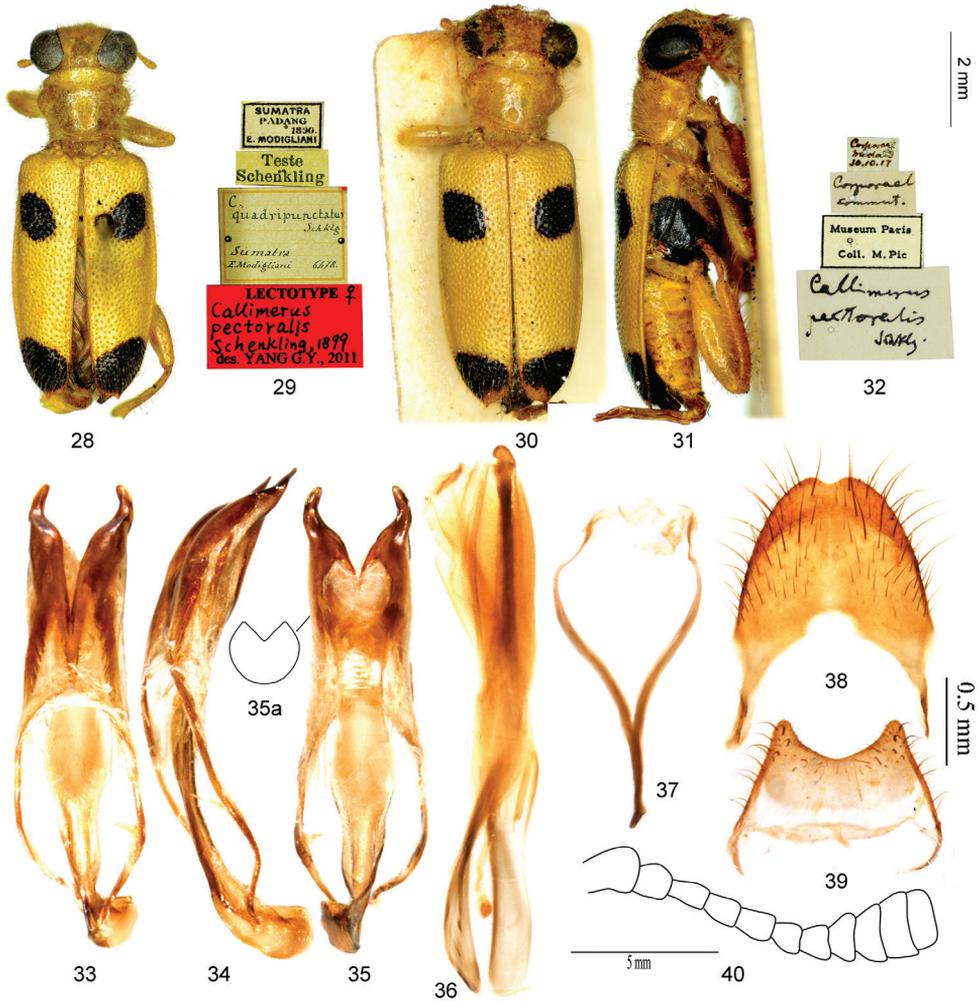
http://species-id.net/wiki/Callimerus_pectoralis

Figs 28–40, 72

pectoralis Schenkling, 1899b: 335 (*Callimerus*; type locality: “Sumatra (Padang)”).

Type material examined. **Lectotype** of *Callimerus pectoralis* Schenkling designated here: “Sumatra / Padang, 1890, E. Modigliani / Teste Schenkling / *C. quadripunctatus* Schklg, Sumatra, E. Modigliani, 6478 [hw. by Raffaello Gestro] / Lectotype ♀: *Callimerus pectoralis* Schenkling, 1899, des. Yang G. Y, 2011” (MCSN, ♀; Figs 28–29).

Note on Type material. The lectotype is one of the specimens sent to S. Schenkling for study from MCSN, with a label “quadripunctatus Schklg” handwritten by R. Gestro, the former curator of MCSN. The name “quadripunctatus Schklg” has never been published, however, the locality and morphological characters of this specimen perfectly accord with the original publication of *C. pectoralis*. On the other hand, a



Figures 28–40. *Callimerus pectoralis* Schenkling, 1899. **28–29** lectotype of *C. pectoralis* Schenkling, 1899 (**28** dorsal view **29** labels) **30–32** a specimen determined by Schenkling as *C. pectoralis* (**30** dorsal view **31** lateral view **32** labels) **33–39** male terminalia, specimen from Sumatra **33–35** tegmen (**33** dorsal view **34** lateral view **35** ventral view **35a** outline of ventral membranous region) **36** phallus **37** spicular fork **38** tergite VIII **39** sternite VIII **40** antennae, specimen from Yunnan.

specimen found in Coll. M. Pic from MNHN (locality Medan, Sumatra) determined as *C. pectoralis* by Schenkling himself is conspecific with the specimen labeled “quadripunctatus Schklg” (Figs 30–32). In this case, it is assumed that “quadripunctatus” was the first name that came to Schenkling’s mind and written down in the identification list that sent to MCSN, but later Schenkling changed his mind and published the species with another name “pectoralis”. Regardless of the details, the specimen found in MCSN undoubtedly belongs to the type series and we therefore designated it as the lectotype of *Callimerus pectoralis* Schenkling here for the taxonomic purpose of fixing

the name to a single specimen and preventing further uncertainty regarding the taxon to which the name is applied.

Diagnosis. This species is most similar to *C. rusticus* and *C. latesignatus*. However, it differs from *C. rusticus* by: (1) mesepisternum yellow (black in *C. rusticus*); (2) posterior spot on elytron located vertical-apically, rounded rectangle, length to width ratio about 1.5:1 (Fig. 28) (*C. rusticus* with posterior spot on elytron located lateral-apically, bar-shaped, length to width ratio about 4:1; Fig. 41); (3) anterior spot on elytron of *C. pectoralis* larger than that of *C. rusticus*, in *C. pectoralis* short diameter of anterior spot on elytron in most cases larger than distance between that spot and elytral suture (Fig. 28, 30) (*C. rusticus* short diameter of anterior spot on elytron in most cases not larger than distance between that spot and elytral suture; Fig. 41, 44); (4) outer margin of ventral membranous region of tegmen strongly curved, TML/TMW about 0.9, TMaL/TML about 0.3 (Figs 35, 35a) (*C. rusticus* with outer margin of ventral membranous region of tegmen slightly curved, TML/TMW about 1.3, TMaL/TML about 0.2; Figs 48, 48a); (5) tergite VIII with posterior margin rounded, slightly notched in middle (Fig. 38) (*C. rusticus* with tergite VIII with posterior margin almost straight; Fig. 51).

The difference between this species and *C. latesignatus* is provided in the diagnosis section under *C. latesignatus*.

Description. *Size:* length 7.5–8.8 mm, width 2.8–3.3 mm. *Color:* Head yellow, mandibles black; pronotum yellow. Elytron yellow with two spots, anterior spot at basal one fourth, posterior spot at vertical-apex; anterior spot rounded rectangle, neither reaching outer margin nor suture, short diameter of anterior spot on elytron in most cases greater than distance between that spot and elytral suture (Fig. 28, 30); posterior spot rounded rectangle, length to width ratio about 1.5:1 (Fig. 28, 30). Legs yellow with metacoxae mostly black. Prosternum, mesepisternum, mesepimeron and mesosternum yellow; metepisternum, metasternum and katepisternum black; abdominal ventrites yellow. *Head:* AL/AD about 1.0; EyD/EyW about 1.0. *Prothorax:* PL/PW about 0.8. *Elytra:* EL/EW about 1.7. *Male terminalia:* apices of parameres convergent (Figs 33–35); TML/TMW about 0.9; TMaL/TML about 0.3, outer margin of ventral membranous region strongly curved (Figs 35, 35a); SApL/SFL about 0.3 (Fig. 37); tergite VIII with posterior margin rounded, slightly notched in middle (Fig. 38); sternite VIII with posterior margin roundly concave (Fig. 39).

Other material examined. **China: Yunnan:** Xishuangbanna, Damenglong, 650 m, 1958.IX.17, PU Fuji leg., IOZ (E) 1126329 (IZAS, 1♂); **Malaysia:** Perak, Doherty (MNHN, 1 ex.; NHML, 5 ex.); Malacca, Perak, W. Doherty (MNHN, 1 ex.); Perak, Malacca (Doherty) (MNHN, 1 ex.); “Penang / Bowring 63.47* / Callimerus pectoralis Scklg, S. Schenkling det.” (NHML, 2); “Penang / Ex. A. R. Wallace, Private collection, Purchased 1860–70, Ox. Uni. Mus. of Nat. Hist. (OUMNH)” (OUM, 4 ex.); Kuching, Sarawak, G.E. Bryant, 28.XI.13 (NHML, 1 ex.); **Indonesia:** J.B. Corporaal; Sumatra’s O. K., Medan, 1.11.20, 20 M (MNHN, 1♂)*; same data but 20.2.18 (MNHN, 1 ex.); same data but 8.2.21 (MNHN, 1 ex.); same data but 9.8.1921 (MNHN, 3 ex.); same data but 11.8.1921 (MNHN, 1); same data but 18.8.1921 (MNHN, 1 ex.); same data but 10.9.1921 (MNHN, 1 ex.); “Corporaal, Medan, 30.10.17 / Corporaal

comment / Museum Paris, Coll. M. Pic / *Callimerus pectoralis* Schklg [hw. by Schenkling]” (MNHN, 1♂); Sumatra, Padang Sidempoean, XII.1902-I.1903 (MNHN, 2 ex.); “Dolok Merangir, 18.VII-9.X.1980 / Sumatra, Dr. E. Diehl” (NHMB, 2 ex.); “42618 / Borneo, Labuan / Fry Coll. 1905. 100 / *C. rusticus* G. [hw. by Gorham] / *Callimerus rusticus* Gorham, det. Borneo, Perak [hw. by Fry]” (NHML, 1 ex.); Sud Borneo, Goenong Pandjang, Tanggarang, M. E. Walsh, VI.1937 (MNHN, 1 ex.).

Distribution (Fig. 72). China (Yunnan), Malaysia, Indonesia (Sumatra, Borneo).

Callimerus rusticus Gorham, 1883

http://species-id.net/wiki/Callimerus_rusticus

Figs 41–53, 72

rusticus Gorham, 1883: 252 (*Callimerus*; localities: “Celebes”, “Sangir”).

bipunctatus Kuwert, 1893: 485 (*Lemidia*; type locality: “Celebes”); –Schenkling, 1898: 169 (synonymized with *rusticus* Gorham).

Type material examined. **Lectotype** of *Callimerus rusticus* Gorham designated here: “Celebes / *Callimerus rusticus*, Gorh. / Gorham Type / Museum Paris, Coll. H. S. Gorham, 1911/ Lectotype ♂: *Callimerus rusticus* Gorham, 1883, des. Yang G. Y., 2011” (MNHN, ♂; Figs 41–43); **Paralectotype** of *Callimerus rusticus*: “Rosenb., Sangir / *Callimerus rusticus* Gorham / Type ♀ / Type / *rusticus* Gorh. n. sp.” (RMNH, 1♀); **Holotype** of *Lemidia bipunctatus* Kuwert: “S. Celebes, Aug.-Sept. ‘91, W. Doherty / Ex-Musaeo, W. Rothschild, 1899 / Museum Paris, 1952, Coll. R. Oberthür / *Lemidia bipunctata* Kuw. Type / Holotype: *Lemidia bipunctata* Kuwert, 1893, ♂, det. Yang G. Y., 2011” (MNHN, ♂; Figs 44–45).

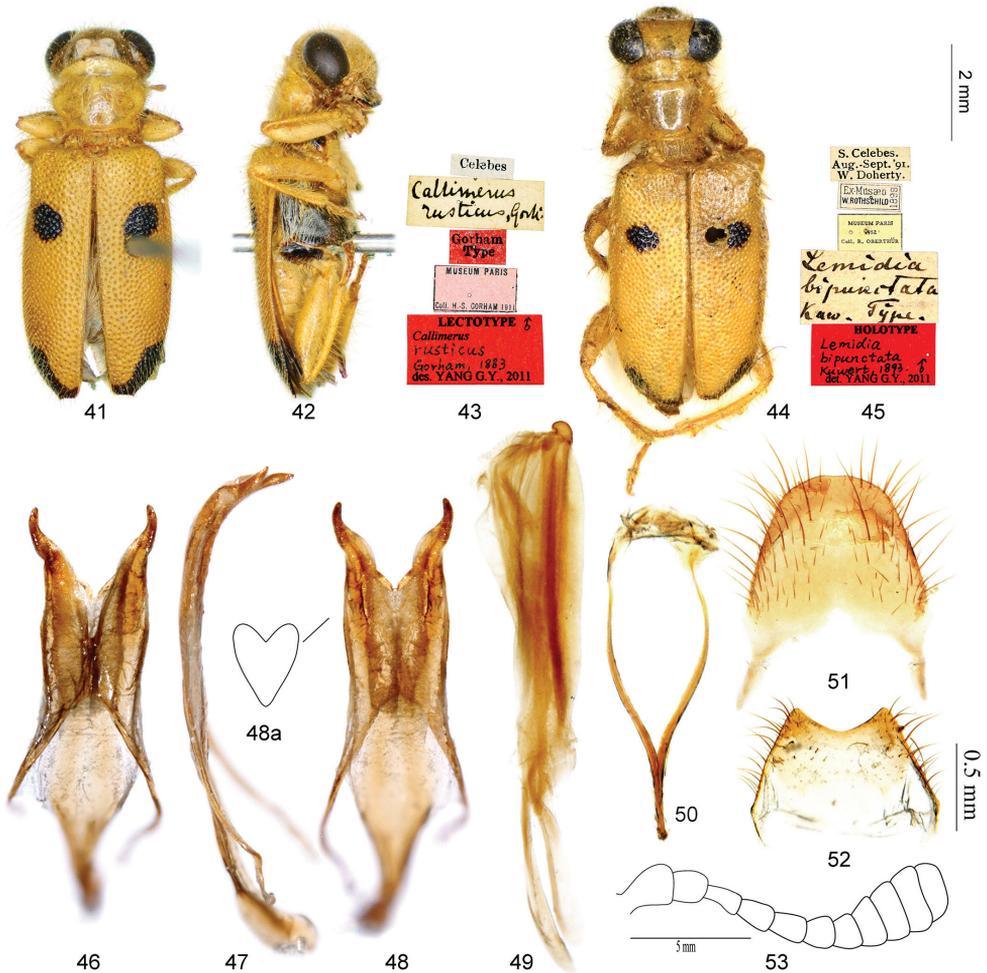
Note on Type material. The original description of *Callimerus rusticus* Gorham mentioned two specimens, but the name-bearing type was not fixed. We found both syntypes in MNHN and RMNH respectively, and designate the male from Coll. Gorham in MNHN as lectotype here to express the taxonomic purpose of fixing the name to a single specimen and preventing further uncertainty regarding the taxon to which the name is applied.

The original publication of *Lemidia bipunctatus* Kuwert noted that only one specimen was examined, so the holotype was originally fixed by monotypy.

Diagnosis. This species can be rapidly distinguished from other species of the *latifrons* species-group by posterior spot on elytron being located lateral-apically, bar-shaped, with a length to width ratio of about 4:1 (Fig. 41).

This species is most similar to *C. pectoralis*; the difference between them is provided in the diagnosis section under *C. pectoralis*.

Description. *Size:* length 7.5–9.5 mm, width 2.4–3.0 mm. *Color:* Head yellow, mandibles black; pronotum yellow. Elytron yellow with two spots, anterior spot at basal fourth, posterior spot at lateral-apex; anterior spot round and small, clearly neither reaching outer margin nor suture, short diameter of anterior spot on elytron in most cases not greater



Figures 41–53. *Callimerus rusticus* Gorham, 1883. **41–43** Lectotype of *C. rusticus* Gorham, 1883 (**41** dorsal view **42** lateral view **43** labels) **44–45** Holotype of *Lemidia bipunctatus* Kuwert, 1893 (**44** dorsal view **45** labels) **46–52** male terminalia, specimen from Celebes **46–48** tegmen (**46** dorsal view **47** lateral view **48** ventral view **48a** outline of ventral membranous region) **49** phallus **50** spicular fork **51** tergite VIII **52** sternite VIII **53** antennae, specimen from Celebes.

than distance between that spot and elytral suture (Fig. 41, 44); posterior spot bar-shaped, length to width ratio about 4:1 (Fig. 41). Legs yellow with metacoxae mostly black. Prosternum yellow; mesepisternum black, mesepimeron and mesosternum yellow; metepisternum, metasternum and katapisternum black; abdominal ventrites yellow. *Head*: AL/AD about 1.0; EyD/EyW about 1.0. *Prothorax*: PL/PW about 0.8. *Elytra*: EL/EW about 1.8. *Male terminalia*: apices of parameres convergent (Figs 46–48); TML/TMW about 1.3; TMaL/TML about 0.22, outer margin of ventral membranous region slightly curved (Figs 48, 48a); SApL/SFL about 0.3 (Fig. 50); tergite VIII with posterior margin almost straight, sternite VIII with posterior margin shallowly concave (Figs 51, 52).

Other material examined. Ost-Celebes, Tombugu, H. Kühn 1885 (MNHN, 1♂)*; Ost-Celebes, Tombugu, H. Kühn 1885 (MNHN, 1 ex.); W. Celebes, G. Rangkoenau, J.P. Ch. Kalis, 900' 1937 (MNHN, 1 ex.); Celebes, Menado (MNHN, 1♀); "Celebes, G. Heinrich, B. M. 1933-117 / Celebes, Latimodjonggeb. Uru, 800 m, Aug / Sept. 1930, G. Heinrich / *Brachycallimerus pectoralis* (Schenkling), det. G. Ekis, 1985" (NHML, 1 ex.); "Drs. Sarasin, S. Celebes, Makassar / *Callimerus rusticus* Gorh., Determ K. M. Heller" (NHMB, 8 ex.); "Men [Sulawesi, Manado] / Ex. A. R. Wallace, Private collection, Purchased 1860–70, Ox. Uni. Mus. of Nat. Hist. (OUM-NH)" (OUM, 1 ex.).

Distribution (Fig. 72). Indonesia (Sulawesi).

***Callimerus cacuminis* G.Y. Yang & X.K. Yang, sp. n.**

urn:lsid:zoobank.org:act:4F0856EE-E6E2-473C-86D7-05B84D1143F4

http://species-id.net/wiki/Callimerus_cacuminis

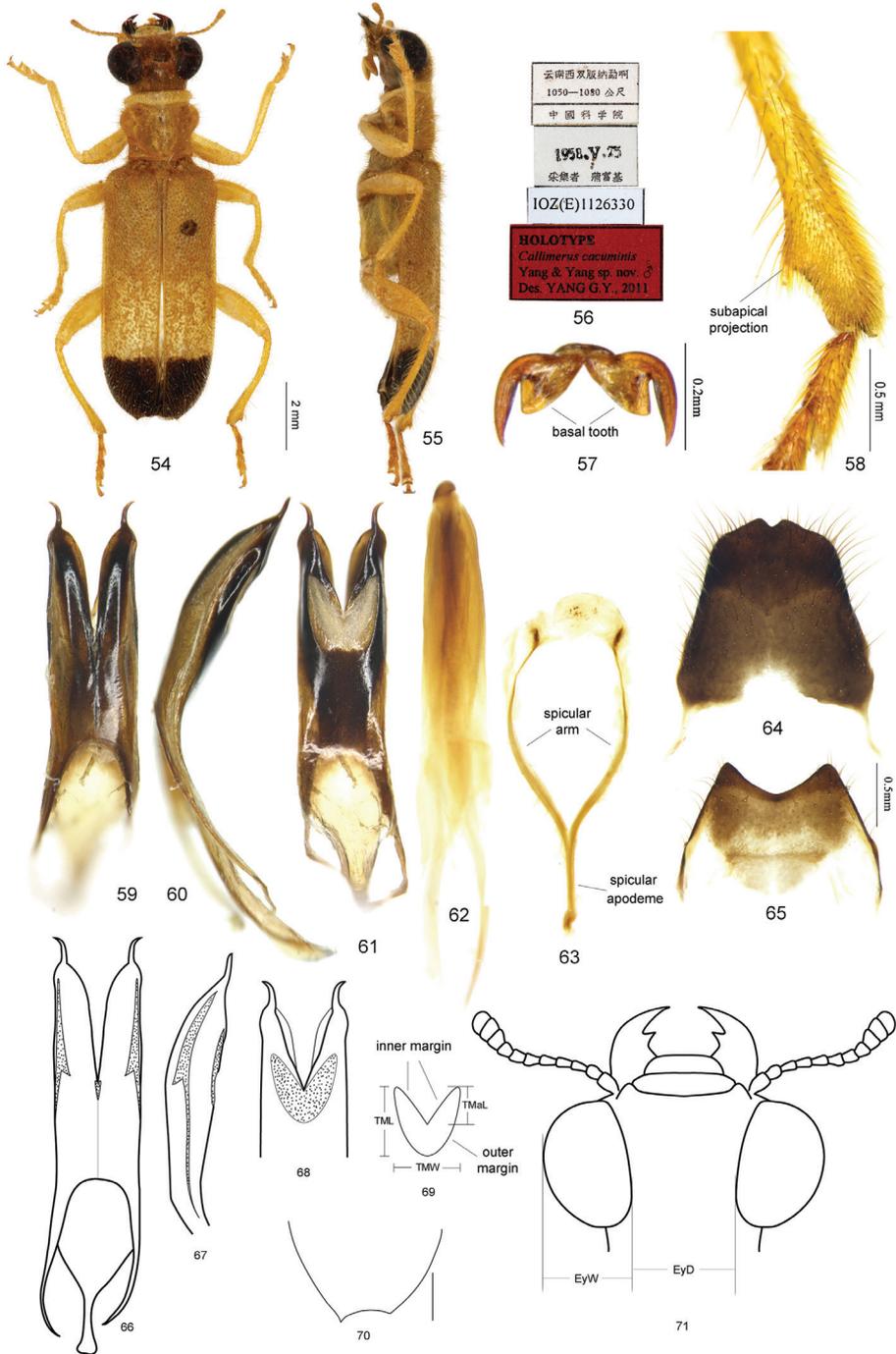
Figs 54–72

Holotype. China: "云南西双版纳勐啊, 1050–1080公尺; 中国科学院 [Yunnan, Xishuang-banna, Meng'a, 1050–1080 m] / 1958.V.25, 采集者: 蒲富基 [PU Fuji leg.] / IOZ(E)1126330 / Holotype: *Callimerus cacuminis* Yang & Yang sp. nov. ♂, Des. Yang G. Y., 2011" (IZAS, ♂; Figs 54–56)*; **Paratypes** (6 ex). **China:** same data as holotype, but 1958.VIII.17, IOZ(E)1126331 (IZAS, 1♀); same data but 1958.V.23, ZHANG Yiran leg., IOZ(E)1126332 (IZAS, 1♂); Yunnan, Xishuangbanna, Mengla, 620–650 m, 1959.V.30, ZHANG Yiran leg., IOZ(E)1126996 (IZAS, 1♂); Yunnan, Menglongbanna, Mengsong, 1600 m, 1958.VIII.8, WANG Shuyong leg., IOZ(E)1126333 (IZAS, 1♀); **Laos:** "Laos-NE, Xieng Khouang prov., 19°37–8'N 103°20–1'E, 30km NE Phonsavan: Ban Na Lam→Phou Sane Mt., 1300–1500 m, 10.-30.v.2009, M. Brancucci leg./NHMB Basel, NMPC Prague, Laos 2009 Expedition: M. Brancucci, M. Geiser, Z. Kraus, D. Hauck, V. Kuban" (NHMB, 1♀); "Laos-NE, Xieng Khouang prov., ~19°37–8'N 103°20'E, Phonsavan (30 km NE): Phou Sane Mt., ~1400–1500 m, 10.-30.v.2009, Z. Kraus leg./NHMB Basel, NMPC Prague, Laos 2009 Expedition: M. Brancucci, M. Geiser, Z. Kraus, D. Hauck, V. Kuban" (NHMB, 1♀).

Diagnosis. The new species can be rapidly distinguished from other species of the *latifrons* species-group by: elytron with only one black spot at apex, lacking anterior spot; metasternum and metepisternum yellow; apices of parameres sharply attenuate, then divergent.

The coloration of this new species is similar to that of *Callimerus pallidus* Gorham and *Callimerus gorhami* Corporaal, which are excluded from the *latifrons* species-group in the present paper. The new species, however, differs from *C. pallidus* by EL/EW 2.27–2.34, PL/PW about 0.9, EyD/EyW about 1.1 (Fig. 54) (EL/EW about 3.1, PL/PW about 1.2, EyD/EyW about 1.9 in *C. pallidus*; Fig. 79).

The new species differs from *C. gorhami* by: PL/PW about 0.9, EyD/EyW about 1.1, elytra parallel-sided, without scales, apical black spot on elytron with anterior bor-



Figures 54–71. Holotype of *Callimerus cacuminis* YANG & YANG. **54–55** habitus (**54** dorsal view **55** ventral view) **56** labels **57** claw **58** subapical metatibia **59–61** tegmen (**59** dorsal view **60** lateral view **61** ventral view) **62** phallus **63** spicular fork **64** tergite VIII **65** sternite VIII **66–69** tegmen (**66** dorsal view **67** lateral view **68** ventral view **69** outline of ventral membranous region) **70** elytron apex **71** head.

der straight (Fig. 54) (*C. gorhami* with PL/PW about 1.1, EyD/EyW about 2.4, elytra slightly rounded at posterior sides, elytra apex with white scales, apical black spot with anterior border sinuate (Figs 81, 82)).

Description. *Size:* length 9.9–11.7 mm, width 2.9–3.7 mm. *Color:* Head yellow, mandibles black; pronotum yellow; elytron yellow with a black spot at apex; legs yellow; under surface totally yellow except for last two ventrites of male abdomen and part of last ventrite of female abdomen darker. *Head:* AL/AD about 1.2 (Fig. 71); EyD/EyW about 1.1 (Fig. 71). *Prothorax:* PL/PW about 0.9. *Elytra:* EL/EW about 2.27–2.34. *Male terminalia:* apices of parameres sharply attenuate, slender and divergent (Figs 59–61, 66–68); TML/TMW about 1.1, TMaL/TML about 0.54, outer margin of ventral membranous region of tegmen curved (Figs 61, 68, 69); tegmen with an additional tiny membranous region at dorsal-central side (Fig. 66); SApL/SFL about 0.31 (Fig. 63); tergite VIII with posterior margin pointed, notched in middle (Fig. 64), sternite VIII with posterior margin deeply concave (Fig 65).

Variation. In the holotype and a paratype (No. IOZ(E)1126332), the black spot on elytron reach to the extreme apex; in the other paratypes, the black spot does not reach to the extreme apex so that a tiny region in extreme apex is yellow.

Distribution (Fig. 72). China (Yunnan), Laos.

Etymology. The Latin adjective “*cacuminis*” means of a peak, top or tip, and emphasizes the singular black spot on elytra apex.

Species excluded from the *latifrons* species-group:

Corynommadius trifasciatus (Schenkling, 1899a), comb. n.

http://species-id.net/wiki/Corynommadius_trifasciatus

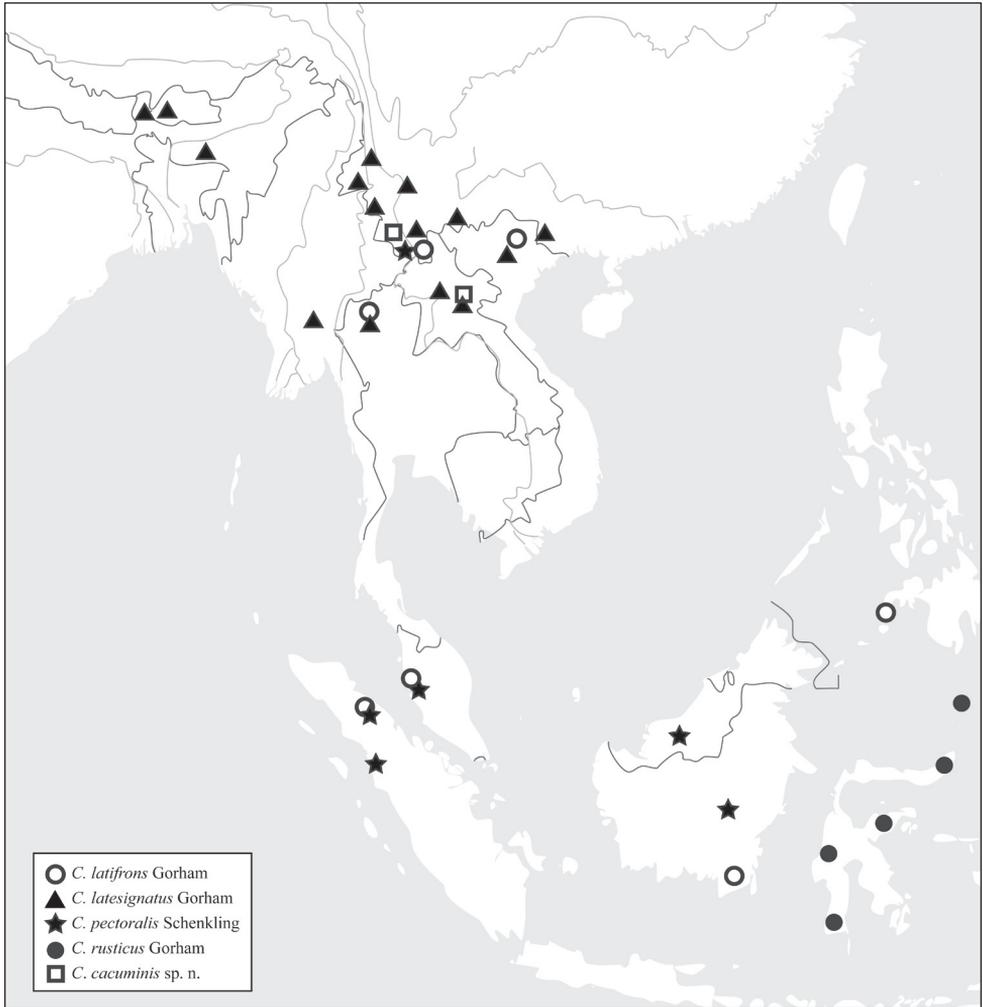
Figs 73–75

trifasciatus Schenkling, 1899a: 136 (*Callimerus*; type locality: “Neu Guinea (Fly River)”; –Chapin, 1924: 190 (“*Brachycallimerus?*”); –Corporaal, 1937: 60 (*Brachycallimerus*).

Type material examined. Lectotype of *Callimerus trifasciatus* Schenkling designated here: “Nuova Guinea, Fly River, L. M. D. Albertis, 1876–77 / Typus / trifasciatus Schenkling. / *C. trifasciatus* Schklg, Typus! N. Guinea: Fly riv., L.M.D’Albertis, 6462 [hw. by Raffaello Gestro]” (MCSN, ♀; Figs 73–75).

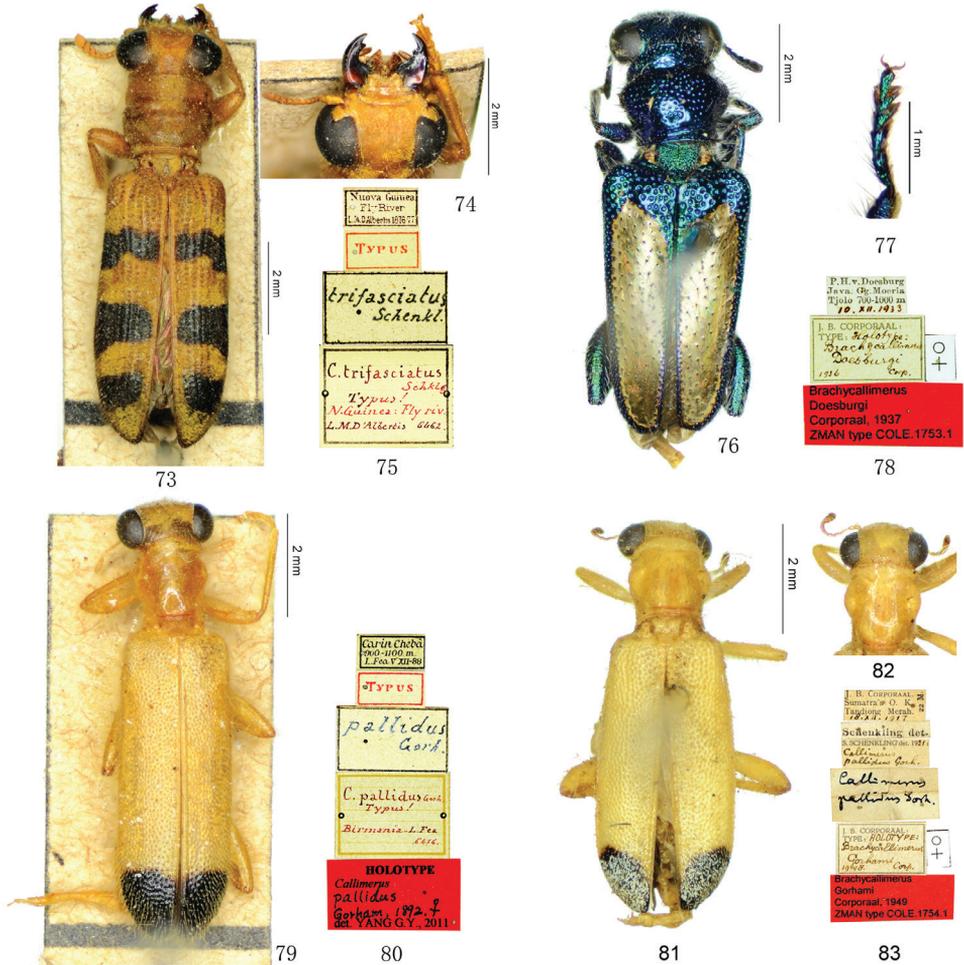
Note on Type material. The name-bearing type of *trifasciatus* was not fixed in the original publication. We designate the only specimen found in MCSN as lectotype to express the taxonomic purpose of fixing the name to a single specimen and preventing further uncertainty regarding the taxon to which the name is applied [The red lectotype label will be sent to MCSN after this paper published].

Taxonomic position. This species is excluded from the genus *Callimerus* for its following characters: labrum deeply incised; eyes deeply emarginated near the antennal insertions; elytral punctures in rows; elytra clothed with unspecialized de-



Figures 72. Distribution map of *Callimerus, latifrons* species-group.

scent setae (not scales); the first tarsomeres very small and invisible from dorsal view; metatibia with 2 spurs in apex; metatarsi having pulvillus on tarsomere IV (in *Callimerus* labrum with apex straight or very slightly emarginated in the middle; eyes very slightly emarginated at antennal insertions; elytral punctures not in rows; elytra with scales or glabrous; the first tarsomeres of normal size, not shorter than the second tarsomeres; metatibia with 1 spur in apex; metatarsi having pulvilli on tarsomere I–IV). Furthermore, we consider it should be assigned in the genus *Corynommadius* Schenkling, 1899a. Its closest relative is *Corynommadius speciosus* Schenkling, 1899a, the type species of *Corynommadius* Schenkling; the difference of these two species only shows in variation of anterior black spot on elytron (Fig. 73; Gerstmeier 2002: 425, 432, fig. 2).



Figures 73–83. 73–75 Lectotype of *Callimerus trifasciatus* Schenckling, 1899 (73 habitus 74 head 75 labels) 76–78 *Brachycallimerus doesburgi* Corporaal, 1937 (76 habitus of holotype 77 hind leg of paratype 78 labels of holotype) 79–80 Holotype of *Callimerus pallidus* Gorham, 1892 (79 habitus 80 label) 81–83 Holotype of *Callimerus gorbami* Corporaal, 1949 (81 habitus 82 head 83 labels).

***Callimerus doesburgi* (Corporaal, 1937)**

http://species-id.net/wiki/Callimerus_doesburgi

Figs 76–78

doesburgi Corporaal, 1937: 60 (*Brachycallimerus*; type locality: “Java”); –Kolibáč, 1998: 182 (*Callimerus coomani*-group).

Type material examined. Holotype of *Brachycallimerus doesburgi* Corporaal: “P. H. v. Doesburg, Java, Gg. Moeria, Tjolo, 700–1000, 10.XII.1933 / J. B. Corporaal: Holotype: *Brachycallimerus doesburgi* Corp., 1936 [hw. by Corporaal] / *Brachycallimerus*

doesburgi Corporaal, 1937, ZMAN type COLE. 1753. 1” (ZMAN, ♀; Figs 76–78); **Paratype** of *Callimerus doesburgi*: “Java merid, 1500, 1891, H. Fruhstorfer / J. B. Corporaal, Allotype: Brachycallimerus doesburgi Corp., 1936 [hw. by Corporaal] / Museum Paris, 1952, Coll. R. Oberthür / Type / Paratype: Brachycallimerus doesburgi Corporaal, 1937; det. Yang G. Y., 2011” (MNHN, 1♀).

Note on Type material. The sex of the paratype was mistaken in the original publication.

Taxonomic position. This species was included in Kolibáč’s (1998) “*coomani*-group” for its claws without a basal tooth; moreover, its metatibia without subapical projection on outer edge and body with metallic luster, are evidence in support of Kolibáč’s assignment.

***Callimerus pallidus* Gorham, 1892 [*Callimerus incertae sedis*]**

http://species-id.net/wiki/Callimerus_pallidus

Figs 79–80

pallidus Gorham, 1892: 727 (*Callimerus*; type locality: “Carin Hills (Chebà)"); –Corporaal, 1937: 60 (*Brachycallimerus*).

Type material examined. Holotype of *Callimerus pallidus* Gorham: “Carin Chebà, 900–1000 m, L. Fea V XII-88 / Typus / *pallidus* Gorh. [hw. by Gorham] / *C. pallidus* Gorh. Typus! Birmania, L. Fea, 6476 [hw. by Raffaello Gestro] / Holotype: *Callimerus pallidus* Gorham, 1892, ♀, det. Yang G. Y., 2011” (MCSN, ♀; Figs 79–80).

Note on Type material. The original publication of *C. pallidus* noted that only one specimen was examined, so the holotype was fixed in the original publication by monotypy.

Taxonomic position. Although this species has a basal tooth on claw, and we didn’t examine its character of metatibia subapical projection (the only examined specimen is glued on board with metatibia not viewable), we are still confident to exclude it from the *latifrons* species-group for the following character states: PL/PW >1 (ratio 1.2), EyD evidently larger than EyW (ratio 1.9). Its nearest relative within the large genus *Callimerus* is still unclear.

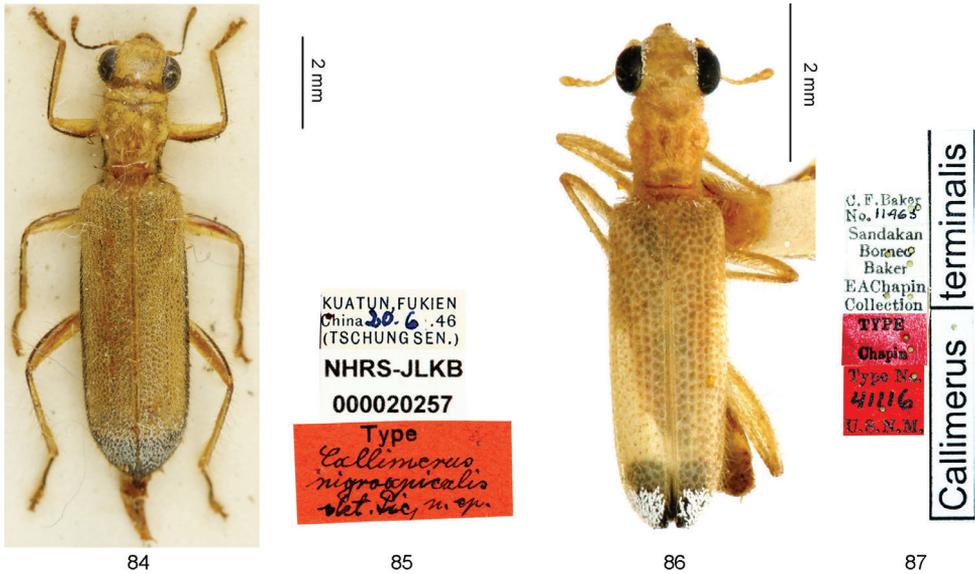
***Callimerus gorhami* Corporaal, 1949 [*Callimerus incertae sedis*]**

http://species-id.net/wiki/Callimerus_gorhami

Figs 81–83

gorhami Corporaal, 1949: 326 (*Callimerus*; type locality: “Tandjong Merah, Sumatra’s East Coast”); –Corporaal, 1950: 90 (*Brachycallimerus*).

Type material examined. Holotype of *Callimerus gorhami* Corporaal: “J. B. Corporaal, Sumatra’s O. K., Tandiong Merah, 18.XII.1917, 22m / Schenkling det. / S. Schenkling



Figures 84–87. 84–85 Holotype of *Callimerus nigroapicalis* Pic, 1955 deposited in NHRS, photographed by J. Bergsten (84 habitus 85 labels) 86–87 Holotype of *Callimerus terminalis* Chapin, 1919 deposited in USNM (86 habitus 87 labels).

det. 1921: *Callimerus pallidus* Gorh. / *Callimerus pallidus* Gorh. [hw. by Schenkling] / J. B. Corporaal: Holotype: *Brachycallimerus gorhami* Corp., 1948 / ♀ / *Brachycallimerus gorhami* Corporaal, 1949, ZMAN type COLE. 1754.1” (ZMAN, ♀; Figs 81–83).

Note on Type material. The original publication of *C. gorhami* noted that only one specimen was examined, so the holotype was fixed in the original publication by monotypy.

Taxonomic position. This species has a basal tooth on claw and metatibia with subapical projection on outer edge. Although it accords with the *latifrons* species-group in these two important characters, our exclusion of it from this species-group is based on the following characters: PL/PW >1 (ratio 1.1); EyD evidently larger than EyW (ratio 2.4); elytra apex with scales. Its nearest relative is still unclear.

Discussion

Within these five species of the *latifrons* species-group, *C. latesignatus*, *C. pectoralis* and *C. rusticus* seem to be most closely related. This assumption is supported by the apices of paramere convergent and EL/EW less than 2 (ratio 1.7–1.8); moreover, they have similar arrangement of elytral spots, with only different degrees of spots size and black pigmentation on ventral side. Furthermore, *C. pectoralis* and *C. rusticus* could be closest to each other, because of their similarly shaped parameres and male sternite VIII. The distribution of *C. pectoralis* and *C. rusticus* shows a substitute pattern (Fig. 72), whereas *C. latesignatus* is distributed to their northern border, and sympatric with *C. pectoralis* in Yunnan, China.

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On the identity of *Liolaemus nigromaculatus* Wiegmann, 1834 (Iguania, Liolaemidae) and correction of its type locality

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Abstract

In the current study, we review the taxonomic status of *Liolaemus nigromaculatus*. Despite being the nominal species of the *nigromaculatus* group and being the second species of the genus *Liolaemus* that was described, this species is of uncertain type locality and its true identification is a matter of discussion. After carefully analyzing several digital pictures of the holotype (juvenile male), reviewing all of the literature concerning the issue, examining specimens of nearly all recognized species of the *nigromaculatus* group, and determining the locations visited by the specimen collector, we are able to point out the following: 1) *L. nigromaculatus* was collected between Puerto Viejo and Copiapó of the Atacama region in Chile, and not in Huasco 2) *L. bisignatus* is a *nomen nudum*, and populations attributed to *L. bisignatus* should be referred to as *L. nigromaculatus*. 3) There is agreement that *L. copiapensis* is indistinguishable from populations currently referred to as *L. bisignatus* (= *L. nigromaculatus*), 4) Populations found in Huasco (currently considered the type locality of *L. nigromaculatus*) are very similar to those found in Caldera (currently considered *L. bisignatus*) and should be designated as *L. nigromaculatus*, and 5) *L. oxycephalus* and *L. inconspicuus* are not synonymous with *L. nigromaculatus*, although their true identities are difficult to determine. We also detail several characteristic based on the holotype of *L. nigromaculatus*, in addition to drawing diagnostic comparisons between this species and others belonging to the *nigromaculatus* group.

Keywords

Liolaemus, *nigromaculatus*, *bisignatus*, *copiapensis*, Atacama

Introduction

The genus *Liolaemus* is comprised of 230 species (Uetz 2012) distributed throughout the southern portion of South America from the central mountains of Peru to the Tierra del Fuego in Chile. *L. nigromaculatus* (Wiegmann 1834) belongs to the subgenus *Liolaemus* and the *nigromaculatus* group (Lobo 2005). This is the second species that was described for the genus *Liolaemus* and it is the nominal species of the *nigromaculatus* group. However, *L. nigromaculatus* is a species with an uncertain provenance and a muddled taxonomic history (Donoso-Barros 1966, Valladares 2011). Apart from the original description, only Müller and Hellmich (1933a) have indicated data for this species based on the holotype, while the latest revisions either do not indicate the material examined (Ortiz 1981) or the specimens examined were not deposited in an institutional collection (Pincheira-Donoso and Núñez 2005).

Wiegmann (1834) described *Tropidurus nigromaculatus* from Chile based on one juvenile specimen collected by Franz Julius Ferdinand Meyen on his journey around the world during 1830–1832, without making mention of a specific type locality. He pointed out that the species is characterized by a gray color and rhomboid-oval shaped dorsal scales which have a keel but are obtuse. Also, he indicates that the scales of the dorsum are black spotted, “sind die einzelnen schuppen am Grunde schwarz...” (231 p), and that the dorsal pattern presents two series of dark spots which transversely extend to the base of the tail.

Duméril and Bibron (1837) transferred the species to the genus *Proctotretus* and provided a re-description. They show uncertainty about the locality of origin for *P. nigromaculatus*, stating that they examined specimens from Coquimbo (Fig. 1), which were collected by Charles Gaudichaud and deposited in the Muséum National d’Histoire Naturelle, France. These authors mention that the species has large scales which are strongly keeled and mucronate on the dorsum and flanks, characteristics that do not match with the description made by Wiegmann (1834).

Later, Fitzinger (1843) created the genus *Ptychodeira* and designated *P. nigromaculata* as its type species. The author indicates Chile as the type locality. Although he does not list the specimens examined, he indicates that they are located in the Muséum National d’Histoire Naturelle, France.

Bell (1843) examined one specimen collected by Charles Darwin in Coquimbo and once again included the species in the genus *Proctotretus*. He points out that the dorsal scales of this species are strongly keeled and with mucrons.

Gray (1845) considered this species a member of the genus *Liolaemus*, based on specimens from Coquimbo. The description of the species is very similar to that made by Duméril and Bibron (1837) and by Bell (1843). Later, Girard (1858a,b) included the species within the genus *Rhytidodeira*, a decision that was rejected by Steindachner (1867), who once again included the species in the genus *Liolaemus*.

Boulenger (1885), examined three specimens from Coquimbo and three specimens from unknown origins, all deposited in the British Museum (London, England),

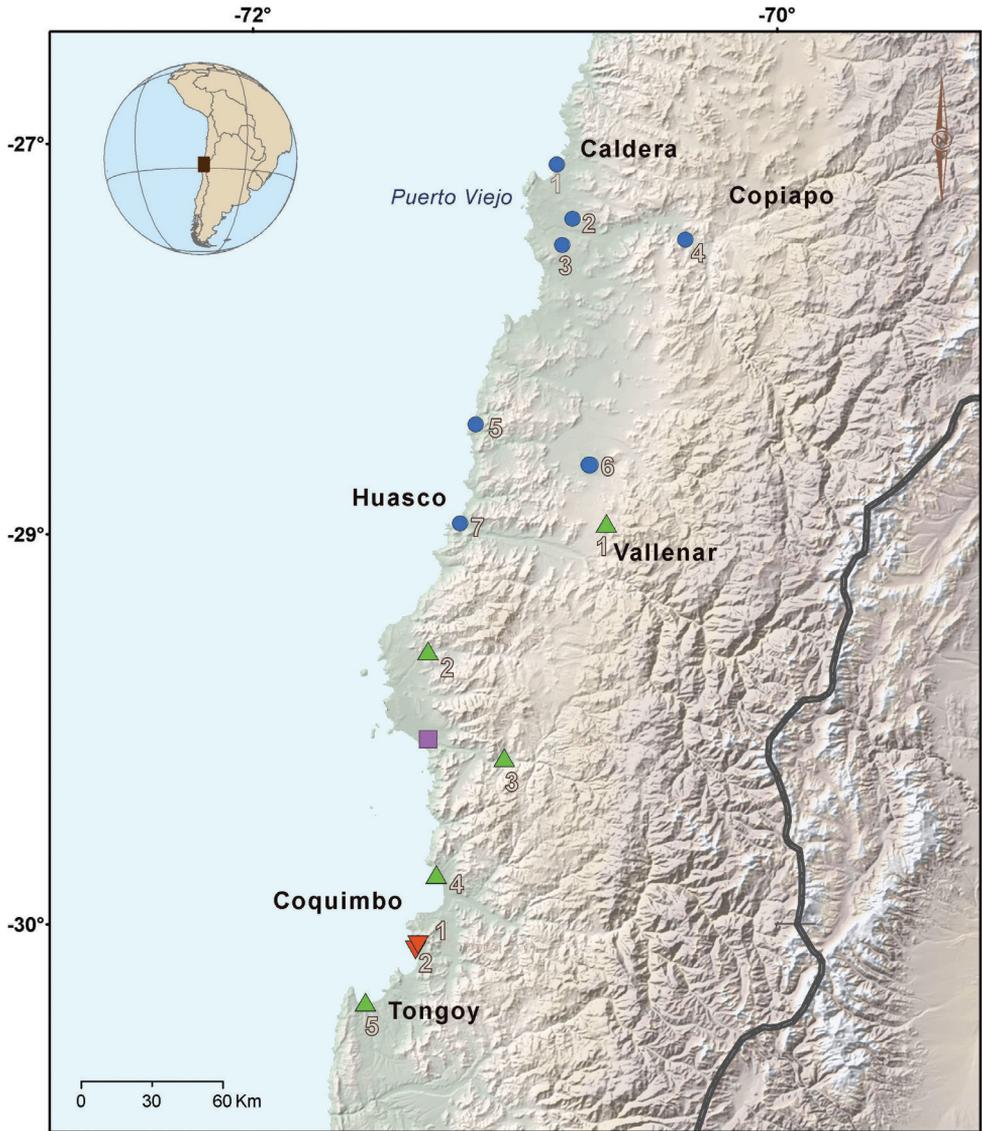


Figure 1. Distribution map of specimens used in this study. Blue circle: *L. nigromaculatus* (1 Caldera 2 Road between Caldera and Copiapó 3 Near to Puerto Viejo 4 Copiapó 5 Llanos de Challe 6 Road between Vallenar and Copiapó and 7 Huasco). Green triangle: *L. atacamensis* (1 Near to Vallenar 2 Lomas de Buitre 3 El Trapiche 4 Punta Teatinos and 5 Pachingo). Lilac square: *L. silvai* (Carrizalillo). Red triangle: *L. zapallarensis* (1 Totoralillo and 2 Las Tacas). The main localities are indicated.

and described them similar to those mentioned above for specimens from Coquimbo. Also, he indicated that *Liolaemus oxycephalus* (Wiegmann 1834), *L. inconspicuus* (Gray 1845), and *L. pallidus* (Philippi 1860) are synonyms of *L. nigromaculatus*, although he did not provide data to support these claims.

With such uncertainty about the type locality, Müller and Hellmich (1933a) finally examined the holotype deposited in Museum für Naturkunde (Berlin, Germany), stating that the holotype of *Tropidurus nigromaculatus* is numbered “ZMB 613” and suggesting that the true type locality of this species is Huasco (Fig. 1), as specimens from this locality are those that most resemble the holotype of *L. nigromaculatus*: *Am besten stimmt mit dem typus von n. nigromaculatus ein exemplar unseres materials überein, das von Huasco stammt* (128 p).

Unfortunately, Müller and Hellmich (1933a) did not describe the characteristics that led to these conclusions. Also, they indicate that the only known specimen is a juvenile (Müller and Hellmich 1933b). Additionally, these authors described several subspecies of *Liolaemus nigromaculatus* (*L. n. atacamensis*, *L. n. ater*, *L. n. copiapoensis*, *L. n. kuhlmanni*, and *L. n. zapallarensis*) and included *L. bisignatus* (Philippi 1860) as a subspecies of *L. nigromaculatus* (Müller and Hellmich 1933a,b).

Donoso-Barros (1954) described a new subspecies, *Liolaemus nigromaculatus sieversi*. Thereafter, in his classic book *Reptiles de Chile*, Donoso-Barros (1966) states that it “has been very difficult to establish with certainty the status of the *L. n. nigromaculatus* subspecies, initially described by Wiegmann. Müller and Hellmich considered Huasco as the type locality” (our translations). Faced with this uncertainty, Donoso-Barros (1966) decided to transcribe part of the original description and present it in his book.

Ortiz (1981) performed an analysis of the subspecies of *Liolaemus nigromaculatus* and concluded that *L. n. sieversi* and *L. n. ater* are subspecies of *L. zapallarensis*, and that *L. bisignatus*, *L. copiapoensis*, *L. kuhlmanni*, and *L. zapallarensis* are full species, so *L. nigromaculatus* included no subspecies. Unfortunately, he did not include *L. atacamensis* in his analysis. Although Ortiz (1981) indicated several characteristics for *L. nigromaculatus*, he did not list the specimens examined and only lists the localities, which are from Huasco to southern Coquimbo. However, Troncoso and Ortiz (1987) list specimens of *L. nigromaculatus* located in the Museo Regional de Concepción, Chile.

Simonetti and Núñez (1986) recorded specimens of *Liolaemus nigromaculatus* from Sierra Las Tapias, to the north of Chañaral. They pointed out that *L. nigromaculatus* can be differentiated from *L. atacamensis*, but they did not included a comparison with *L. bisignatus*.

Finally, Pincheira-Donoso and Núñez (2005), in a review of the Chilean species of the genus *Liolaemus*, redescribe *L. nigromaculatus*, keeping Huasco as the type locality. However, the authors examined specimens from Pan de Azúcar, Diego de Almagro, and Inca de Oro, localities never before mentioned for this species. In addition, these specimens were not deposited in a formal collection and were instead incorporated in the personal collection of D. Pincheira-Donoso, which is not located in any public or private institution, and so their results are currently unverifiable.

Therefore, in this paper we review the taxonomic status of *Liolaemus nigromaculatus* through the characterization of the holotype and clarification of the location in which it was collected. In addition, we provide a diagnosis respect of the other species of the *nigromaculatus* group.

Materials and methods

The characteristics used for descriptions were taken from Ortiz (1981), Etheridge (1995), and Lobo (2001, 2005). Body measurements were taken with a digital vernier caliper (0.02 mm precision). Observations of scales were performed under different magnifying lenses. Through the courtesy of Frank Tillack (Museum für Naturkunde, Berlin, Germany), we examined high-resolution pictures from several views of the holotypes of *Liolaemus nigromaculatus* (ZMB 613) and *L. oxycephalus* (ZMB 615). Measurements and midbody scale counts for the ZMB 613 specimen were taken from Müller and Hellmich (1933a). Finally, some specimens were collected with a noose in several locations of the Coquimbo and Atacama Region, Chile: El Trapiche, Lomas de Buitre, Caldera and near to Puerto Viejo (Fig. 1). These specimens were fixed in 95% ethanol, preserved in 70% ethanol, and were deposited in Colección de Flora y Fauna, Profesor Patricio Sánchez Reyes of the Pontificia Universidad Católica de Chile (SSUC Re). These and other specimens examined are listed in Appendix I. We performed a Student's *t*-test for comparison of SVL between *L. bisignatus* and *L. copiapoensis*. Data for *L. ater* was taken from Donoso-Barros (1966).

Acronyms mentioned in this publication are: MNHN-CL (Museo Nacional de Historia Natural, Chile), MZUC (Museo de Zoología, Universidad de Concepción), MRC (Museo Regional de Concepción), SSUC Re (Colección de Flora y Fauna Patricio Sánchez Reyes, Pontificia Universidad Católica de Chile) and ZMB (Museum für Naturkunde).

Results

Characteristics of the *Liolaemus nigromaculatus* holotype, ZMB 613. The holotype is a juvenile male (Figs 2, 3). The following measurements were taken from Müller and Hellmich (1933a): SVL = 48 mm; Tail length = 76 mm; Head length = 12 mm; Head width = 10 mm; Head height = 7 mm; Forelimb length = 20 mm; Hindlimb length = 33 mm; and Midbody scales = 53. Furthermore, we observed the following: Pentagonal interparietal is smaller than the parietals and surrounded by six scales; seven scales between the interparietal and rostral; orbital semicircles are incomplete; four supraoculars; six supercilliar scales and projected ciliary scales. The subocular is whitish and with a vertical black line at the center. The frontal region is fragmented into four scales. There are five scales between the frontal region and rostral scale; two scales between the nasal and canthal. The nasal is separated from the rostral by one scale and surrounded by five scales. One row of lorilabials between the supralabials and subocular; four supralabials, with the fourth curved upward and without contacting the subocular. Five infralabial scales and four pairs of post-mental shields with the second pair being in contact. Two scales on the anterior edge of the ear, projected onto the meatus but without covering it. Temporal scales are smooth (a few are slightly keeled) and subimbricated. The lateral neck fold is "Y" shaped and an antehumeral



Figure 2. Dorsal view of the *Liolaemus nigromaculatus* holotype (ZMB 613).



Figure 3. Ventral view of the *Liolaemus nigromaculatus* holotype (ZMB 613). Photograph by F. Tillack.

fold is present. Six temporal scales between the level of the superciliaries and commissure. Dorsal scales are rounded or lanceolated, imbricated, slightly keeled, and without mucrons. Ventral scales are rounded, smooth, and subimbricated. There are at least 80 ventral scales and three preloacal pores, two according to Müller and Hellmich (1933a). Dorsal scales of the tail are rounded, imbricated, keeled, and mucronate.

Color in alcohol. Dorsal and lateral views of the head are light brown in color, the same tone of the dorsum, and have numerous black spots which do not form a clear pattern. On the neck, these spots become smaller. The color of the dorsum is gray-brown (gray according to Wiegmann 1834). Nine series of dark spots are over the paravertebral fields, from the base of the neck to the base of the tail. These spots are composed of approximately 8-10 scales. Additionally, over the dorsum there are numerous black spotted

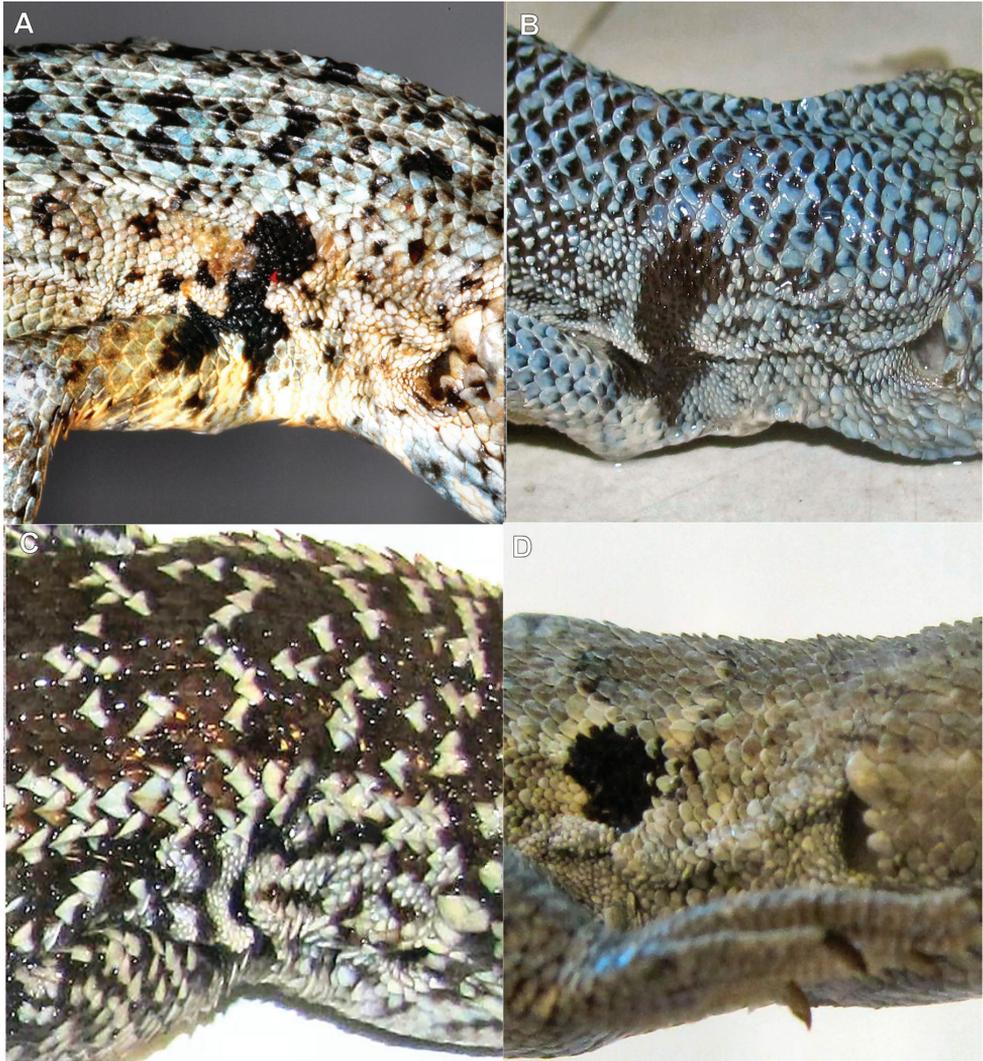


Figure 4. Lateral shoulder view of some specimens studied. **A** Holotype of *Liolaemus nigromaculatus* (ZMB 613, juvenile male) with black “λ” shaped antehumeral spot and dorsal scales without mucrons (Photograph by F. Tillack) **B** Holotype of *Liolaemus bisignatus* (= *L. nigromaculatus*, adult male MNHN-CL 1477) with black “λ” shaped antehumeral spot and dorsal scales without mucrons **C** Male specimen of *Liolaemus zapallarensis* (MZUC 29118) with irregular antehumeral spot and dorsal scales with mucrons **D** Male specimen of *Liolaemus atacamensis* (SSUC Re 469) with rounded antehumeral spot and dorsal scales without mucrons.

scales. The temporal band has seven dark spots, which are smaller than the spots over the paravertebral fields. There is a marked, black antehumeral spot from the shoulder to the humeral zone which shows a constriction in the middle and is divided into two at the base, as forming a “λ” shape (Fig. 4). Forelimbs and hindlimbs have a gray-brown color and black spots. Flanks are of a gray-brown color. The tail has a brown color and few dark

spots. The belly, ventral surface of the tail, and ventral surface of forelimbs and hindlimbs are whitish. The belly has abundant dark spots. The throat has a strong dark reticulation.

Diagnosis of the *nigromaculatus* group. Currently, it is difficult to establish a diagnosis for this group. Preliminary evidence in an ongoing molecular phylogenetic study (Troncoso-Palacios and Schulte, *in prep*) shows that this group is composed of two clades. One clade includes *L. atacamensis*, *L. ater*, *L. kuhlmanni*, *L. melaniceps*, *L. nigromaculatus*, *L. sieversi*, *L. silvai* and *L. zapallarensis*; and the second includes *L. hellmichi*, *L. platei* and *L. velosoi*. A similar proposal is made in Pincheira-Donoso and Núñez (2005). The first clade (*nigromaculatus* group, *sensu stricto*) can be distinguished from other groups of the *Liolaemus* subgenus through the following combination of characteristics: 1) nasal and rostral scales separated by one scale, 2) an antehumeral black spot whether it is on males, females or juveniles, and 3) a series of black spots on the paravertebral fields at least in juveniles.

However, since a formal study is lacking, the following diagnosis includes the currently considered species as members of the group *nigromaculatus*.

Diagnosis of *Liolaemus nigromaculatus* based on the holotype. *Liolaemus nigromaculatus* can be differentiated from the other species of the *nigromaculatus* group through the following combination of characteristics: 1) nasal and rostral scales separated by one scale, 2) presence of projected ciliary scales, 3) dorsum with abundant, black-spotted scales, 4) series of black spots on the paravertebral fields, from the base of the neck to the base of the tail, 5) marked “λ” shaped antehumeral black spot from the shoulder to the humeral zone, 6) dorsal scales are rounded or lanceolated, slightly keeled, and without mucrons. Diagnosis with respect to other species of the *nigromaculatus* group is listed below.

Liolaemus nigromaculatus differs from *L. hellmichi* (Donoso-Barros 1975), *L. platei* (Werner 1898), and *L. velosoi* (Ortiz 1987) because in all of these species the nasal scale always contacts the rostral scale and they never have projected ciliary scales.

Liolaemus nigromaculatus differs from *L. melaniceps* (Pincheira-Donoso and Núñez 2005) because in this species the dorsal scales are juxtaposed. In contrast, *L. nigromaculatus* has imbricated dorsal scales. Head color in *L. melaniceps* is remarkably darker than the body, whereas *L. nigromaculatus* maintains the same color.

Liolaemus nigromaculatus differs from *L. ater*, *L. kuhlmanni*, *L. zapallarensis* (Müller and Hellmich 1933a, b), *L. sieversi* (Donoso-Barros 1954) and *L. silvai* (Ortiz 1989) because these species have strongly keeled and mucronate dorsal scales (Fig. 4), whereas in *L. nigromaculatus* dorsal scales are not mucronate and are slightly keeled.

Finally, *Liolaemus nigromaculatus* differs from its most similar species, *L. atacamensis* (Müller and Hellmich 1933b), because this latter species never has black spotted scales on the dorsum, which are abundant in *L. nigromaculatus*. The antehumeral spot is rounded in male *L. atacamensis* and does not contact the humeral zone (Fig. 4, Table 1). Moreover, the male *L. atacamensis* has abundant blue-sky scales dispersed over the dorsum, a trait absent in *L. nigromaculatus*. The ventral scales vary between 66–77 for *L. atacamensis* but are at least 80 in *L. nigromaculatus*.

Table I. Scale and morphological characteristics of geographically close species to *Liolaemus nigromaculatus* (examined juveniles are excluded). M = males and F = females.

	<i>L. nigromaculatus</i> (Puerto Viejo-Copiapó and surroundings) M= 19, F= 16	<i>L. atacamensis</i> M=7, F=9	<i>L. kuhlmanni</i> M= 7, F= 9	<i>L. zapallarensis</i> M= 1, F= 2
Midbody Scales	50–61	48–54	52–58	48–52
Ventrals	77–84	66–77	80–90	79–80
Nasal Separated from Rostral	Yes	Yes	Yes	Yes
Color of Male	Gray (with olive or yellow shades)	Gray or brown	Black	Black
Shape of Dorsal Scales	Rounded or lanceolate	Rounded or lanceolate	Lanceolate	Lanceolate
Mucrons in Dorsal Scales	No	No	Yes	Yes
Black Spotted Dorsal Scales	Yes	No	No	No
Male with “x” Shaped Antehumeral Spot	Yes	No	Indistinguishable	Indistinguishable
Maximum SVL (mm)	83.0	67.2	81.2	72.4

The relationship between *Liolaemus bisignatus* (Philippi 1860) and *L. copiapoensis* (Müller and Hellmich 1933b). Philippi (1860) illustrated (without a description, see below) *Proctotetrus bisignatus* (= *L. bisignatus*) without mention of a type locality. Later, Müller and Hellmich (1933b) restricted the type locality of *L. bisignatus* to Caldera, Chile. On the other hand, Müller and Hellmich (1933b) described *L. n. copiapoensis* as being from Copiapó. Hellmich (1950) indicated that *L. n. copiapoensis* is very similar to *L. n. bisignatus*, and differs in being smaller and lacking a light green color. Donoso-Barros (1966) also noted the similarities between *L. n. copiapoensis* and *L. n. bisignatus*, although he considered both species valid and added as a diagnosing characteristic the absence of a keel on temporal scales of *L. n. copiapoensis*. Conversely, Ortiz (1981) states that the two species do not differ in the size or development of a keel on the temporal scales. Although in his analysis both species appear to be very close, he points out the following diagnostic characteristics: the ventral color of the thighs and cloaca is yellow in *L. bisignatus* and orange in *L. copiapoensis* (listed as a weak difference), *L. bisignatus* has dorsal color grayish green whereas *L. copiapoensis* has dorsal color yellowish white, *L. bisignatus* is a coastal species while *L. copiapoensis* is a valley species, and *L. bisignatus* takes refuge in dunes whereas *L. copiapoensis* does so in burrows. Lobo (2001, 2005), in a phylogenetic analysis, found both species to be sister taxa, but maintains their status as full species.

Pincheira-Donoso and Núñez (2005), after studying topotypes of both species, concluded that *Liolaemus copiapoensis* is a synonym of *L. bisignatus*. However, Valladares (2011) considered *L. copiapoensis* a valid species.

We agree with Pincheira-Donoso and Núñez (2005) as our examination of topotypes of both populations, including the specimen considered as the holotype of

Liolaemus bisignatus, shows that: 1) Both species do not differ in size. Adult males of *L. bisignatus* ($n = 11$; $\bar{X} = 74.1$ mm; rank = 60.9 – 83.0 mm) do not show significant differences as compared to adult males of *L. copiapoensis* ($n = 8$; $\bar{X} = 70.1$ mm; rank = 60.7 – 78.1 mm) ($t = 1.27$; $P = 0.22$). Adult females of *L. bisignatus* ($n = 12$; $\bar{X} = 63.7$ mm; rank = 56.6 – 80.7 mm) do not show significant differences compared to adult females of *L. copiapoensis* ($n = 4$; $\bar{X} = 56.9$ mm; rank = 56.5 – 59.8 mm) ($t = 1.69$; $P = 0.11$), 2) Both species do not differ in color pattern, as the males of *L. bisignatus* can have orange color on thighs and cloaca and males of both populations have a gray dorsal color, with green or yellow shades in some specimens, 3) Both species have smooth or slightly keeled temporal scales, which keel more developed in males, 4) The distribution of populations attributable to *L. bisignatus* or *L. copiapoensis* is continuous from the coast to the valley, and the type of refuge used by these lizards cannot be used to identify a species as this depends on the availability of refuge types in the habitat.

The relationship between *Liolaemus nigromaculatus* (Wiegmann 1834) and *L. bisignatus* (Philippi 1860). Philippi (1860), included eight species of reptiles and one amphibian (all numbered) in the “Zoology of the Atacama Desert” section of his book. Among them, *Proctotretus nigromaculatus* (= *L. nigromaculatus*, number 2) was briefly mentioned and he pointed out that in the lamina of his book the species is labeled as *P. bisignatus*: “Tab. VI, Fig. 2, nomine *Proct. bisignatus*”. Apparently, Philippi (1860) intended to describe the specimen that he collected as a new species (*P. bisignatus*), but subsequent to the completion of the lamina, he would have realized that the species was already described as *P. nigromaculatus*. In fact, Philippi (1860) only provides three data for *P. nigromaculatus*: snout-vent length (SVL), tail length, and shape of dorsal scales. Therefore, *L. bisignatus* was never described by Philippi (1860). Indeed, according to Article 12.1 of the “Names published before 1931” section of the International Code of Zoological Nomenclature, *L. bisignatus* is a *nomen nudum* because it was never described, as to be available every new name published before 1931 must be accompanied by a description or a definition of the taxon that it denotes, or by an indication (ICZN 1999).

The second publication which deals with this species (Müller and Hellmich 1933b) includes *Liolaemus bisignatus* as a subspecies of *L. nigromaculatus*. However, Müller and Hellmich (1933b) indicated that it is probable *L. bisignatus* could be a synonym of *L. nigromaculatus*. Later, Ortiz (1981) considered *L. bisignatus* a full species, a status which remains until today. Although Ortiz (1981) did not list the specimens examined, Troncoso and Ortiz (1987) list several specimens of *L. nigromaculatus* (from Huasco and Caldera) and *L. bisignatus* (from Huasco and Caldera). This mixture of locations suggests a difficulty in differentiating both species. Our examination of these specimens shows that all are assignable to *L. nigromaculatus* (Fig. 5). Although Philippi (1860) did not designate a holotype or type locality for *L. bisignatus*, Müller and Hellmich (1933b) restrict the type locality to Caldera, Chile, and according to Ortiz and Núñez (1986), the holotype is specimen MNHN-CL 1477 collected by R.A. Philippi in Atacama.

Our review of twenty-three specimens of *Liolaemus bisignatus* (adults and juveniles, including the holotype) allows us to determine that the populations currently referred



Figure 5. Some specimens listed by Troncoso and Ortiz (1987). All are assignable to *Liolaemus nigromaculatus*, from top left to bottom right: MRC 274 and 226 (*L. nigromaculatus* from Huasco), MRC 282 (*L. nigromaculatus* from Caldera), MRC 276 (*L. bisignatus* from Caldera), MRC 225 (*L. nigromaculatus* from Huasco), MRC 272 (*L. bisignatus* from Huasco), and MRC 090 and 094 (*L. copiapoensis* from Copiapó).

to as *L. bisignatus* should be referred to as *L. nigromaculatus* based on the following: 1) Of the species in the *nigromaculatus* group that have the nasal separated from the rostral, only *L. bisignatus* and *L. atacamensis* (Figs 6, 7) have dorsal scales without mucrons, and of these, only *L. bisignatus* overlaps with the diagnostic characters of *L. nigromaculatus*, 2) The color of the *L. nigromaculatus* holotype is brown-gray with a series of black spots over the paravertebral fields, as in juveniles of *L. bisignatus*, 3) *L. nigromaculatus* has a black “x” shaped antehumeral spot, from the shoulder to the humeral zone, like *L. bisignatus*, 5) *L. nigromaculatus* has abundant black spotted scales on the dorsum, like *L. bisignatus*, 6) The holotype of *L. nigromaculatus* has at least 80 ventral scales, which is



Figure 6. Variation of color pattern in *Liolaemus nigromaculatus*. **A** and **B** Adult males from 20 Km SE from Puerto Viejo **C** Adult female from the same location **D** Juvenile from Caldera.

in the range of *L. bisignatus* but not for *L. atacamensis* (Table 1), 7) Of the species in the *nigromaculatus* group with the nasal separated from the rostral, only *L. bisignatus* and *L. atacamensis* are known to be from the zone in which Meyen collected the holotype of *L. nigromaculatus* (see below), and of these only *L. bisignatus* overlaps with the diagnostic characteristics of *L. nigromaculatus*, 8) In Huasco, the location currently accepted as the type locality of *L. nigromaculatus*, it is only possible to find two other species of *Liolaemus* (*L. bisignatus* and *L. fuscus*), this explains why Müller and Hellmich (1933a) assigned Huasco as the type locality of *L. nigromaculatus*. In contrast to *L. nigromaculatus*, *L. fuscus* has the nasal scale always in contact with the rostral.

The true type locality of *Liolaemus nigromaculatus*. Wiegmann (1834) described *L. nigromaculatus* based on one specimen collected by the doctor and naturalist FJF Meyen. Wiegmann (1834) designated “Chile” as the type locality. Later, Duméril and Bibron (1837) indicated that *L. nigromaculatus* inhabits Coquimbo because the examined specimens from this locality were, according to their criteria, consistent with the description of Wiegmann (1834). Thereafter, Müller and Hellmich (1933a) reviewed the holotype and proposed Huasco as the type locality based on the similarities of *L. nigromaculatus* with the examined specimens from Huasco. For this reason, the subsequent studies that have mentioned this species consider Huasco as the type locality (Donoso-Barros 1966, Ortiz 1981, Pincheira-Donoso and Núñez 2005).

According to Meyen (1834) he traveled for Chile for three months (from January to March 1831) mainly in the central region (San Fernando, Rancagua, Cajón del Maipo, Colina and Valparaíso). On March 6, he sailed from Valparaíso to Coquimbo where he stayed for two days. Later, he went to northern Chile, landing in Puerto Viejo (Puerto de Copiapó) on March 10 and then going to Copiapó and its surround-



Figure 7. Variation of color pattern in *Liolaemus atacamensis*. **A** Adult male from El Trapiche **B** Adult male from Lomas de Buitre **C** Adult female from Lomas de Buitre.

ings (e.g. Tierra Amarilla, El Checo mine). Ten days later, he returned to Puerto Viejo and sailed to Peru. Meyen's journey is also detailed in Domeyko (1859).

We can discard the area from San Fernando to Valparaíso as the type locality of *Liolaemus nigromaculatus* since no species of the *nigromaculatus* group has been documented for this area. On the other hand, all species of *nigromaculatus* group with the nasal scale separated from rostral and that inhabit the surroundings of Coquimbo (*L. atacamensis*, *L. kuhlmanni* and *L. zapallarensis*) are clearly distinguishable from *L. nigromaculatus*, so *L. nigromaculatus* is not found in Coquimbo.

Meyen never visited Huasco, so it is impossible that the specimen ZMB 613 was collected by him there. Müller and Hellmich (1933a) restricted the type locality of *Liolaemus nigromaculatus* to Huasco based on morphological characteristics, but without considering the probable location of collection. Later, this decision was never questioned by another author and the mistake remains today.

In conclusion, the true type locality of *Liolaemus nigromaculatus* should be restricted to the route and surroundings from Puerto Viejo to Copiapó because in the entirety of this route specimens of *L. nigromaculatus* can be found and are being by far the most abundant species. Since this route covers approximately 60 Km, it is impossible to obtain a more precise location.

Variation of the species. Variation analysis was based on 40 specimens (19 males, 16 females, and 5 juveniles) from a transect of Puerto Viejo – Copiapó and the surroundings, including Caldera. The data are as follows: SVL adult males: 75.7 ± 5.4 mm. SVL adult females: 67.4 ± 7.2 mm. Tail length in adult males: 84.4 ± 15.5 mm.

Tail length in adult females: 80.8 ± 9.7 mm. Head length in adult males: 19.3 ± 1.8 mm. Head length in adult females: 17.6 ± 2.7 mm. Head width in adult males: 14.3 ± 0.9 mm. Head width in adult females: 11.9 ± 0.4 mm. Head height in adult males: 9.5 ± 1.0 mm. Head height in adult females: 8.0 ± 0.8 mm. Forelimb length in adult males: 25.4 ± 3.8 mm. Forelimb length adult in females: 19.6 ± 1.7 mm. Hind limb in adult males: 40.2 ± 5.5 mm. Hind limb in adult females: 32.1 ± 1.6 mm.

Pentagonal or hexagonal interparietal, smaller than the parietals and surrounded by 6-7 scales; 7-9 scales between the interparietal and rostral; orbital semicircles are complete, formed by 8-10 scales, or incomplete; 3-5 supraoculars and 6 supercilliaris. The subocular is whitish with a vertical black line at the center. Two scales between nasal and canthal. The nasal is separated from the rostral by one scale and surrounded by six scales. There is one row of lorilabials between the supralabials and subocular. There are 4-5 supralabials, the last of which is curved upward without contact to the subocular; 5-6 infralabial scales. The mental is pentagonal and in contact with four scales. There are four pairs of post-mental shields; the second pair is in contact or is separated by one scale. There are 2-3 enlarged scales on the anterior edge of the ear but without covering the meatus. Temporal scales are subimbricated and smooth or slightly keeled. The lateral neck fold is "Y" shaped and antehumeral fold is present. There are 6-7 temporal scales between the level of supercilliaris and commissure. Midbody scales: 50-61. Dorsal scales are rounded or lanceolated, subimbricated or imbricated, slightly keeled and without mucrons, and some specimens have interstitial granules. Dorsal scales are similar or smaller than the ventrals. Ventrals : 77-84. Ventral scales are rounded, smooth, subimbricate, and without interstitial granules. There are 2-3 preloacal pores in the males. The suprafemoral scales are rounded, imbricated, and keeled without mucrons. Infracemoral scales are rounded, smooth, and imbricated. Supraantibrachials scales are rounded, imbricated, and keeled without mucrons. Infraantibrachials are rounded, imbricated, and smooth. The ventral tail scales are lanceolate, imbricated, keeled, and with mucrons.

Color: There is a highly variable color pattern, which varies with the size and sex of individuals. The juveniles have a brown head, with the same shade on the dorsum and with some dark spots or no spots. The dorsum has a brown-yellow color. The vertebral line is fragmented or absent, always disappearing in larger juveniles. There are nine to ten dark spots on the paravertebral fields, from the neck to the base of the tail. These spots have white or yellow on the posterior edge. There is a yellow supraocular line, and black "λ" shaped antehumeral spot. The temporal band is formed by four to seven dark spots which have white or yellow on the posterior edge. The limbs are brown with small black and white spots. There is a whitish ventral color, sometimes with small dark spots. The throat is striated or spotted. The tail is brown, with vertebral line and ringed.

For adult males, the following observations were made: The supraoculars lines of juveniles disappear. The head is gray, has the same shade as the body, and which, in some specimens, also has yellow or olive shades. The dark spots of the temporal bands and paravertebral fields progressively merge until disappearing in the larger specimens,

leaving a gray color on the dorsum without design, and sometimes with olive and yellow shades. On the dorsum there are abundant black spotted scales, dispersed and without forming a design. There is a black “λ” shaped antehumeral spot, and in some specimens it is accompanied by three to six round and smaller dark spots from shoulder towards the rear. There is an absence of a vertebral line. In some specimens, the flanks have yellow or orange color. The tail has either a vertebral line or no design. The limbs are gray with small black and white spots, and the belly is whitish. The throat is striated or spotted, and the cloacal region is orange or yellow.

Finally, for females observations were as follows: There is a gray or brown color and abundant black spotted scales dispersed on the dorsum. There is a black “λ” shaped antehumeral spot, but it is more diffuse than in males. Females differ from the males in that they have dark spots over the dorsum with white on the posterior edge. Also, females have a yellow supraocular line. There is an absence of vertebral line. The limbs are gray with small black and white spots. There is a whitish belly, but in some specimens there is orange in the middle. The throat is striated or spotted. The tail has a vertebral line and may be ringed.

Discussion

Without a doubt, one of the most confused issues in the taxonomy of Chilean herpetology is the definition of *Liolaemus nigromaculatus*, whose taxonomic status and type locality have been uncertain for many years (Donoso-Barros 1966, Troncoso-Palacios and Marambio 2011). Furthermore, the species is very polymorphic. The dorsal pattern varies with both size and sex. It is even possible that the yellow and orange color on the flanks of some adult males is related to the reproductive status. In the past, this led to the description of populations from Copiapó as a new species, *L. copiapuensis* (Müller and Hellmich 1933b). Moreover, some species have been placed under synonymy with *L. nigromaculatus* without appropriate justification. Boulenger (1885) indicated that *Liolaemus oxycephalus* (Wiegmann 1834) is a synonym of *L. nigromaculatus*. However, the holotype of *L. oxycephalus* has the nasal in contact with rostral scale, which is always separated in *L. nigromaculatus*. The type locality of *L. oxycephalus* is not indicated in its description, but the holotype of *L. oxycephalus* strongly resembles *L. platei* and *L. velosoi*. However, both of these species are very similar and inhabit localities visited by Meyen, and since the state of conservation of *L. oxycephalus* is poor, it is difficult to indicate a relationship of synonymy, so we propose maintaining the specific names of *L. platei* and *L. velosoi*. Boulenger (1885) also indicated that *Liolaemus pallidus* (Philippi 1860) from Paposo is a synonym of *L. nigromaculatus*. For the moment, it is impossible to clarify this issue because the types of *L. pallidus* are lost (Ortiz and Núñez 1986). Finally, Boulenger (1885) also indicated that *L. inconspicuus* (Gray 1845) is a synonym of *L. nigromaculatus*. The type locality of *L. inconspicuus* is not indicated in the description, but according to Gray (1845) *L. inconspicuus* has strongly keeled and mucronate dorsal scales, so it can not be a synonym of *L. nigromaculatus*.

Several authors mentioned Coquimbo as the inhabiting locality of *Liolaemus nigromaculatus* (Duméril and Bibron 1837, Bell 1843, Gray 1845, Boulenger 1885). However, these authors describe a lizard with strongly keeled and mucronated dorsal scales, and with a dorsal pattern formed by a series of dark spots. Probably, these authors confused juvenile specimens of *L. zapallarensis* or *L. kuhlmanni* with *L. nigromaculatus*.

The most similar species to *Liolaemus nigromaculatus* is *L. atacamensis*. Müller and Hellmich (1933b) described *L. atacamensis* from Atacama, north of Copiapó, based on two specimens (SVL = 57–55 mm). Later, Hellmich (1950) examined 18 more specimens from Vicuña and La Serena, both in Coquimbo Region, but unfortunately he does not provide SVL data, although he does provide the range of midbody scales: 48–54. We examined 16 specimens of *L. atacamensis* from several locations from both the Atacama and Coquimbo Regions, and the SVL (46.6 – 67.2 mm) and midbody scales (48–54) are in the range of previous data.

Use of digital pictures of type specimens has proved to be a powerful and useful tool for clarifying confusing taxonomic issues. Recently, Langstroth (2011) clarified the taxonomic status of *Liolaemus stolzmanni* (Steindachner 1891) and *L. pachecoi* (Laurent 1995), and Troncoso-Palacios and Etheridge (2012) restrict the distribution of *L. tacnae* (Shreve 1941) using digital pictures of types.

Here, we hope to have contributed to the clarification of the taxonomic identity of *Liolaemus nigromaculatus* in addition to providing new data and correcting some mistakes, all with the end of trying to understand the still uncertain semantics of the *nigromaculatus* group.

Conclusion

The type locality of *Liolaemus nigromaculatus* should be restricted to the transect and surroundings of Puerto Viejo – Copiapó, and the populations currently recognized as *L. bisignatus* or *L. copiapensis* are assignable to *L. nigromaculatus*.

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Appendix I

Specimens examined

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Afroprinus cavicola gen. et sp. n. from the Afrotropical region with notes on cave-dwelling Sapriniinae (Coleoptera, Histeridae)

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Abstract

A new genus and species from Kenya, *Afroprinus cavicola* is herein described and illustrated and its systematic position is discussed. By the prosternal pre-apical foveae connected by marginal prosternal stria it resembles most of the Afrotropical species of the genus *Chalcionellus* Reichardt, 1932, or some species of the genus *Pholioxenus* Reichardt, 1932 from South Africa and Namibia. *Afroprinus* can be distinguished from *Chalcionellus* chiefly by the lack of pronotal depressions and a coarsely sculptured, non-metallic dorsum; from Afrotropical species of *Pholioxenus* it can be most easily distinguished by the asetose pronotal hypomeron. The new taxon was discovered in a cave, but lacks obvious troglomorphic adaptations. Notes on other Sapriniinae taxa found in caves are given. An identification key to the genera of Afrotropical Sapriniinae is provided.

Keywords

Coleoptera, Histeridae, Sapriniinae, *Afroprinus*, Afrotropical, taxonomy

Introduction

The Sapriniinae of the Afrotropical Region are quite well known and have been studied for many years, and except for descriptions of genera or species scattered in the entomological literature of the past 180 years there are several generic revisions (e.g. Gomy and Vienna 1996), as well as many studies on the Histeridae fauna of particular countries that also contain data on the Sapriniinae. Such country studies (in most cases called ‘Contributions to the knowledge’) were mostly published by Gomy (see e.g. Gomy 1978, 1983 or 1986), but also by other authors (e.g. Desbordes 1930 or Penati and Vienna 1996). Despite this, there is still no systematic revision of the Afrotropical Sapriniinae, or a catalogue to deal specifically with this region. According to the recent world catalogue of Mazur (2011) there are 22 genera and 199 species of Sapriniinae occurring in the Afrotropical region. However, it is probable that such a large tropical area must house much larger diversity of the Sapriniinae than the taxonomic literature indicates.

During a visit to the Natural History Museum, London, UK in 2009 I have examined a series of apparently unknown Sapriniinae specimens, identified as *Gnathoncus* sp. After having performed a phylogenetic analysis of the Sapriniinae subfamily (Lackner, unpublished), I can conclude that this is an unknown taxon belonging to a new genus. The prosternal pre-apical foveae connected by the marginal prosternal stria found in this taxon is a rare feature among the Old World Sapriniinae and it is more likely to be found among the members of *Euspilotus* Lewis, 1907, common to the Neotropical region (Lackner, pers. observ.). However, in the Afrotropical region there are Sapriniinae that have the prosternal pre-apical foveae connected by the marginal prosternal stria. These taxa are found among ill-defined and most likely polyphyletic genera *Chalcionellus* Reichardt, 1932 and *Pholioxenus* Reichardt, 1932. Revisions of both afore-mentioned genera are badly needed.

In this contribution to the systematics and taxonomy of the Sapriniinae a new genus and its type species are described and the systematic position of the new genus in the Sapriniinae subfamily is discussed. A tentative key to the genera of the Afrotropical Sapriniinae is provided.

Material and methods

All dry-mounted specimens were relaxed in warm water for several hours or overnight, depending on the body size. After removal from original cards, the beetles were side-mounted on triangular points and observed under a Nikon 102 stereoscopic microscope with diffused light. Some structures were studied using methods described by Ôhara (1994): the head and male genitalia were macerated in a hot 10% KOH solution for about 15 minutes, cleared in 80% alcohol, macerated in lactic acid with fuchsin, incubated at 60°C for two hours, and subsequently transferred into a mixture of glacial acetic acid 1 part and methyl salicylate 1 part heated at 60°C for 15 minutes and cleared in xylene. Specimens were then observed in α -terpineol in a small glass dish.

The mentum, labium, labrum, mandibles and antennae were disarticulated. Digital photographs of the male terminalia, mouthparts and antenna were taken by a Nikon 4500 Coolpix camera and edited in Adobe Photoshop CS4. Based on the photographs or direct observations, the genitalia, mouthparts and antennal structures were drawn using a light-box Hakuba klv-7000. SEM photographs were taken with a JSM 6301F microscope at the laboratory of Faculty of Agriculture, Hokkaido University, Sapporo, Japan. All available specimens were measured with an ocular micrometer. Morphological terminology follows that of Ôhara (1994) and Lackner (2010). Separate lines of the same label are demarcated by a slash (/). The following acronyms of museums and private collections are used throughout the text:

NMH Natural History Museum, London, UK (R. Booth);

TLAN Tomáš Lackner's collection, temporarily housed at Naturalis Biodiversity Centre, Leiden, Netherlands.

Abbreviations of body measurements (from Ôhara 1994) are as follows:

PEL length between anterior angles of pronotum and apices of elytra

APW width between anterior angles of pronotum

PPW width between posterior angles of pronotum

EL length of elytron along sutural line

EW maximal width between outer margins of elytra.

Results

***Afroprinus* gen. n.**

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<http://species-id.net/wiki/Afroprinus>

Type species: *Afroprinus cavicola* sp. n.

Diagnosis. Body length 2.125–2.375 mm, dorsal surface entirely punctate; cuticle dark brown to black, without metallic luster, frontal and supraorbital striae present, well developed; sensory structures of antennal club in form of small sensory area and corresponding vesicle situated on internal distal margin; pronotal hypomerone asetose; elytral disc with four long carinate dorsal elytral striae, fifth stria occasionally present on fourth elytral interval; apex of prosternal process convex, prosternal pre-apical foveae large and deep, connected apically by marginal prosternal stria; carinal prosternal striae shortened apically, not united anteriorly; lateral prosternal striae terminating in large deep prosternal pre-apical foveae; meso-metaventral sutural stria present, undulate. Venter asetose.

Differential diagnosis. The general appearance of *Afroprinus* somewhat resembles that of *Hypocacculus*, differing chiefly in the large prosternal pre-apical foveae connected by the deep marginal prosternal stria and in the marginal pronotal stria that in

dorsal view is visible along its entire length. By the convex apical third of the prosternal process and by the prosternal pre-apical foveae connected by the marginal prosternal stria *Afroprinus* can also be confused with several Afrotropical species of the genera *Chalcionellus* or *Pholioxenus*. It differs from those species of *Chalcionellus* that have the prosternal pre-apical foveae connected by the marginal prosternal stria by the sculpture of dorsal surface, which is metallic and much coarser in *Afroprinus* and by lacking the pronotal depressions of *Chalcionellus*. From those species of Afrotropical *Pholioxenus* (mainly from South Africa and Namibia) that likewise have their prosternal pre-apical foveae connected by marginal prosternal stria, *Afroprinus* differs by the aetose pronotal hypomeron and much coarser and denser elytral punctuation.

Biology. The type series of *Afroprinus cavicola* has been found on bat droppings in a Kenyan cave.

Distribution. Kenya.

Etymology. The generic name is a combination of the genus name ‘*Saprinus*’ with a prefix derived from the continent of Africa. Gender masculine.

***Afroprinus cavicola* sp. n.**

urn:lsid:zoobank.org:act:BE636DF4-CDA8-40D8-98F2-8ECA078706FD

http://species-id.net/wiki/Afroprinus_cavicola

Figs 1–21

Type locality. Kenya, Chyulu Hills.

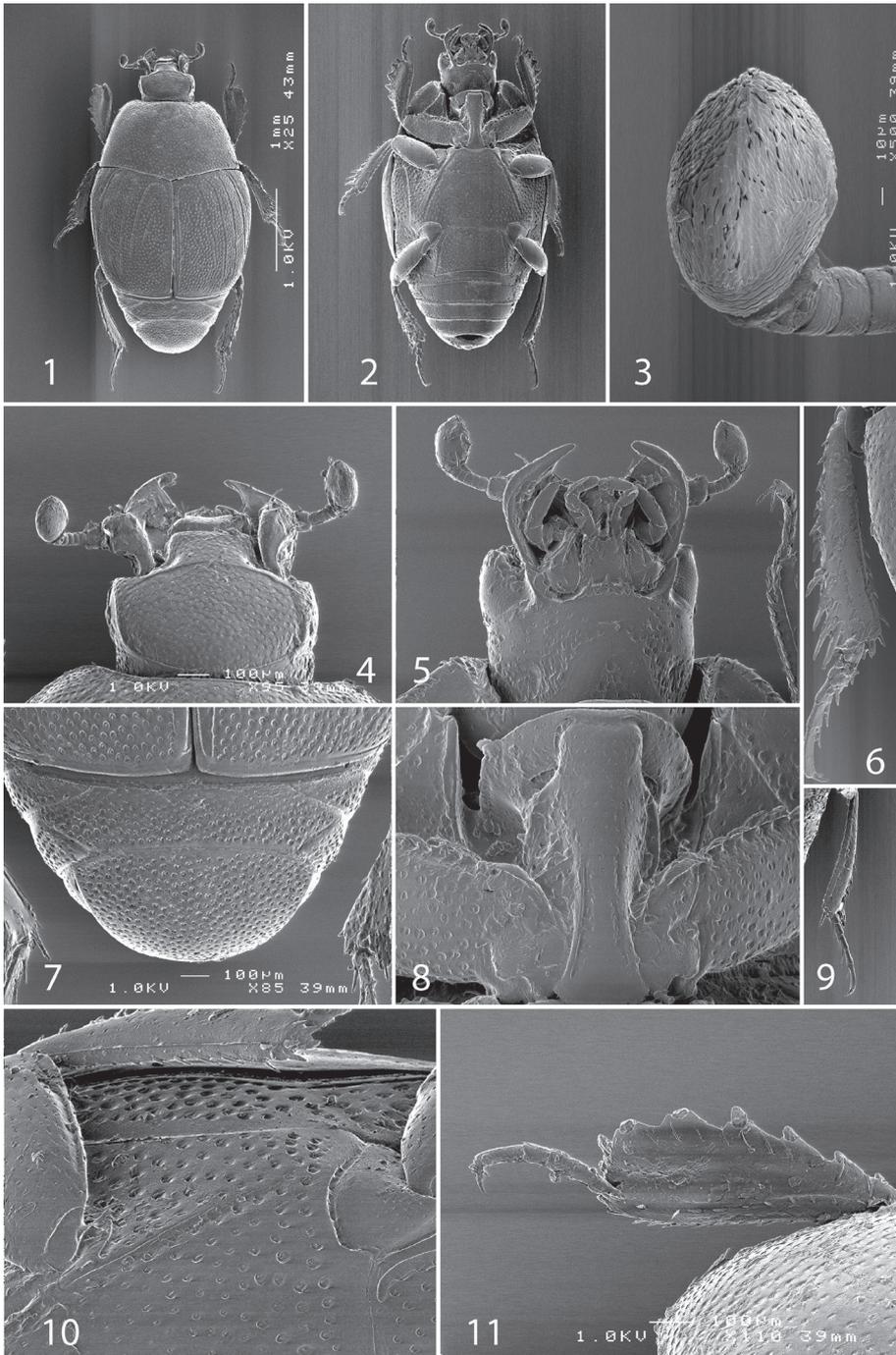
Type specimens examined. Holotype, ♂, side-mounted on a triangular mounting card with male genitalia glued to the same card; “KENYA: / Chyulu Hills / Univ. of Nairobi” [written]; “bat droppings / in cave” [written]; “Brit. Mus. / 1972-215” [printed-written]; “*Gnathoncus* sp. / P.M. Hammond / det. 1972” [written-printed]; “09-071” [yellow label, pencil-written, added during the present study]; “*Afroprinus cavicola* / n. gen. & sp. / HOLOTYPE / det. T. Lackner 2010” [red label, written] (NMH). Paratypes, 4 ♂♂ and 2 ♀♀, idem, but without the identification label by P.M. Hammond (NMH; 1 ♂ PT in TLAN).

Description. Male and female. Body length: PEL: 2.125–2.375 mm; APW: 0.75–0.875 mm; PPW: 1.625–1.75 mm; EL: 1.375–1.50 mm; EW: 1.875–2.00 mm.

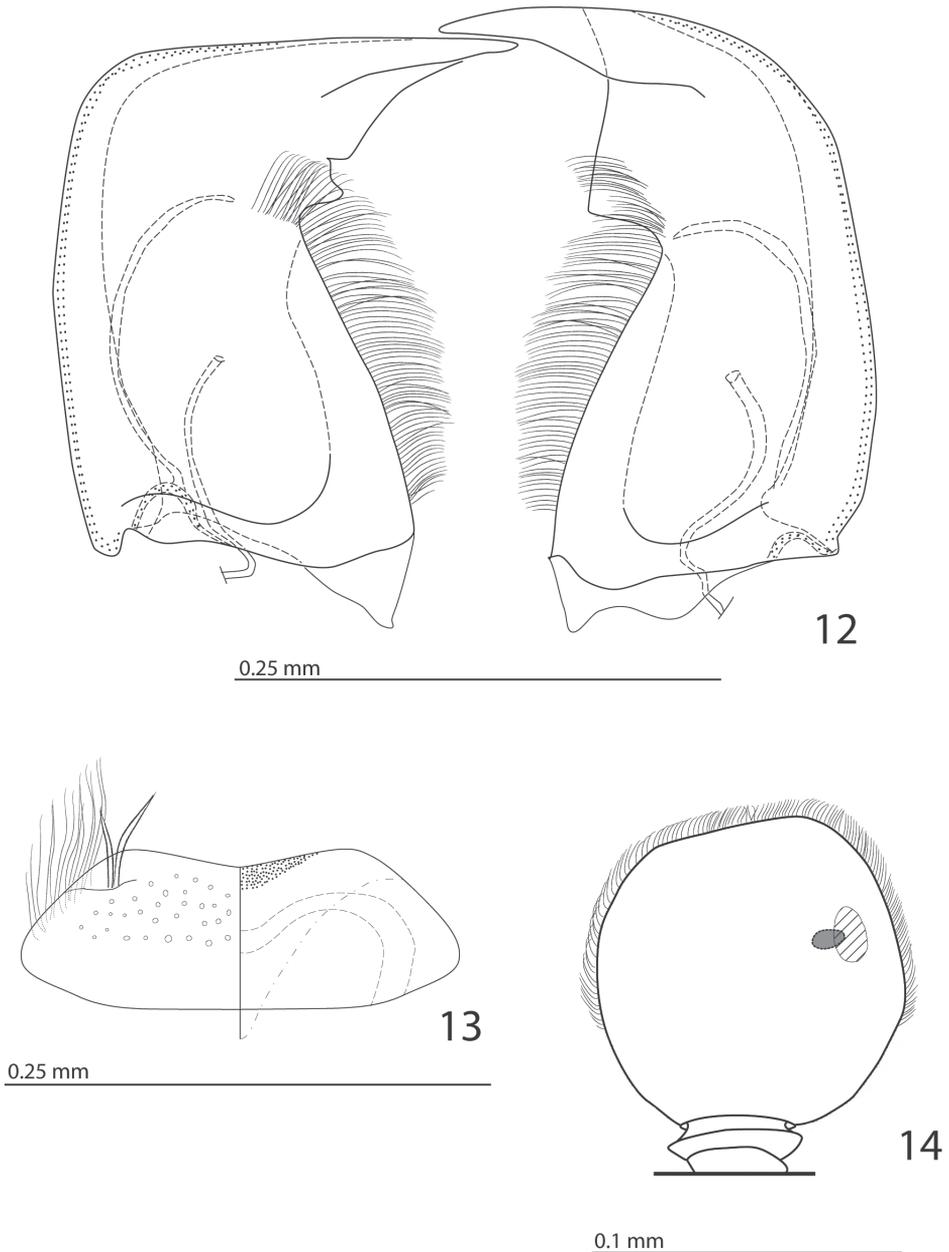
Body (Figs 1,2) ovoid, convex, ventral surface slightly flattened, cuticle matte, dark brown; legs, mouthparts and antennomeres I and II rufous; remaining part of antenna somewhat lighter.

Antennal scape (Fig. 4) with several short setae; antennal club (Figs 3,14) round, without visible articulation, somewhat flattened dorso-ventrally; approximately distal half of its surface with thick short sensilla; proximal half with imbricate microsculpture, sensilla absent; sensory structures of antennal club (Fig. 14) with tiny sensory area accompanied by a tiny stipe-shaped vesicle on internal distal margin of antennal club.

Mouthparts. Mandibles (Fig. 12) with rounded outer margin strongly curved inwardly, apically pointed; sub-apical tooth on inner margin of left mandible large, al-



Figures 1–11. *Afroprinus cavicola* gen. et sp. n., SEM micrographs. **1** habitus, dorsal view **2** ditto, ventral view **3** antennal club, dorso-lateral view **4** head, dorsal view **5** ditto, ventral view **6** mesotibia, dorsal view **7** propygidium and pygidium **8** prosternum **9** metatibia, dorsal view **10** lateral disc of metaventrite + metepisternum **11** protibia, dorsal view.



Figures 12–14. *Afroprinus cavicola* gen. et sp. n., mouthparts and sensory structures of the antenna. **12** mandibles, dorsal view **13** labrum, left half showing dorsal view; right half showing ventral view **14** antennal club showing sensory structures of the antenna

most perpendicular; disc of labrum (Fig. 13) convex, labral pits each with two setae; terminal labial palpomere elongate, four times as long as broad; cardo of maxilla with several short setae, stipes triangular, with three long setae; mentum quadrate, anterior

margin with deep median notch, anterior and lateral margins with a row of sparse short ramose setae, disc of mentum with several short setae; terminal maxillary palpomere (Fig. 5) elongate, five times as long as broad, approximately 2.5 times as long as penultimate palpomere.

Anterior margin of clypeus (Fig. 4) slightly elevated, surface punctate, slightly depressed medially; frontal stria well impressed, curved outwardly, carinate, complete; continued as carinate supraorbital stria; disc of frons (Fig. 4) entirely densely and coarsely punctate, punctures separated by spaces shorter than half of their diameter, sparser near margins; eyes flattened, visible in dorsal view.

Pronotal sides (Fig. 1) moderately narrowing anteriorly, anterior angles blunt; marginal pronotal stria complete, slightly carinate, visible along its entire length in dorsal view; pronotal disc entirely punctate, punctures separated by spaces 1-2 times as wide as puncture diameter; pronotal hypomeron setose; scutellum small, inconspicuous.

Elytra: epipleuron with fine scattered punctures; marginal epipleural stria complete; marginal stria straight, well impressed, carinate, continued as intermittent apical stria. Humeral stria well impressed on basal third, somewhat obliterated by coarse punctuation; inner subhumeral stria well developed, visible as long median fragment posteriorly nearly reaching first dorsal stria; with carinate dorsal striae 1-4 (some specimens with a vague fragment of fifth stria on fourth elytral interval); striae 1-3 sub-equal in length, posteriorly reaching approximately five-sixths of elytral length, fourth dorsal stria slightly shorter, anteriorly well-connected with carinate sutural stria; sutural stria straight, well impressed, posteriorly connected with fragmented apical stria; between sutural stria and suture with row of microscopic punctures. Entire surface coarsely and densely punctate, punctures separated by spaces sub-equal to their diameter or shorter, periscutellar area with slightly sparser punctuation; interspaces with isodiametric microsculpture.

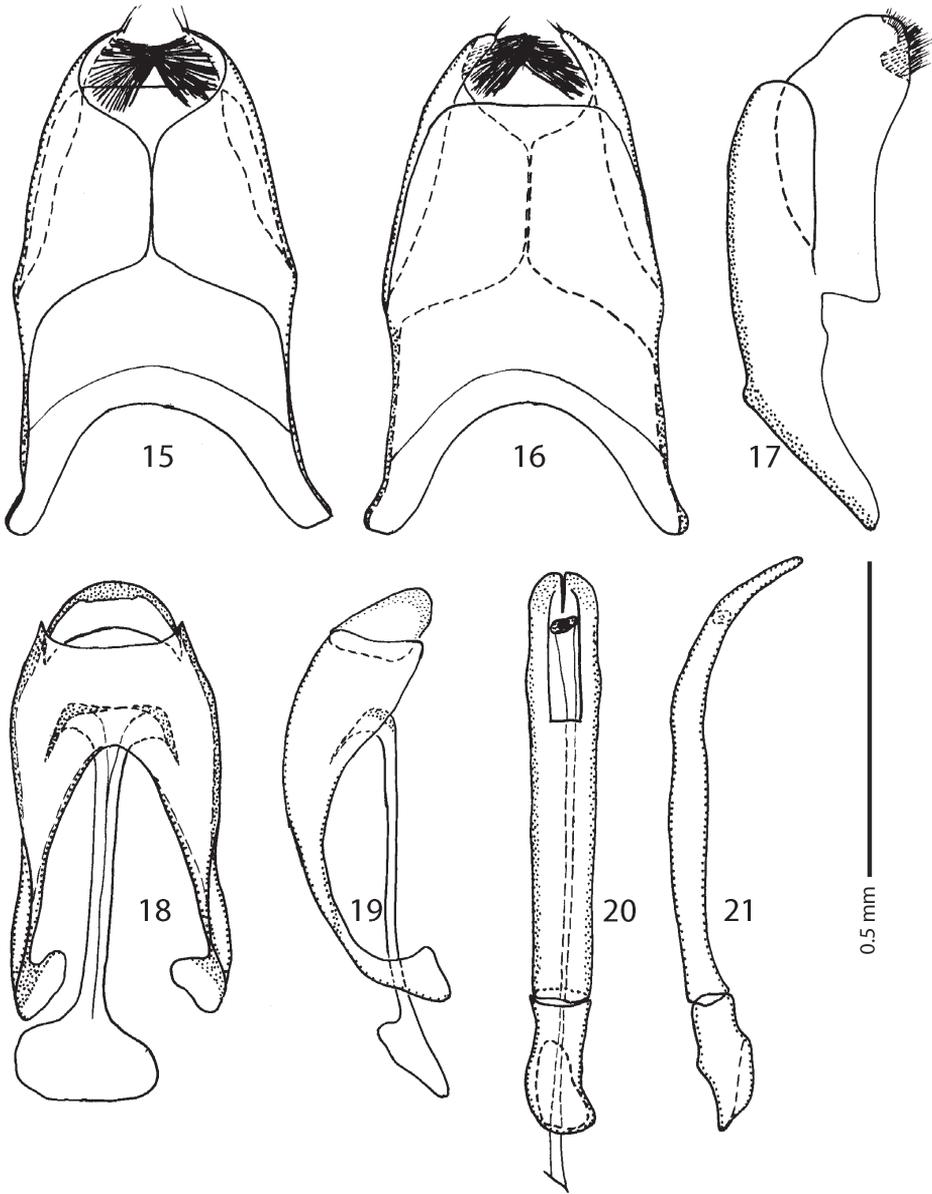
Propygidium (Fig. 7) completely exposed, its punctuation similar to that on elytra and pygidium.

Antero-median margin of prosternum (Fig. 8) straight, rounded laterally; pre-apical foveae deep, connected by marginal prosternal stria; prosternal process apically convex, rounded; carinal prosternal striae (Fig. 8) almost parallel-sided, apically reaching approximately half-length of prosternal process; lateral prosternal striae carinate, terminating in large pre-apical foveae; entire prosternal process with scattered punctures.

Antero-median margin of mesoventrite straight; discal marginal mesoventral stria well impressed, emarginate anteriorly, complete; disc of mesoventrite with scattered round punctuation; meso-metaventral sutural stria undulate.

Intercoxal disc of metaventrite slightly convex, entirely covered with scattered fine punctures separated by spaces 2-3 times as wide as their diameter, anteriorly punctures becoming coarser and denser, in male more so; lateral metaventral stria (Fig. 10) straight, carinate, almost reaching metacoxa; lateral disc of metaventrite slightly impressed, with deep round punctures; metepisternum + fused metepimeron with distinctly denser punctures; marginal metepisternal stria complete, deeply impressed.

Intercoxal disc of first abdominal sternite with complete lateral striae, disc with scattered fine punctures, separated spaces as wide as 3 times puncture diameter.



Figures 15–21. *Afroprinus cavicola* gen. et sp. n., male terminalia. **15** eighth sternite and tergite, ventral view **16** ditto, dorsal view **17** ditto, lateral view **18** ninth and tenth tergites, dorsal view; spiculum gastrale, ventral view **19** ninth, tenth tergites and spiculum gastrale, lateral view **20** aedeagus, dorsal view **21** ditto, lateral view.

Protibia (Fig. 11) slightly dilated; outer margin with 6 short teeth, each topped by short rounded denticle gradually reducing in size towards base of tibia, followed by a minute denticle; setae of outer row sparse, short; setae of median row even shorter; pro-

tarsal groove deep; anterior protibial stria carinate, shortened apically; protibial spur minuscule, approximate to tarsal insertion; outer part of posterior surface of protibia smooth, demarcated from median part by distinct straight line; posterior protibial stria complete, terminating in two inner posterior denticles, separating median part of posterior surface from smooth inner part of posterior surface; inner margin of protibia with dense row of lamellate setae that gradually increase in size towards tibial apex.

Mesotibia (Fig. 6) slender, outer margin with a single row of short denticles gradually increasing in size towards tibial apex; setae of outer row moderately long, sparse, lightly sclerotized; setae of median row much thinner and sparser; posterior stria almost complete and only slightly shortened distally; anterior surface with a row of short denticles on outer margin, surface otherwise smooth; anterior stria complete; apical spur short; apical margin of with several stout denticles; claws of terminal tarsomere slightly bent, shorter than half tarsomere length.

Metatibia (Fig. 9) more slender than mesotibia, its denticles sparser than those of mesotibia, otherwise similar to it.

Male genitalia: Eighth sternite (Figs 15–16) divided longitudinally; vela present, with dense brush of long setae; apex of eighth sternite with one or two short setae (Fig. 15); eighth tergite and eighth sternite fused laterally (Fig. 17). Ninth tergite (Fig. 18) not longitudinally divided medially; spiculum gastrale (Fig. 18) almost parallel-sided, abruptly dilated apically; basal end broadly rounded, spatulate. Aedeagus (Figs 20–21) almost parallel-sided, slightly broadening apically, in apical third curved ventrad; basal piece short, ratio of its length to length of parameres 1 : 4; parameres fused almost along their basal two-thirds.

Etymology. The specific epithet was derived using a compounding method of word formation, by stringing together Latin word ‘caverna’ meaning cave and combining element of Latin origin ‘-cola’ (orig. *colo, ere* to inhabit) meaning inhabitant, referring to the cavernicolous habitat of this new species. ‘Cavicola’ is a noun in apposition, which is in accordance with ICZN rules; Article 11.9.1.2

Key to identification of Afrotropical genera of Saprinae

This key is preliminary and in future will be revised, especially in regard to the ill-defined and heterogeneous genera *Saprinus*, *Hypocacculus*, *Chalcionellus* and *Pholioxenus*. *Pholioxenus* shows a discontinuous distribution, with about two-thirds of its species living nidicolously inside burrows and faecal chambers of small ground mammals in the Palearctic region and one-third found free-living in South Africa, Namibia etc., with a single species of unknown biology (*P. trichooides* Kapler, 1992) described from north Sudan (Mazur 2011). Revision of the genus *Pholioxenus* is in preparation (Lackner, manuscript). Subgenera, with exceptions of *Hesperosaprinus* and *Neosaprinus* of the Nearctic and mainly Neotropical genus *Euspilotus* which are pertinent to this key, are excluded, since they fall within the limits of their respective genera. Limits of the Afrotropical region are according to Löbl and Smetana (2004) and encompass the

entire continent of Africa south of Sahara, the island of Madagascar, along with Cape Verde Archipelago, São Tomé & Príncipe, Seychelles, Réunion, Comoros, island of Saint Helena and other smaller islands.

- 1 (10) Frontal and supraorbital striae completely absent (for fig. see Lackner 2010: fig. 302)¹
- 2 (7) Prosternal pre-apical foveae absent (for fig. see Lackner 2010: fig. 305)
- 3 (6) Prosternum setose, elytral epipleuron setose, marginal elytral stria single
- 4 (5) Lateral metaventral stria reaching metepisternum; all dorsal elytral striae 1–4 well developed; carinal prosternal striae strongly approximate, weak (absent in some specimens); lateral prosternal striae anteriorly joined by marginal prosternal stria (Fig. 22) ***Saprinus* subgenus *Pilisaprinus* Kanaar, 1996**
- 5 (4) Lateral metaventral stria shortened, not reaching metepisternum; dorsal elytral striae weakly developed, almost obliterated by coarse and dense punctation; carinal prosternal striae present as vague rudiments on prosternal apophysis or completely absent; lateral prosternal striae rudimentary, never joined anteriorly (for fig. see Lackner 2009: fig. 64); pronotal depressions absent ***Terametopon* subgenus *Psammoprinus* Gomy & Vienna, 1996**
- 6 (3) Prosternum asetose, elytral epipleuron asetose; marginal elytral stria double .
..... ***Gnathoncus* Jacquelin-Duval, 1858**
- 7 (2) Prosternal pre-apical foveae present (Fig. 8)
- 8 (9) Prosternal pre-apical foveae small and connected by a deep sulcus (Fig. 23)..
..... ***Euspilotus* subgenus *Neosaprinus* Bickhardt, 1909**
- 9 (8) Prosternal pre-apical foveae well developed, deep and not connected by a deep sulcus (Fig. 24); marginal prosternal stria present anteriorly, but not connecting prosternal pre-apical foveae.....
..... ***Euspilotus* subgenus *Hesperosaprinus* Bickhardt, 1909**
- 10 (1) At least supraorbital striae always present, often both frontal and supraorbital striae present (Fig. 4)
- 11 (12) Frons with a massive frontoclypeal projection with a remnant of frontal stria (for fig. see Lackner 2009, fig. 4)
..... ***Terametopon* subgenus *Terametopon* Vienna, 1987**
- 12 (11) Frons without any projection (Fig. 4)
- 13 (22) Prosternal pre-apical foveae absent (for fig. see Lackner 2010, fig. 305)²
- 14 (17) Dorsal surface almost completely impunctate; hind femora swollen (Fig. 25)

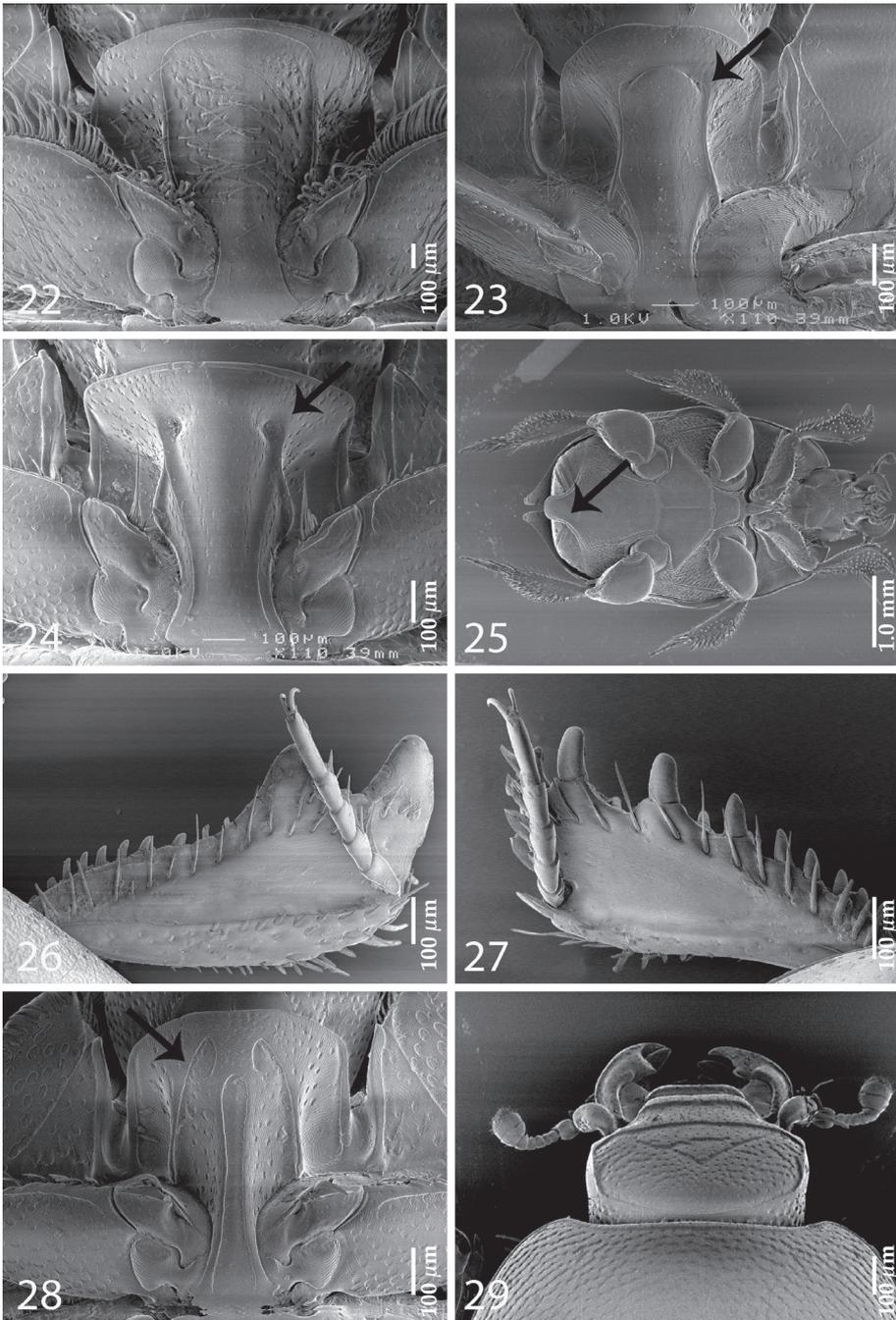
¹ The species *Xenonychus tridens* (Jacquelin du Val, 1852) also known from several sub-Saharan countries (Chad, Mauritania and Niger) as well as from the Cape Verde Archipelago has variable frontal and supraorbital striae, which are mostly present. This species possesses well-developed prosternal pre-apical foveae and setose elytral epipleuron. The other African species, *X. somaliensis* (Thérond, 1963) known only from Somalia, lacks frontal and supraorbital striae altogether, but has likewise well-developed pre-apical foveae and setose elytral epipleuron (see also Lackner 2012 for details).

² Species *Neopachylopus secqi* Kanaar, 1998 recorded from Djibouti possesses extremely small pre-apical foveae visible only with strong magnification.

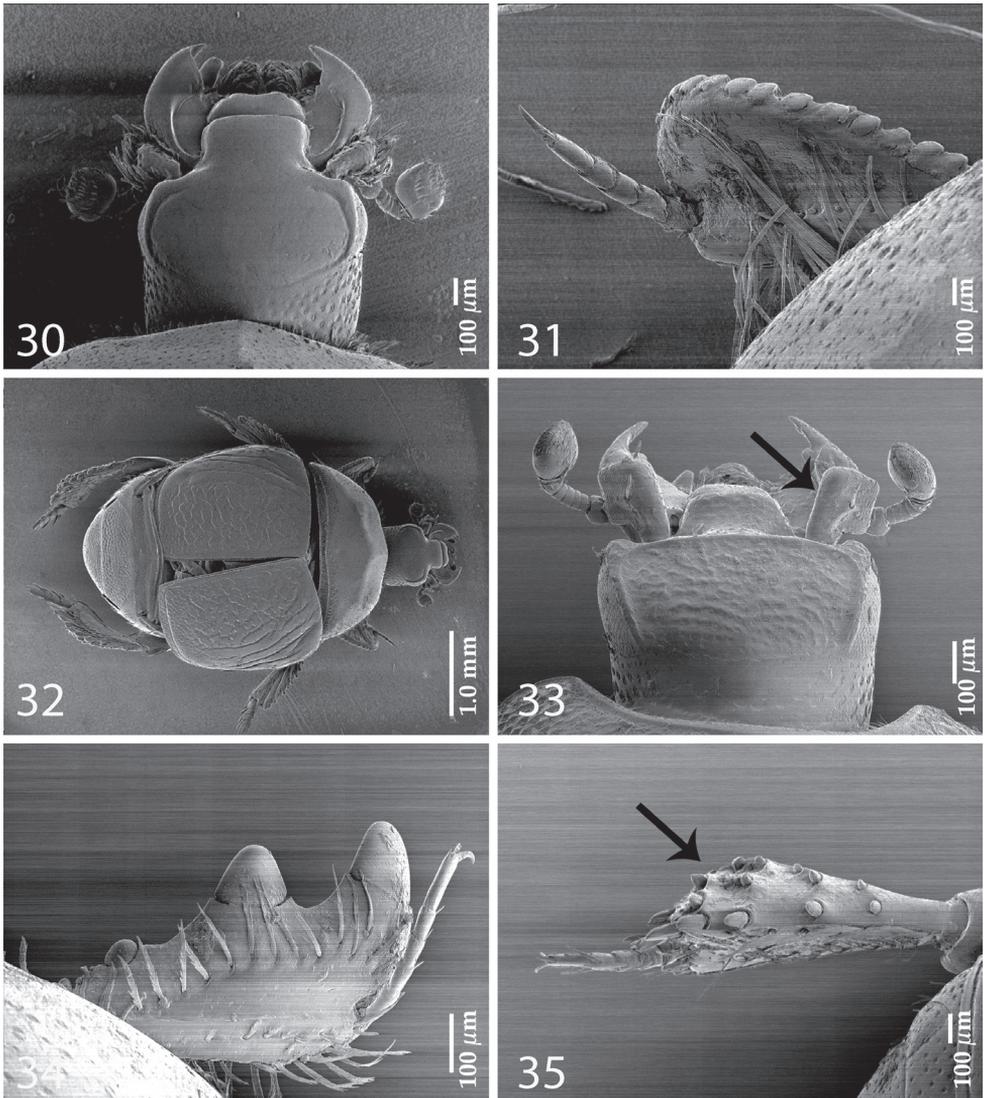
- 15 (16) Protibia on outer margin with two massive triangular distal teeth topped by short rounded denticle, followed by approximately ten short thin denticles diminishing in size in proximal direction (Fig. 26). Sexually dimorphic taxon with female having pointed elytral apices and first abdominal sternite projected, overlying the rest of the sternites (Fig. 25).....***Pachylopus* Erichson, 1834**
- 16 (15) Protibia on outer margin with approximately nine low teeth topped by large denticle gradually diminishing in size in proximal direction (Fig. 27); both sexes similar in appearance, sexual dimorphism absent.....
.....***Neopachylopus secqi* Kanaar, 1998**
- 17 (14) Dorsal surface usually punctate; hind femora normally not swollen (Fig. 1)
- 18 (19) Lateral prosternal striae apically conspicuously hooked inwardly (Fig. 28); frontal disc with two deeply marked chevrons (Fig. 29)
.....***Parahypocaccus* Vienna, 1995**
- 19 (18) Configuration of lateral prosternal striae variable, but their apices never hooked inwardly and frontal disc without chevrons
- 20 (21) Frontal stria almost absent, supraorbital stria well developed (Fig. 30), protibia with dense row of small round almost identical stout denticles on anterior and outer margins (Fig. 31); elytral disc with deep transverse rugae (Fig. 32)
.....***Paraphilothis* Vienna, 1994**
- 21 (20) Frontal stria complete or interrupted (and occasionally prolonged onto clypeus); shape of protibia variable, but never with a dense row of short identical stout denticles; elytral disc usually punctate, transverse rugae never present.....
.....***Saprinus* Erichson, 1834**
- 22 (13) Prosternal pre-apical foveae present (Fig. 4)
- 23 (28) Prosternal pre-apical foveae connected by marginal prosternal stria (Fig. 4)
- 24 (25) Pronotal hypomeron setose; body black, never metallic
.....***Pholioxenus*³ (in part) Reichardt, 1932**
- 25 (24) Pronotal hypomeron glabrous; body metallic or not
- 26 (27) Pronotal depressions (for fig. see Lackner 2010: fig. 146; 'pronotal fovea') present, body in most cases metallic, dorsal punctuation not coarse or very dense
.....***Chalcionellus*⁴ Reichardt, 1932**
- 27 (26) Pronotal depressions absent, species not metallic, punctuation of dorsum very coarse and dense (Fig.1)
.....***Afroprinus* gen. n.**
- 28 (23) Prosternal pre-apical foveae not connected by marginal prosternal stria (for fig. see Lackner 2010: fig. 148)
- 29 (30) Antennal scape strongly thickened (Fig. 33).....
.....***Dahlgrenius* Penati & Vienna, 1995**
- 30 (29) Antennal scape not strongly thickened (Fig. 4)

³ Several species of *Pholioxenus* do not have their pre-apical foveae connected by marginal prosternal stria. In this regard, they resemble species of the genus *Hypocacculus*. Limits of both genera are unclear and highly subjective, pending the revision of both genera.

⁴ Exception *C. io* Mazur, 1993.



Figures 22–29. Assorted Sapriniinae characters. **22** *Saprinus (Pilisaprinus) verschureni* Thérond, 1959, prosternum **23** *Euspilotus (Neosaprinus) rubriculus* (Marseul, 1855), prosternum **24** *Euspilotus (Hesperosaprinus) modestus* (Erichson, 1834), prosternum **25** *Pachylopus dispar* Erichson, 1834, female, ventral view **26** *Pachylopus dispar* Erichson, 1834, protibia, dorsal view **27** *Neopachylopus secqi* Kanaar, 1998, protibia, dorsal view **28** *Parahypocaccus weyerichi* Vienna, 1995, prosternum **29** *Parahypocaccus weyerichi* Vienna, 1995, head, dorsal view.



Figures 30–35. Assorted Sapriniinae characters. **30** *Paraphilothis mirabilis* Vienna, 1994, head, dorsal view **31** *Paraphilothis mirabilis* Vienna, 1994, protibia, dorsal view **32** *Paraphilothis mirabilis* Vienna, 1994, habitus, dorsal view **33** *Dahlgrenius aurosus* (Bickhardt, 1921), head, dorsal view **34** *Exaesiopus laevis* Théron, 1964, protibia, dorsal view **35** *Exaesiopus laevis* Théron, 1964, metatibia, dorsal view.

31 (32) Frontal stria widely open anteriorly, prolonged onto clypeus; dorsal elytral striae 1-3 completely erased by coarse and dense punctuation.....

..... ***Saprinus (Saprinus) caeruleatus* Lewis, 1905**

32 (31) Frontal stria usually complete and often carinate; elytral striae 1-3 normally observable

- 33 (37) Frons coarsely and densely punctate, with numerous short rugae, occasionally with several transverse deep rugae (for fig. see Lackner 2010: fig. 420)
- 35 (36) Pronotal hypomeron setose; protibia with two massive triangular distal denticles (Fig. 34); metatibia strongly thickened, outer margin with three-four rows of short denticles (Fig. 35)..... ***Exaesiopus* Reichardt, 1926**
- 36 (35) Pronotal hypomeron setose or not; protibia with four to seven low teeth topped by moderately large denticles gradually diminishing in size in proximal direction (for fig. see Lackner 2010: 461); metatibia normally not very thickened, its outer margin normally with two to three rows of denticles.....
..... ***Hypocaccus* Thomson, 1867**
- 37 (33) Frons finely to moderately punctate (for fig. see Lackner 2010: fig. 400)
- 38 (39) Pronotal hypomeron normally asetose, most of the taxa with metallic tinge..
..... ***Hypocacculus* Bickhardt, 1914**
- 39 (38) Pronotal hypomeron always setose, taxa almost always without metallic tinge ***Pholioxenus* Reichardt, 1932** (in part)

Discussion

In the recently performed phylogenetic analysis focused on the resolving the relationships of the higher taxa of the Sapriniinae subfamily, this new genus has been placed within a large and unresolved clade of genera that all share a unique synapomorphy of a single, pear-shaped vesicle inside the antennal club, as well as several weaker synapomorphies, which are possibly homoplasies (Lackner, unpublished). Within that large unresolved clade, *Afroprinus* was placed in a small dichotomy, sister to a South African member of the genus *Pholioxenus*, *P. oleolus* Théron, 1965 that was included in the analysis to test the monophyly of the genus *Pholioxenus*. Both *Afroprinus* and *P. oleolus* are characterized by the putatively plesiomorphic feature of prosternal pre-apical foveae connected by marginal prosternal stria. Such a feature, which might also represent a convergence, is normally present among the members of the subgenera *Hemisaprinus* and *Neosaprinus* of the genus *Euspilotus* and its absence among other members of *Pholioxenus* points to the possible polyphyly of the genus. In the analysis, *Hemisaprinus* and *Neosaprinus* came out closer to the root of the cladogram unrelated to the large clade mentioned above.

Cavernicolous habits are not common in the Histeridae, with most of the troglophilous genera belonging to subfamilies and tribes containing mostly microhisteridae: Dendrophilinae: Bacaniini (e.g. genera *Troglobacanius* Vomero, 1974, or *Sardulus* Patrizi, 1955), Abraecinae: Abraecini (genus *Spelaeabraeus* Moro, 1957), Acritini (genus *Spelaeacritus* Jeannel, 1934), see also Kovarik and Caterino (2005) for more thorough enumeration of the cavernicolous histerids. *Spelaeacritus anophthalmus* Jeannel, 1934 even shares some of the morphological adaptations that are typical of cavernicolous beetles: elongate body appendages, quasi-prognathous head, and fused elytra (Kovarik and Caterino 2005). In the Sapriniinae there are currently several genera whose species

are known to have been collected inside caves: *Gnathoncus* Jacquelin du Val, 1858 (*G. cerberus* Auzat, 1923 and *G. cavicola* Normand, 1949), *Tomogenius* Marseul, 1862 (*T. incisus* (Erichson, 1842); *T. ripiciola* (Marseul, 1870); *T. motocola* Mazur, 1990 and *T. papuaensis* Gomy, 2007)), *Euspilotus* Lewis, 1905 (*E. (Neosaprinus) rubriculus* (Marseul 1855); *E. (N.) scrupularis* (J.E. LeConte, 1859); *E. (N.) burgeoisi* (Desbordes, 1920); *E. (N.) turikensis* Kanaar, 1993 and *E. (Hesperosaprinus) modestus* Erichson, 1834 and *E. (H.) sterquilinus* (J.L. LeConte, 1859) (Kovarik & Caterino 2005 and Lackner, unpublished)). None of these taxa exhibit any morphological adaptations to the cavernicolous way of life and according to Kovarik & Caterino (2005), they are attracted to bat guano accumulated inside these caves and presumably feed on fly larvae developing in it. The habitat of *Afroprinus*, which is similar to the genera mentioned above, is atypical for the members of the large and poorly resolved clade of the yet unpublished phylogeny of the Sapriniinae subfamily. Typically, its other members, such as the genus *Chalcionellus* are predators inhabiting open areas and are normally found on dung or carcasses in dry or semiarid steppe zones, on shoals of rivers or beaches. This group contains all of the hitherto known true psammophiles, as well as an obligate termitoxene.

Regarding the Sapriniinae collected in caves in the Afrotropical region apart from *Afroprinus cavicola*, a single non-native species, *Euspilotus (Neosaprinus) rubriculus* (Marseul, 1855) has also been collected inside a cave. This Neotropical species (for details on its distribution see Mazur 2011: 192) has been introduced to the French island of La Réunion in the Indian Ocean and to the British Overseas Territory of Saint Helene in the Atlantic Ocean (Desbordes 1919; Thérond, 1972; Gomy 2005). Specimens collected on La Réunion have been found inside a lava tube in the faeces of the Mascarene Swiftlet (*Collocalia francica* Gmelin, 1789) (Gomy 2005). Gomy (2005) concluded that its cavernicolous habitat “*n’a rien d’exceptionnel*” and hypothesized that this species could have come from Brazil with a shipment of some kind of legumes, probably soy beans or corn. The species seems to be well established on the island, since it has been collected in the same environment again (Gomy 2005). Perhaps the above-mentioned Sapriniinae taxa (including *Afroprinus*) that have been collected inside caves show an early stage of colonisation of the cave environment by Sapriniinae histerids. Sapriniinae are one of the most ecologically plastic histerids, occurring inside mammals’ burrows, ant nests, on decomposing vegetation, on coastal wrack, deep under shifting sands, and even on flowering plants (see Lackner 2010 for details on Sapriniinae biology). The discovery of this peculiar new genus inside an African cave proves that our knowledge of Afrotropical Sapriniinae is still incomplete.

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Description and scanning electron microscopic observation of a new species of the genus *Polycopetta* (Crustacea, Ostracoda, Cladocopina) from an interstitial habitat in Japan

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Abstract

A new species of the genus *Polycopetta* Chavtur, 1981, *Polycopetta quadrispinata* sp. n. is described from the interstitial environment of Mihomasaki Beach in Japan. These observations showed some morphological peculiarities of *Polycopetta quadrispinata* sp. n. compared with its congeners; *P. monneroni* Chavtur, 1979, *P. curva* Chavtur, 1979, *P. bransfieldensis* (Hartmann, 1987), and *P. pax* Kornicker and Harrison-Nelson, 2005. Three characteristics are described for the first time: (1) a seta with serrated tip on the male antennula, (2) the endopodite of the fifth limb consisting of two podomeres, (3) the long spermatozoa in the male posterior body. More detailed observations of the type species are needed in order to update the generic diagnosis.

Keywords

Endopodite of fifth limb, long spermatozoa, male antennula, pore systems, *Polycopetta*

Introduction

The genus *Polycopetta*, belonging to the Suborder Cladocopina, was originally proposed by Chavtur (1979), but the name of this genus could not be used because the type species had not been designated. Subsequently, Chavtur (1981) assigned the type species and gave a diagnosis for the genus, after which *Polycopetta* Chavtur, 1981 was accepted as a valid name. The generic diagnosis of *Polycopetta* based on Chavtur (1981) is as follows: Carapace oval and concave anteriorly; frontal organ consists of one seta split at distal half; third podomere of male antennula with two ventral setae; male antennal endopodite bearing dorsal outgrowth and hook-like protrusion, and terminal podomere in both sexes with ventral protuberance; basis of fifth limb with one internal and three external setae, and exopodite with four terminal setae; outgrowth between the furcal lamellae rounded and armed with spines; male left furcal lamella with six claws.

Thus far four species have been described in this genus: the type species *Polycopetta monneroni* Chavtur, 1979, *P. curva* Chavtur, 1979, *P. bransfeldensis* (Hartmann, 1987) and *P. pax* Kornicker & Harrison-Nelson, 2005. Three species are found in the sediment of the seafloor at depths of 60 to 265m, except for *P. pax*. This species has been reported from a *Riftia pachyptila* (giant tube worm) aggregation at a depth of 2500m.

During the faunal survey along the Pacific coast in Japan, a species of *Polycopetta* was found in interstitial habitats for the first time. In the present paper, the authors describe this new species, including observations of the detailed structure of the carapace and appendages, obtained by using a scanning electron microscope (SEM).

Materials and methods

Sand material was collected from the Mihomasaki beach, Shizuoka City, Shizuoka Prefecture, Japan (Fig. 1) at 40 cm below the shoreline sand surface, at low tide. The samples were washed five times in a bucket with fresh water, and the top layer of water was strained through nets of 40 μ m mesh size. The living specimens were picked out from the remaining deposits under a stereo-binocular microscope (SZH 10, OLYMPUS). The observed specimens were fixed in 8% formalin with neutral buffer (hexamethylenetetramine), and preserved in 80% ethanol at room temperature. The soft parts and valves were dissected with fine needles and mounted in Neo-Shigalar (Shiga Konchu Fukyusha, Tokyo, Japan), or glycerine, on glass slides under a stereo-binocular microscope, and then observed and sketched using a transmitted-light binocular microscope (BX 50, OLYMPUS) with a differential interference contrast system and a camera Lucida. The valves and soft parts, treated with the t-butyl alcohol freeze-drying method, were also coated with osmium and observed by SEM (JSM-5600LV, JEOL).

The type series was deposited in the collection of the Shizuoka University Museum, identified by registration numbers with prefix SUM-CO.

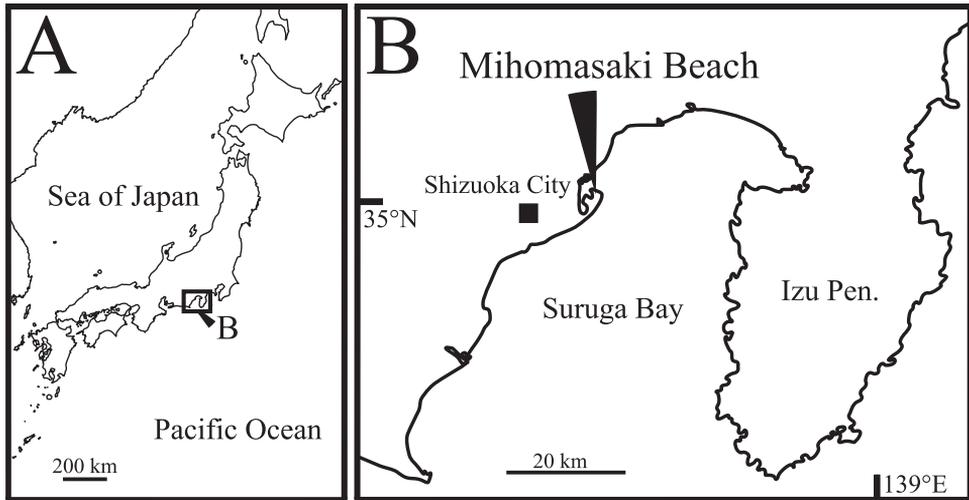


Figure 1. Sampling site. **A** map of Japan **B** type locality of *Polycopetta quadrispinata* sp. n.

Taxonomy

Order Halocyprida Dana, 1853

Suborder Cladocopina Sars, 1866

Family Polycopidae Sars, 1866

Genus *Polycopetta* Chavtur, 1981

***Polycopetta quadrispinata* sp. n.**

urn:lsid:zoobank.org:act:2247D429-CEB0-4BA8-BD51-D9FF89F995FD

http://species-id.net/wiki/Polycopetta_quadrispinata

Figs 2–13

Type series. Holotype: adult male (SUM-CO-2093), right valve length 357 μm , height 301 μm , left valve length 358 μm , height 288 μm , soft parts mounted on a slide and valves preserved in a cardboard cell slide, Paratypes: 10 adult males (SUM-CO-2094–2103) and 11 adult females (SUM-CO-2104–2114). All specimens were collected on 24 June 2009.

Type locality. The holotype specimen was collected from Mihomasaki beach, Shizuoka City, Shizuoka Prefecture, along the Pacific coast of central Japan, 35°01'13"N, 138°31'20"E (Fig. 1B); in an interstitial environment at 40 cm below the shoreline sand surface. The substrate consisted mainly of clastic very coarse sand (median grain size is about 1.5 mm).

Diagnosis. Carapace oval and anteriorly concave in lateral view. Carapace peripheral surface covered with shallow pits, except on posterodorsal area, and with scale-like sculptures in anterior area. Anterior end of both valves with one conspicuous spine. Posteroventral margin of right valve with four conspicuous spines in both sexes. In each valve, 73 simple pores, 23 pore systems involving a circular depression and two

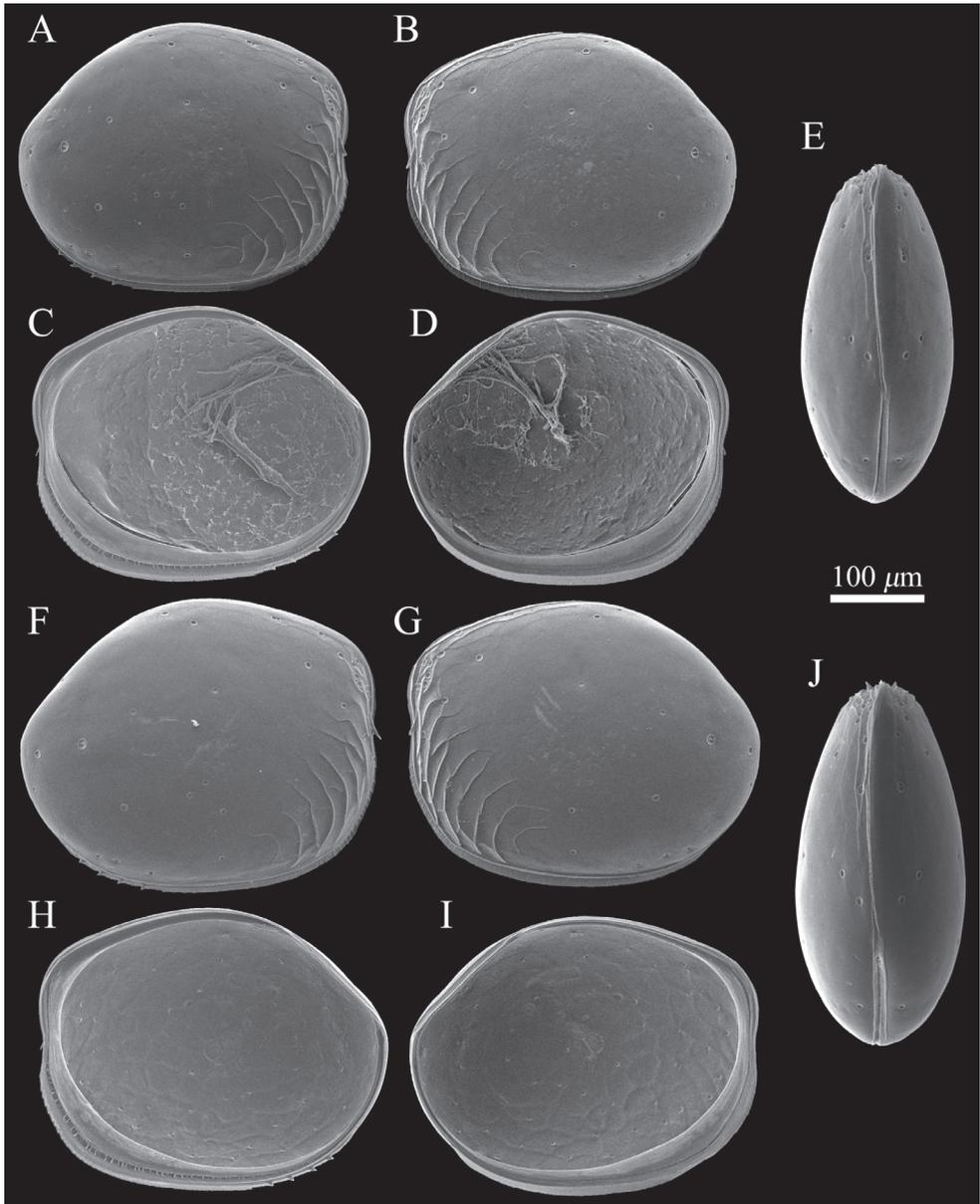


Figure 2. SEM images of *Polycopetta quadrispinata* sp. n. valves. **A** and **B** male paratype (SUM-CO-2095) **C** and **D** male, paratype (SUM-CO-2096) **E** male, paratype (SUM-CO-2097) **F** female, paratype (SUM-CO-2105) **G** female paratype (SUM-CO-2106) **H** and **I** female, paratype (SUM-CO-2107) **J** female, paratype (SUM-CO-2108). **A** right external lateral view **B** left external lateral view **C** right internal lateral view **D** left internal lateral view **E** dorsal view **F** right external lateral view **G** left external lateral view **H** right internal lateral view **I** left internal lateral **J** dorsal view.

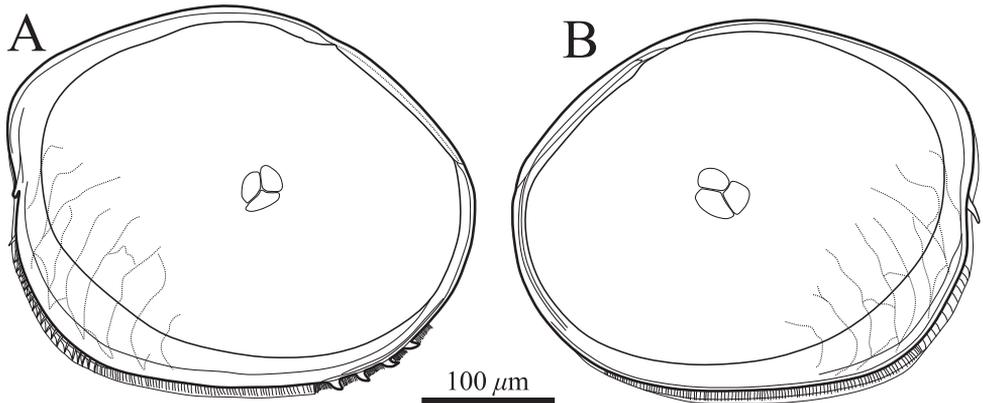


Figure 3. Valves of *Polycopetta quadrispinata* sp. n. Male, holotype (SUM-CO-2093). **A** right internal view **B** left internal view.

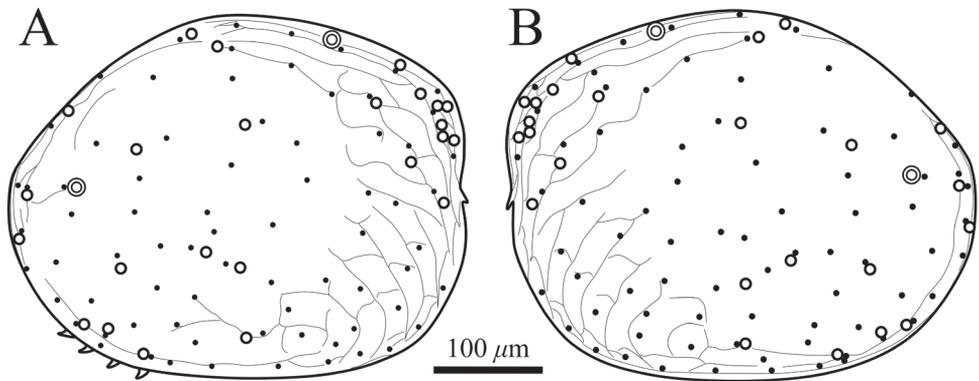


Figure 4. Distribution of pore systems and surface ornamentation of *Polycopetta quadrispinata* sp. n. drawn from an SEM image. Male, paratype (SUM-CO-2095). **A** right external view **B** left external view. Solid circle, open circle and double circle indicate the positions of simple pores, pore systems involving a circular depression and contiguous pore systems, respectively.

contiguous pore systems. Male second podomere of the antennula with one ventral seta, third podomere with one ventral seta with serrated tip. Spermatozoa length approximately 750 µm.

Description of adult male. Carapace (Figs 2A–E, 3–6). Carapace oval and anteriorly concave in lateral view. Yellowish white colour in living individuals. Carapace periphery surface covered with shallow pits except on posterodorsal area, and with scale-like sculptures on anterior area (Figs 2A, B, 3, 4). Anterior end of both valves with one conspicuous spine (Figs 2A, B, 3, 4). Mid-anterior to posteroventral margin covered with serration and fringe (Figs 2A, B, 3). Posteroventral margin of right valve with four conspicuous spines and fringe (Fig. 5A, B) and of left valve with fine serrations (Figs 2B, 3B). In each valve, 73 simple pores (Figs 4, 5C, D), 23 pore systems

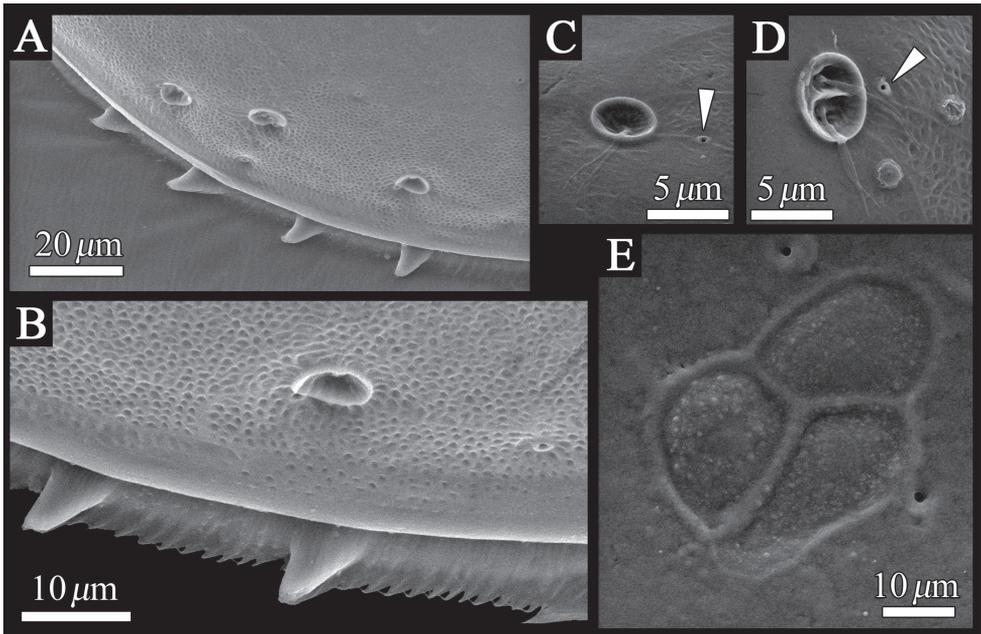


Figure 5. SEM images of the detailed structure of *Polycopetta quadrispinata* sp. n. valves. **A** male, paratype (SUM-CO-2095) **B–D** male, paratype (SUM-CO-2098) **E** male, paratype (SUM-CO-2094). **A** four spines at posteroventral margin of right valve **B** spines and fringe at posteroventral margin of right valve **C** pore system with circular depression **D** contiguous pore system **E** internal lateral view of adductor muscle scars of right valve. Arrowheads indicate simple pores.

involving a circular depression with bifurcated seta (Figs 4, 5C) and two contiguous double pore systems with bifurcated seta (Figs 4, 5D). Adductor muscle scar consisting of three closely spaced scars (Fig. 5E). Marginal infold of each valve developed along anterior to posteroventral margins (Figs 2C, D, 6B, C, J–L). Along hinge margin of right valve: anterodorsal bar and groove (Fig. 6A), anterior socket (Fig. 6E), median bar (Fig. 6F), posterior socket (Fig. 6G), and posteroventral groove (Fig. 6D, H). Along hinge margin of left valve: anterodorsal bar (Fig. 6I), anterior knob (Fig. 6M), median bar (Fig. 6N), posterior knob (Fig. 6O), and posterior bar (Fig. 6P).

Frontal organ (Figs 7A, 8B). Spinous seta divided at mid-length. Distal half with long and proximal half with short setae, respectively (Fig. 8B).

Antennula (Figs 7B, 8C). Uniramous, four articulated podomeres. First podomere rectangular in shape and tapering distally, with setulae on dorsal margin, lateral surface and at ventrodistal end, respectively. Second podomere about four-fifths as long as first podomere, with one annulated setulous seta at dorsoproximal end, one simple seta on ventrodistal end (Figs 7B, 8C), and setulae on dorsal margin, lateral surface, ventral middle margin and at ventrodistal end, respectively. Third podomere about one-fifth as long as first podomere, with one short simple seta at dorsodistal end and one seta

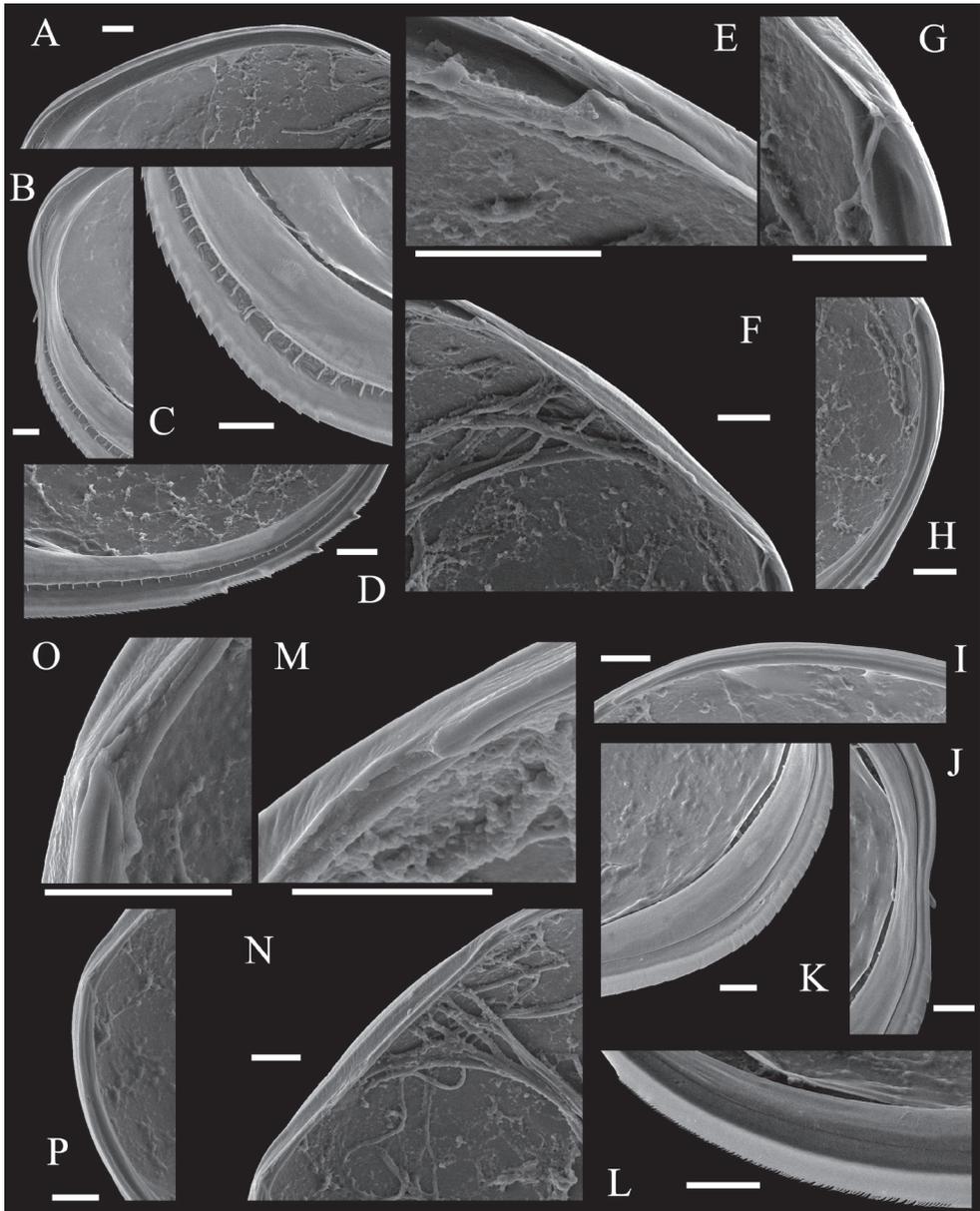


Figure 6. SEM images of internal view of *Polycopetta quadrispinata* sp. n. valves. Male, paratype (SUM-CO-2096). **A–H** right valve **I–P** left valve **A** anterodorsal bar and groove **B** anterior area of marginal infold **C** anteroventral area of marginal infold **D** posteroventral area of marginal infold **E** anterior socket of hinge structure **F** median bar of hinge structure **G** posterior socket of hinge structure **H** posteroventral groove **I** anterodorsal bar **J** anterior area of marginal infold **K** anteroventral area of marginal infold **L** posteroventral area of marginal infold **M** anterior knob of hinge structure **N** median bar of hinge structure **O** posterior knob of hinge structure **P** posterior bar. Scale bars indicate 20 μm .

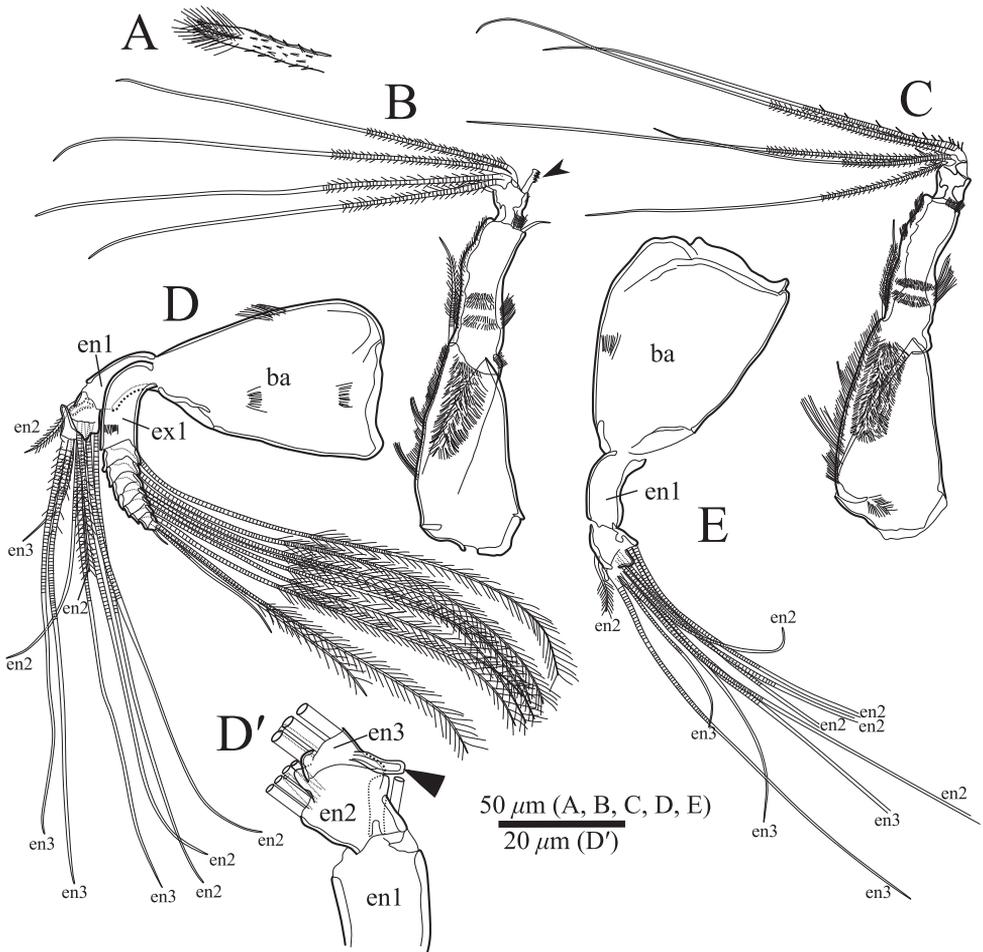


Figure 7. *Polycopetta quadrispinata* sp. n. **A, B** and **D** male, holotype (SUM-CO-2093) **C** and **E** female, paratype (SUM-CO-2104). **A** frontal organ **B** male antennula **C** female antennula **D** male antenna **D'** endopodite of male antenna without all setae **E** female antenna except the exopodite. Abbreviations: **ba** basis **en** endopodite **ex** exopodite.

with serrations at ventrodistal end (Figs 7B, 8C). Fourth podomere small, with four long setulous annulated setae.

Antenna (Figs 7D, D', 8D). Typically biramous, with exopodite and endopodite consisting of nine and three podomeres, respectively. Basis triangular and tapering distally. Exopodite: first podomere about one-third as long as basis; podomere lengths decreasing in size from second to eighth, each podomere with one long plumose annulated seta, respectively; ninth (distal-most) podomere very small, with one long annulated, one medium annulated and one short bare setae at distal end. Endopodite (Figs 7D, D', 8D): first podomere about two-thirds as long as first podomere of exopodite; second podomere half as long as first podomere, with one setulous seta along dorsal

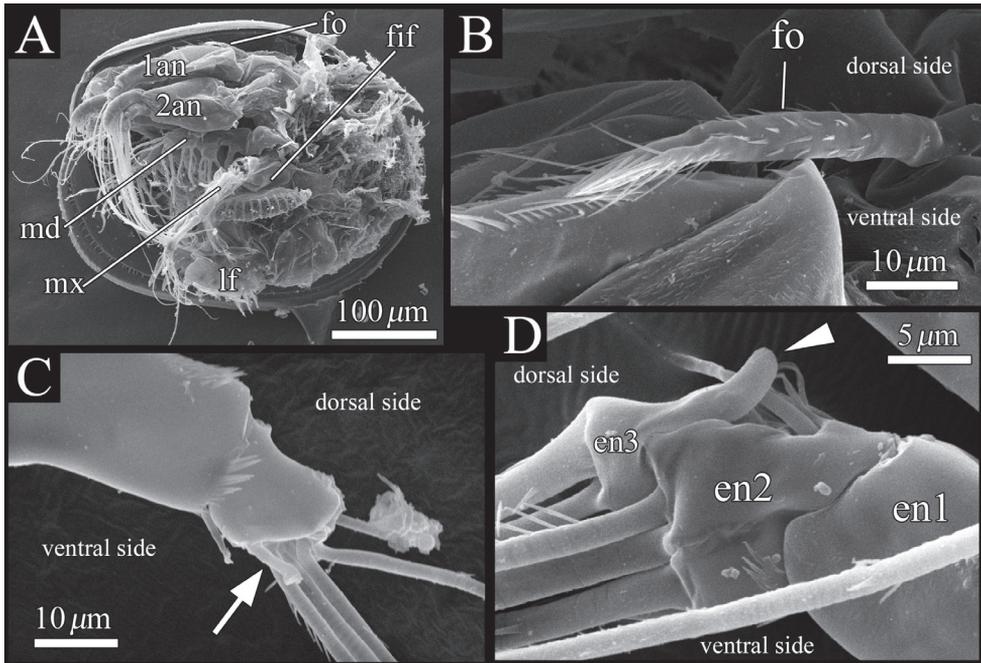


Figure 8. SEM images of male soft parts of *Polycopetta quadrispinata* sp. n. **A** left lateral view of whole body with left valve removed **B** left lateral view of frontal organ **C** right lateral view of distal area of antennula **D** left lateral view of antennal endopodite. Arrow indicates a seta with serrations at ventrodistal end. Arrowhead indicates a dorsal outgrowth of male antennal endopodite. Abbreviations: **1an** antennula **2an** antenna **en** endopodite **fif** fifth limb **fo** frontal organ **lf** left furcal lamella **md** mandibula **mx** maxillula.

margin, one clavate process at proximal middle end (Fig. 7D') and five setae at distal end consisting of three long annulated, one medium annulated and one short annulated setulous. Third podomere one-fifth as long as first podomere, with one dorsal outgrowth (Figs 7D', 8D), and two long spinous annulated, one long annulated and one short setulous annulated setae at distal end.

Upper lip (Fig. 10A). Semicircular in lateral view, with fine setae on surface (Fig. 13A).

Mandibula (Fig. 10B). Coxal endite with four teeth. Basis with four plumose annulated setae on ventral margin, and one plumose annulated seta at mid-lateral surface. Exopodite pear-shaped, distal end jagged, with thin setae, and one simple seta. Endopodite consisting of two podomeres. First podomere with three annulated plumose setae on ventral margin and two annulated long setulous setae at dorsodistal end. Second podomere very small, bearing two plumose setae at distal end.

Maxillula (Fig. 10C, C', C''). Precoxa (Fig. 10C') with seven annulated plumose setae and one stout setulous seta on ventral side. Coxa (Fig. 10C'') with two short and two medium plumose setae on lateral surface near ventroproximal margin, two short and two medium plumose setae on lateral surface of ventral middle margin. Basis rectangular, dorsally-convex in lateral view, with one medium and one long

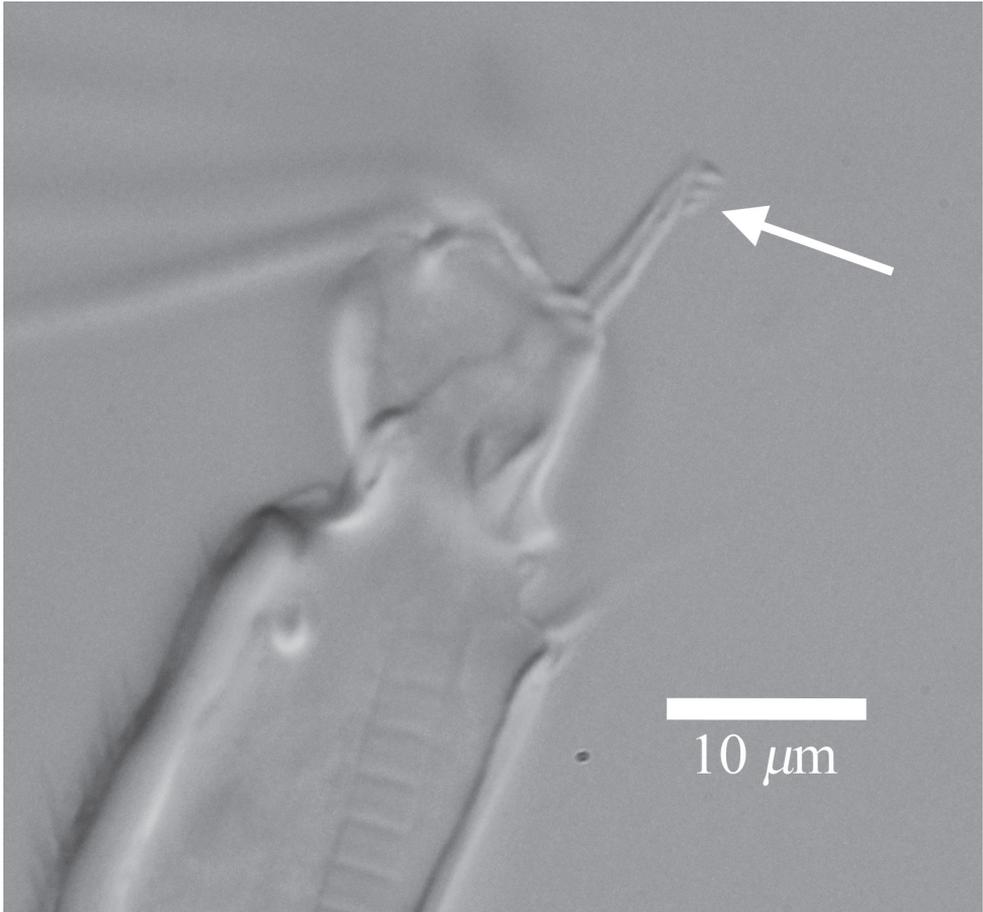


Figure 9. Light micrograph of male antennula of *Polycopetta quadrispinata* sp. n. Arrow indicates seta with serrations at ventrodistal end.

plumose setae on ventral margin, and setulae along ventral margin. First podomere of endopodite with one long plumose seta at ventrodistal end. Second podomere three-fourths as long as first podomere, with two long and one medium annulated setulous setae on ventrodistal area, one short annulated and one medium setulous annulated seta at dorsodistal end. Third podomere small, with 4 long annulated setulous setae. Exopodite with four tufts along dorsal margin, and nine annulated setae at distal end.

Fifth limb (Figs 10D, 11). Coxa bearing branchial plate (epipodite) with 15 long plumose setae, and four short setulous setae on dorsolateral area. Basis with three setulous and three plumose setae on dorsal and ventral margin, respectively. Endopodite consisting of two podomeres (Fig. 11). First podomere with one plumose seta. Second podomere rectangle, with one plumose seta. Exopodite with four setulous setae.

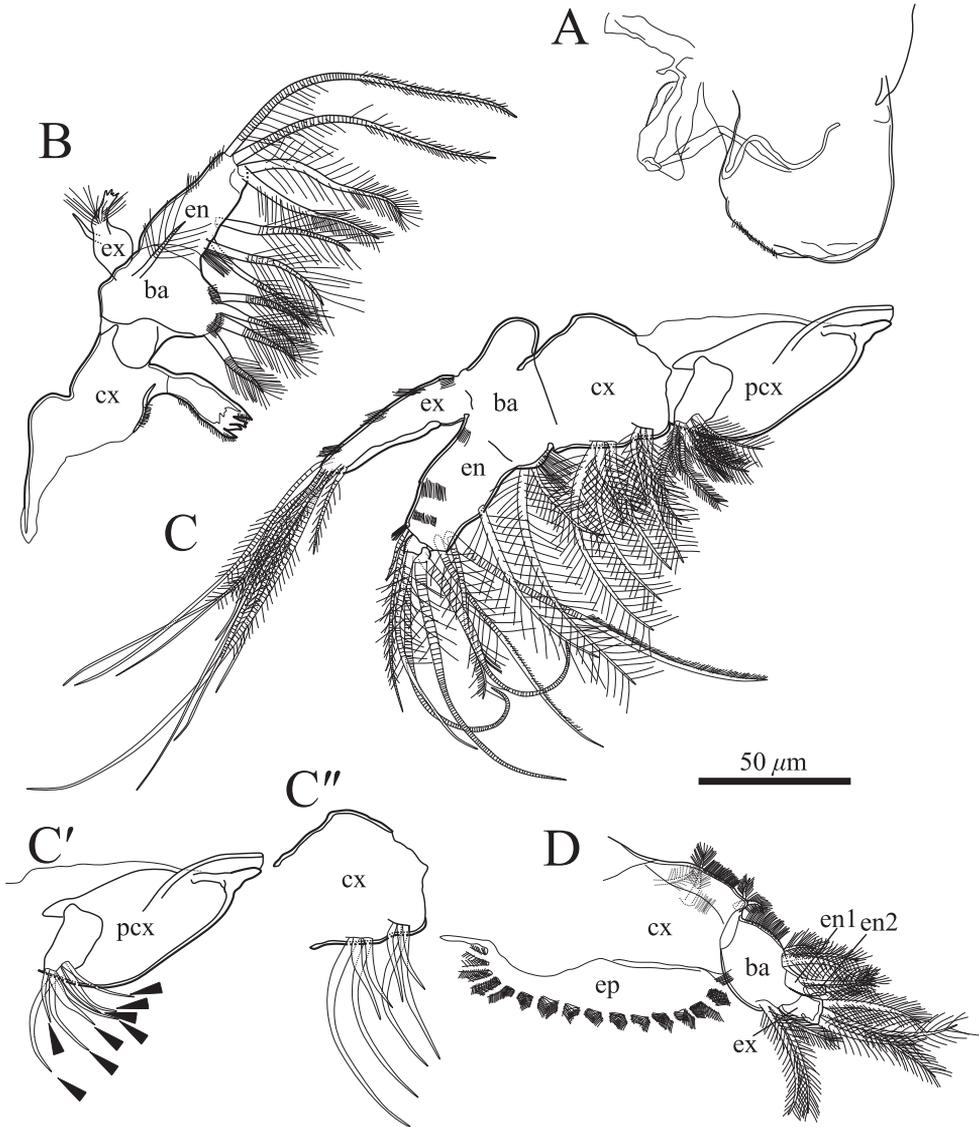


Figure 10. *Polycopetta quadrispinata* sp. n. **A** and **D** male, paratype (SUM-CO-2094) **B** and **C** male, holotype (SUM-CO-2093). **A** right lateral view of upper lip **B** mandibula **C** maxillula **C'** precoxa of maxillula except setulae on setae **C''** coxa of maxillula except setulae on setae **D** fifth limb. Arrowheads indicate tip of precoxal setae of maxillula. Abbreviations: **ba** basis **cx** coxa **en** endopodite **ex** exopodite **pcx** precoxa.

Furca (Figs 12A, 13B). Furcal claws six and seven on left and right lamella, respectively, with row of setae on dorsal side.

Male copulatory organ and posterior body (Figs 12A, 13B–D). Arising from outer surface of body on left side of terminal trunk segment as long curved copulatory duct.

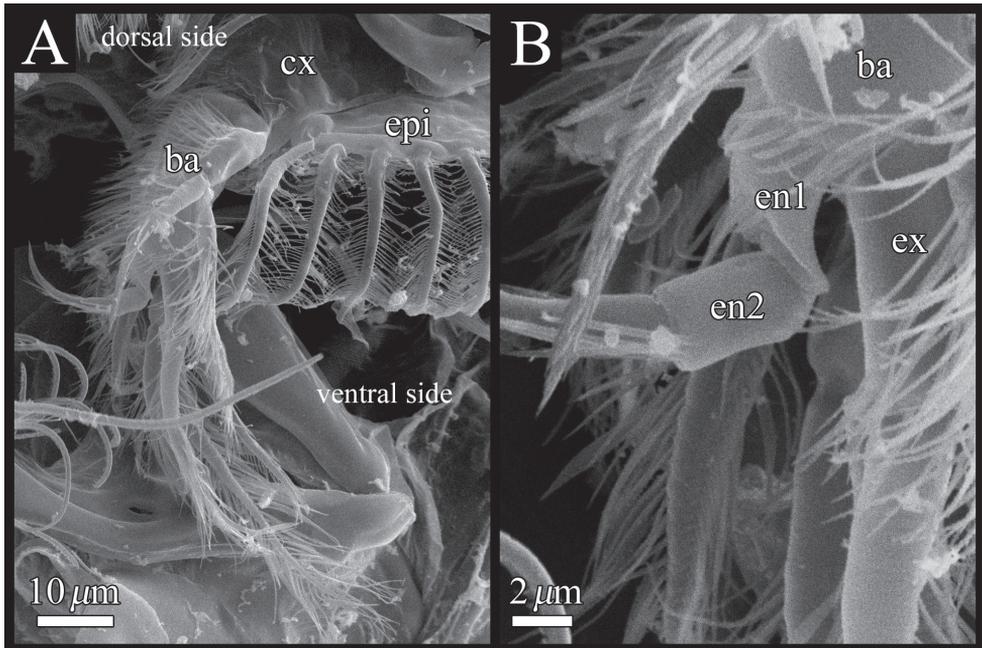


Figure 11. SEM images of male fifth limb of *Polycopetta quadrispinata* sp. n. **A** left lateral view **B** enlarged view of figure 11A. Abbreviations: **ba** basis **cx** coxa **en** endopodite **ex** exopodite **epi** epipodite.

Tuft of stout setae at ventral right side (Fig. 12A, 13C). Posterior body including a lot of very long spermatozoa, approximately 750 µm long (Fig. 12A, 13D).

Description of adult female. Mandibula, maxillula, fifth limbs, and upper lip similar to those of adult male.

Carapace (Fig. 2F–J). Carapace length and height larger than adult males.

Antennula (Fig. 7C). Uniramus, four articulated podomeres. First podomere similar to that of adult male. Second podomere about four-fifths as long as first podomere, with one annulated setulose seta at dorsoproximal end, and setulae on dorsal margin, lateral surface, ventral middle margin and at ventrodistal end, respectively. Third podomere about one-fifth as long as first podomere, with one short simple seta at dorso-distal end. Fourth podomere small, with five long setulose annulated setae.

Antenna (Fig. 7E). Only second and third podomeres of endopodite different from those of adult male. Endopodite consisting of three podomeres. Second podomere half as long as first podomere, with one setulose seta along dorsal margin and five annulated setae at distal end. Third podomere one-fifth as long as first podomere with four annulated setae at distal end.

Furca (Fig. 12B). Each lamella with seven claws.

Dimensions. See Table 1.

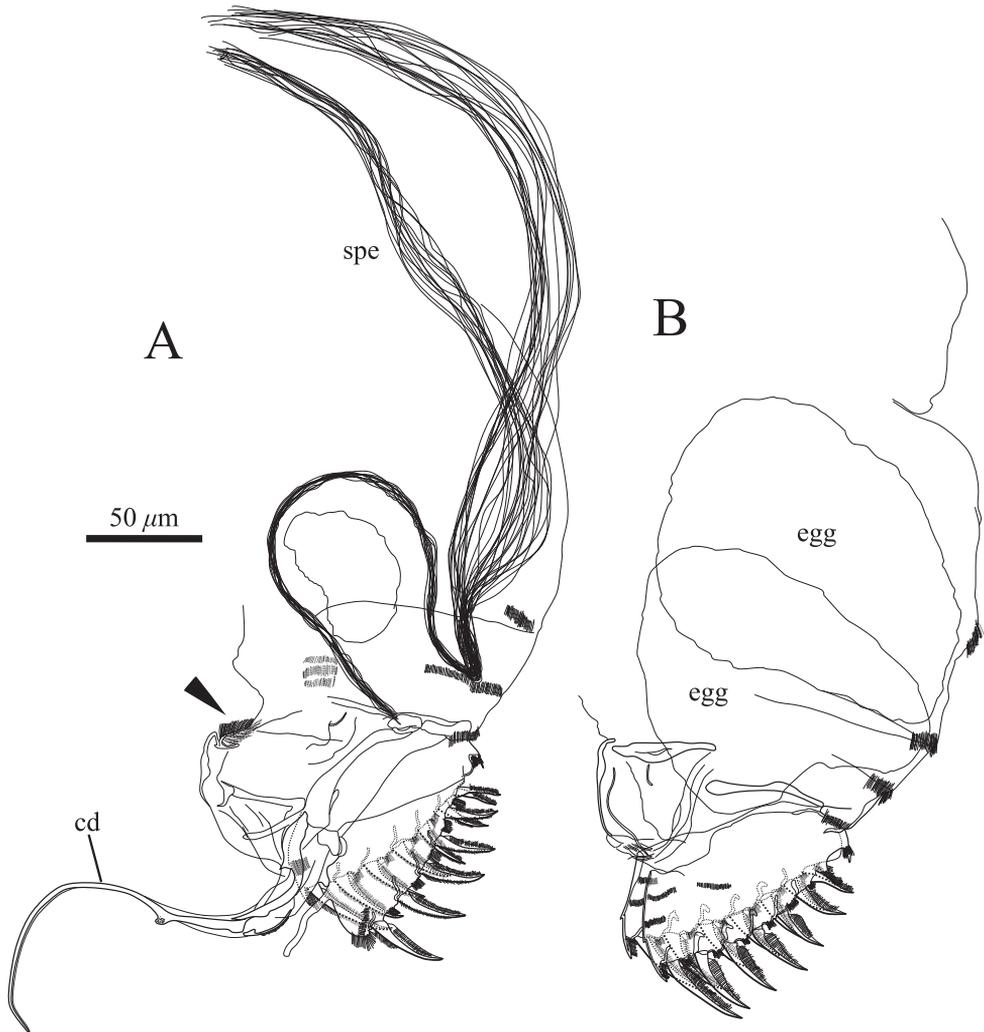


Figure 12. Posterior body of *Polycopetta quadrispinata* sp. n. **A** male, holotype (SUM-CO-2093) **B** female, paratype (SUM-CO-2106). Arrowhead indicates the tuft of stout setae. Abbreviations: **cd** copulatory duct **spe** spermatozoa.

Table 1. Dimensions of valves of *Polycopetta quadrispinata* sp. n. from type locality.

		Length (μm)			Height (μm)		
		Mean	Observed range	N	Mean	Observed range	N
Male	Right valve	357	353–361	10	296	292–301	10
	Left valve	356	353–364	10	290	288–294	10
Female	Right valve	380	372–388	9	312	306–322	9
	Left valve	381	373–389	9	308	302–316	9

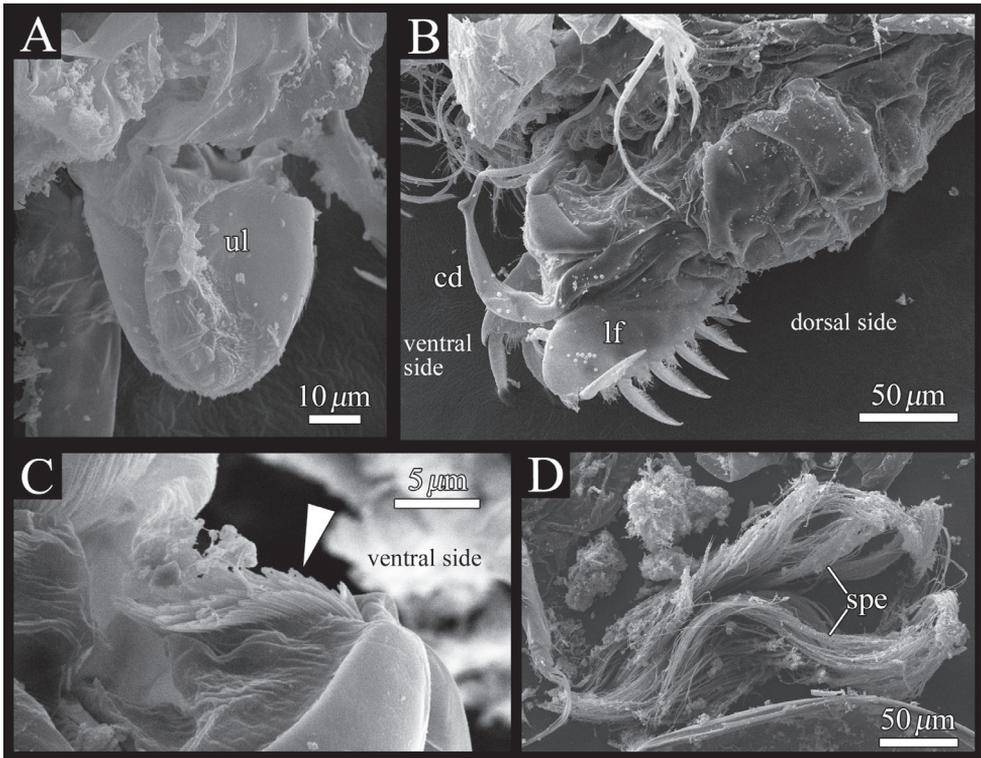


Figure 13. *Polycopetta quadrispinata* sp. n. SEM images of male soft parts of. **A** right lateral view of upper lip **B** left lateral view of posterior body, furcal lamellae and copulatory organ **C** right lateral view of the tuft of stout setae **D** fascicle of spermatozoa. Arrowhead indicates the tuft of stout setae. Abbreviations: **cd** copulatory duct **lf** left furcal lamella **spe** spermatozoa **ul** upper lip.

Occurrence. So far known only from type locality.

Etymology. Specific name *quadrispinata*, an adjective derived from the Latin prefix *quadri-* (four) and Latin adjective *spinatus* (spiny), referring to the four spines on the posteroventral margin of the right valve in both sexes.

Discussion

Existing species of *Polycopetta* are known from only a few specimens in seafloor sediment and deep sea tube worm aggregations. This study is the first report of a species of *Polycopetta* from the interstitial environment. Because 21 specimens were obtained, the authors could observe the details of their morphologies.

Four species of *Polycopetta* have been described: *P. monneroni*, *P. curva*, *P. bransfieldensis*, *P. pax*. *P. a quadrispinata* sp. n. and *P. curva* are similar to each other; i.e. both species have scale-like sculpture on the anterior carapace surface (Fig. 2A, B), one clavate process at proximal middle end of second podomere of male antennal endo-

Table 2. Interspecific morphological comparison of the genus *Polycopetta*. The dashes indicate no information from original descriptions.

Character	<i>P. monneroni</i>	<i>P. curva</i>	<i>P. bransfieldensis</i>	<i>P. pax</i>	<i>P. quadrispinata</i>
Female					
Carapace, length (μm)	325–350	450	480–490	540	372–389
Height (μm)	–	350	–	470	302–322
Height/Length (%)	–	78	–	87	79–84
number of spines at posteroventral margin of right valve	–	1	–	6?	4
Mandible, coxal endite	2 teeth	4 teeth	–	4 bifurcate teeth	4 teeth
shape of exopodite tip	flat	flat	jagged	flat	jagged
Maxillula, seta number on precoxa	7	7	5	5	8
Fifth limb, podomere number of endopodite	1	1	1	1	2
seta number of epipodite	–	–	–	12	15
Furca, claw number (left-right)	(7-7)	(6?-7?)	(7-7)	(6?-6?)	(7-7)
Male					
Carapace, length (μm)	–	450	490	–	353–364
Height (μm)	–	350	–	–	288–301
Height/Length (%)	–	78	–	–	80–85
Antennula, seta with serrations at ventrodistal end	absent	absent	–	–	present
Antenna, shape of process on 2nd podomere of endopodite	distally tapered hook-like	distally expanded and rounded hook-like	–	–	clavate
Furca, claw number (left-right)	(6-7)	(6-7)	–	–	(6-7)

podite (Fig. 8D), and four teeth as coxal endites of mandibula (Fig. 10B). They are distinguished by the number of spines at posteroventral margin of right valve, four for *P. quadrispinata* (Fig. 5A) and one for *P. curva*, respectively. This new species is distinguishable from each of the other three species by the number of coxal teeth (endites) of the mandibula (two in *P. monneroni* vs four (Fig. 10B) in *P. quadrispinata* the carapace surface ornamentation (absent in *P. bransfieldensis* vs scale-like sculpture and pits (Fig. 2A, B) in *P. quadrispinata* and the number of adductor muscle scars (six in *P. pax* vs three (Fig. 5E) in *P. quadrispinata* This new species also differs from all previously described species by details of the chaetotaxy of the antennula, antenna, maxillula and fifth limb (see Table 2).

Our observation shows some morphological peculiarities of *Polycopetta quadrispinata* sp. n. when compared with its congeners. First, the third podomere of male antennula bears one seta with serrations at the ventrodistal end (Figs 7B, 8C). This seta

has not been identified in the other species. Since this seta is only found in the male, it must be related to sexual activity; however the function of this seta is unknown at the present time. Second, the endopodite of the fifth limb consists of two podomeres (Fig. 11B). Kornicker and Harrison-Nelson (2005) stated that the podomere number is only one in *P. pax*. Third, the long spermatozoa (Figs 12A, 13D) are described in *Polycopetta* for the first time. The males have been known for three species (*P. monneroni*, *P. curva* and *P. bransfieldensis*), but there is no information about their spermatozoa. In the family Polycopidae the sperm length of *Eupolycope dispar* (Müller, 1894) and *Polycope cancella* Hartmann, 1954 have been reported (Hartmann 1955; 1968). The length of the former species is 45 μm (carapace length is 300 μm), the latter is 15 μm (carapace length is 500 μm). The sperm length (750 μm) of the new species is extreme for this family. These characters are likely to be present in other incompletely described species. In future, more detailed observation of all of these species may be needed, in order to update the generic diagnosis.

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