

# HYDROPHILIDAE:

## The genus *Kanala* BALFOUR-BROWNE

### (Coleoptera)

M. FIKÁČEK

#### Abstract

The genus *Kanala* BALFOUR-BROWNE, 1939 (Coleoptera: Hydrophilidae), endemic to New Caledonia (Grande Terre), is redescribed. Five species are recognized: *Kanala bipunctata* sp.n., *K. loebli* sp.n., *K. montaguei* BALFOUR-BROWNE, 1939, *K. punctiventris* sp.n. and *K. reticulata* BALFOUR-BROWNE, 1939. An identification key to the species is provided along with illustrations of morphological characters and habitus photographs of all species. A preliminary phylogenetic analysis of the species of *Kanala* and related genera based on morphological characters supports the monophyly of *Kanala* and points out a closer relationship with some Australian genera: *Notocercyon* BLACKBURN, 1898, *Ceronocyon* HANSEN, 1990 and *Cenebriophilus* HANSEN, 1990.

**Key words:** Coleoptera, Hydrophilidae, Sphaeridiinae, Megasternini, *Kanala*, morphology, taxonomy, phylogeny, endemism, Grande Terre, New Caledonia, Pacific.

#### Introduction

The genus *Kanala* was described by BALFOUR-BROWNE (1939) on the basis of few specimens from New Caledonia collected by P.D. Montague in 1914. The material comprised two very distinctive species and the genus was supposed to be endemic to New Caledonia. No additional data on the genus were published since that time.

Even though BALFOUR-BROWNE (1939) noted that the genus is quite similar to the Australian genus *Notocercyon* BLACKBURN, 1898, HANSEN (1990) did not mention *Kanala* in the discussions on the differential characters and relationships of seven new Australian Megasternini genera standing close to *Notocercyon* (*Australocyon* HANSEN, 1990; *Cenebriophilus* HANSEN, 1990; *Cetiocyon* HANSEN, 1990; *Chledocyon* HANSEN, 1990; *Ceronocyon* HANSEN, 1990; *Ercycodes* HANSEN, 1990; *Pseudoosternum* HANSEN, 1990).

Recently I had the opportunity to study numerous specimens of *Kanala* collected by various entomologists in New Caledonia. The morphological study revealed three undescribed species. Illustrations, SEM photographs of external characters, and an identification key to the species of *Kanala* are included.

To clear up the generic delimitations of *Kanala* and its relationships to other Megasternini genera, a preliminary phylogenetic analysis of the species of *Kanala* together with species of related genera (*Australocyon*, *Cenebriophilus*, *Cercyodes* BROUN, 1886, *Ceronocyon*, *Cetiocyon*, *Chledocyon*, *Ercycodes*, *Motonerus* HANSEN, 1989, *Notocercyon*, *Oosternum* SHARP, 1882, *Platycyon* HANSEN, 1999, *Pseudoosternum*, and *Sacosternum* HANSEN, 1989) is carried out in the present study. The analysis is based on morphological characters described by HANSEN (1989, 1990, 1991, 1999b). Additional cuticular structures of *Kanala* described in the present contribution could serve for future phylogenetic studies of this group.

## Material and methods

All holotypes and several specimens of each paratype series were dissected. The genitalia were placed on the same mount as the beetle in water-soluble dimethyl hydantoin formaldehyde resin (DMHF). The label data are cited verbatim for each type specimen, using a slash (/) for dividing rows, double-slash (//) for separate labels and square brackets ([]) for additional notes of the author; label data are adapted into the common format for non-type material.

Morphological nomenclature largely follows KOMAREK (2004) for male genitalia and most external structures and BEUTEL & KOMAREK (2004) for specific thoracic features. The nomenclature of the hind wing venation is based on KUKALOVÁ-PECK & LAWRENCE (1993, 2004), the nomenclature of female genitalia follows BAMEUL (1992) and NASSERZADEH et al. (2005). For specific features of Sphaeridiinae terms introduced by HANSEN (1991) and FIKÁČEK & BOUKAL (2004) and some new terms are used (see also figures). In contrast to earlier studies (e.g. FIKÁČEK & BOUKAL 2004), “preepisternal elevation (of mesothorax)” refers to the entire elevated posteromedian portion of the mesoventrite. A plate-like substructure of the elevation is referred to as “preepisternal plate”. The supraspecific nomenclature follows HANSEN (1999a).

Specimens of *Kanala montaguei* and *K. punctiventris* were examined using slide preparations and scanning electron microscopy (JEOL 6380 LV, Laboratory of Electronic Microscopy, Section of Biology, Charles University, Prague). In the generic description, characters based only on the examination of these species are marked by a double asterisk (\*\*), those only verified for *K. montaguei* by a single asterisk (\*). As a detailed comparison with other genera of Megasternini is not possible presently, characters which are likely shared with some or most representatives of the tribe are also mentioned.

The figures of external characters were traced from photographs; drawings of the aedeagophores and of structural details of *Kanala montaguei* were prepared using a drawing tube attached to an Olympus BX40 light microscope (from temporary glycerine slides for aedeagophores and permanent euparal slides for other features). Asymmetries shown in a drawing but not mentioned in the respective description are caused by artefacts of preparation. Habitus pictures were taken with a Olympus Camedia C-5060 camera attached to an Olympus SZX9 binocular microscope and subsequently adapted in Adobe Photoshop 7.0 partly using the procedures described at Darci Kampschroeder’s www sites at <http://nhm.ku.edu/illustration>.

A preliminary phylogenetic analysis (19 characters, 24 terminal taxa) aiming to the clarification of the position of *Kanala* within Megasternini was performed using TNT. 1.1 (GOLOBOFF et al. 2000) using exhaustive search under maximum parsimony criterion. Only taxa of the “Gondwanan” group of genera (i.e. those characterized by crescent-like median part of male abdominal sternite IX, and restricted anteroposterior movability of the median lobe) were included. The genus *Agna* SMETANA, 1978 (median part of sternite 9 crescent-like, median lobe probably without restricted anteroposterior movability, see SMETANA 1978) was excluded. *Cercyon* and *Cryptopleurum* were used as outgroups. As material of most of the included genera was not available, characters treated or illustrated by HANSEN (1990, 1991) were used. The morphology of the mesothoracic preepisternal elevation was not included in the analysis, as a re-evaluation of this structure in most genera is required.

The specimens examined are deposited in the following collections:

BMH	Bishop Museum, Honolulu; G.A. Samuelson
CNC	Canadian National Collection, Ottawa; A. Davies, P. Bouchard
FMNH	Field Museum of Natural History, Chicago; A.F. Newton, M. Thayer
IAC	Institut Agronomique Néo-Calédonien, Poquereux, New Caledonia; S. Cazères, C. Mille
KSEM	Natural History Museum, University of Kansas, Lawrence, USA; A.E.Z. Short
MHNG	Muséum d’Histoire naturelle, Genève; G. Cuccudoro, I. Löbl

MNHN	Muséum national d'Histoire naturelle, Paris, France; A. Nel
MNHW	Museum of Natural History, Wrocław University, Poland; M. Wanat
NHML	The Natural History Museum, London, U.K. (formerly British Museum of Natural History); R. Booth, M. Barclay
NMP	Národní muzeum v Praze, Czech Republic
NMW	Naturhistorisches Museum Wien, Vienna, Austria; M.A. Jäch, A. Komarek
NZAC	New Zealand Arthropod Collection, Auckland, New Zealand; R.A.B. Leschen
TTPC	Collection Thomas Théry, Fleury les Aubrais, France

### List of Localities

(**Loc. 2001/NC**: leg. Balke & Wewalka, **Locs. 2009/NC**: leg. Jäch)

**Loc. 2001/NC 36**: 5–10 km south of Kouaoua, Creek des Orangers, 180 m a.s.l., 15.XI.2001. Stream (max. 2–4 m wide), in deep creek besides road, partly shaded, with pools (max. 1.5 m deep), ground rocky/gravelly, with slow flowing sections, banks sandy/gravelly, in part with leaves.

**Loc. 2009/NC 26** (see JÄCH & BALKE 2010: Fig. 50): Mt. Do, ca. 20 km ESE La Foa, near summit (ca. 1,000 m a.s.l., 21°45'14"S/166°48'00"E) and further below (ca. 820 m a.s.l., 21°45'38"S/165°59'59"E), 3.XII.2009.

**Loc. 2009/NC 27** (see JÄCH & BALKE 2010: Fig. 46): ca. 8 km NNE Bouloupari, ca. 120 m a.s.l., 21°48'08"S/166°04'12"E, 3.XII.2009. Stream (La Wamuttu), hardly flowing, mostly over bare rock and between big boulders, with numerous rock pools, through degraded forest.

### *Kanala* BALFOUR-BROWNE, 1939

*Kanala* BALFOUR-BROWNE 1939: 373.

TYPE SPECIES: *Kanala reticulata* BALFOUR-BROWNE, 1939 (orig. des.).

REDESCRIPTION: Total length 1.5–3.5 mm. Body moderately to strongly convex dorsally, elongate to broadly oval, without pronoto-elytral angle. Coloration dark, black to brown, yellowish lateral margins of pronotum and/or small yellowish to reddish spots on the basal and apical parts of the elytra in some species (see Figs. 29–33).

Head: **Clypeus and frons** with fine to very coarse and densely arranged setiferous punctures, anterior clypeal margin slightly convex to very slightly excised, narrowly rimmed, very indistinctly widened laterad; frontoclypeal sulcus not visible; interantennal ridge not developed, visible only as a narrow transverse area without punctuation on each side, not connected medially to each other. **Eyes** small, convex, separated by 6.0–8.5 × of width of one eye. **Gula** distinct, quite narrow, gular sutures slightly concave; posterior tentorial pits small. **Labrum** (Fig. 20, \*) retracted under clypeus, weakly sclerotized, anterior margin trilobate, median lobe less protruding anteriorly than lateral lobes; basally distinctly narrowed; anterolateral margin with numerous long, hair-like setae, length increasing towards lateral edge, extremely long in posterolateral corners; lateral portions of median lobe with groups of ca. six stouter setae near anterior margin; anterior margin of left lateral lobe with row of ca. seven longer setae of similar thickness. **Mandible** (Fig. 21, \*) with simple obtusely pointed apex, angle between basal and apical parts distinct; outer margin with sparsely arranged setae, both ventral and dorsal surfaces with numerous campaniform sensilla; mesal margin with field of densely arranged microtrichia; microtrichia of medio-distal area longer; retinaculum absent; mola large, protruding mesad, with complicated superficial microsculpture. **Maxilla** (Fig. 22, \*) with small subtriangular cardo attached in groove laterally of submentum; basistipes subtriangular, bearing numerous campaniform sensilla and a few short setae; mediostipes slightly longer than basistipes, bearing long setae; palpifer ca. as long as basistipes, bearing a row of short stout setae on outer margin and a group of long setae on mesal area; lacinia bilobed, proximal lobe larger, rounded, distal lobe small, finger-like, both lobes bearing densely arranged microtrichia; galea bilobed, distal lobe much longer than proximal lobe, both lobes with densely arranged hair-like setae, setae of

proximal lobe only indistinctly arranged in longitudinal rows; basal part of galea with large sucking disc in males, margin of disc with fine but very dense pubescence (Fig. 1, \*\*); maxillary palp with four palpomeres; palpomere 1 minute; palpomeres 2 and 4 subequal in length; palpomere 3 slightly shorter than 4; numerous very long and thin hair-like setae inserted on palpomere 2, setae on palpomeres 3 and 4 sparse and slightly stouter; palpomeres 2 and 3 slightly to distinctly widened apically, palpomere 4 spindle-like. **Labium** (\*\*) with submentum as wide as and slightly shorter than mentum, bearing numerous setae; microsculpture absent; mentum (Figs. 2, 19) ca.  $2.0 \times$  as wide as long, widest in posterior 0.33, slightly narrowing posteriorly, strongly narrowing anteriorly; anterior margin more or less bisinuate, with distinct median emargination, mesally with a transverse sulcus along anterior margin, surface bearing setiferous punctures; prementum distinctly protruding, subdivided into densely pubescent lateral lobes bearing crescent-shaped palpiger with numerous setae; labial palpus with three palpomeres, attached to palpiger; palpomere 1 minute, without setae; palpomere 2 ca. twice as long, with subapical fringe of long setae; palpomere 3 longest, with few subapical setae. **Antenna** with nine antennomeres (Fig. 6); scapus long and thin, ca. as long as antennal club; antennomeres 2–6 combined shorter than scapus; cupula small; antennal club compact, elongate, ca.  $2.0\text{--}2.5 \times$  longer than wide, antennomere 8 distinctly shorter than antennomeres 7 and 9.

Prothorax (Figs. 3–5): **Pronotum** arcuately narrowed anteriorly, anterior margin slightly bisinuate, posterior margin nearly simply arcuate; lateral margins not explanate and not deflexed, narrowly rimmed; surface with fine to coarse setiferous punctures, without recognizable row of punctures at posterior margin. **Hypomeron** with very narrow lateral glabrous portion distinctly separated from mesal pubescent portion; mesal portion subdivided into posteromesal and intermediate part by glabrous intrahypomeral ridge, anteriorly continuous with narrow but well defined antennal grooves anteriorly; hypomeral process not developed. **Prosternum** carinate medially, median part forming pubescent portion limited from lateral glabrous parts by very distinct oblique ridges, anteromedian part slightly projecting towards gula; posterior part forming “prosternal process” with large posterior notch. **Coxal cavity** closed internally; sclerotized postcoxal bridge reinforced mesally, protruding into bluntly pointed lobe posteromesally; coxal fissure very short; notopleural suture nearly indistinct. Accessory ridge below posterior pronotal margin present, laterally obliterated, recognizable as indistinct “transverse fold”. **Profurca** composed of a short and wide stalk and a slightly widened asymmetrical extension with distinctly shorter mesal margin and blunt apex.

Mesothorax (Figs. 7–14): **Scutum** (\*) fused with scutellum (scuto-scutellar suture not recognizable), smooth, with a row of small setae along posterior margin. Scutellar shield exposed, triangular, slightly longer than wide; a few setae present along anterior margin and few punctures on surface. **Elytron** (Figs. 12–13) with 10 series of punctures, series 1–5, 7 and 10 nearly reaching elytral base; series 6 and 8–9 arising subbasally; sequence of rows reaching apical part of elytra (\*\*, from apex basad): 1, 2, 3+8+9, 4+5, 6+7, 10; elytral interstices bearing fine to dense setiferous punctation; elytral margin not explanate and not deflexed laterally, without denticulation or serration; pseudopipleuron ca. twice wider than epipleuron subbasally, obliquely vertical, glabrous, reaching elytral apex; epipleuron pubescent, narrow, reaching metathorax; paler than dorsal elytral surface. **Mesoventrite** fused with anepisternum 2, anapleural suture absent; anterior collar large and subdivided into two large lobes laterally, very narrow and fused with anepisternum 2 medially. Cavities for reception of procoxae deep and wide, lacking pubescence, not reaching mesocoxae, complicated in structure. Posterior portion of anepisternum 2 with distinct coxal lobe not reaching epimeron 2 laterad, with posterolateral roundly rectangular lobe delimiting large excision laying laterally. Pleural suture distinctly developed; epimeron 2 with large ventral portion reaching posterior margin of anterior collar. Mesoventrite with high posteromedian **preepisternal elevation** (Figs. 8–11) subdivided by a shallow notch into short anterior part steeply declining anteriorly and long posterior part widely

contacting anteromesal margin of metaventrite, in some species bearing distinctly defined elongate oval or drop-like median plate; posterolaterally with large laterad protruding bulges separating the elevation from coxal lobe. **Mesofurca** (Fig. 14) well developed, with two arms arising separately from coxal wall, connected by a median bridge subbasally; arms short, thin, fused with mesoventrite subapically, without leaf-like basal extensions; apical part with plate-like rounded extension.

Metathorax (Figs. 9, 16): **Metanotum** weakly sclerotized, ca.  $2.5 \times$  wider than long, with well developed anteromedian membranous area, alacristae slightly diverging posteriad. Katepisternum 3 and metacoxal processes not exposed. **Metaventrite** with slightly raised subpentagonal median portion with smooth interstices and fine to coarse setiferous punctation; lateral portions bearing dense hydrofuge pubescence, interstices with variable scale-like microsculpture (see Fig. 18 for microsculpture of *K. montaguei*). Anteromedian part of metaventrite slightly projecting anteriad, reaching ca. half of length of mesocoxal cavities (Figs. 9–11). Anterior margin of metaventrite with very distinct anterolateral ridges arising on anterolateral corners of anteromedian projection, not meeting and not bending posteriad mesally; parallel to posterior margin of mesocoxal cavities, nearly reaching anterolateral corner of metaventrite, here arcuately bending posteriad, reaching ca. anterior 0.4–0.9 of length of metaventrite laterally. Surface indistinctly crenulate immediately behind anterolateral ridges. Femoral lines absent, median part of metaventrite with obtusely rounded projection posteriorly. **Anepisternum 3** narrow, ca.  $4.8\text{--}5.8 \times$  as long as wide, bearing short transverse ridge anteriorly. **Epimeron 3** with minute but distinct ventral portion. **Metafurcal** stalk carinate medially, widened towards to arms, without basal extension; metafurcal arms without basal extensions, with large lateral extension directed laterad at apices (Fig. 16, \*). **Hind wing** (Fig. 23, \*): Radial cell strongly pigmented, situated in proximal 0.45 of wing length; r3 absent, r4 arising close to proximal end of radial cell. Medial loop well-developed, with RP developed only distad of r4, not visible more proximad. Apical field with strongly pigmented  $RA_4+RP_1$ ,  $RP_2$  and  $RP_{3+4}$ . Cross vein  $rp\text{-}mp_2$  absent. MP strong,  $MP_{1+2}$  fused directly with RP; medial spur well developed, short. MP connected with CuA by cross vein  $mp\text{-}cua$  (which represents most probably fusion of two cross veins, J. Kukulová-Peck, personal communication). Cu well developed, forked subdistally into  $CuA_{1+2}$  and  $CuA_{3+4}$ ,  $CuA_{1+2}$  fused with remains of  $MP_{3+4}$ . Anal vein with well-developed  $AA_{3+4}$  forked into  $AA_3$  and  $AA_4$  subproximally;  $AA_3$  fusing with Cu and forming very short and narrow first cubito-anal cell (“basal cell” sensu HANSEN 1991),  $AA_4$  nearly reaching posterior wing margin. Second cubito-anal cell (“wedge cell” sensu auct.) not developed. Jugal lobe not developed. All known species are macropterous.

Legs (Figs. 24–26, \*): Procoxae subglobular, narrowly separated; mesocoxae transverse, moderately separated by preepisternal elevation and anteromedian part of metaventrite; metacoxae transverse, contiguous medially. Pro- and mesocoxae pubescent ventrally, metacoxae with glabrous anterior and pubescent posterior portions. Proximal part of all trochanters concealed by coxae, distal parts obliquely projecting anteriorly (in anterior legs) or posteriorly (in middle and posterior legs), bearing only few hair-like setae. All femora not contacting whole lateral margin of trochanters, with well-defined tibial grooves delimited in whole femoral length ventrally and in distal half dorsally. Femora pubescent at least in proximal parts, pubescence dense in profemora, sparser in meso- and metafemora. Protibia slightly widened distally, without lateral or laterodistal emargination, bearing a row of short spiniform setae along both outer and inner margins, ventral surface with three longitudinal rows of fine setae and with a group of four small spines apically, dorsal surface with one longitudinal row of very stout spines alternating with finer ones and with large and stout spiniform setae along outer margin and apically. Meso- and metafemora with a row of short spines along outer and inner margins, some long and stout spines present on outer margin of mesofemora; both ventral and dorsal surface with three longitudinal rows of fine spiniform setae; distal apices with long stout spines. Tarsi slightly

shorter than tibiae, pro- and mesotarsi with tarsomere 1 slightly longer than tarsomeres 2–4 but slightly shorter than tarsomere 5, metatarsi with tarsomere 1 longest, tarsomeres 2–5 subequal in size; all tarsi sparsely to densely pubescent ventrally. Claws small, arcuate, empodium minute, bisetose.

**ABDOMEN** (Fig. 15) with five ventrites extensively covered with hydrofuge pubescence, ventrite 1 slightly longer than ventrites 2–5, carinate medially, bearing numerous more or less distinct parallel longitudinal ridges submesally. Ventrites 2–5 ecarinate, lacking submesal ridges.

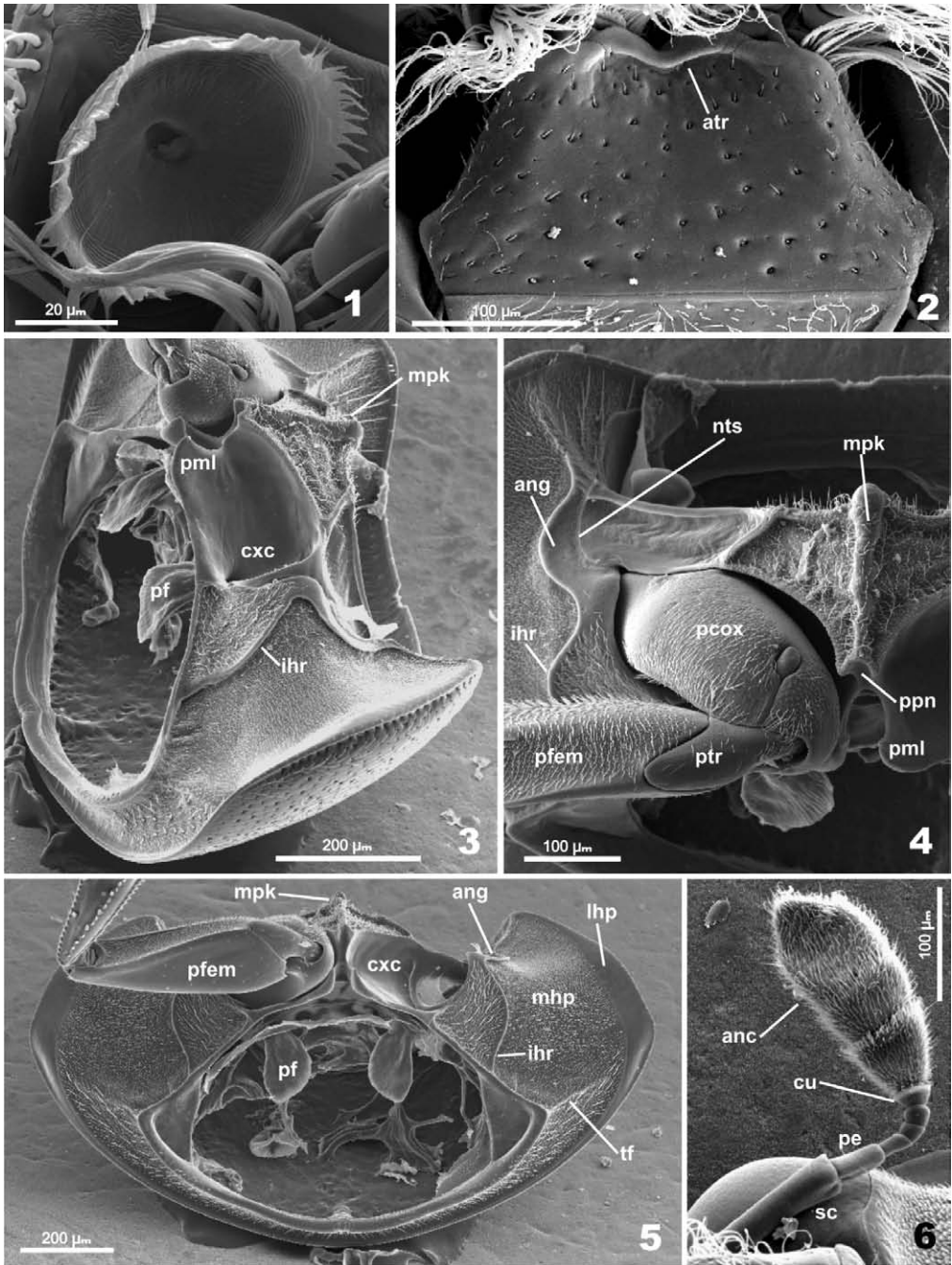
**Male genitalia** (Figs. 17, 43–49): Aedeagus of trilobed type. Phallobase longer than parameres, symmetrical, arcuately bending in lateral view, ventral surface with acute median longitudinal edge, basal part with long symmetrical manubrium bending ventrad. Median lobe with basal apophyses very short, only indistinctly reaching into phallobase, with restricted antero-posterior mobility, with distinctly developed corona in subapical position and with very narrow, finely ridged lateral rim in apical portion. Ventrite 9 with crescent-like median part lacking anteromedian tongue-like projection, lateral stalk-like sclerites attaching to narrow anterolateral projection of median sclerite; basal part of median sclerite with short median projection.

**Female genitalia** (Fig. 27, \*): Coxo- and gonostyli 9 thick, stalk-like; coxostylus ca.  $2.2 \times$  as long as gonostylus, bearing a few campaniliform sensilla proximally and subdistally; gonostylus with two campaniliform sensilla proximally and two long hair-like sensilla at distal apex. Mediotergite 8 only partly sclerotized, with numerous sensilla in its narrow sclerotized distal part. Laterotergite 8 T-shaped, weakly sclerotized distally. “Median sclerite” bilobed, densely pubescent on posterior margin, lateral-most hairs longest. Membraneous portions of genitalia not examined.

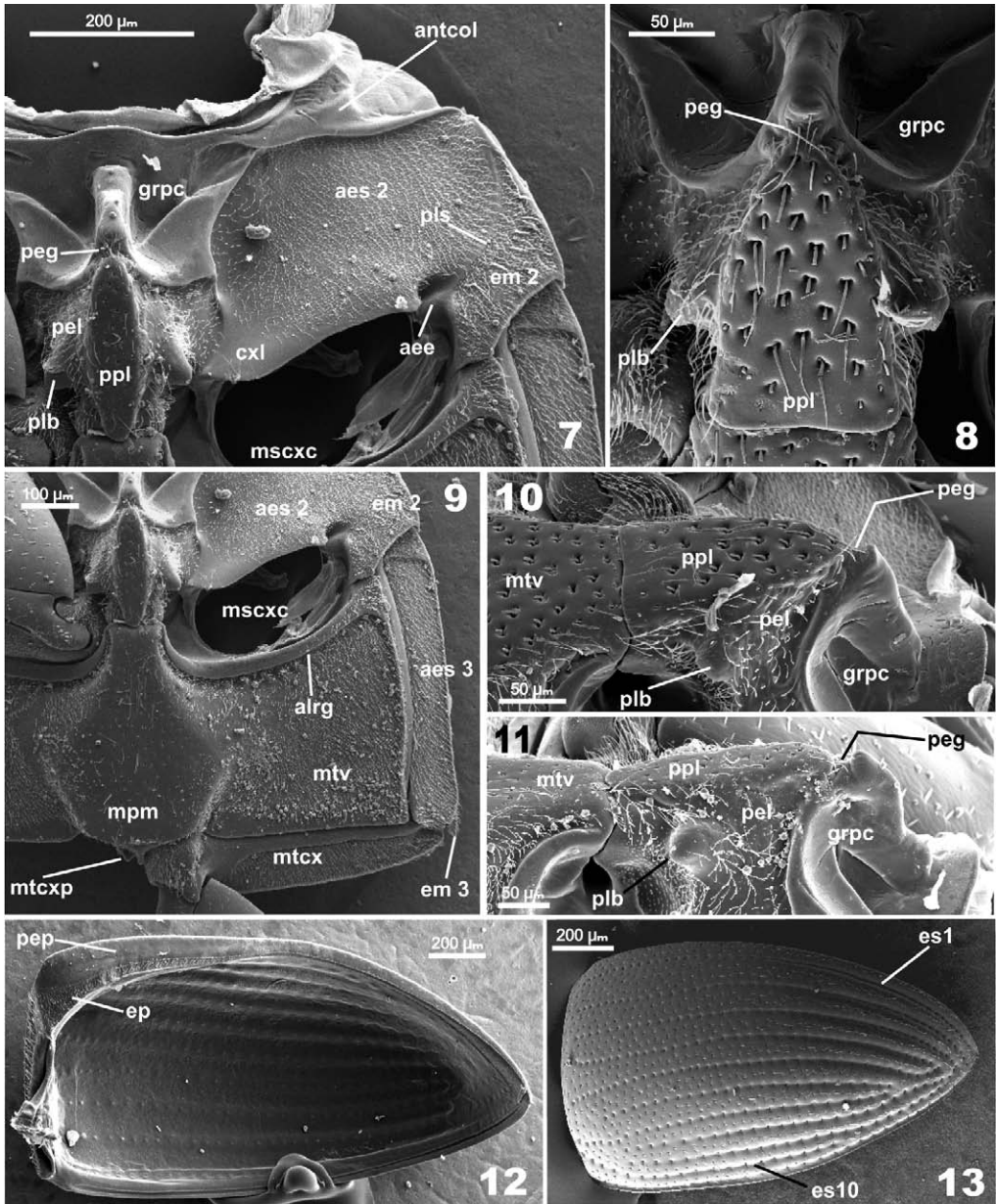
**Differential diagnosis:** Based on the comparison with other genera of the “Gondwanan” group and the preliminary phylogenetic analysis performed in this study, three character states are supposed to be unique for *Kanala* and supporting the monophyly of the genus: (1) preepisternal elevation with large posterolateral bulges, (2) manubrium of phallobase inflexed ventrad, and (3) anteromedian part of metaventrite protruding anteriorly to ca. midlength of mesocoxae.

BALFOUR-BROWNE (1939) and HANSEN (1991) mentioned two additional diagnostic characters of *Kanala*: (1) a triangular preepisternal plate, and (2) widely separated mesocoxae. The triangular shape of the preepisternal elevation seems to correspond with the presence of the posterolateral bulges on the elevation (the preepisternum seems thus triangular on the first view, irrespective to its detailed morphology). Mesocoxae are widely separated in all species of *Kanala* (in contrast to e.g. *Cercyon*), but this character is shared also by some other “Gondwanan” Megasternini (e.g. *Ceronocyton*, see HANSEN 1990: Fig. 138) and therefore cannot be regarded as a generic synapomorphy.

The combination of the following characters can be helpful for routine generic identification: (1) prosternum carinate medially; (2) median part of prosternum limited from lateral parts by sharp oblique ridges; (3) antennal grooves present, but very small; (4) posterior tentorial pits not enlarged; (5) preepisternal elevation without median carina, bearing triangular, arrow-shaped, drop-like or narrowly oval plate; (6) anterolateral ridge of metaventrite laying along whole posterior margin of metacoxal cavity. From non-“Gondwanan” genera, *Kanala* can be easily distinguished also by crescent-like median part of male abdominal sternite 9. In dorsal view, the general coloration of all species is dark, often with small paler spots. The elytral intervals are never costate.



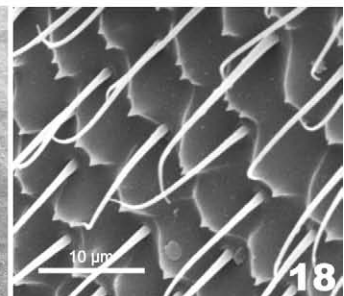
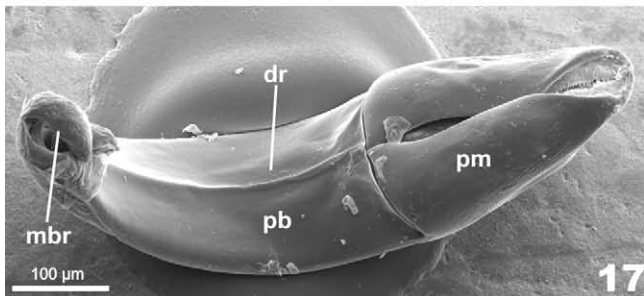
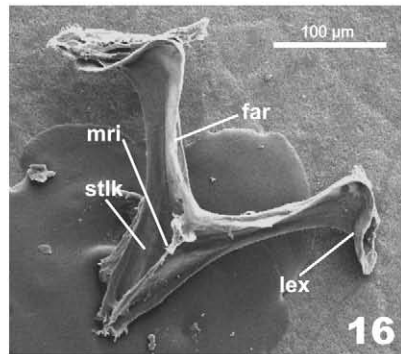
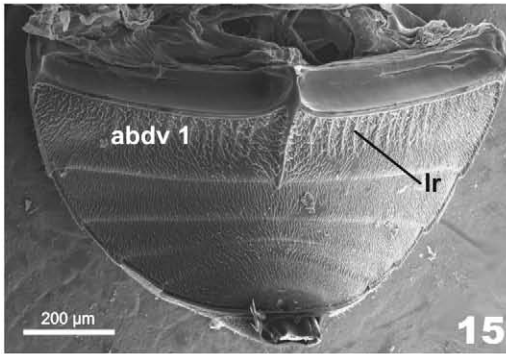
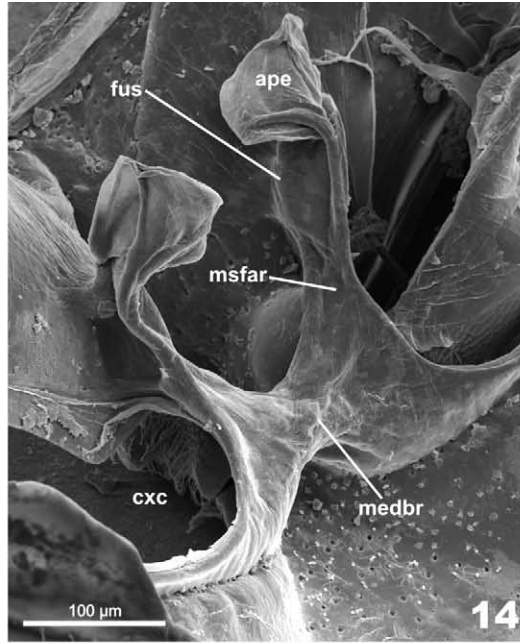
Figs. 1–6: Morphology of *Kanala*: 1) sucking disc of male, 2) mentum, 3) prothorax, ventrolateral, 4) prothorax, ventral, 5) prothorax, posteroventral, 6) antenna; 1: *K. punctiventris*, 2–6: *K. montaguei*. Abbreviations: anc – antennal club, ang – antennal groove, atr – anterior transverse sulcus of mentum, cu – cupula, cxc – procoxal cavity, ihr – intrahypomeral ridge, lhp – lateral glabrous part of hypomeron, mhp – mesal pubescent part of hypomeron, mpk – median carina of prosternum, nts – notopleural suture, pcox – procoxa, pe – pedicel, pf – profurca, pfem – profemur, pml – posteromedian lobe of postcoxal bridge, ppn – posterior prosternal notch, ptr – protrochanter, sc – scapus, tf – transverse fold.



Figs. 7–13: Morphology of *Kanala*: 7) mesothorax, ventral, 8) preepisternal elevation, 9) meso- and metathorax, ventral, 10–11) preepisternal elevation, lateral, 12) elytron, ventral, 13) elytron, dorsal; 7, 9, 11, 12: *Kanala montaguei*, 8, 10, 13: *K. punctiventris*.

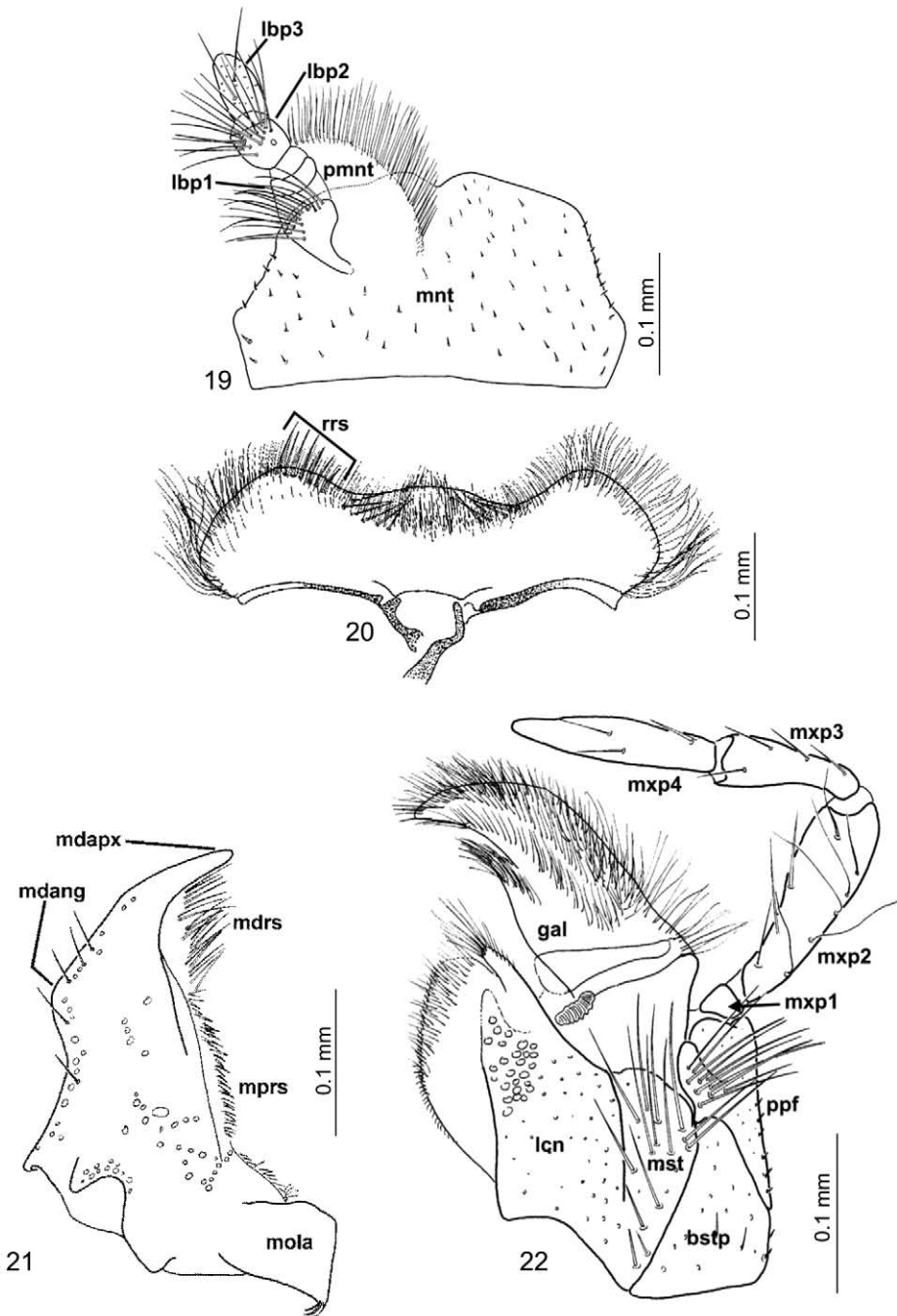
Abbreviations: aee – anepisternal emargination of mesothorax, aes2 – anepisternum 2, aes3 – anepisternum 3, alrg – anterolateral ridge, antcol – anterior colar of mesothorax, cxl – coxal lobe of anepisternum 2, em2 – ventral portion of epimeron 2, em3 – ventral portion of epimeron 3, ep – epipleuron, es1 – elytral series 1, es10 – elytral series 10, grpc – groove for reception of procoxae, mpm – median portion of metaventrite, mscxc – mesocoxal cavity, mtcx – metacoxa, mtcxp – metacoxal process, mtv – metaventrite, peg – preepisternal groove, pel – preepisternal elevation of mesothorax, pep – pseudepipleuron, plb – posterolateral bulges of preepisternal elevation, pls – pleural suture, ppl – preepisternal plate.





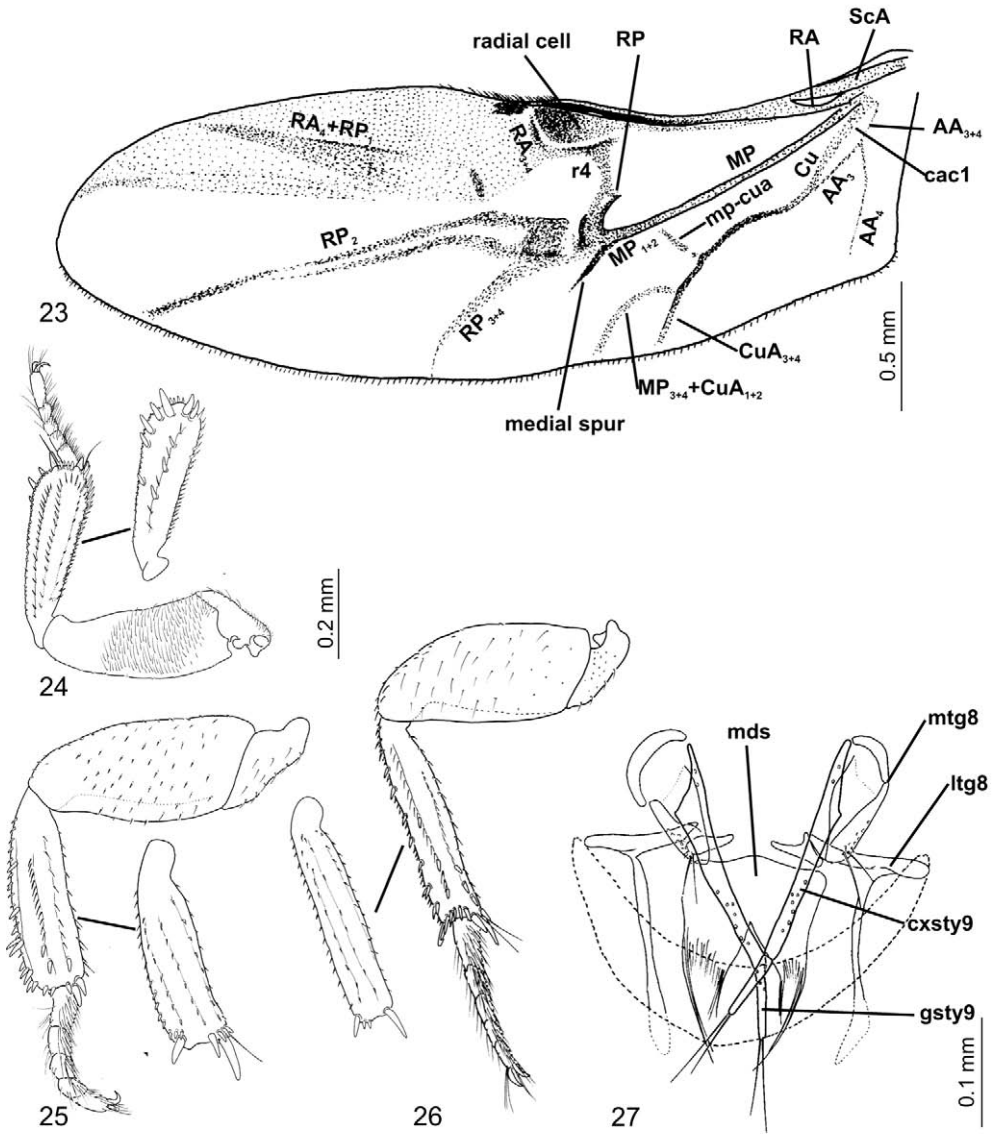
Figs. 14–18: Morphology of *Kanala*: 14) mesofurca, posterolateral, position of apical parts artificial, 15) abdomen, ventral, 16) metafurca, 17) aedeagus, dorsal, 18) microsculpture of lateral portion of metaventrite; 14–16, 18: *K. montaguei*, 17: *K. punctiventris*.

Abbreviations: abdv1 – abdominal ventrite 1, ape – apical extension of mesofurcal arm, cxc – mesocoxal cavity, dr – dorsal ridge of phallobase, far – metafurcal arm, fus – fusion of mesofurcal arm with mesoventrite, lex – lateral extension of furcal arm, lr – lateral ridges, mbr – manubrium, medbr – median bridge of mesofurca, mri – median ridge of metafurcal stalk, msfar – mesofurcal arm, pb – phallobase, pm – paramere, stlk – stalk of metafurca.



Figs. 19–22: Mouthparts of *Kanala montaguei*: 19) labium, submentum and right part of prementum and palpus omitted, 20) labrum, 21) mandible, 22) maxilla, cardo omitted.

Abbreviations: bstp – basistipes, gal – galea, lbp1–3 – labial palpomere 1–3, lcn – lacinia, mdang – mandibular angle, mdapx – mandibular apex, mdrs – medio-distal row of setae, mnt – mentum, mprs – medio-proximal row of setae, mstp – mediostipes, mxp1–4 – maxillary palpomere 1–4, pmnt – prementum, ppf – palpifer, rrs – row of stout setae.



Figs. 23–27: Morphology of *Kanala montaguei*: 23) hind wing, 24–26) legs, ventral (whole leg) and dorsal (isolated tibia), 24) foreleg, 25) middle leg, 26) hind leg, 27) female genitalia. Abbreviations: AA – anterior anal vein, cac1 – first cubito-anal cell, Cu – cubitus, CuA – anterior cubitus, cxsty9 – coxostylus 9, gsty9 – gonostylus 9, ltg8 – laterotergite 8, mds – “median sclerite”, MP – posterior media, mp-cua – cross vein connecting MP and CuA, mtg8 – mediotergite 8, r4 – radial cross vein 4, RA – anterior radius, RP – posterior radius, rp-mp2 – radio-medial cross vein 2, ScA – anterior subcosta. Subscript numbers refer to the branches of the respective vein.

### Position of *Kanala* within Megasternini

#### List of characters included

1. Dorsal surface: (0) without distinct pubescence; (1) at least finely pubescent.

The punctuation of dorsal surface consists of setiferous punctures in most species included to the analysis. The pubescence is absent in *Cercyodes*, *Ercycodes*, *Platycyon*, *Cetiocycon* and some *Chledocycon* according to HANSEN (1990, 1999b).

2. Posterior tentorial pits: (0) small to nearly indistinct; (1) very large.

Posterior tentorial pits are small to nearly indistinct in most taxa included (see e.g. HANSEN 1990: Fig. 136 for *Ceronocyton simile* HANSEN, 1990). They are enlarged to deep and large holes in *Chledocycon semiopacus*, *Notocercyon* (HANSEN 1990: Fig. 134) and *Cenebriophilus costatus* HANSEN, 1990.

3. Transverse punctural series on posterior margin of pronotum: (0) absent; (1) present.

There is a row of serially arranged punctures situated along the posterior margin of pronotum in *Cercyodes laevigatus* BROWN, 1886, *Ercycodes fossus* (BLACKBURN, 1888), in species of genera *Chledocycon*, *Oosternum* and *Cryptopleurum*. This series is absent in *Australocycon*, *Cenebriophilus*, *Cercyon*, *Ceronocyton*, *Cetiocycon*, *Kanala*, *Motonerus*, *Platycyon*, *Pseudoosternum* and *Sacosternum*. The character state is not known for *Notocercyon*.

4. Raised median longitudinal carina on prosternum: (0) absent; (1) present.

In most taxa included, the prosternum bears a sharp, raised longitudinal carina medially. This carina is absent from *Australocycon calderi* HANSEN, 1990, *Cetiocycon papuensis* ORCHYMONT, 1924 and *Cryptopleurum*.

5. Median portion of prosternum: (0) continuous with lateral portions; (1) divided from lateral portions by sharp ridges.

Median portion of prosternum is divided from lateral portions by a sharp ridge of various shape in most taxa included (Fig. 4). In *Cercyon*, *Cercyodes*, *Ercycodes*, *Platycyon* and *Pseudoosternum*, the median portion is continuous with lateral portions and can differ only in superficial sculpture (HANSEN 1990: Fig. 132).

6. Posterior process of prosternum: (0) blunt; (1) with a notch.

In most taxa included, the prosternum is deeply notched posteromedially (Fig. 4, ppn). This notch is absent in *Cetiocycon*, *Platycyon* and *Sacosternum* according to HANSEN (1990, 1991, 1999b). The character state is not known for *Ercycodes fossus*.

7. Antennal grooves on hypomeron: (0) absent; (1) very small; (2) moderately large, not reaching lateral margins of hypomeron; (3) very large, reaching lateral margins of hypomeron.

Antennal grooves are situated on prothoracic hypomeron laterally to notopleural suture. In *Cryptopleurum* they are very large, contacting lateral margins of the hypomeron. In other taxa, they do not reach the lateral margins of the hypomeron and can be moderately large (in *Australocycon*, *Cercyon*, *Chledocycon*, *Oosternum*, *Platycyon*, *Pseudoosternum*, *Sacosternum*), minute but still distinct (Fig. 4, ang; *Ceronocyton*, *Kanala*, *Notocercyon*) or completely absent (*Cercyodes*, *Cetiocycon*, *Ercycodes*, *Motonerus*).

8. Mesothoracic grooves for reception of procoxae: (0) not reaching to mesocoxal cavities; (1) deep, reaching anterior margin of mesocoxal cavities.

Grooves for reception of procoxae are shallow, not reaching mesocoxal cavities in most taxa included (Figs. 7–8, grpc). In *Australocycon*, the grooves reach the anterior margin of mesocoxal cavities (Figs. 125–126 in HANSEN 1990).

9. Posterolateral processes of preepisternal elevation of mesothorax: (0) absent; (1) present.

There is a small projecting bulge laterally on each side of preepisternal elevation of mesothorax in *Kanala* (Fig. 8, plb). This bulges are absent from all other genera included.

10. Lateral margins of elytra: (0) without denticulation; (1) with distinct denticulation.

Lateral margins of elytra are finely to moderately denticulate in *Motonerus*, *Sacosternum* and *Oosternum* (see FIKÁČEK & SHORT 2006: Figs. 54–59). This denticulation is absent from all other taxa included (e.g. in *Kanala*, see Fig. 12).

11. Anterolateral ridge of metaventrite: (0) going along the whole posterior margin of mesocoxal cavities, reaching anterolateral corner of metaventrite; (1) arcuately bent posteriad sublaterally.

In *Australocyon*, *Chledocyon*, *Ercycodes*, *Cercyodes*, *Cetiocyon*, *Motonerus*, *Cercyon* and *Cryptopleurum*, the anterolateral ridge goes along the whole posterior margin of mesocoxal cavities, nearly reaching anterolateral corner of metaventrite (Fig. 9, alrg). In *Platycyon*, *Pseudoosternum*, *Notocercyon*, *Ceronocyon*, *Cenebriophilus*, *Oosternum* and *Sacosternum*, the anterolateral ridge diverges from posterior margin of mesocoxal cavities before reaching anterolateral corner of metaventrite and bent arcuately posteriad to the lateral margin of metaventrite; the ridge diverges from mesocoxal cavities already submesally in *Cenebriophilus*, it is coded as (1).

12. Shape of anterolateral ridges medially: (0) disappearing submedially; (1) nearly contacted and bent posteriad medially.

Anterolateral ridges do not reach the midwidth of metaventrite in most taxa included, but disappear submedially (Figs. 9–10). They reach midwidth of metaventrite, nearly contact each other, bent posteriad and form a longitudinal keel of various length in *Motonerus* (see FIKÁČEK & SHORT 2006: Figs. 32–41) and *Sacosternum*.

13. Femoral lines: (0) absent; (1) present.

Femoral lines (i.e. ridges arising from posterolateral corner of elevated median portion of metaventrite and going towards to anterolateral corner of metaventrite) are well developed in *Ceronocyon*, *Cryptopleurum* and *Oosternum costatum*. They are absent from all other taxa included.

14. Additional lateral ridges on abdominal ventrite 1: (0) absent; (1) present.

Abdominal ventrite 1 with a median longitudinal carina, but otherwise lacks any longitudinal ridges in *Australocyon*, *Cercyodes*, *Cercyon*, *Cetiocyon*, *Cryptopleurum*, *Ercycodes*, *Kanala reticulata*, *K. loebli* and *Platycyon*. Lateral portions of ventrite 1 bear distinct longitudinal ridges in *Cenebriophilus*, *Ceronocyon*, *Chledocyon*, *Kanala bipunctata*, *K. punctiventris*, *K. montaguei* (Fig. 15, lr), *Motonerus*, *Oosternum*, *Pseudoosternum* and *Sacosternum*. The character state is not known for *Notocercyon*.

15. Number of longitudinal series on elytra: (0) none; (1) nine; (2) ten.

Elytra bear 10 longitudinal series in most taxa included; series 10 is reduced to a great extent in *Oosternum soricoides*, with only short anterior portion well developed, coded as (2). Elytral series 10 is completely absent from *Cenebriophilus*, *Motonerus*, *Oosternum costatum* and *Sacosternum*. In *Cercyodes laevigatus*, elytra lack any trace of longitudinal series.

16. Sucking disc on male maxilla: (0) absent; (1) present.

The sucking disc (Fig. 1) is present on maxilla of the male of most taxa included. It is absent from *Ceronocyon obscurus* and *Pseudoosternum maculatum*.

17. Median sclerite of male sternite 9: (0) crescent-like; (1) with median projection.

Median sclerite of male sternite 9 projects to a variously shaped process medially in *Cryptopleurum* and *Cercyon*. The projection is absent in all other taxa included (thus, median sclerite crescent-like in these taxa, see e.g. Figs. 45–46).

18. Manubrium of phallobase: (0) absent; (1) present, asymmetrical; (2) present but directed ventrally (i.e. symmetrical in dorsal view).

The phallobase bears an asymmetrical basal projection (manubrium) in *Australocyon flavolineatus*, *Cenebriophilus*, *Cercyodes*, *Cercyon*, *Cetiocyon*, *Chledocyon*, *Cryptopleurum* and *Pseudoosternum*. Manubrium is symmetrical and bent ventrally in all species of *Kanala* (Fig. 17, mbr). It is absent from *Australocyon calderi*, *A. variegatus*, *Ceronocyon*, *Motonerus*, *Oosternum* and *Sacosternum*. The character state is not known for *Ercycodes fossus*, *Notocercyon* and *Platycyon*.

19. Median lobe: (0) freely movable; (1) with restricted movability.

Median lobe is freely movable in antero-posterior direction in *Cercyon* and *Cryptopleurum* (in these taxa the basal portion of the median lobe reaches deeply into the phallobase, in which it can move anteriad and posteriad without any restriction). The antero-posterior movability is restricted in other taxa included (the base of median lobe is attached to the bases of parameres, usually does not reach deeply into phallobase and cannot move there freely). This character state is not known for *Notocercyon*.

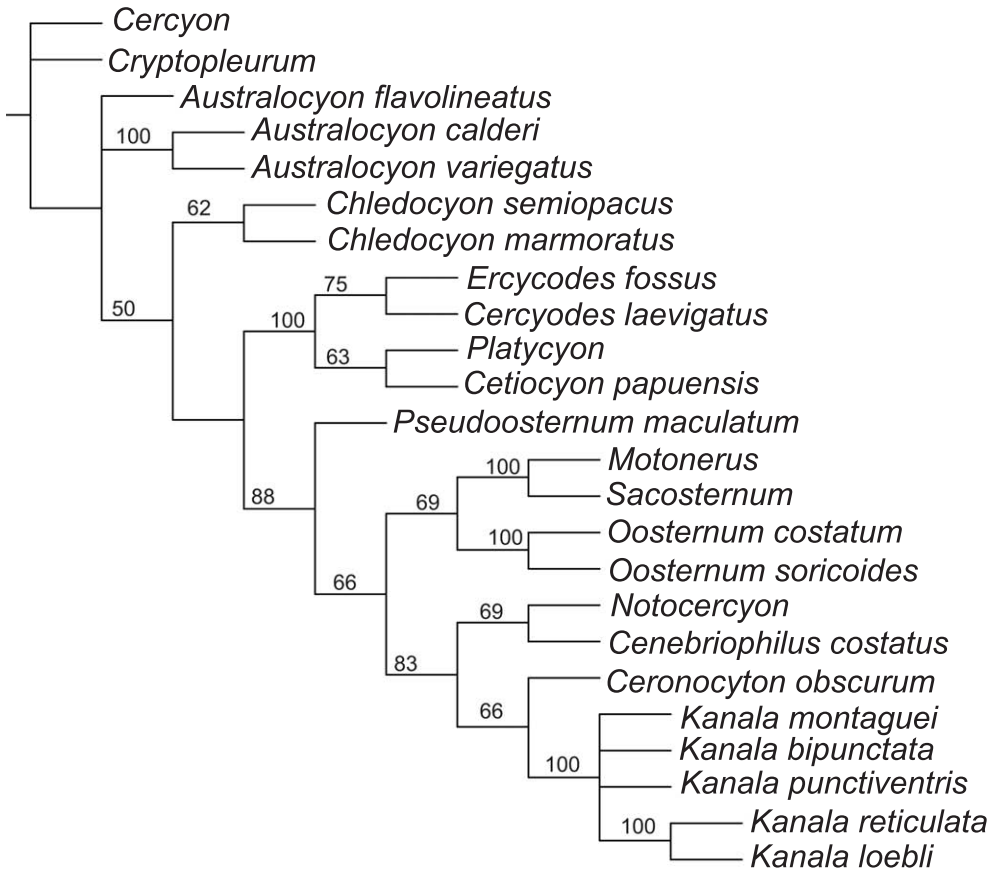


Fig. 28: Strict consensus tree based on a preliminary phylogenetic analysis of the “Gondwanan” genera of Megasternini. Numbers above branches: bootstrap values > 50.

### Preliminary phylogenetic analysis

The analysis resulted in three equally parsimonous trees (length = 45 steps, CI = 0.51, RI = 0.71), for strict consensus of these trees see Fig. 28. Bootstrap values are low for most clades, with values >50 only for the following clades: all taxa except *Cryptopleurum*, *Motonerus* + *Sacosternum* and clade consisting of all *Kanala* species. The results suggest that the genus *Kanala* forms a sister group to a clade containing the Australian genera *Pseudoosternum*, *Ceronocyton*, *Notocercyon* and *Cenebriophilus*. The clade of *Kanala* plus all four mentioned genera is supported by very small antennal grooves (7:1, unique synapomorphy).

Character matrix:

Characters	00000000011111111111
	1234567890123456789
<i>Australocyon calderi</i>	1000112010000021001
<i>Australocyon flavolineatus</i>	1001112010000021011
<i>Australocyon variegatus</i>	1001112010000021001
<i>Cenebriophilus costatus</i>	1101111000100111011
<i>Cercyodes laevigatus</i>	0011010000000001011
<i>Cercyon</i>	1001012000000021110
<i>Ceronocyton obscurum</i>	1001111000101120001
<i>Cetiocyon papuensis</i>	00000000000000021011
<i>Chledocyon marmoratus</i>	0011112000000121011
<i>Chledocyon semiopacus</i>	1111112000000121011
<i>Cryptopleurum</i>	1010113000001021110
<i>Ercycodes fossus</i>	00110?00000000210?1
<i>Kanala bipunctata</i>	1001111100000121021
<i>Kanala loebli</i>	1001111100000021021
<i>Kanala montaguei</i>	1001111100000121021
<i>Kanala punctiventris</i>	1001111100000121021
<i>Kanala reticulata</i>	1001111100000021021
<i>Motonerus</i>	1001110001010111001
<i>Notocercyon</i>	11?1111000100?210??
<i>Oosternum attacomis</i> group	1011112001101111001
<i>Oosternum soricoides</i>	1011112001100121001
<i>Platycyon</i>	00010020001000210?1
<i>Pseudoosternum maculatum</i>	1001012000100120011
<i>Sacosternum</i>	1001102001110111001

**Key to species of *Kanala***

- 1 Elytral intervals with very strong mesh-like sculpture (Fig. 43). Dorsal surface of the body black to piceous (Fig. 29); elytron without paler spots. Body length 3.2–3.5 mm..... ***reticulata***
- Elytral intervals without any microsculpture (Figs. 39–42). Body dark, sometimes with paler spots at least on elytral base (Figs. 30–33). Body length 1.5–3.2 mm ..... 2
- 2 Lateral margins of pronotum distinctly paler than pronotal disc. Each elytron with one or two basal pale spots (Figs. 29, 31). Punctuation of elytral intervals as well as median part of metaventricle fine and sparse (Figs. 34, 36, 39, 41)..... 3
- Pronotum dark, even at lateral margins. Elytron black or with one small pale spot basally (Figs. 31, 33). Punctuation of metaventricle coarse and very dense (Figs. 35, 37), punctuation of elytral intervals variable, but never fine (Figs. 40, 42)..... 4
- 3 Base of each elytron with only one pale spot placed on intervals 3–4, humeral area and basal part of lateral elytral margin dark. Pronotum with very wide pale lateral margins (Fig. 30). Preepisternal elevation subpentagonal, without defined elongate plate (Fig. 34). Body length (2.75–3.20 mm) ..... ***bipunctata***
- Base of each elytron with two pale spots – first spot on base of intervals 3–4, second basally in humeral area. Lateral margins of pronotum narrowly but very distinctly paler (Fig. 32). Preepisternal elevation of mesothorax with narrowly elongate oval plate, rarely in form of elongate oval bulge without clearly defined plate (Figs. 7, 9, 11, 36). Body length (1.95–2.50 mm)..... ***montaguei***
- 4 Whole dorsal surface with very coarse punctuation and very narrow interstices (Fig. 40), thus whole beetle dull on the first view (Fig. 33). Elytron never with pale spot basally. Preepisternal elevation of mesothorax without defined plate, subpentagonal with rounded

lateral apices (Fig. 35). Median lobe distinctly shorter than parameres (Fig. 45). Body length (1.90–2.35 mm) ..... *loebli*

- Dorsal surface with moderately coarse but not extremely dense punctation (Fig. 42), interstices wide, shiny, thus the beetle shiny on the first view (Fig. 31). Elytron usually with a small yellowish to reddish spot at base of interval 4 and a not very distinct spot subapically, rarely whole elytron dark without pale spots. Preepisternal elevation with defined median drop-like to triangular plate (Figs. 8, 10, 38). Median lobe slightly longer than parameres (Fig. 49). Body length (1.55–1.90 mm) ..... *punctiventris*

### *Kanala bipunctata* sp.n.

TYPE LOCALITY: New Caledonia, Grande Terre, South Province, Mt. Koghi, 500 m a.s.l.

TYPE MATERIAL: **Holotype** ♂ (BMH): “NEW CALEDONIA / Mt. Koghi, 500 m / 27.X.1967 // J. & M. Sedlacek / Collectors / BISHOP”.

**Paratypes**: 1 ♂ (NMW): “Table d’Unio / Neukaledonien / [underside of same label] Pa 71 [all text handwritten]” [7.IX.1970, leg. H. Franz]; 1 ex. (BMH): “NEW CALEDONIA / Mt. Koghi, 500 / 26-30.I.1963 / G. Kuschel / Collector / BISHOP”.

**DIAGNOSIS**: Body large; lateral and anterior margins of pronotum widely pale, yellowish; elytron with one pale spot basally, without clearly limited pale spot subapically; punctation of elytral intervals very fine, punctures much smaller than punctures of elytral series; elytral interstices without microsculpture; median plate of preepisternal elevation without delimited lateral portions, subpentagonal in shape, ca. 1.5 × as long as wide, broadly contacting anterior projection of metaventrite; median part of metaventrite with very fine punctation; parameres ca. 0.7 × as long as phallobase, widely rounded apically.

Regarding general habitus and coloration resembling *K. montaguei* (see under this species for differential characters).

**DESCRIPTION**: Body elongate oval, maximum width in anterior 0.3 of elytra; elytra narrowed posteriad, rather flat, weakly convex in lateral view. Length: 2.8–3.2 mm (HT: 2.8 mm); width: 1.6–1.9 mm (HT: 1.7 mm).

**Coloration** (Fig. 30): Dorsal side dark brown to black, clypeus and anterior part of frons, anterior and lateral pronotal margins widely pale, yellowish to reddish. Elytron with quite sharply delimited yellowish to reddish pale spots on base of elytral intervals 3 and 4; elytral apex only indistinctly paler, without distinctly defined paler spot; epipleuron reddish. Ventral side reddish brown; ventral face of head, legs, antennae and mouthparts slightly paler, reddish; cupula and antennal club slightly darker than antennomeres 1–5.

**Head**: Clypeus with fine and not very dense setiferous punctation, interstices shiny, without microsculpture; anterior margin very slightly convex. Frons with punctation similar to punctation on clypeus. Eyes small, separated by 6.5 × of width of one eye. Mentum with anterior margin bisinuate; surface with small and sparsely distributed setiferous punctures, interstices without microsculpture. Length of antennomeres of antennal club: 8 < 7 < 9, antennomere 9 obtuse apically, with indistinct strangulation subapically.

**Prothorax**: Pronotum with maximum width at posterior margin; posterolateral corners not pronounced. Punctation slightly finer but as dense as on frons, consisting of setiferous punctures, interstices without microsculpture. Prosternum strongly carinate medially, median part slightly protruding anteriorly.

**Mesothorax**: Scutellar shield with a few minute setiferous punctures. Elytron with intervals only indistinctly convex basally at suture, becoming more distinctly convex laterad and mainly posteriad; all intervals with very fine punctation bearing long pubescence, punctures slightly



smaller than fine punctures of elytral series, rasp-like in shape; interstices without microsculpture (Fig. 39). Median plate of preepisternal elevation (Fig. 34) without delimited lateral portions, subpentagonal with equilaterally triangular anterior portion, widely contiguous with anterior projection of metaventrite,  $1.5 \times$  as long as wide, bearing very fine setiferous punctation, microsculpture absent.

Metathorax: Median portion of metaventrite bearing fine, sparse setiferous punctation, interstices without microsculpture (Fig. 34). Anterolateral ridges nearly reaching posterior margin of metaventrite.

Legs short, femora apart from their apical portions with fine and sparse setiferous punctures, meso- and metafemora slightly widened distally; tarsi sparsely pubescent ventrally.

Abdomen: Ventrite 1 strongly carinate medially; lateral portions with distinct submedian ridges; ventrites 2–5 without ridges. All ventrites finely pubescent.

Male genitalia (Fig. 44): Parameres ca  $0.6 \times$  as long as phallobase, gradually narrowing to apical  $0.3$ , strongly widened and bearing numerous sensilla apically, with pointed top directed mesad. Median lobe wide, as long as parameres, acutely pointed apically; corona in subapical position.

VARIABILITY: No variation of mentioned characters was observed, probably because of a low number of examined specimens. In some specimens the pale spots on pronotum and elytra are more distinct than in others, probably due to preparation artefacts.

HABITAT: Unknown.

DISTRIBUTION (Fig. 51): So far known only from two localities in central and southern Grande Terre.

ETYMOLOGY: The specific name refers to the coloration of the elytra.

### *Kanala loebli* sp.n.

TYPE LOCALITY: New Caledonia, Grande Terre, South Province, Mt. Koghi, 500–600 m.

TYPE MATERIAL: **Holotype** ♂ (MHNG): “New Caledonia / Mt. Koghi, 500-600m / 14.IX.1997 I. Löbl / prim. forest, litter”.

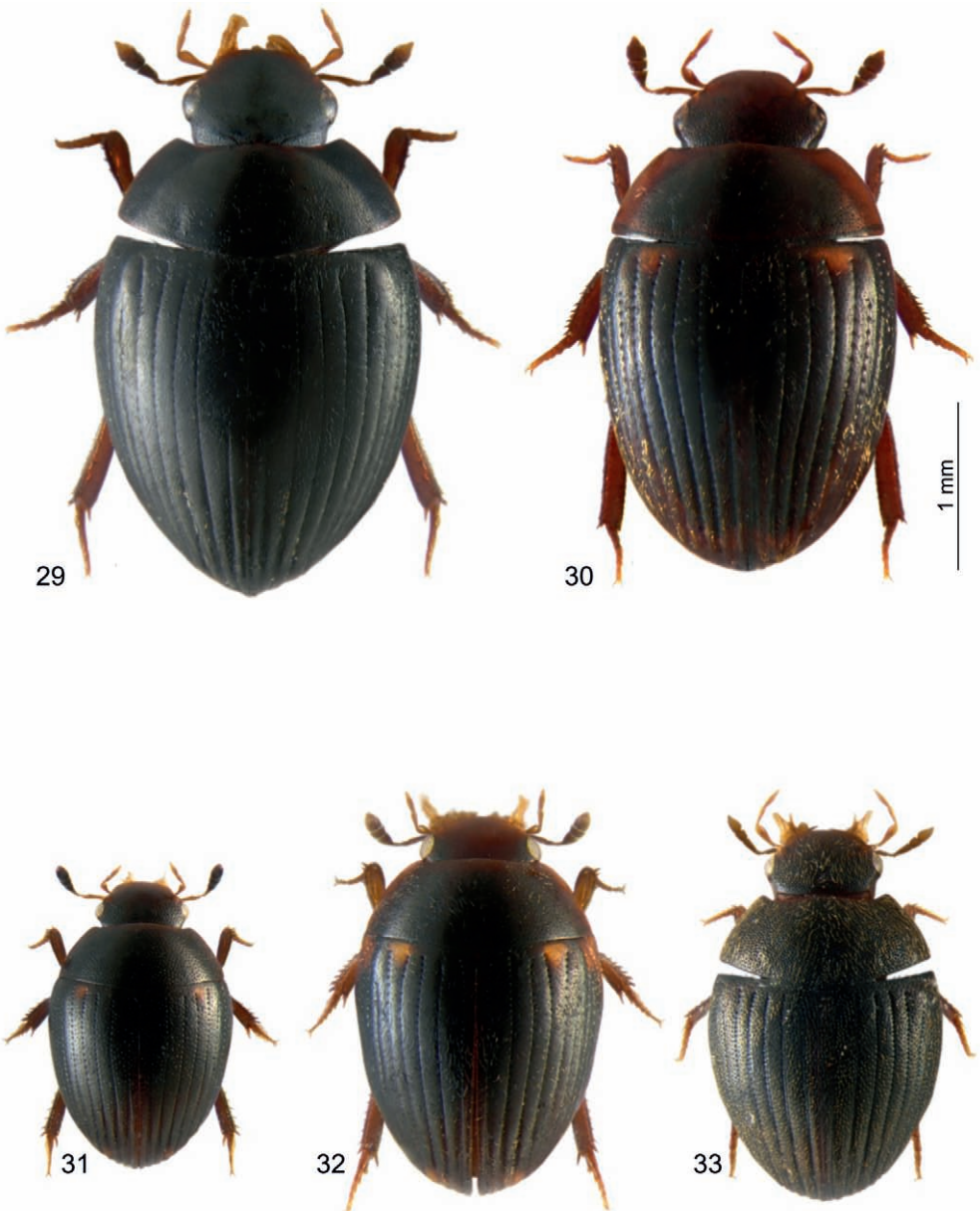
**Paratypes**: 10 exs. (MHNG): same locality as holotype; 2 exs. (MHNG): “NEW CALEDONIA / Rivière Bleue / prim. forest, litter / 20.X.1998, I. Löbl”.

DIAGNOSIS: Body moderately sized; black to brown, without paler spots; punctation of elytra very coarse and dense, interval punctures only slightly smaller than serial punctures; elytral interstices without microsculpture; median plate of preepisternal elevation without delimited lateral portions, subpentagonal with obtusely rounded lateral apices, slightly longer than wide, broadly contacting anterior projection of metaventrite; median part of metaventrite with coarse and dense punctation; parameres  $0.65 \times$  as long as phallobase, their top directed anteromesad.

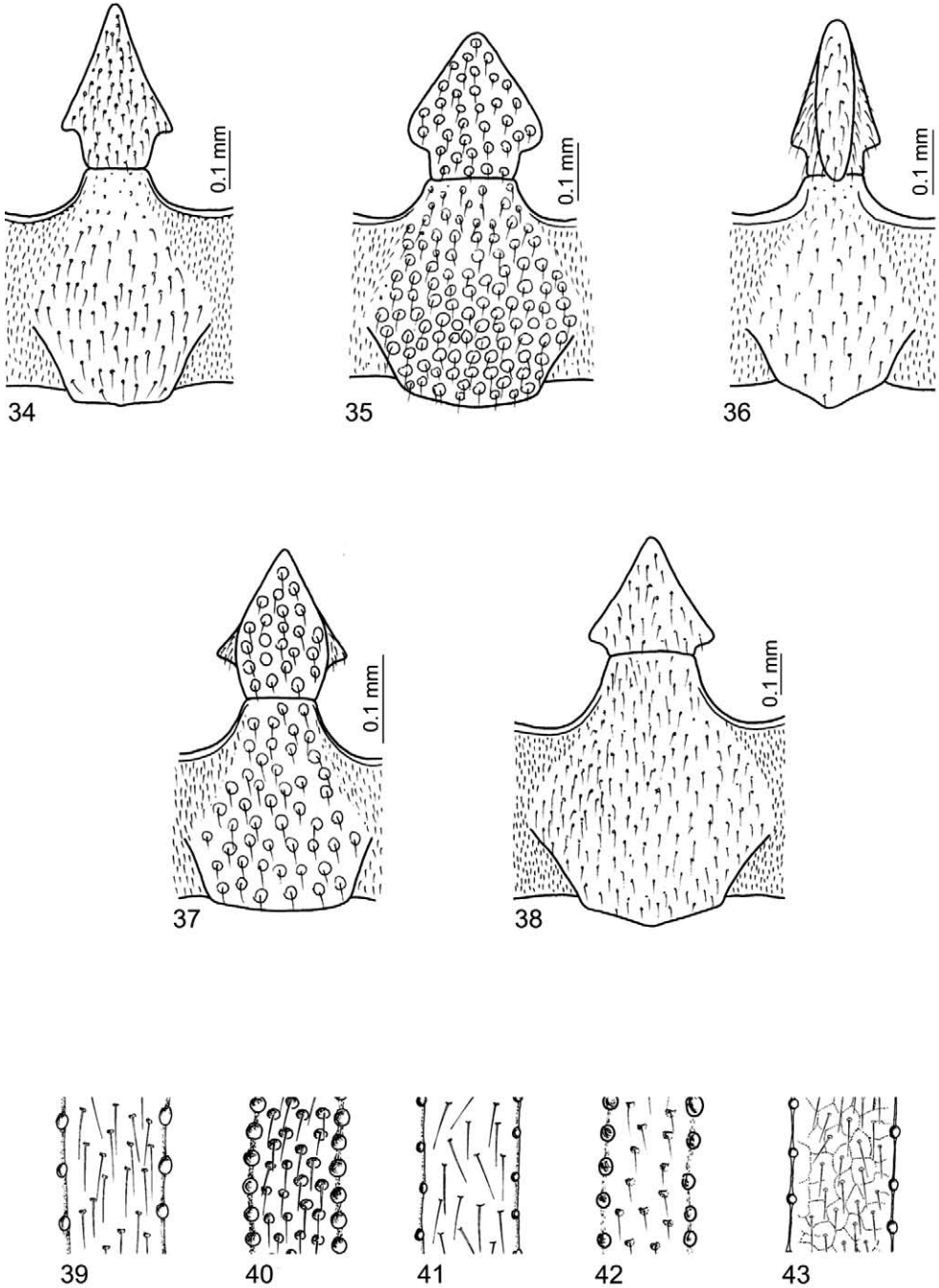
Easily distinguishable from all other *Kanala* species by shorter and wider oval body shape, dark color without black spots and by coarse and dense superficial punctation.

DESCRIPTION: Body shortly and widely elongate oval, maximum width in anterior  $0.25$  of elytra; elytra narrowed posteriorly, highly convex in lateral view. Length: 1.9–2.4 mm (HT: 2.2 mm); width: 1.3–1.5 mm (HT: 1.4 mm).

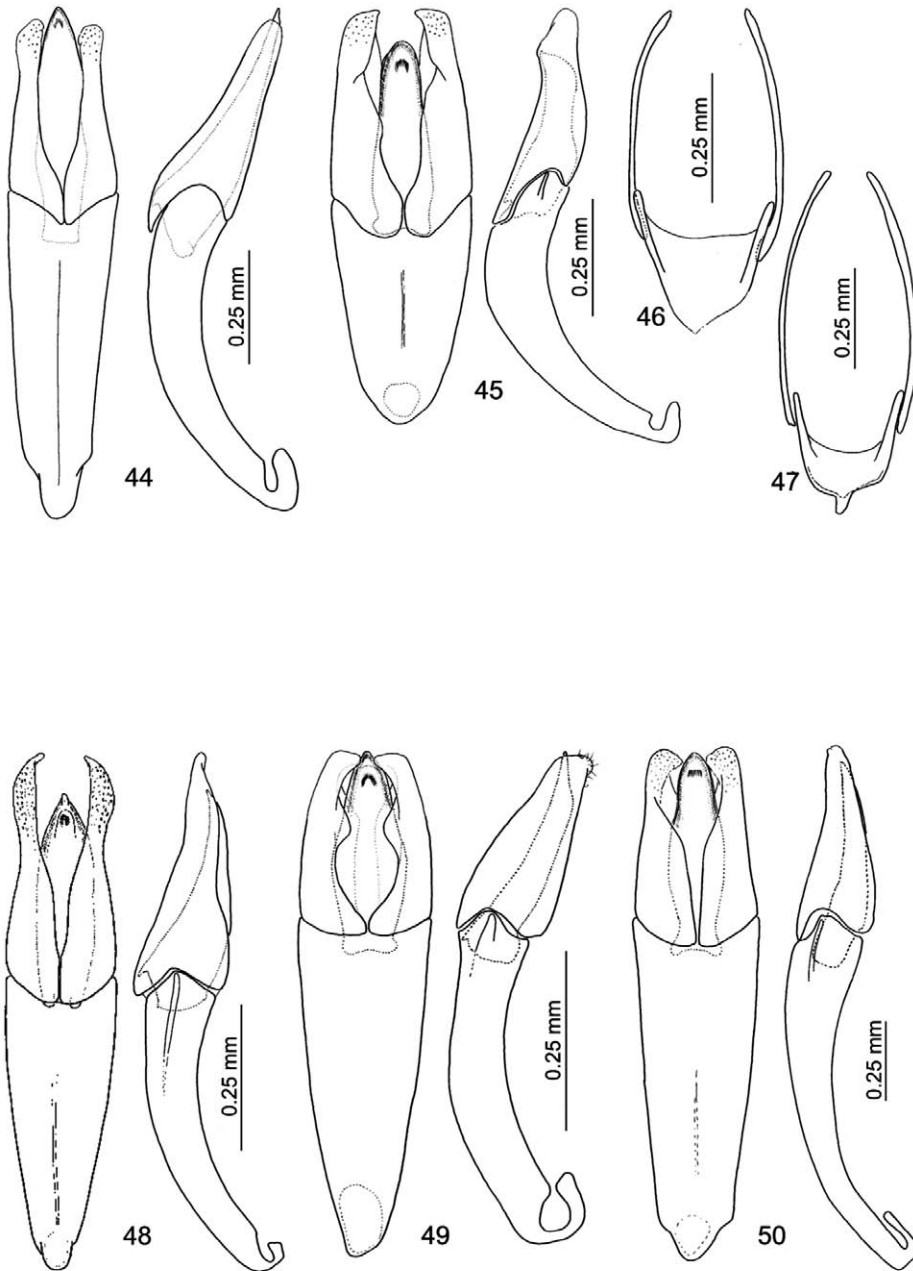
Coloration (Fig. 33): Dorsal side dark brown to black, anterior part of clypeus slightly paler, dark reddish brown. Elytron unicolored, without paler spots; epipleuron reddish. Ventral side dark reddish brown; legs and ventral face of head reddish, mouthparts and antennae including cupula and club yellowish.



Figs. 29–33: Habitus of *Kanala* species: 29) *K. reticulata*, 30) *K. bipunctata*, 31) *K. punctiventris*, 32) *K. montaguei*, 33) *K. loebli*.



Figs. 34–43: Morphology of *Kanala*: 34–38) preepisternal elevation of mesothorax and median portion of metaventrete, 39–43) punctation of elytral intervals; 34, 39: *K. bipunctata*, 35, 40: *K. loebli*, 36, 41: *K. montaguei*, 37, 42: *K. punctiventris*, 38, 43: *K. reticulata*.



Figs. 44–50: Male genitalia of *Kanala*: 44–45, 48–50) aedeagus in ventral and lateral views, 46–47) sternite 9: 44: *K. bipunctata*, 45–46: *K. loebli*, 47, 50: *K. reticulata*, 48: *K. montaguei*, 49: *K. punctiventris*.

Head: Clypeus with not very strong but quite dense setiferous punctation, interstices shiny, without microsculpture; anterior margin slightly concave. Frons with very dense punctation, consisting of setiferous punctures slightly larger than on clypeus, interstices very narrow, without microsculpture. Eyes small, separated by  $8 \times$  of width of one eye. Mentum with anterior margin bisinuate; surface coarse and very dense punctation; interstices narrow, without microsculpture. Length of antennomeres of antennal club:  $8 < 7 = 9$ , antennomere 9 obtuse apically, with not very distinct strangulation subapically.

Prothorax: Pronotum with maximum width at posterior margin; posterolateral corners not pronounced. Punctation as dense and coarse as on frons, consisting of punctures bearing yellowish setae; interstices narrow, without microsculpture. Prosternum short, strongly carinate medially, very distinctly protruding anteriad medially.

Mesothorax: Scutellar shield with few minute punctures. Elytral intervals only indistinctly convex basally at suture, becoming more distinctly convex laterad and mainly posteriad; all intervals with very dense and coarse punctation, slightly sparser than on pronotum, bearing yellowish pubescence, interval punctures slightly smaller than large and closely standing punctures of elytral series; interstices narrow, without microsculpture (Fig. 40). Median plate of preepisternal elevation  $1.1 \times$  as long as wide, without delimited lateral portions, subpentagonal with obtusely rounded lateral apices, widely contiguous with anteromedian projection of metaventricle, bearing very coarse and dense setiferous punctation; interstices narrow, without microsculpture (Fig. 35).

Metathorax: Median portion of metaventricle (Fig. 35) with coarse and dense setiferous punctation; interstices narrow, without microsculpture. Anterolateral ridges reaching posterior margin of metaventricle.

Legs short, femora except their distal-most part with coarse and dense setiferous punctures. Tibiae slightly longer than tarsi. Tarsi densely pubescent ventrally.

Abdomen: Ventricle 1 carinate medially; lateral parts only with indistinct traces of additional sublateral ridges basally; remaining ventrites without any ridges; all ventrites finely pubescent.

Male genitalia (Figs. 45–46): Parameres ca  $0.65 \times$  as long as phallobase, gradually narrowed to apical  $0.25$ , strongly widened and bearing numerous sensilla more apically, with more or less pointed top directed anteromesad. Median lobe wide, ca.  $0.85 \times$  as long as parameres, acutely rounded apically; corona situated subapically.

VARIABILITY: No variation except the coloration was observed. Some specimens including the holotype are slightly teneral, with lighter general coloration (dark brown).

HABITAT: Sifted from primary forest leaf litter.

DISTRIBUTION (Fig. 51): So far known only from two localities in southern Grande Terre.

ETYMOLOGY: This species is dedicated to Dr. Ivan Löbl, an outstanding entomologist, excellent collector and a kind teacher in my Sphaeridiinae studies, who collected a great part of the material examined for this study, including the type series of this species.

### ***Kanala montaguei* BALFOUR-BROWNE, 1939**

*Kanala montaguei* BALFOUR-BROWNE 1939: 374.

TYPE LOCALITY: New Caledonia, Grande Terre, North Province, Pombei.

TYPE MATERIAL: **Holotype** (unsexed specimen, NHML): “Type [round label with red margin] // Loc. Paompaï [= Pombei] / Date 14-9-14 / Coll. P. D. Montague / New Caledonia Exped. // Pampaï [= Pombei] / New Caledonia / 14.IX.1914 / 1918-87 // Kanala / montaguei Type! / Balfour-Browne det.”

**Paratype** (unsexed specimen, NHML): “Cotype [round label with yellow margin] // Pampai [= Pombéi] / New Caledonia / 14.IX.1914 / 1918-87 // Kanala sp. / Hansen det.”

#### ADDITIONAL MATERIAL EXAMINED:

**NORTH PROVINCE:** 1 ex. (MNH): Mt. Mandjéla summit, 20°23.9'S 164°31.9'E, 750–780 m a.s.l., sifting rainforest litter, 11.I.2007, leg. M. Wanat & R. Dobosz; 9 exs. (MHNG): Tao waterfalls nr. Panié, litter, 9.IX.1997, leg. I. Löbl; 3 ♂♂, 1 ♀, 37 exs. (IAC, KSEM, MNHN, NMP, NZAC; 5 exs. in pure alcohol deposited in KSEM and NMP): Mt. Panié, leaf litter, 200–500 m, 20°49'S/164°49'E (NC064), leg. R.A.B. Leschen; 2 ♀♀ (NMW): Tindou, nr. Hienghène, 2.IX.1970, leg. H. Franz “Pa 63”; 4 exs. (MHNG): Hienghène, Wérap, 8.IX.1997, leg. I. Löbl; 37 exs. (IAC, KSEM, MNHN, NMP; 4 exs. in pure alcohol deposited in KSEM and NMP): Aoupinié, 800 m, leaf litter berlesate, 21°11'S/165°17'E (NC077), 24.III.2007, leg. R.A.B. Leschen; 1 ex. (FMNH): 13 km NE Poya, Grotte d'Adio, 200 m, 6.VIII.1978, leg. S. & J. Peck; 1 ♂ (BMH): La Crouen, near Canala, 150 m, light trap, 20.–22.III.1968, leg. J.L. Gressitt.

1 ♂, 1 ex. (NMW): Loc. 2001/NC 36.

**SOUTH PROVINCE:** 6 exs. (MHNG): Col de Roussettes, ravine, forest litter, 25.X.1998, leg. I. Löbl; 8 exs. (MHNG): same locality, litter in ravine, 12.IX.1998, leg. I. Löbl; 1 ♂, 1 ♀, 7 exs. (CNC, FMNH, NMP): Bourail, Col de Roussettes, carrion bait traps, 500 m, berlese, litter, 7.VIII.1978, leg. S. Peck; 4 exs. (CNC, FMNH): same locality, 31.VII.–7.VIII.1978, rainforest, leg. S. & J. Peck; 1 ♀, 2 exs. (CNC): 11 km ESE of Bourail, Ouauoué, 200 m, rotting saprophyte, 8.VIII.1978, leg. S. & J. Peck; 2 exs. (FMNH): same locality, karst area, forest, karst area, leg. S. & J. Peck; 7 exs. (MHNG): Col d'Amieu, leaf litter + log, 11.XI.1997, leg. I. Löbl; 25 exs. (MHNG): same locality, 480–520 m, secondary forest, 22.X.1998 (#6), leg. I. Löbl; 1 ex. (MNH): 1 km W of Col d'Amieu, 21°37'S 165°49'E, 400 m a.s.l., 10.II.2004, leg. M. Wanat; 3 exs. (CNC): N of La Foa, Col d'Amieu, berlese, leaf litter, 500 m, 7.VIII.1978, leg. S. Peck; 1 ex. (FMNH): same locality, 31.VII.–7.VIII.1978, rainforest, leg. S. & J. Peck; 1 ex. (FMNH): same locality, 9.VIII.1978, rainforest litter, leg. S. & J. Peck; 9 exs. (CNC, FMNH, NMP): same locality, Mé Ongué, 700 m, rainforest, dung trap, 30.VII.–8.VIII.1978, leg. S. & J. Peck; 1 ex. (CNC): same locality, rainforest, dung traps, 8.VIII.1978, leg. S. & J. Peck; 22 exs. (MHNG): above Sarraméa, creek, leaf litter, 24.X.1998, leg. I. Löbl; 1 ex. (MHNG): Sarraméa: trail to Plateau de Dogny, 700–900 m, wood and leaf litter, 23.X.1998, leg. I. Löbl; 62 exs. (MNHN, NMP, TTPC): Col d'Amieu (Sarraméa), 21°34.407'S 165°45.674', FIT, 23.XI.–5.XII.2007, leg. T. Théry; 28 exs. (MNHN, NMP, TTPC): same data 5.–19.XII.2007; 51 exs. (MNHN, NMP, TTPC): same data, 19.XII.2007–11.I.2008; 25 exs. (MNHN, NMP, TTPC): same data, 7.–14.II.2008; 1 ♂, 2 exs. (NMW): Table Unio, 7.IX.1970, leg. H. Franz “Pa 70”; 3 ♂♂, 3 ♀♀ (NMP: 2, NMW: 4): Nouméa env., Mt. Koghi, 30.VIII.1970, leg. H. Franz “Pa 58”; 1 ex. (CNC): Mt. Koghi, 26.VIII.1978, leg. S. Peck; 1 ex. (CNC): same locality, berlese, woody fungi, 13.VIII.1978, S. & J. Peck; 17 exs. (CNC, FMNH, NMP): Mt. Koghi, Auberge, 500 m, rainforest, carrion trap and rainforest leaf litter, 26.VII.–13.VIII.1978, leg. S. & J. Peck; 1 ex. (CNC): same locality data, log and bark litter, 26.VIII.1978; 1 ex. (BMH): Mt. Koghi, 600–900 m, 19.III.1968, leg. T.C. Maa; 1 ♂ (BMH): same locality and date, 300–600 m, leg. J.L. Gressitt & T.C. Maa; 4 exs. (MHNG): Mt. Koghi, creek, litter, 19.X.1998, leg. I. Löbl; 23 exs. (MHNG, 1 ex. used for SEM photos in coll. NMP): Mt. Koghi, primary forest, 400–500 m, litter, 18.–19.X.1998, leg. I. Löbl; 5 exs. (MHNG): same locality, 500–600 m, primary forest, litter, 14.XI.1997, leg. I. Löbl; 1 ex. (BMH): Yahoué, gallery forest, leg. G. Kuschel, 22.I.1963; 7 exs. (MHNG): La Trappe above St. Louis, wood and leaf litter, 22.X.1998, leg. I. Löbl; 2 exs. (FMNH): Col de Mouirange, 30 km E Nouméa, 300 m, berlese, forest litter, 11.VIII.1978, leg. S. & J. Peck; 2 exs. (MHNG): Col de Mouirange, 260 m, litter, 16.IX.1997, leg. I. Löbl; 2 ♂♂, 1 ex. (NMW): Rivière Bleue (provincial park), 27.VIII.1970, leg. H. Franz “Pa 52–54”; 1 ex. (NMP): Rivière Bleue (provincial park), Houp Géant trail, 330 m, leaf litter, fungus and rotten wood, 22°09'28"S/166°30'48"E (NC022), leg. R.A.B. Leschen; 13 exs. (MHNG): Rivière Bleue (provincial park), primary forest, litter, 20.X.1998, leg. I. Löbl.

6 exs. (NMW): Loc. 2009/NC 26; 1 ex. (NMW): Loc. 2009/NC 27.

**DIAGNOSIS:** Body moderately sized; lateral margins of pronotum widely pale, yellowish; elytron with two yellowish spots basally and one spot subapically; punctuation of elytral intervals very fine, punctures much smaller than those of elytral series; elytral interstices without microsculpture; median plate of preepisternal elevation with delimited lateral bulges, elongately oval, slightly overlapping anterior margin of metaventrite; bearing very fine punctuation; parameres ca. 0.8 × as long as phallobase, their top directed apicad.

On the basis of the general habitus somewhat resembling *K. bipunctata*, but easily distinguished from it by the comparatively smaller size, coloration (two spots on the base of each elytron and

lateral parts of pronotum not very widely paler), shape of preepisternal elevation and male genitalia.

**REDESCRIPTION:** Body elongate oval, maximum width in anterior 0.33 of elytra; elytra narrowed posteriad, rather flat, weakly convex in lateral view. Length: 1.9–2.5 mm (HT: 2.3 mm); width: 1.2–1.6 mm (HT: 1.4 mm).

**Coloration (Fig. 32):** Dorsal side brown to dark brown, anterior margin of clypeus and lateral margins of pronotum widely paler, yellowish to reddish. Elytron with quite sharply delimited yellowish to reddish pale spots on base of elytral intervals 3–4 and 7–10, the lateral spot extending to anterior 0.25 last interval; elytral apex with yellowish subapical spot on intervals 7–9; epipleuron reddish. Ventral side reddish brown; ventral face of head, lateral parts of prosternum, legs, antennae and mouthparts slightly paler, reddish; cupula and antennal club slightly darker than antennomeres 1–5.

**Head:** Clypeus with fine and not very dense setiferous punctation, interstices shiny, without microsculpture; anterior margin straight. Frons with setiferous punctures ca. as large and densely arranged as on clypeus, only with some slightly larger punctures mixed with the normal-sized ones, these larger punctures more numerous posteriorly. Eyes small, separated by  $8 \times$  of width of one eye. Mentum with anterior margin bisinuate; surface with very small and sparsely distributed punctures, interstices without microsculpture. Length of antennomeres of antennal club:  $8 < 7 < 9$ ; antennomere 9 obtuse apically, with not very distinct strangulation subapically (Fig. 6).

**Prothorax:** Pronotum with maximum width at posterior margin; posterolateral corners not pronounced. Punctation slightly ca. as dense as on anterior part of frons, consisting of setiferous punctures similar with those on clypeus, with some sparsely distributed and slightly larger punctures posterolaterally, interstices without microsculpture; Prosternum carinate and slightly protruding apicad medially (Figs. 3–5).

**Mesothorax:** Scutellar shield with few minute punctures. Elytral intervals slightly convex basally at suture, becoming more distinctly convex laterad and posteriad; all intervals with very fine punctation bearing long pubescence, punctures much smaller than those of elytral series, rasp-like in shape; interstices without microsculpture (Fig. 41). Preepisternal elevation (Fig. 9, 36) subpentagonal, ca.  $1.7 \times$  as long as wide, widely contiguous with anteromedian projection of metaventricle; median part plate-like, divided from lateral portions, subpentagonal, ca.  $4.4 \times$  as long as wide, bearing fine setiferous punctation, interstices without microsculpture.

**Metathorax:** Median portion of metaventricle (Fig. 36) with fine sparse setiferous punctation, interstices without microsculpture; anterolateral ridges reaching ca. anterior 0.4 laterally.

**Legs short,** femora except their distal-most part with fine and sparse setiferous punctures; tibiae slightly longer than tarsi; tarsi sparsely pubescent ventrally.

**Abdomen:** Ventricle 1 (Fig. 15) strongly carinate medially; lateral parts with strongly developed additional submedian ridges; remaining ventricles without any ridges; all ventricles finely pubescent.

**Male genitalia (Fig. 48):** Parameres ca  $0.7 \times$  as long as phallobase, gradually narrowed to apical 0.33, slightly widened and bearing numerous sensilla more apically, widely rounded apically. Median lobe wide, slightly longer than parameres, acutely pointed apically; corona subapical.

**VARIABILITY:** Rather variable species especially in coloration and shape of the preepisternal plate on mesothorax. Some species are darker, with pale spots not as distinct as in most specimens, but always recognizable without any problem (at least after wetting the beetle). In contrast, pale specimens with pale reddish head and pronotum and rather large spots on elytral base were found near Mt. Panié. In most specimens, the preepisternal plate is widest at about the mid-

length, slightly narrowing both anteriorly and posteriorly, without slight widening present in type specimens. In some cases, the lateral margins of the preepisternal plate are only vaguely defined, and the preepisternal elevation has then the form of a narrow, prolonged elevated bulge rather than a plate. Male genitalia are constant among all specimens examined in all mentioned characters.

**HABITAT:** *Kanala montaguei* was sifted by M.A. Jäch and R. Schuh from leaf litter in a primary forest on Mt. Do (Loc. 2009/NC 26, see JÄCH & BALKE 2010: Fig. 50). One specimen was found at the margin of a small forest stream (Loc. 2009/NC 27, see JÄCH & BALKE 2010: Fig. 46). According to the label data of the other examined specimens, this species occurs in both primary and secondary forests, inhabiting many kinds of humid decaying matter (e.g. in leaf litter, “rotting saprophyte” and “woody fungi”). It was collected also using baited carrion and dung traps. Recorded from 120 to 1,000 m a.s.l.

**DISTRIBUTION** (Fig. 52): Widely distributed throughout Grande Terre.

### *Kanala punctiventris* sp.n.

**TYPE LOCALITY:** New Caledonia, Grande Terre, South Province, Mt. Koghi, 500 m.

**TYPE MATERIAL:** **Holotype** ♂ (CNC): “NEW CALED. / Monts Koghis / 26.VIII.1978 / S. Peck, 500m”.

**Paratypes:** 4 exs. (CNC): same data as holotype. NORTH PROVINCE: 5 exs. (MHNG): “New Caledonia / Tao Waterfalls nr. / Panié, 9.xi.97 / I. Löbl, litter”. SOUTH PROVINCE: 2 exs. (MHNG): “NEW CALEDONIA / above Sarramea / creek, leaf litter / 24.X.1998, I. Löbl”; 4 exs. (MHNG): “New Caledonia / Col d’Amieu / 11.xi.1997 I. Löbl / leaf litter + log”; 2 exs. (MHNG): “New Caledonia / Sarraméa: trail to / Plateau Dogny / 700-900m, 23.X.98 / I. Löbl, wood&leaf litter”; 4 exs. (MNHN, NMP, TTPC): “New Caledonia: P. Sud / Col d’Amieu (Sarraméa) / 21°34.407’S 165°45.674’ / 412 m, FIT, 5.19.xii.2007 / T. Théry lgt.”; 3 exs. (MNHN, TTPC): same data but “19.xii.07-11.i.2008”; 4 exs. (MNHN, NMP, TTPC): same data but “7.-14.ii.2008”; 2 exs. (MHNG): “New Caledonia / Col d’Amieu, 480- / 520m, 22.x.1998 / I. Löbl, sec. for. #6”; 18 exs. (CNC): “NEW CALEDONIA N of / La Foa, Col d’Amieu / 500m, 7.VIII.1978 / S. & J. Peck, berlese / rainforest litter”; 2 exs. (CNC): “NEW CALEDONIA / N. of La Foa, Col / d’Amieu, 500m / 7.VIII.1978, S. Peck”; 3 exs. (CNC, FMNH, NMP, one ex. used for SEM photography, covered with gold): same locality, but with date “9.VIII.1978”; 2 ♂♂, 2 ♀♀ (NMW): “Table d’Unio / Neukaledonien / [underside of same label] Pa 70 [all text handwritten]” [7.IX.1970, leg. H. Franz]; 10 exs. (CNC, FMNH, NMP): “NEW CALEDONIA, Col / de Roussettes nr. / Bourail, 500m, 7.VIII. / 1978, S. Peck berl. litter”; 1 ♂, 6 exs. (CNC, FMNH, NMP): “NEW CALEDONIA / Monts Koghis, Auberge / near Nouméa, 500m / 26.VII.-13.VIII.1978 / S&J Peck, rainforest // berl., rain forest / leaf litter”; 1 ♂, 1 ♀, 1 ex. (NMP: 2, NMW: 1): “Umg. Noumea / Neu-Kaledonien / lg. H. Franz / [underside of same label] Pa 58 // Mont Koghis [handwritten]” [30.VIII.1970]; 1 ex. (MHNG): “New Caledonia / Mt. Koghi, 500-600m / 14.XI.1997, I. Löbl / prim. forest litter”; 1 ♂, 1 ♀, 7 exs. (CNC, FMNH, NMP): “NEW CALEDONIA / Col de Mouirange / 30km E Nouméa, 300m / 11.VIII.78 S&JPeck / berl. forest litter”; 1 ♂ (NMW): “Pic du Pin / S Neu-Kaledonien / lg. H. Franz / [underside of same label] Pa 48-49 [hardly legible]” [26.VIII.1970]; 1 ex. (MHNG): “NEW CALEDONIA / Rivière Bleue / prim. forest, litter / 20.X.1998, I. Löbl”.

#### ADDITIONAL MATERIAL EXAMINED:

NORTH PROVINCE: 2 exs. (KSEM, NMP; in pure alcohol): Mt. Panié, 20°49’S/164°49’E (NC062), 200–500 m, leaf litter, 22.III.2007, leg. R.A.B. Leschen.

**DIAGNOSIS:** Body small, without pale lateral pronotal margins, in most specimens with one small pale elytral spot basally; punctuation of elytral intervals moderately strong, punctures smaller than those of elytral series; elytral interstices without microsculpture; preepisternal elevation with defined triangular to drop-shaped median plate widely contacting anterior projection of metaventricle; median part of metaventricle with strong and very dense punctuation; parameres 0.55 × as long as phallobase, apex directed mesad, with rounded mesal tooth in apical 0.4.

The specimens with distinct pale elytral spots resemble *K. bipunctata* and *K. montaguei*, differing from them by completely dark pronotum (not pale laterally), small, wide and short



body shape and very dense punctation of metaventricle. Black specimens can resemble *K. loebli* by body shape and absence of elytral mesh-like microsculpture, but differs from the latter by much sparser punctation of elytra and pronotum, different shape of preepisternal elevation and morphology of male genitalia.

**DESCRIPTION:** Body shortly and widely elongate oval, maximum width in anterior 0.2 of elytra; elytra narrowed posteriad, highly convex in lateral view. Length: 1.5–1.9 mm (HT: 1.9 mm); width: 1.0–1.4 mm (HT: 1.3 mm).

**Coloration (Fig. 31):** Dorsal side brown to dark brown, anterior margin of clypeus slightly paler. Elytron with indistinctly limited reddish pale spot on base of elytral interval 4; elytral apex with reddish subapical spot on interval 4; epipleuron reddish. Ventral side dark brown to black; legs, antennae and mouthparts brown to reddish brown; cupula and antennal club darker than antennomeres 1–5.

**Head:** Clypeus with coarse but not very dense punctation, interstices shiny, without microsculpture; anterior margin straight. Frons with punctation only indistinctly denser than on clypeus. Eyes small, separated by  $8.5 \times$  of width of one eye. Mentum with anterior margin bisinuate; surface with only a few small and sparsely distributed setiferous punctures, interstices without microsculpture. Length of antennomeres of antennal club:  $8 < 7 < 9$ , antennomere 9 obtuse apically, without distinct strangulation subapically.

**Prothorax:** Pronotum with maximum width at posterior margin; posterolateral corners not pronounced. Punctation ca. as dense as on frons, interstices without microsculpture. Prosternum carinate and slightly protruding anteriorly medially.

**Mesothorax:** Scutellar shield with a few minute punctures. Elytral intervals flat basally at suture, becoming slightly convex laterad and posteriad; all intervals with very fine punctation bearing short pubescence, punctures much smaller than those of elytral series, rasp-like in shape; interstices without microsculpture (Fig. 42). Preepisternal elevation (Fig. 8, 10, 37) with distinctly defined subtriangular to drop-like plate medially, plate ca.  $1.8 \times$  as long as wide, widely contiguous with anteromedian projection of metaventricle, bearing moderately coarse and quite dense setiferous punctation, interstices without microsculpture.

**Metathorax:** Median portion of metaventricle (Fig. 42) bearing moderately coarse and very dense setiferous punctation, interstices without microsculpture. Postcoxal ridges reaching posterior margin of metaventricle along its lateral margin.

**Legs short,** femora except their distal-most part with fine and sparse setiferous punctures; tibiae slightly longer than tarsi; tarsi densely pubescent ventrally.

**Abdomen:** Ventricle 1 carinate medially; lateral parts with strongly developed additional submedian ridges; remaining ventrites without any ridges; all ventrites finely pubescent.

**Male genitalia (Fig. 49):** Parameres ca  $0.55 \times$  as long as phallobase, gradually narrowed to apical 0.2, with rounded “tooth” directed mesad at their apical 0.4, slightly widened in apical 0.2, roundly pointed tip directed mesad. Median lobe wide, ca. as long as parameres, roundly pointed apically; corona subapical.

**VARIABILITY:** Not very variable species. The only variability was observed in the precise shape of the preepisternal plate (from drop-like with evenly arcuate sides to nearly triangular) and in the coloration (in some specimens, the pale elytral spots are very distinct, whereas they are virtually absent from dark specimens). The male genitalia are constant in all characters mentioned.

**HABITAT:** According to the label data of the specimens examined, this species occurs in primary forests at 200–900 m a.s.l. It can be sifted from forest leaf litter.

DISTRIBUTION (Fig. 53): Widely distributed on Grande Terre, but obviously less common than *Kanala montaguei*.

ETYMOLOGY: The specific name reflects the dense punctation on the metaventricle, one of the differential characters of this species (“punctiventris” = with punctate venter).

***Kanala reticulata* BALFOUR-BROWNE, 1939**

*Kanala reticulata* BALFOUR-BROWNE 1939: 374.

TYPE LOCALITY: New Caledonia, Grande Terre, North Province, Mt. Ignambi.

TYPE MATERIAL: **Holotype** ♂ (NHML): “Type [round label with red margin] // Loc. Ignambi / Date. 2-9-14 / Coll. P. D. Montague / New Caledonia Expedition // Mt. Ignambi / New Caledonia / 2.IX.1914 / P. D. Montague / 1918-87 // *Kanala* ♂ / *reticulata* Type! / Balfour-Browne det.”. The holotype is most probably teneral, general coloration dark reddish brown.

ADDITIONAL MATERIAL EXAMINED:

NORTH PROVINCE: 2 exs. (MNHV): North Province, Mandjéla summit, 20°23.9'S 164°31.9'E, 750–780 m a.s.l., ex *Pandanus*, 11.I.2007, leg. M. Wanat & R. Dobosz; 1 ♂, 1 ex. (BMH): New Caledonia, Mt. Panié, 1,000–1,200 m, ex *Pandanus*, 3.IV.1981, leg. J.L. Gressitt “Acc. #1981.166”.

DIAGNOSIS: Body large, black without paler spots; punctation of elytral intervals very fine, punctures slightly smaller than those of elytral series, elytral interstices with coarse mesh-like microsculpture; median plate of preepisternal elevation without delimited lateral portions, subpentagonal in shape, ca. as long as wide, broadly contacting anterior projection of metaventricle; median part of metaventricle with very fine punctation; parameres ca. 0.6 × as long as phallobase, with top directed mesad.

Easily distinguishable from all other *Kanala* species by its large body-size, uniformly black coloration and mesh-like sculpture of elytral interstices.

REDESCRIPTION: Body widely elongate oval, maximum width in anterior 0.33 of elytra; elytra narrowed posteriad, moderately convex in lateral view. Length: 3.1–3.5 mm (HT: 3.15 mm); width: 1.8–2.1 mm (HT: 1.8 mm).

Coloration (Fig. 29): Dorsal side black, anterior margin of clypeus only indistinctly paled. Elytron unicolored, without paler spots; epipleuron reddish. Ventral side dark reddish brown; submentum, legs, antennae and mouthparts slightly paler, dark reddish; cupula and antennal club slightly darker than antennomeres 1–5.

Head: Clypeus with fine and not very dense setiferous punctation, interstices shiny, without microsculpture; anterior margin very slightly concave. Frons with punctation similar to that on clypeus. Eyes small, separated by 6 × of width of one eye. Mentum with anterior margin bisinuate; surface with small and sparsely distributed setiferous punctures, interstices with fine mesh-like microsculpture. Length of antennomeres of antennal club: 8<7=9, antennomere 9 obtuse apically, with not very distinct strangulation subapically.

Prothorax: Pronotum with maximum width at posterior margin; posterolateral corners not pronounced. Punctation slightly finer but as dense as on frons, consisting of setiferous punctures, interstices without microsculpture. Prosternum strongly carinate medially, with median part slightly protruding anteriorly.

Mesothorax: Scutellar shield with few minute setiferous punctures. Elytral intervals only indistinctly convex basally at suture, becoming more distinctly convex laterad and mainly posteriad; all intervals with very fine punctation bearing long pubescence, punctures slightly smaller than fine punctures of elytral series, rasp-like in shape; interstices with coarse mesh-like microsculpture (Fig. 43). Preepisternal elevation (Fig. 38) 0.9 × as long as wide, without plate-

like median part limited from lateral parts, subpentagonal, widely contiguous with anteromedian part of metaventrite, anterior part in shape of equilateral triangle, bearing very fine setiferous punctation, interstices without microsculpture.

Metathorax: Median portion of metaventrite (Fig. 37) with fine, sparse setiferous punctures, interstices without microsculpture. Anterolateral ridges reaching anterior 0.8 along lateral margin.

Legs short, femora except their distal-most part with fine and sparse setiferous punctures, meso- and metafemora distinctly widened distally; tibiae slightly longer than tarsi; tarsi sparsely pubescent ventrally.

Abdomen: Ventrite 1 strongly carinate medially; all ventrites without additional sublateral ridges, finely pubescent.

Male genitalia (Fig. 46, 50): Parameres ca  $0.6 \times$  as long as phallobase, gradually narrowed to apical 0.33, strongly widened, bearing numerous sensilla more apically, with more or less pointed top directed mesad. Median lobe wide, as long as parameres, acutely pointed apically; corona subapical.

VARIABILITY: No variation of the mentioned characters except of coloration was observed, probably because of the low number of specimens examined.

HABITAT: According to the label data this species seems to inhabit primary forests in higher altitudes (above 750 m a.s.l.). One specimen was collected in *Pandanus* forest.

DISTRIBUTION (Fig. 53): Known only from three mountains of northeastern Grande Terre (Ignambi, Mandjéla, Panié).

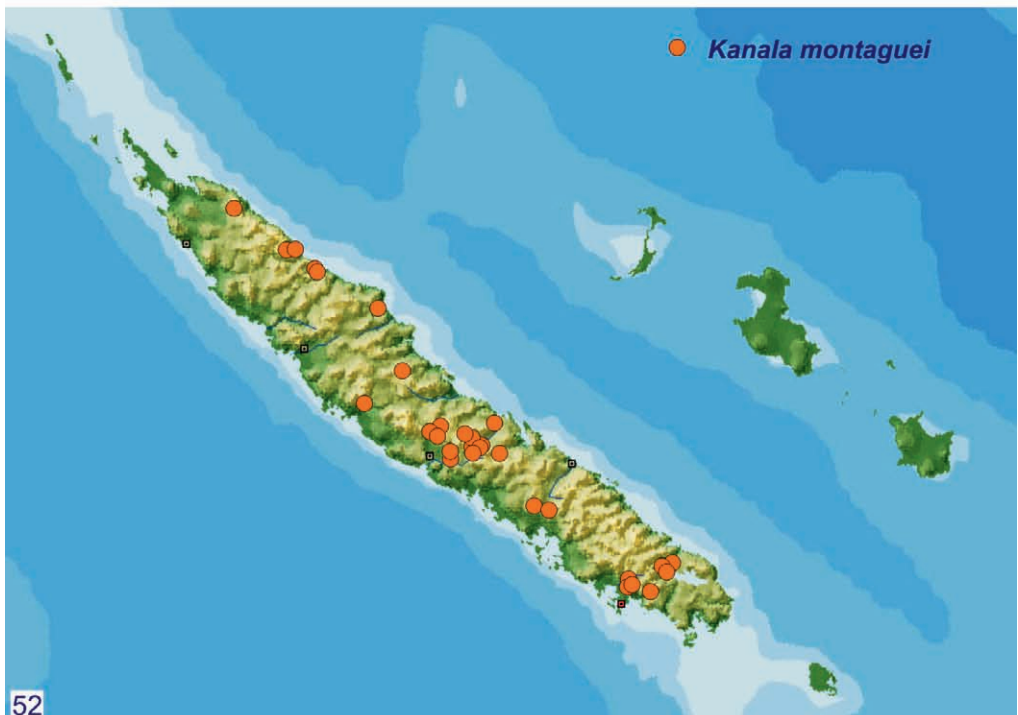
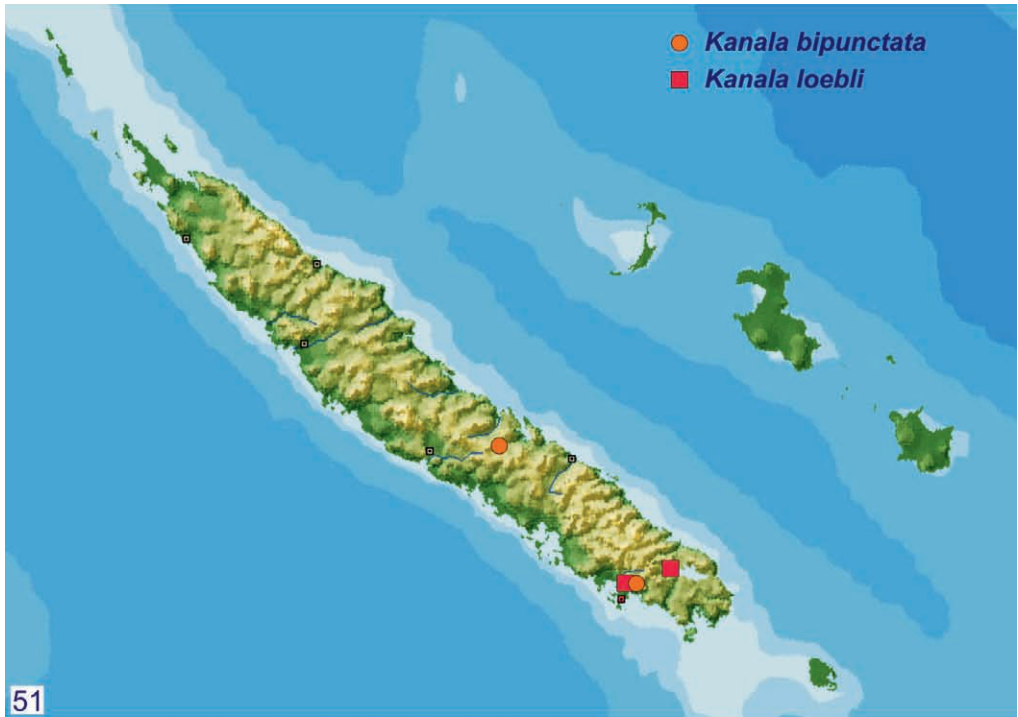
### Discussion

The genus *Kanala* is obviously endemic to Grande Terre; there are no records from any other New Caledonian island.

Although the autapomorphies of *Kanala* are inconspicuous and difficult to observe in routine identification, they seem to justify the position of *Kanala* as a separate genus. This is confirmed also by the preliminary phylogenetic analysis performed (see Fig. 28). Detailed examination of the related genera is, however, needed to evaluate additional characters supporting the topology obtained in this study. Also, low bootstrap values obtained are probably caused by low number of characters used for the analysis. When the geographic distribution of the taxa is included to the analysis, the strict consensus tree shows that *Kanala* probably is of Australian origin.

Systematics of the Megasternini genera is to a great extent based on the morphology of the preepisternal elevation (see e.g. HANSEN 1991). The highly variable morphology of the preepisternal elevation of *Kanala* shows clearly that this character can vary considerably among related taxa within one genus. In *Kanala*, this variability could be caused by a quick adaptive radiation of the ancestors after reaching New Caledonia. Detailed re-examination of the morphology of the preepisternal elevation in other Megasternini genera seems to be therefore desirable to evaluate its relevance for delimiting genera.

The knowledge on the bionomy and distribution of the *Kanala* species remains relatively scarce. Except of the most probably recently introduced species of the genus *Cercyon*, the species of *Kanala* are the only Megasternini in New Caledonia. Two species, *K. montagui* and *K. punctiventris* are widely distributed on Grande Terre. The remaining three species seem to be more restricted (*K. bipunctata* in central and southern parts of the island, *K. loebli* in the south, and *K. reticulata* in the north). The known distributional patterns of all species, however, correspond widely with the most frequently visited entomological localities (see Figs. 51–53) and additional material is needed to clarify the actual distribution.



Figs. 51–52: Geographical distribution of 51) *Kanala bipunctata*, *K. loebli*, 52) *K. montaguei*.

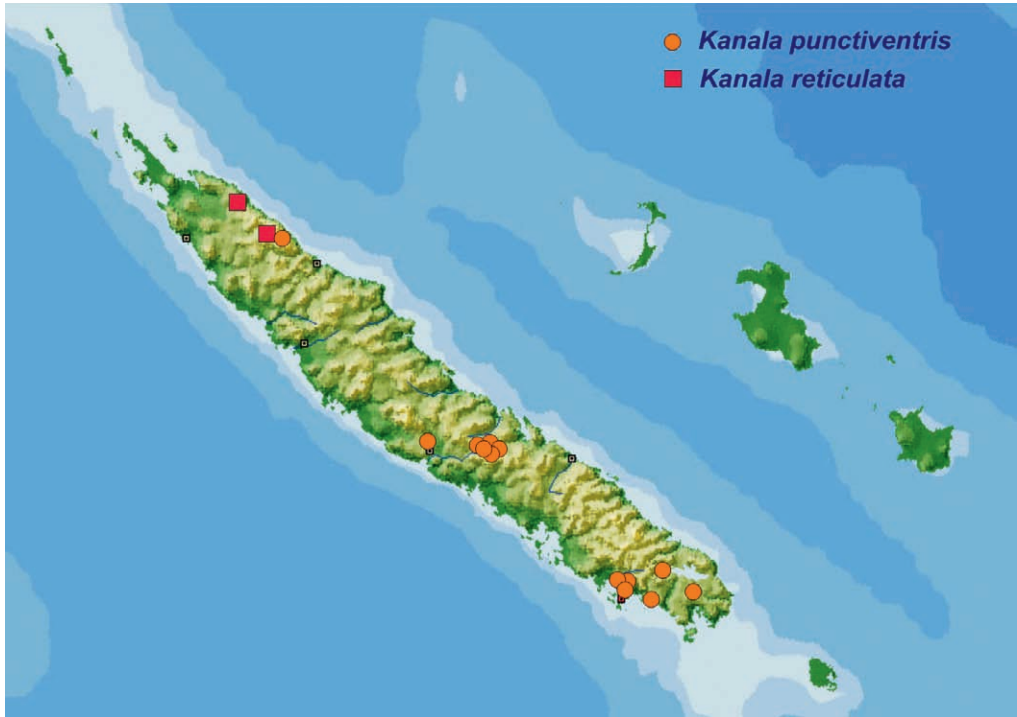


Fig. 53: Geographical distribution of *Kanala punctiventris*, and *K. reticulata*.

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## References

- BALFOUR-BROWNE, J. 1939: New and rare species of aquatic Coleoptera from New Caledonia. Dytiscidae and Palpicornia. – *The Annals and Magazine of Natural History* (11) 3: 370–376.
- BAMEUL, F. 1992: Revision of the genus *Psalitrus* d'Orchymont from Southern India and Sri Lanka (Coleoptera: Hydrophilidae: Omicrini). – *Systematic Entomology* 17 (1): 1–20.
- BEUTEL, J. & KOMAREK, A. 2004: Comparative study of thoracic structures of adults of Hydrophiloidea and Histeroidea with phylogenetic implications (Coleoptera, Polyphaga). – *Organisms Diversity & Evolution* 4 (1–2): 1–34.
- FIKÁČEK, M. & BOUKAL, M. 2004: *Pachysternum capense*, a new genus and species for Europe, and updated key to genera and subgenera of European Sphaeridiinae (Coleoptera: Hydrophilidae). – *Klapalekiana* 40: 1–12.
- FIKÁČEK, M. & SHORT, A.E.Z. 2006: A revision of the Neotropical genus *Motonerus* Hansen (Coleoptera: Hydrophilidae: Sphaeridiinae). – *Zootaxa* 1268: 1–38.
- GOLOBOFF, P., FARRIS, S. & NIXON, K. 2000: TNT (Tree analysis using New Technology) ver. 1.1. Published by the authors, Tucumán, Argentina.
- HANSEN, M. 1989: New genera of Sphaeridiinae (Coleoptera: Hydrophilidae). – *Entomologica Scandinavica* 20 (3): 251–262.
- HANSEN, M. 1990: Australian Sphaeridiinae (Coleoptera: Hydrophilidae): A taxonomic outline with description of new genera and species. – *Invertebrate Taxonomy* 4 (2): 317–395.
- HANSEN, M. 1991: The Hydrophiloid Beetles. Phylogeny, classification and a revision of genera (Coleoptera, Hydrophiloidea). – *Biologiske Skrifter* 40: 1–367.
- HANSEN, M. 1999a: Hydrophiloidea (Coleoptera). – In: Hansen, M. (ed.): *World Catalogue of Insects*. Vol. 2. – Stenstrup: Apollo Books, 416 pp.
- HANSEN, M. 1999b: Fifteen new genera of Hydrophilidae (Coleoptera), with remarks on the generic classification of the family. – *Entomologica Scandinavica* 30 (2): 121–172.
- JÄCH, M.A. & BALKE, M. 2010: Introduction, pp. 1–29. – In: Jäch, M.A. & Balke, M. (eds.): *Water beetles of New Caledonia (part 1)*. – *Monographs on Coleoptera* 3: IV+449 pp.
- KOMAREK, A. 2004: Taxonomic revision of *Anacaena* Thomson, 1859. I. Afrotropical species (Coleoptera: Hydrophilidae). – *Koleopterologische Rundschau* 74: 303–349.
- KUKALOVÁ-PECK, J. & LAWRENCE, J.F. 1993: Evolution of the hind wing in Coleoptera. – *The Canadian Entomologist* 125 (2): 181–258.
- KUKALOVÁ-PECK, J. & LAWRENCE, J.F. 2004: Relationships among coleopteran suborders and major endoneopteran lineages: Evidence from hind wing characters. – *European Journal of Entomology* 101 (1): 95–144.
- NASSERZADEH, H., HOSSEINIE, S. & MONSEFI, M. 2005: Morphology of the reproductive systems of the Iranian species of *Hydrochara* Berthold (Coleoptera: Hydrophilidae). – *Koleopterologische Rundschau* 75: 227–245.
- SMETANA, A. 1978: Revision of the subfamily Sphaeridiinae of America North of Mexico (Coleoptera: Hydrophilidae). – *Memoirs of the entomological Society of Canada* 105: 1–292.

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