Papillocepheus banari sp. nov. (Acari, Oribatida, Otocepheidae) from Malawi

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Abstract
A new species of oribatid mite of the genus *Papillocepheus* is described from Malawi. *Papillocepheus banari* sp. nov. differs from *Papillocepheus deficiens* by the larger body size, the localization of dorsal notogastral setae, and the direction of posterior notogastral setae.

Key words: oribatid mites, taxonomy, morphology, Afrotropical region.

Introduction
The oribatid mite genus *Papillocepheus (=Clavazetes* Hammer, 1966) was proposed by Balogh & Mahunka (1966) with *Papillocepheus heterotrichus* Balogh & Mahunka, 1966 as type species. At present, the genus comprises 10 species, which are distributed in the Afrotropical (six species), Australasian (two species), Neotropical (one species), and Oriental (one species) regions (Subías 2004, online version updated 2021). The taxonomic revision, generic diagnosis and identification key to known species of *Papillocepheus* were presented by Ermilov et al. (2014).

Among the oribatid mite materials collected from Malawi, we found a new species, which is the first representative of *Papillocepheus* recorded in this country. The main goal of the paper is to describe this new species.

Material and methods
Specimens. All specimens of a new species were kindly provided by the Moravian Museum, Brno, Czech Republic; the collection locality is given in the Material examined section. Type specimens are deposited in two institutions: the Senckenberg Museum of Natural History, Görlitz, Germany (SMNH); and the Tyumen State University Museum of Zoology, Tyumen, Russia (TSUMZ).
Observation and documentation. Specimens were mounted in lactic acid on temporary cavity slides for measurement and illustration. Body length was measured in lateral view, from the tip of the rostrum to the posterior edge of the notogaster. Body width refers to the maximum width of the notogaster in dorsal view. Lengths of body setae were measured in lateral aspect. All body measurements are presented in micrometers. Formulas for leg setation are given in parentheses according to the sequence trochanter-femur-genu-tibia-tarsus (famulus included). Formulas for leg solenidia are given in square brackets according to the sequence genu-tibia-tarsus. Drawings were made with a camera lucida using a Leica transmission light microscope “Leica DM 2500”.

Terminology. Morphological terminology partially used in this paper follows that of Aoki (1965, 1967), Norton (1977), Ermilov & Starý (2018), Ermilov & Khaustov (2020).

Abbreviations. Prodorsum: cos = costula; ro, le, in, bs = rostral, lamellar, interlamellar, and bothridial seta, respectively; co.pl = lateral prodorsal condyle; tu = tutorium. Notogaster: co.nl = lateral notogastral condyle; la, lm, lp, h, p = setae; ia, im, ip, ih, ips = lyrifissures; gla = opisthontonal gland opening. Gnathosoma: a, m, h = subcapitular setae; d, l, sup, inf, cm, ul, sul, vt, lt = palp setae; ω = palp solenidion; cha, chb = cheliceral setae; Tg = Trägårdh’s organ. Epimeral and lateral podosomal regions: 1a–c, 2a, 3a–c, 4a–c = epimeral setae; PdII, PdIII = pedotectum I, II, respectively; dis = discidium. Anogenital region: g, ag, an, ad = genital, aggenital, anal, and adanal seta, respectively; iag, iad = aggenital and adanal lyrifissure, respectively; cvr = circumventral ridge; p.o. = preanal organ. Legs: Tr, Fe, Ge, Ti, Ta = trochanter, femur, genu, tibia, and tarsus, respectively; p.a. = porose area; ω, φ, σ = solenidia; ε = famulus; d, l, v, bv, ev, ft, tc, lt, p, u, a, s, pv = setae.

Taxonomy

Papillocephus banari sp. nov.
http://zoobank.org/urn:lsid:zoobank.org:act:03624BED-96F0-4E82-AF2E-AD8C64305A8A
(Figs 1–10)

Diagnosis. Body length: 830–1326. Cuticle densely microgranulate; prodorsum, notogaster and ventral side foveolate. Rostral seta long, setiform, barbed. Lamellar seta long, hardly phylliform, barbed. Interlamellar seta long, narrowly phylliform, barbed. Bothridial seta short, clavate, barbed. Paired lateral prodorsal and lateral notogastral condyles tubercle-like; medial prodorsal and medial notogastral condyles absent. Nine pairs of notogastral setae: la, lm, lp, h, p narrowly phylliform, barbed, inserted in two longitudinal rows; h3, p1, p2, p3 setiform, barbed; c absent. Epimeral and anogenital setae setiform, barbed. Adanal lyrifissure obliquely oriented. Leg seta u of all tarsi setiform.

Description of adult. Measurements. Large and elongate species. Body length: 996 (holotype, male), 830–1079 (eight males), 1211–1326 (nine females); notogaster width: 415 (holotype), 332–464 (eight males), 547–614 (nine females).

Integument. Colour yellowish brown. Body partially covered by thick layer of gel-like cerotegument. Cuticle densely microgranulate. Prodorsum, notogaster, ventral side and anal plate with sparse foveolae (diameter up to 10). Lateral part of body between bothridium and acetabula I–III with dense tubercles (up to 8).

Prodorsum. Rostrum broadly rounded. Costula long, reaching bothridium basally and insertion of lamellar seta distally. Rostral seta (90–102) setiform, barbed. Lamellar seta (90–102) hardly phylliform, barbed. Interlamellar seta (106–123) narrowly phylliform, barbed. Bothridial seta (length outside bothridium: 45–49) clavate, barbed. Exobothridial seta absent. Tutorium strong. Paired lateral prodorsal condyles tubercle-like; medial prodorsal condyles absent. Interbothridial region with two unclear longitudinal ribs.

Notogaster. With circummarginal depression. Paired lateral notogastral condyles tubercle-like; medial notogastral condyles absent. Notogaster with nine pairs of setae (h3, p1, p2, p3): 69–82; others: 106–123; dorsal setae (la, lm, lp, h1, h2) narrowly phylliform, barbed, inserted in two longitudinal rows; posterior setae (h3, p1, p2, p3) setiform, barbed; c absent. Opisthontonal gland opening and all lyrifissures distinct: gla located lateral to lm; ia between co.nl and la; im posterolateral to lm; ip between p2 and p3; ips lateral to h3; ih anterior to h3.
Figures 1–3. *Papillocepheus banari* sp. nov., adult: 1—dorsal view (legs omitted); 2—ventral view (gnathosoma and legs omitted); 3—lateral view (gnathosoma and legs omitted). Scale bar 100 μm.
Figures 4–10. Papillocepheus banari sp. nov., adult: 4—subcapitulum, ventral view; 5—palp, right, antiaxial view; 6—chelicera, right, antiaxial view; 7—leg I, right, antiaxial view; 8—leg II (tarsus omitted), right, antiaxial view; 9—leg III (tarsus omitted), left, antiaxial view; 10—leg IV, left, antiaxial view. Scale bars 50 μm (4, 6–10), 20 μm (5).
Gnathosoma. Subcapitulum size: 184–192 × 123–143. Subcapitular setae (a: 28–32; m: 36–41; h: 49–53) setiform, barbed. Palp (94–102) setation: 0–2–1–3–8(tero). Postpalpal seta (8) spiniform, smooth. Chelicera (184–192) with two (cha: 61–65; chb: 28–32) setiform, barbed setae.

Epimeral and lateral podosomal regions. Apodemes I, II, III and sejugal apodeme well developed. Epimeral formula: 3–1–3–3. Setae (1a, 2a, 3a: 12–16; 1b: 57–69; others: 45–57) setiform, barbed. Pedotectum I represented by large lamina. Discidium subtriangular, rounded distally.

Anogenital region. Genital (41–53), aggenital (53–57), adanal (53–65), and anal (24–28) setae setiform, barbed. Distance ad1–ad3 larger than ad2–ad3 and ag–ag. Adanal lyrifissure oblique, located between anterior part of anal aperture and insertion of ad1. Circumventral ridge developed.

Legs. Claw of each leg strong, slightly barbed on dorsal side. Dorsoparial porose area present on femora I–IV; porose area on trochanters III, IV not visible. Formulas of leg setation and solenidia: I (1–4–3–4–16) [1–2–2], II (1–4–3–3–15) [1–1–2], III (1–3–0–2–15) [1–1–0], IV (1–2–1–2–14) [0–1–0]; homology of setae and solenidia indicated in Table 1. Seta u of all tarsi setiform.

Table 1. Leg setation and solenidia of Papillocepeus banari sp. nov.

| Leg | Tr | Fe | Ge | Ti | Ta |
|-----|----|----|----|----|----|
| I   | v' | d, (l), bv'' | (l), v', σ | (l), (v), φ₁, φ₂ | (ft), (tc), (it), (p), (u), (a), s, (pv), ε, ω₁, ω₂ |
| II  | v' | d, (l), bv'' | (l), v', σ | l', (v), φ | (ft), (tc), (it), (p), (u), (a), s, (pv), ω₁, ω₂ |
| III | v', l' | d, l', ev' | σ | (v), φ | (ft), (tc), (it), (p), (u), (a), s, (pv) |
| IV  | v' | d, ev' | d | (v), φ | ft'', (tc), (it), (p), (u), (a), s, (pv) |

Note: Roman letters refer to normal setae, Greek letters to solenidia (except ε = famulus); single quotation mark (’) designates setae on the anterior and double quotation mark (”) setae on the posterior side of a given leg segment; parentheses refer to a pair of setae.

Material examined. Holotype (male) and 17 paratypes (eight males and nine females): sample #9, Malawi, Maloza, Malanje Mts., Maloza stream valley, 16°01'3.9"S, 35°32'36.6"E, 972 m a.s.l., sifting litter, Winkler extraction, 24.XI.2012 (leg. P. Baňař).

Type deposition. The holotype is deposited in the collection of the SMNH; 17 paratypes are deposited in the collection of the TSUMZ. All specimens are preserved in 70% solution of ethanol with a drop of glycerol.

Etymology. The species name is dedicated to our colleague, Dr. Petr Baňař (Brno, Czech Republic) renowned entomologist, specialist on soil Heteroptera, collector of large material of soil samples from Malawi.

Remarks. Papillocepeus banari sp. nov. is morphologically most similar to Papillocepeus deficiens Balogh & Balogh, 1983 from Australia in having five pairs of narrowly phylliform notogastral setae, but the new species differs from the latter by the larger body size (length: 830–1326 versus 503), the localization of dorsal notogastral setae (inserted in two longitudinal rows versus widely placed on notogaster), and the direction of posterior notogastral setae (erect versus pressed to notogastral surface).

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