

Oribatid mites (Acarina, Oribatida) from French Guyana II. Two new species from superfamily Crotonioidea Thorell, 1876

Ladislav Miko^a

^a Charles University Prague, Institute for Environmental Studies, Czech Republic.

Original research

ABSTRACT

Two new species from the superfamily Crotonioidea, *Malaconothrus kawensis* **n. sp.** and *Cyrthermannia bifurcata* **n. sp.**, found in material collected in Kaw mountains (Montagne de Kaw), and near the Saül, French Guyana, are described. The relationships of both new species within respective genera are analysed, and determination keys are provided for all South-American and other closely related *Malaconothrus* species and for all known *Cyrthermannia* species. *Cyrthermannia formosana* Tseng, 1982 is newly recombined as *Nanhermannia (Nippohermannia) formosana* (Tseng, 1982) **n. comb.**, following analysis of morphological characters.

Keywords oribatids; *Cyrthermannia*; *Malaconothrus*; French Guyana; Kaw mountains; Saül; mite taxonomy; mite morphology

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Introduction

The oribatid fauna of French Guyana was completely unknown, with no published information before my previous work referring to mites from the family Rhynchoribatidae (Miko, 2016). In this second contribution on oribatids of French Guyana, the aim is to describe two new species from the superfamily Crotonioidea Thorell, 1876 *Malaconothrus kawensis* **n. sp.** and *Cyrthermannia bifurcata* **n. sp.**, found in material collected in Kaw mountains (Montagne de Kaw) and in the vicinity of Saül, respectively, and to analyse their relationships within their relevant genera.

Methods

Material studied for this publication was collected in the range of Kaw Mountains (*Malaconothrus kawensis* **n. sp.**) and in the vicinity of Saül (*Cyrthermannia bifurcata* **n. sp.**). Samples were collected in tropical forest, and comprised mostly of decomposing litter and decaying wood, including mosses and lichens growing on the ground, on rocks and as epiphytes. Detailed information about samples, their composition, location and date of collection is provided in respective species descriptions. Samples were transported in plastic bags and extracted immediately for 3 days in field extractors, based on the principle of Berlese apparatus or entomological xero-photo-elector and constructed from simple linen cloth with a small plastic funnel at the bottom. Electric bulb was used as a source of light and heat as much as the electricity supply allowed, and the rest of the time samples were left to dry in the sun as much as possible. Extracted material was collected into 75% alcohol (ethanol). Samples

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Corresponding author
Ladislav Miko:
ladislavmiko@seznam.cz

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were transported to Europe and sorted. Individuals were studied in temporary open slides after maceration in lactic acid. Material after study is kept in 75% alcohol (ethanol) and held either in collections of Senckenberg Museum in Goerlitz (Germany), or in the private collection of the author (for details see description of individual species).

For description and detailed study, standard terminology summarised by Norton and Behan Pelletier (2009) was used. All measurements are given in micrometers. Body length is given as maximum length (from tip of the rostrum to posterior end of notogaster) and as a ventral length (from tip of the rostrum to posterior margin of ventral plate). Length of prodorsum was measured in dorsal view as a distance between tip of the rostrum and anterior margin of the notogaster. Maximum width of body was measured in the broadest part of the notogaster, usually between tips or slightly behind discidia, depending on the species. Maximum width of prodorsum was measured in the broadest part between lateral margins of pedotecta I.

Genus *Malaconothrus* Berlese, 1904

Genus has global distribution, with 84 known species (Subías, 2004, 2018). Two more species were described recently from Africa (Ermilov and Starý, 2019). The concept and generic definitions within the family Malaconothridae have been reviewed for several times (Weigmann, 1997, 2006; Subías, 2018; Colloff, 2013; Colloff and Cameron, 2013). As a result, the new definition of the genus was proposed (Colloff and Cameron, 2013) and species have been grouped into 5 quite well defined species groups: *plumosus*, *opisthoseta*, *crispus*, *monodactylus* and *marginatus* group (Colloff, 2013). The species found in the Kaw mountains clearly belongs to the “*plumosus*” group, which is defined by Colloff (2013) as “... monodactylous species with broad, well-developed notogastral ridges; a broad, sub-rectangular rostrum; barbed or smooth, thick rostral setae; five pairs of genital setae, often thick and dilated basally, with g_5 considerably longer than the others and further from g_4 than the distance between g_4 and g_3 . The interlamellar seta is often very short, sub-equal in length to the exobothridial seta or only twice as long”. Nevertheless, none of the 5 species known from Central and South America is similar to the new species. The only similar species are known from Japan (Yamamoto 1996; Yamamoto and Aoki, 1997), and they belong to the same subgroup according to Colloff (2013). Recently, Ermilov and Starý (2019) described two species from Cameroon with very similar general appearance to the new species. However, *Malaconothrus* found in French Guyana clearly differs from all these species and is described below as a new species. The differences to similar species are discussed in discussion and in attached determination key.

Malaconothrus kawensis n. sp.

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Figures 1, 2

Diagnosis — *Malaconothrus* species from “*plumosus*” group (Colloff, 2013), with most of notogastral setae slightly dilated and bilaterally barbed, and some notogastral setae (e_2 , h_1 , h_2 , p_2) smooth, setae h_2 being the longest. Centrodorsal setae of notogaster d_1 reaching significantly behind half distance of d_1 and e_1 . Prodorsal setae, particularly *in*, quite short, smooth, with only rostral setae densely bilaterally barbed. Epimeral setae *4b* longest of epimeral setae IV and not positioned on posterior tectum of epimere IV. Dotted/porose areas present parallel to insertions of centrodorsal setae, also along lateral margins of notogaster and parallel to lateral edges of anogenital plate.

Material examined — 5 females collected 10-III-2012 in Kaw Mountains, in litter, dead leaves and rotting timber on the soil surface in tropical rainforest near to Coq du Roche Reserve, 4°34'2" N, 52°11'58" W (sample nr. LM-2012-008), French Guyana. Type and one paratype preserved in acarological collection of Senckenberg Museum in Goerlitz, 3 paratypes (one damaged) in collection of the author.

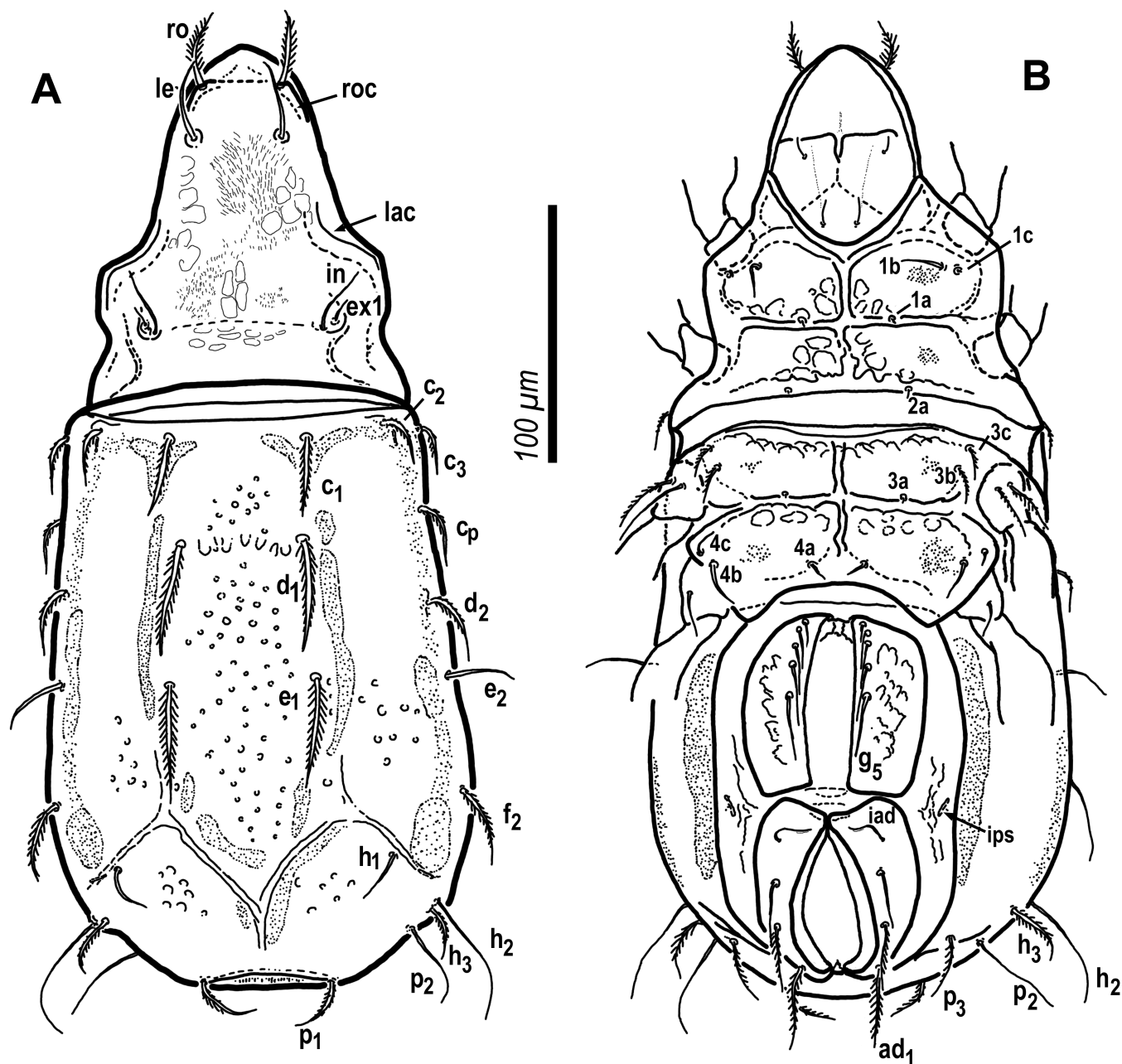


Figure 1 *Malaconothrus kawensis* n. sp., adult female: A – dorsal view, B – ventral view (legs not depicted). Abbreviations and descriptions: *1a-1c, 2a, 3a-3c, 4a-4c* – epimeral setae; *ad₁* – adanal seta 1; *c₁-c₃, cp, d₁-d₃, e₁-e₃, f₂, h₁-h₃, p₁-p₃* – notogastral setae; *ex₁* – exobothridial seta 1; *g₅* – genital seta 5; *iad, ips* – lyrifissures; *in* – interlamellar seta; *lac* – lateral carina; *le* – lamellar seta; *ro* – rostral seta; *roc* – rostral carina. Bar indicating 100 micrometers.

Description — Measurements — Values given for holotype, with range observed in paratypes in parentheses. Total body length 371 (365–385), prodorsum length 132 (130–136), prodorsum width 127 (125–132), width of notogaster 142 (142–145).

Integument – (Figs 1A-B, 2B). Body color pale, yellowish or white. Body surface with different types of sculpture: notogaster with small foveolae (diameter mostly around 2.5–3, up to 5 in posterior part of notogaster), with mutual distances larger than their diameter (5–6.5). Prodorsum with dense punctuation, in the area behind setae *le* with perforated cuticle

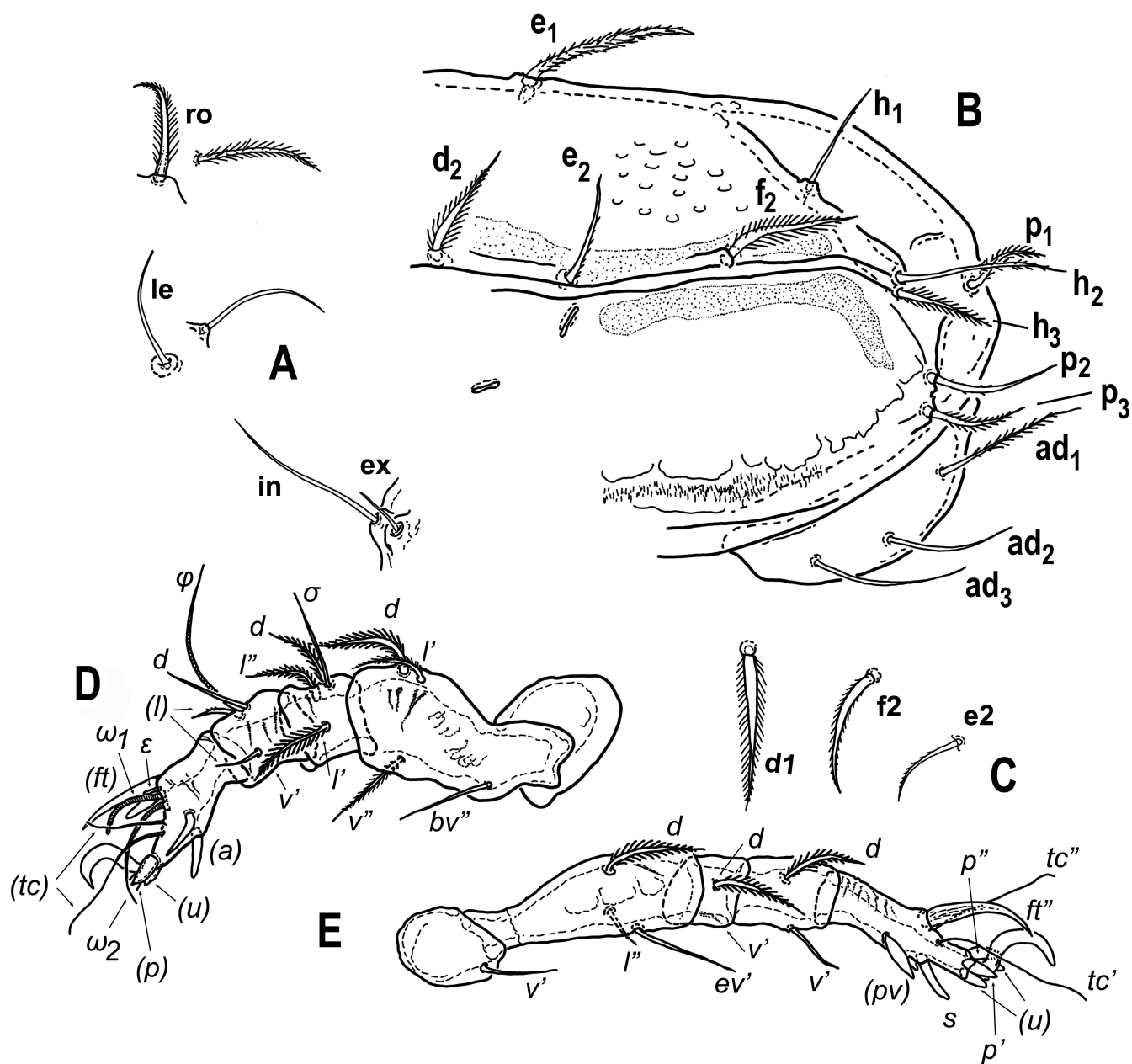


Figure 2 *Malaconothrus kawensis* n. sp., adult female: A – prodorsal seta *ro* in dorsal and lateral view, seta *le* in dorsal and lateral view, complex of setae *in-ex*; B – lateral view on posterior part of the body; C – notogastral setae *d*₁, *f*₂ and *e*₂ in dorsal view; D – leg I in antiaxial view with description of setae, E – leg IV in antiaxial view with description of setae. Size of structures given in text. Abbreviations and descriptions: *ad*₁–*ad*₃ – adanal setae 1–3; *d*₂, *e*₁–*e*₂, *f*₂, *h*₁–*h*₃, *p*₁–*p*₃ – notogastral setae; *ex*₁ – exobothridial seta 1; *in* – interlamellar seta; *le* – lamellar seta; *ro* – rostral seta.

(“chagrenation”), with maculae visible laterally and also between setae *in*. Ventrally densely punctate on epimeres, these also with muscle maculae. On both dorsal and ventral side of body, distinct areas of dense punctuation present, resembling porose areas of higher oribatids, some of these areas more distinctly framed, some not. These areas aligned antiaxially along insertions

of setae e_1 and f_1 , axially to lateral setae (from c_2 to the level of h_1 insertion). Irregular areas also present along notogastral posterior ridges, and V-shaped areas present behind insertions of setae c_1 . Similar, longitudinal areas present on ventral side, laterally along anogenital plate. Genital plates with more or less distinct, rugose surface sculpture.

Prodorsum – (Figs 1A, 2A). Rostrum conical, with very blunt tip or almost rounded. Short rostral carinae (*roc*) present, running posteriad from *ro* insertions, their anterior ends connected with distinct transversal line; this structure giving rostrum angular appearance in slightly posterodorsal view. Lateral carinae (*lac*) poorly developed, visible only in proximal part, not reaching insertions of setae *le*. Posterior of prodorsum behind insertions of setae *in* and *ex* narrowed, creating elbow-like postbothridial carinae. Indistinct transverse line visible between insertions of *in*, probably representing slightly thickened cuticle on anterior edge of deepened posterior part of prodorsum. Rostral setae (*ro*) medium long (31–39), slightly thickened at base, distinctly barbed. Lamellar setae (*le*) of about the same length as *ro* (32–39), simple setiform, smooth. Interlamellar setae (*in*) largest of prodorsal setae (47–50), smooth, setiform. Setae *ex*₁ short, between one quarter and one third of *in* length (14–15), smooth, setiform. Setae *ex*₂ absent.

Notogaster – (Figs 1A, 2B, 2C). Anterior margin straight, posterior margin slightly angulate in area of p_1 insertions. Notogaster slightly dilated posteriad, broadest part is at level of setae f_2 . Notogastral ridges present, well visible only in posterior part as inverted “W” with anterior ridges reaching more or less posterior to e_1 insertions. Distinct transverse ridge present between insertions of setae p_1 in posterior part of notogaster. Setae c_2 inserted on blunt tubercular thickening of cuticle. Notogastral setae of different length and form, d_1 , e_1 and h_2 longest (42–49), c_2 , c_3 , e_2 , h_1 , h_3 , p_1 and p_3 shortest (24–28). All notogastral setae barbed, most of them slightly thickened and with distinct barbs longer than width of setae, only e_1 , h_1 , p_2 and h_2 appearing almost smooth, but in detailed view each with at least few minute barbs. All lyrifissures distinct.

Ventral characters – (Fig. 1B). Gnathosoma as in other species in genus (Colloff and Cameron, 2013), setae *a*, *m* and *h* short, simple setiform. Epimeral region with distinct apodemes, epimeres IV with blunt posterior tectum projecting posteriad over anterior part of anogenital plate. Epimeral setal formula 3-1-3-3, epimeral setae mostly simple setiform and smooth (with only few minute barbs at most), except setae *3b* and *3c* which are distinctly barbed. Length of epimeral setae very different, *1a*, *1c*, *2a* and *3a* minute or vestigial, *4a* and *4c* short (around 7–8) and *1b*, *3b*, *3c* and *4b* somewhat longer (13–18). Anogenital plate with more or less parallel sides, length of genital plates 70, width 29, anal and adanal plates slightly longer (83), maximum width of anal plates 8, adanal 31. Five pairs of smooth genital setae present, with growing size from anterior to posterior, g_1 (10) more than 2 times shorter than g_5 (23). Alveoli of single pair of anal setae indistinct. Three pairs of quite long (38–44) adanal setae present, ad_1 distinctly barbed, ad_2 almost smooth or with some barbs, ad_3 setiform and smooth. Adanal lyrifissures large, distinct, mostly transversal, located anteriorly to ad_3 . Lyrifissures *ips* quite large, positioned near lateral edge of anogenital plate at level of anterior margin of anal plates.

Legs – (Figs 2D, 2E). Robust and rather short, as typical for genus, with smooth claws. Setae differently shaped, mostly (except tarsi) setiform or slightly thickened and barbed, on tarsi some setae strong, spiniform, with blunt or pointed and curved tip. Trochanteral setal formula 0-0-2-1, setae of trochanter III barbed. Only leg I and IV studied in detail, setal formula of leg I 0-4-3[1]-4(1)-11, setal formula of leg IV 1-3-2-2-10. Setae *d* of femur, genu and tibia I and IV, lateral setae of genu I as well as setae *l'* and *v''* of femur I barbed similar to notogastral setae. Setae *tc* of tarsus on both leg I and IV long (44–46), filiform, tactile. Setae *u*, *pv* and *ft'* of leg I and *p*, *u*, *s* and *pv* of leg IV thick, spiniform, rather short and more or less blunt, seta *ft''* of tarsus IV long (33), thickened, curved and acute, claw-like. Solenidia longer than setae *d* on genu and tibia of leg I (solenidion φ the longest, 47), tarsal solenidia as long as seta *ft''* or longer, but shorter than setae *tc*. Famulus short, baculiform.

Derivatio nominis — The name *kawensis* relates to the typical locality, where the species was found – Montagne de Kaw.

Remarks — The species of genus *Malaconothrus* as redefined by Colloff and Cameron (2013) have been recently organised into 5 distinct species-groups (Colloff, 2013). *Malaconothrus kawensis* belongs clearly to “*plumosus*” species group, originally proposed by Mahunka (1992) and extended by P. Balogh (1997). This group contains 28 known species with broad pan-tropical and subtropical distribution. The species of this group may be further sub-divided into 4 well defined groups, regarding development of notogastral setae (Colloff, pers. comm.): with notogastral setae all smooth (15 species); all barbed (9 species); notogastral setae e_2 , some of h series, and p_2 smooth, others barbed (3 species); and setae of c and p series and h_3 smooth, others barbed (1 species). The new species described here belongs to the rather small subgroup of the “*plumosus*” group, characterised by notogastral setae partly smooth (setae e_2 , some of h series, p_2) and partly slightly dilated and barbed (remaining setae). Three other species belong to this subgroup: *M. kiiensis* Yamamoto 1996, *M. iriomotensis* Yamamoto and Aoki, 1997 and *M. variosetosus* Hammer, 1971. *Malaconothrus variosetosus* can be easily distinguished by the different number of genital setae (6, vs. 5 in all other species including *M. kawensis*). In comparison to *M. kawensis*, it has much shorter notogastral setae, particularly c_1 , d_1 and e_1 , which do not reach even half the distance to the following setae (vs. almost reaching it in *M. kawensis*), and barbed notogastral (and rostral) setae barbed only unilaterally (vs. bilateral in *M. kawensis*). The other two species of the subgroup appear to be more closely related to *M. kawensis* – apart of mentioned characters, they also share weak development of lamellar ridges, presence of rostral carinae, presence of indistinct ridge between insertions of interlamellar setae and presence of broad, dotted/porose areas in position of the notogastral longitudinal ridges. These species also share presence of 5 genital setae, mostly concentrated in anterior half of the genital plates. Interesting similarity was found also on shape of adanal setae – in all three species they are longest of the ventral setae, and they may be variable regarding presence of bristles: Yamamoto and Aoki (1997) found that seta ad_1 may be smooth or with bristles, similar to seta ad_2 of the new species. The Japanese species *M. kiiensis* and *M. iriomotensis*, however, share some characters which are not present in the new species: longer prodorsal setae (in particular *in*, but also *le* and *ro*), relatively shorter notogastral setae (particularly centrodorsal, setae d_1 reaching only to half distance between d_1 and e_1) with shorter and less dense bristles, and position of very short epimeral seta *4b* (indicated in original descriptions of both species as *4a*) on posterior tip of epimeral tectum IV. *Malaconothrus kawensis* has prodorsal setae shorter, centrodorsal setae of notogaster longer (d_1 reaching far posterior of half distance d_1 and e_1) and with much denser and longer bristles, and epimeral setae *4b* much longer and positioned much more anteriorly, not on posterior tectum of epimere IV. The new species differs also by presence of V-shaped dotted/porose areas posterior to insertions of c_1 , parallel along the notogaster laterally, and lateral to anogenital plate ventrally. Sculpture of notogastral cuticle is also different, *M. kawensis* has the notogaster with distinct and mutually quite distant small foveolae, the two Japanese species have notogaster with much finer ornamentation: very small and quite dense round foveolae or dots in *M. kiiensis* and dense punctuation in *M. iriomotensis*.

Two recently (Ermilov and Starý, 2019) described species from Cameroon – *Malaconothrus crassilamellaris* Ermilov and Starý, 2019 and *Malaconothrus ciliarostralis* Ermilov and Starý, 2019 have very similar general appearance to the new species (particularly very similarly developed notogaster, with similar porose areas along notogastral ridges, and similar length of notogastral setae). *M. ciliarostralis* has further similarities in development of some setae (barbed rostral setae, most of notogastral setae bilaterally barbed). Both species from Cameroon are easily distinguished from the new species, as the notogastral setae are either all smooth (*M. crassilamellaris*) or all barbed (*M. ciliarostralis*), and the development of ventral setation differs as well – particularly seta *4b* (designated in paper of Ermilov and Starý as *4a*) is long and not positioned on posterior tectum of epimere IV in *M. kawensis*, unlike in both Cameroon species (and two Japanese species discussed above).

In the following determination key, the main differences between species of “*plumosus*” group from the closely related subgroup of species discussed above (indicated in key as (a) following the species name) as well as species from other subgroups of “*plumosus*” group known from Latin America (indicated as (b) following the species name). Remaining species of the group are presented only as overall numbers in subgroups, not further elaborated.

Key to the species of the genus *Malaconothrus*

(*plumosus* group)

1. All notogastral setae smooth (15 species overall, 2 in Latin America) 3
 — At least some notogastral setae with sparse or dense, unilateral or bilateral bristles 2
2. All notogastral setae barbed, with bristles (9 species overall, 2 in Latin America) 4
 — Only some notogastral setae barbed, at least one seta from series *p* or *h* smooth 5
3. Rostral setae thickened, lamellar and adanal setae simple setiform. Adanal setae and setae of *p* series subequal in length. Genital seta *g*₅ not more than 2-times longer than *g*₄. Size 410 .
 *Malaconothrus robustus* Hammer, 1958 (b)
 — Rostral setae smooth setiform, lamellar and adanal setae slightly widened, narrowly blade-shaped. Lamellar setae inserted on distinct tubercles. Setae *p*₁ and *p*₂ very long, 1.5–2 times longer than adanal setae. Genital seta *g*₅ about 4-times longer than *g*₄. Size 410
 *Malaconothrus rohri* P. Balogh, 1997 (b)
4. Setae *in* very long, simple setiform, much longer than seta *ex*. All other prodorsal and all notogastral setae long (reaching or almost reaching insertion points of subsequent row), robust, blade-like, with short, sparse barbs, adanal and genital setae also broadened, blade-like. Genital plates with 5 genital setae. Size 417–447 *Malaconothrus hauseri* Mahunka, 1984 (b)
 — Setae *in* short, simple setiform, subequal in length to *ex*. Setae *le* and *ro* much longer, robust, bilaterally barbed. All notogastral setae short (not reaching even half of the distance to insertions of next row), setiform, densely bilaterally barbed. Ventral setae all also heavily barbed. Genital plates with 4 genital setae. Size 300–315
 *Malaconothrus neoplumosus* Balogh and Mahunka, 1969 (b)
5. Only seta *h*₁ of notogaster smooth, all other notogastral setae robust, mostly slightly thickened basally, bilaterally barbed. Rostral, lamellar and adanal setae also bilaterally with short barbs. Size 375 *Malaconothrus granulosus* Palacios-Vargas and Iglesias, 1997 (b)
 — 3 or more notogastral setae smooth, remaining setae of different shape, barbed bi- or unilaterally, with barbs of different length 6
6. Notogastral setae relatively short, robust, more or less broadened. Setae of *c* series, *p* series and *h*₃ always smooth, at least some of others unilaterally, finely barbed (2 species: *Malaconothrus keriensis* Hammer, 1966 with 6 genital setae and *Malaconothrus kotozenus* Fujikawa, 2005 with 5 genital setae, none of them in Latin America)
 — Longer notogastral setae (*e*₂, some of *h* series, *p*₂) smooth, all others slightly thickened and bilaterally barbed 7
7. Prodorsal setae, particularly setae *in* short, centrodorsal setae of notogaster longer (*d*₁ reaching far posterior of half distance *d*₁ and *e*₁) and with much denser and longer bristles. Epimeral setae *4b* longest of epimeral setae IV and positioned much more anteriorly, not on posterior tectum of epimere IV. Dotted/porose areas present along lateral margins of notogaster and parallel to lateral edges of anogenital plate. Size 365–385
 *Malaconothrus kawensis* n. sp. (a, b)
 — Prodorsal setae, particularly *in* quite long, overhanging lateral edges of prodorsum. Centrodorsal setae *d*₁ of notogaster reaching only to half distance between *d*₁ and *e*₁, or less.

Epimeral setae *4b* very short, positioned on posterior projection of tectum of epimere IV. Dotted/porose areas along lateral margins of notogaster and parallel to lateral edges of anogenital plate absent. 8

8. Rostral setae strong, densely barbed, curled. Lamellar setae straight and rather long, bilaterally barbed. Pedotectum I angular, short humeral ridges present on notogaster between setae *c*₂ and *cp*. Notogastral seta *e*₂ significantly longer than surrounding notogastral setae *d*₂ and *f*₂. Setae *p*₂ and *p*₃ subequal in length, both barbed. Genital setae long, seta *g*₅ reaching almost to the posterior end of genital plate. Anal setae absent (only alveoli present) Size 405–470

. *Malaconothrus kiiensis* Yamamoto, 1996 (a)

— Rostral and lamellar setae smooth, setiform, curved backwards. Pedotectum I obtuse, humeral ridges absent or indistinct. Notogastral seta *e*₂ subequal in length to surrounding notogastral setae *d*₂ and *f*₂. Setae *p*₂ smooth, much longer than barbed *p*₃. Genital setae short, seta *g*₅ not reaching the posterior end of genital plate (distance to it is greater than length of seta *g*₅). Short anal setae present. Size 385–435

. *Malaconothrus iriomotensis* Yamamoto and Aoki, 1997 (a)

Genus *Cyrthermannia* Balogh, 1958

Balogh (1958) proposed the genus *Cyrthermannia* for Nanhermanniidae with 6–8 large, blunt and rounded protuberances on posterior part of the notogaster; and notogastral setae much shorter than those of *Nanhermannia*, and narrowly lanceolate. This definition is very broad and simple, but genus as such was established and accepted by most authors. A more modern diagnosis of the genus was never given. Some additional characters of the genus may be extracted from later published determination keys. Balogh (1972) added the following diagnostic characters: notogaster without pteromorphs, areae porosae, sacculi or pori (Apterogasterina-Gymnonota); more than 6 pairs of genital setae (Polytricha), notogaster with 16 pairs of setae (!), concentric or excentric exuviae never present on notogaster, diagastric (with semicircular, medially interrupted suture between genital and anal plates – Nanhermannioidea), notogastral setae simple, whole, without flagelliform apical section, short; posterior portion of notogaster with tubercles. Later, Balogh and Balogh (1992) placed the family within nothroid genera, and precised information about genus as follows: sensillus present, legs monodactyle, 9g, 2ag, 2an, 3ad, epimeral setal formula 3-1-3-3. Genital and anal plates of brachypylinae type, separated by ventral plate. Anal plates with 2 pairs of setae. Semicircular, medially interrupted suture between genital and anal plates present (Nanhermanniidae). Notogaster with blunt tubercles bearing part of notogastral setae. Notogastral setae short, setiform or leaf-shaped, never bifurcate. Posterior protuberance of prodorsum with one triangular process on each side. Later, Hammer (1979) proposed a separate genus *Bicyrthermannia* for species differing from *Cyrthermannia* by having two distinct projections on the posterior side of interbothridial protuberances, and 16 setae on notogaster (even if her own figure shows only 15 notogastral setae). Later described species of both *Cyrthermannia* and *Bicyrthermannia* showed a variability in setation, particularly of genital plates (7–9 pairs of setae), but also on epimeres (with formulas 3-2-3-3, 3-1-3-4 and 3-2-3-4 also present). Variable number of notogastral setae was reported (from 13 to 16), but from descriptions it is difficult to judge if all setae were really counted. The figures sometimes indicate the possibility that some setae may have been omitted. In any case, the most common number of notogastral setae is 15 (and not 16 as given by Balogh, 1972). Given the presence of 15 notogastral setae in several species of *Bicyrthermannia*, the presence of two large spiniform tubercles on the posterior part of prodorsum against a single one in *Cyrthermannia* remains the only distinguishing character of the genus. Characteristics of legs are usually not given at all in most of described species, or only very scarce and general information is available. More detailed description of legs is available only for single species of *Bicyrthermannia* (Badejo and al., 2002).

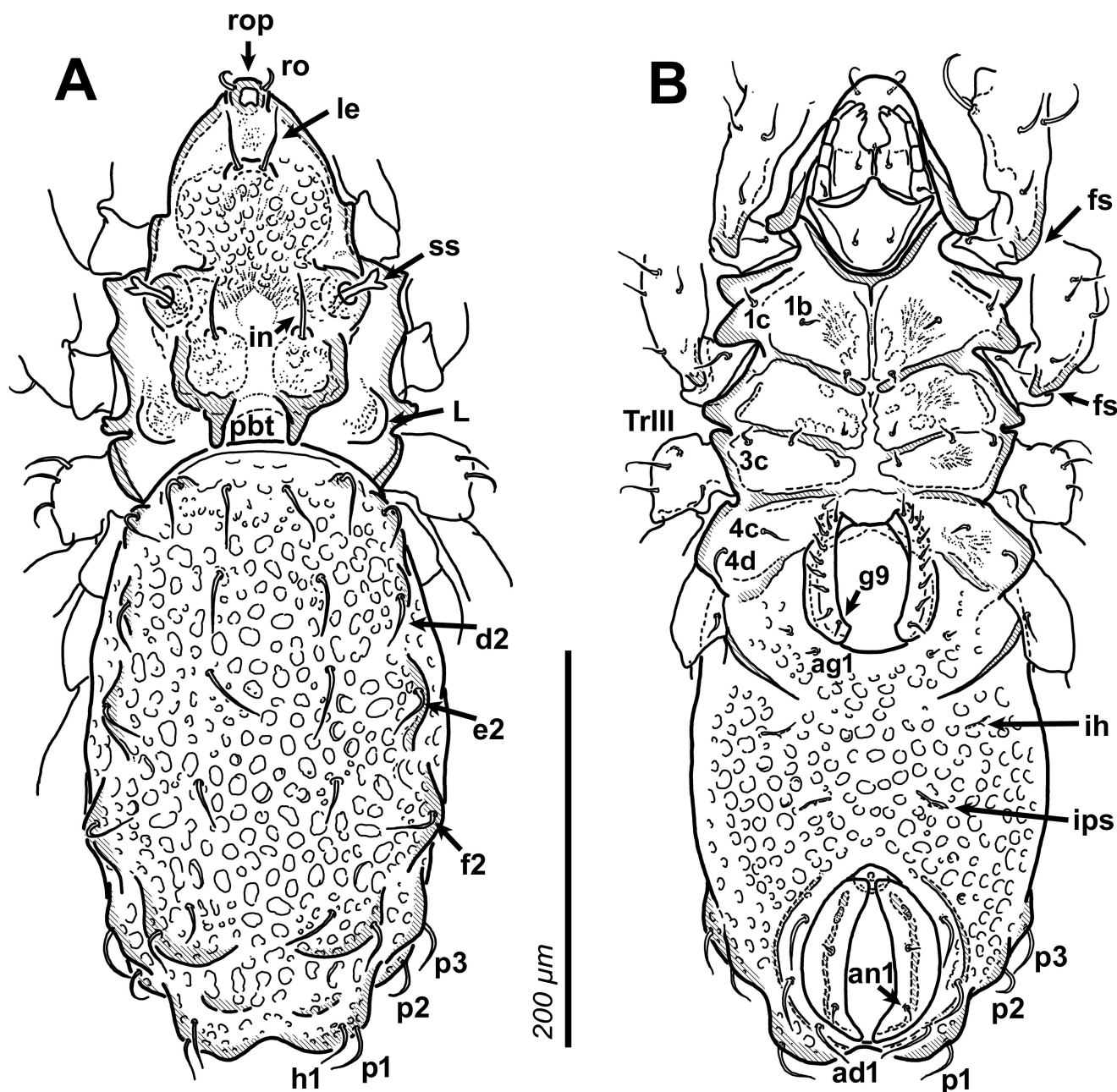


Figure 3 *Cyrthermannia bifurcata* n. sp., adult female: A – dorsal view, B – ventral view (legs only partly depicted). Bar indicating 200 micrometers. Abbreviations and descriptions: 1b, 1c, 3c, 4c, 4d – epimeral setae; ad₁ – adanal seta 1; ag₁ – adgenital seta 1; an₁ – anal seta 1; d₂, e₂, f₂, p₁–p₃, h₁ – notogastral setae; fs – femoral spur; g₉ – genital seta 9; ih, ips – lyrifissures; in – interlamellar seta; L – lateral tubercle (ridge); le – lamellar seta; pbt – postbothridial tooth; ro – rostral seta; rop – rostral protuberance; ss – sensillus (bothridial seta); TrIII – trochanter III.

Cyrthermannia bifurcata n. sp.

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Figures 3, 4

Diagnosis — *Cyrthermannia* with short, smooth and distally bifurcate sensillus, with rostral protuberance and lamellar ridge present. Notogaster with distinct protuberances pronounced in

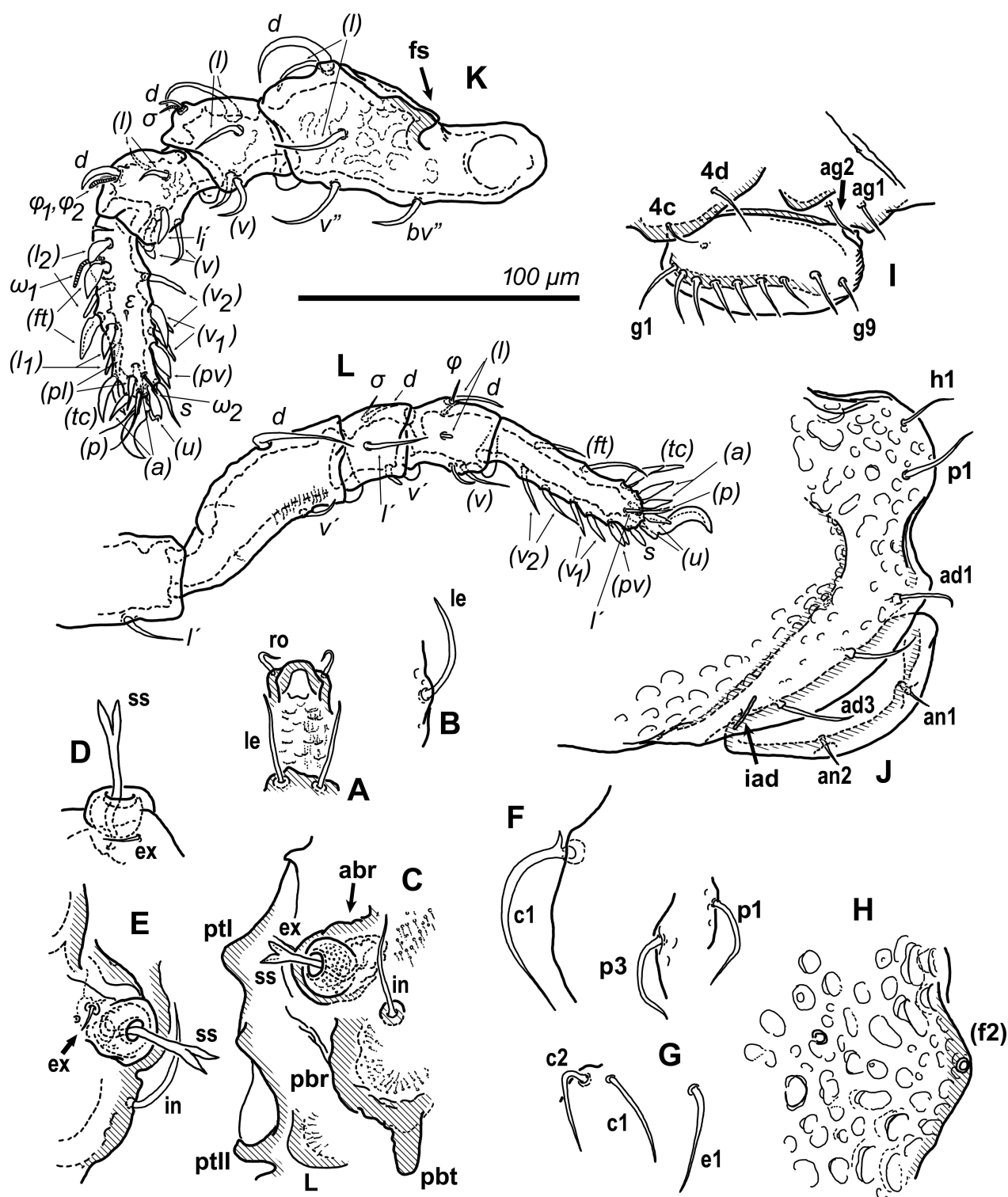


Figure 4 *Cyrthermannia bifurcata* n. sp., adult female: A – detail of rostrum; B – seta *le* in lateral view; C – lateral part of prodorsum; D – sensillus and bothridium; E – bothridial area in lateral view; F – notogastral seta *c*₁ with spur, in lateral view; G – notogastral setae *c*₁, *e*₁, *p*₁ and *p*₃; H – detail of sculpture on lateral notogastral protuberance around insertion of seta *f*₂; I – genital plate in lateral view; J – ano-adanal area in lateral view; K – leg I in antiaxial view, with description of setae; L – leg IV in antiaxial view, with description of setae. Bar indicating 100 micrometers (for A–E and G–L), 50 micrometers for F. Abbreviations and descriptions: *lb*, *lc*, *3c*, *4c*, *4d* – epimeral setae; *abr* – antebothridial ridge; *an*₁, *an*₂ – anal setae; *ad*₁–*ad*₃ – adanal setae; *ag*₁–*ag*₂ – adgenital setae; *ex* – exobothridial seta; *iad* – lyrifissure *iad*; *d*₂, *e*₂, *f*₂, *p*₁–*p*₃, *h*₁ – notogastral setae; (*f*₂) – insertion point of seta *f*₂; *fs* – femoral spur; *g*₁, *g*₉ – genital setae; *in* – interlamellar seta; L – lateral tubercle (ridge); *le* – lamellar seta; *pbr* – postbothridial ridge; *pbt* – postbothridial tooth; *ptI* – pedotectum I; *ptII* – pedotectum II; *ro* – rostral seta; *rop* – rostral protuberance; *ss* – sensillus (bothridial seta); *TrIII* – trochanter III.

both posterior and lateral parts of notogaster. Notogastral setae simple, setiform, smooth, some with short spur basally. Epimeral setae short setiform, 9 pairs of genital setae, 2 pairs of short and simple aggenital setae, 3 pairs of adanal setae which are the longest setae on ventral side. Genital and anal plates with longitudinal sclerotised ridge.

Material examined — 2 females collected 2-III-2012 in mosses, rotting timber and dead leaves on and under fallen tree trunk in tropical rainforest, Saül, Boucle de Monts La Fumée, near confluence of Crique Cochon and Crique quee Hocco, 150 m, 3°37'66"N, 53°12'00"W (sample nr. LM-2012-001), French Guyana. Type preserved in acarological collection of Senckenberg Museum in Goerlitz, paratype (damaged, in parts) in collection of the author.

Description — Measurements – Values of holotype given only, as damaged paratype prevented precise measurements. Total body length 500, prodorsum length 186, prodorsum width between tips of pedotecta I 156, notogaster length 314, notogaster width 186.

Integument – (Figs 3A, 3B, 4C, 4H, 4J). Body robust, colour dark reddish brown. Integument distinctly ornamented, anterior part of prodorsum on prodorsal field (between prodorsal furrow and rostral setae), as well as whole notogaster and ventral plate foveolate, with foveae framed by mostly simple and not undulated margin, some foveolae may have double margins. Size of foveolae variable (mostly 8–15), largest ones (central on notogaster) not larger than half of the length of shortest notogastral setae, their mutual distances equal or smaller than diameter of largest. Some parts of prodorsum (lateral to postbothridial protuberances, axial between setae *in* and along dorsosejugal furrow smooth, rostral area with fine punctuation. Bothridia with distinct punctuation, narrow strip between bothridia, postbothridial protuberances and tubercles L, as well as epimeral area with dense fine punctuation and cuticle densely, finely penetrated (“chagrenation”).

Prodorsum – (Figs 3A, 4A–E). Rostrum conical, broadly rounded, distally with distinct rostral protuberance (*rop*), this protuberance centrally with lighter, less sclerotised cuticle. Rostral setae (*ro*) inserted on sides of this protuberance, short (16), curved mediad and ventrad, smooth. Lamellar setae (*le*) much longer (37), more or less straight, smooth setiform, inserted on short but distinct transversal lamellar ridge. Distal end of setae *le* almost reaching base of rostral protuberance in dorsal view. Interlamellar setae (*in*) same or slightly longer in size (43) and similar in shape as setae *le*, inserted at anterior border of postbothridial protuberances, insertions on small tubercles or areas with strengthened sclerotisation. Bothridium almost rounded, with rather narrow opening. Sensillus smooth, short (36), not longer than setae *le* and *in*, distally bifurcate, with short branches attenuated towards the end. Exobothridial seta (*ex*) shortest of prodorsal setae (10), thin, hardly visible dorsally. Anterior part of bothridial protuberance with distinct transverse anterobothridial ridge, not longer than diameter of bothridium. Prodorsum anterior to this ridge with rather deep prodorsal furrow, causing significant posterior constriction of prodorsal field (area behind setae *le*). Postbothridial protuberances well developed, almost quadrangular, laterally and posteriorly with distinct postbothridial ridge, posteriorly with single, strong, irregularly spiniform or dentiform tubercle (*pbt*), reaching anterior margin of notogaster or slightly beyond. Between tubercles, less pronounced and deeper positioned cuticular thickening connects the protuberances. Two distinct semicircular lateral ridges (*L*) present laterally and slightly posterior to postbothridial protuberances, between postbothridial tubercles and pedotecta II, above dorsosejugal groove,. Lateral outline of prodorsum with slightly pronounced angular pedotectum I, pedotectum II more distinct, triangular or irregular. Blunt projection present also on anterior end of acetabulum II. Acetabulum III dorsally with thickened margins.

Notogaster – (Figs 3A, 4F–H). Regularly oval in general shape, with well pronounced protuberances on posterior end (protuberances bearing setae h_3 most developed, followed by those bearing $h_1 + p_1$, p_3 and p_2), but distinct also on lateral sides, diminishing anteriad (largest bearing seta f_2 , followed by e_2 and d_2), even setae c_2 and c_3 on small protuberances. Notogastral setae simple setiform, attenuated distally, relatively short (28–40, e_1 longest), setae of rows *c*, *d*, *e* and *f* not reaching insertions of following more posterior setae. Lateral and posterior

setae more curved than others. Some of anterior setae (pair c_1 at least) with small, sometimes indistinct basal spur, this often visible only in detailed lateral view (Fig. 4F).

Ventral characters – (Figs 3B, 4I, 4J). Gnathosoma relatively short (86), mentum broader than its length (66×46), inverted bell-like, with three blunt projections. Seta a , h , m very short (around 10), smooth, simple. Tectum of podocephalic fossa (tpf) well developed and broad, bluntly rounded, projecting distinctly laterad. Lateral outline of epimeral area with several distinct projections, pedotectum I and II of similar, dentiform or tubercular shape. Posterior to pedotectum I strong, lateral projection covering partly anterior part of acetabulum II, separated from pedotectum I by distinct ridge. Similar, but smaller tubercular projection present also posterior to pedotectum II. Epimeral fields with well visible apodemes, broad and flat, epimeres I largest. Epimeral setal formula 3-1-3-3, epimeral setae simple, setiform and very short (5–10), only $4b$ and $4c$ slightly longer (17, 20). Genital plates (72×35) with longitudinal ridge, well visible in lateral view, bearing 9 simple setiform genital setae, anterior ones slightly longer (22) than more posterior (14–18). Two pairs of adgenital setae (ag) very short (14–16). Anal plates (86×31) with longitudinal sclerotised ridge, bearing 2 pairs of very short (11), simple anal setae, lyrifissure ian not observed. Adanal area well discernible, framed laterally by narrow semicircular ridge, with 3 pairs of adanal setae, these longer than other ventral setae (26–28), simple setiform. Lyrifissure iad present in area of adanal ridges, visible better in lateral view. Lyrifissures ih and ips large, well visible, more-less transverse, positioned anterior to anal opening, mutual distance of ips smaller than distance of ih .

Legs – (Figs 4K, 4L). All legs very strong, robust, with quadrangular or cylindrical segments, genu and tibia of similar length, both about as long as or only slightly longer than broad. Femora I and II proximally with distinct, spur-like projection oriented posteriad. Setae of legs of different shape, those on ventral and lateral side of proximal segments (trochanters, femora, genua and tibiae) setiform, more or less curved, smooth, dorsal setae of the same segments usually stronger, claw-like, curved. Setae of tarsi, particularly at distal end and more on anterior legs than on leg IV, modified, broadened, spiniform or phylliform, with sharp or sometimes bifid end distally, only proral setae usually longer and not broadened, setiform. Trochanteral setal formula 1-1-4-1, setal formula of leg I: 1-5-5[1]-6[1]-24(3), setal formula of leg IV: 1-2-3[1]-5[1]-17. Solenidia small, short (8-10), setiform or bacilliform, slightly curved, only solenidium ω of tarsus I larger, slightly longer (16) than surrounding setae.

Derivatio nominis — The name *bifurcata* recalls the specific form of bifurcate sensillus, which is very unusual within this genus.

Remarks — Genus *Cyrthermannia* Balogh, 1958 is known mostly from tropical regions of the world, with some species occurring also in the subtropics. Species of the genus, despite being easily recognized and distinguished, are mostly insufficiently described (with some characters simply missing in descriptions), which makes any analysis of taxonomical relations within the genus quite difficult. Also concepts of the genus have evolved – originally, the genus was proposed for species of Nanhermanniidae, having visible protuberances at least in posterior part of notogaster and with generally short notogastral setae (shorter than distance to the setae positioned in the next posterior row). Later, further genera or subgenera were proposed for species differing in development of the posterior margin of postbothridial ridge. Species with a single strongly developed postbothridial tubercle were left in *Cyrthermannia*, species with 2 such teeth were placed in the genus *Bicyrthermannia* Hammer, 1979, and finally species with posterior margin of postbothridial ridge bearing several smaller tubercles similarly as in some species of genus *Nanhermannia* were placed into *Nippohermannia* Balogh, 1985, a separate subgenus of *Nanhermannia* Berlese, 1913. However, separation of genera only on the basis of development of posterior edge of prodorsum may not be sufficient taking into account that *Nanhermannia* includes both species with a single large tubercle, species with such a tubercle in combination with smaller tubercles, and species with a set of smaller tubercles, and that similarly in *Cyrthermannia* there are some species which have a few smaller tubercles present laterally to a large tubercle. For further comparison of known species with the new species described herein, I keep the concept of *Cyrthermannia* as presently defined.

Among the 11 species of *Cyrthermannia*, as given by Subías (2004, 2018), there are three which I consider either doubtful or not belonging to this genus. *Cyrthermannia formosana* Tseng, 1982 lacks a single, strongly developed postbothridial tubercle but has a set of numerous small tubercles on the posterior end of postbothridial ridge. Thus, it should be clearly transferred and treated as *Nanhermannia* (*Nippohermannia*) *formosana* (Tseng, 1982) **n. comb.** *Linothrus perinfamis* Tseng, 1982 was described on the basis of tritonymph. The figure (Tseng, 1982) indicated that notogastral setae of the nymph are very long, even longer than in some species of *Nanhermannia*. It is not clear, on what basis *Linothrus* Tseng, 1982 was synonymised with *Cyrthermannia* and consequently the species *L. perinfamis* Tseng, 1982 transferred to this genus by Subías (2004, 2018) as *species inquirenda*. I consider this placement is doubtful and both genus and species of Tseng need be considered as *incertae sedis*. As such, it cannot be included in following considerations. Finally, the position of the species *Hermannia nasata* Warburton, 1912, transferred to *Cyrthermannia* as *species inquirenda* by Subías (2004, 2018) remains unclear, as the original description and figure do not provide the necessary information – it is not clear if a strong postbothridial tubercle is or is not present, and prodorsal and all notogastral setae are not mentioned nor depicted. The only indication for placing the species into *Cyrthermannia* is the overall form of the body with truncate end of notogaster and body surface covered by circular foveolae. As such, the species cannot be included in further analysis and its placement in *Cyrthermannia* remains questionable.

Thus, disregarding the abovementioned 3 species, 8 species of *Cyrthermannia* are known. *C. bifurcata* can be easily distinguished from all of these by the unusual, short and bifurcate sensillus. All other species have a more or less clavate sensillus, with either more distinct, or indistinct and narrow sensillus head. As far as existing information allows analysis, this is not the only difference. First, the new species has setae *in* inserted on small but distinct tubercles, which were not reported in other species. Second, most if not all species have also at least some epimeral setae distinctly longer, often dilated and sometimes with bristles, while in *C. bifurcata*, even the longest of epimeral setae are quite short, smooth and setiform.

The new species belongs to the broader group of species with setae *le* of the same length or only slightly shorter as setae *in* (for the species included see the determination key below), so that their tips often almost reach insertions of setae *ro*. Distance of insertions *le-ro* is therefore usually much less, in some species closer to double length of seta *le*. Rostral setae are usually positioned on a distinct rostral protuberance or on tubercles. Similarly, several species of this group, including the new species have setae *le* placed on a short, transverse lamellar ridge. Another, quite remarkable character is indicated for two species of this group and is present on the new species – quite distinct and large, semicircular lateral ridge *L*, a probable analogue of tubercle *L* in the lateral postbothridial region, known for example in some Damaeidae (Miko, 2010, 2015). Unfortunately, in many species this area is not depicted with details and there is no mention of this structure – so it is not possible to decide definitely, if this character is specific for the whole group or not.

Within *Cyrthermannia*, species have 7–9 pairs of genital setae. 9 genital setae appear only within the group mentioned above, however there are also species with 8 genital setae within the group. The only known species with 7 genital setae is *C. vicinicornuta* Aoki, 1965, which differs also by position of postbothridial tubercles, which are positioned more medially, closer to each other than in other species.

Distribution of other characters seems to be irregular among all known species of the genus, and does not indicate any particular group pattern – the differences are in shape of notogastral setae (smooth setiform vs. broadened to phylliform), presence of small tubercles on lateral part of postbothridial ridge (one to three small tubercles present or absent), and development of cuticular foveolae (round or oval with simple borders vs. modified: irregularly shaped or with doubled or punctuated margins).

Based on analysis of known morphological character, the following determination key distinguishes all known species of *Cyrthermannia*, including the new species described herein:

Key to the species of the genus *Cyrthermannia*

1. Setae *le* much shorter than setae *in* (less than half of their length), thus *le* by far not reaching insertions of *ro* 2
 — Setae *le* of almost the same length as setae *in*, or only slightly shorter (more than half of their length), *le* often reaching or almost reaching *ro* insertions in dorsal view 3
2. Postbothridial ridges lateral to large postbothridial tubercle with 2–3 small tubercles. Notogastral and ventral setae simple, not broadened. Notogastral surface with larger, oval foveolae, their distances smaller than their size. Surface of postbothridial protuberances and epimeres with distinct, dense fine punctuation. Genital plates with 8 setae. Size 540
 *Cyrthermannia baloghorum* Pérez-Iñigo and Baggio, 1988
 — Postbothridial ridges with single large postbothridial tubercle, without small tubercles. Notogastral and ventral setae broadened. Notogastral surface with medium sized, circular or oval foveolae, their mutual distance usually larger than their diameter. Surface of postbothridial protuberance with few very small foveolae, epimeral area without distinct punctuation. Genital plates with 7 setae. Size 506 *Cyrthermannia vicinicornuta* Aoki, 1956
3. Sensillus short or medium long, clavate, with narrow or more distinct and broadened head, never bifurcate distally. Setae *in* not inserted on tubercles. At least some epimeral setae long (similar to or slightly shorter than notogastral setae), often broadened and sometimes with short bristles 4
 — Sensillus short, distally bifurcate, with two short branches. Setae *in* inserted on distinct tubercles. Epimeral setae simple, smooth setiform, short or even vestigial, the longest of them significantly shorter than notogastral setae. — Setae *ro* inserted on distinct rostral protuberance, setae *le* inserted on transversal short lamellar ridge. Postbothridial area laterally with distinct, semicircular ridge *L*. Size 500 *Cyrthermannia bifurcata* n. sp.
4. Notogastral setae setiform, not broadened. Notogastral foveolae with distinctly undulated margins 5
 — Notogastral setae robust, more or less broadened. Notogastral foveolae simple circular or oval, rarely irregular oval with light dots and interruptions along margins, margins never distinctly undulated 6
5. Setae *ro* inserted on rostral protuberance. Setae *le* quite long, with tips clearly reaching behind half of distance to *ro* insertions, positioned directly on central part of prodorsum. Notogastral foveolae appearing almost stellate, with light dots along margins. Surface of postbothridial protuberances and epimeral area distinctly finely punctuated. Size 568–578
 *Cyrthermannia stellata* Balogh, 1970
 — Rostral protuberance absent or indistinct. Setae *le* short, clearly not reaching beyond half of distance to *ro* insertions, inserted on distinct, short transverse lamellar ridge. Notogastral foveolae resembling shape of flowers. Notogastral setae with distinct spurs. Surface of postbothridial protuberances punctuated, and also with distinct round foveolae. Epimeres without distinct punctuation. Size 478–510 *Cyrthermannia florens* Balogh and Mahunka, 1980
6. Setae *le* inserted on transversal short lamellar ridge. Sensillus medium long, longer or as long as seta *in*, with narrow, not significantly thickened head. Outer margin of circular or oval notogastral foveolae smooth, without interruptions or luminous dots 7
 — Setae *le* inserted directly on prodorsal surface, lamellar ridge absent. Sensillus short, shorter than length of setae *in*, with short peduncle and distinct, broadened head. Notogastral foveolae irregularly oval, with outer margins interrupted and/or with luminous dots. Notogastral and prodorsal setae blade-like, sharp, with distinct spurs. Size 500
 *Cyrthermannia luminosa* Hammer, 1971

7. Notogastral setae simple blade-like, mostly with spurs, short – seta c_1 not reaching insertion of d_1 . Setae ro inserted directly on rostrum, or on individual tubercles, rostral protuberance absent. Notogastral foveolae round or slightly irregular oval, with simple smooth margins. Notogaster without humeral tubercles 8
- Notogastral setae broadened, with a velum on both sides, long - seta c_1 reaching distinctly posterior of insertion of d_1 . Setae ro inserted on well developed rostral protuberance. Notogastral foveolae round, with smooth external margin and with irregular internal line. Notogaster with distinct humeral tubercles. Size 487–535 *Cyrthermannia tuberculata* Balogh, 1958
8. Setae ro inserted on distinct individual tubercles. Notogastral and prodorsal setae only slightly broadened. Sensillus with relatively broad head. Genital plates with 8 setae. Adanal setae setiform. Size 508–525 *Cyrthermannia simplex* Mahunka, 1985
- Setae ro inserted on rostral surface, not on tubercles. Notogastral and prodorsal setae strongly broadened. Sensillus with narrow head, not significantly broader than stalk. Genital plates with 9 setae. Adanal setae long and distinctly broadened, phylliform. Size 502–535 *Cyrthermannia guadeloupensis* Mahunka, 1985

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