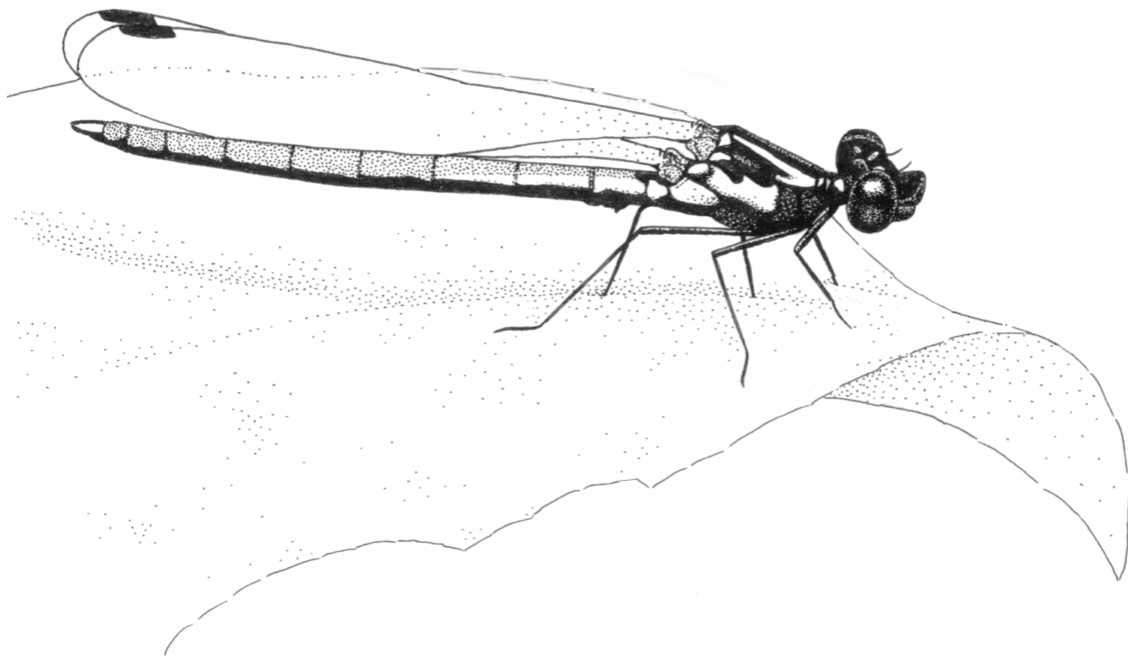


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Front cover: Chlorocypha tenuis, a species of damselfly found in Kakamega Forest. Drawing by K.-D. B. Dijkstra.



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FIRST RECORDS OF THE MILLIPEDE GENUS *EVIULISOMA* (DIPLOPODA: POLYDESMIDA: PARADOXOSOMATIDAE) FROM BURUNDI, WITH DESCRIPTIONS OF TWO NEW SPECIES

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ABSTRACT

From 2003–2008, during soil zoological surveys in the Kibira National Park, Burundi, millipedes of the genus *Eviulisoma* were collected. Samples of *E. cylindricum* and *E. silvaticum* were recovered in addition to those containing two new species. *Eviulisoma kirama* sp. nov. and *Eviulisoma nzigidahera* sp. nov. are described and additional records, illustrations, and descriptive notes are given for the other two species. A key for the Burundian species and a distribution map for all species of the genus is presented.

Keywords: *Eviulisoma*, new species, taxonomy, East Africa, map

INTRODUCTION

The millipede genus *Eviulisoma* Silvestri, 1910 is among the most diverse and widespread genera of the family Paradoxosomatidae Daday, 1889 endemic to tropical Africa (Hoffman, 1953; VandenSpiegel & Golovatch, 2014). According to the latest publications (Enghoff *et al.*, 2016; Enghoff, 2018; Nzoko Fiemapong *et al.*, 2018), this genus presently encompasses ± 60 species, most of which are reported from East Africa (Carl, 1909; Hoffman, 1953; Jeekel, 2003; Nguyen & Sierwald, 2013; VandenSpiegel & Golovatch, 2014; Enghoff, 2018). Species of the genus *Eviulisoma* are easy to recognize by the paranota being very strongly to even completely reduced, resulting in a virtually cylindrical body, by the strongly reduced body ring setation, two rows of very thin setae on the collum and only one row on each of the following rings, and by the gonopods which are often partly inserted in a deep excavation of the sternite of body ring 6.

During several years (2003, 2004–2005, 2008) of field work along altitudinal gradients (793–2650 m) in the afromontane forest of Kibira, the miombo forest of Rumonge, and the circum-Guinean forest of Kigwena, four species of *Eviulisoma* have been revealed. Two of them are new to science whereas the remaining two, *E. cylindricum* Attems, 1953 and *E. sylvaticum* Attems, 1953, were previously described from the Democratic Republic of the Congo (DRC) and Rwanda, respectively. Apparently, the latter two species have wider distributions, also covering Burundi. The present paper gives new details for the species already known and describes the two new species.

MATERIALS AND METHODS

All material underlying the present contribution was collected in the Kibira National Park, Burundi and is housed in the collection of the Royal Museum for Central Africa (RMCA), Tervuren, Belgium. The samples are stored in 70 % ethanol. Specimens for scanning electron microscopy (SEM) were air-dried, mounted on aluminum stubs, coated with gold and studied using a JEOL JSM-6480LV scanning electron microscope. The pictures were taken using the focus stacking setup as described by Brecko *et al.* (2014)

which consisted of a Canon EOS 700D, a Canon MP-E 65 mm 1:2.8 1-5x Macro Photo Lens, 2 Yongnuo YN560II flashlights, one remote control for the flashlights, a Cognisys StackShot and an Ikea “Metod” kitchen cupboard. Canon EOS Utility software was used to control the camera. Zerene Stacker was used for stacking the individual pictures into one ‘stacked image’.

The gonopodal terminology used in the present work follows that of Enghoff (2018).

TAXONOMY

Family Paradoxosomatidae Daday, 1889

Subfamily Paradoxosomatinae Daday, 1889

Tribe Eviulisomatini Brölemann, 1916

Genus *Eviulisoma* Silvestri, 1910

Diagnosis

See Nzoko Fiemapong *et al.* (2018) for a full diagnosis of the genus, with the following additional observations: the lamellae linguales and stipites of the gnathochilarium are clothed with a field of short and often modified setae.

Eviulisoma cylindricum Attems, 1953 (figures 1, 5)

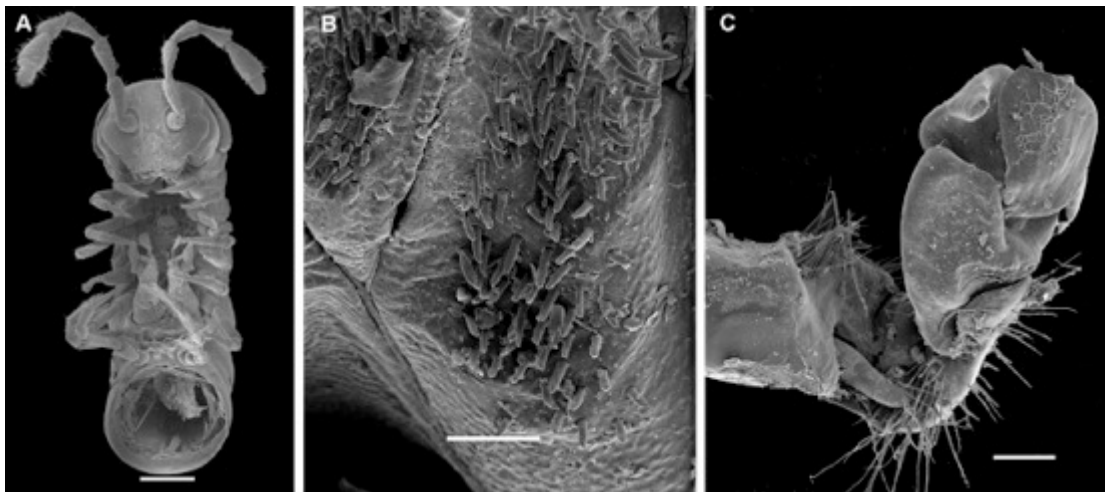


Figure 1: *Eviulisoma cylindricum* Attems, 1953, ♂ from Mount Musumba (SEM micrographs). A: Anterior part of body, ventral view; B: Stipites, ventral view; C: Right gonopod, mesal view. Scale bars: A = 500 μ m; B = 50 μ m; C = 100 μ m.

Type material

Jeekel (2003) stated that the type material of this species seemed to have been mislabeled, containing a single male with only one gonopod and fragments of about 14 females and 14 juveniles, all housed at the RMCA, Belgium (RMCA 8178). That observation was confirmed during a short visit to the Vienna Museum by the first author where a slide with a single gonopod of *E. cylindricum* was recovered. This gonopod, now returned to Tervuren, appears to be the missing gonopod of the single male contained in the mislabeled vial RMCA 8178 and used by Attems (1953) to describe the species. This specimen is designed herewith as the lectotype (RMCA 8178), the other specimens as paralectotypes (RMCA 23163).

New material observed

BURUNDI: ♂, Kibira National Park, Rwegura, Mount Musumba, 02.86435°S, 029.49540°E, site 7, tea plantation, 25 Dec. 2008, 2100 m, pitfall traps, Nzigidahera B. (RMCA 23155).

Distribution

Previously only known from Uvira, southeastern DRC, presently revealed to also occur in Burundi.

Remark

The specimen studied agrees completely with the detailed redescription by Jeekel (2003).

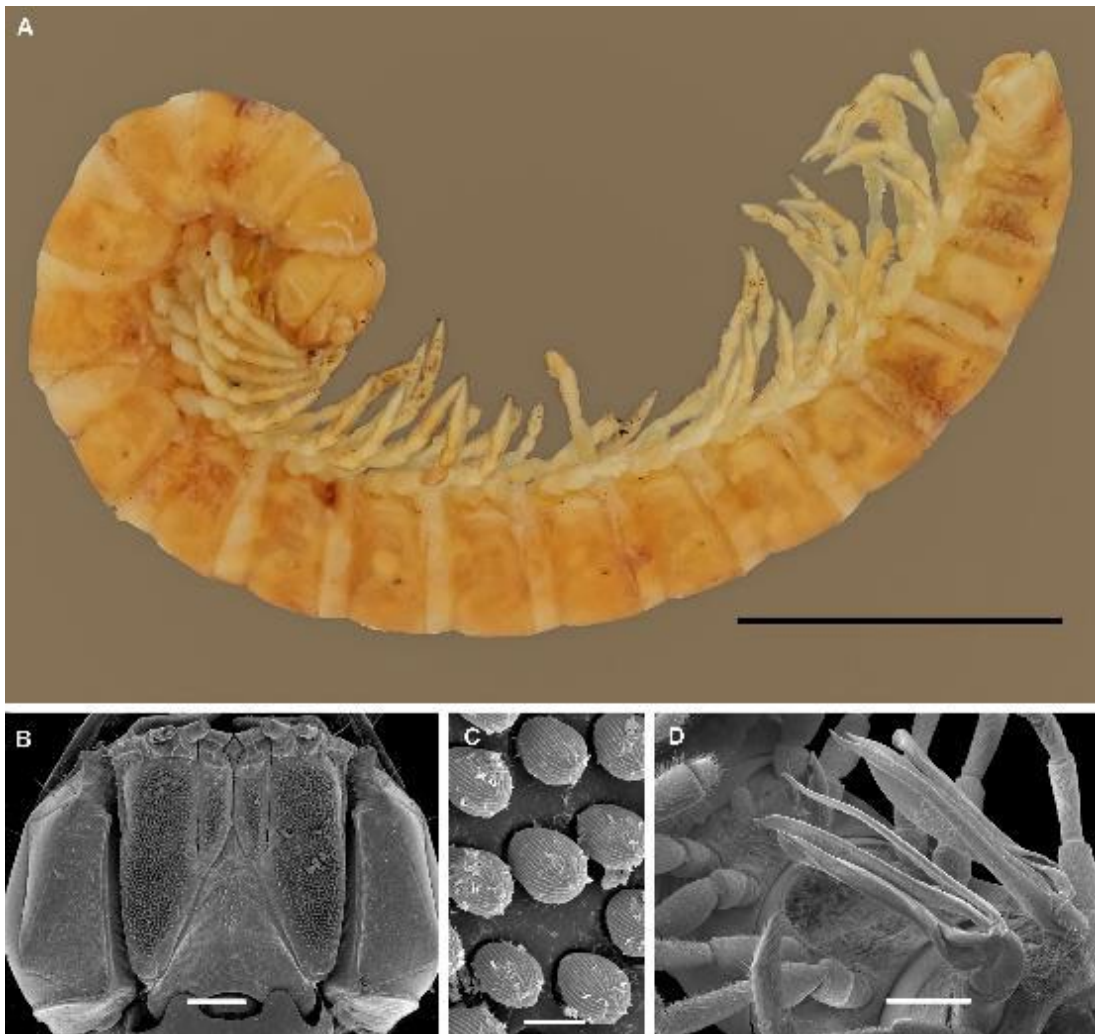
Eviulisoma silvaticum Attems, 1953 (figures 2, 5)

Figure 2: *Eviulisoma silvaticum* Attems, 1953, ♂ from Musigati (site Ntabarwa). A: Habitus, lateral view; B: Gnathochilarium, ventral view; C: Details of setation covering the lamellae linguales and stipites; D: Gonopod in situ, ventrolateral view. Scale bars: A = 50 mm; B = 200 μ m; C = 10 μ m; D = 500 μ m.

Type material

Jeekel (2003) stated that the material housed in the RMCA was a single male that lacked the gonopods, these likely to have been retained by Attems in the Vienna Museum. A visit to Vienna by the first author has allowed tracing of the missing gonopods and return them to the RMCA. Following Jeekel's (2003) suggestion, the RMCA specimen (RMCA 8351) used by Attems to describe the species, is designated herewith as the lectotype.

New material observed

BURUNDI: 1 ♂, Kibira National Park, Musigati, site Ntabarwa, 2137 m, 09 Sept. 2017, NTASHAVU Dieudonné (RMCA 23156); 2 ♂♂, same data, 30 Sept. 2017, Ntashavu Dieudonné (RMCA 23157); 1 ♂, Kibira National Park, Musigati, site Kijobejobe, 2083m, 08 Oct. 2017, Ntashavu Dieudonné (RMCA 23158)

Distribution

Previously only known from the Rugege Forest in Rwanda, presently revealed to also occur in Burundi.

Remark

The specimens studied agree completely with the detailed redescription given by Jeekel (2003).

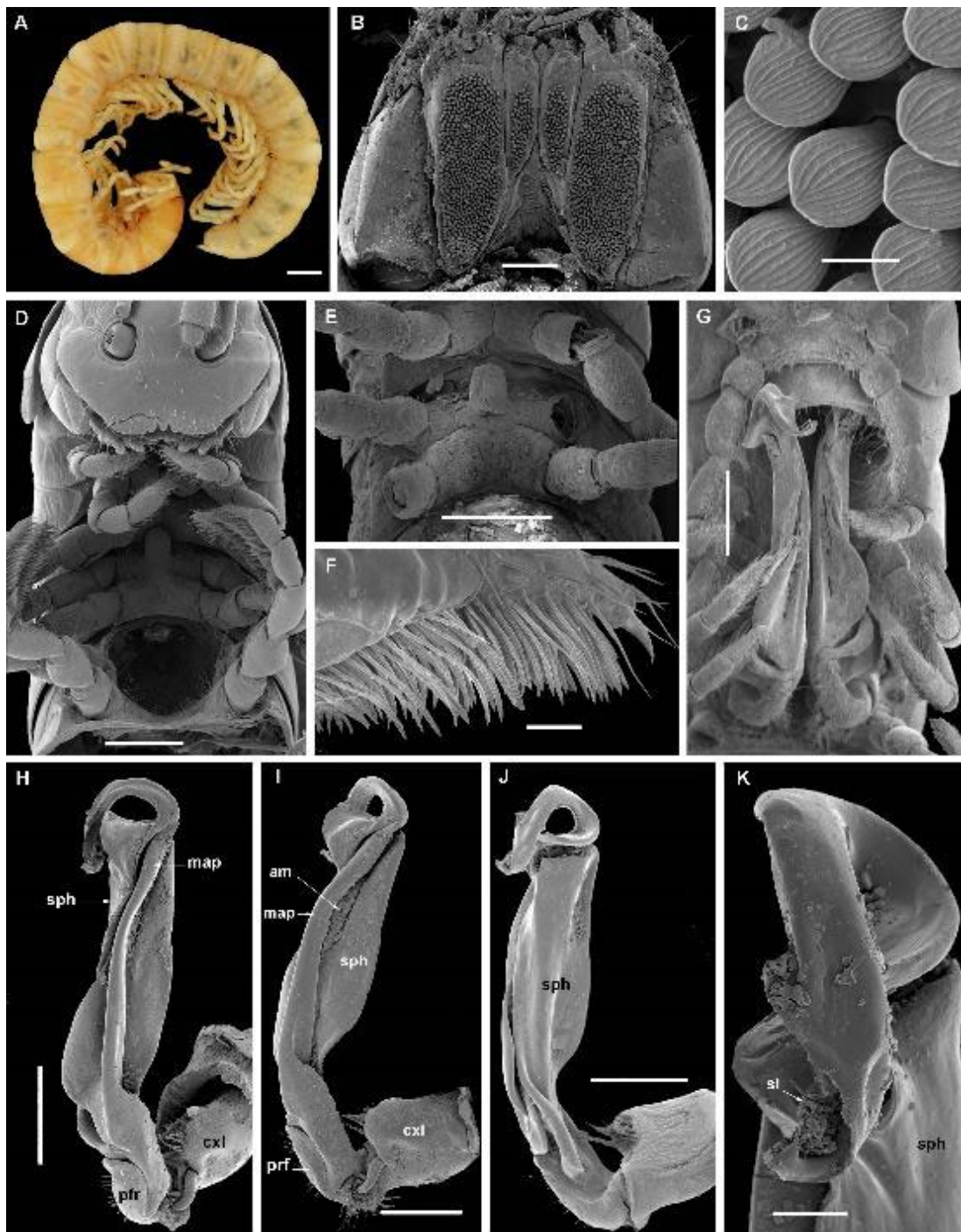
Eviulisoma kirama sp. n. (Figs 3, 5)

Figure 3: *Eviulisoma kirama* sp. n., ♂ paratype from Mt. Musumba. A: Habitus, lateral view; B: Gnathochilarium, ventral view; C: Details of setation covering the lamellae linguales and stipites; D: Anterior part of body, ventral view; E: Ring 5 with a median process between anterior legs, ventral view; F: Tarsal brushes, lateral view; G: Gonopods in situ, ventral view; H-I: Right gonopod, subcaudal (H) and mesal views (I), respectively; J: Left gonopod, lateral view; K: Distal part of gonopod, caudal view. Designations: am: amorphous mass, cxi: coxal lobe, map: mesal acropodital process, prf: prefemoral part, sl: solenomere, sph: solenophore. Scale bars: A = 5 mm; B = 200 µm; C = 10 µm; D, E, G-I = 500 µm; F = 50 µm; K = 100 µm.

Holotype

BURUNDI: ♂, Kibira National Park, Musigati, site Kirama, 2030 m, 25 Nov. 2016, Ntashavu Dieudonné (RMCA 23159).

Paratypes

BURUNDI: 1 ♂, same data as holotype (RMCA 23160); 1 ♂, Kibira National Park, Rwegura, Mount Musumba, pitfall traps, 02.87696°S, 029.49709° E, site 1, 25 Nov. 2008 (RMCA 23161); 3 ♂♂, Kibira National Park, Musigati, site Kijobejobe, 2083 m, 29 Oct. 2017, Ntashavu Dieudonné (RMCA 23166); 1 ♂, Kibira National Park, Musigati, site Monyi, 2120 m, 15 Dec. 2016, Ntashavu Dieudonné (RMCA 23162).

Diagnosis

This species differs from all congeners by the structure of the gonopod which has a third apical part tossed at 360°, placed, when at rest, in a deep excavation of the sternite of body ring 6.

Etymology

This species is named after the type locality, name in apposition.

Description

SIZE. Length of holotype ca 22 mm (♂), of adult paratypes up to 27 mm (♂), width of midbody metazonae 1.9–2.0 mm (♂).

COLOUR. Colouration in alcohol uniformly yellowish, often with an annulated pattern of slightly more vividly yellowish metazonae and genae, antennae and legs usually slightly lighter to nearly pallid (figure 3A).

HEAD. Antennae medium-sized, only slightly clavate, reaching when stretched dorsally the body ring 2 (♂); interantennal isthmus subequal to diameter of antennal socket; in length, antennomeres 1=7 < 2 = 3–6, mostly subconical; antennomeres 5 and 6 each with a compact distodorsal group of bacilliform sensilla.

Gnathochilarium as usual for the genus (figure 3B). Mentum (me) smooth; lamellae linguales each with two strong apical setae, one equally strong seta behind these, plus 2/3 basal part covered with a field of short, rounded, longitudinally striated setae (figure 3C); stipites covered with a field of similar modified setae, apical margin with two rows of stout setae.

BODY. Body subcylindrical, with 20 rings (♂), metazonae only faintly vaulted (Fig. 3A). In width, collum = ring 2 > head = rings 3–17; thereafter body gradually tapering towards telson. Clypeolabral region smooth, bearing a few setae (figure 3D).

Paraterga nearly missing; a modest, caudally invariably rounded ridge demarcated by a premarginal lateral sulcus. Ozopores lateral, rather inconspicuous, lying at ca 1/3 metazonite length. Body surface dull to poorly shining, smooth, micro-alveolate; axial line missing.

Tergal setae short, largely abraded or missing, traceable only as 1+1 setae in a transverse row, mostly visible on collum and telson.

Stricture dividing pro- and metazonae rather thin, shallow and smooth. Pleurosternal carinae present only on rings 2–7, demarcated by a premarginal lateral sulcus, thereafter totally wanting. Epiproct long, flattened dorsoventrally, very faintly concave apically. Hypoproct nearly semi-circular, caudal 1+1 setae clearly separated, borne on minute knobs and clearly removed from caudal margin. Sterna usually without modifications, deeply impressed along axis, densely and finely setose, cross- and axial impressions evident; ring 5 with a median tongue-shaped process between anterior legs (figures 3E, D). Sternite between rings 6 and 7 clearly depressed and forming a deep excavation to accommodate distal part of gonopodal telopodite (figures 3D, G); anterior margin of excavation with a fringe of long setae. Gonopod aperture without peculiarities. Legs moderately long (ca 1.4 times as long as body width), tibial and tarsal brushes consisting of modified setae (as in figure 3F), present until a few last leg-pairs, tibiae thereby being a little, but clearly shorter than tarsi. Hypoproct trapezoid, almost rectangular, with three strong marginal tubercles.

GONOPODS (figures 3G–K). Coxal lobe (cxl) moderate. Prefemoral part (prf) ca 0.3x as long as acropodite. Mesal acropodital process (map) a straight pointed rod narrow over most of its length, solenophore (sph) thinning out drastically in its distal quarter to form a 360° loop. Solenomere emerging from top of solenophore (figure 3K, sl). No intermediate acropodital process.

Distribution

Known only from the Kibira National Park, Burundi.

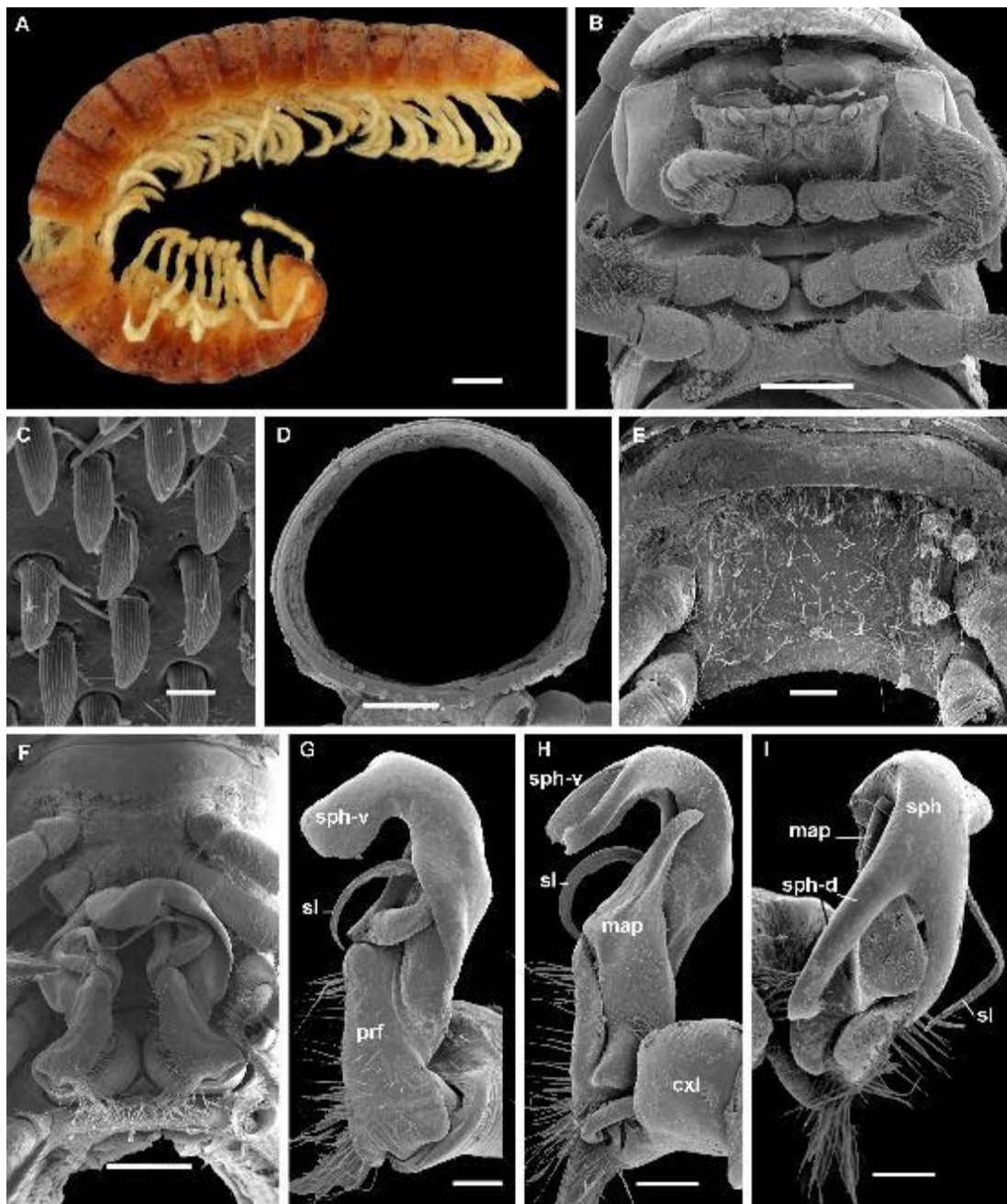
Eviulisoma nzigidahera sp. n. (Figs 4, 5)

Figure 4: *Eviulisoma nzigidahera* sp. n., ♂ paratype. A: Habitus, lateral view; B: Anterior part of body, ventral view; C: Details of setation covering the lamellae linguales and stipites; D: Cross-section at midbody; E: Sternite of ring 6 showing a low excavation, ventral view; F: Gonopods in situ, ventral view; G: Left gonopod, ventrolateral view; H-I: Right gonopod, mesal (H) and anterior views (I), respectively. Designations: cxi: coxal lobe, map: mesal acropodital process, prf: prefemoral part, sl: solenomere; sph: solenophore, sph-d: solenophore dorsal lobe, sph-v: solenophore ventral lobe. Scale bars: A = 5 mm; B, D, F = 500 μ m; C = 10 μ m; E = 200 μ m; G-I = 200 μ m.

Holotype

BURUNDI: ♂, Kibira National Park, Rusarenda, 28 Jan. 2003, Ntashavu Dieudonné (RMCA 23152).

Paratype

BURUNDI: ♂, same data as holotype (SEM, RMCA 23153).

Diagnosis

Differs from other species known from Burundi by the absence of a median process between anterior legs of ring 5, from all other congeners by having a strongly bilobed solenophore and a short mesal acropodital process.

Etymology

The species name honours Benoit Nzigidahera in recognition of his dissemination of taxonomic research in Burundi.

Description

SIZE. Length of holotype and paratype ca 21 mm (♂), width of midbody metazonae 1.9–2.0 mm (♂, figure 4D).

COLOUR. Coloration in alcohol brown to dark brown; metazonae and genae light brown; antennae and clypeolabral region light yellow-brown; venter and legs yellowish to nearly pallid (figure 4A).

Somatic characters as in *E. kirama* sp. n. except as follows: Antennae long, only poorly clavate, reaching past posterior margin of metazonae of body ring 3 when stretched dorsally. Lamellae linguales and stipites covered with a field of oblong and longitudinally striated setae (figures 4B, C).

Collum slightly flattened on top, without sulcus at dorsolateral margin, but carrying 2+2 slightly better visible setae on top.

Ring 5 without a median process between anterior legs (figure 4B). Sternite between rings 6 and 7 slightly depressed and forming a low excavation to accommodate gonopodal telopodite tips; excavation covered with long setae (figure 4E).

GONOPODS (figures 4F-I). Coxal lobe (cxl) moderate. Prefemoral part (prf) about half as long as acropodite. Mesal acropodital process (map) broad in proximal half, then twisted at 45° and gradually tapering up to top. Solenophore (sph) large, ca 2x as long as map process, curved apically and divided, halfway up, into a bifid lobe, a slender dorsal lobe (sph-d), and a broader, apically rounded, ventral lobe (sph-v).

Distribution

Known only from Rusarendu, the type locality in the Kibira National Park. Burundi.



Figure 5: Distribution of the genus *Eviulisoma*. The numbers indicate the number of species known per country.

KEY TO BURUNDIAN SPECIES OF *EVIULISOMA*

The key is based on adult males.

- 1 Ring 5 with a median process between anterior legs 2
 Ring 5 without a median process between anterior legs *E. nzigidahera* sp. n.
- 2 Sternite between rings 6 and 7 slightly depressed and forming a low excavation to accommodate gonopodal telopodite *E. cylindricum* Attems, 1953
 Sternite between rings 6 and 7 deeply depressed and forming a deep excavation to accommodate gonopodal telopodite 3
- 3 Solenophore forming a 360° loops in its distal quarter *E. kirama* sp. n.
 Solenophore strait, almost as long as mesal acropodital process *E. silvaticum* Attems, 1953

CONCLUSION

In Burundi, the four species known of the genus *Eviulisoma* were collected in different mountain forests of the Kibira National Park at the altitude above 2000 meters. This confirms information extracted from literature showing that the highest diversity of the genus *Eviulisoma* occurs from 1400 m upward. This kind of habitat in Africa is still only marginally explored and certainly hide a considerable number of *Eviulisoma* species awaiting discovery and description.

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