



## Monograph

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# **A mountain of millipedes VII: The genus *Eviulisoma* Silvestri, 1910, in the Udzungwa Mountains, Tanzania, and related species from other Eastern Arc Mountains. With notes on *Eoseviulisoma* Brolemann, 1920, and *Suohelisoma* Hoffman, 1963 (Diplopoda, Polydesmida, Paradoxosomatidae)**

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**Abstract.** Twenty-two new species of the genus *Eviulisoma* Silvestri, 1910, from the Eastern Arc Mountains, Tanzania, are described: *E. acaciae* sp. nov., *E. aequilobatum* sp. nov., *E. akkariae* sp. nov., *E. angulatum* sp. nov., *E. articulatum* sp. nov., *E. biquintum* sp. nov., *E. breviscutum* sp. nov., *E. cetafi* sp. nov., *E. chitense* sp. nov., *E. commelina* sp. nov., *E. coxale* sp. nov., *E. ejti* sp. nov., *E. grumslingslak* sp. nov., *E. kalimbasiense* sp. nov., *E. navuncus* sp. nov., *E. nessiteras* sp. nov., *E. ottokrausi* sp. nov., *E. paradisiacum* sp. nov., *E. sternale* sp. nov. and *E. zebra* sp. nov. from the Udzungwa Mts, *E. culter* sp. nov. from the Rubeho Mts and *E. kangense* sp. nov. from the Kanga Mts. *Eviulisoma kwabuniense* Kraus, 1958, and *E. dabagaense* Kraus, 1958, both from the Udzungwa Mts, are redescribed based on new material. Notes are provided on *E. iuloideum* (Verhoeff, 1941) based on type material. *Eoseviulisoma* Brolemann, 1920, is synonymized under *Eviulisoma*, based on newly collected material of *E. julinum* (Attems, 1909), type species of *Eoseviulisoma*. New material of *Suohelisoma ulugurens* Hoffman, 1964, type species of *Suohelisoma* Hoffman, 1964, has revealed that the gonopod structure is more similar to that of *Eviulisoma* than originally thought, but *Suohelisoma* is retained as a valid genus. Four species groups are recognized among *Eviulisoma* species from the Udzungwa Mts, but the need for a revision of the entire genus is emphasized. Two types of epizootic fungi are recorded from *Eviulisoma* spp., and an enigmatic amorphous mass, which may be a kind of plugging substance, is recorded from the gonopod tips and excavated sixth sternum of several species.

**Keywords.** Taxonomy, new species, epizootic fungi, copulatory plug.

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## Introduction

This is the seventh in a series of articles dealing with the millipede fauna of the Udzungwa Mts. For general information on the Udzungwa Mts, see Enghoff (2014) and Scharff *et al.* (2015).



The previous six articles in the series (Enghoff 2014, 2016a, 2016b, 2016c, 2018; Enghoff & Frederiksen 2015) all deal with the family Odontopygidae, but the present contribution concerns the genus *Eviulisoma* Silvestri, 1910, of the very large family Paradoxosomatidae, which is distributed over all zoogeographical regions, except the Nearctic (Enghoff *et al.* 2015).

The large genus *Eviulisoma*, as understood by recent workers (Jeekel 2003; Nguyen & Sierwald 2013; VandenSpiegel & Golovatch 2014), is endemic to the African continent. *Eviulisoma* belongs to the ‘ecarinate’ paradoxomatids in which the paranota are very strongly or even completely reduced, resulting in a virtually cylindrical body (cf. the name which alludes to the ‘julid’ appearance of these millipedes). The original description (Silvestri 1910), although possibly based on a misidentified type species (Jeekel 2003), mentions several important characters and is accompanied by quite a nice gonopod drawing.

So far, only four species of *Eviulisoma* have been described from the Eastern Arc Mts, viz., *E. dabagaense* Kraus, 1958, and *E. kwabuniense* Kraus, 1958, from the Udzungwa Mts, and *E. taita* VandenSpiegel & Golovatch, 2014, and *E. taitaorum* VandenSpiegel & Golovatch, 2014, from the northernmost part of the Eastern Arcs, the Taita Hills in southern Kenya.

Twenty new species of *Eviulisoma* from the Udzungwa Mts are described here, as are two additional species, obviously closely related to Udzungwan species, but coming from other Eastern Arc mountain blocks (Rubeho Mts and Kanga Mts). For the sake of simplicity these two species are included wherever “Udzungwan species of *Eviulisoma*” are referred to. When only species from the Udzungwa Mts themselves are meant, the term “Udzungwan s. str. species” is used. Figure 1 shows one of the more strikingly coloured new species described here.



**Fig. 1.** *Eviulisoma zebra* sp. nov., one of the strikingly marked species from the Udzungwa Mts. Photograph by Martin Nielsen.

## Material and methods

The vast majority of material comes from the zoological collections of the Natural History Museum of Denmark, University of Copenhagen (ZMUC). Much of the material was collected during several field trips to the Udzungwa Mts by ZMUC staff and students, but a very substantial part of it was collected by the NGO Frontier Tanzania (<https://frontiergap.com/About-Us/Background-Mission.aspx>) and was subsequently deposited in ZMUC. Additional material derives from the collections of the Virginia Museum of Natural History (VMNH), where the very large collection of Tanzanian millipedes accumulated by Richard L. Hoffman (1927–2012) is housed.

Marshall *et al.* (2001a) described how the material from West Kilombero FR was collected: “Ground-dwelling millipedes were primarily sampled by timed searching of 3 m × 3 m quadrats. [...] The leaf litter and topsoil within quadrats was searched thoroughly by hand for a total of eight person hours per quadrat at all trapsites. In addition, the general proximity of all trapsites was searched for two person hours. During such searches, particular attention was paid to rotting logs, the underside of rocks and other such microhabitats, which may have been missed by the quadrat samples.” The collecting procedure in New Dabaga/Ulangambi FR was the same (Marshall *et al.* 2001b). Andrew R. Marshall (pers. comm.) further informs that during these campaigns the collectors had to dig down to around 15 cm to find millipedes after initially fruitless searches in the topsoil alone.

Figure 2 shows the areas from where the specimens derive. All studied specimens are from Tanzania, Udzungwa (sometimes spelled Uzungwa) Mts.

A total of 155 male specimens were examined. All samples are kept in 70% alcohol.

Specimens were examined in alcohol under a stereo microscope. Specimens for scanning electron microscopy (SEM) were cleaned with ultrasound, transferred to 96% ethanol, then to acetone, air dried, mounted on aluminium stubs or on triangles of flexible aluminium tape in turn mounted on stubs, coated with platinum/palladium and studied in a JEOL JSM-6335F scanning electron microscope.

Quite often, more than one species was present and represented by males in a sample. Under ‘Distribution and habitat’ for each species such co-occurrences are summarized in statements starting with “Collected together with ...”

## Descriptions

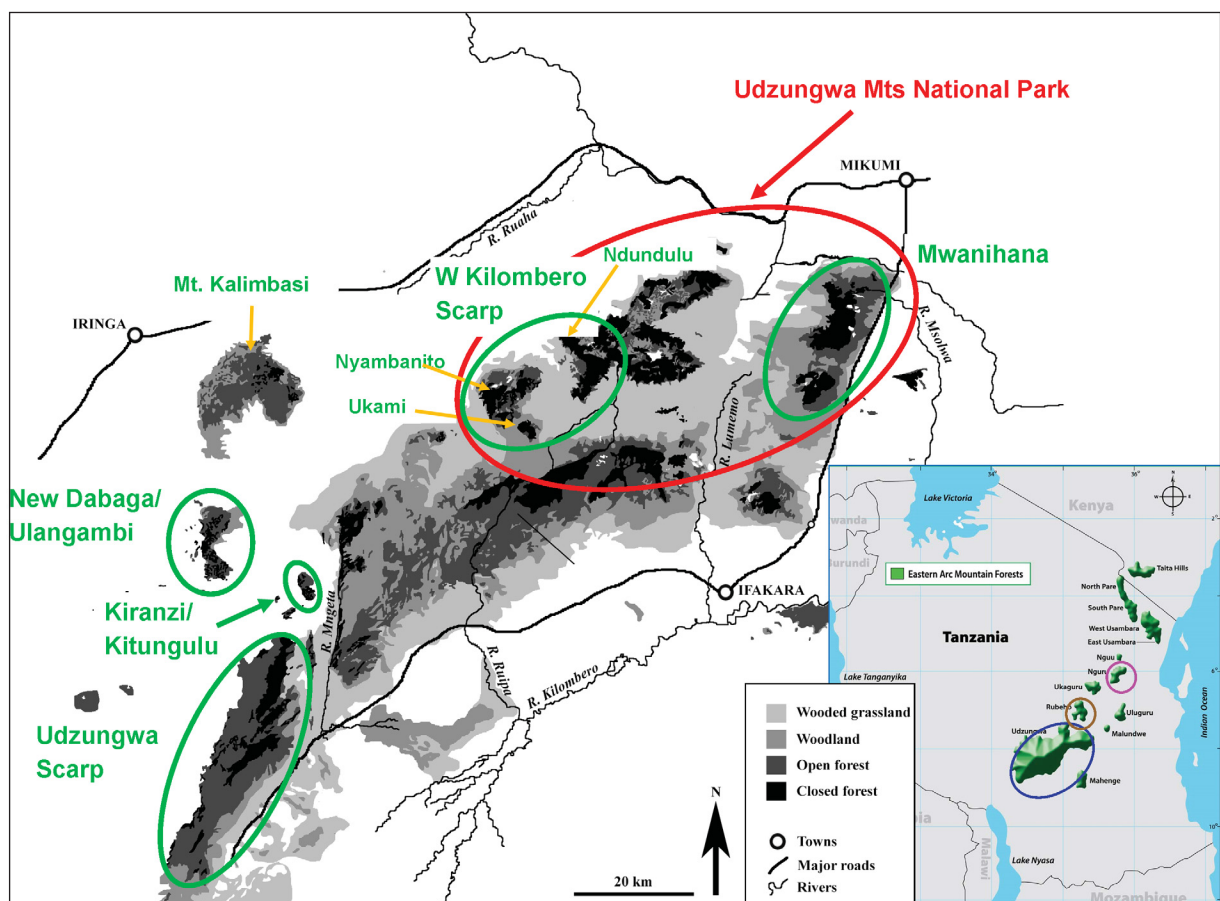
In light of the large amount of material at hand, and the modest (males) to very small/virtually non-existent (females) number of non-gonopodal differences between the studied species, only adult males are considered. In those cases where females could with some confidence be referred to a particular species, they are listed, but no separate description is given for them. Females are generally larger, especially thicker, than males.

Previous recent descriptions of species of *Eviulisoma* vary from extremely detailed (Jeekel 2003) to much briefer (VandenSpiegel & Golovatch 2014). I have chosen to follow the lead of the latter authors, and even to make the species description shorter still, because many of the characters specified for each species by VandenSpiegel & Golovatch (2014) hardly vary between the species from the Udzungwa Mts. Instead, these characters are treated under the generic heading.

Characters treated at species level include:

- Body length
- Midbody width
- Colour
- Length of antennae
- Paranota
- Stricture
- Pilosity of body rings
- Length of legs, relative lengths of podomeres from prefemur to tarsus
- Scopulae
- Hypoproct
- Modification of sternum 5
- Modification of sternum 6
- Gonopods

For the relative lengths of podomeres, notations such as the following are used: femur > prefemur  $\approx$  tarsus > tibia (>) postfemur. This means that femur is clearly longer than prefemur, prefemur is approximately as long as tarsus, tarsus is clearly longer than tibia, tibia is slightly longer than postfemur.



**Fig. 2.** Map of the Udzungwa Mountains, showing the location of the forest reserves (green ovals), the Udzungwa Mountains National park (red oval) and some individual mountains (yellow arrows) where specimens of *Eviulisoma* have been collected. Inset: the Eastern Arc Mountains, showing the location of the Udzungwa (blue oval), Rubeho (brown ring) and Kanga (pink ring) Mountains. Based on Marshall *et al.* (2010: fig. 1); inset by permission of the Eastern Arc Mountains Conservation Endowment Fund.

### Abbreviations for morphological terms used in descriptions and illustrations

<i>am</i>	=	amorphous mass sometimes seen in excavation of sternum 6 and/or on tip of process <i>map</i>
<i>bap</i>	=	basal acropodital process
<i>cxl</i>	=	coxal lobe
<i>cxp</i>	=	coxal process
<i>dr</i>	=	dentate ridge
<i>ep</i>	=	epiproct
<i>fe</i>	=	femur
<i>fet</i>	=	‘femorite’
<i>hy</i>	=	hypoproct
<i>iap</i>	=	intermediate acropodital process
<i>lt</i>	=	lateral tubercle
<i>map</i>	=	mesal acropodital process
<i>oz</i>	=	ozopore
<i>pk</i>	=	pleural keel
<i>pn</i>	=	paranotum
<i>pof</i>	=	postfemur
<i>pp</i>	=	paraproct
<i>prf</i>	=	prefemur/prefemoral part of gonopod
<i>ra</i>	=	ridged area of solenophore
<i>sb</i>	=	subapical branch of <i>map</i>
<i>sc</i>	=	sternal cone
<i>slm</i>	=	solenomere
<i>sp</i>	=	spinneret
<i>sph</i>	=	solenophore
<i>sph-d</i>	=	dorsal lobe of <i>sph</i>
<i>sph-i</i>	=	intermediate lobe of <i>sph</i>
<i>sph-p</i>	=	slender process from <i>sph</i>
<i>sph-v</i>	=	ventral lobe of <i>sph</i>
<i>sr</i>	=	serrated ridge
<i>str</i>	=	stricture between pro- and metazonite
<i>ta</i>	=	tarsus
<i>ti</i>	=	tibia
<i>tn</i>	=	apical tines of <i>map</i>
<i>tr</i>	=	transverse ridges
<i>tt</i>	=	terminal tubercle

### Other abbreviations used in the text

a.s.l.	=	above sea level
FR	=	Forest Reserve
NHMW	=	Naturhistorisches Museum, Vienna, Austria
VMNH	=	Virginia Museum of Natural History, VA, USA
ZMUC	=	Natural History Museum of Denmark (Zoological Museum), Copenhagen, Denmark
ZSM	=	Zoologische Staatssammlung München, Munich, Germany



## Taxonomy

Class Diplopoda de Blainville in Gervais, 1844

Order Polydesmida Leach, 1815

Family Paradoxosomatidae Daday, 1889

Subfamily Paradoxosomatinae Daday, 1889

Tribe **Eviulisomatini** Brölemann, 1916

## Diagnosis

Paradoxosomatidae in which paranota are very strongly reduced or virtually absent, and the ‘femorite’ of the gonopod is strongly reduced, such that solenomere, solenophore and up to two acropodital processes seem to originate directly from the end of the prefemoral part.

*Eviulisoma* is classified in the tribe Eviulisomatini which, according to Nguyen & Sierwald (2013) and Reboleira & Enghoff (2013), also contains *Boreviulisoma* Brolemann, 1928 (SW Palaearctic: NW Africa, SW Europe), *Eoseviulisoma* Brolemann, 1920 (Afrotropical), *Onciurosoma* Silvestri, 1932 (Neotropical), *Scolodesmus* Cook, 1896 (Afrotropical), *Suohelisoma* Hoffman, 1964 (Afrotropical) and *Wubidesmus* Chamberlin, 1927 (Afrotropical). To these should be added *Jeekelosoma* Mauriès, 1985, raised to full generic status from subgenus under *Eviulisoma* by Enghoff & Reboleira (in prep.), and possibly *Stirosoma* Attems, 1953 (Afrotropical). See below concerning *Eoseviulisoma* and *Suohelisoma*. In the key to Central African eviulisomatine genera by Hoffman (1971), *Eviulisoma* keys out together with *Suohelisoma* in couplet 1 because of the ‘dorsal’ (actually cranio-distal) lobe on the mesal side of the gonopod coxa. These two nominal genera also share the strongly excavated sternum 6 (absent in a few species of *Eviulisoma*, however), a character also present in *Wubidesmus*. Various excavated sterna 6 have been described for certain other paradoxosomatids, e.g., *Luzonomorpha pallidula* Jeekel, 2000, and *Montesecaria golovatchi* Jeekel, 2002 (Jeekel 2000, 2002), but as far as can be deduced from the descriptions, these excavations are quite different from those seen in *Eviulisoma* spp. Most eviulisomatine genera share a strongly reduced body ring setation: two rows of very thin setae on the collum and only one row on each of the following body rings. The majority of paradoxosomatid genera have two or three rows of setae on postcollar body rings, and this character state is shared by the eviulisomatine genera *Boreviulisoma* (Reboleira & Enghoff 2013) and *Jeekelosoma* (Mauriès 1985; Enghoff & Reboleira in prep.).

Table 1 summarizes some important characters across the eviulisomatine genera.

Genus ***Eviulisoma*** Silvestri, 1910

*Eviulisoma* Silvestri, 1910: 463 (type species: *Iulidesmus cavallii* Silvestri, 1907: 3, by original designation).

*Eoseviulisoma* Brolemann, 1920: 163 (as subgenus of *Eviulisoma*, elevated to full genus by Hoffman (1953); type species: *Strongylosoma iulinum* Attems, 1909: 10, by original designation).

*Strandiellus* Attems, 1927: 54 (synonymized by Attems (1929); type species: *Strandiellus cervicornis* Attems, 1927: 54, by original designation).

*Himatiopus* Verhoeff, 1941: 241 (synonymized by Jeekel (1968); type species: *Himatiopus iuloides* Verhoeff, 1941: 243, by monotypy).

## Included species

See Table 2.

Table 1. Comparison of eviulisomatine genera.

	<i>Boreviulisoma</i>	<i>Eviulisoma</i> incl. <i>Eoseviulisoma</i>	<i>Jeekelosoma</i>	<i>Onciurosoma</i>	<i>Scolodesmus</i>	<i>Suohelisoma</i>	<i>Wubidesmus</i>
Paranota	present	absent <sup>1</sup>	absent <sup>2</sup>	present	absent or tiny	absent	absent
Metazonal setae	2–3 rows	1 row	2 rows	1 row	1 row	1 row	1 row
Process on sternum of ring 5	no	present in most species	no	present	present, bilobed	a pair of tiny knobs	present
Sternum of ring 6	not excavated	deeply excavated in most species	not excavated	not excavated	not excavated	deeply excavated	deeply excavated
Some male femora with tubercles	yes (only some spp.)	no	slightly inflated	no	no	no	no
Scopulae	no	yes	no	no	no	yes	no
Gonopod aperture medially divided by lamella	no	no	yes	?	no	no	no
Meso-anterior lobe on gonopod coxa	yes ( <i>B. barrocalse</i> )	yes	yes (small)	no	no	yes	no
Solenomere	quite stout, distally forming a loop	flagelliform	flagelliform	flagelliform	flagelliform <sup>3</sup>	flagelliform	flagelliform
Acropodital ‘postfemoral’ process	absent	one or two	one	not distinct from solenophore	not distinct from solenophore	absent(?)	not distinct from solenophore
Distribution	SW Palaearctic	Afrotropical	Morocco	Neotropical (S America)	Afrotropical (W Africa)	Afrotropical (E Africa)	Afrotropical (C Africa)
Reference(s)	Brolemann 1928; Reboleira & Enghoff 2013	Jeekel 2003; pers. obs.	Mauriès 1985; Enghoff & Reboleira in prep.	Jeekel 1963; Golovatch 1992	Hoffman 1953; pers. obs. <sup>4</sup>	Hoffman 1964; pers. obs. <sup>5</sup>	Hoffman 1971

<sup>1</sup> except for tiny keel on ring 2<sup>2</sup> but peritremata present on poriferous rings<sup>3</sup> Hoffman (1953) was in doubt about the existence of a separate solenomere; dissection of the gonopod of a ♂ of *S. ventricornis* (Attems, 1931) from Ghana revealed a short, thin, flagelliform solenomere hidden inside the folds of the solenomere<sup>4</sup> 1 ♂ of *S. ventricornis* from Ghana, Cape Three Points, burnt forest, 1961, V. Schiötz leg. and det. (ZMUC); 1 ♂ of *S. scutigeroide* (Porat, 1894) from Nigeria (East), Osomba, 56 miles from Calabar, 1963, V. Schiötz leg. and det. (ZMUC)<sup>5</sup> 2 ♂♂ of *S. ulugurnense* Hoffman, 1964, from Tanzania, Uluguru Mts, M. Stoltze and N. Scharff leg. (ZMUC); 1 ♂, Lukwangule West, 2100 m a.s.l., 22 Jul. 1981; 1 ♂, Lupanga West, 1900 m a.s.l., 1 Jul. 1981



ENGHOFF H., *Eviulisoma* millipedes from the Udzungwa Mountains**Table 2.** Species of *Eviulisoma* Silvestri, 1910. (continued next page)

Species	Distribution	Source
<i>E. abnorme</i> (Attems, 1937) comb. nov.	Congo	present study
<i>E. acaciae</i> sp. nov.	Tanzania	present study
<i>E. aequilobatum</i> sp. nov.	Tanzania	present study
<i>E. akkariae</i> sp. nov.	Tanzania	present study
<i>E. alluaudi</i> Brolemann, 1920	Kenya	Vandenspiegel & Golovatch 2014
<i>E. angulatum</i> sp. nov.	Tanzania	present study
<i>E. articulatum</i> sp. nov.	Tanzania	present study
<i>E. biquintum</i> sp. nov.	Tanzania	present study
<i>E. boranicum</i> Manfredi, 1939	Ethiopia	Nguyen & Sierwald 2013
<i>E. breviscutum</i> sp. nov.	Tanzania	present study
<i>E. castaneum</i> Attems, 1953	D.R. Congo	Nguyen & Sierwald 2013
<i>E. cavallii</i> (Silvestri, 1907)	Uganda	Nguyen & Sierwald 2013
<i>E. cervicorne</i> (Attems, 1927)	“Africa”	Nguyen & Sierwald 2013
<i>E. cetafi</i> sp. nov.	Tanzania	present study
<i>E. chitense</i> sp. nov.	Tanzania	present study
<i>E. commelina</i> sp. nov.	Tanzania	present study
<i>E. congicollens</i> (Chamberlin, 1927)	Congo	Nguyen & Sierwald 2013
<i>E. coxale</i> sp. nov.	Tanzania	present study
<i>E. culter</i> sp. nov.	Tanzania	present study
<i>E. cylindricum</i> Attems, 1953	D.R. Congo	Nguyen & Sierwald 2013
<i>E. cylindricum simile</i> Attems, 1953	D.R. Congo	Nguyen & Sierwald 2013
<i>E. dabagaense</i> Kraus, 1958	Tanzania	Nguyen & Sierwald 2013
<i>E. debile</i> Attems, 1938	D.R. Congo	Nguyen & Sierwald 2013
<i>E. egregium</i> Attems, 1938	D.R. Congo	Nguyen & Sierwald 2013
<i>E. ejti</i> sp. nov.	Tanzania	present study
<i>E. fossiger</i> (Carl, 1909)	Tanzania	Nguyen & Sierwald 2013
<i>E. graueri</i> Attems, 1944	Tanzania	Nguyen & Sierwald 2013
<i>E. grumslingslak</i> sp. nov.	Tanzania	present study
<i>E. insulare</i> Brölemann, 1920	Tanzania	Nguyen & Sierwald 2013
<i>E. iugans</i> (Chamberlin, 1927)	Congo	Nguyen & Sierwald 2013
<i>E. iuloideum</i> (Verhoeff, 1941)	Tanzania	Nguyen & Sierwald 2013
<i>E. jeanneli</i> Brölemann, 1920	Kenya	Nguyen & Sierwald 2013
<i>E. julinum</i> (Attems, 1909)	Tanzania	present study
<i>E. kalimbasiense</i> sp. nov.	Tanzania	present study
<i>E. kangaense</i> sp. nov.	Tanzania	present study
<i>E. kirimeri</i> Vandenspiegel & Golovatch, 2014	Kenya	Vandenspiegel & Golovatch 2014
<i>E. kakamega</i> Vandenspiegel & Golovatch, 2014	Kenya	Vandenspiegel & Golovatch 2014
<i>E. kwabuniense</i> Kraus, 1958	Tanzania	Nguyen & Sierwald 2013
<i>E. lanceolatum</i> Attems, 1953	D.R. Congo	Nguyen & Sierwald 2013
<i>E. muturanum</i> Attems, 1937	D.R. Congo	Nguyen & Sierwald 2013
<i>E. navuncus</i> sp. nov.	Tanzania	present study

**Table 2.** Species of *Eviulisoma* Silvestri, 1910. (continued)

Species	Distribution	Source
<i>E. nessiteras</i> sp. nov.	Tanzania	present study
<i>E. ngaia</i> Vandenspiegel & Golovatch, 2014	Kenya	Vandenspiegel & Golovatch 2014
<i>E. ngaiaorum</i> Vandensp. & Golovatch, 2014	Kenya	Vandenspiegel & Golovatch 2014
<i>E. obesum</i> Attems, 1953	D.R. Congo	Nguyen & Sierwald 2013
<i>E. obscurum</i> Attems, 1937	D.R. Congo	Nguyen & Sierwald 2013
<i>E. ottokrausi</i> sp. nov.	Tanzania	present study
<i>E. pallidum</i> Attems, 1939	Uganda, Kenya	Nguyen & Sierwald 2013
<i>E. paradisiacum</i> sp. nov.	Tanzania	present study
<i>E. rugegeanum</i> Attems, 1953	Rwanda	Sierwald 2017
<i>E. schoutedeni</i> Attems, 1929	D.R. Congo	Nguyen & Sierwald 2013
<i>E. silvaticum</i> Attems, 1953	D.R. Congo	Nguyen & Sierwald 2013
<i>E. silvestre</i> (Carl, 1909)	Tanzania	Nguyen & Sierwald 2013
<i>E. somaliense</i> Ceuca, 1971	Somalia	Nguyen & Sierwald 2013
<i>E. sternale</i> sp. nov.	Tanzania	present study
<i>E. taita</i> Vandenspiegel & Golovatch, 2014	Kenya	Vandenspiegel & Golovatch 2014
<i>E. taitaorum</i> Vandensp. & Golovatch, 2014	Kenya	Vandenspiegel & Golovatch 2014
<i>E. tertalinus</i> Manfredi, 1941	Ethiopia	Nguyen & Sierwald 2013
<i>E. tritonium</i> Attems, 1937	D.R. Congo	Nguyen & Sierwald 2013
<i>E. ussuwiense</i> (Carl, 1909)	Tanzania	Nguyen & Sierwald 2013
<i>E. zebra</i> sp. nov.	Tanzania	present study

Mauriès (1985) described a subgenus of *Eviulisoma*, based on a species from Morocco. However, a study by Enghoff & Reboleira (in prep.) shows that *Jeekelosoma* Mauriès, 1985, should be upgraded to full generic status, and by this action *Eviulisoma* will again become an endemic Afrotropical genus.

### Diagnosis

A succinct diagnosis of *Eviulisoma* was provided by Hoffman (1953). Supplemented with information from Hoffman (1964, 1971), Jeekel (2003), Vandenspiegel & Golovatch (2014) and the present study, and with an updated terminology (see below), *Eviulisoma* may be diagnosed as follows:

A genus of Paradoxosomatidae in which:

- paranota are missing, or at most present as tiny keels on ring 2 only
- there is (usually) a process between the coxae of the fourth male legs
- the sternum of body ring 6 is usually deeply excavated
- the collum bears two transverse rows of thin setae, postcollar body rings bear only one such row
- the gonopod coxa usually has a conspicuous meso-anterior lobe
- the gonopod prefemur is shorter than the acropodite, usually less than half as long
- the acropodite consists of at least three branches which seem to originate directly from the prefemur:
  - the flagelliform solenomere
  - a mesal acropodital process which is often the longest of the acropodital branches
  - sometimes an intermediate acropodital process originating between the mesal acropodital process and the solenomere
- a lateral solenophore which serves as protection of the solenomere

### Gonopod terminology

Jeekel (2003) gave detailed redescriptions of many species of *Eviulisoma*, as well as general comments on the gonopods. In Jeekel's terminology, the gonopod in *Eviulisoma* consists of a basal coxa, followed by a prefemur and a terminal acropodite. The 'femorite' which usually forms a distinct basal 'shaft' of the acropodite is extremely reduced in *Eviulisoma*, and "Moreover, it has made a torsion of 180° which is shown by the course of the spermal channel along the anterior side towards the lateral side. The result is that the solenomere arises from the lateral side of the femorite" (Jeekel 2003: 48).

On the acropodite Jeekel (2003) distinguished three elements: the "solenomerite", the "tibiotarsus" and a mesal process which he called the "postfemoral process". There has been a long tradition of attempting to homologise parts of millipede gonopods with podomeres of ordinary walking legs, from which the gonopods have evolved. In the colobognathan orders, where the gonopods retain an obviously leglike structure, this is no problem, but in the eugnathan groups (Nematophora, Merocheta and Juliformia) the homologisation is not straightforward. Eugnathan gonopods often show some more or less obvious articulations, sutures, or constrictions which might correspond to articulations between podomeres, but apart from the articulation between coxa and telopodite, these subdivisions of the gonopod probably have nothing to do with the original leg segmentation. Thus, developmental studies on polydesmid millipedes indicated that the entire telopodite corresponds to the prefemur of a walking leg (Petit 1976). It therefore makes sense to minimize use of a gonopod terminology suggesting homology with walking leg podomeres. VandenSpiegel & Golovatch (2014) already took such a step for *Eviulisoma*, using the functional term "solenophore" for what Jeekel (2003) called "tibiotarsus". I suggest a further step in the same direction and herewith propose the terms "mesal acropodital process" and "intermediate acropodital process" for what Jeekel (2003) and Vandenspiegel & Golovatch (2014) referred to as postfemoral processes.

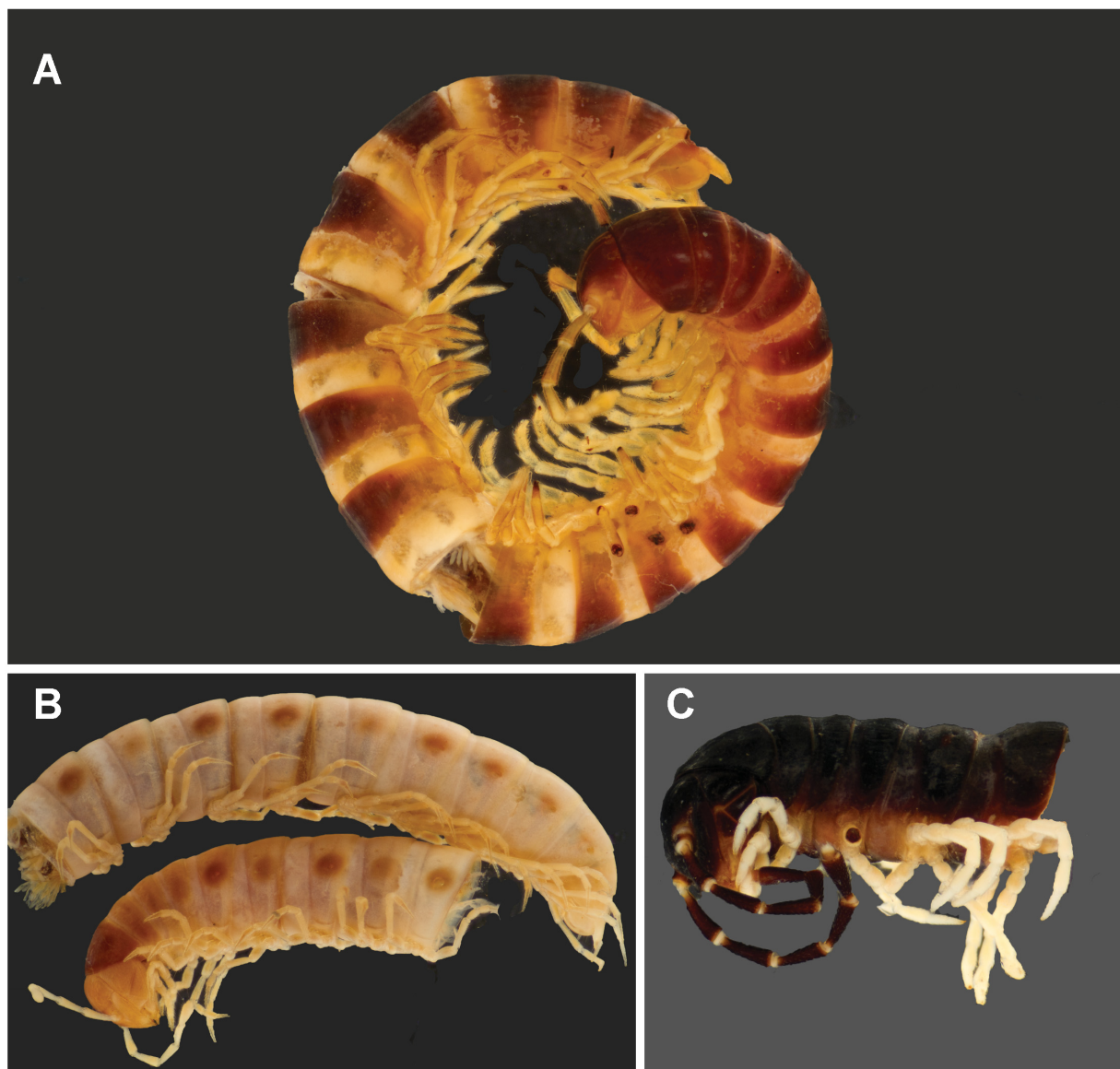
### General description of Udzungwan *Eviulisoma*

In order to minimize redundancy in the species descriptions, the following general description is presented. It is based on the Udzungwan species studied here, but when appropriate, additional literature-based information from other species is added [in square brackets]. The description applies to adult males.

- 18 podous + 1 apodous body rings + telson, i.e., '20 segments'. 'Ring' is used as short for 'body ring' in descriptions.
- Body length [13]14–34 mm; width [1]1.3–3.4 mm.
- Colour highly variable. Some species are uniform pale whitish (this seems not always to be a result of preservation), some are more or less uniform brownish or even black (*E. biquintum* sp. nov., partly), many are more or less strikingly ringed, with metazonites or a part thereof being brown or black, contrasting with pale prozonites (e.g., *E. zebra* sp. nov., Fig. 1; *E. akkariae* sp. nov., Fig. 3A), one colour form of *E. coxale* sp. nov. has large brownish dots at the ozopore level, contrasting with a pale background (Fig. 3B), and one colour form of *E. biquintum* sp. nov. is pitch black with contrasting white legs (Fig. 3C).
- Lower part of head capsule 'clypeo-labral region' with numerous setae up to between antennal sockets; upper part ('vertigial region') with at most a few scattered setae, sometimes arranged in one or more pairs close to midline (Fig. 4).
- Antennae (Fig. 4) reaching back to ring [2]3–5 when folded along the side of the body. Antennomeres 2–6 of roughly same length, 1 and 7 much shorter.
- Collum (Fig. 4) unmodified, with two transverse rows of thin setae, one row near anterior margin, one ca in the middle, laterally somewhat wrinkled.

- Body rings:

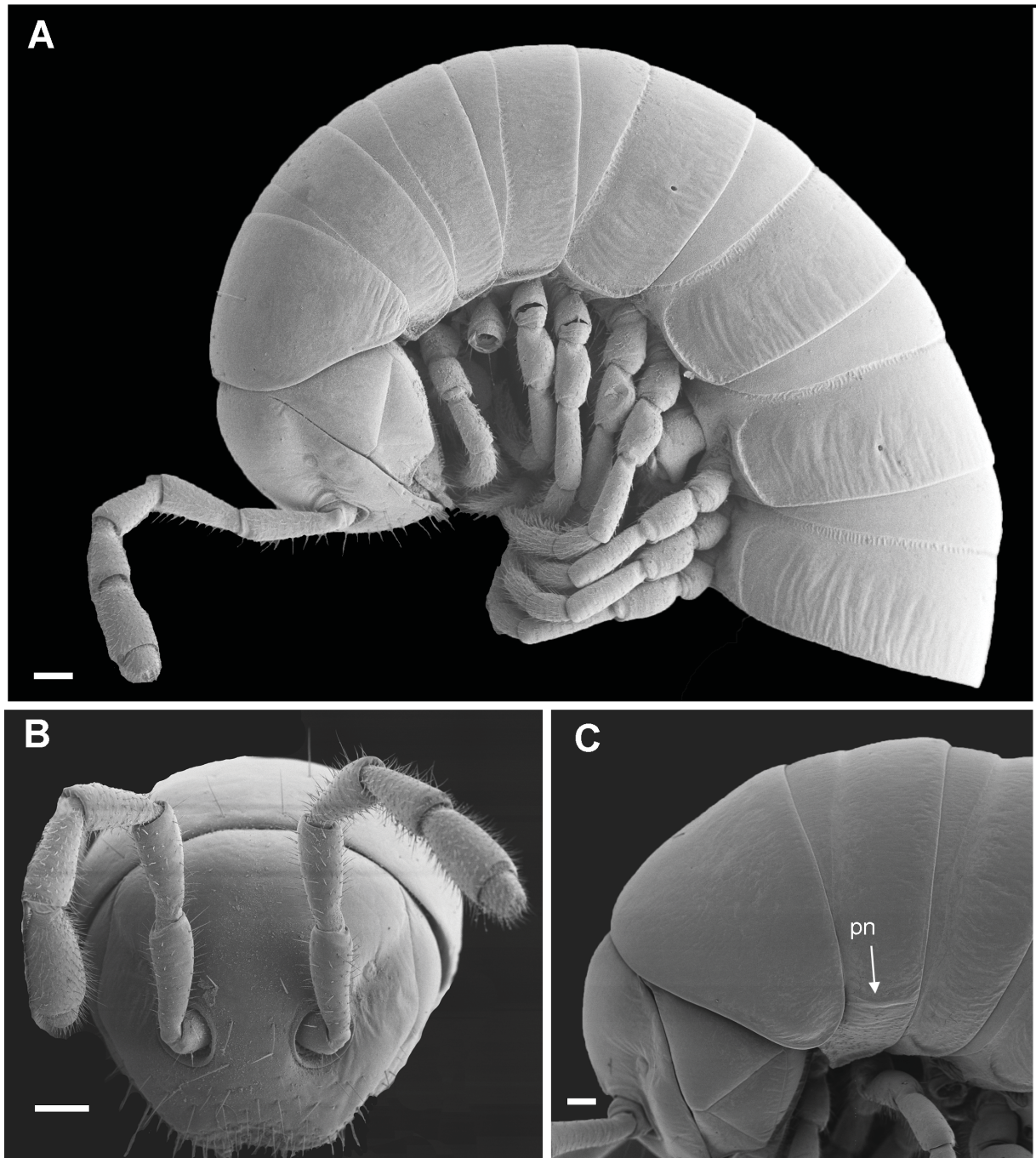
- Paranota completely absent or present as inconspicuous, simple ridges on ring 2 only (Fig. 4). In some species, such ridges are seen in some specimens, not in others.
- Pleurosternal keels (Fig. 5) simple, not prominent, not drawn out as posterior denticles, best developed on rings 2–5(7), decreasing in size backwards, but in some species recognizable as far back as ring 17.
- Surface smooth, sometimes with visible cellular structure, metazonites more or less longitudinally wrinkled, especially ventro-laterally.
- Stricture between pro- and metazonite sometimes smooth, sometimes more or less conspicuously striolate (Fig. 5).



**Fig. 3.** *Eviulisoma* spp., examples of colour patterns. **A.** *E. akkariae* sp. nov., paratype, showing a banded pattern (pale prozonites, dark metazonites) similar to that shown in Fig. 1. **B.** *E. coxale* sp. nov., tentatively referred female from type locality, showing dark lateral spots on a pale background. **C.** *E. biquintum* sp. nov., paratype from Mito Mitatu, showing a black body contrasting with white legs. Not to scale. Photographs by F. Vad and A. Illum.

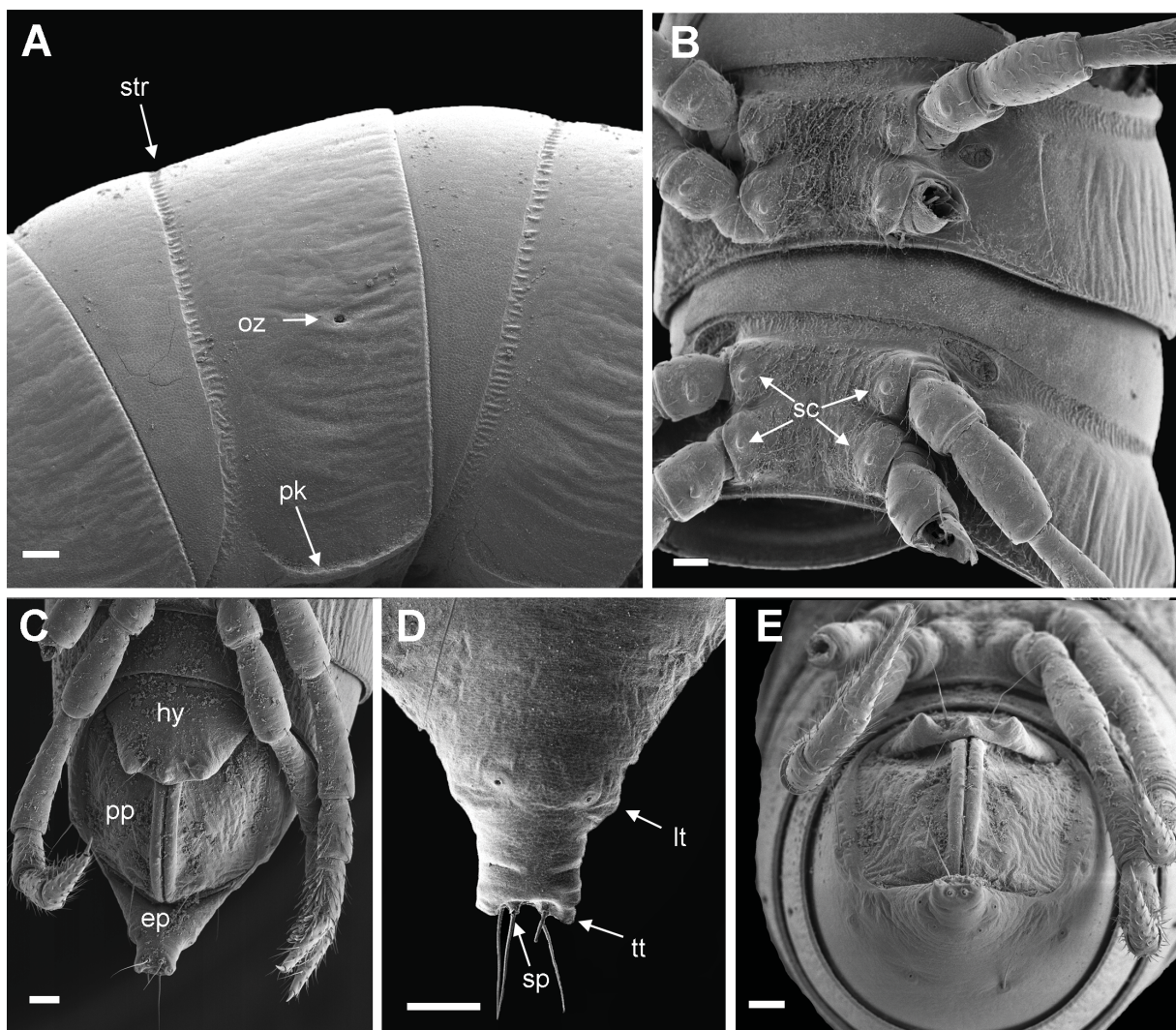


- Ozopores opening flush with metazonital surface at ca  $\frac{2}{3}$  of metazonital length behind stricture (Fig. 5).
- A single transverse row of two (1+1) or four (2+2) thin setae often present on metazonites, sometimes only seen on ring 2, sometimes apparently missing (probably abraded in many cases).
- Sterna sometimes with small cones at base of legs (Fig. 5), at least on ring 8.



**Fig. 4.** *Eviulisoma* spp. **A–B.** *E. paradisiacum* sp. nov., ♂. A. Head and rings 1–8, lateral view. B. Head and collum, frontal view. **C.** *E. zebra* sp. nov., ♂, head and rings 1–3, lateral view. Abbreviation: *pn* = paranotum. Scale bars: 0.2 mm.

- Telson (Fig. 5):
  - Preanal ring with a long triangular epiproct; lateral setiferous tubercles usually poorly differentiated, sometimes virtually absent; apical tubercles also usually not prominent.
  - Anal valves (paraprocts) with margin raised as narrow lips.
  - Subanal scale (hypoproct) variable, sometimes semicircular, sometimes trapezoid, sometimes with three more or less conspicuous tubercles at distal margin.
- Legs  $0.8\text{--}1.5\times$  as long as body diameter. Relative lengths of podomeres variable; femur the longest in most cases, but in some short-legged species, prefemur is as long as femur, and in a few long-legged ones, tarsus is as long as or longer than femur.
- Non-gonopodal sexual characters:
  - Sternum 5 usually with a tongue-shaped/subtriangular/subrectangular process (Fig. 6) between anterior legs (pair 4). One species (*E. breviscutum* sp. nov.) without a process (Fig. 36) and one

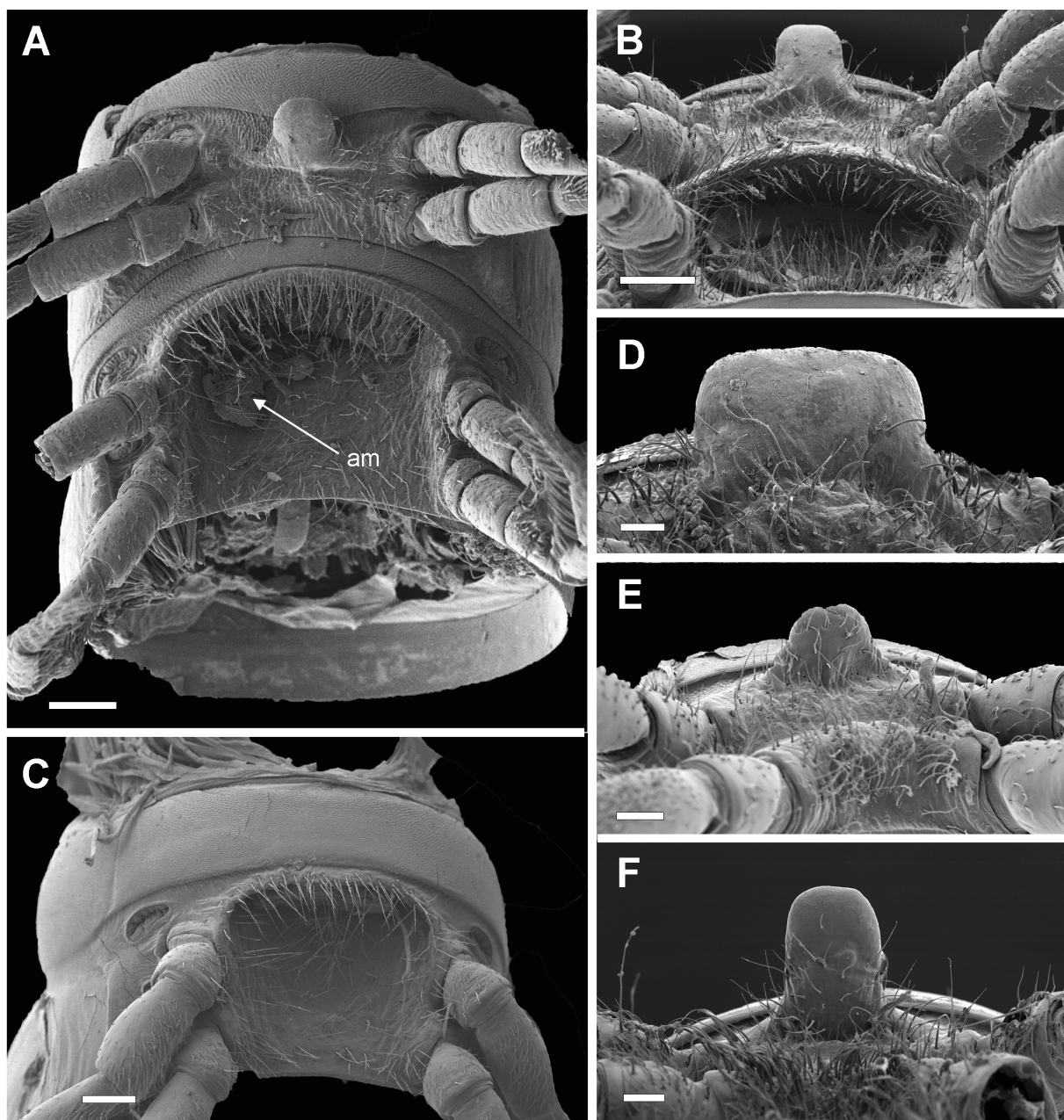


**Fig. 5.** *Eviulisoma paradisiacum* sp. nov., ♂. **A.** Two midbody rings, lateral view, showing pleurosternal keel and striolate stricture. **B.** Two midbody rings, ventral view, showing sternal cones. **C–E.** Telson. **C.** Ventral view. **D.** Dorsal view. **E.** Posterior view. Abbreviations: *ep* = epiproct; *hy* = hypoproct; *lt* = lateral tubercle; *oz* = ozopore; *pk* = pleural keel; *pp* = paraproct; *sc* = sternal cone; *sp* = spinneret; *str* = stricture; *tt* = terminal tubercle. Scale bars: 0.1 mm.



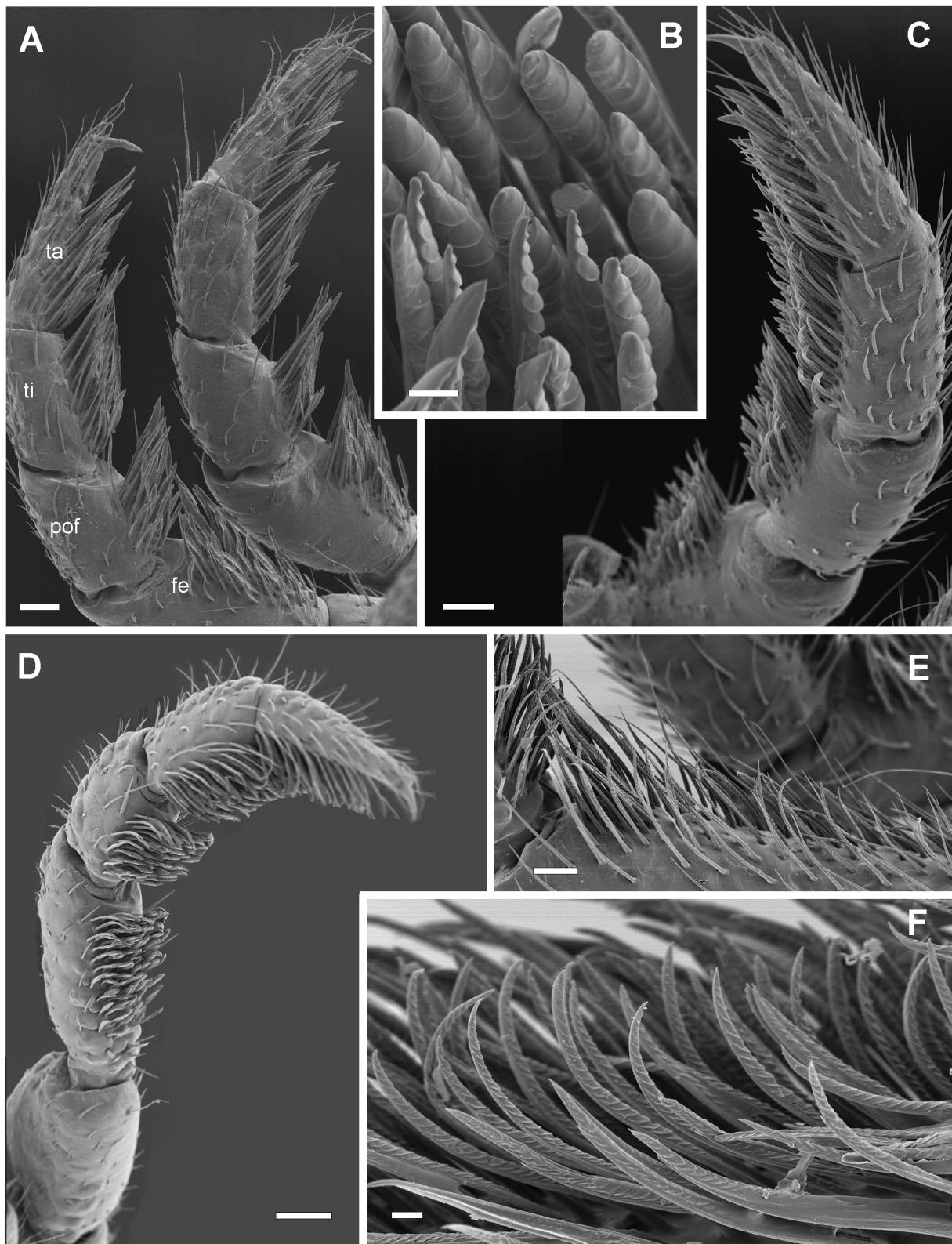
(*E. biquintum* sp. nov.) with a small tubercle between the 4<sup>th</sup> leg pair and a similar one between the 5<sup>th</sup> (Fig. 35).

- Sternum 6 usually deeply excavated (Fig. 6), anterior margin of excavation curved, with a row of long setae. Fig. 6 shows a sternum 6 excavation as it appears in most species; deviating morphologies occur in certain species (Figs 26, 28, 30, 34). *E. breviscutum* sp. nov. and *E. biquintum* sp. nov. have no excavation.



**Fig. 6.** *Eviulisoma* spp., male sternum 5 with lobe between 4th legs and sternum 6 with excavation. **A–B.** *E. ejti* sp. nov., paratype, sternum 5 and 6. **A.** Ventral view. **B.** Sub-posterior view. **C.** *E. acaciae* sp. nov., paratype, sternum 6, ventral view. **D–F.** Sternum 5 lobe, posterior view. **D.** *E. chitense* sp. nov., paratype. **E.** *E. dabagaense* Kraus, 1958, specimen from Udzungwa Scarp FR, above Chita Village. **F.** *E. coxale* sp. nov., specimen from Mito Mitatu. Abbreviation: *am* = amorphous mass. Scale bars: A–C = 0.2 mm; D = 0.05 mm; E–F = 0.1 mm.





**Fig. 7.** *Eviulisoma* spp., scopulae on postfemur (*pof*), femur (*fe*), tibia (*ti*) and tarsus (*ta*) of male legs. **A.** *E. paradisiacum* sp. nov., paratype. **B, D.** *E. cetafi* sp. nov., paratype. **C.** *E. ejti* sp. nov., paratype. **E–F.** *E. coxale* sp. nov., paratype from Mito Mitatu. Scale bars: A, C, E = 0.05 mm; B, F = 0.01 mm; D = 0.1 mm.

- Scopulae (dense coverings of modified setae) usually present on the ventral side of femur, postfemur, tibia and tarsus on anterior legs (Fig. 7), decreasing in size from anterior to posterior, often disappearing from (femur and) postfemur on posteriormost legs (scopulae only on tibia and tarsus in some non-Udzungwan species). *E. kangense* sp. nov. and *E. sternale* sp. nov. furthermore with the ventral surfaces of prefemora and femora flattened and hairless on some leg pairs. No podomeres with swellings or processes.
- Gonopods (Fig. 8):
  - Coxa (*cx*) with a rounded distomedial lobe of variable size.
  - Telopodite forming right angles with coxa.
  - Prefemoral part (*prf*) densely hirsute, usually much shorter than acropodite.
  - Acropodite consisting of a highly reduced basal part from which solenomere, solenophore, mesal acropodital and sometimes intermediate acropodital process arise at ca same level.
  - Solenomere (*slm*) originating near lateral side of gonopod, simple, whip-like, usually largely concealed within folded solenophore (Fig. 8A–B).
  - Solenophore (*sph*) originating on lateral side of gonopod, very variable in shape, sometimes a simple rolled sheet, sometimes with a distinct ‘conductor’ process guiding the solenomere; in species with an ‘open’ solenophore, an area with parallel ridges (e.g., Figs 12–13, 18 ) is sometimes seen – whether similar ridges are present in rolled-up solenophores is unknown.
  - Mesal acropodital process (*map*) originating on mesal side of gonopod, mostly but not always the longest part of the acropodite, very variable in shape. In species with an intermediate acropodital process (*iap*), *map* is basally closely contiguous with the solenomere and *map* might be interpreted as a solenomer process (?parasolenomere). In species without *iap*, the solenomere articulates with the highly reduced femorite, close to the basis of *map*.
  - Intermediate acropodital process (*iap*) only present in some species, originating between *map* and *slm*, long, slender, often spinose.

Females are generally larger than males. Although females have not been considered in the present species descriptions, it is worth noting that the ventral part of the third body ring (‘epigyne’) and the basal part of the second pair of legs show considerable variation among species (Brolemann 1920). Also within the Udzungwan species of *Eviulisoma*, several distinct types of ‘epigyne’ and second legs exist, but often it was not possible to correlate a particular female morphotype with a particular species as defined by male characters.

### Species groups

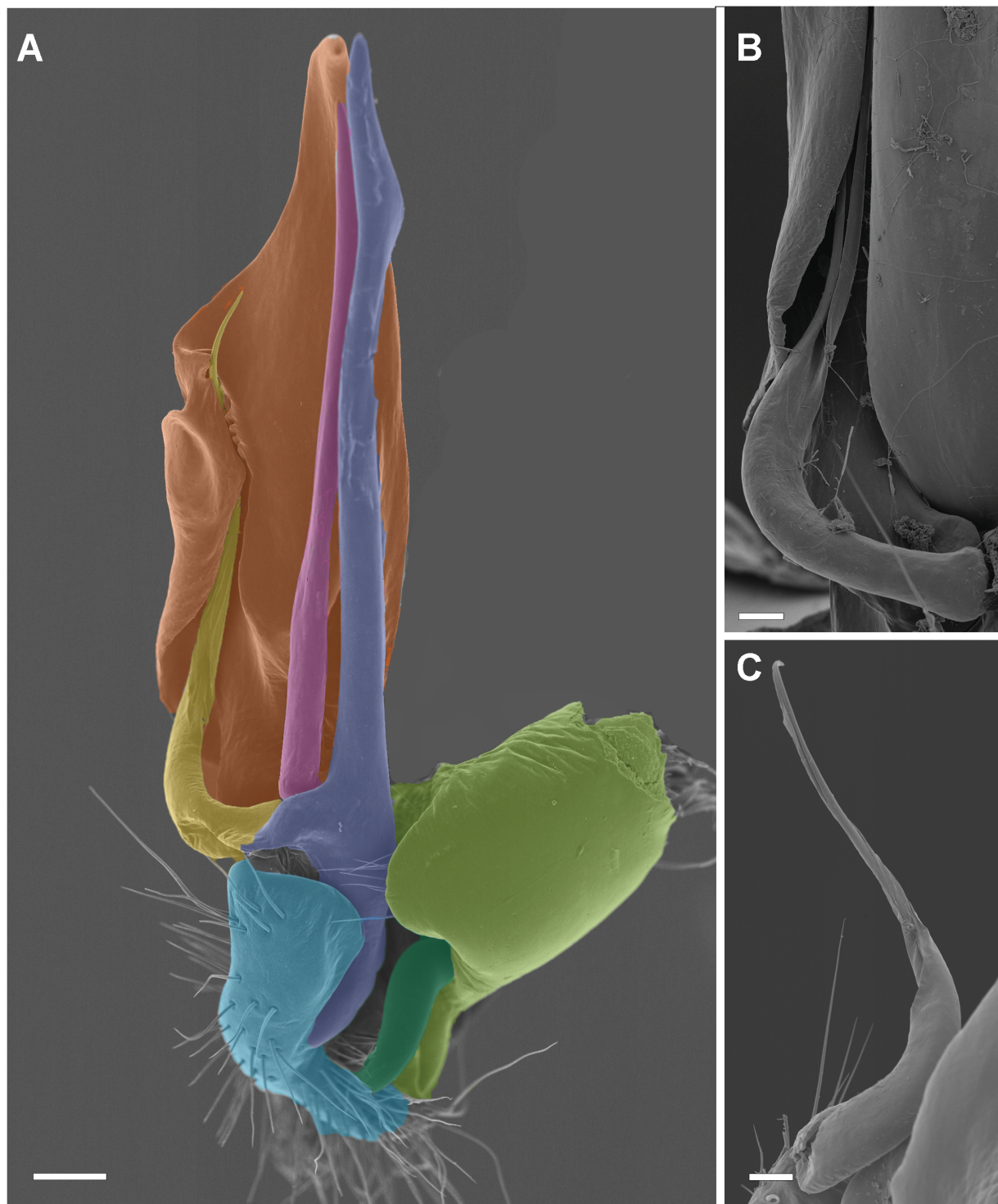
Four species groups can be recognized among the *Eviulisoma* species treated here (Table 3). All groups include species with an excavated male sternum 6 and a ventral process/lobe on sternum 5. One group is characterized by the presence of an intermediate acropodital process (*iap*), one by having the margins of the sternum 6 excavation lobed, one by having a laterally compressed mesal acropodital process (*map*) and one by having neither of these characteristics, but a large, sheet-like, unrolled solenophore (*sph*) and, notably, a separate basal part (‘femorite’) of the acropodite. Three species are left ungrouped, being not particularly similar to any other new or previously described species. Two of the ungrouped species lack the sternum 6 excavation and the sternum 5 lobe.

### The *kwabuniense* group

#### Diagnosis

Species of *Eviulisoma* in which male sternum 6 is deeply excavated with unlobed margins, there is an intermediate acropodital process and the solenophore is a relatively open sheet with mostly three, more rarely two apical lobes.





**Fig. 8.** Gonopods in *Eviulisoma* spp. **A.** *E. akkariae* sp. nov., paratype, right gonopod, colour-coded: light green = coxa; dark green = cannula; light blue = prefemoral part; purplish blue = mesal acropodital process; pink = intermediate acropodital process; orange = solenophore; yellow = solenomere. **B.** *E. culter* sp. nov., paratype, right gonopod, solenomere entering solenophore. **C.** *E. ottokrausi* sp. nov., paratype, left gonopod, solenomere dislodged from solenophore. Scale bars: A = 0.1 mm; B–C = 0.05 mm.

**Table 3.** Species groups of *Eviulisoma* Silvestri, 1910, their constituent species and main morphological characters. Note that with the exception of *E. alluaudi* Brolemann, 1920, *E. jeanneli* Brolemann, 1920 and *E. silvaticum* Attems, 1953, which are tentatively assigned to the *kwabuniense* group, the table only includes species from the Udzungwa, Rubeho and Kanga Mts.

Group name	Included species	CHARACTERS									
		sternum 6 excavation and lobe between coxae 4	margins of sternum 6 excavation	acropodite with a separate basal 'femorite'	intermediate acropodital process	mesal acropodital process	solenophore				
kwabuniense group	<i>E. kwabuniense</i>	+ & +	not lobed	no	+	not compressed	large, not rolled, with (two-)three apical lobes				
	<i>E. acaciae</i> sp. nov.										
	<i>E. aequilobatum</i> sp. nov.										
	<i>E. akkariae</i> sp. nov.										
	<i>E. cetafi</i> sp. nov.										
	<i>E. chitense</i> sp. nov.										
	<i>E. commelina</i> sp. nov.										
	<i>E. ejii</i> sp. nov.										
	<i>E. kalimbasiense</i> sp. nov.										
	<i>E. navuncus</i> sp. nov.										
<i>E. nessiteras</i> sp. nov.											
<i>E. ottokrausi</i> sp. nov.											
<i>E. paradisiacum</i> sp. nov. ( <i>E. alluaudi</i> ) ( <i>E. jeanneli</i> ) ( <i>E. silvaticum</i> )											
dabagaense group	<i>E. dabagaense</i>	+ & +	not lobed	no	–	strongly laterally compressed	tubular, 'rolled sheet'				
	<i>E. grumslingslak</i> sp. nov.										
	<i>E. coxale</i> sp. nov.										
	<i>E. culter</i> sp. nov.										
sternale group	<i>E. sternale</i> sp. nov.	+ & +	lobed	no	–	not compressed	tubular, 'rolled sheet'				
	<i>E. zebra</i> sp. nov.										
	<i>E. kangaense</i> sp. nov.										
iuloideum group	<i>E. iuloideum</i>	+ & +	not lobed	yes	–	not compressed	large, not rolled, no apical lobes				
	<i>E. articulatum</i> sp. nov.										
Ungrouped	<i>E. angulatum</i> sp. nov.	+ & +	angled	no	–	not compressed	large, not rolled, two apical lobes				
	<i>E. breviscutum</i> sp. nov.										
								NA	no	–	not compressed, short, shield-like apical lobes
	<i>E. biquintum</i> sp. nov.							NA	no	–	not compressed large, rolled

The included species furthermore share a hypoproct with three prominent marginal tubercles. Most of the species are apparently pallid (although fading of colour cannot be excluded), only *E. akkariae* sp. nov., which is also larger than the others, having a distinct ringed colour pattern.

Included species:

*E. kwabuniense* Kraus, 1958

*E. acaciae* sp. nov.

*E. aequilobatum* sp. nov.

*E. akkariae* sp. nov.

*E. cetafi* sp. nov.

*E. chitense* sp. nov.

*E. commelina* sp. nov.

*E. ejti* sp. nov.

*E. kalimbasiense* sp. nov.

*E. navuncus* sp. nov.

*E. nessiteras* sp. nov.

*E. ottokrausi* sp. nov.

*E. paradisiacum* sp. nov.

*E. alluaudi* Brolemann, 1920, *E. jeanneli* Brolemann, 1920, and *E. silvaticum* Attems, 1953, may also be tentatively included in this group, based on published descriptions (Attems 1953; Brolemann 1920; Jeekel 2003; VandenSpiegel & Golovatch 2014).

### *Eviulisoma kwabuniense* Kraus, 1958

Fig 9

*Eviulisoma kwabuniense* Kraus, 1958: 3 (holotype (not studied) in the Überseemuseum Bremen).

### Diagnosis

Differs from all other species of *Eviulisoma* by the presence of a basal acropodital process. Further differs from other Udzungwan members of the *E. kwabuniense* group by the combination of largely identical, smooth *map* and *iap*, and a relatively short solenophore with three lobes of approximately equal length.

### Material studied (total: 1 ♂)

TANZANIA: 1 ♂, Iringa Region, Iringa District, New Dabaga/Ulangambi FR, 08°05'34.5" S, 35°55'31.3" E, montane, 1800–1900 m a.s.l., Plot 16, 15–16 Nov. 2000, Frontier Tanzania leg. (ZMUC).

### Descriptive notes (male)

Information on the holotype, from Kraus (1958), in square brackets when different.

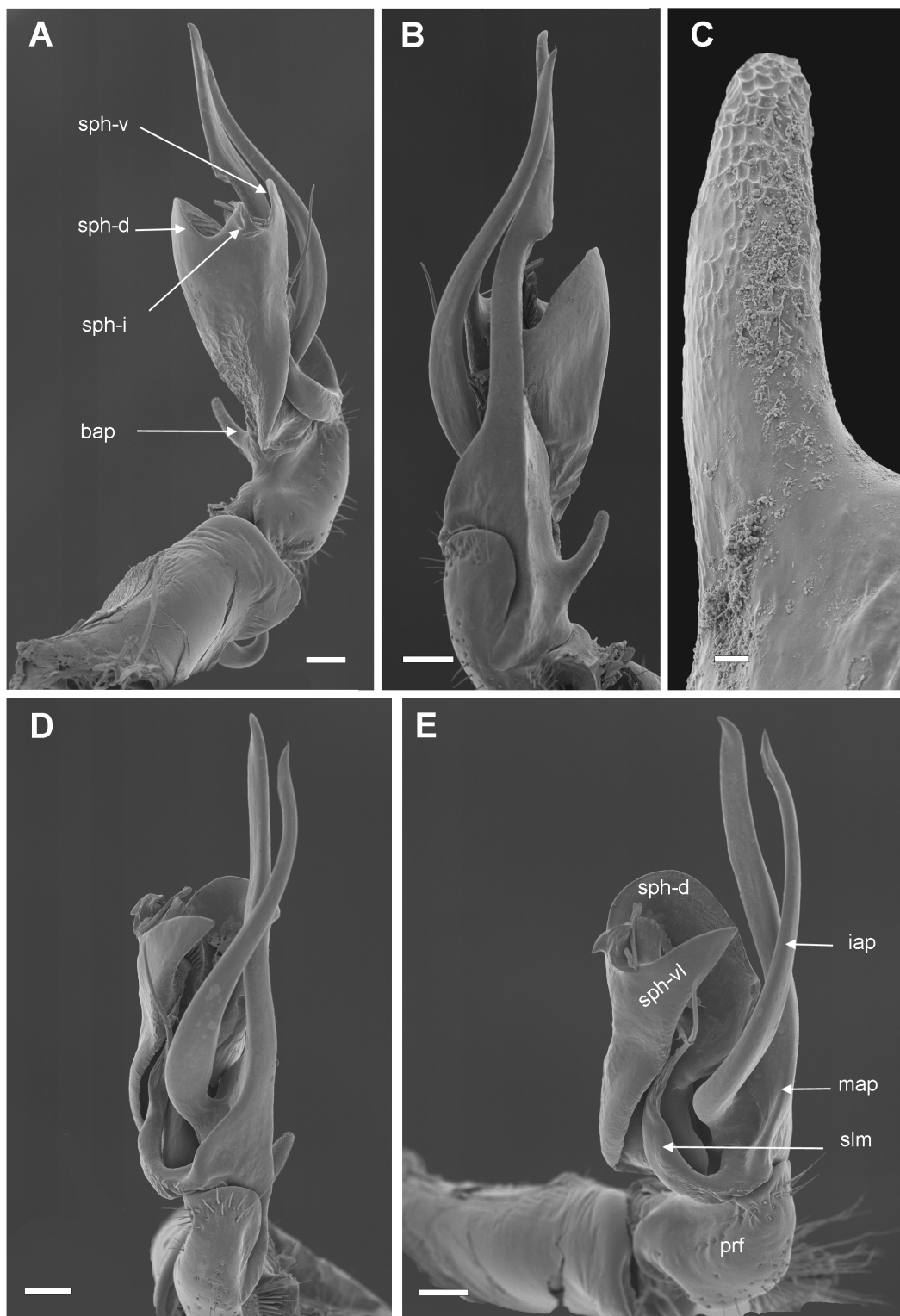
SIZE. Length 15 mm, max. width 1.8 mm [1.6 mm].

COLOUR. Completely pallid after 17 years in alcohol, possibly not due to fading, cf. remarks under *E. ottokrausi* sp. nov. [very pale, just weakly horn brown mainly on collum and metazonites].

ANTENNAE. Reaching back to end of ring 3.

BODY RINGS. Paranota completely missing. Stricture between pro- and metazonite clearly striolate. No setae seen on post-collar body rings.





**Fig. 9.** *Eviulisoma kwabuniense* Kraus, 1958, ♂, non-type, from New Dabaga-Ulangambi FR, right gonopod. **A.** Dorso-lateral view. **B.** Dorso-mesal view. **C.** Close-up of basal acropodital process. **D.** Ventral view. **E.** Lateral view. Abbreviations: *bap* = basal acropodital process; *iap* = intermediate acropodital process; *map* = mesal acropodital process; *prf* = prefemoral part; *slm* = solenomere; *sph-d*, *sph-i*, *sph-v* = dorsal, intermediate and ventral lobes of solenophore. Scale bars: A–B, D–E = 0.1 mm; C = 0.01 mm.

**HYPOPROCT.** Trapezoid, with three prominent apical tubercles.

**LEGS.** Short, stout, length  $0.9 \times$  body width. Relative lengths of podomeres: prefemur = femur > tarsus > postfemur = tibia. Scopulae strongly developed on femur, postfemur, tibia and tarsus, continuing until last legs, except on femur.

**STERNUM 5.** A tongue-shaped process between legs 4.

**STERNUM 6.** Deeply excavated. Rim of excavation simple.

**GONOPODS** (FIG. 9). Coxal lobe (*cxl*) large (not seen in Fig. 9). Prefemoral part (*prf*) ca half as long as acropodite. Acropodite with a small basal, finger-shaped process (*bap*); surface of *bap* with honey-comblike microsculpture (Fig. 9C). Mesal and intermediate acropodital processes (*map* and *iap*) largely identical, slender, smooth, pointed rods (*iap* distally hooked). Solenophore (*sph*) large, ca  $\frac{2}{3}$  as long as acropodital processes, folded around solenomere (*slm*), three-lobed, dorsal lobe (*sph-d*) large, semicircular, ventral lobe (*sph-v*) pointed-triangular, intermediate lobe (*sph-i*) smaller, triangular.

### Distribution and habitat

Known only from the New Dabaga/Ulamgambi FR. Altitudinal range 1800–2100 m a.s.l. (upper limit according to Kraus 1958). Habitat: montane forest (studied specimen) and semi-rainforest, under leaf litter (Kraus 1958). Collected together with *E. ottokrausi* sp. nov.

### Remarks

The studied specimen, which is a near-topotype, agrees completely with the original description (Kraus 1958); a side-by-side comparison with the holotype was therefore deemed unnecessary.

*Eviulisoma acaciae* sp. nov.

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Figs 6C, 10

### Diagnosis

Differs from other species of the *E. kwabuniense* group by the combination of a *map* ending in two equal, parallel prongs, a spinose *iap* and a two-lobed solenophore with a dorsal lobe reaching tip of acropodital processes.

### Etymology

This species is named after the dominant tree at the type locality.

**Material studied** (total: 5 ♂♂)

#### Holotype

TANZANIA: ♂, Iringa Region, Iringa District, West Kilombero Scarp FR, 07°45'34.2" S, 36°26'37.4" E, (open) woodland, 1510 m a.s.l., Plot *Acacia*, 5 Dec. 2000, Frontier Tanzania leg. (ZMUC).

#### Paratypes

TANZANIA: 4 ♂♂, same collection data as for holotype, except 7 Dec. 2000 (ZMUC).

### Description (male)

**SIZE.** Length unmeasurable, all specimens broken, max. width 2.0 mm.

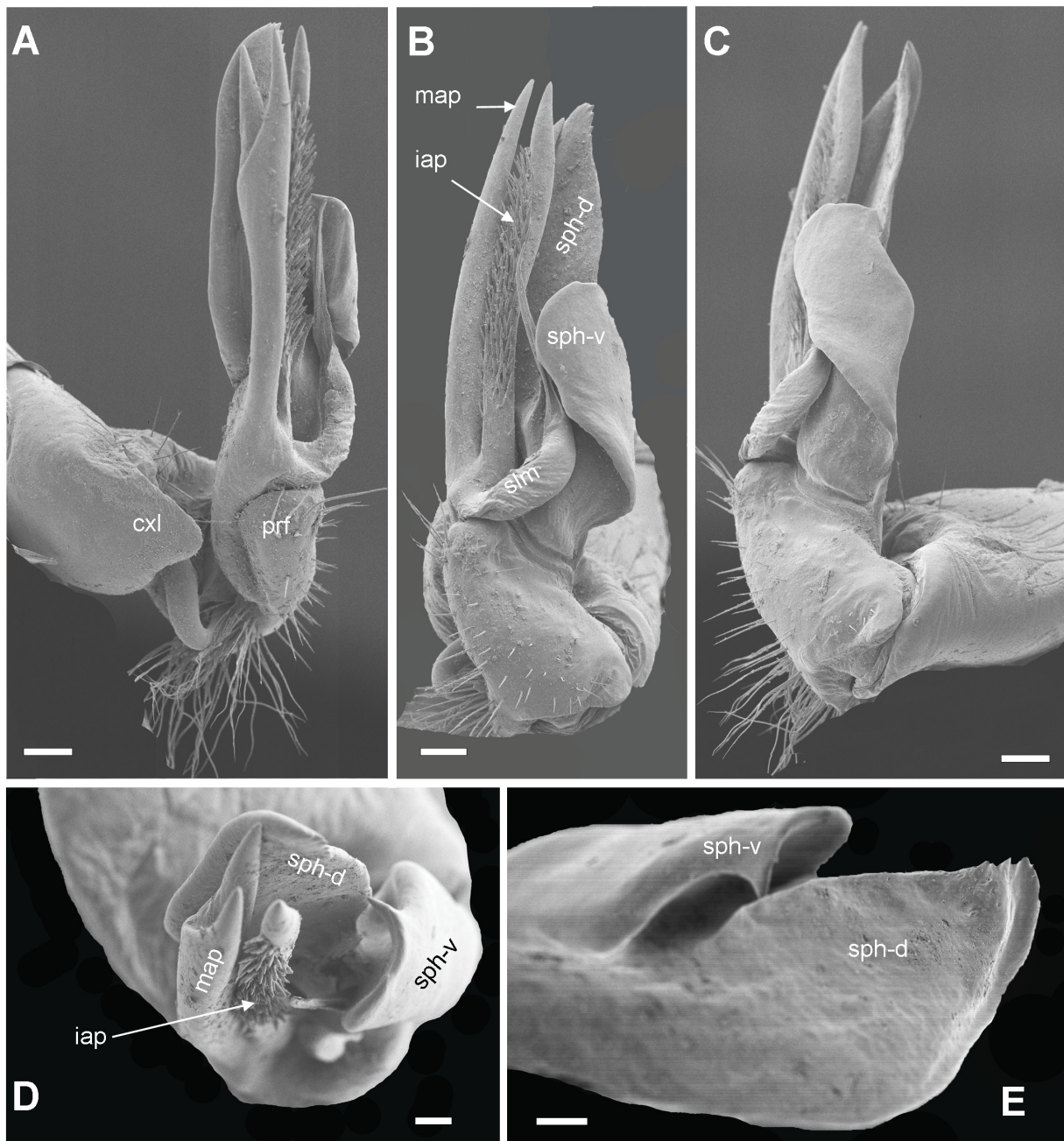
**COLOUR.** After 17 years in alcohol whitish to pale yellowish, dorsal half of metazonites very faintly light brown in some specimens.



ANTENNAE. Reaching back to end of ring 3.

BODY RINGS. Paranota represented by very faintly developed keels on body ring 2 (as in Fig. 4C), otherwise completely absent. Stricture between pro- and metazonite not striolate. A transverse row of setae on all body rings, but many setae abraded.

HYPOPROCT. Trapezoid, almost rectangular, with three strong marginal tubercles.



**Fig. 10.** *Eviulisoma acaciae* sp. nov., paratype, left gonopod. **A.** Mesal view. **B.** Ventral view. **C.** Lateral view. **D.** Acropodite, apical (anterior) view. **E.** Tip of solenophore, dorso-apical view. Abbreviations: *cxl* = coxal lobe; *iap* = intermediate acropodital process; *map* = mesal acropodital process; *prf* = prefemoral part; *slm* = solenomere; *sph-d*, *sph-v* = dorsal and ventral lobes of solenophore. Scale bars: A–C = 0.1 mm; D–E = 0.05 mm.

LEGS. Length  $1.1 \times$  body width. Relative lengths of podomeres: femur > prefemur > tarsus > tibia > postfemur. Scopulae on femur, postfemur, tibia and tarsus, diminishing towards posterior and present on tibia and tarsus only on posteriormost legs.

STERNUM 5. A tongue-shaped process between legs 4.

STERNUM 6 (Fig. 6C). Deeply excavated. Rim of excavation simple.

GONOPODS (Fig. 10). Coxal lobe (*cxl*) large. Prefemoral part (*prf*) ca  $\frac{1}{3}$  as long as acropodite. Mesal acropodital process (*map*) a rather stout rod, apically expanded and ending in two equal, stout, pointed tines. Intermediate acropodital process (*iap*) a slender straight rod, as long as *map*, densely covered in spines on mesal and ventral surfaces, except basally and apically. Solenophore (*sph*) large, deeply divided into two broad lobes, dorsal lobe (*sph-d*) as long as *map*, apically with a few minute teeth, ventral lobe (*sph-v*) much shorter, broadly rounded, curved around solenomere (*slm*).

### Distribution and habitat

Known only from West Kilombero Scarp FR, (open) woodland, 1510 m a.s.l. As implied by the plot name on the label ("Plot *Acacia*") the vegetation is open *Acacia* woodland (cf. Doody *et al.* 2001: 27, 174). Collected together with *E. grumslinglak* sp. nov.

*Eviulisoma aequilobatum* sp. nov.

[urn:lsid:zoobank.org:act:2CDA3FA8-41C9-4A3E-8349-344D4EB38358](https://zoobank.org/urn:lsid:zoobank.org:act:2CDA3FA8-41C9-4A3E-8349-344D4EB38358)

Fig. 11

### Diagnosis

Differs from other species of the *E. kwabuniense* group by having the solenophore almost as long as *map* and *iap*, which are both smooth, in combination with the equal length of the three apical lobes of the solenophore.

### Etymology

The name is an adjective referring to the equally long apical lobes of the solenophore.

**Material studied** (total: 1 ♂)

#### Holotype

TANZANIA: ♂, Iringa Region, Iringa District, New Dabaga/Ulangambi FR, 08°04'05.6" S, 35°54'20.41" E, montane, 1930 m a.s.l., Plot 6, 29 Oct. 2000, Frontier Tanzania leg. (ZMUC).

### Description (male)

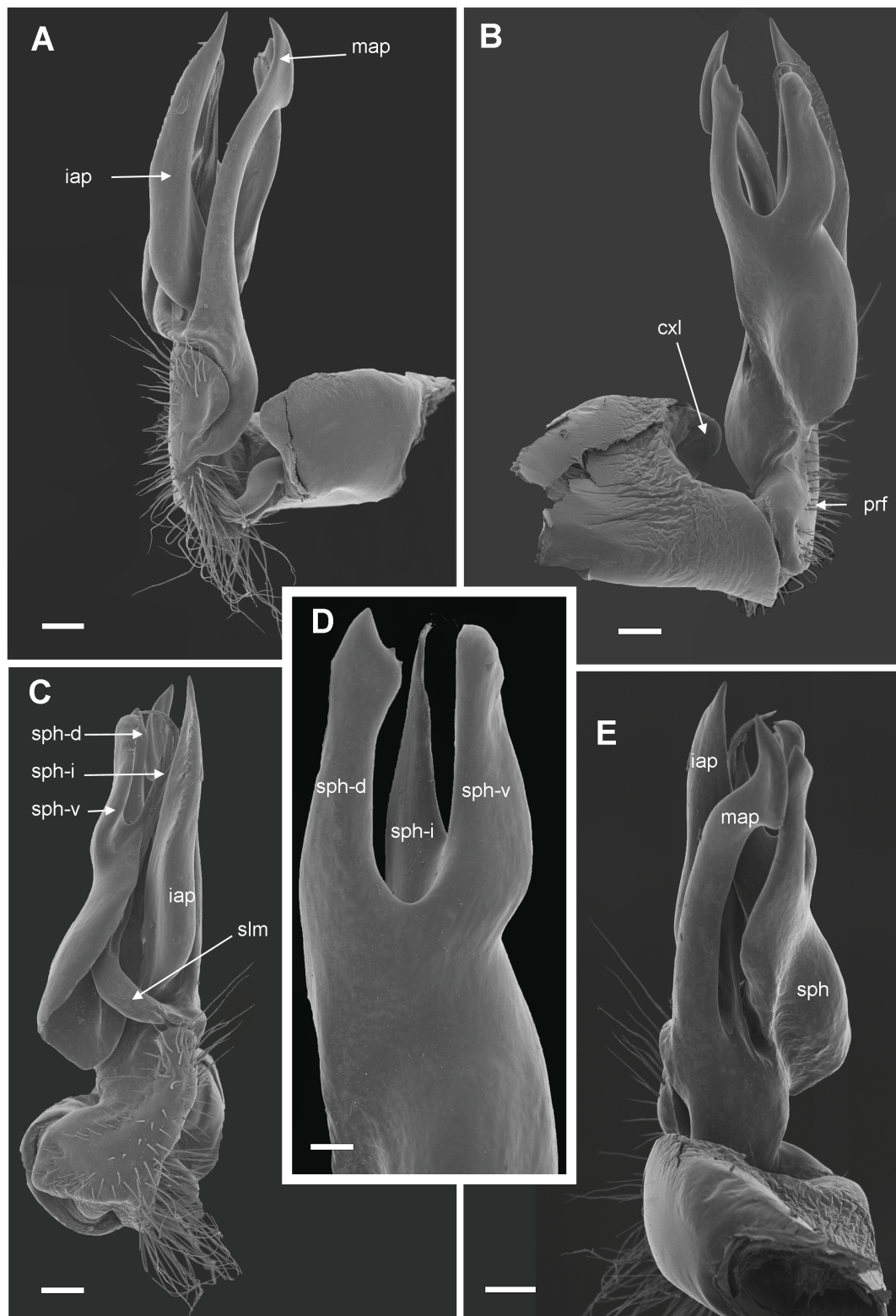
SIZE. Length not measurable, hind end of unique specimen missing; max. width 1.7 mm.

COLOUR. Completely pallid after 17 years in alcohol, possibly not due to fading, cf. remarks under *E. ottokrausi* sp. nov.

ANTENNAE. Reaching back to end of ring 4.

BODY RINGS. Paranota completely absent. Stricture between pro- and metazonite not striolate. A pair of dorsal setae on body ring 2, other rings apparently naked.

TELSON. Missing from specimen.



**Fig. 11.** *Eviulisoma aequilobatum* sp. nov., holotype, right gonopod. **A.** Mesal view. **B.** Lateral view. **C.** Ventral view. **D.** Tip of solenophore, sublateral view. **E.** Dorsal view. Abbreviations: *cxl* = coxal lobe; *iap* = intermediate acropodital process; *map* = mesal acropodital process; *prf* = prefemoral part; *slm* = solenomere; *sph-d*, *sph-i*, *sph-v* = dorsal, intermediate and ventral lobes of solenophore. Scale bars: A–C, E = 0.1 mm; D = 0.05 mm.



LEGS. Length  $1.2 \times$  body width. Relative lengths of podomeres: femur > prefemur = tarsus > tibia > postfemur. Scopulae on femur, postfemur, tibia and tarsus, hardly diminished on body ring 11 (last ring present on specimen).

STERNUM 5. A trapezoid process between legs 4.

STERNUM 6. Deeply excavated. Rim or margin simple.

GONOPODS (Fig. 11). Coxal lobe (*cxl*) large. Prefemoral part (*prf*) ca half as long as acropodite. Mesal acropodital process (*map*) long, slender, slightly arched, apically expanded, somewhat axe-shaped. Intermediate acropodital process (*iap*) as long as *map*, basally stouter than *map* but apically tapering to pointed tip, smooth except for slight rugosities on distal part. Solenophore (*sph*) large, almost as long as *map*, folded around solenomere (*slm*), three-lobed, all lobes of equal length, but dorsal and ventral lobes (*sph-d* and *sph-v*) stouter, finger-shaped, intermediate lobe (*sph-i*) tapering to long pointed tip.

### Distribution and habitat

Known only from the type locality, New Dabaga/Ulangambi FR, 1930 m a.s.l.

*Eviulisoma akkariae* sp. nov.

[urn:lsid:zoobank.org:act:F8D49FFD-E331-467C-A1BF-06750D070007](https://zoobank.org/urn:lsid:zoobank.org:act:F8D49FFD-E331-467C-A1BF-06750D070007)

Figs 3A, 8A, 12

### Diagnosis

Differs from other species of the *E. kwabuniense* group by being larger (width 2.6–3.3 mm vs 1.5–2.1 mm in other species), in having contrasting dark and pale transverse bands, and in the combination of a smooth intermediate acropodital process (*iap*) and a large, two-lobed solenophore with a dorsal lobe (*sph-d*) as long as acropodital processes and ending in a hook.

### Etymology

This species is named after Nesrine Akkari, one of the very few myriapodologists from the African continent, author of several important papers on myriapods, now curator of the important myriapod collection in the Naturhistorisches Museum Wien, Austria, and always a dear friend.

**Material studied** (total: 7 ♂♂)

#### Holotype

TANZANIA: ♂, Morogoro Region, Udzungwa Mts National Park, Mito Mitatu, Plot MM1, Trap #3, 07°50'14.3" S, 36°50'46.8" E, 1207 m a.s.l., 7 Jan. 2014, pitfall trapping, T. Pape and N. Scharff leg. (ZMUC).

#### Paratypes

TANZANIA: 1 ♂, same collection data as for holotype, except Trap #4; 5 ♂♂, Morogoro Region, Udzungwa Mts National Park, Sanje Kati Camp and Plot, 850 m a.s.l., 07°45'47.6" S, 36°53'10.4" E, pit fall trap, Plots 2, 6, 8, 17 and 24, 7 Feb. 2014, J. Malumbres-Olarte leg. (ZMUC, NHMW).

### Description (male)

SIZE. Length 26–28 mm, max. width 2.6–3.3 mm.

COLOUR (Fig. 3A). After 3 years in alcohol: overall impression contrasting dark and pale transverse bands. Head light to medium brown. Antennomeres 1–5 light brown; antennomeres 6–7 pale yellow. Collum brown. Postcollar body rings: prozonites pale yellow; metazonites dorsally brown, gradually



lighter brown ventrally. Legs brownish yellow. Dorsal anterior half of preanal ring brown, rest of telson yellowish.

ANTENNAE. Reaching back to end of ring 4.

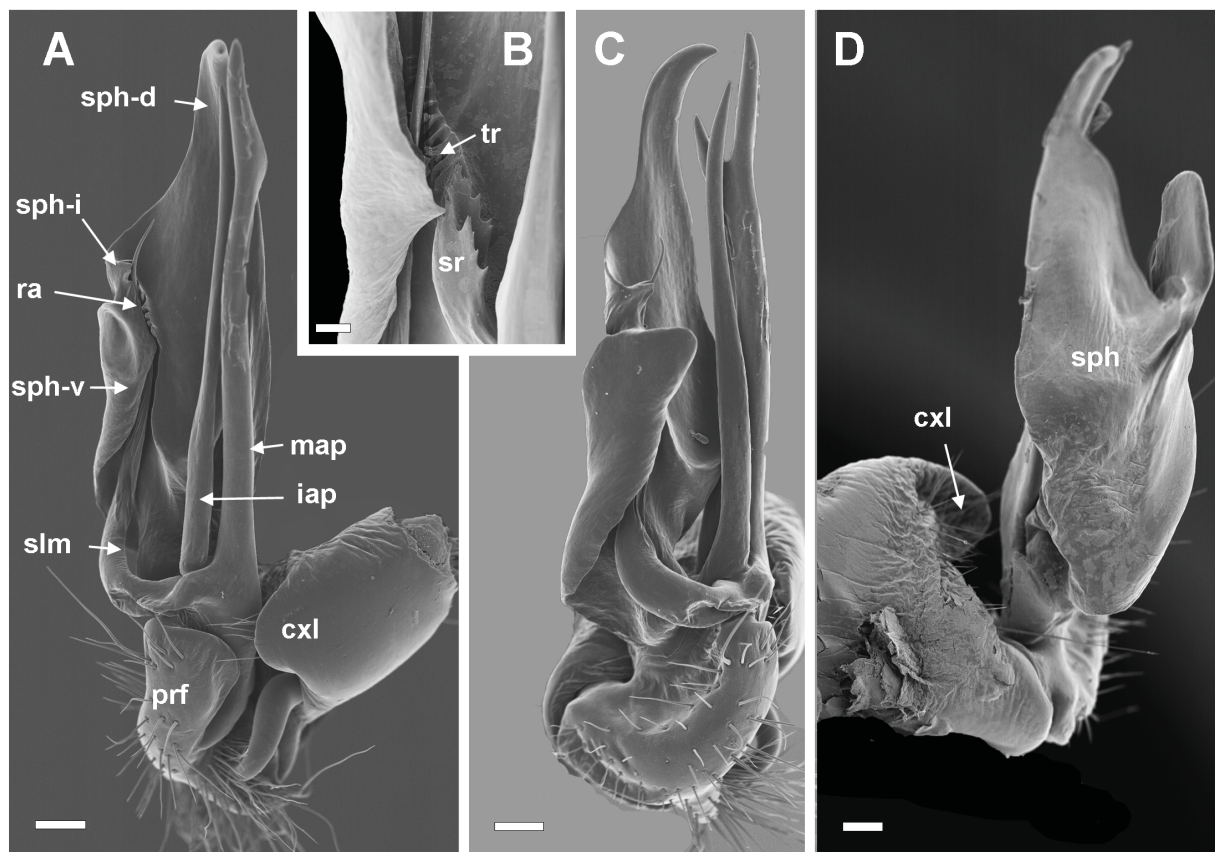
BODY RINGS. Paranota represented by a tiny keel on ring 2 (as Fig. 4C), otherwise completely absent. Stricture between pro- and metazonite not striolate. A transverse row of setae on all body rings.

HYPOPROCT. Rounded-trapezoid, with three prominent marginal tubercles.

LEGS. Length  $1.2 \times$  body width. Relative lengths of podomeres: femur > prefemur (>) tarsus > post-femur = tibia. Scopulae on anterior legs on femur, postfemur, tibia and tarsus; those on femur and postfemur missing from posterior legs.

STERNUM 5. A small, low, rectangular process between legs 4.

STERNUM 6. Deeply excavated, rim simple.



**Fig. 12.** *Eviulisoma akkariae* sp. nov., paratypes from Udzungwa Mts National Park, Sanje Kati camp and plot (A, C) and Udzungwa Mts National Park, Milo Mitatu (B, D), right gonopods. **A.** Mesal view. **B.** Ridged area on inner surface of solenophore. **C.** Ventral view. **D.** Lateral view. Abbreviations: *cxi* = coxal lobe; *iap* = intermediate acropodital process; *map* = mesal acropodital process; *prf* = prefemur; *ra* = ridged area of solenophore; *slm* = solenomere; *sph* = solenophore; *sph-d*, *sph-i*, *sph-v* = dorsal, intermediate and ventral lobes of solenophore; *sr* = serrated ridge; *tr* = transverse ridges. Scales: A, C–D = 0.1 mm; B = 0.05 mm.

GONOPODS (Figs 8A, 12). Coxal lobe (*cxl*) well-developed, semicircular. Prefemoral part (*prf*) ca  $\frac{1}{4}$  as long as acropodite; mesal acropodital process (*map*) long, slender, straight, apically pointed, with a prominent subterminal pointed-triangular side branch; intermediate acropodital process (*iap*) a little shorter than *map*, slender, smooth, acuminate; solenophore very large, as long as *map*, folded around solenomere, with two large lobes; dorsal lobe (*sph-d*) ending in hook-shaped process; ventral lobe (*sph-v*) much shorter than *sph-d*, apically broadly rounded; a tiny intermediate lobe (*sph-i*) between *sph-d* and *sph-v*; inner surface of *sph* with two parallel, longitudinal serrated ridges (*sr*) followed by an area of parallel transverse ridges (*tr*).

### Distribution and habitat

Known from two sites in the Udzungwa Mts National Park. Altitudinal range 850–1207 m a.s.l.

### *Eviulisoma cetafi* sp. nov.

[urn:lsid:zoobank.org:act:2754E233-F5D6-493B-B410-1067FF17A521](http://urn:lsid:zoobank.org:act:2754E233-F5D6-493B-B410-1067FF17A521)

Figs 7B, D, 13

### Diagnosis

Differs from other species of the *E. kwabuniense* group by having the solenophore two-lobed, its dorsal lobe developed as a very strong hook, hook much larger than those seen in certain other species (*E. ejti* sp. nov., *E. akkariae* sp. nov., *E. nessiteras* sp. nov.).

### Etymology

The species name honours CETAF, Consortium of European Taxonomic Facilities, [www.cetaf.org](http://www.cetaf.org), in recognition of the immense importance of CETAF for natural history collections in Europe and for collections-based research.

### Material studied (total: 12 ♂♂)

#### Holotype

TANZANIA: ♂, Iringa Region, Udzungwa Scarp FR, above Chita Village, 1300–1400 m a.s.l., 26 Oct.–14 Nov. 1984, pitfall traps in montane rain forest, N. Scharff leg. (ZMUC).

#### Paratypes

TANZANIA: 2 ♂♂, Iringa Region, Udzungwa Scarp FR, above Chita Village, 1450 m a.s.l., 4–9 Nov. 1984, pitfall traps in montane rain forest, N. Scharff leg. (ZMUC); 4 ♂♂, Iringa Region, Udzungwa Scarp FR, above Chita Village, 1500 m a.s.l., 2–13 Nov. 1984, pitfall traps in montane rain forest, N. Scharff leg. (ZMUC); 2 ♂♂, Iringa Region, Udzungwa Scarp FR, above Chita Village, 1500–1550 m a.s.l., 2–13 Nov. 1984, pitfall traps in montane rain forest, N. Scharff leg. (ZMUC); 1 ♂, Iringa Region, Udzungwa Scarp FR, above Chita Village, 1300 m a.s.l., 2–6 Nov. 1984, pitfall traps in montane rain forest, N. Scharff leg. (ZMUC); 2 ♂♂, Iringa Region, Udzungwa Scarp FR, above Chita Village, 1400 m a.s.l., 4–5 Nov. 1984, pitfall traps in montane rain forest, N. Scharff leg. (ZMUC).

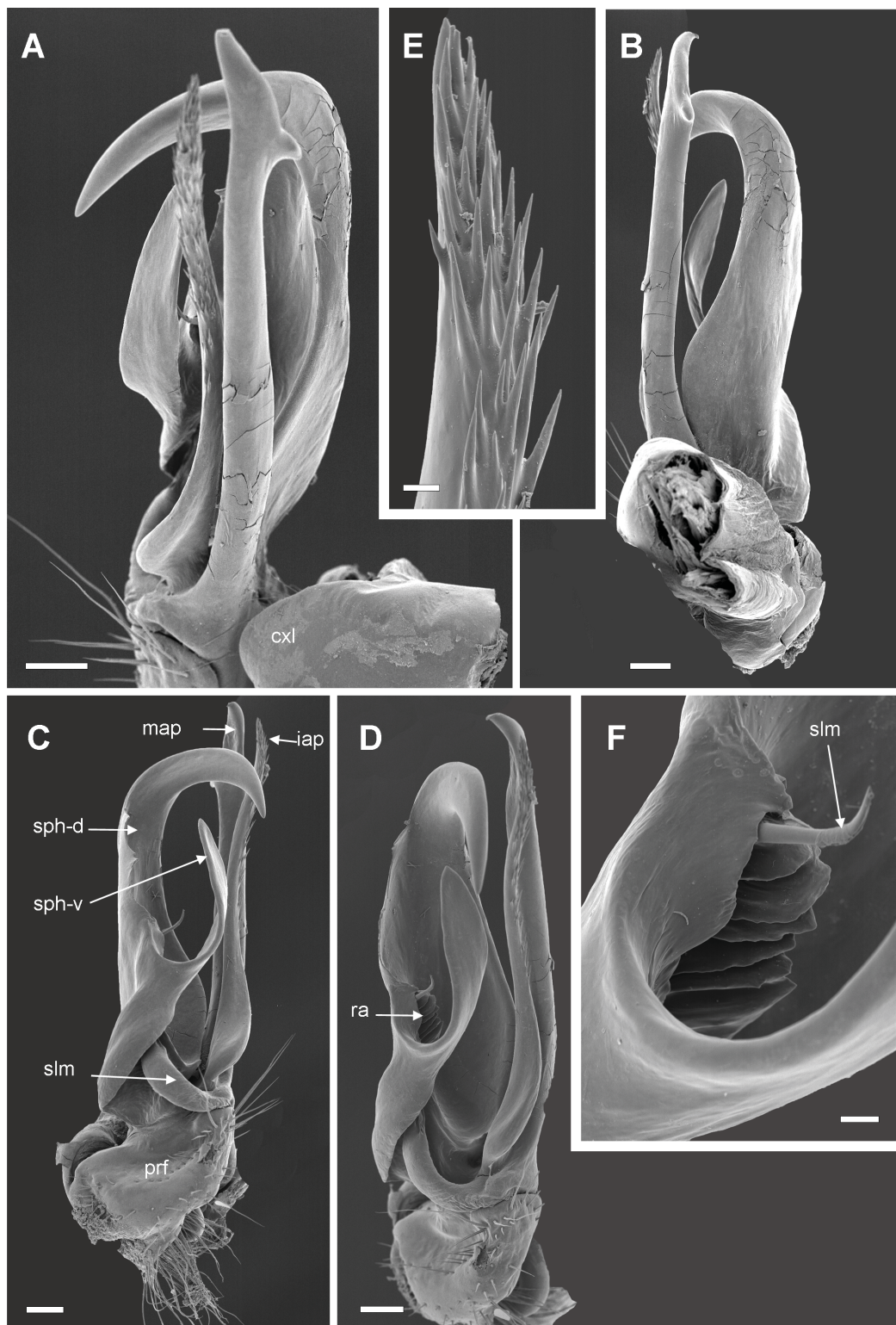
### Description (male)

SIZE. Length 20 mm, max. width 1.9–2.1 mm.

COLOUR. After 33 years in alcohol all whitish.

ANTENNAE. Reaching back to middle of ring 3.

BODY RINGS. Paranota indicated by very faint ridges on body ring 2 (as in Fig. 4C), otherwise completely absent. Stricture between pro- and metazonite not striolate. A transverse row of setae on all body rings, but the majority of setae abraded in most specimens.



**Fig. 13.** *Eviulisoma cetafi* sp. nov., paratype, right gonopod. **A.** Mesal view. **B.** Meso-dorsal view. **C.** Latero-ventral view. **D.** Ventral view. **E.** Spiny tip of *iap*. **F.** Ridged area of solenophore with tip of solenomere sticking out. Abbreviations: *cxl* = coxal lobe; *iap* = intermediate acropodital process; *map* = mesal acropodital process; *prf* = prefemoral part; *ra* = ridged area of solenomere; *slm* = solenomere; *sph-d*, *sph-i*, *sph-v* = dorsal, intermediate and ventral lobes of solenophore. Scale bars: A–D = 0.1 mm; E = 0.01 mm; F = 0.02 mm.



**HYPOPROCT.** Large, trapezoid, with three prominent apical tubercles, middle tubercle larger.

**LEGS.** Length  $1.2 \times$  body width. Relative lengths of podomeres: femur > prefemur > tarsus > tibia > postfemur. Scopulae (Fig. 7B, D) on femur, postfemur, tibia and tarsus until ca midbody, thereafter gradually disappearing.

**STERNUM 5.** A small trapezoid process between legs 4.

**STERNUM 6.** Deeply excavated. Rim of excavation simple.

**GONOPODS** (Fig. 13). Coxal lobe (*cxl*) moderate. Prefemoral part (*prf*) ca half as long as acropodite. Mesal acropodital process (*map*) a long, smooth, almost straight rod, apically pointed, subapically with small triangular side branch. Intermediate acropodital process (*iap*) a very slender, straight rod, densely covered in long spines on part of its surface, especially on apical part (Fig. E). Solenophore (*sph*) deeply split into two long lobes; dorsal lobe (*sph-d*) a very large, strong hook, almost reaching to tip of acropodital processes; ventral lobe (*sph-v*) much shorter, lanceolate; no intermediate process between *sph-d* and *sph-v*; internal surface of *sph* with a ridged area (*ra*, Fig. 13D, F).

### Distribution and habitat

Known only from the Udzungwa Scarp FR. Altitudinal range 1300–1550 m a.s.l. Habitat: montane rain forest. Collected together with *E. chitense* sp. nov.

*Eviulisoma chitense* sp. nov.

[urn:lsid:zoobank.org:act:13931F2B-13C9-4987-A3AA-B9F42BB5796D](http://urn:lsid:zoobank.org:act:13931F2B-13C9-4987-A3AA-B9F42BB5796D)

Figs 6D, 14

### Diagnosis

Differs from other species of the *E. kwabuniense* group by the combination of a *map* with a short subapical laterad side branch, a partly spinose *iap*, and a clearly three-lobed solenophore that is much shorter than *map* and *iap*, dorsal lobe of solenophore much longer than the others.

### Etymology

The name is an adjective referring to the type locality.

**Material studied** (total: 5 ♂♂)

#### Holotype

TANZANIA: ♂, Iringa Region, Udzungwa Scarp FR, above Chita Village, 1400 m a.s.l., 4–5 Nov. 1984, pitfall traps in montane rain forest, N. Scharff leg. (ZMUC).

#### Paratypes

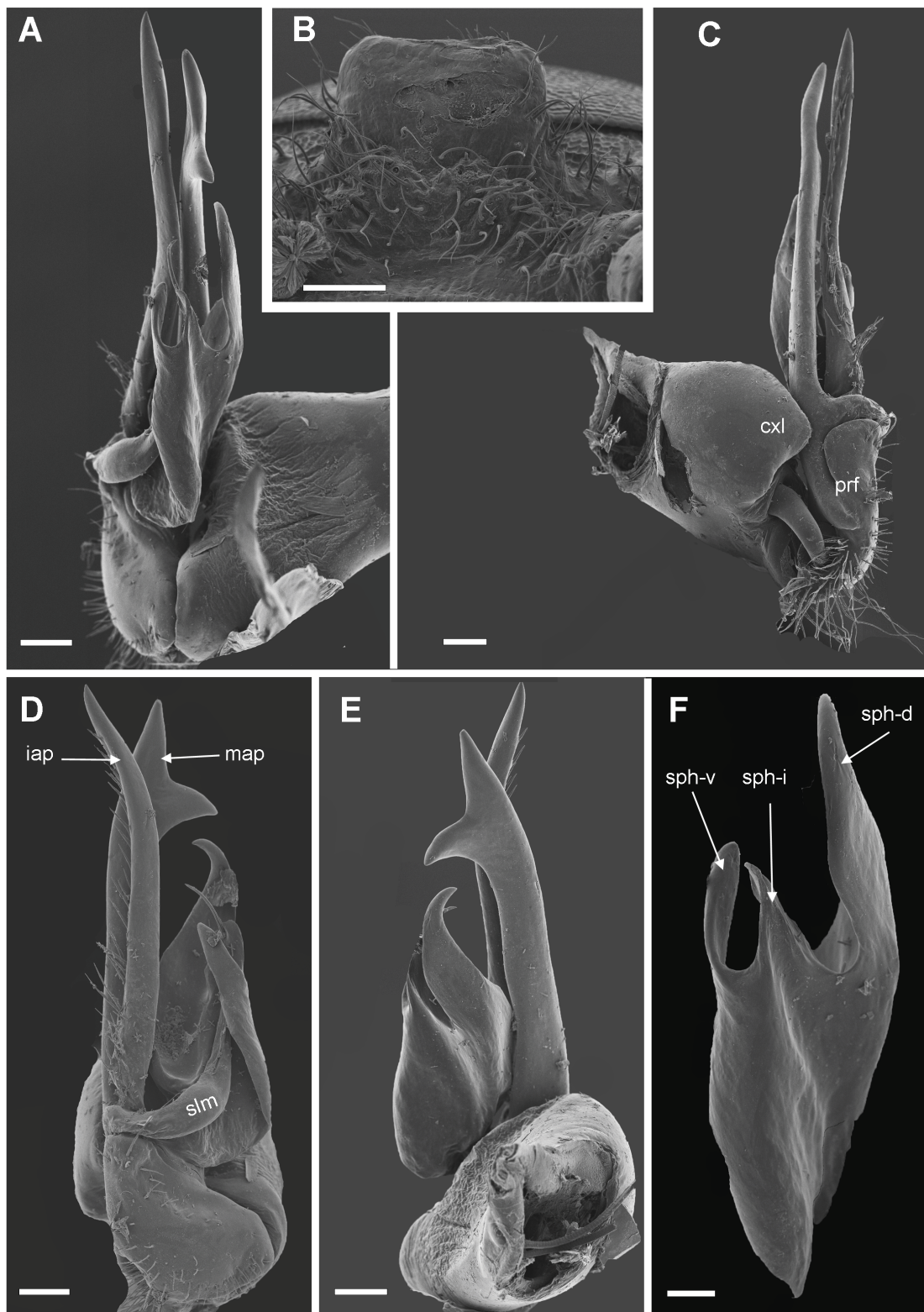
TANZANIA: 4 ♂♂, same locality as for holotype but 1050 m a.s.l., 26–29 Oct. 1984, pitfall traps in intermediate rain forest, N. Scharff leg. (ZMUC).

### Description (male)

**SIZE.** Length 20 mm, max. width 1.6–1.9 mm.

**COLOUR.** After 33 years in alcohol whitish to very light brown, a little darker dorsally.

**ANTENNAE.** Reaching back to middle of ring 4.



**Fig. 14.** *Eviulisoma chitense* sp. nov. paratype. **A, C–F.** Left gonopod. **A.** Lateral view. **C.** Mesal view. **D.** Ventral view. **E.** Dorsal view. **F.** Isolated solenophore, lateral view. **B.** Lobe between legs 4. Abbreviations: *cxl* = coxal lobe; *iap* = intermediate acropodital process; *map* = mesal acropodital process; *prf* = prefemoral part; *slm* = solenomere; *sph-d*, *sph-i*, *sph-v* = dorsal, intermediate and ventral lobes of solenophore. Scale bars: A–E= 0.1 mm; F= 0.05 mm.

**BODY RINGS.** Paranota indicated by very faint ridges on body ring 2 (as Fig. 4C), otherwise completely absent. Stricture between pro- and metazonite smooth. A transverse row of setae on all body rings.

**HYPOPROCT.** Trapezoid, almost rectangular with three large apical tubercles.

**LEGS.** Length  $1.1 \times$  body width. Relative lengths of podomeres: femur > prefemur > tarsus > tibia > postfemur. Scopulae on femur, postfemur, tibia and tarsus until midbody, gradually disappearing on more posterior legs.

**STERNUM 5.** A small subrectangular lobe between legs 4 (Fig. 6D).

**STERNUM 6.** Deeply excavated. Rim of excavation simple.

**GONOPODS** (Fig. 14). Coxal lobe (*cxl*) distally right-angled. Prefemoral part (*prf*) ca half as long as acropodite. Mesal acropodital process (*map*) a straight, smooth rod with a subapical curved side branch. Intermediate acropodital process (*iap*) a curved pointed rod, covered in long spines along mesal side. Solenophore (*sph*) much shorter than acropodital processes, curving around solenomere (*slm*), apically with three slender lobes/processes, dorsal lobe (*sph-d*) longer, intermediate process (*sph-i*) thinner than the others.

### Distribution and habitat

Known only from the Udzungwa Scarp FR, above Chita Village. Altitudinal range 1050–1400 m a.s.l. Habitat: intermediate and montane rain forest. Collected together with *E. cetafi* sp. nov.

*Eviulisoma commelina* sp. nov.

[urn:lsid:zoobank.org:act:ADAC88CB-9F53-4CF4-A784-47B874C7166B](http://urn:lsid:zoobank.org:act:ADAC88CB-9F53-4CF4-A784-47B874C7166B)

Fig. 15

### Diagnosis

Differs from other species of the *E. kwabuniense* group by having the solenophore somewhat shorter than the smooth *map* and *iap*, in combination with the small size of the intermediate apical lobe of the solenophore, compared with the very long, slender dorsal and ventral lobes.

### Etymology

The name is a noun in apposition, referring to the one short and two long apical lobes of the solenophore. *Commelina* L. is a genus of plants ('dayflowers') with flowers characterized by one small and two large petals. Linnaeus (1737: 79) dedicated this genus to three members of the family Commelijn, two of whom were well-known botanists, while the third accomplished nothing (at least not in botany); see also Wijnand (1983: 11).

**Material studied** (total: 1 ♂)

#### Holotype

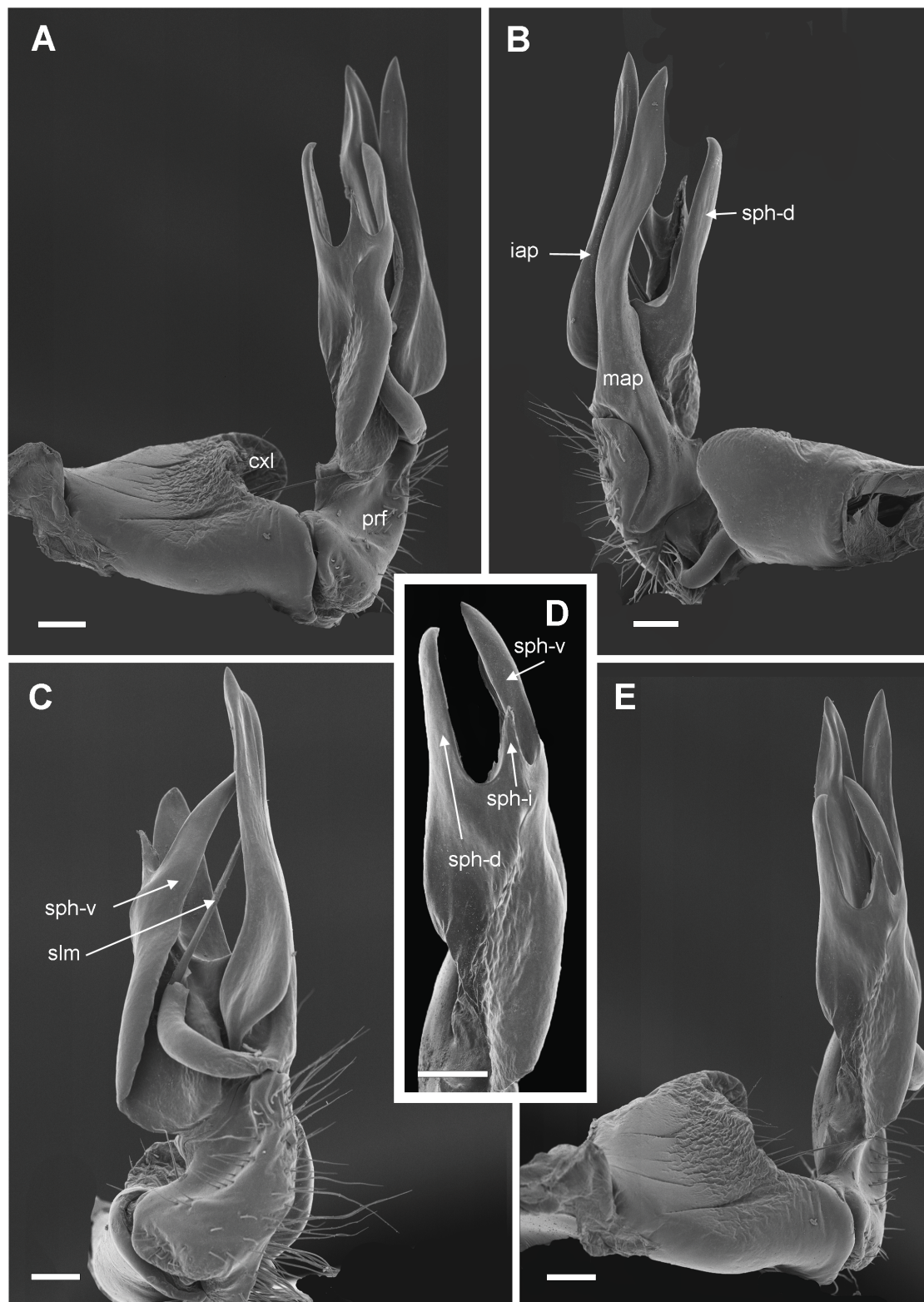
TANZANIA: ♂, Iringa Region, Iringa District, New Dabaga/Ulangambi FR, 08°05'34.5" S, 35°51'31.3" E, montane, 1800–1900 m a.s.l., Plot 16, 15–16 Nov. 2000, Frontier Tanzania leg. (ZMUC).

#### Description (male)

**SIZE.** Length 14 mm, max. width 1.5 mm.

**COLOUR.** Completely pallid after 17 years in alcohol, possibly not due to fading, cf. remarks under *E. ottokrausi* sp. nov.





**Fig. 15.** *Eviulisoma commelina* sp. nov., holotype, right gonopod. **A.** Lateral view. **B.** Mesal view. **C.** Ventral view. **D.** Solenophore, dorso-lateral view. **E.** Dorso-lateral view. Abbreviations: *cxl* = coxal lobe; *iap* = intermediate acropodital process; *map* = mesal acropodital process; *prf* = prefemoral part; *slm* = solenomere; *sph-d*, *sph-i*, *sph-v* = dorsal, intermediate and ventral lobes of solenophore. Scale bars: 0.1 mm.

ANTENNAE. Reaching back to end of ring 3.

BODY RINGS. Paranota completely absent. Stricture between pro- and metazonite striolate. A transverse row of setae on pre-gonopodal rings, a few scattered setae seen on post-gonopodal rings.

HYPOPROCT. Trapeziform with three apical tubercles.

LEGS. Stout, short, length  $0.9 \times$  body width. Relative lengths of podomeres: femur = prefemur > tarsus > postfemur = tibia. Scopulae on femur, postfemur, tibia and tarsus, continuing until last legs, except on femur.

STERNUM 5. A rounded-rectangular process between legs 4.

STERNUM 6. Deeply excavated. Rim of excavation simple.

GONOPODS (Fig. 15). Coxal lobe (*cxl*) large. Prefemoral part (*prf*) ca half as long as acropodite. Mesal and intermediate acropodital processes (*map* and *iap*) largely identical, slender, smooth, pointed rods. Solenophore (*sph*) large, ca  $0.8 \times$  as long as acropodital processes, folded around solenomere (*slm*), three-lobed, dorsal and ventral lobes (*sph-d* and *sph-v*) finger-shaped, much longer than pointed-triangular intermediate lobe (*sph-i*).

### Distribution and habitat

Known only from the New Dabaga/Ulangambi FR. Altitude 1800–1900 m a.s.l.

*Eviulisoma ejti* sp. nov.

[urn:lsid:zoobank.org:act:8DAFBA5D-17C5-49A6-A290-D0D540D1295F](http://urn:lsid:zoobank.org:act:8DAFBA5D-17C5-49A6-A290-D0D540D1295F)

Figs 6A–B, 7C, 16

### Diagnosis

Differs from other species of the *E. kwabuniense* group by *map* being apically shaped like a narrow, slightly hooked spoon and at ca  $\frac{3}{4}$  of its length having a side branch, in combination with a spinose *iap* and a solenophore with a large, hooked dorsal lobe.

### Etymology

The species name honours the *European Journal of Taxonomy* (*EJT*), in recognition of its immense importance for the dissemination of taxonomic research in Europe, and beyond.

**Material studied** (total: 5 ♂♂)

#### Holotype

TANZANIA: ♂, Iringa District, Udzungwa Scarp FR, 11 km SE of Masisiwe Village, Kihanga Stream, 1800 m a.s.l., 08°22'05.7" S, 35°58'41.6" E, 17–27 May 1997, ZMUC and SI Exp. leg. (ZMUC).

#### Paratypes

TANZANIA: 4 ♂♂, same collection data as for holotype (ZMUC).

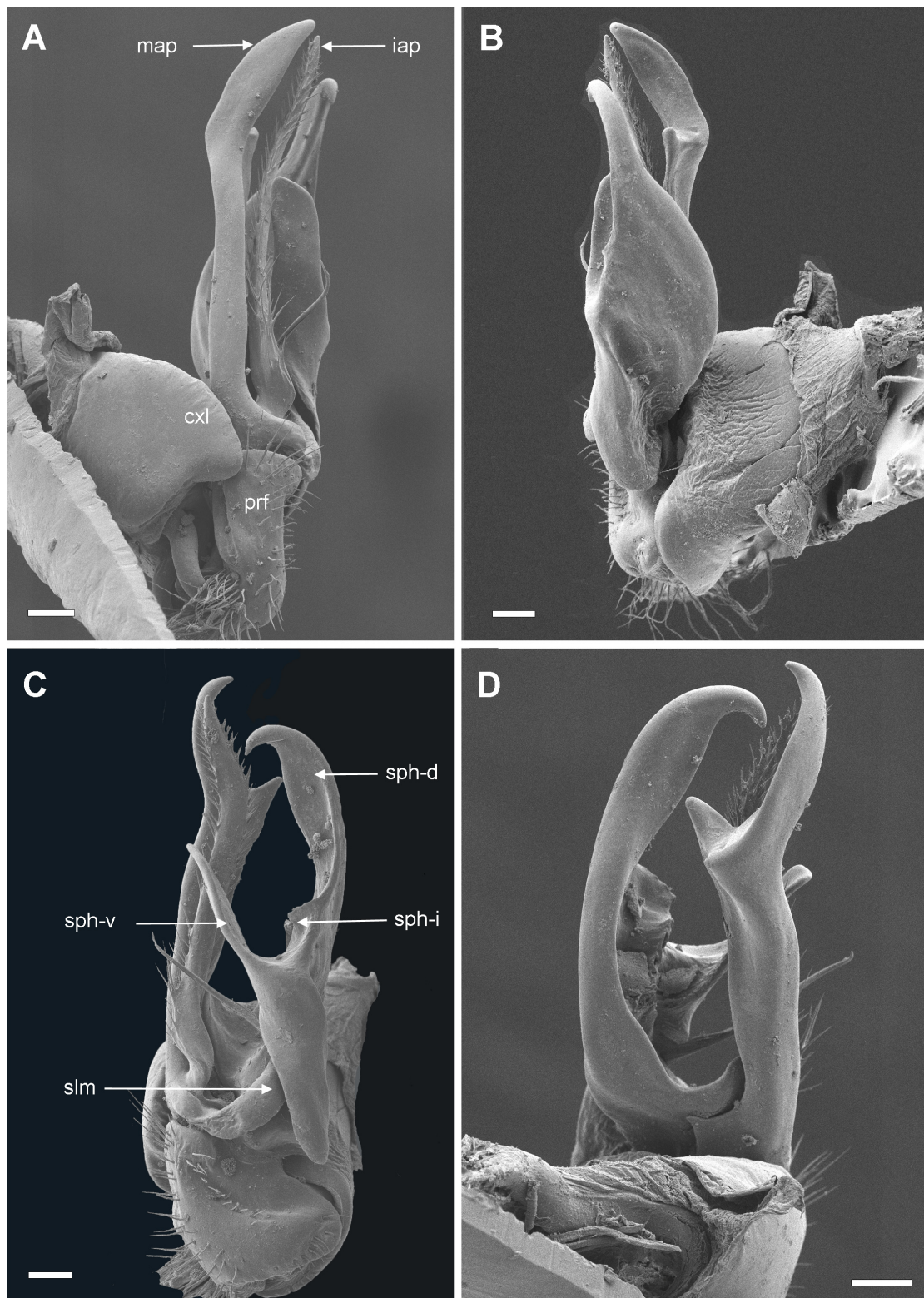
#### Referred non-type material

TANZANIA: 1 ♀, tentatively referred to this species, same collection data as for holotype (ZMUC).

### Description (male)

SIZE. Length 15 mm, max. width 1.5 mm.





**Fig. 16.** *Eviulisoma ejti* sp. nov., paratype, left gonopod. **A.** Mesal view. **B.** Lateral view. **C.** Ventral view. **D.** Dorsal view. Aluminium tape used for mounting visible in lower left corner of A and D. Abbreviations: *cxl* = coxal lobe; *iap* = intermediate acropodital process; *map* = mesal acropodital process; *prf* = prefemoral part; *slm* = solenomere; *sph-d*, *sph-i*, *sph-v* = dorsal, intermediate and ventral lobes of solenophore. Scale bars: 0.1 mm.



COLOUR. After 20 years in alcohol uniformly light yellowish brown, a little darker dorsally.

ANTENNAE. Reaching back to middle of ring 3.

BODY RINGS. Paranota completely absent. Stricture between pro- and metazonite clearly striolate. A transverse row of setae on all body rings, but many setae abraded.

HYPOPROCT. Large, trapezoid, almost rectangular, with three prominent marginal tubercles.

LEGS. Length  $\approx$  body width. Relative lengths of podomeres: prefemur = femur > tarsus > tibia > postfemur. Scopulae (Fig. 7C) on femur, postfemur, tibia and tarsus, present until last pair of legs, although less dense posteriorly.

STERNUM 5. A trapezoid process, slanting anteriad, between legs 4 (Fig. 6A–B).

STERNUM 6. Deeply excavated. Rim of excavation simple (Fig. 6A–B).

GONOPODS (Fig. 16). Coxal lobe (*cxl*) prominent. Prefemoral part (*prf*) ca  $0.4\times$  as long as acropodite. Mesal acropodital process (*map*) stout, straight, apically divided into long, narrowly spoon-shaped, slightly hooked branch and short, rounded-triangular side branch. Intermediate acropodital process (*iap*) almost as long as *map*, very slender, straight, densely spinose. Solenophore (*sph*) very large, ca  $0.8\times$  as long as *map*, deeply divided into relatively broad, mesally concave, apically hooked dorsal process (*sph-d*) and much shorter, long, lamelloid ventral process (*sph-v*), a very short lamelloid process between *sph-d* and *sph-v*.

### Distribution and habitat

Known only from the Udzungwa Scarp FR, 11 km SE of Masisiwe Village, Kihanga Stream, 1800 m a.s.l.

*Eviulisoma kalimbasiense* sp. nov.

[urn:lsid:zoobank.org:act:347BA562-0339-4D55-992C-4E14B6FEAB93](http://urn:lsid:zoobank.org:act:347BA562-0339-4D55-992C-4E14B6FEAB93)

Fig. 17

### Diagnosis

Differs from other species of the *E. kwabuniense* group by having a smooth *iap* much shorter than *map* and by having the large dorsal lobe of the solenomere bifid.

### Etymology

Named after the type locality, Mt Kalimbasi (Kalimbazi).

**Material studied** (total: 4 ♂♂)

#### Holotype

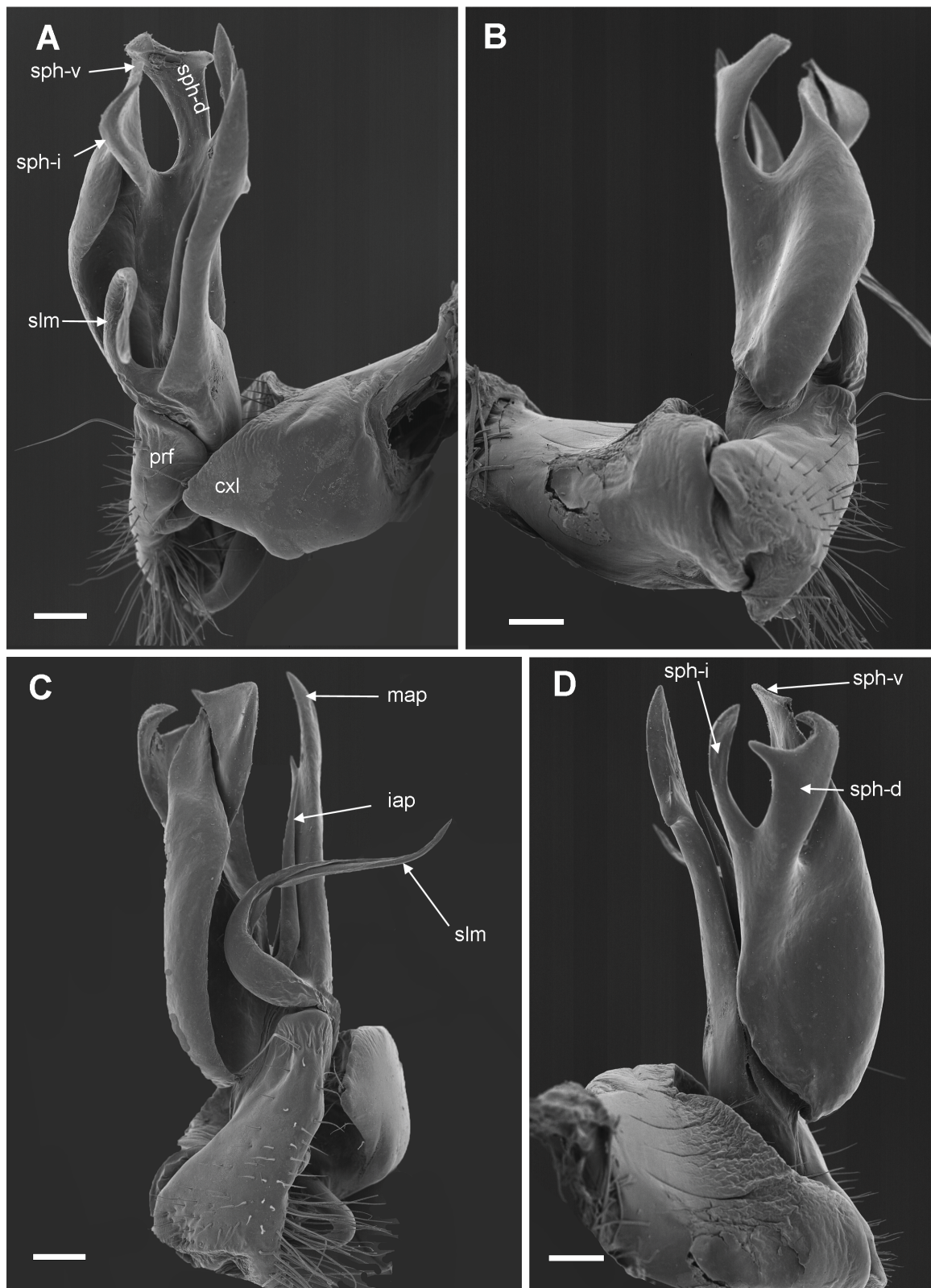
TANZANIA: ♂, Iringa Region, Iringa District, Kalimbasi Mountain, 2000–2100 m a.s.l., 10 km S of Mazombe (forest floor), Jan. 1984, J. Kielland leg. (VMNH).

#### Paratypes

TANZANIA: 3 ♂♂, same collection data as for holotype (VMNH, ZMUC).

### Description (male)

SIZE. Length 19 mm, max. width 1.6 mm.



**Fig. 17.** *Eviulisoma kalimbasiense* sp. nov., paratype, right gonopod. **A.** Mesal view. **B.** Lateral view. **C.** Ventral view. **D.** Dorsal view. Abbreviations: *cxl* = coxal lobe; *iap* = intermediate acropodital process; *map* = mesal acropodital process; *prf* = prefemoral part; *slm* = solenomere; *sph-d*, *sph-i*, *sph-v* = dorsal, intermediate and ventral lobes of solenophore. Scale bars: 0.1 mm.

COLOUR. After 34 years in alcohol completely whitish.

ANTENNAE. Reaching back to end of ring 4.

BODY RINGS. Paranota completely absent. Stricture between pro- and metazonite smooth. A transverse row of setae on all body rings.

HYPOPROCT. Trapezoid, almost rectangular, with three strong marginal tubercles.

LEGS. Length  $\approx$  body width. Relative lengths of podomeres: femur > prefemur (>) tarsus > tibia (>) postfemur. Scopulae well-developed on postfemur, tibia and tarsus all the way to last leg pairs, also weakly on femora of anterior legs.

STERNUM 5. A tongue-shaped process between legs 4.

STERNUM 6. Deeply excavated. Rim of excavation simple.

GONOPODS (Fig. 17). Coxal lobe (*cxl*) moderate. Prefemoral part (*prf*) ca half as long as acropodite. Mesal acropodital process (*map*) a straight pointed rod with a small lateral bump ca at  $\frac{2}{3}$  of its length. Intermediate acropodital process (*iap*) much shorter than *map*, slender, straight, pointed, smooth. Solenophore (*sph*) very large, ca as long as *map*, apically divided into a bifid dorsal lobe (*sph-d*), a slender, pointed intermediate lobe (*sph-i*) and a broader, apically linearly obtuse ventral lobe (*sph-v*).

### Distribution and habitat

Known only from Kalimbasi Mountain, S of Mazombe town, 2000–2100 m a.s.l. The site is located in the Kisinga-Rugaro FR.

*Eviulisoma navuncus* sp. nov.

[urn:lsid:zoobank.org:act:91A53055-C236-4F4E-A32A-172D2289DE25](http://urn:lsid:zoobank.org:act:91A53055-C236-4F4E-A32A-172D2289DE25)

Fig.18

### Diagnosis

Differs from other species of the *E. kwabuniense* group by having a long, curved side branch from *map* fitting over the semicircular dorsal lobe of the solenophore, in combination with an extremely slender, spinose *iap*.

### Etymology

The name is a noun in apposition, from the Latin *navis* ('boat') and *uncus* ('hook'), referring to the boat-hook shape of the mesal acropodital process.

**Material studied** (total: 7 ♂♂)

#### Holotype

TANZANIA: ♂, Kitungulu FR, 1500 m a.s.l., 08°09' S, 36°05' E, forest, Jan.1996, M. Andersen, P. Gravlund and A. Jakobsen leg. (ZMUC).

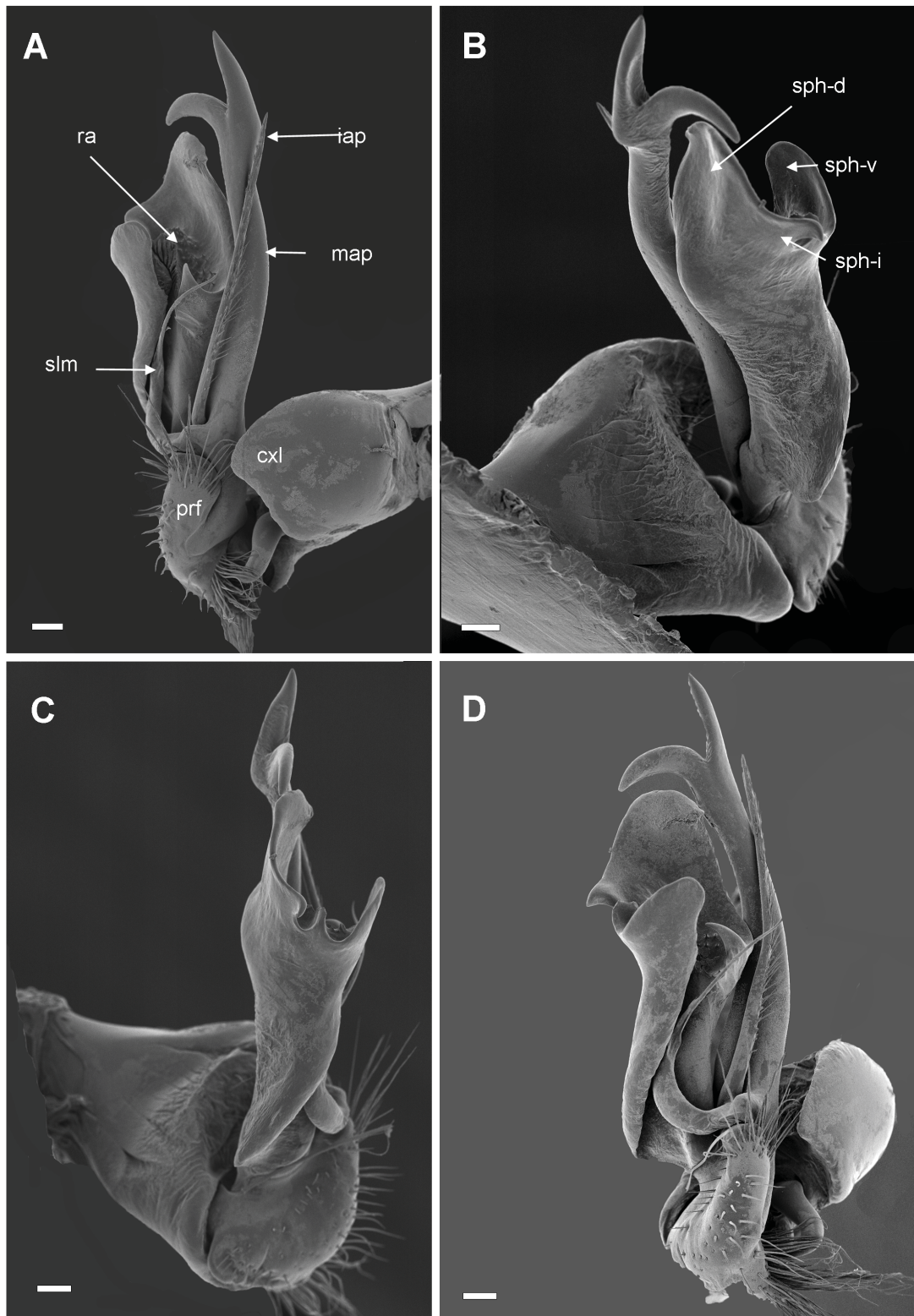
#### Paratypes

TANZANIA: 6 ♂♂, "Bomalamzinga, Uzungwa FR, Muhange Village, Uzungwa Mountains", 36.03/8.12 [must be longitude/latitude, but format unknown], 19 Jun. 1979, W.A. Rodgers leg. (VMNH).

#### Referred non-type material

TANZANIA: 6 ♀♀, tentatively referred to this species, same collection data as for paratypes (VMNH).





**Fig. 18.** *Eviulisoma navuncus* sp. nov., holotype, right gonopod. **A.** Mesal view. **B.** Lateral view. **C.** Ventro-lateral view. **D.** Ventral view. Aluminium tape used for mounting visible in lower left corner of B. Abbreviations: *cxl* = coxal lobe; *iap* = intermediate acropodital process; *map* = mesal acropodital process; *prf* = prefemoral part; *ra* = ridged area of solenophore; *slm* = solenomere; *sph-d*, *sph-i*, *sph-v* = dorsal, intermediate and ventral lobes of solenophore. Scale bars: 0.1 mm.

### Description (male)

SIZE. Length 22 mm, max. width 2.0 mm.

COLOUR. After 21 years in alcohol uniform whitish yellow, only vertigial region of head and hind edge of body rings very light brown.

ANTENNAE. Reaching back to middle of ring 3.

BODY RINGS. Paranota indicated by very faint keels on body rings 2 (as in Fig. 4C), otherwise completely absent. Stricture between pro- and metazonite striolate. A transverse row of setae on all body rings.

HYPOPROCT. Trapezoid, with three apical tubercles.

LEGS. Length  $0.9 \times$  body width. Relative lengths of podomeres: prefemur = femur > tarsus > post-femur = tibia. Scopulae on femur, postfemur, tibia and tarsus, disappearing towards hind end.

STERNUM 5. A broadly rounded-rectangular process between legs 4.

STERNUM 6. Deeply excavated. Rim of excavation simple.

GONOPODS (Fig. 18). Coxal lobe (*cxl*) large. Prefemoral part (*prf*) ca half as long as acropodite. Mesal acropodital process (*map*) a long, slightly sinuous rod, with pointed tip and a large, pointed lateral hook subapically; hook curving over dorsal lobe (*sph-d*) of solenophore. Intermediate acropodital process (*iap*) very thin, straight, covered in long spines along dorsal side. Solenophore (*sph*) large, with dorsal lobe (*sph-d*) largest, broadly rounded, fitting under lateral hook of *map*, intermediate lobe (*sph-i*) very small, ventral lobe (*sph-v*) broadly rounded; internal surface of *sph* with a coarsely ridged area (*ra*).

### Distribution and habitat

Known from two sites, one in Kitungulu/Kiranzi FR, the other in Udzungwa Scarp FR. Altitudinal range includes 1500 m. Collected together with *E. dabagaense* Kraus, 1958 and *E. nessiteras* sp. nov. in Kitungulu/Kiranzi FR.

### Remarks

Interpreting the locality name “Bomalamzinga” caused a lot of problems until Andy Marshall (pers. comm.) informed me that it refers to a place at the northern end of the Udzungwa Scarp FR.

*Eviulisoma nessiteras* sp. nov.

[urn:lsid:zoobank.org:act:7442C1C4-8C4F-4CCB-BD53-64347CB6185A](http://urn:lsid:zoobank.org:act:7442C1C4-8C4F-4CCB-BD53-64347CB6185A)

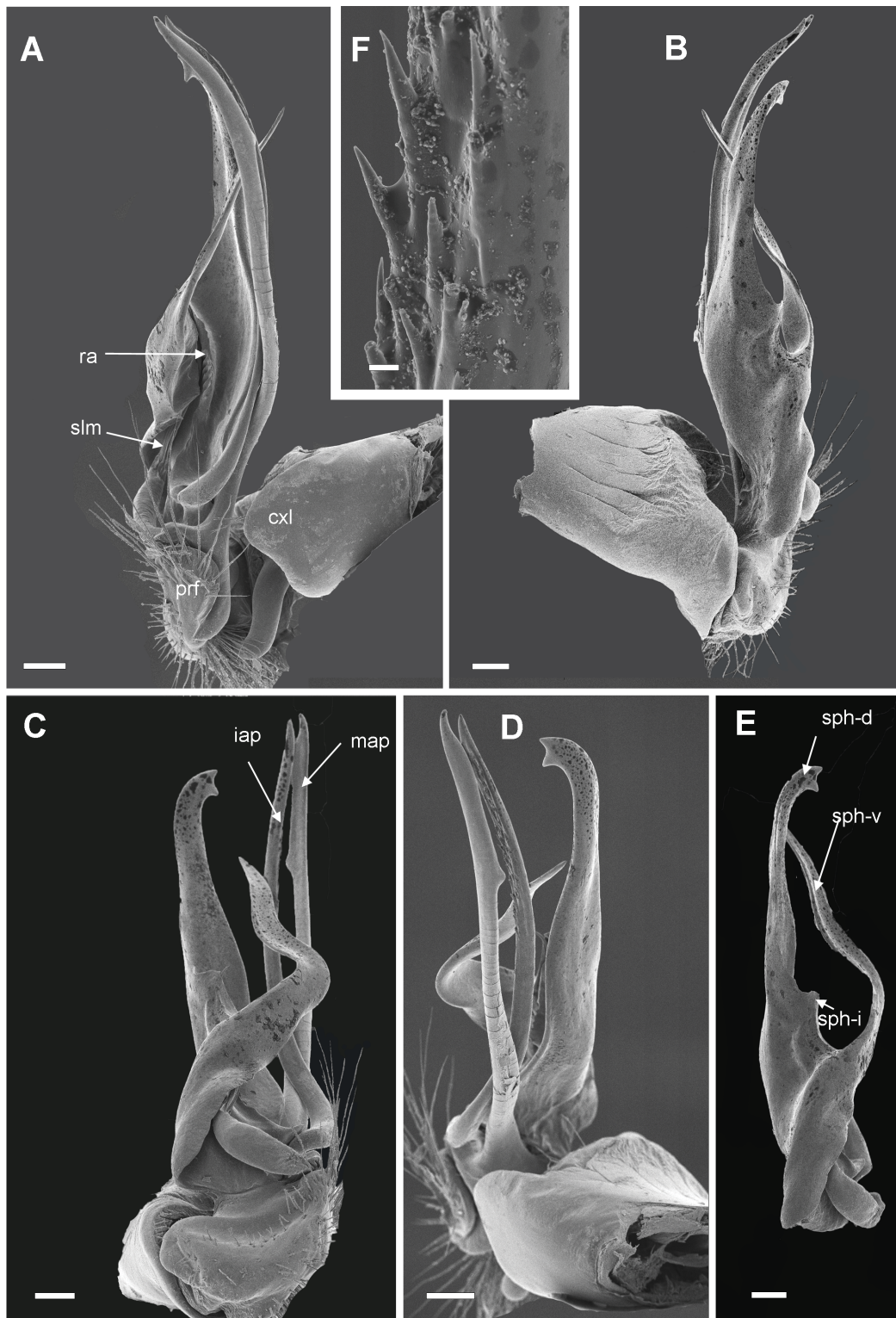
Fig. 19

### Diagnosis

Differs from other species of the *E. kwabuniense* group by having *map* and the spinose *iap* extremely slender, in combination with a solenophore with very to extremely slender dorsal and ventral processes, such that the acropodite seems to consist of four very slender branches (in addition to the solenomere).

### Etymology

The specific epithet is a noun in apposition. *Nessiteras* is the genus name given to the famous Loch Ness Monster, and the dorsal lobe of the solenophore of *E. nessiteras* sp. nov. resembles the most famous photograph of the alleged monster sticking its long neck out from the lake surface.



**Fig. 19.** *Eviulisoma nessiteras* sp. nov., paratypes from Udzungwa Scarp Catchment FR, right gonopod. A. Mesal view. B. Lateral view. C. Ventral view. D. Dorsal view. E. Solenophore, latero-ventral view. F. Spiny surface of *iap*. Abbreviations: *cxl* = coxal lobe; *iap* = intermediate acropodital process; *map* = mesal acropodital process; *prf* = prefemoral part; *ra* = ridged area of solenophore; *slm* = solenomere; *sph-d*, *sph-i*, *sph-v* = dorsal, intermediate and ventral lobes of solenophore. Scale bars: A–E = 0.1 mm; F = 0.005 mm.



**Material studied** (total: 7 ♂♂)

**Holotype**

TANZANIA: ♂, Kitungulu FR, 1500 m a.s.l., 08°09' S, 36°05' E, forest, Jan. 1996, M. Andersen, P. Gravlund and A. Jakobsen leg. (ZMUC).

**Paratypes**

TANZANIA: 3 ♂♂, same collection data as for holotype (ZMUC); 3 ♂♂, Morogoro Region, Udzungwa Scarp Catchment FR, Chita, Plot 18, 2 Nov. 2014. 08°29'19.5" S, 35°54'27.3" E, 1531 m a.s.l., pitfall trap, J. Malumbres-Olarte leg., sample codes 18 PT1 and 18 PT6 (ZMUC).

**Referred non-type material**

TANZANIA: 1 ♀, tentatively referred to this species, Morogoro Region, Udzungwa Scarp Catchment FR, Chita, Plot 18, 2 Nov. 2014. 08°29'19.5" S, 35°54'27.3" E, 1531 m a.s.l., pitfall trap, J. Malumbres-Olarte leg., sample code 18 PT6 (ZMUC).

**Description** (male)

SIZE. Length 18 mm, max. width 1.9 mm.

COLOUR. After three years in alcohol all whitish, only vertigial region of head very light brownish.

ANTENNAE. Reaching back to end of ring 3.

BODY RINGS. Paranota at most indicated by faint ridge on body ring 2 (as Fig. 4C), otherwise completely absent. Stricture between pro- and metazonite striolate. A transverse row of setae on all body rings.

HYPOPROCT. Large, trapezoid to almost rectangular, with three apical tubercles.

LEGS. Length  $1.2 \times$  body width. Relative lengths of podomeres: femur > prefemur > tarsus > tibia > postfemur. Scopulae prominent on femur, postfemur, tibia and tarsus, only missing from posteriormost legs.

STERNUM 5. A small subpentagonal process between legs 4.

STERNUM 6. Deeply excavated. Rim of excavation simple.

GONOPODS (Fig. 19). Coxal lobe (*cxl*) large. Prefemoral part (*prf*) ca  $0.3 \times$  as long as acropodite. Mesal acropodital process (*map*) a very slender, smooth, slightly arched rod with a short triangular subapical side branch. Intermediate acropodital process (*iap*) as slender and ca as long as *map*, slightly arched, densely covered in long spines along dorsal side (Fig. 19F). Solenophore (*sph*) deeply split into two long lobes; dorsal lobe (*sph-d*) almost as long as acropodital processes, stouter than these, apically bent at right angles and ending in two triangular lobes; ventral lobe (*sph-v*) ca as long and stout as *sph-d*, somewhat sinuous (in Fig. 19C the *sph-v* looks strongly twisted, but this is due to distortion during preparation of the SEM mount), apically pointed; a tiny intermediate lobe (*sph-i*) between *sph-d* and *sph-v*; internal surface of *sph* with a ridged area (*ra*).

**Distribution and habitat**

Known from Udzungwa Scarp FR and Kitungulu/Kiranza FR. Altitudinal range 1500–1531 m a.s.l. Collected together with *E. dabagaense* and *E. navuncus* sp. nov. in Kitungulu/Kiranza FR.

*Eviulisoma ottokrausi* sp. nov.

[urn:lsid:zoobank.org:act:4AC6017F-F868-4073-9A60-61FB1922F8E1](http://urn:lsid:zoobank.org:act:4AC6017F-F868-4073-9A60-61FB1922F8E1)

Figs 8C, 20

**Diagnosis**

Differs from other species of the *E. kwabuniense* group by having a short subterminal side branch on the *map*, in combination with having spines on the basal part of the long, slender *iap* and having the dorsal lobe of the solenophore much longer than the ventral and intermediate lobes.

**Etymology**

The name honours Otto Kraus (1930–2017) who described the first species of *Eviulisoma* from the Udzungwa Mountains and authored numerous other papers on myriapod (and arachnid) taxonomy.

**Material studied** (total: 13 ♂♂)

**Holotype**

TANZANIA: ♂, Iringa Region, Iringa District, New Dabaga/Ulangambi FR, 08°05'34.5" S, 35°55'31.3" E, montane, 1800–1900 m a.s.l., Plot 16, 15–16 Nov. 2000, Frontier Tanzania leg. (ZMUC).

**Paratypes**

TANZANIA (all from Iringa Region, Iringa District, New Dabaga/Ulangambi FR, Frontier Tanzania leg.): 1 ♂, 08°00'26.6" S, 35°56'06.1" E, scrub/thicket/bush, 1915 m a.s.l., Plot Kinyonga, 18 Oct. 2000; 1 ♂, 08°03'39.9" S, 35°54'41.91" E, montane, 1955 m a.s.l., Plot 24, 2 Nov. 2000; 1 ♂, 08°03'39.9" S, 35°54'41.91" E, montane, 1962 m a.s.l., Plot 24, 27 Oct. 2000; 1 ♂, 08°04'05.6" S, 35°54'13.8" E, montane, 1940 m a.s.l., Plot 1, 18 Oct. 2000; 2 ♂♂, 08°00'26.6" S, 35°56'06.1" E, montane forest, 1910 m a.s.l., Plot Kinyonga, 24 Oct. 2000; 1 ♂, 08°05'34.5" S, 35°55'31.3" E, montane, 1800 m a.s.l., Plot 16, 15 Nov. 2000; 5 ♂♂, 08°04'05.6" S, 35°54'20.41" E, montane, 1930 m a.s.l., Plot 6, 27 Oct. 2000 (all in ZMUC).

**Description** (male)

SIZE. Length 18 mm, max. width 2.0 mm.

COLOUR. Completely pallid after 17 years in alcohol (probably not due to fading because whereas all adult specimens are pallid, the samples also contain some juveniles, possibly of another species, in which the metazonites have retained a brownish colouration similar to that seen in *E. dabagaense*).

ANTENNAE. Reaching back to middle of ring 4.

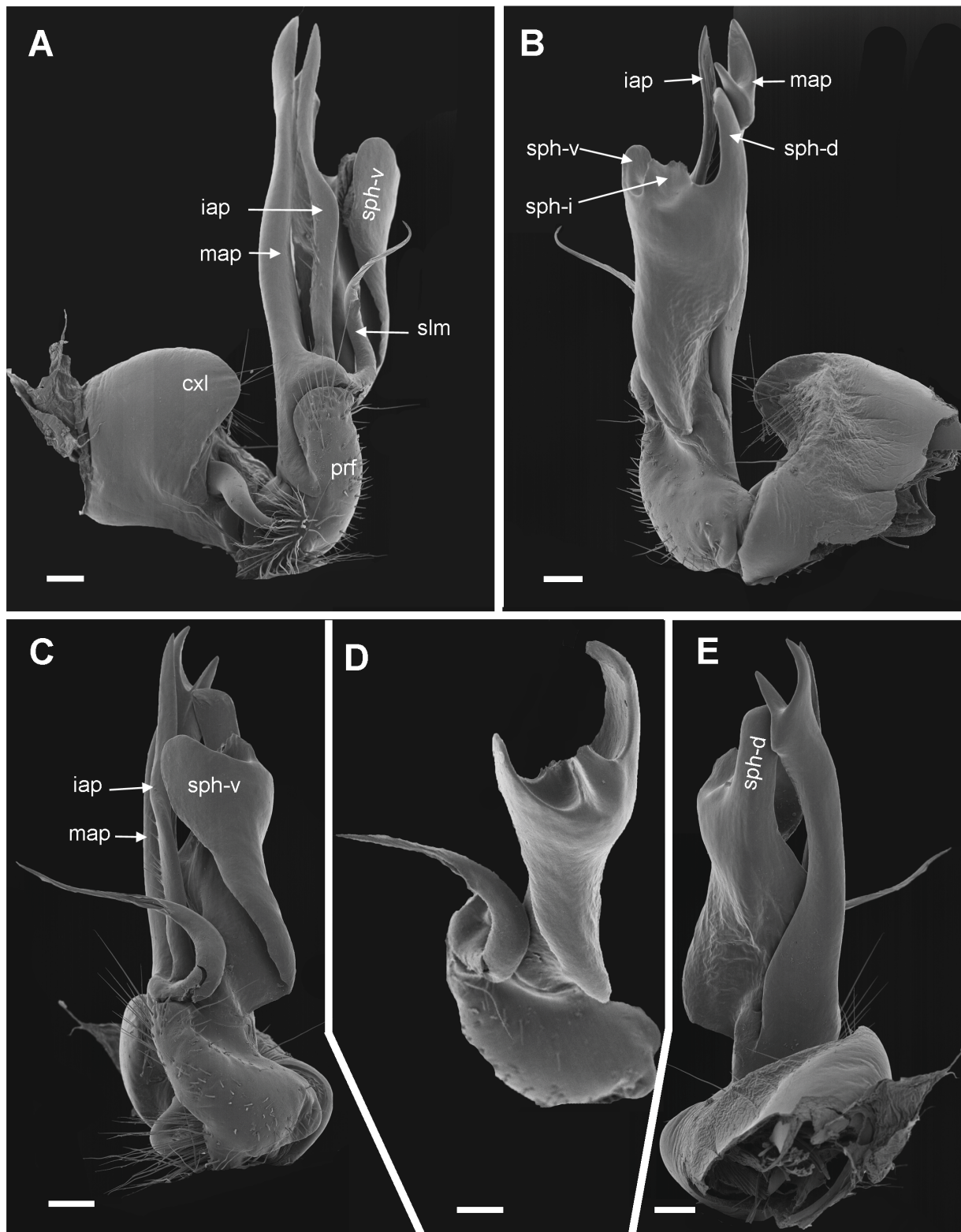
BODY RINGS. Paranota seen as extremely inconspicuous ridges on ring 2 in one specimen (as Fig. 4C), completely absent in others. Stricture between pro- and metazonite striolate. A transverse row of setae on all body rings back to ring 9 in one specimen, only on ring 2 in another.

HYPOPROCT. Trapezoid, with three very prominent marginal tubercles.

LEGS. Length  $0.8 \times$  body width. Relative lengths of podomeres: femur (>) prefemur > tarsus > tibia (>) postfemur. Scopulae strongly developed on femur, postfemur, tibia and tarsus; those on femur missing from posterior legs.

STERNUM 5. A tongue-shaped process between legs 4.

STERNUM 6. Deeply excavated, rim of excavation simple.



**Fig. 20.** *Eviulisoma ottokrausi* sp. nov, paratype, left gonopod. **A.** Mesal view. **B.** Lateral view. **C.** Ventral view. **D.** Acropodite, latero-ventro-apical view. **E.** Dorsal view. Abbreviations: *cxl* = coxal lobe; *iap* = intermediate acropodital process; *map* = mesal acropodital process; *prf* = prefemoral part; *slm* = solenomere; *sph-d*, *sph-i*, *sph-v* = dorsal, intermediate and ventral lobes of solenophore. Scale bars: A–D = 0.1 mm.



GONOPODS (Figs 8C, 20). Coxal lobe (*cxl*) large. Prefemoral part (*prf*) slightly more than half as long as acropodite; mesal acropodital process (*map*) long, slender, straight, apically bifurcate; intermediate acropodital process (*iap*) as long as *map*, slender, with several long spines on basal half, apically pointed; solenophore (*sph*) large, ca 0.8 × as long as *map*, folded around solenomere (*slm*), three-lobed, dorsal lobe (*sph-d*) longest, subrectangular, ventral lobe (*sph-v*) large, apically broadly rounded; a small intermediate lobe (*sph-i*) between *sph-d* and *sph-v*.

#### Distribution and habitat

Known only from the New Dabaga/Ulangambi FR. Altitudinal range 1800–1962 m a.s.l. Habitats include montane forest and scrub/thicket/bush. Collected together with *E. kwabuniense* Kraus, 1958.

#### Remarks

One male infested with nematodes, one worm sticking out from each gonopore.

*Eviulisoma paradisiacum* sp. nov.

[urn:lsid:zoobank.org:act:EF53C636-FF60-4E60-93AB-911BAACD56E0](https://zoobank.org/act:EF53C636-FF60-4E60-93AB-911BAACD56E0)

Figs 4A–B, 5, 7A, 21

#### Diagnosis

Differs from other species of the *E. kwabuniense* group by having a strong hook emerging from the concave side of the solenophore and, together with the ventral lobe of the solenophore, delimiting a narrow slit.

#### Etymology

The name is an adjective referring to the name Frontier Tanzania gave to the montane forest plot where the species was found.

**Material studied** (total: 29 ♂♂)

##### Holotype

TANZANIA: ♂, Iringa Region, Iringa District, West Kilombero Scarp FR, 07°50'38.4" S, 36°22'17.6" E, montane woodland, 1400 m a.s.l., Plot Paradiso, 16 Nov. 2000, Frontier Tanzania leg. (ZMUC).

##### Paratypes

TANZANIA (all from Iringa Region, Iringa District, West Kilombero Scarp FR, Frontier Tanzania leg.): 8 ♂♂, same collection data as for holotype; 2 ♂♂, same collection data as for holotype, except montane forest, 1390 m a.s.l., 12 Nov. 2000; 18 ♂♂, same collection data as for holotype, except 1390–1410 m a.s.l., 18 Nov. 2000 (all in ZMUC).

#### Description (male)

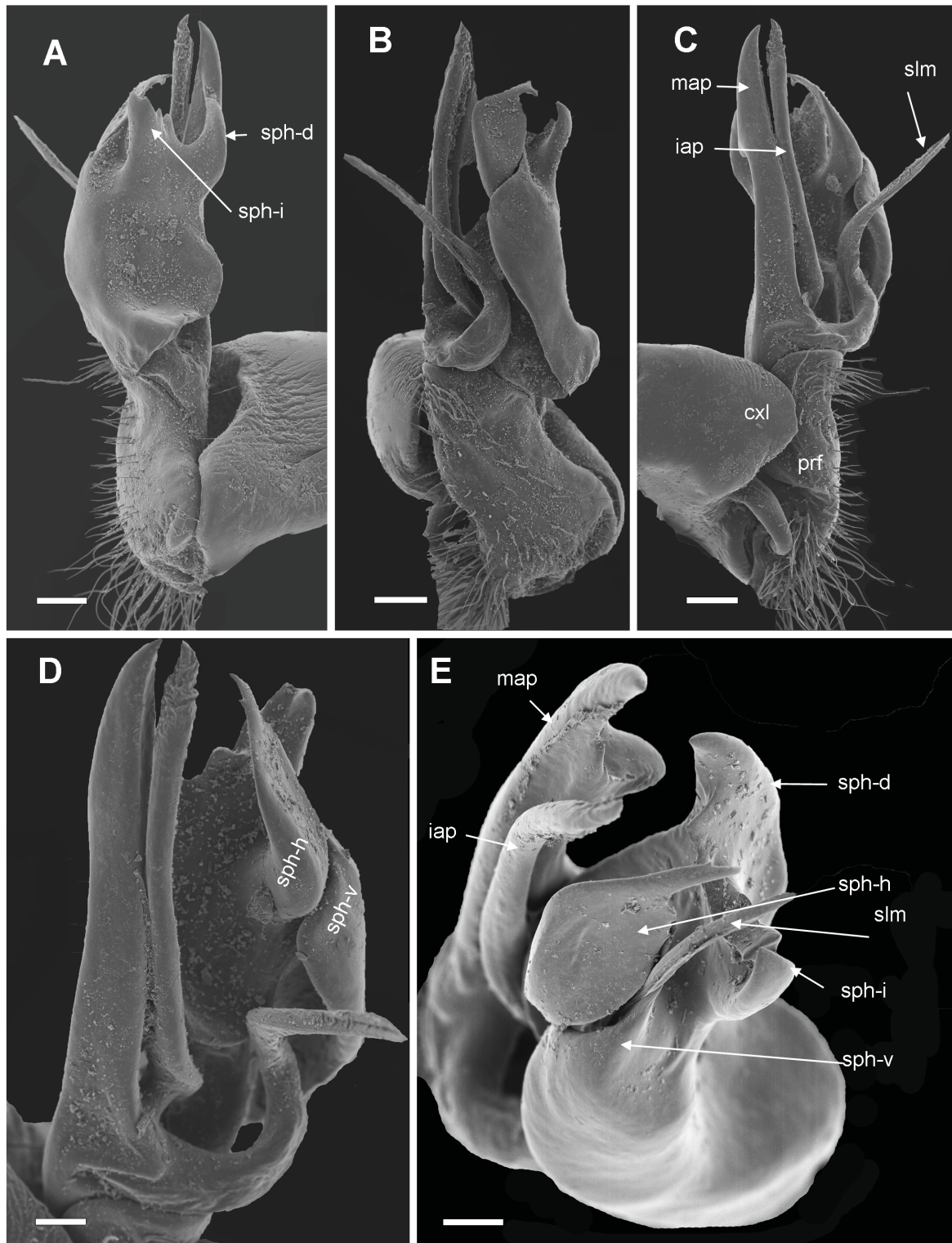
SIZE. Length 16 mm, max. width 1.7 mm.

COLOUR. After 17 years in alcohol whitish to pale yellowish, anterior part of dorsum very light brownish in some specimens.

ANTENNAE. Reaching back to end of ring 3.

BODY RINGS. Paranota completely absent. Stricture between pro- and metazonite clearly striolate (Fig. 7A). A transverse row (1 + 1) of setae on all body rings.

HYPOPROCT. Large, trapezoid, with three marginal tubercles.



**Fig. 21.** *Eviulisoma paradisiacum* sp. nov. A–D. Paratype, left gonopod, solenomere dislodged from solenophore. A. Lateral view. B. Ventral view. C. Mesal view. D. Dorsal view. E. Another paratype, gonopod acropodite, apical (anterior) view, solenomere sticking out from solenophore slit. Abbreviations: *cxl* = coxal lobe; *iap* = intermediate acropodital process; *map* = mesal acropodital process; *prf* = prefemoral part; *slm* = solenomere; *sph-d*, *sph-i*, *sph-v* = dorsal, intermediate and ventral lobes of solenophore; *sph-h* = solenophore hook. Scale bars: A–C = 0.1 mm; D–E = 0.05 mm.

LEGS. Length  $0.9 \times$  body width. Relative lengths of podomeres: femur > prefemur > tarsus > postfemur = tibia. Scopulae (Fig. 7A) on femur, postfemur, tibia and tarsus, diminishing towards posterior, especially on femur.

STERNUM 5. A bell-shaped process between legs 4.

STERNUM 6. Deeply excavated. Rim of excavation simple.

GONOPODS (Fig. 21). Coxal lobe (*cxl*) moderately large. Prefemoral part (*prf*) ca  $\frac{2}{3}$  as long as acropodite. Mesal acropodital process (*map*) a long, straight, stout, pointed rod with a subapical lateral flange. Intermediate acropodital process (*iap*) a more slender, straight, non-spinose pointed rod, as long as *map*. Solenophore (*sph*) a massive sheet, almost as long as *map*, with a large, hook-shaped process (*sph-h*) on the hollow side, basal part of *sph-h* separated from small ventral, ‘solenomere-conducting’ lobe (*sph-v*) by narrow slit, dorso-lateral part of *sph* apically with a finger-shaped dorsal lobe (*sph-d*) separated by U-shaped incision from multi-cusped intermediate lobe (*sph-i*).

### Distribution and habitat

Known only from the West Kilombero Scarp FR, Plot Paradiso. Altitudinal range: 1390–1410 m a.s.l. Habitat: montane forest. According to Frontier Tanzania (2001: 27, 174), ‘Plot Paradiso’ is dominated by *Millettia usaramensis* Taub.

### The *dabagaense* group

#### Diagnosis

Species of *Eviulisoma* in which sternum 6 is deeply excavated, with unlobed margins, there is no intermediate acropodital process, the solenophore is a tightly rolled-up sheet of a tube-like appearance (with a few small processes) and the mesal acropodital process is strongly laterally compressed.

Included species:

*E. dabagaense* Kraus, 1958

*E. coxale* sp. nov.

*E. culter* sp. nov.

*E. grumslingslak* sp. nov.

No further species can be assigned to this group based on the existing literature.

***Eviulisoma dabagaense* Kraus, 1958**

Figs 6E, 22

*Eviulisoma dabagaense* Kraus, 1958: 2 (holotype (not studied) in the Überseemuseum Bremen).

#### Diagnosis

Differs from other species of the *E. dabagaense* group by the combination of a gonopod coxa without a distolateral process and a parallel-margined *map* with two strong apical denticles and several smaller ones on the dorsal margin.

#### Material studied (total: 5 ♂♂)

TANZANIA: 1 ♂, Iringa Region, Iringa District, New Dabaga/Ulangambi FR, 08°06'47.4" S, 38°56'50.4" E, montane, 1800 m a.s.l., Plot MS–Plot A, 9 Nov. 2000, Frontier Tanzania leg. (near



topotype) (ZMUC); 3 ♂♂, Iringa Region, Udzungwa Scarp FR, above Chita Village, 1600–1650 m a.s.l., 8–13 Nov. 1984, pitfall traps in montane rain forest, N. Scharff leg. (ZMUC); 1 ♂, Kitungulu FR, 1500 m a.s.l., 08°09' S, 36°05' E, forest, Jan. 1996, M. Andersen, P. Gravlund and A. Jakobsen leg. (ZMUC); 3 ♀♀, tentatively referred to this species, same collection data as preceding (ZMUC).

### **Descriptive notes (male)**

**SIZE.** Length 17–18 mm, max. width 1.8–2.1 mm.

**COLOUR.** After 17–33 years in alcohol overall colour of body, antennae and legs whitish. Occipital region of head, as well as collum, light brown. Dorsal half of posterior  $\frac{3}{4}$  of metazonites also light brown, making entire animal transversely striped.

**ANTENNAE.** Reaching back to middle of ring 4.

**BODY RINGS.** Paranota represented by a tiny keel on ring 2 (as Fig. 4C), otherwise completely absent. Stricture between pro- and metazonite smooth or indistinctly striolate. A transverse row of setae on all body rings.

**HYPOPROCT.** Rounded trapezoidal, without distinct tubercles.

**LEGS.** Length  $1.3\text{--}1.5 \times$  body width. Relative lengths of podomeres: femur > prefemur  $\approx$  tarsus > tibia > postfemur. Scopulae on anterior legs on femur, postfemur, tibia and tarsus, disappearing from femur and postfemur on posterior legs.

**STERNUM 5.** A trapezoidal process between legs 4 (Fig. 6E).

**STERNUM 6.** Deeply excavated, rim simple.

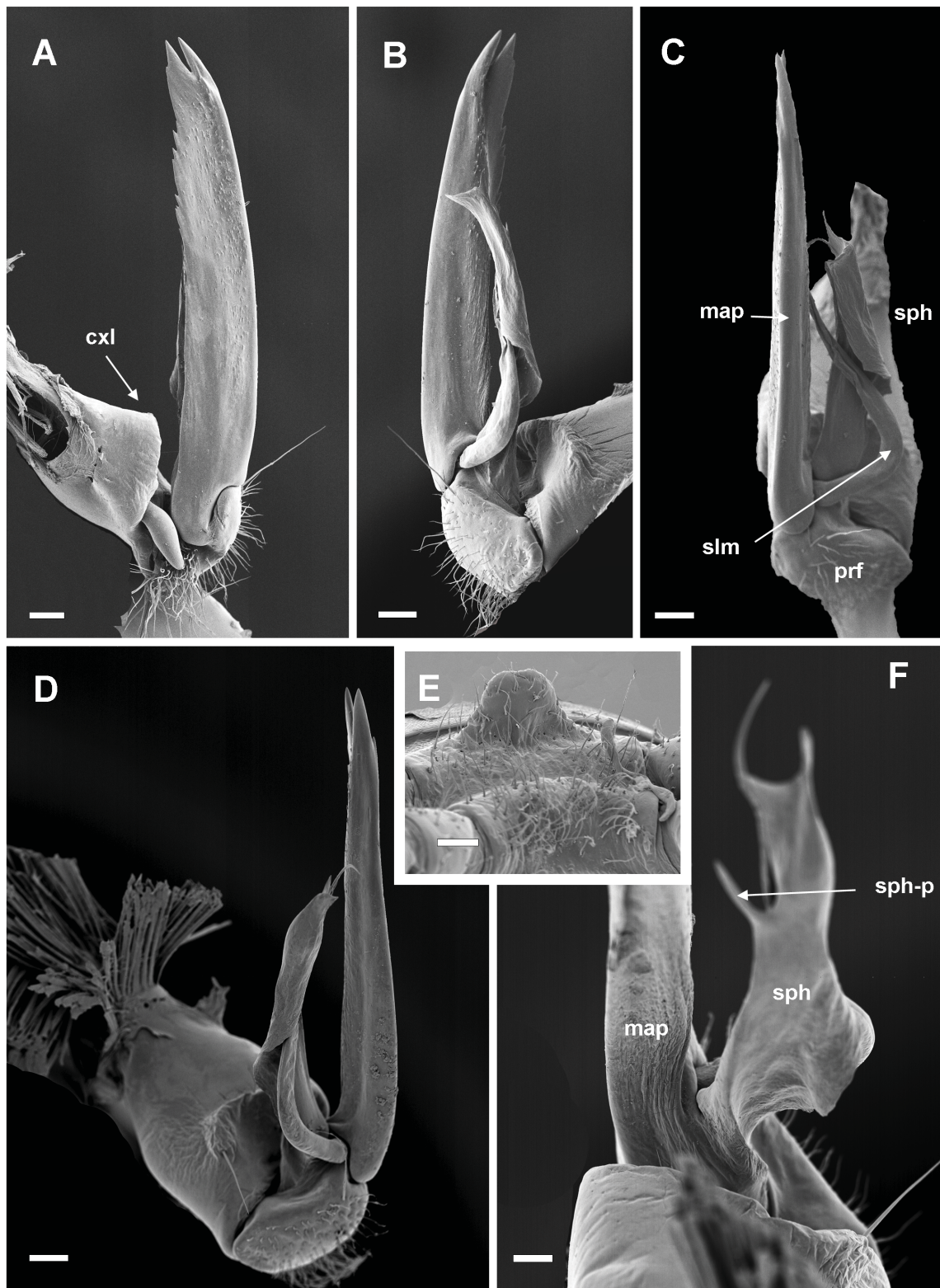
**GONOPODS** (Fig. 22). Coxa without a lateral process; coxal lobe (*cxl*) small. Prefemoral part (*prf*) ca  $0.25 \times$  as long as acropodite; mesal acropodital process (*map*) large, lamelloid, straight, with parallel margins, tip of process with two strong denticles, a few smaller denticles distally on dorsal margin; solenophore (*sph*) a rolled sheet, less than  $\frac{2}{3}$  as long as *map*, forming a tube with two small apical denticles and a slender process (*sph-p*) ca at mid-length.

### **Distribution and habitat**

Known from three forest reserves in the western Udzungwas (New Dabaga/Ulamgambi FR, Kiranzi/Kitungulu FR, Udzungwa Scarp FR). Altitudinal range 1500–2100 m a.s.l. (upper limit according to Kraus 1958). Habitat: montane rain forest (studied specimens) and semi-rainforest (Kraus 1958). Collected together with *E. navuncus* sp. nov. and *E. nessiteras* sp. nov. in Kitungulu/Kiranzi FR.

### **Remarks**

The studied near-topotype agrees completely with the original description (Kraus 1958); a side-by-side comparison with the holotype was therefore deemed unnecessary. Several juveniles with a colour pattern like that of *E. dabagaense* were found in samples from New Dabaga-Ulangambi FR containing no males of *E. dabagaense*, but one or several males of the entirely pallid *E. ottokrausi* sp. nov. Although a safe identification of these juveniles cannot be made, they probably belong to *E. dabagaense*.



**Fig. 22.** *Eviulisoma dabagaense* Kraus, 1958. A–C. Topotype, ♂, left gonopod. A. Mesal view. B. Lateral view. C. Ventral view. D–F. ♂ from Udzungwa Scarp FR, above Chita Village, right gonopod. D. Ventrolateral view. E. Sternal lobe between legs 4. F. Subdorsal view, emphasizing solenophore. Abbreviations: *cxl* = coxal lobe; *map* = mesal acropodital process; *prf* = prefemur; *slm* = solenomere; *sph* = solenophore; *sph-p* = slender process from *sph*. Scale bars: A–E: 0.1 mm; F = 0.05 mm.

*Eviulisoma coxale* sp. nov.

[urn:lsid:zoobank.org:act:10D5E316-6E8F-4A38-8D58-197DDA963339](http://urn:lsid:zoobank.org:act:10D5E316-6E8F-4A38-8D58-197DDA963339)

Figs 3B, 6F, 7E–F, 23

**Diagnosis**

Differs from other species of the *E. dabagaense* group, except *E. culter* sp. nov., by having a distolateral process on the gonopod coxa. Differs from *E. culter* sp. nov. by having *map* with two strong apical denticles and several small denticles along the dorsal margin.

**Etymology**

The name, an adjective, refers to the peculiar modification of the gonopod coxa.

**Material studied** (total: 7 ♂♂)

**Holotype**

TANZANIA: ♂, Iringa Region, Mahenge District, West Kilombero Scarp FR, Nyambanitu Mts, S of Udekwa Village, 07°48' S, 36°21' E, 1500 m a.s.l., Dec. 1993, J.O. Svendsen leg. (ZMUC).

**Referred non-type material**

TANZANIA: 2 ♀♀, tentatively referred to this species, same collection data as for holotype (ZMUC); 1 ♂, Morogoro Region, Mwanihana FR, 1800–1850 m a.s.l., 28–29 Sep. 1984, litter in montane forest, N. Scharff leg. (ZMUC); 1 ♂, same collection data as preceding, but 1650 m a.s.l., 25–29 Sep. 1984, pitfall trap in montane rain forest (ZMUC); 1 ♂, same collection data as preceding, but 1400–1650 m a.s.l., montane rain forest (ZMUC); 1 ♂, Mwanihana Forest above Sanje, 1650 m a.s.l., 18 Aug. 1982, litter, M. Stoltze and N. Scharff leg. (ZMUC); 1 ♀ (tentatively assigned), 2 ♂♂, Morogoro Region, Udzungwa Mts National Park, Mito Mitatu, Plot 15, 07°49'39.8" S, 36°50'26.0" E, 1552 m a.s.l., 27 Nov. 2014, pitfall trapping, J. Malumbres-Olarte leg., sample codes 15 PT6 and 15 PT8 (ZMUC).

**Description** (holotype, male)

SIZE. Length 22 mm, max. width 2.0 – 2.5 mm.

COLOUR (Fig. 3B). Specimen from Nyambanitu Mts after 24 years in alcohol pallid, except collum and large lateral spots on body rings brownish, on poriferous rings the spots cover the ozopore. Specimens from Mito Mitatu and Mwanihana FR almost all pallid.

ANTENNAE. Reaching back to middle of ring 4.

BODY RINGS. Paranota absent, except for barely discernible keels on ring 2 (as in Fig. 4C). Stricture between pro- and metazonite indistinctly striolate. A transverse row of setae on most body rings (probably abraded where absent).

HYPOPROCT. Rounded-trapezoidal, without distinct tubercles.

LEGS. Length  $1.3 \times$  body width. Relative lengths of podomeres: femur > prefemur  $\approx$  tarsus > tibia > postfemur. Scopulae (Fig. 7E–F) on anterior legs on femur, postfemur, tibia and tarsus, diminishing and eventually disappearing on more posterior legs, especially on femur.

STERNUM 5. A rounded-trapezoidal process between legs 4 (Fig. 6F).

STERNUM 6. Deeply excavated, rim simple.

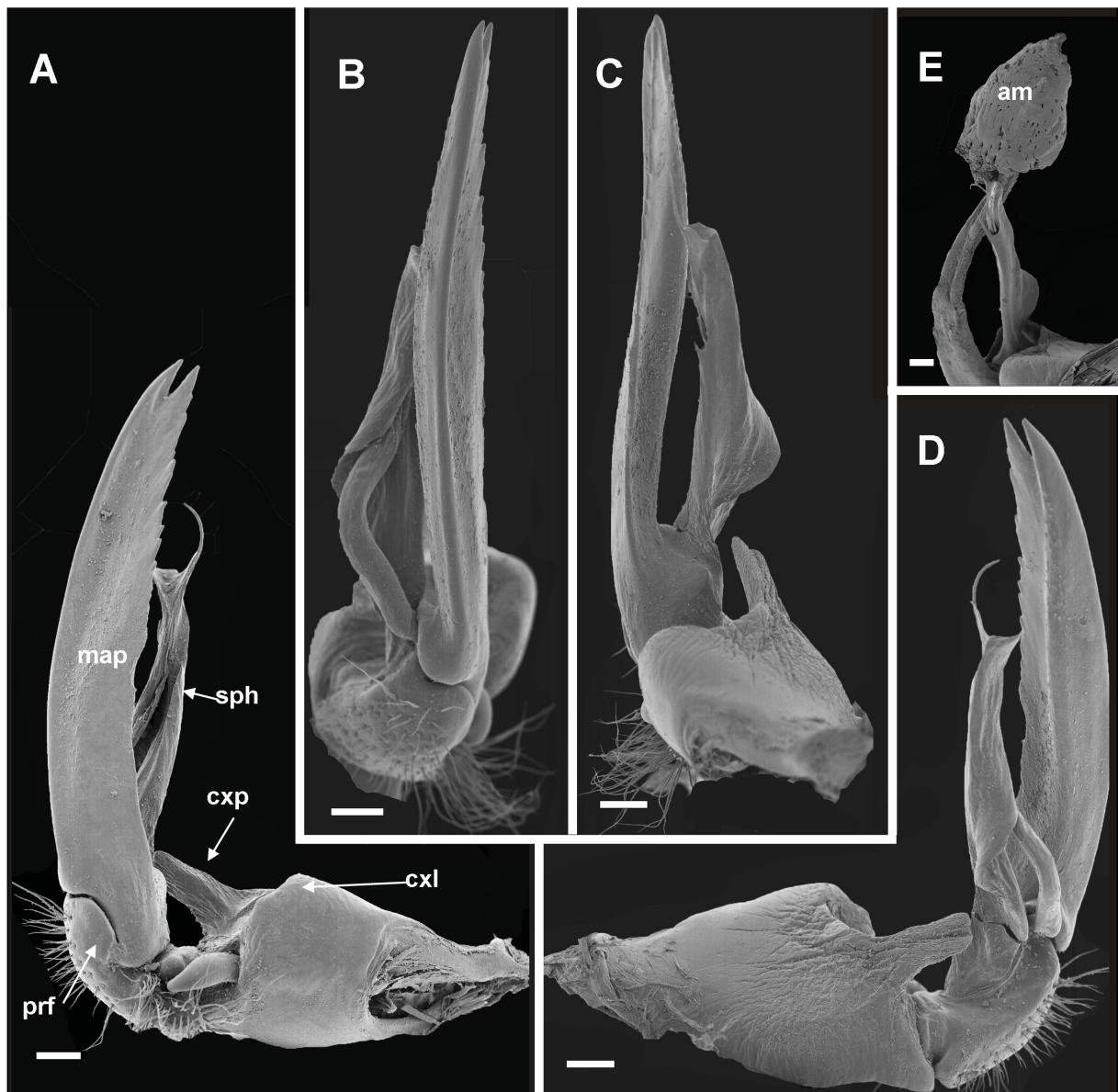


GONOPODS (Fig. 23). Coxa with a long, digitiform distolateral process (*cxp*). Other gonopodal characters as in *E. dabagaense*: coxal lobe (*cxl*) moderate; prefemoral part (*prf*) ca  $0.25 \times$  as long as acropodite; mesal acropodital process (*map*) lamelloid, straight, with parallel margins, tip of process with two strong denticles, a row of smaller denticles along apical part of dorsal margin; solenophore (*sph*) a rolled sheet, separated from *map* by a distinct gap, less than  $\frac{2}{3} \times$  as long as *map*, forming a tube with two small apical denticles and a slender process ca at mid-length.

#### Specimens from Udzungwa Mts National Park

Similar to type specimens, except as follows:

SIZE. Length 25 mm, max. width 2.5 mm.



**Fig. 23.** *Eviulisoma coxale* sp. nov. A–D. Holotype, right gonopod. A. Mesal view. B. Ventral view. C. Dorsal view. D. Lateral view. E. Paratype from Mito Mitatu, right gonopod, showing lump of amorphous mass on tip of process *map*. Abbreviations: *am* = amorphous mass; *cxl* = coxal lobe; *cxp* = coxal process; *map* = mesal acropodital process; *prf* = prefemur; *sph* = solenophore. Scale bars: 0.1 mm.

**COLOUR.** Overall pallid after 3 years in alcohol; only head and collum slightly ochre-yellow; a small brown patch between antennae.

**ANTENNAE.** Reaching back to middle of ring 4. Antennomeres 2–6 subequal.

### **Distribution and habitat**

Known from two sites in the Udzungwa Mts National Park. Altitudinal range 1400–1850 m a.s.l. Habitat: montane rain forest. Collected in litter and pitfall traps, together with *E. breviscutum* sp. nov. in Mwanihana Forest.

### **Remarks**

This species is very similar to *E. dabagaense*, but differs in the presence of a distolateral finger-formed process on the gonopod coxa, the latter character being shared with *E. culter* sp. nov. There are several females and juveniles in the same sample as the holotype, in addition to the listed females. They agree with the holotype in all non-sexual characters except that they are uniformly pale. Whether this is due to fading of the large lateral spots seen in the holotype, or to the possibility that they represent a different species, is difficult to say. Several specimens from Udzungwa Mountains National Park carry large lumps of an amorphous mass (see Discussion) on the tip of process *map* (Fig. 23E). These specimens are slightly larger than the holotype and they do not have large lateral spots on the body rings, but these differences hardly warrant the recognition of a separate species.

*Eviulisoma culter* sp. nov.

[urn:lsid:zoobank.org:act:AB9254B1-5D83-4B68-A56C-6ED62B509286](http://urn:lsid:zoobank.org:act:AB9254B1-5D83-4B68-A56C-6ED62B509286)

Figs 8B, 24

### **Diagnosis**

Differs from other species of the *E. dabagaense* group by lacking denticles on the dorsal and ventral margins of *map*.

### **Etymology**

The name is a noun in apposition, meaning ‘knife’ in Latin and referring to the shape of the mesal acropodital process (*map*).

**Material studied** (total: 5 ♂♂)

#### **Holotype**

TANZANIA: ♂, Dodoma Region, Mpwapwa District, Rubeho Mts (48 km W of Kilosa), Mangalisa Peak, 2100 m a.s.l., 26 Feb. 1984, J. Kielland leg. (VMNH).

#### **Paratypes**

TANZANIA: 4 ♂♂, same collection data as for holotype (VMNH, ZMUC).

### **Description (male)**

**SIZE.** Length up to 27 mm (smaller specimens incomplete), max. width 2.2–2.4 mm.

**COLOUR.** After 33 years in alcohol uniformly yellowish, probably faded.

**ANTENNAE.** Reaching back to middle of ring 4.

**BODY RINGS.** Paranota absent, except for barely distinguishable keels on ring 2 (as in Fig. 4C). Stricture between pro- and metazonite smooth. A transverse row of setae on all rings.

HYPOPROCT. Rounded-triangular, without distinct tubercles.

LEGS. Length  $1.2 \times$  body width. Relative lengths of podomeres: femur > prefemur > tarsus > tibia > postfemur. Scopulae on anterior legs on femur, postfemur, tibia and tarsus; those on femur missing from posterior legs, those on postfemur, tibia and tarsus present almost until end of body.

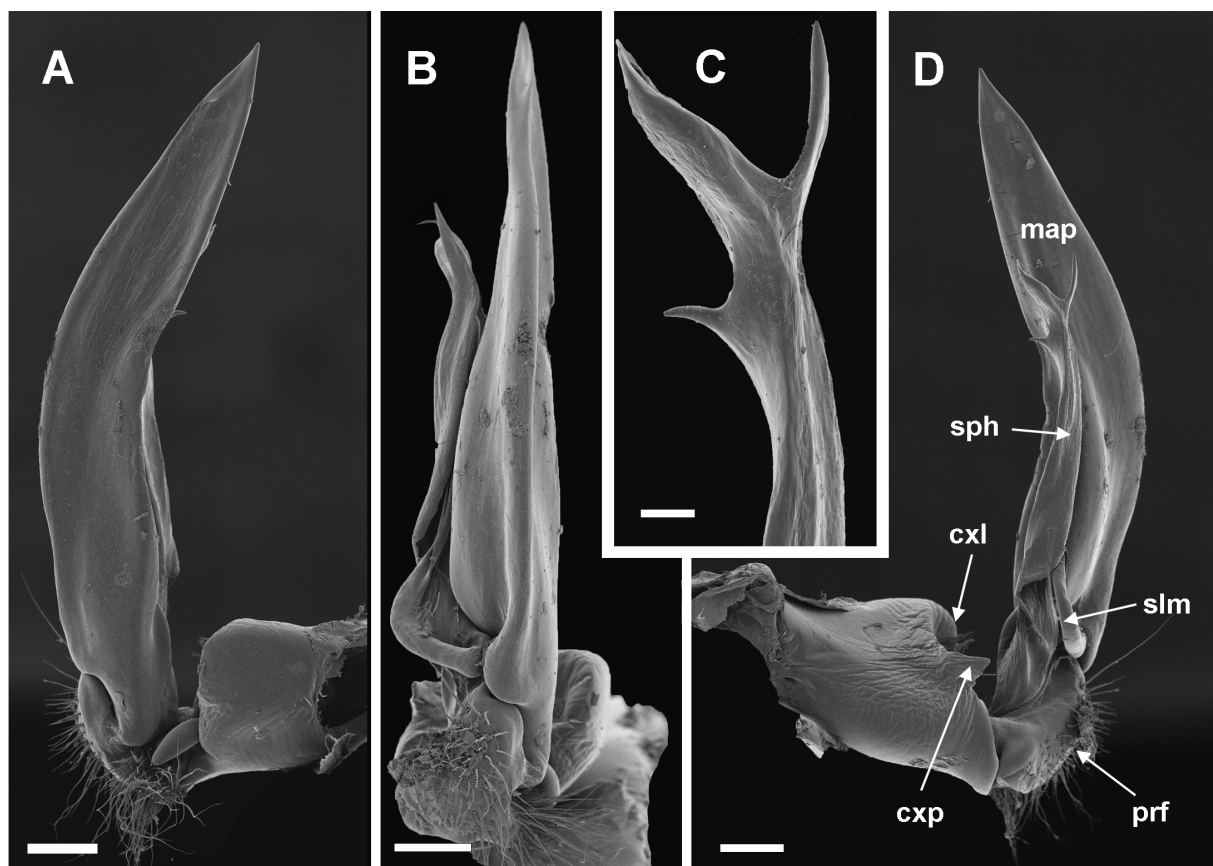
STERNUM 5. An almost semicircular process between legs 4.

STERNUM 6. Deeply excavated, rim simple.

GONOPODS (Figs 8B, 24). Coxa with a short, triangular distolateral process (*cxp*); coxal lobe (*cxl*) small; prefemoral part (*prf*) ca  $0.2 \times$  as long as acropodite; mesal acropodital process (*map*) large, simple, lamelloid, knife-like, gently curved, with basally parallel and apically converging margins, tip of process simple, sharp, dorsal and ventral margins of process without denticles; solenophore (*sph*) a rolled sheet, less than  $\frac{2}{3} \times$  as long as *map*, forming a tube with three apical processes (Fig. 24C).

### Distribution and habitat

Known only from Mangalisa Peak in the Rubeho Mts, 2100 m a.s.l.



**Fig. 24.** *Eviulisoma culter* sp. nov., paratype, right gonopod. **A.** Mesal view. **B.** Ventral view. **C.** Tip of solenophore, lateral view. **D.** Lateral view. Abbreviations: *cxl* = coxal lobe; *cxp* = coxal process; *map* = mesal acropodital process; *prf* = prefemur; *slm* = solenomere; *sph* = solenophore. Scale bars: A–B, D = 0.2 mm; C = 0.05 mm.



***Eviulisoma grumslingslak* sp. nov.**

urn:lsid:zoobank.org:act:07C12948-4168-49D7-B074-95DC69716565

Fig. 25

**Diagnosis**

Differs from other species of the *E. dabagaense* group by its larger size (width 2.5–3.4 mm vs 1.8–2.4 mm in other species) and by having the ventral margin of *map* strongly convex.

**Etymology**

The name, here to be regarded as a noun in apposition, means ‘pregnant’ in the now extinct Danish cryptolect ‘rotvælsk’ and refers to the shape of the gonopodal postfemoral process which (somewhat) resembles the profile of a pregnant woman’s torso.

**Material studied** (total: 9 ♂♂)

**Holotype**

TANZANIA: ♂, Morogoro Region, Udzungwa Mts National Park, Kidatu, Plot 6, 07°40′42.1″ S, 36°55′06.8″ E, 1482 m a.s.l., 21 Oct. 2014, pitfall trapping, J. Malumbres-Olarte leg. (ZMUC).

**Paratype**

TANZANIA: ♂, same collection data as for holotype (ZMUC).

**Referred non-type material**

TANZANIA: 1 ♂, 3 ♀♀, Iringa Region, Udzungwa Mts, Ndundulu Forest, 07°46′ S, 36°29′ E, Waller’s Camp, tropical semi-evergreen forest, 1550 m a.s.l., 1–12 Jan. 2007. L.A. Hansen and local assistants leg. (ZMUC); 1 ♂, 5 ♀♀, 1 juv., same collection data as preceding, but Dec. 2006 (ZMUC); 1 ♂, Iringa Region, Udzungwa Mts, Ndundulu Forest, 07°46′ S, 36°29′ E, Luwasia Camp, semi-evergreen tropical, montane virgin forest, 1880 m a.s.l., 19 Feb.– 10 Mar. 2007, L.A. Hansen and local assistants leg. (ZMUC); 1 ♂, Iringa Region, Iringa District, West Kilombero Scarp FR, 07°45′34.2″ S, 36°26′37.4″ E, (open) woodland, 1510 m a.s.l., Plot *Acacia*, 7 Dec. 2000, Frontier Tanzania leg. (ZMUC); 3 ♂♂, same collection data as preceding, but 5 Dec. 2000, Frontier Tanzania leg. (ZMUC).

**Description** (male)

**Holo- and paratype**

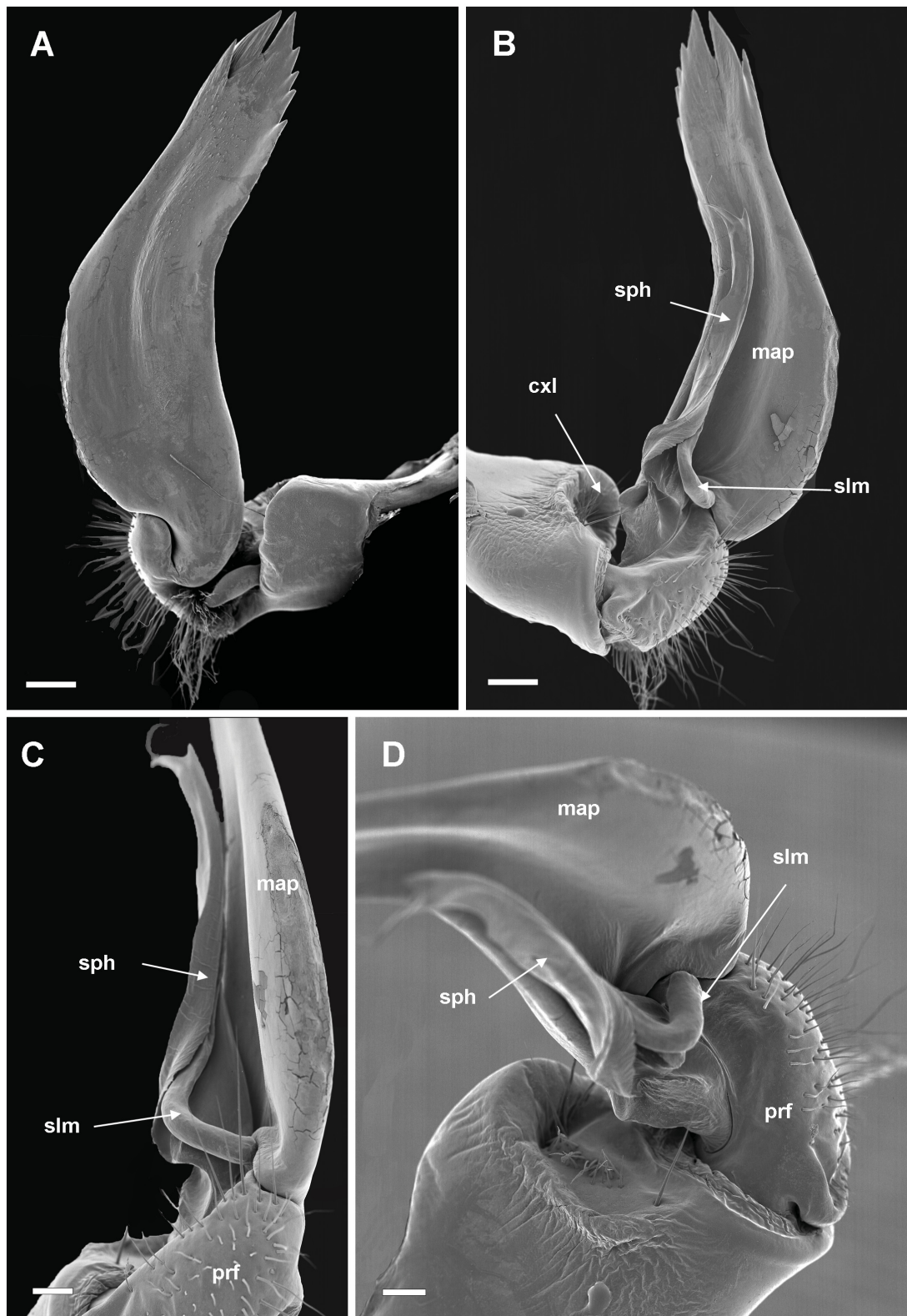
SIZE. Length 34 mm, max. width 3.4 mm.

COLOUR. After 3 years in alcohol, overall impression: contrasting dark and pale transverse bands. Head light brown, vertigial region darker. Antennae pale yellow, or antennomeres 1–5 light brown, antennomeres 6–7 pale yellow. Collum brownish black. Postcollar body rings pale yellow; posterior dorsal quarter of metazonites brownish black; these dark transverse bands expanded in areas around ozopores. Legs pale yellow. Dorsal middle ⅓ of preanal ring brownish black.

ANTENNAE. Reaching back to middle of ring 4.

BODY RINGS. Paranota represented by a tiny keel on ring 2 (as in Fig. 4C), otherwise completely absent. Stricture between pro- and metazonite indistinctly striolate. A transverse row of setae on all rings.

HYPOPROCT. Rounded-triangular, with a large median and a pair of smaller lateral tubercles.



**Fig. 25.** *Eviulisoma grumslingslak* sp. nov., paratype, right gonopod. **A.** Mesal view. **B.** Lateral view. **C.** Ventral view. **D.** Lateral view, detail, showing coxal lobe and entrance of solenomere into solenophore. Abbreviations: *cxl* = coxal lobe; *map* = mesal acropodital process; *prf* = prefemur; *slm* = solenomere; *sph* = solenophore. Scale bars: A–B = 0.2 mm; C–D = 0.1 mm.

LEGS. Length  $1.5 \times$  body width. Relative lengths of podomeres: femur > prefemur > tarsus > post-femur = tibia. Scopulae on anterior legs on femur, postfemur, tibia and tarsus; those on femur and postfemur missing from posterior legs.

STERNUM 5. A small semicircular process between legs 4.

STERNUM 6. Deeply excavated, rim simple.

GONOPODS (Fig. 25). Coxa without a lateral process; coxal lobe (*cxl*) not very prominent. Prefemoral part (*prf*) ca  $0.3 \times$  as long as acropodite; mesal acropodital process (*map*) large, lamelloid, ventral margin strongly convex, dorsal margin concave, in profile the process vaguely resembles the torso of a pregnant woman (sway-backed, big belly), tip of process with two strong denticles, a few smaller denticles along apical part of ventral and especially dorsal margin; solenophore (*sph*) a simple rolled sheet, less than  $\frac{2}{3} \times$  as long as *map*, forming a tube with two small apical denticles.

### **Specimens from West Kilombero Scarp FR, including Ndundulu Forest:**

Similar to type specimens, except as follows:

SIZE. Max. width 2.5–2.9 mm.

COLOUR. After 10 years in alcohol more or less faded, but differs from type specimens in having the collum pale with dark margins.

ANTENNAE. Reaching middle of ring 3.

LEGS. Length  $1.4 \times$  body diameter.

GONOPODS. Denticles on ventral and dorsal margin of *map* in part indistinct/missing.

### **Distribution and habitat**

Known from several sites in the Udzungwa Mts National Park and West Kilombero FR. Altitudinal range 1452–1880 m a.s.l. Habitat: mainly found in tropical semi-evergreen forest, but also in (open) *Acacia* woodland (cf. Frontier Tanzania 2001: 27, 174). Collected together with *E. acaciae* sp. nov. in West Kilombero FR, Plot *Acacia*, and with *E. sternale* sp. nov. in Ndundulu Forest.

### **Remarks**

The differences between the type specimens and those from West Kilombero FR seem to be constant, but they are not regarded as significant enough to distinguish the two populations taxonomically.

## **The *sternale* group**

### **Diagnosis**

Species of *Eviulisoma* in which sternum 6 is deeply excavated, there is no intermediate acropodital process, the solenophore is a tightly rolled-up sheet of a tube-like appearance (with a few small processes), the mesal acropodital process is not particularly compressed, but is apically furcate and longer than the solenophore, and the rim of sternum 6 forms four lobes.

Included species:

*E. sternale* sp. nov.

*E. kangense* sp. nov.

*E. zebra* sp. nov.



No further species can be assigned to this group based on the existing literature. VandenSpiegel & Golovatch (2014: fig. 6e) illustrated the sternum 6 excavation in *E. taita* VandenSpiegel & Golovatch, 2014, and it appears that there are small lobes at the base of legs 6–7. However, in *E. taita* the mesal acropodital has no apical furcation and is shorter than the solenophore.

*Eviulisoma sternale* sp. nov.

[urn:lsid:zoobank.org:act:C1C01D8B-4082-4DF2-83F0-FB8F444CF9F7](http://urn:lsid:zoobank.org:act:C1C01D8B-4082-4DF2-83F0-FB8F444CF9F7)

Figs 26–27

**Diagnosis**

Differs from other species of the *E. sternale* group by its smaller size (width 2.0 mm, vs 3.0–3.2 mm in other species) and by having an apical dentate ridge on *map*.

**Etymology**

The name is an adjective referring to the modified 6<sup>th</sup> male sternum.

**Material studied** (total: 1 ♂)

**Holotype**

TANZANIA: ♂, Iringa Region, Udzungwa Mts, West Kilombero Scarp FR, Ndundulu Forest 07°46' S, 36°29' E, Waller's camp, tropical semi-evergreen forest, 1550 m a.s.l., 1–12 Jan. 2007, L.A. Hansen and local assistants leg. (ZMUC).

**Referred non-type material**

TANZANIA: 2 ♀♀, same collection data as for holotype (ZMUC); 1 ♀, 3 juv., same collection data as for holotype, but Dec. 2006 (ZMUC).

**Description** (male)

SIZE. Length 23 mm, max width 2.0 mm.

COLOUR. After 10 years in alcohol, overall impression: contrasting dark and pale transverse bands. Head brown; collum black; prozonites yellowish white; metazonites black; antennae and legs light yellow; telson brown, darker (black) dorsally.

ANTENNAE. Reaching back to middle of ring 4.

BODY RINGS. Paranota completely absent. Stricture deep, broad, smooth. Setae absent, except for a mid-dorsal pair on ring 2.

HYPOPROCT. Semicircular, no distinct tubercles.

LEGS. Length 1.5 × body width. Relative lengths of podomeres: femur > tarsus > prefemur > tibia > postfemur. Scopulae present on tibia and tarsus on pre-gonopodal legs (Fig. 26C); also present, but poorly developed, on femur and postfemur. Prefemur and femur of post-gonopodal legs ventrally smooth, almost hairless (Fig. 26B).

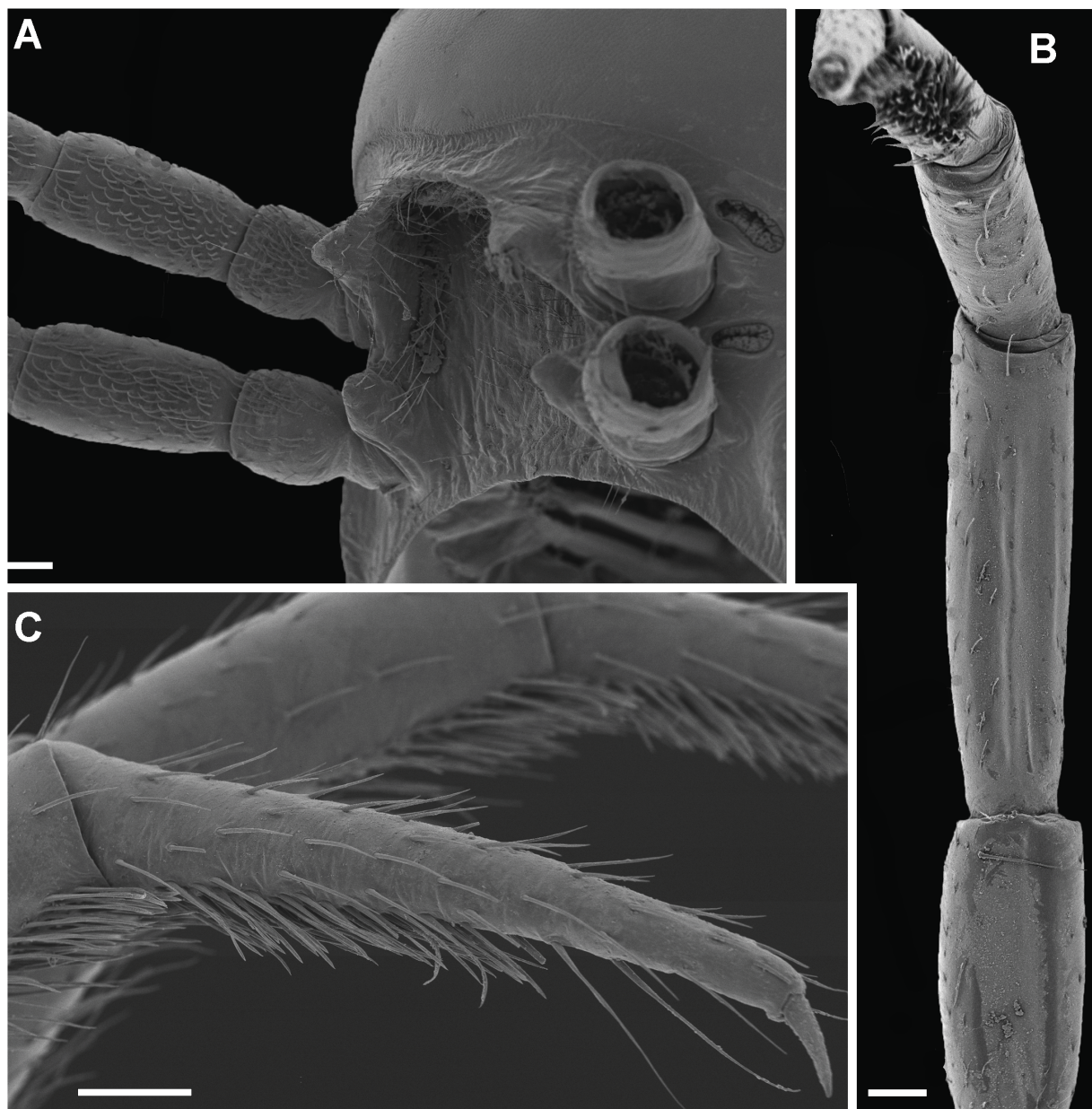
STERNUM 5. A bell-shaped process between coxae 4.

STERNUM 6 (Fig. 26A). Deeply excavated. Lateral rims of excavation produced into two lobes on each side, one lobe at basis of each leg.

GONOPODS (Fig. 27). Coxal lobe (*cxl*) moderately developed. Prefemoral part (*prf*) ca half as long as acropodite. Mesal acropodital process (*map*) long, straight, stout, with a deep, broad furrow on apical part of mesal surface, apically with three stout, triangular tines (*tn1*, *tn2*, *tn3*) and a transverse, dentate ridge (*dr*). Solenophore (*sph*) a simple rolled sheet, considerably shorter than process *map*, apically with two small processes.

#### Distribution and habitat

Known only from the West Kilombero Scarp FR, Ndundulu Forest, 1550 m a.s.l. Habitat: tropical semi-evergreen forest. Collected together with *E. grumslingslak* sp. nov.

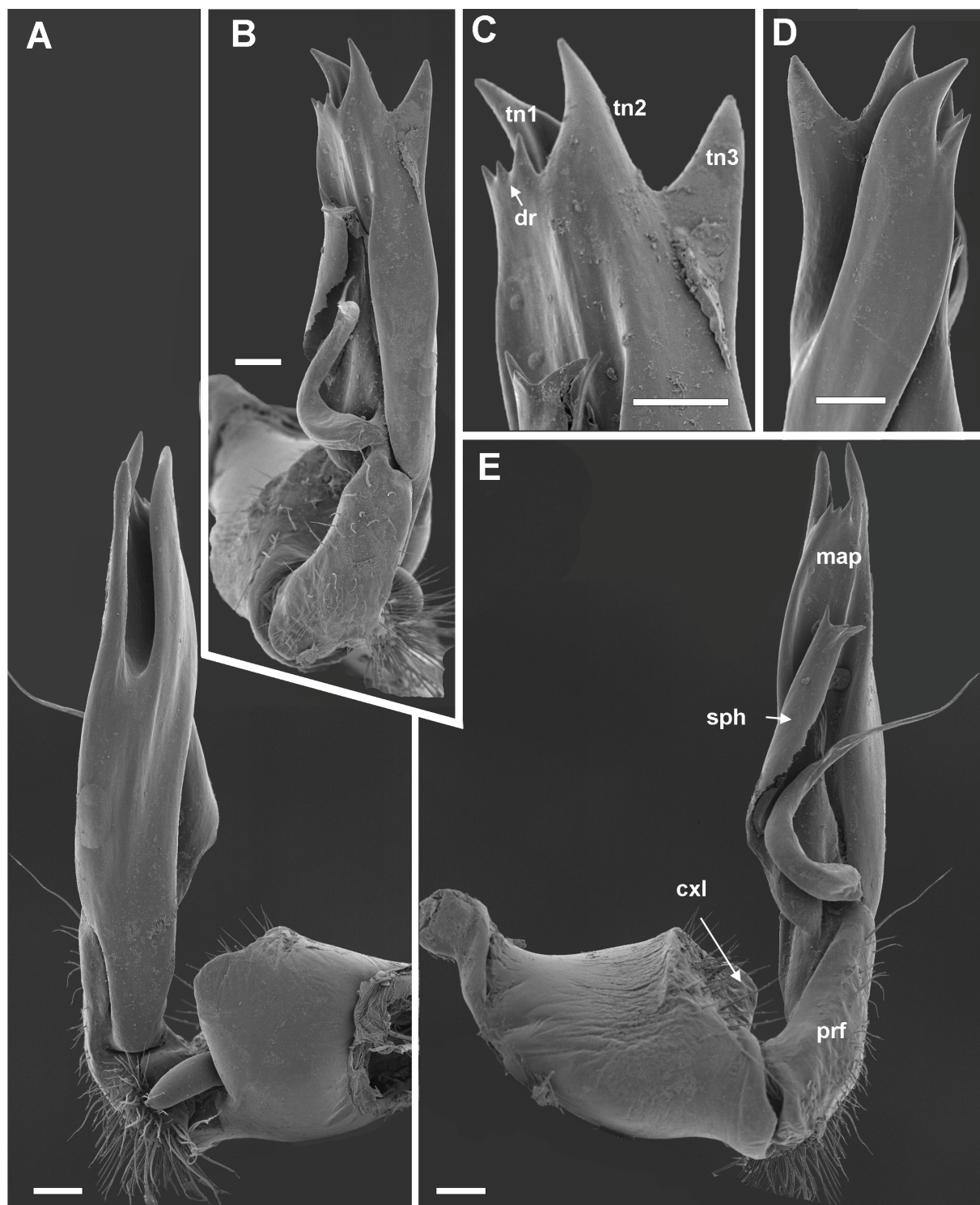


**Fig. 26.** *Eviulisoma sternale* sp. nov., holotype. **A.** Ventral side of 6<sup>th</sup> body ring with right side legs, showing lobed rim of excavation. **B.** Post-gonopodal leg, showing smooth prefemur and femur. **C.** Pre-gonopodal leg, showing scopula. Scale bars: 0.1 mm.



# Remarks

The ventrally smooth prefemora and femora is an unusual feature of this species, shared only with *E. kangense* sp. nov. (see Discussion).



**Fig. 27.** *Eviulisoma sternale* sp. nov., holotype, right gonopod. **A.** Mesal view. **B.** Ventral view. **C.** Tip of mesal acropodital process (*map*), ventral view. **D.** As C, dorsal view. **E.** Lateral view. Abbreviations: *cxl* = coxal lobe; *dr* = dentate ridge; *map* = mesal acropodital process; *prf* = prefemoral part; *sph* = solenophore; *tn1*, *tn2*, *tn3* = apical tines of process *map*. Scale bars: 0.1 mm.



***Eviulisoma kangense* sp. nov.**

[urn:lsid:zoobank.org:act:5BB2A851-08A1-439E-95A5-241DF9AA50DD](http://urn:lsid:zoobank.org:act:5BB2A851-08A1-439E-95A5-241DF9AA50DD)

Figs 28–29

**Diagnosis**

Differs from other species of the *E. sternale* group by having the solenophore almost as long as *map*. Differs from *E. sternale* sp. nov. by its larger size (width 3.2 mm vs 2.0 mm) and by having a slenderer *map* without an apical dentate ridge. Differs from *E. zebra* sp. nov. by having a flattened, almost hairless area on the ventral side of the prefemora and femora of the legs of a number of post-gonopodal body rings.

**Etymology**

The name is an adjective referring to the type locality, the Kanga Mts.

**Material studied** (total: 12 ♂♂)

**Holotype**

TANZANIA: ♂, Kanga Mts, Morogoro Region, Kanga FR, 400–500 m a.s.l., 22–25 Nov. 1984, lowland rainforest, N. Scharff leg. (ZMUC).

**Paratypes**

TANZANIA: 11 ♂♂, same collection data as for holotype (ZMUC).

**Referred non-type material**

TANZANIA: 4 ♀♀, 1 juv., same collection data as for holotype (ZMUC).

**Description** (male)

SIZE. Length 33 mm, max. width 3.2 mm.

COLOUR. Overall impression ringed. Head, collum, posterior  $\frac{2}{3}$  of metazonites, epiproct and paraprocts dark brown, rest of body and appendages pale yellowish.

ANTENNAE. Reaching back to middle of ring 4.

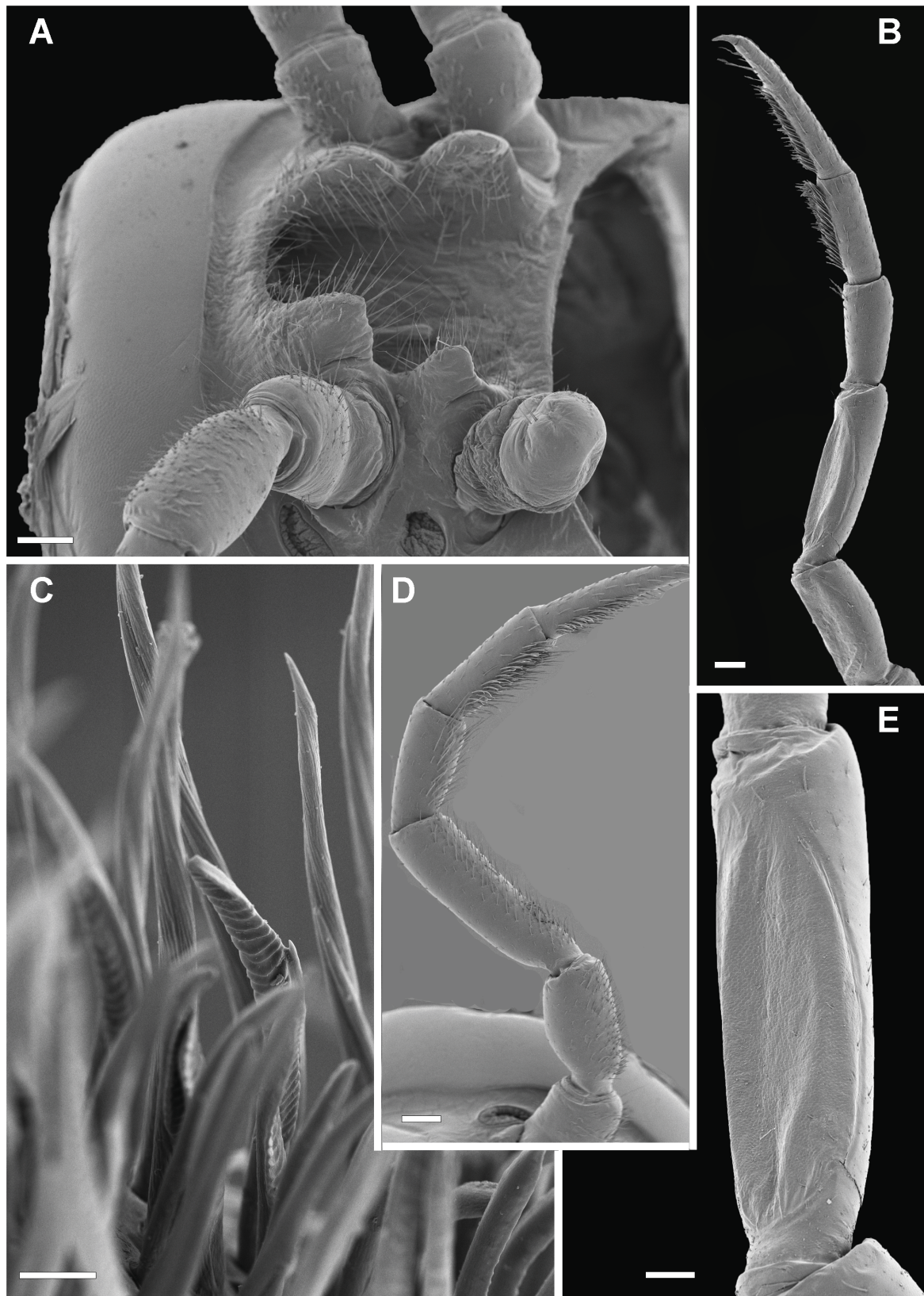
BODY RINGS. Paranota sometimes visible as a very faint line/keel on ring 2 (as Fig. 4C), otherwise completely absent. Stricture between pro- and metazonite striolate. A transverse row of setae on all rings, but many setae abraded.

HYPOPROCT. Rounded-trapezoid, without distinct tubercles.

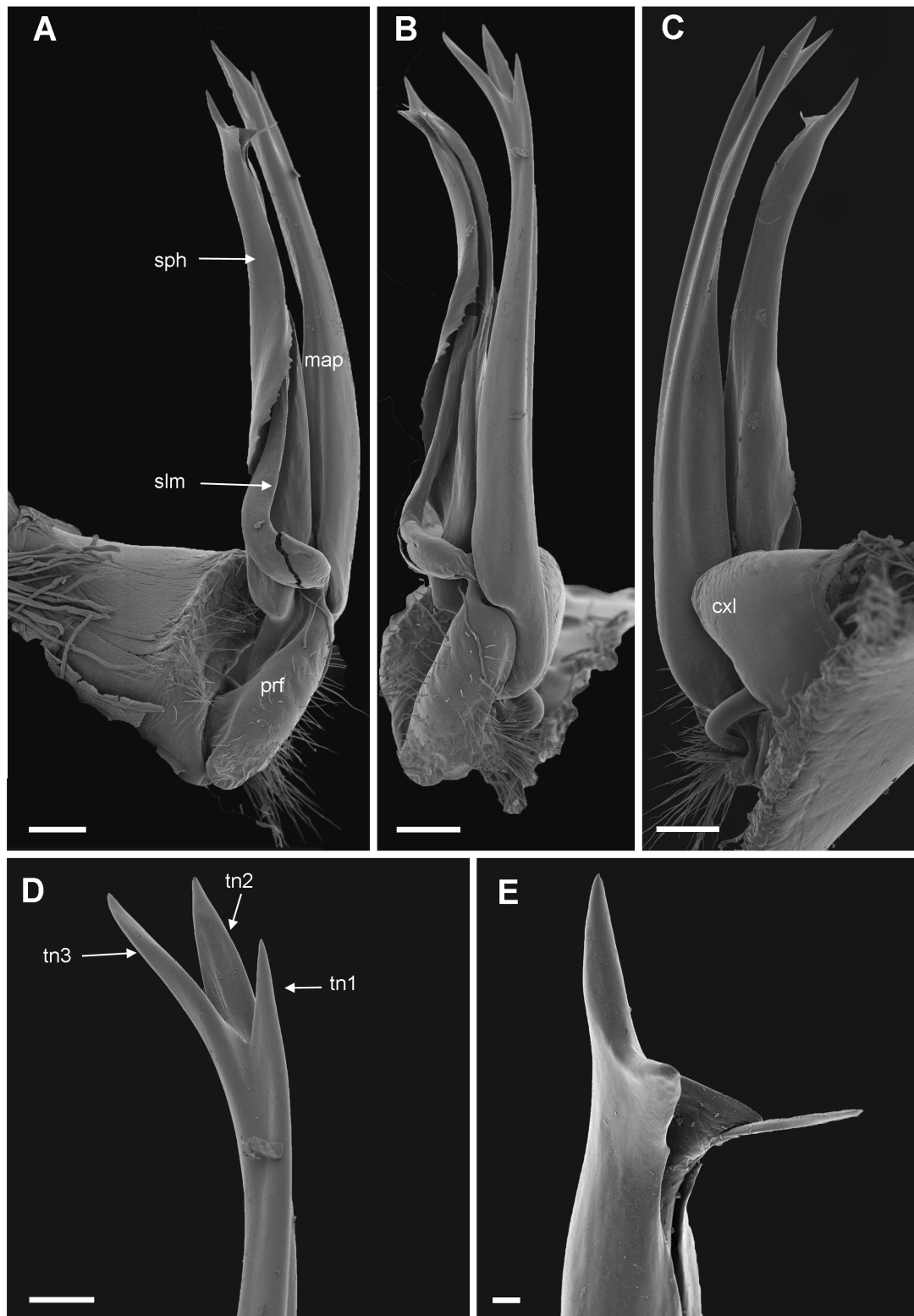
LEGS. Length  $1.5 \times$  body width. Relative lengths of podomeres: femur  $\approx$  tarsus  $>$  prefemur  $>$  tibia  $>$  postfemur. Tibiae and tarsi with dense scopulae (Fig. 28B–C); prefemora and femora of legs of rings 8–18 ventrally with a flattened, almost hairless area clearly demarcated against the normal surface (Fig. 28E).

STERNUM 5. A rounded-rectangular process, sometimes slightly bilobed, between legs 4.

STERNUM 6. Deeply excavated. Lateral rims of excavation produced into two lobes on each side, one lobe at basis of each leg (Fig. 28A).



**Fig. 28.** *Eviulisoma kangense* sp. nov., paratype. **A.** Body ring 6, oblique ventral view. **B.** Post-gonopodal leg. **C.** Detail of scopula. **D.** Pre-gonopodal leg (leg from ring 6). **E.** Femur of post-gonopodal leg, showing smooth, soft ventral surface. Scale bars: A–B, D = 0.2 mm; C = 0.01 mm; E = 0.1 mm.



**Fig. 29.** *Eviulisoma kangense* sp. nov., paratype, right gonopod. **A.** Lateral view. **B.** Ventral view. **C.** Mesal and slightly dorsal view. **D.** Tip of mesal acropodital process (*map*). **E.** Tip of solenomere. Aluminium tape used for mounting visible in lower right part of **C**. Abbreviations: *cxi* = coxal lobe; *map* = mesal acropodital process; *prf* = prefemoral part; *slm* = solenomere; *sph* = solenophore; *tn1*, *tn2*, *tn3* = apical tines of process *map*. Scale bars: **A–C** = 0.2 mm; **D** = 0.1 mm; **E** = 0.02 mm.



GONOPODS (Fig. 29). Coxal lobe (*cxl*) prominent. Prefemoral part (*prf*) ca  $\frac{1}{3}$  as long as acropodite. Mesal acropodital process (*map*) long, slender, slightly curved, apically divided into three pointed tines (*tn1*, *tn2*, *tn3*); dorsal tine (*tn1*) shortest, separated from the two other tines by a V-shaped incision. Solenophore (*sph*) almost as long as *map*, a simple 'rolled sheet', ending in two small triangular processes.

### Distribution and habitat

Known only from the Kanga Mts, Kanga FR, 400–500 m a.s.l. Habitat: lowland rainforest. The Kanga Mts belong to the Nguru massif, one of the smaller blocks of the Eastern Arc Mountains, situated some 150 km N of the Udzungwa Mts.

### Remarks

Although females have in general not been considered in this paper, it is worth noting that in this species, female legs are without dense setation on any podomere, and without modified prefemora and femora. See also Discussion.

*Eviulisoma zebra* sp. nov.

[urn:lsid:zoobank.org:act:CDF79D62-E412-4DC3-AE93-6832AAC737A4](http://urn:lsid:zoobank.org:act:CDF79D62-E412-4DC3-AE93-6832AAC737A4)

Figs 1, 4C, 30–31

### Diagnosis

Differs from other species of the *E. sternale* group by the combination of its large size (width 3.0 mm), the lack of an apical dentate ridge on *map* and the lack of modification of post-gonopodal prefemora and femora.

### Etymology

A noun in apposition alluding to the striped appearance of this species.

**Material studied** (total: 5 ♂♂)

#### Holotype

TANZANIA: ♂, Udzungwa Mts National Park, 07°40.786' S, 36°55.120' E, 1450 m a.s.l., 8 Oct. 2014, Martin Nielsen leg. (ZMUC).

#### Paratypes

TANZANIA: 4 ♂♂, same collection data as for holotype (ZMUC).

### Description (male)

SIZE. Length 31 mm, max. width 3.0 mm.

COLOUR. Live (Fig. 1) and freshly preserved animals vividly ringed. Head, collum, telson and metazonites except for a narrow anterior zone deep black, contrasting with white prozonites, antennomeres 1–5 and legs; antennomeres 6–7 brown.

ANTENNAE. Reaching back to anterior part of ring 5.

BODY RINGS. Paranota absent, except for tiny keels on ring 2 (Fig. 4C). Stricture between pro- and metazonite clearly striolate (Fig. 30A). A transverse row of setae on ring 2, ring 3 sometimes with a few tiny setae, following rings without setae.

HYPOPROCT. Rounded-trapezoid, without distinct tubercles.

**LEGS.** Length  $1.3 \times$  body width. Relative lengths of podomeres: femur > prefemur  $\approx$  tarsus > tibia > postfemur. Legs densely hirsute on ventral surface (Fig. 30D), but proper scopulae poorly developed, on postfemur, tibia and tarsus (Fig. 30C); those on tarsus also present on posteriormost legs, however.

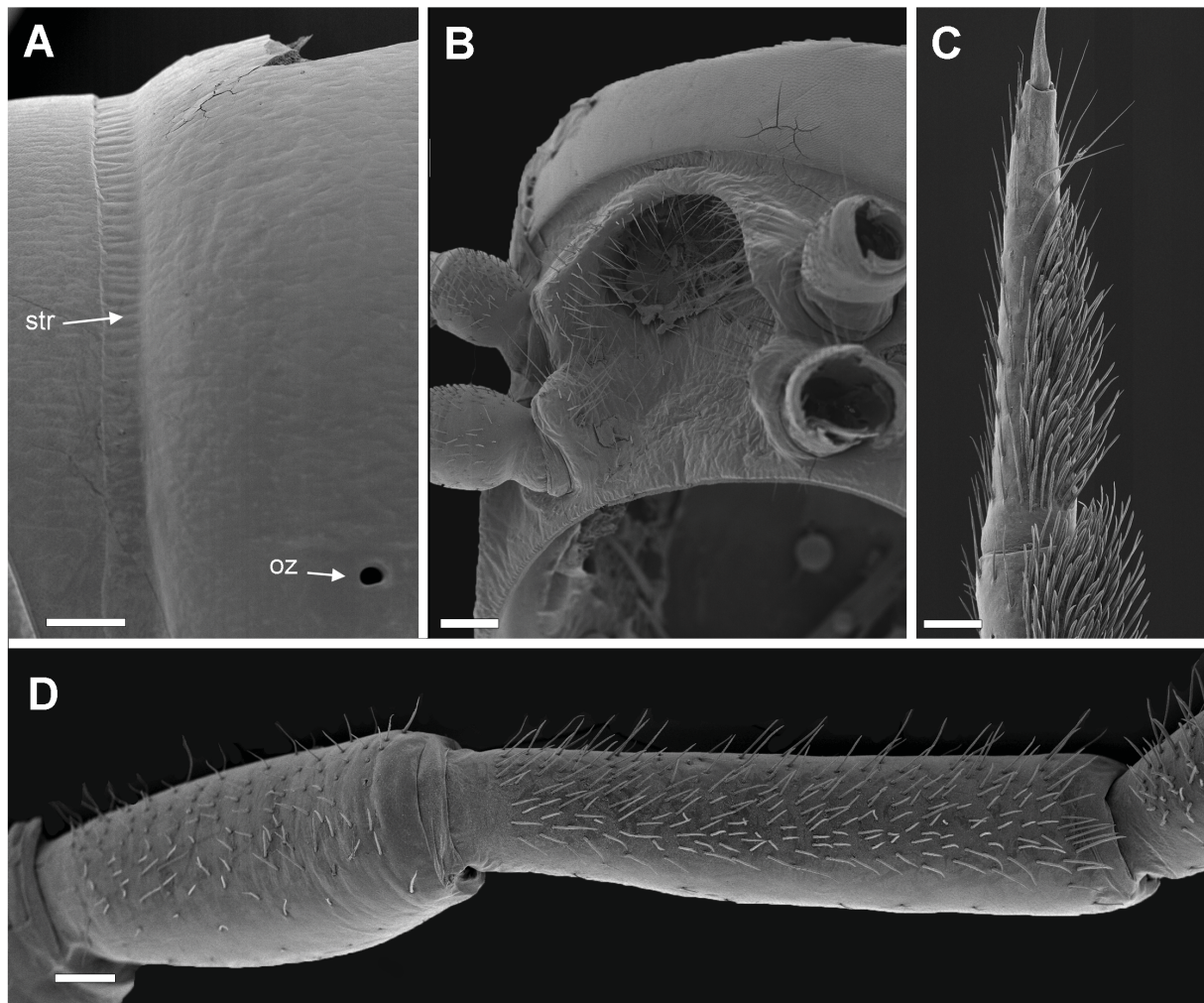
**STERNUM 5.** A rounded-trapezoid process between legs 4.

**STERNUM 6** (Fig. 30B). Deeply excavated. Lateral rims of excavation produced into two lobes on each side, one lobe at basis of each leg.

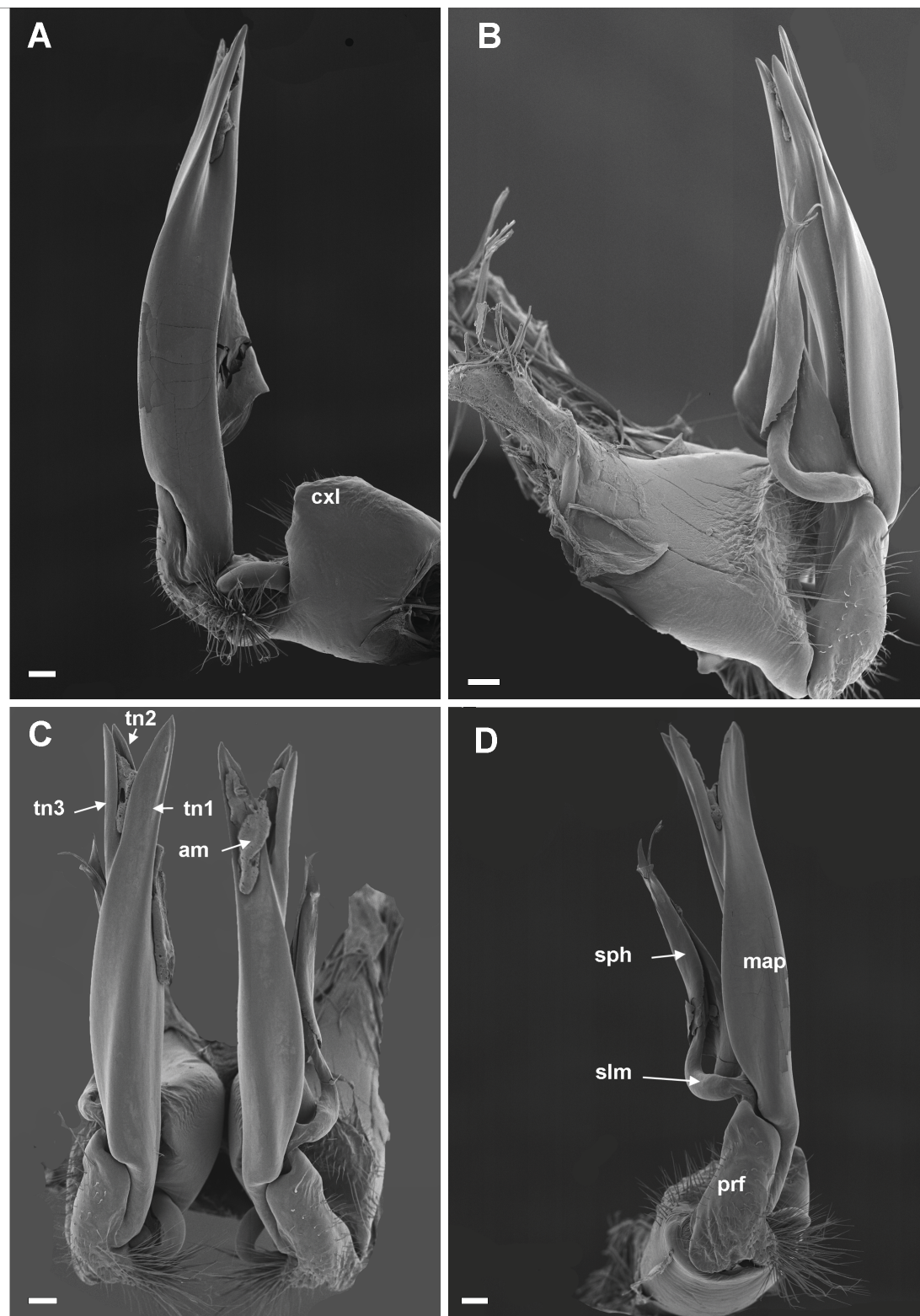
**GONOPODS** (Fig. 31). Coxal lobe (*cxl*) prominent. Prefemoral part (*prf*) ca  $0.3 \times$  as long as acropodite. Mesal acropodital process (*map*) long, slender, slightly curved, apically divided into three pointed tines (*tn1*, *tn2*, *tn3*); ventral tine (*tn1*) process largest, separated from the two others by a V-shaped incision; lumps of an amorphous mass (*am*) adhering to tip of *map*. Solenophore (*sph*) ca  $0.7 \times$  as long as *map*, a simple rolled sheet, ending in two small processes, one slender, the other broadly triangular.

### Distribution and habitat

Known only from the Udzungwa Mts National Park, 1450 m a.s.l.



**Fig. 30.** *Eviulisoma zebra* sp. nov., paratype. **A.** Midbody ring, showing carinulate stricture and ozopore. **B.** Sternum 6, showing lobate rim of excavation. **C–D.** Midbody leg. **C.** Tarsus and part of tibia, showing scopulae. **D.** Prefemur and femur, showing dense setation. Abbreviations: *oz* = ozopore; *str* = stricture. Scale bars: A–B = 0.2 mm; C–D = 0.1 mm.



**Fig. 31.** *Eviulisoma zebra* sp. nov., paratypes. **A.** Paratype 1, right gonopod, mesal view. **B–C.** Paratype 2, gonopods. **B.** Lateral view. **C.** Ventral view; notice lumps of secretion between apical tines. **D.** Paratype 1, right gonopod, (latero-)ventral view. Abbreviations: *am* = amorphous mass; *cxl* = coxal lobe; *map* = mesal acropodital process; *sph* = solenophore; *slm* = solenomere; *tn1*, *tn2*, *tn3* = apical tines of process *map*. Scale bars: 0.1 mm.



## Remarks

Although this species is very similar to the two other species in the *E. sternale* group, especially to *E. kangense* sp. nov., it differs by lacking the peculiar modifications of the prefemur and femur of at least some post-gonopodal legs.

## The *iuloideum* group

### Diagnosis

Species of *Eviulisoma* in which sternum 6 is deeply excavated with unlobed margins, the gonopod acropodite has a separate basal ‘femorite’ part, there is no intermediate acropodital process and the solenophore is a large, unrolled sheet without apical lobes.

Included species:

*E. iuloideum* (Verhoeff, 1941)

*E. articulatum* sp. nov.

This group corresponds to the genus *Himatiopus* Verhoeff, 1941. The description of *E. iuloideum* by Verhoeff (1941) is quite good, and the similarity with *E. articulatum* sp. nov. is obvious. An examination of the type material of *Himatiopus iuloideus* confirmed the similarity but also confirmed that the two species are indeed different.

*E. lanceolatum* Attems, 1953 (Congo) also seems to have an articulated acropodite, but the solenophore is quite different (Jeekel 2003); hence, *E. lanceolatum* is not regarded as a member of the *iuloideum* group.

### *Eviulisoma iuloideum* (Verhoeff, 1941)

Fig. 32

*Himatiopus iuloideus* Verhoeff, 1941: 243.

*Eviulisoma iuloides* – Jeekel 1968: 101.

*Eviulisoma iuloideus* – Mortiz & Fischer 1978: 105.

*Eviulisoma iuloideum* – Jeekel 2003: 69.

### Diagnosis

Differs from all other *Eviulisoma* species, except *E. articulatum* sp. nov. and *E. lanceolatum*, by the obviously articulated gonopod acropodite. Very similar to *E. articulatum* sp. nov., with which it shares the very large, subrectangular solenophore, but differs from that species by having a cylindrical mesal acropodite process (*map*) without a subapical side branch (vs *map* tapering, with a side branch), as well as by having a triangular hypoproct (vs a rounded trapezoid, tritubercuate hypoproct).

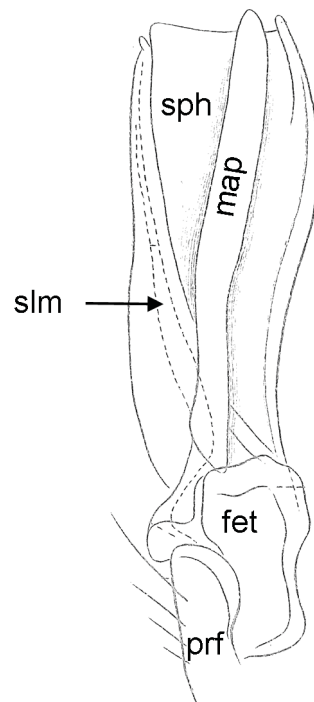
### Material studied

#### Syntypes

TANZANIA (all in ZSM): 1 ♂ (only posterior half), 1 ♀, in alcohol, non-original label “*Himatiopus iuloideus* Verhoeff, Tanganjika, Tier mit Originaldet.-Etik. (Typus-Verd.), ehem. Trockenm. Etik. Nr.1277”; slide with gonopod, labelled “A20035148, *Himatiopus juloideus* Verh. Gp. ♂ Tanganjika”; slide with male leg pairs 1–6, labelled “A20035147, *Himatiopus juloideus* Verh. 1.–6. B. ♂ Tanganjika”; 2 ♀♀, in alcohol, “Tanganykia, Mufindi, Iringa, in tea nursery, xii – 1930, W. V. Harris, from DAO”.

### Remarks

As far as can be seen from the available material, *E. iuloideum* shares the general morphology of the Udzungwan *Eviulisoma* species. It is especially similar to *E. articulatum* sp. nov., from which it differs



**Fig. 32.** *Eviulisoma iuloideum* (Verhoeff, 1941), right gonopod telopodite, mesal view. Abbreviations: *fet* = ‘femorite’; *map* = mesal acropodital process; *prf* = prefemoral part; *slm* = solenomere (hidden behind a fold of the solenophore); *sph* = solenophore. After Verhoeff (1941), modified.

gonopod-wise as specified in the diagnosis. Figure 32 (from Verhoeff 1941) shows the gonopod telopodite of *E. iuloideum*; a restudy of the gonopod slide confirmed that Verhoeff’s drawing is accurate. In particular, the mesal acropodital process (*map*) does not have a subapical side branch. The two species also differ in the shape of the hypoproct, which in *E. iuloideum* is triangular vs rounded trapezoid, with three tubercles in *E. articulatum* sp. nov. According to Verhoeff (1941), *E. iuloideum*, unlike *E. articulatum* sp. nov., has no setae on the collum and body rings (“spärliche Beborstung nur am Telson”), but considering how delicate and hard to see these setae are, this difference is hardly significant. The type locality of *E. iuloideum*, “Tanganjikasee bei Mufundi-Iringa”, probably refers to Mufundi SW of Iringa City, some 100 km SW of the type locality of *E. articulatum* sp. nov., i.e., outside the Udzungwa Mts (and, as is the case with several other localities at the “Tanganjikasee” mentioned by Verhoeff 1941, very far from Lake Tanganjika [did Verhoeff misread “tea nursery”?]).

***Eviulisoma articulatum* sp. nov.**

[urn:lsid:zoobank.org:act:FD505E16-0A0E-47FB-AB2D-5200D8346CF2](http://urn:lsid:zoobank.org:act:FD505E16-0A0E-47FB-AB2D-5200D8346CF2)

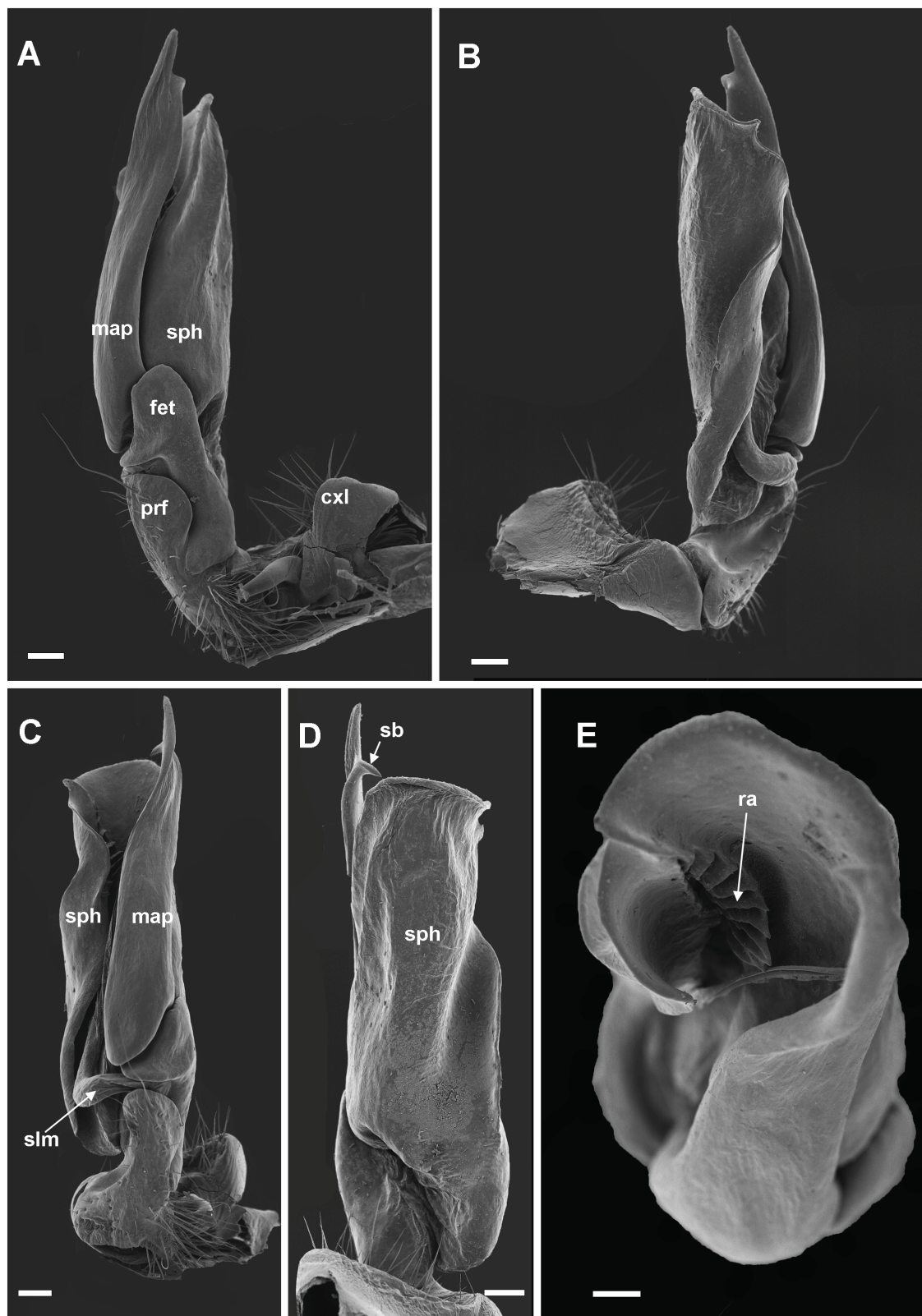
Fig. 33

**Diagnosis**

Differs from all other *Eviulisoma* species, except *E. iuloideum* and *E. lanceolatum*, by the obviously articulated gonopod acropodite. Very similar to *E. iuloideum*, with which it shares the very large, subrectangular solenophore, but differs from that species by having a pointed, tapering mesal acropodite process (*map*) with a subapical side branch (vs *map* cylindrical, not tapering and without a side branch), as well as by having a rounded trapezoid, tritubercuate hypoproct (vs a triangular hypoproct).

**Etymology**

The specific epithet is an adjective referring to the articulated gonopod acropodite.



**Fig. 33.** *Eviulisoma articulatum* sp. nov., holotype, right gonopod. **A.** Mesal view. **B.** Lateral view. **C.** Ventral view. **D.** Dorsal view. **E.** Acropodite, distal (-anterior) view. Abbreviations: *cxi* = coxal lobe; *fet* = 'femorite'; *map* = mesal acropodital process; *ra* = ridged area on internal surface of *sph*; *sb* = side branch of *map*; *slm* = solenomere; *sph* = solenophore. Scale bars: A–D = 0.1 mm; E = 0.05 mm.



**Material studied** (total: 1 ♂)

**Holotype**

TANZANIA: ♂, Iringa Region, Iringa District, Kalimbasi Mountain, 2000–2100 m a.s.l., 10 km S of Mazombe, forest floor, Jan. 1984, J. Kielland leg. (VMNH).

**Description** (male)

SIZE. Length 18 mm, max. width 1.9 mm.

COLOUR. Completely pallid after 33 years in alcohol.

ANTENNAE. Reaching back to middle of ring 3.

BODY RINGS. Paranota completely absent. Stricture between pro- and metazonite faintly striolate. A transverse row of setae on all body rings.

HYPOPROCT. Rounded trapezoid, with three poorly developed tubercles.

LEGS. Stout, length  $0.8 \times$  body width. Relative lengths of podomeres: femur > prefemur > tarsus > postfemur > tibia. Scopulae very well-developed, on femur, postfemur, tibia and tarsus, absent from femur only on posteriormost leg pairs.

STERNUM 5. A rounded-rectangular process, between legs 4.

STERNUM 6. Deeply excavated. Lateral rims of excavation simple.

GONOPODS (Fig. 33). Coxal lobe (*cxl*) moderate. Prefemoral part (*prf*) ca half as long as acropodite. Acropodite with a separate basal part ('femorite', *fet*) separated from apical part by an arched articulation at ca  $\frac{1}{3}$  of its length. Mesal acropodital process (*map*) simple, stout, slightly arched, tapering, apically pointed, with a small laterad subapical side branch (*sb*). Solenophore (*sph*) a very large subrectangular sheet, almost as long as *map*, distal margin in lateral view (Fig. 33B) oblique with a small triangular tooth in middle. Internal surface (Fig. 33E) with a deeply ridged area (*ra*).

**Distribution and habitat**

Known only from Kalimbasi Mountain, S of Mazombe town, 2000–2100 m a.s.l. The site is located in the Kisinga-Rugaro FR.

**Ungrouped species**

Three species have no very similar congeners, neither among the species treated here, nor, as far as can be deduced, among previously described species. Rather than erecting a group for each of these, they are left ungrouped.

Ungrouped species:

*E. angulatum* sp. nov.

*E. biquintum* sp. nov.

*E. breviscutum* sp. nov.

*Eviulisoma angulatum* sp. nov.

[urn:lsid:zoobank.org:act:B9772330-5C4A-4CFC-A5A0-A8A4DE67AC65](http://urn:lsid:zoobank.org:act:B9772330-5C4A-4CFC-A5A0-A8A4DE67AC65)

Fig. 34

**Diagnosis**

Differs from all other *Eviulisoma* species by the angular rim of the sternum 6 excavation and by the opposing hooks of the mesal acropodital process (*map*) and the solenophore (*sph*).

**Etymology**

The specific epithet is an adjective referring to the angular shape of the rim of the excavation of the male sternum 6.

**Material studied** (total: 7 ♂♂)

**Holotype**

TANZANIA: ♂, Morogoro Region, Udzungwa Mts National Park, Kidatu, Plot 5, 07°40'45.5" S, 36°55'06.9" E, 1448 m a.s.l., 21 Oct. 2014, pitfall trapping, J. Malumbres-Olarte leg. (ZMUC).

**Paratypes**

TANZANIA: 6 ♂♂, same collection data as for holotype (ZMUC).

**Description** (male)

SIZE. Length 14 mm, max. width 1.3 mm.

COLOUR. Overall colour after 3 years in alcohol medium brown, lighter ventrally. Clypeolabral region, mandibular bases, antennae and legs pale yellowish.

ANTENNAE. Reaching back to middle of ring 3.

BODY RINGS. Paranota completely absent. Stricture between pro- and metazonite indistinctly striolate. No setae on postcollar body rings.

HYPOPROCT. Triangular, tubercles indistinct.

LEGS (Fig. 34G). Stout, length  $\approx$  body width. Relative lengths of podomeres: femur > prefemur > tarsus > postfemur = tibia. Scopulae on femur, postfemur, tibia and tarsus on anterior legs, only on tibia and tarsus on posterior legs.

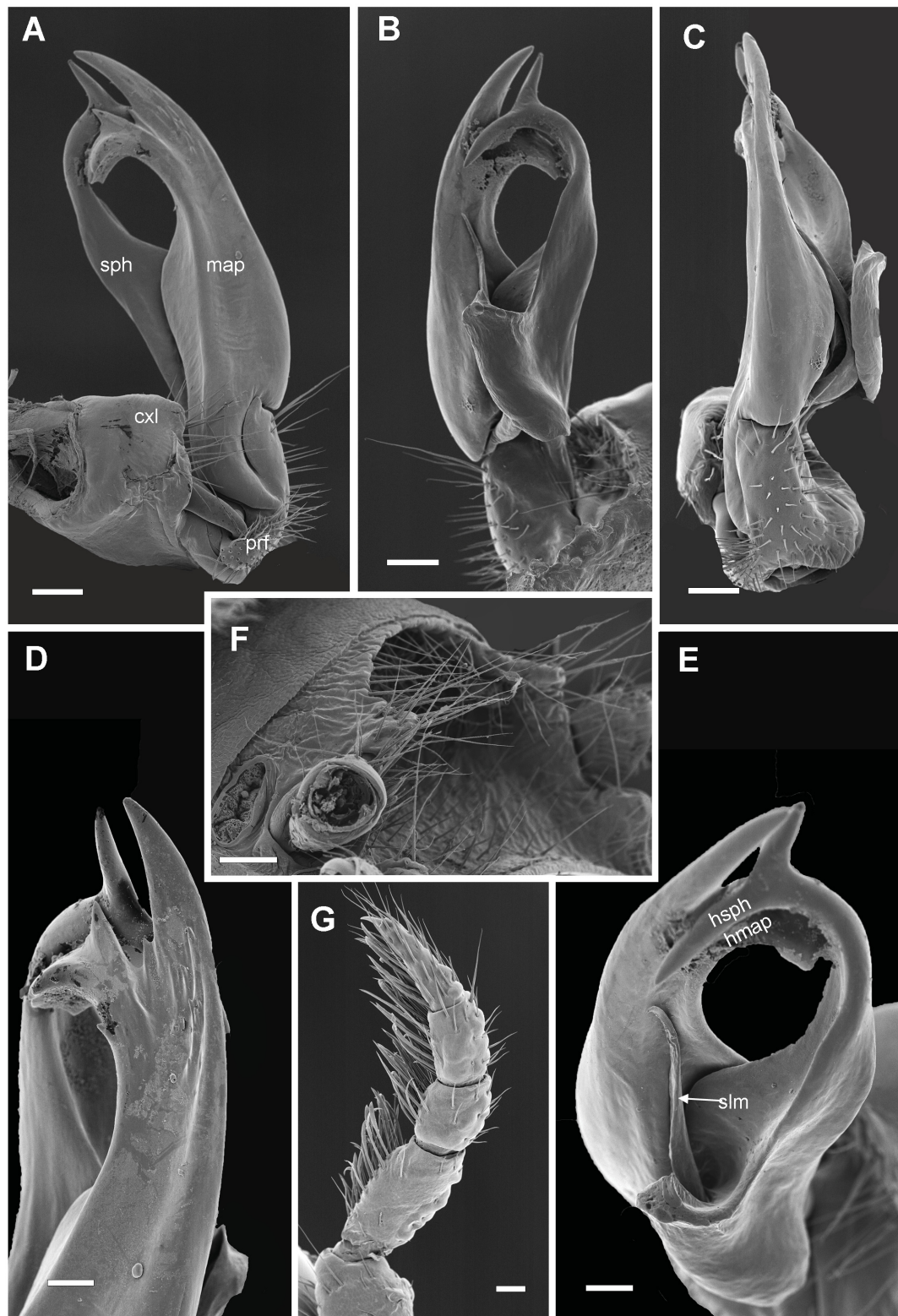
STERNUM 5. A high, narrow, rectangular hairy process between legs 4.

STERNUM 6 (Fig. 34F). Deeply excavated. Rim of excavation laterally forming prominent rectangular 'corners'.

GONOPODS (Fig. 34A–E). Coxal lobe (*cxl*) moderate. Prefemoral part (*prf*) almost half as long as acropodite. Mesal acropodital process (*map*) stout, slightly arched, subapically with irregular ridges on mesal surface, ending in pointed tip; a large subapical irregular, dorsad hook (*hmap*), with a small pointed side branch. Solenophore (*sph*) as long as *map*, stout, arched, ending in pointed tip similar to that of *map*; a large subapical ventrad hook (*hsph*) lying parallel to hook (*hmap*) of mesal acropodital process.

**Distribution and habitat**

Known only from the Udzungwa Mts National Park, Kidatu, 1448 m a.s.l.



**Fig. 34.** *Eviulisoma angulatum* sp. nov., paratype. A–E. Left gonopod. A. Mesal view. B. Lateral view. C. Ventral view. D. Tips of mesal acropodital process and solenophore, mesal view. E. As D, latero-dorsal view, also showing solenomere. F. Excavation of sternum 6. G. Leg from ring 6. Abbreviations: *cxl* = coxal lobe; *hmap* = hook-shaped process of *map*; *hsph* = hook-shaped process of *sph*; *prf* = prefemoral part; *slm* = solenomere; *sph* = solenophore. Scale bars: A–C, F = 0.1 mm; D–E, G = 0.05 mm.



*Eviulisoma biquintum* sp. nov.

[urn:lsid:zoobank.org:act:0B213B4D-8455-4489-B253-13B7769E1611](http://urn:lsid:zoobank.org:act:0B213B4D-8455-4489-B253-13B7769E1611)

Figs 3C, 35, 39C

**Diagnosis**

Differs from all other species of *Eviulisoma* by having two knobs on sternum 5, one between coxae 4 and one between coxae 6. Differs from most species of *Eviulisoma* by lacking an excavation of sternum 6.

**Etymology**

The name is composed of the Latin *bi*, meaning ‘two’, and *quintum*, meaning ‘fifth’, and refers to the two knobs on sternum 5.

**Material studied** (total: 3 ♂♂)

**Holotype**

TANZANIA: ♂, Iringa Region, Iringa District, Nyambanike Mts, Udekwa Village, Ukami Forest, 7°42'49" S, 36°25'15" E, Jul.–Nov. 1994, David Moyer leg. (ZMUC).

**Paratypes**

TANZANIA: 1 ♂, Iringa District, Mwanihana FR, Uzungwa Mts, Sanje River valley near Sanje Falls, 3000 ft a.s.l., 23 Nov. 1979, W.A. Rodgers and K.H. Bulstrode leg. (VMNH); 1 ♂, Morogoro Region, Udzungwa Mts National Park, Mito Mitatu, Plot MM1, 07°50'16.3" S, 36°50'44.6" E, 800 m a.s.l., 22 Mar. 2013, hand collected, T. Pape and N. Scharff leg. (ZMUC).

**Description** (male)

SIZE. Length 19–24 mm, max. width 2.0–2.4 mm.

COLOUR. Specimen from Mito Mitatu after 4 years in alcohol with entire body deep black, except for amber-coloured sternal regions and contrastingly white legs (Fig. 3C). Specimen from Udekwa Village (holotype): after 23 years in alcohol head reddish brown; antennae, collum, metazonites and telson dark brown; prozonites and legs yellowish. Specimen from Mwanihana FR overall pallid after 38 years in alcohol, only metazonites dorsally very light brownish.

ANTENNAE. Reaching back to ring 4 or 5.

BODY RINGS. Paranota represented by very indistinct keels on body ring 2 (as Fig. 4C), otherwise completely absent. Stricture between pro- and metazonite smooth. No setae seen on post-collar metazonites (abraded?).

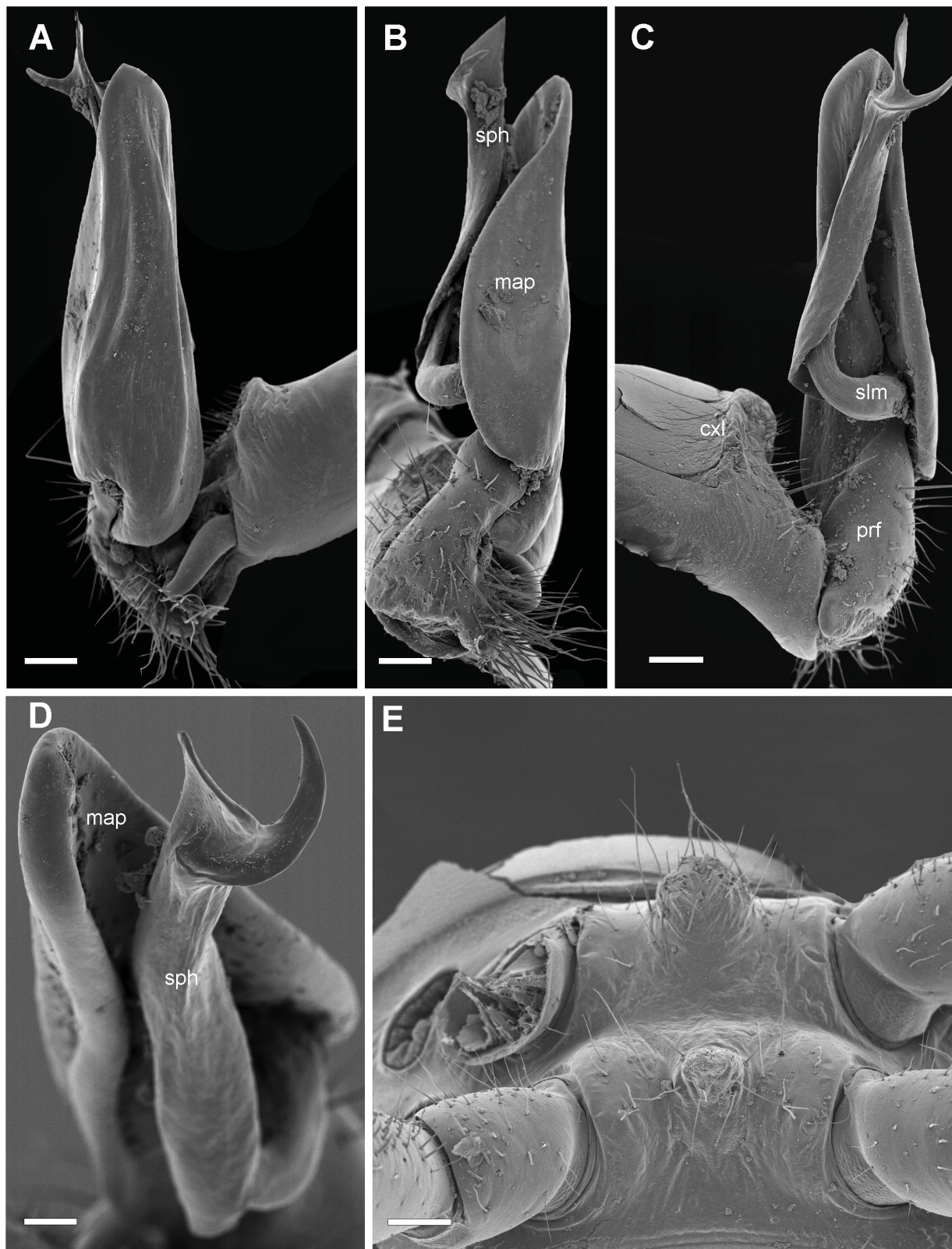
HYPOPROCT. Semicircular, no marginal tubercles.

LEGS. Length  $1.5 \times$  body width. Relative lengths of podomeres: tarsus ( $>$ ) femur  $>$  tibia ( $>$ ) prefemur ( $>$ ) postfemur. Scopulae poorly developed, only on tibia and tarsus, absent from posteriormost leg pairs.

STERNUM 5. With two small median knobs, one between legs 4, one between legs 5.

STERNUM 6. Not excavated, coxae more separated than on normal body rings.

GONOPODS (Fig. 35). Coxal lobe (*cxl*) moderate, irregular, not evenly rounded. Prefemoral part (*prf*) ca  $0.4 \times$  as long as acropodite. Mesal acropodital process (*map*) long, narrow, straight sides tapering



**Fig. 35.** *Eviulisoma biquintum* sp. nov., holotype. **A–D.** Right gonopod. **A.** Mesal view. **B.** Ventral view. **C.** Lateral view. **D.** Acropodite, subapical view. **E.** Sternum 5. Abbreviations: *cxi* = coxal lobe; *map* = mesal acropodital process; *prf* = prefemoral part; *slm* = solenomere; *sph* = solenophore. Scale bars: A–C, E = 0.1 mm; D = 0.05 mm.

towards tip, apically regularly rounded, dorsally concave, forming gutter for solenophore. Solenophore (*sph*) slender, simple, a little longer than *map*, apically with two slender processes.

### Distribution and habitat

Known from two parts of the Udzungwa Mts: Udzungwa Mountains National Park (incl. Mwanihana FR) and Nyambanike Mts in West Kilombero Scarp FR.

### Remarks

The newly collected specimen from the Udzungwa National Park is strikingly coloured – black body and white legs (Fig. 3C) – whereas the one from Nyambanike seems to be less remarkable in this respect. Fading with age of the specimen may explain the difference, but more specimens from each of these sites would be highly desirable in order to ascertain whether we are really dealing with only one species.

The gonopods resemble those of *E. taitaorum* VandenSpiegel & Golovatch, 2014, and *E. taita* VandenSpiegel & Golovatch, 2014. These two species, however, have an excavated sternum 6, and *E. taitaorum* lacks a lobe on sternum 5. No other species has two processes behind each other on sternum 5, according to available descriptions.

*Eviulisoma breviscutum* sp. nov.

[urn:lsid:zoobank.org:act:D7C4195B-37DF-4B02-BD3B-4447DBCBB23C](http://urn:lsid:zoobank.org:act:D7C4195B-37DF-4B02-BD3B-4447DBCBB23C)

Fig. 36

### Diagnosis

Differs from other Udzungwan species of *Eviulisoma* by the combination of unmodified sterna 5 and 6 and a very short *map* (ca half as long as solenophore).

### Etymology

The name is a noun in apposition meaning ‘short shield’ and refers to the short, shield-like mesal acropodital process.

**Material** (total: 3 ♂♂)

#### Holotype

TANZANIA: ♂, Mwanihana Forest, above Sanje, 1650 m a.s.l., pitfall trap, 18 Aug. 1982, M. Stoltze and N. Scharff leg. (ZMUC).

#### Paratypes

TANZANIA: 1 ♂, Morogoro Region, Kilombero District, Udzungwa Mts National Park, forest below Mwanihana Peak, 7°49' S, 36°50' E, 1800 m a.s.l., sifted from leaf litter, 20 Aug. 2017, T. Pape leg. (ZMUC); 1 ♂, Morogoro Region, Udzungwa Mts National Park, Mito Mitatu, above Mang'ula, 07°49'3" S, 36°52'58" E, 1487 m a.s.l., 16 Dec. 2016, T. Pape and N. Scharff leg. (ZMUC).

### Description (male)

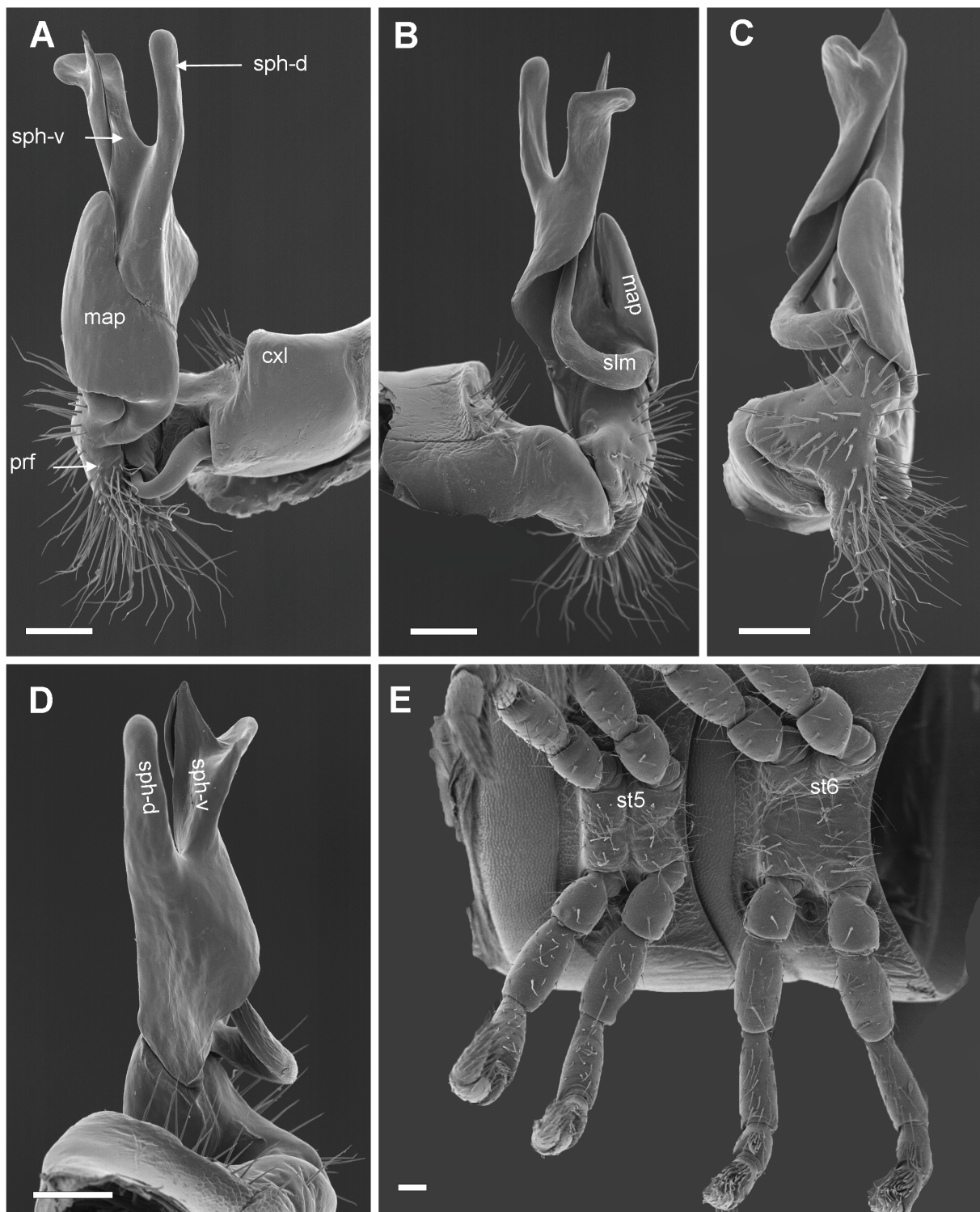
SIZE. Length 14–15 mm, max. width 1.5–1.6 mm.

COLOUR. After 3 months in alcohol dorsally dark brown to blackish brown, vertex and metazonites medium brown, rest of head, antennae and legs pale yellowish.

ANTENNAE. Reaching back to middle of ring 3.

BODY RINGS. Ring 2 with barely perceptible keels representing paranota (as in Fig. 4C). Stricture between pro- and metazonite striolate. No setae seen on body rings.





**Fig. 36.** *Eviulisoma breviscutum* sp. nov., paratype from forest below Mwanihana Peak. **A–D.** Right gonopod. **A.** Mesal view. **B.** Lateral view. **C.** Ventral view. **D.** Dorsal view. **E.** Body rings 5 and 6, showing unmodified sterna. Abbreviations *cxi* = coxal lobe; *map* = mesal acropodital process; *prf* = prefemoral part; *slm* = solenomere; *sph-d*, *sph-v* = dorsal and ventral lobes of solenophore; *st5*, *st6* = sterna 5 and 6. Scale bars: 0.1 mm.

**HYPOPROCT.** Triangular, with a distinct median tubercle.

**LEGS.** Length  $0.8\text{--}0.9 \times$  body width. Relative lengths of podomeres: femur > prefemur > tarsus > tibia  $\approx$  postfemur. Scopulae not prominent, on anterior legs on (postfemur), tibia and tarsus, disappearing on more posterior legs.

**STERNUM 5** (Fig. 36E). Unmodified, no process.

**STERNUM 6** (Fig. 36E). Not excavated, coxae 6–7 more separated than on normal body rings.

**GONOPODS** (Fig. 36A–D). Coxal lobe (*cxl*) small. Prefemoral part (*prf*) slightly more than half as long as acropodite. Mesal acropodital process (*map*) short, shield-like, apically smoothly rounded. No intermediate acropodital process. Solenophore (*sph*) large, ca twice as long as *map*, apically divided into a finger-shaped dorsal lobe (*sph-d*) and a more massive ventral lobe (*sph-v*), ventral lobe in turn divided into a pointed erect branch and a rounded ‘head’ set off from main axis by right angles.

### Distribution and habitat

Known from two places in the Udzungwa Mountains National Park forest. Altitudinal range 1487–1800 m a.s.l. Collected together with *E. coxale* sp. nov. in Mwanihana Forest.

### Remarks

The gonopods of this species bear some resemblance to those of *E. somaliense* Ceuca, 1971, sharing a short, shield-like mesal acropodital process (“ramo laterale” of Ceuca 1971) and an apically bifurcate solenomere (“ramo seminale” of Ceuca 1971). However, *E. somaliense* also has a large lobe (“placa allungata”) between *map* and *sph*, and it has a lobe on sternum 5 as well as an excavated sternum 6. The shapes of *map* and *slm* are also reminiscent of those of *E. julinum*, the type species of *Eoseviulisoma*, and with this species *E. breviscutum* sp. nov. also shares the lack of a sternum 6 excavation and a sternum 5 lobe. However, in *E. julinum* the prefemoral part of the gonopod is very much larger than in *E. breviscutum* sp. nov.

### Key to Udzungwan s. str. species of *Eviulisoma*

The key is based on adult males. Identifications should always be checked against the species descriptions and illustrations, as additional species of *Eviulisoma* are expected to exist in the Udzungwa Mts.

1. Sternum 6 with a deep excavation .....2
  - Sternum 6 not excavated .....21
2. Gonopod with an intermediate acropodital process (*iap*) .....3
  - Gonopod without an intermediate acropodital process .....15
3. Acropodite with a finger-shaped basal process (Fig. 9: *bap*) .....*E. kwabuniense* Kraus, 1958
  - Acropodite without a basal process .....4
4. Dorsal lobe of solenophore (*sph-d*) in the shape of a very large hook (Fig. 13) .....*E. cetafi* sp. nov.
  - Dorsal lobe of solenophore different .....5
5. A strong hook emerging from concave side of solenophore (Fig. 21: *sph-h*) .....
  - .....*E. paradisiacum* sp. nov.
  - No strong hook emerging from concave side of solenophore .....6

ENGHOFF H., *Eviulisoma* millipedes from the Udzungwa Mountains

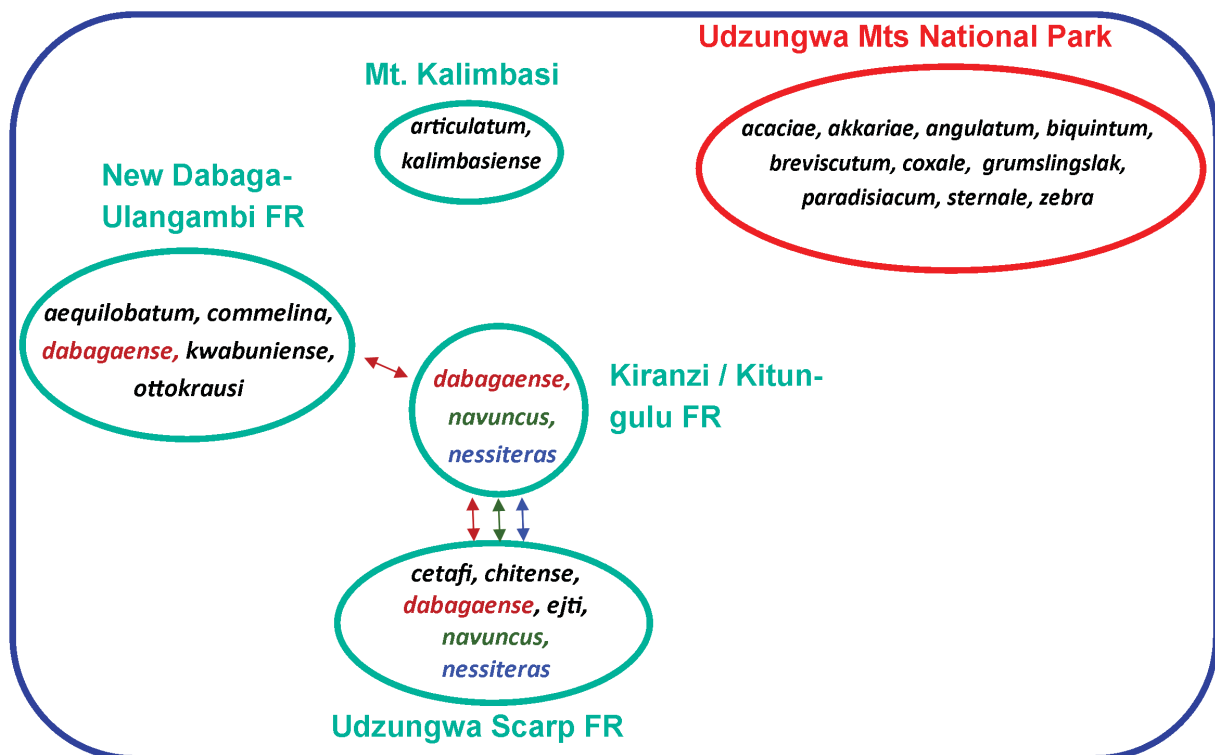
- 
6. Large species (width 2.6–3.3 mm) with contrasting dark and pale transverse bands; dorsal lobe of two-lobed solenophore (*sph-d*) large, as long as acropodital processes and ending in a hook (Figs 8A, 12) ..... *E. akkariae* sp. nov.  
 – Smaller species (width 1.5–2.1 mm), (always?) without contrasting transverse bands; solenophore different ..... 7
  7. Gonopods with four very to extremely slender processes (Fig. 19: *iap*, *map*, *sph-d*, *sph-v*) ..... *E. nessiteras* sp. nov.  
 – At least some of these processes stouter ..... 8
  8. Intermediate acropodital process (*iap*) much shorter than mesal acropodital process (*map*); dorsal lobe of solenophore (*sph-d*) bifid (Fig. 17) ..... *E. kalimbasiense* sp. nov.  
 – Intermediate acropodital process as long or almost as long as mesal acropodital process; dorsal lobe of solenophore different ..... 9
  9. Mesal acropodital process (*map*) with a long, curved side branch fitting over semicircular dorsal lobe of solenophore (*sph-d*) (Fig. 18) ..... *E. navuncus* sp. nov.  
 – Mesal acropodital process different ..... 10
  10. Solenophore with three elongate lobes ..... 11  
 – Solenophore with two lobes, sometimes with a rudimentary intermediate lobe as well ..... 14
  11. All three lobes of solenophore of equal length, but intermediate lobe (*sph-i*) thinner than the others (Fig. 11) ..... *E. aequilobatum* sp. nov.  
 – The three lobes of solenophore of unequal length ..... 12
  12. Intermediate lobe of solenophore (*sph-i*) much shorter than the slender, approximately equally long dorsal and ventral lobes (*sph-d* and *sph-v*) (Fig. 15) ..... *E. commelina* sp. nov.  
 – Dorsal lobe of solenophore (*sph-d*) much longer than intermediate and ventral lobes (*sph-i* and *sph-v*) ..... 13
  13. Intermediate and ventral lobes of solenophore (*sph-i* and *sph-v*) slender; subapical side branch of mesal acropodital process (*map*) directed laterad (Fig. 14) ..... *E. chitense* sp. nov.  
 – Intermediate and ventral lobes of solenophore (*sph-i* and *sph-v*) very short and broad; subapical side branch of mesal acropodital process (*map*) directed obliquely apicad (Fig. 20) ..... *E. ottokrausi* sp. nov.
  14. Solenophore with two broad lobes; mesal acropodital process (*map*) ending in two subequal points (Fig. 10) ..... *E. acaciae* sp. nov.  
 – Solenophore with a stout dorsal lobe (*sph-d*), a slender ventral lobe (*sph-v*) and a rudimentary intermediate lobe (*sph-i*); mesal acropodital lobe (*map*) ending in a hooked point and with a small, pointed subapical side branch (Fig. 16) ..... *E. ejti* sp. nov.
  15. Sternum 6 excavation with four-lobed or angled rim (Figs 26A, 30A, 34F) ..... 16  
 – Sternum 6 excavation with a simple rim (as Fig. 6A–C) ..... 18
  16. Sternum 6 excavation with angled rim (Fig. 34F); mesal acropodital process (*map*) with large subapical hook opposing corresponding hook on solenophore (Fig. 34A–B, D) ..... *E. angulatum* sp. nov.  
 – Sternum 6 excavation with four-lobed rim (Figs 26A, 30A); gonopods different ..... 17



17. Smaller species (width 2.0 mm); a dentate ridge present on mesal acropodital process (*map*) (Fig. 27) ..... *E. sternale* sp. nov.  
 – Larger species (width 3.0–3.2 mm); no dentate ridge on *map* (Fig. 31) ..... *E. zebra* sp. nov.
18. Gonopod acropodite with a separate basal ‘femorite’; solenophore large, plate-like (Fig. 33) ....  
 ..... *E. articulatum* sp. nov.  
 – No separate ‘femorite’; solenophore slender, tube-like (‘rolled sheet’) ..... 19
- 19 Larger species (width 2.5–3.4 mm); ventral margin of mesal acropodital process (*map*) strongly convex (Fig. 25) ..... *E. grumslingslak* sp. nov.  
 – Smaller species (width 1.8–2.4 mm); ventral margin of *map* almost straight ..... 20
20. Gonopod coxa with a slender distolateral process (Fig. 23A: *cxp*) ..... *E. coxale* sp. nov.  
 – Gonopod coxa without a distolateral process (Fig. 22) ..... *E. dabagaense* Kraus, 1958
21. Sterna 5 and 6 each with a knob-like process (Fig. 35) ..... *E. biquintum* sp. nov.  
 – Sterna 5 and 6 without processes (Fig. 36) ..... *E. breviscutum* sp. nov.

### Distribution and habitat patterns

All Udzungwan s. str. species of *Eviulisoma* are endemic to the Udzungwa Mts. Figure 37 shows the distribution of the 22 species plotted on a diagrammatic map of the areas within the Udzungwas where the species have been collected. Only three species (*E. dabagaense*, *E. navuncus* sp. nov. and



**Fig. 37.** Distribution of species of *Eviulisoma* Silvestri, 1910, in the Udzungwa Mts. The positions of the ovals in relation to each other approximately correspond to the relative position of the Udzungwa Mts National Park, Mt Kalimbasi and the three forest reserves, cf. Fig. 2. Species shared between two or three areas are indicated with coloured text and double-headed arrows.

*E. nessiteras* sp. nov.) have been found in more than one area. The Udzungwa Mts National Park, where the highest number of species (nine) has been found, shares no species with other areas.

Table 4 shows the altitudinal distribution of the Udzungwan s. str. species. Although some species occur as low as 800 m a.s.l., the highest diversity occurs from 1400 m a.s.l. upward. *Eviulisoma* covers a larger altitudinal spectrum than the *Chaleponcus dabagaensis* group, which is restricted to 1500–2200 m a.s.l. with a maximum at 1800–2000 m a.s.l. (Enghoff 2014, 2017).

Habitat information is included on the labels of many specimens, and a small amount of habitat information can be extracted from the literature (Kraus 1958, Frontier Tanzania 2001). In by far the most cases, the habitat is indicated as forest, montane rain forest, tropical semi-evergreen forest, etc. Some species have been collected in open *Acacia* woodland (*E. acaciae* sp. nov., *E. grumslingslak* sp. nov.) or ‘scrub/thicket/bush’ (*E. ottokrausi* sp. nov.), but the two last-mentioned have also been collected in proper forests.

### ***The status of Eoseviulisoma Brolemann, 1920***

*Eoseviulisoma* was proposed as a subgenus of *Eviulisoma* by Brolemann (1920) on the basis of the following characters:

- No process between the 4<sup>th</sup> male legs (vs a process present in *Eviulisoma* s. str.)
- Male sternum 6 with a very shallow excavation (vs a pronounced excavation in *Eviulisoma* s. str.)
- Gonopodal prefemur (“tronc du télépodite”) longer than the distal processes (“les rameaux”) (vs shorter in *Eviulisoma* s. str.)
- Transverse suture of body rings striolate (“perlée”) (vs smooth in *Eviulisoma* s. str.)

The type and only species of *Eoseviulisoma* was *Strongylosoma julinum* Attems, 1909.

Hoffman (1953) elevated *Eoseviulisoma* to a full genus and transferred *Dyseviulisoma abnorme* Attems, 1937 to it. In his key to African eviulismatnine genera, Hoffman separated *Eoseviulisoma* from *Eviulisoma* in the first couplet in which genera with a large mesapical lobe on the gonopod coxa (*Eviulisoma* and *Suohelisoma*) were separated from genera without such a lobe (*Scolodesmus*, *Eoseviulisoma* and *Wubidesmus*) (Hoffman 1971). A third species, *Eviulisoma* (*Eoseviulisoma*) *rugegianum* Attems, 1953, was regarded as “generic status uncertain” by Jeekel (1968), but judging from the original description it may be included in the present rather broad concept of *Eviulisoma*.

VandenSpiegel & Golovatch (2014) pointed out some difficulties in distinguishing these two genera. Thus, *Eviulisoma ngaia* VandenSpiegel & Golovatch, 2014, has a process between the 4<sup>th</sup> male legs, but no excavation on sternum 6. *Eviulisoma taitaorum* VandenSpiegel & Golovatch, 2014, has no process between the 4<sup>th</sup> male legs, but it does have an excavated sternum 6 and a smooth suture. They therefore argued that the two genera “may well prove to be synonymous”.

The Udzungwan species studied here offer further examples in favour of this suggestion. Thus, *E. biquintum* sp. nov. has two processes on sternum 5, one between the 4<sup>th</sup> legs and one between the 5<sup>th</sup>, but no excavation on sternum 6. Striation of the transverse suture seems to be quite variable: in some Udzungwan species the suture is clearly striolate (Fig. 5A), in others the striation is indistinct, and in still others the suture is virtually smooth. The relative length of the prefemur and acropodite is also variable; however, most species have the prefemur less than half the length of the acropodite.

Existing illustrations of the gonopod of *E. julinum* (Attems 1909; Brolemann 1920) are not very clear concerning the acropodital part. Thanks to Sara B. Frederiksen, I have been able to examine a male of

**Table 4.** Altitudinal ranges of Udzungwan s. str. species of *Eviulisoma* Silvestri, 1910. The inferred ranges include all 100 m intervals between the lower and upper limits of the recorded range, although a species may not have been found in all 100 m intervals within the recorded range. Species recorded only from an altitude at exactly *x* hundred m a.s.l. have been assigned to the higher of the two 100 m intervals including this altitude.

	Recorded range (m a.s.l.)	Inferred range (m a.s.l.)																
		800–900	900–1000	1000–1100	1100–1200	1200–1300	1300–1400	1400–1500	1500–1600	1600–1700	1700–1800	1800–1900	1900–2000	2000–2100				
<i>kwabuniense</i>	1800–2100											x	x	x				
<i>acaciae</i>	1510							x										
<i>aequilobatum</i>	1930												x					
<i>akkariae</i>	850–1207	x	x		x	x												
<i>cetafi</i>	1300–1500						x											
<i>chitense</i>	1050–1400			x	x	x												
<i>commelina</i>	1800–1900											x						
<i>ejti</i>	1800											x						
<i>kalimbasiense</i>	2000–2100											x						x
<i>navuncus</i>	1500							x										
<i>nessiteras</i>	1500–1531							x										
<i>ottokrausi</i>	1800–1962											x						
<i>paradisiacum</i>	1390–1410					x												
<i>dabagaense</i>	1500–2100								x	x	x	x	x					x
<i>coxale</i>	1400–1850						x		x	x	x	x						
<i>grumslingslak</i>	1482–1880						x		x	x	x	x						
<i>sternale</i>	1550							x										
<i>zebra</i>	1450						x											
<i>articulatum</i>	2000																	x
<i>angulatum</i>	2100																	x
<i>biquintum</i>	800	x																
<i>breviscutum</i>	1487–1800						x		x	x	x							
No. of species		2	1	2	2	2	3	6	8	4	4	7	4	5				



*E. julinum* from Tanzania, Kilimanjaro Region, Moshi Vijijini (rural) District, Mt Kilimanjaro, lower montane forest plot 4, 1623 m a.s.l., 03°15'27.79" S, 37°25'12.74" E, 9 Apr. 2014, S. Frederiksen leg. and det. (ZMUC). Figure 38 shows several images of the right gonopod of the specimen. There is a relatively pronounced 'Eviulisoma type' coxal lobe (*contra* Hoffman 1971; the lobe is also evident in Brolemann 1920: figs 85–86). The prefemoral part is long – as long as or even longer than the acropodital part. The acropodite consists – in addition to the flagelloid solenomere – of a relatively short, simple, lamelloid mesal acropodital process (*map*) and a large complicated solenophore which is split at ca half its length into a mesal process with a rounded, finger-shaped tip and a triangular expansion ca at mid-length, and a large lateral lamella which is rolled up to form a conductor for the solenomere. The entire gonopod telopodite is quite short and does not reach the unexcavated sternum 6.

The second species referred to *Eoseviulisoma* by Hoffman (1953), *E. abnorme*, does indeed, according to the original illustrations of Attems (1937), have the gonopod telopodite reminiscent of that in *E. julinum*, but according to Attems, the 6<sup>th</sup> sternum is excavated. The same applies, more or less, to *E. rugegeanum*.

In conclusion, considering the wide variability in acropodite structure seen in 'typical' species of *Eviulisoma*, there is no justification for recognizing *Eoseviulisoma* as a separate taxon at the generic or subgeneric level. The suggestion by VandenSpiegel & Golovatch (2014) is endorsed, and *Eoseviulisoma* is herewith synonymized under *Eviulisoma*. Of course, the name will remain available if at some point it becomes desirable to recognize subgenera in *Eviulisoma*.

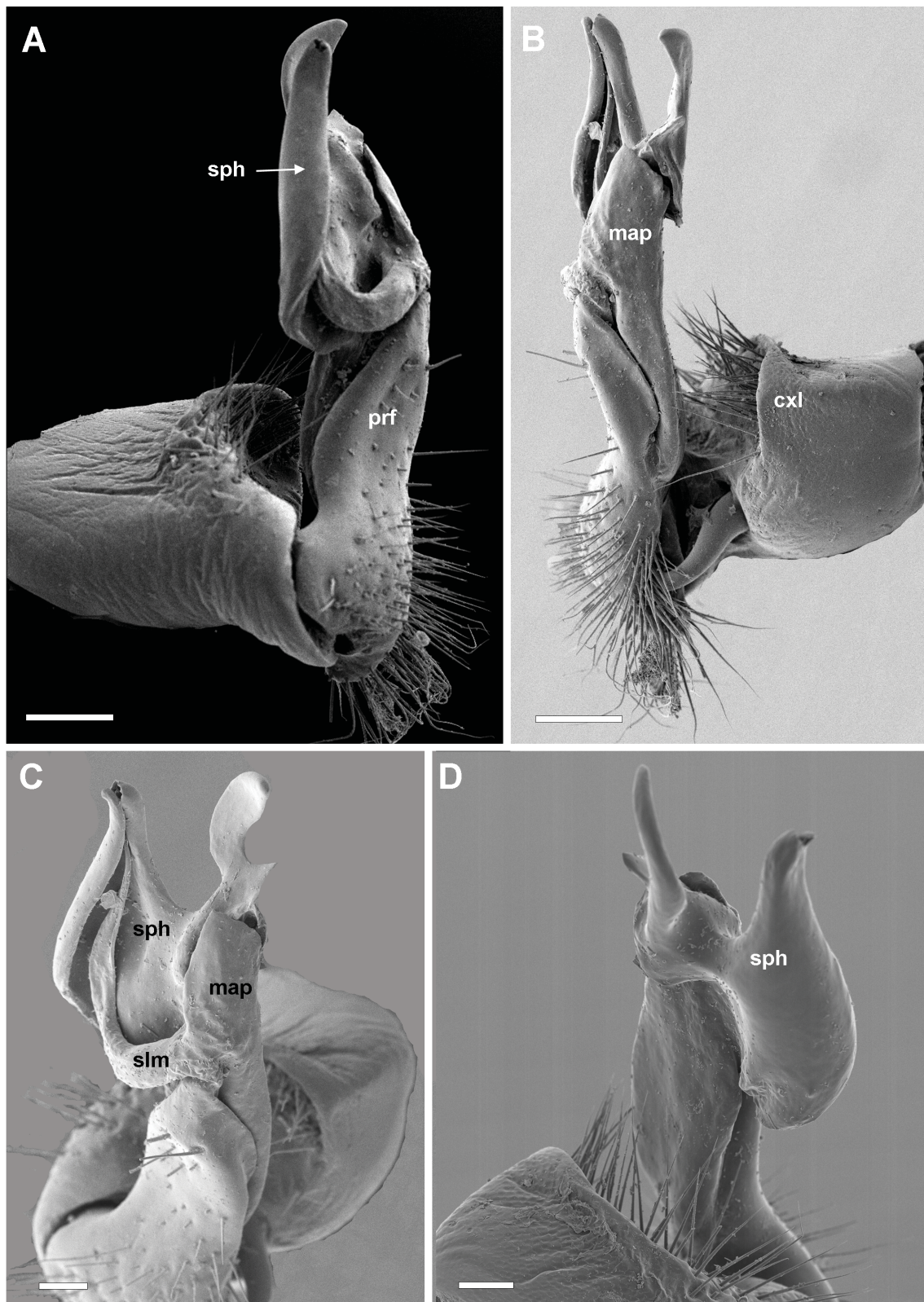
### ***The status of Suohelisoma Hofmann, 1964***

Hoffman (1964) erected *Suohelisoma* (monotypic for *S. ulugurens* Hoffman, 1964) on the basis of an unbranched gonopod telopodite without "Femoralfortsätze". Examination of the gonopod of a specimen of *S. ulugurens* (Tanzania, Uluguru Mts, Lupanga, W, 1900 m a.s.l., 1 Jul. 1981, M. Stoltze and N. Scharff leg., ZMUC) with the SEM (Fig. 39) has, however, revealed a small separate sclerite at the base of the acropodite. This sclerite might be interpreted as a very small mesal acropodital process, but also as a separate 'femorite' as seen in *E. articulatum* (Fig. 33). If the latter interpretation is correct, *S. ulugurens* has no mesal acropodital process.

In other characters, *S. ulugurens* agrees with *Eviulisoma* spp., notably in the presence of a strongly excavated sternum 6 and only one transverse row of setae on postcollar body rings. The sternum 6 excavation in *S. ulugurens* is, however, smaller than that of *Eviulisoma* spp. Future analyses may show that *S. ulugurens* is nothing but a highly specialized *Eviulisoma*, but for the time being *Suohelisoma* is retained as a valid, separate genus.

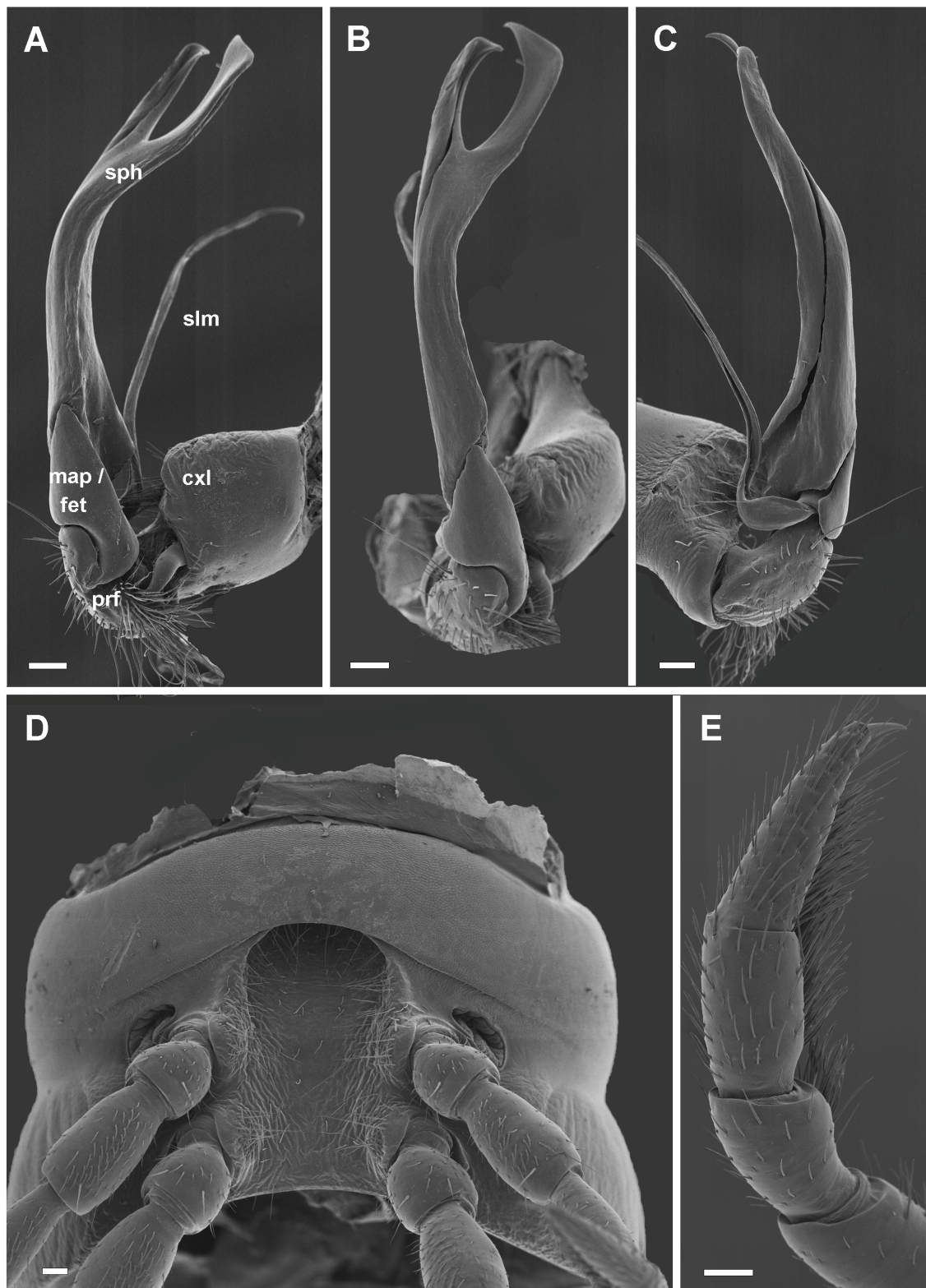
### ***Epizootic fungi***

Millipedes are hosts to a number of fungi growing on their external cuticle. The best known of these are various species of the order Laboulbeniales Engler, which perform their entire life cycle on the host (Santamaria *et al.* 2014, 2016; Enghoff & Santamaria 2015). There are, however, several other groups of fungi which have at least part of their life cycle associated with millipede cuticle. What little is known about these fungi was summarized by Enghoff & Reboleira (2017), and two of the fungus types mentioned by these authors were found on one specimen of *Eviulisoma chitense* sp. nov. Figure 40A shows a secondary capilliconidium of the genus *Basidiobolus* Eidam, a fungus which has been found on several millipede species belonging to different orders and families, including Paradoxosomatidae. Figure 40B shows rows of minute spherules which seemingly come out between the cuticular scales of the millipede. Figure 40C shows similar structures on the ventral side of ring 6 in *E. biquintum* sp. nov. Enghoff & Reboleira (2017) hypothesized that these structures, which have been encountered on several



**Fig. 38.** *Eviulisoma julinum* (Attems, 1909), specimen from Mt Kilimanjaro, S. Frederiksen leg., right gonopod. **A.** Lateral view. **B.** Mesal view. **C.** Anteroventral view. **D.** Dorsal view. Abbreviations: *cxl*= coxal lobe; *map* = mesal acropodital process; *slm* = solenomere; *sph* = solenophore. Scale bars: A–B = 0.1 mm; C–D = 0.05 mm.





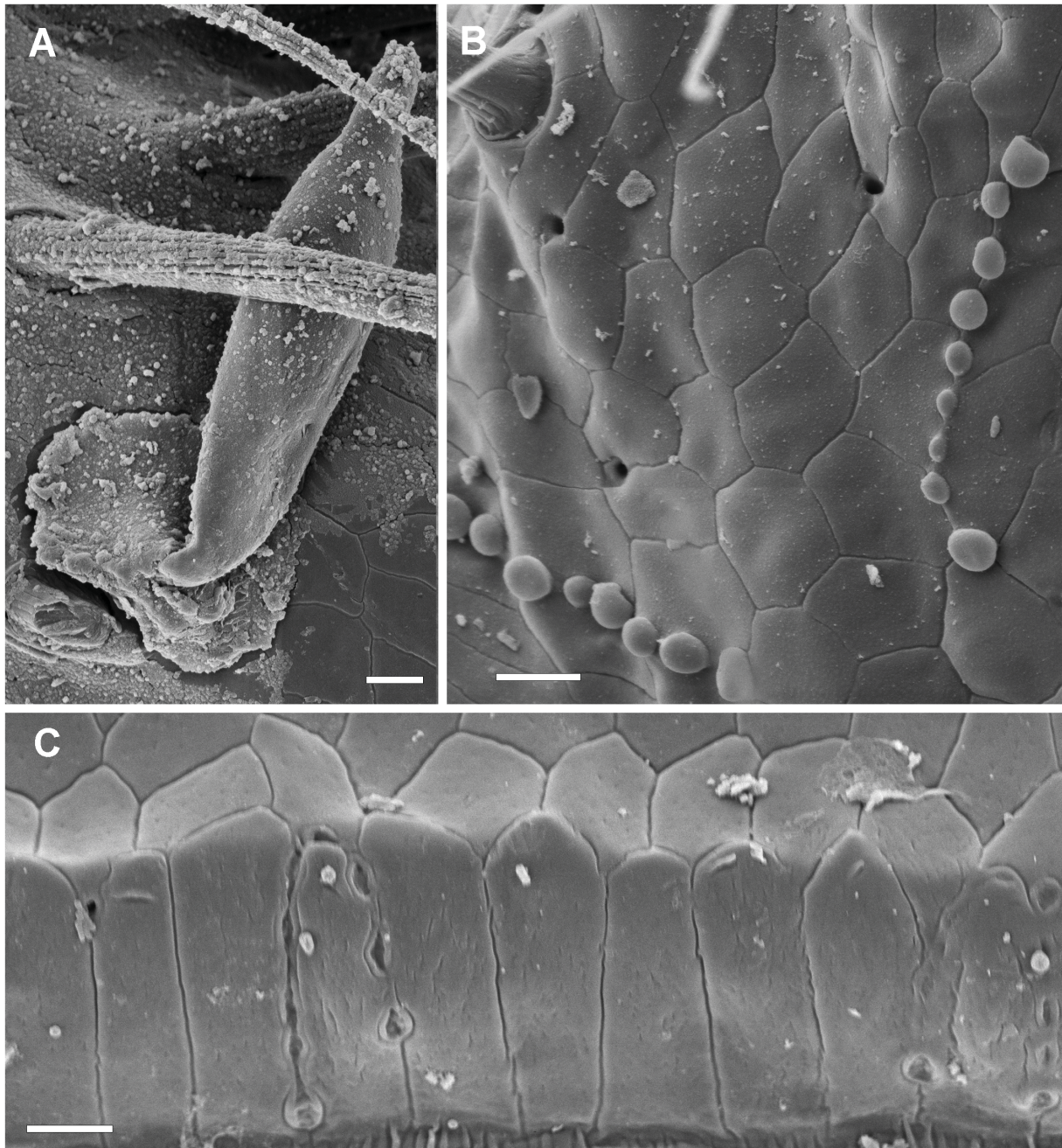
**Fig. 39.** *Suohelisoma ulugurens* Hoffman, 1964, specimen from Uluguru Mts, Lupanga, M. Stoltze and N. Scharff leg. **A–C.** Right gonopod. **A.** Mesal view. **B.** Ventral view. **C.** Lateral view. **D.** Body ring 6 showing excavated sternum, ventral view. **E.** Anterior leg, showing scopulae. Abbreviations: *cxi* = coxal lobe; *map / fet* = mesal acropodital process / 'femorite'; *prf* = prefemoral part; *slm* = solenomere; *sph* = solenophore. Scale bars: 0.1 mm.



different millipedes and have been described as “intercalary cuticular microscutes”, first by Akkari & Enghoff (2011), may also be of fungal nature, although nothing definite can be said about this at present.

## Discussion

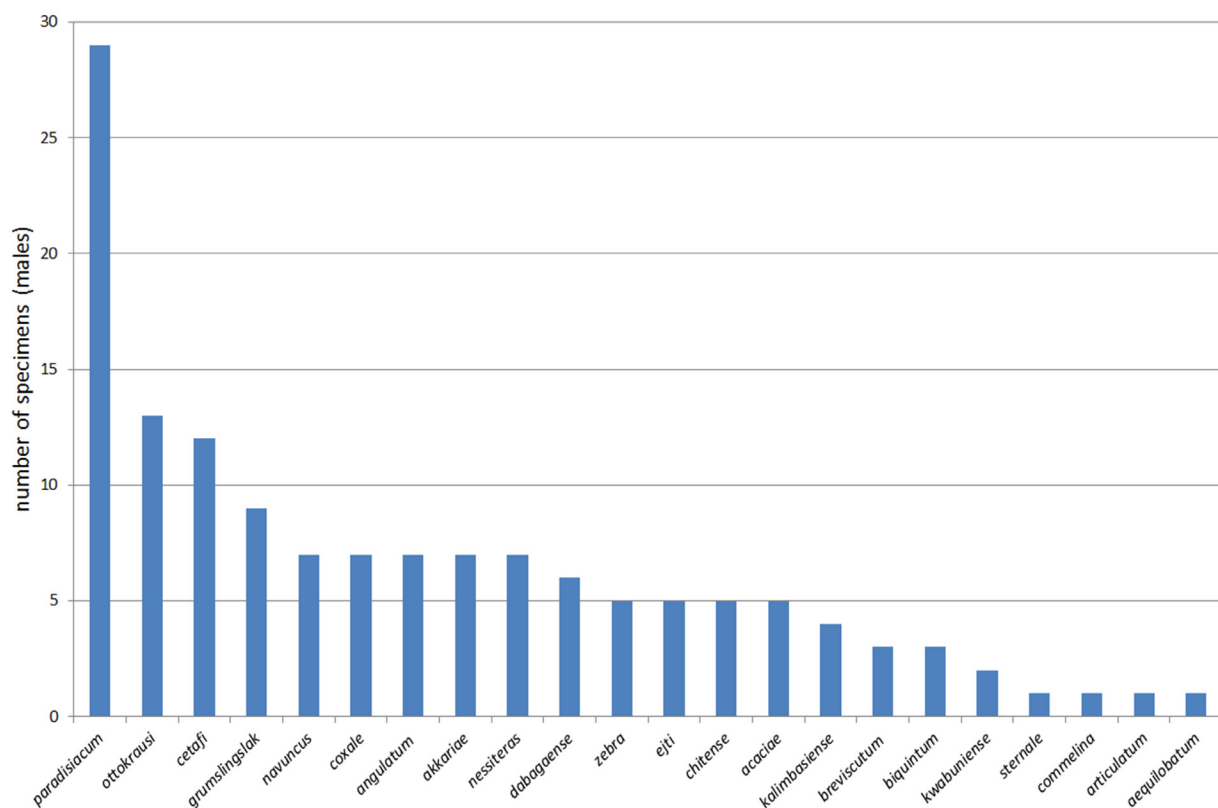
With 22 species now known from the Udzungwa Mts, all apparently endemic, *Eviulisoma* matches the odontopygid genus *Chaleponcus* in terms of Udzungwan species richness. As in the case of *Chaleponcus* (Enghoff 2014) there doubtlessly are additional species of *Eviulisoma* to be found in the Udzungwa Mts,



**Fig. 40.** Epizootic fungi on *Eviulisoma* spp. **A.** *Basidiobolus* Eidam on *E. chitense* sp. nov. **B–C.** Fungi? (‘intercalary cuticular microscutes’) **B.** On *E. chitense* sp. nov. **C.** On *E. biquintum* sp. nov. Scale bars: 0.005 mm.

as indicated, i.a., by the fact that four out of 22 Udzungwan s. str. species are known only from one male (Fig. 41). Some of the species (*E. coxale* sp. nov., *E. grumslingslak* sp. nov. and *E. biquintum* sp. nov.) show geographical variation in colour and size and each may eventually prove to include several species. Whereas the Udzungwan species of *Chaleponcus* all belong to a morphologically well-defined group endemic to the Udzungwa and Rungwe Mts (Enghoff 2014, 2017), the Udzungwan species of *Eviulisoma* belong to several different species groups. At least three of the groups also have species outside the Udzungwas (the *dabagaense* group has *E. culter* sp. nov. in the Rubeho Mts, the *sternale* group has *E. kangense* sp. nov. in the Kanga Mts and the *iuloideum* group has *E. iuloideum* from Mufindi). Whether the *kwabuniense* group also has non-Udzungwan members it not certain, because as noted by Jeekel (2003): “Although the structure of the gonopods is basically simple, it is often quite difficult to identify the various branches.” SEM, as first applied to *Eviulisoma* by VandenSpiegel & Golovatch (2014), and also in the present contribution, greatly helps, but interpretation of earlier authors’ drawings remains difficult, in some cases bordering on impossible. To quote Jeekel again: “an analysis of the genus based upon the available data in literature seems impossible on account of the [...] inadequacy of the published gonopod illustrations” (Jeekel 1968: 102). In other words, a full revision of *Eviulisoma* will require the restudy of a large number of type specimens as well as considerable new material of many species. I have seen several further species of *Eviulisoma* from other Eastern Arc blocks – Usambara Mts, Uluguru Mts, Rubeho Mts – but these belong to different species groups than the Udzungwan species and are not considered here.

In the material studied here I found no examples of polymorphism of sternum 6 and the gonopods, similar to what Carl (1909) observed.



**Fig. 41.** The number of studied specimens (♂♂) per species of Udzungwan s. str. *Eviulisoma* Silvestri, 1910.



### Excavation of sternum 6

The vast majority of species of *Eviulisoma* are characterized by a strongly excavated sternum 6 (e.g., Fig. 6). The margins of the excavation are sharp and usually carry a fringe of long setae. Carl (1909), in his description of *E. fossiger*, pointed out that this structure is unique among “Polydesmiden”, i.e., polydesmidan millipedes. He suggested that the excavation protects the tip of the gonopods when the animal rolls up for protection. He also noticed that “among many specimens of various origin, a few are found here and there in which the gonopods are somewhat shorter and end more bluntly, and in these animals the mentioned cavity is completely missing or only very faintly indicated” (translated from German) and for this reason argued that there is only a “mechanical correlation” [between excavation and gonopods]. There may, however, be more than that.

### A mysterious mass

Quite often, the excavation of sternum 6 is more or less filled up with an amorphous/microgranular mass (a small lump of this mass is seen in Fig. 6A), and just as often, a ‘hood’ of a similar amorphous mass is found attached to the tip of the mesal acropodital processes (Fig. 23E). The nature of the mass is unknown, but the shape of the ‘hood’ often corresponds to the shape of the sternal excavation, so a functional correlation between sternal excavation, gonopods and the amorphous mass is suggested. No spermatozoa could be distinguished in the mass even at high magnification in the scanning electron microscope; since Akkari & Enghoff (2012) were able to see spermatozoa in a similarly amorphous matrix in species of the genus *Ommatoiulus* (Julida, Julidae), this observation speaks against interpreting the amorphous mass in *Eviulisoma* as a spermatophore. Possibly, the mass serves as a ‘copulatory plug’ preventing subsequent matings by the female. ‘Copulatory plugs’ are common in insects, reptiles and certain groups of mammals (Stockley 1997). Amorphous masses more or less similar to those seen in *Eviulisoma* have been described, sometimes as spermatophores, from millipedes of the families Chordeumatidae Koch, 1847 and Tingupidae Loomis, 1966, order Chordeumatida Koch, 1847 (Verhoeff 1926–1932: 195; Schubart 1939; Shear 2010), and have also been seen in the paradoxosomatid genus *Desmoxytes* Chamberlin, 1923 (R. Srisonchai, pers. comm.) the polydesmid genus *Pseudopolydesmus* Attems, 1898 (P. Sierwald, pers. comm.) and the julid genus *Megaphyllum* Verhoeff, 1894 (B. Vagalinski, pers. comm.).

Irrespective of whether the amorphous mass in *Eviulisoma* serves as a spermatophore, a copulatory plug, or both, one would expect to find the mass attached to the female vulvae or their surroundings. Although females were not used for taxonomic purposes in the present study, numerous females were examined, but in no case could a mass similar to that found in males be seen on or near the vulvae. The nature and purpose of the mass remains fully enigmatic.

### Modifications of non-gonopodal legs

Almost all species of *Eviulisoma* have scopulae on some or all of the walking legs of males – females have no scopulae. Scopulae (Fig. 7) are dense brushes of flattened, often transversely ribbed setae and almost certainly play a role during copulation. In two of the species described here, *E. sternale* sp. nov. and *E. kangense* sp. nov., there is also another leg modification in males: the prefemur and femur have a ventral smooth, apparently soft area (Figs 26B, 28E), somewhat reminiscent of the ‘soft pads’ seen on the legs of many juliformian millipedes. Whether this modification also exists in any previously described species is not clear.

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