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## Research article

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# Description of two new species of *Xevioso* (Araneae: Phyxelididae) from Southern Africa, with the northernmost localities for the genus

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**Abstract.** Two new species of Phyxelididae are described from southern Africa: *Xevioso cepfi* sp. nov. (♂♀), from mountains in the Niassa Province of northern Mozambique, and *X. mecummingae* sp. nov. (♂♀), from urban Harare, northern Zimbabwe and the Viphya Mts in Malawi. They represent the northernmost localities of the genus. An identification key, partially adapted for the new species, is presented. The biogeographical importance of the mountain areas on both sides of the northern part of Lake Malawi is discussed.

**Keywords.** Afromontane, Mozambique, spider, taxonomy, Zimbabwe.

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## Introduction

Phyxelididae is a fairly small spider family with 14 genera and only 64 species. It has a peculiar distribution, mainly in southern and eastern Africa and Madagascar, with a few outliers in Turkey and Indonesia. It retained subfamily status in the complete revision by Griswold (1990) but received family status in the study of Griswold *et al.* (2005).

One of the largest genera, *Xevioso* Lehtinen, 1967, currently contains nine nominal species (Griswold 1990). Key characteristics of the genus include a well-developed cup-like sclerotized conductor housing a spiral screw-like embolus, unique among the Phyxelididae. The basal embolic sclerite (EBS) can be simple or tripartite, and the tegulum may have a maximum of four processes (see Griswold 1990 for a detailed generic treatment).

*Xevioso* was so far restricted to Southern Africa, with one species extending its area into Zimbabwe (*X. orthomeles* Griswold, 1990) and one (*X. jocquei* Griswold, 1990) widely separated from the rest in Malawi.

During a BINCO-expedition (see [BINCO.eu](http://BINCO.eu)) in November 2016 to the remote mountains of Chitagal, Sanga and the Njesi Plateau (Niassa Province) in northern Mozambique (Jones *et al.* 2017), an undescribed species of *Xevioso* was found. Further evaluation of the Phyxelididae collection in the Royal Museum for Central Africa (RMCA) uncovered a male and female of a second remarkable species from Zimbabwe, with one more specimen from the Viphya Mts in Malawi.

Knowledge on the distribution of the genus is greatly expanded here with the addition of two new species: one in northern Mozambique and another with a remarkable distribution, in northern Zimbabwe and a remote locality in Malawi. Herein, we describe and illustrate these new species and thus provide the northernmost localities for the genus.

## Material and methods

The specimens examined in the current study were preserved in 70% ethanol and examined using a Nikon SMZ800 stereo microscope for measurements and descriptions. Male palps and female genitalia were drawn with a WILD M10 stereo microscope (Leica). Female epigynes were detached from the abdomen, temporarily mounted in a clearing mixture of methyl salicylate and cedukol (Merck, Darmstadt) and observed with a Leitz Dialux 22 microscope and subject to automontage with the Syncrosopy software. Male palps and habitus were photographed with a Leica MZ16 using the Leica Application Suite (LAS) automontage software (ver. 3.8; Leica, <https://leicacamera.com>), with a Z-stack of 15–25 images merged into a single photomontage. For SEM photos, specimens were dried overnight in hexamethyldisilazane, gold coated, and examined and photographed with a JEOL 6480 LV scanning electron microscope. Maps were created with the online tool SimpleMapp (Shorthouse 2010). All types are deposited in the Royal Belgian Institute of Natural Sciences (RBINS Brussels, Belgium). Specimens are deposited in the Royal Museum for Central Africa (RMCA, Tervuren, Belgium) and in the Museu de História Natural de Maputo (MHNM, Maputo, Mozambique).

All measurements are given in millimetres (mm).

## Abbreviations (following abbreviations used in Griswold 1990)

ALE	=	anterior lateral eyes
AME	=	anterior median eyes
CO	=	copulatory opening
d	=	dorsal
DP	=	setose posterodorsal process of male palpal tibia
disp	=	dispersed
dw	=	distal whorl
EBM	=	median division of EBS
EBA1, 2 and 3	=	mesal, lateral and median branch of tripartite EBS
EBS	=	basal embolic sclerite
F	=	femur
Mt	=	metatarsus
P	=	patella
PC	=	posterior chamber
pl	=	prolateral
PLE	=	posterior lateral eyes
PME	=	posterior median eyes

PML	=	posterior median lobe of epigyne
rl	=	retrolateral
TA2	=	central tegular process
TA3	=	retrolateral tegular process
T	=	tibia
t	=	tarsus
TL	=	total length

## Results

### *Taxonomy*

Class Arachnida Cuvier, 1812  
Order Araneae Clerck, 1757  
Family Phyxelididae Lehtinen, 1967  
Genus *Xevioso* Lehtinen, 1967

*Xevioso cepfi* sp. nov.

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Figs 1–3, 4A, D, 5, 8

### **Diagnosis**

Males of *X. cepfi* sp. nov. can be recognized by the axel-shaped, dark dorsal asetose process of the palpal T, which is thin and transparent in *X. jocquei*, combined with the pronounced, blunt DP (Figs 1C, 3B–C, 4A) and the palpal bulb with sharp bifid tegular process on TA3 which is shorter and blunt in *X. jocquei*. Females are characterized by the double coil of the copulatory duct, the anterior median duct of the spermathecae being almost twice as large as the posterolateral duct, also the anterior median duct converging centrally and almost touching (Fig. 5B–C).

### **Etymology**

Named after the Critical Ecosystem Partnership Fund (CEPF), funders of the Njesi BINCO expedition, during which this species was discovered.

### **Material examined**

#### **Holotype**

MOZAMBIQUE • ♂; Niassa Region, Sanga Plateau; 12°22.580 S, 35°20.013 E; 1724 m a.s.l.; 18 Nov. 2016; L. Geeraert and M. Jocqué leg.; forest; pitfall with fence; RMCA\_ARA\_245493.

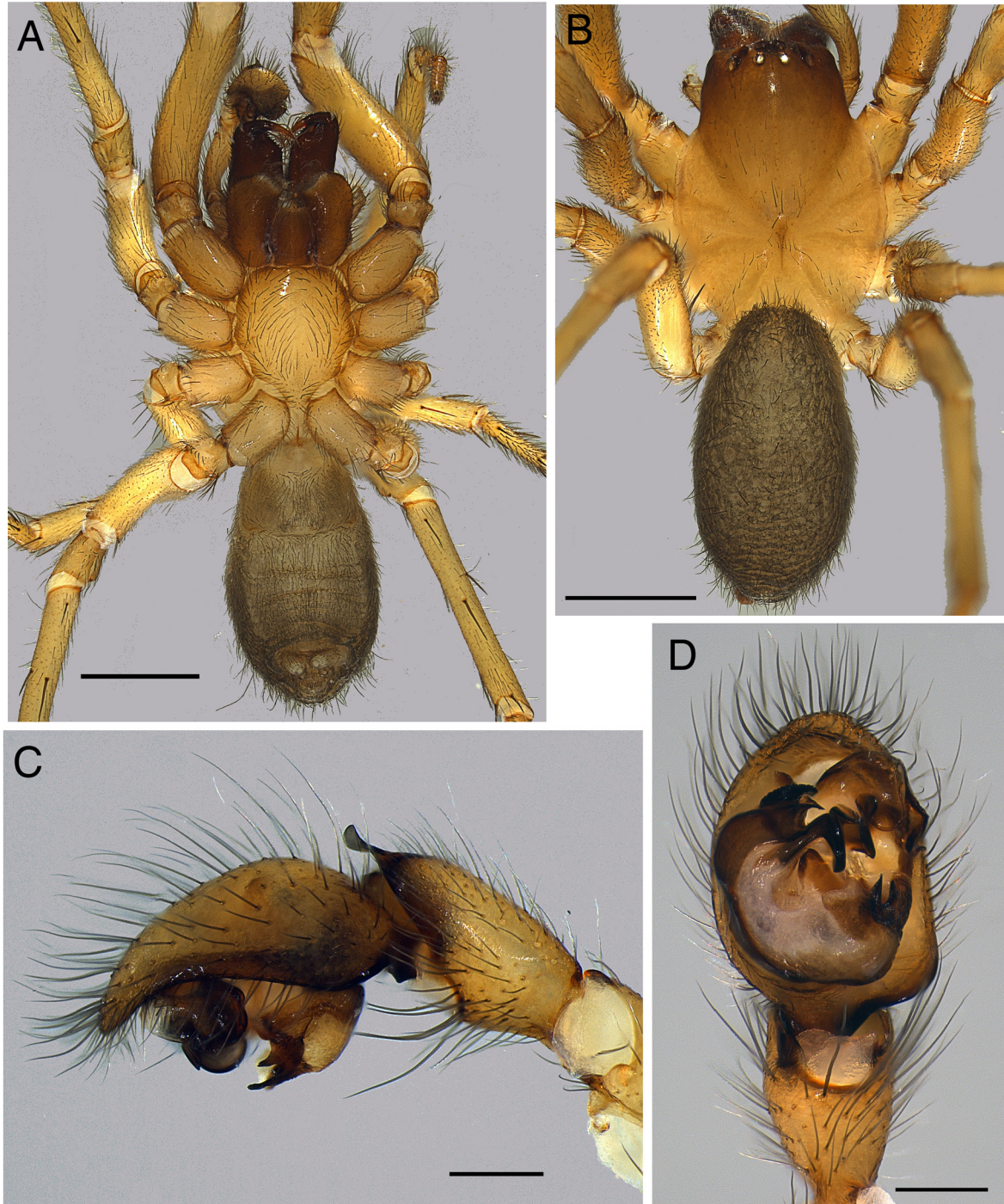
#### **Paratypes**

MOZAMBIQUE • 1 ♀; Niassa Region, Sanga Plateau; 12°22.5802 S; 35°20.0132 E; 1724 m a.s.l.; 15 Nov. 2016; L. Geeraert and M. Jocqué leg.; forest; pitfall with fence; RMCA\_ARA\_246405 • 3 ♂♂; same collection data as for preceding; RMCA\_ARA\_245506 • 2 ♂♂; same collection data as for preceding; MHNM • 1 ♀; Niassa Region, Sanga Plateau; 12°24.007' S, 35°20.070' E; 16 Nov. 2016; L. Geeraert and M. Jocqué leg.; montane forest; pitfall with fence; RMCA\_ARA\_245496 • 2 ♂♂; Niassa Region, Chitagal Plateau; 12°35.4952 S, 35°15.1342 E, 1624 m a.s.l.; Nov. 2016; montane forest; pitfall for herpetology; L. Geeraert and M. Jocqué leg. RMCA\_ARA\_245487.

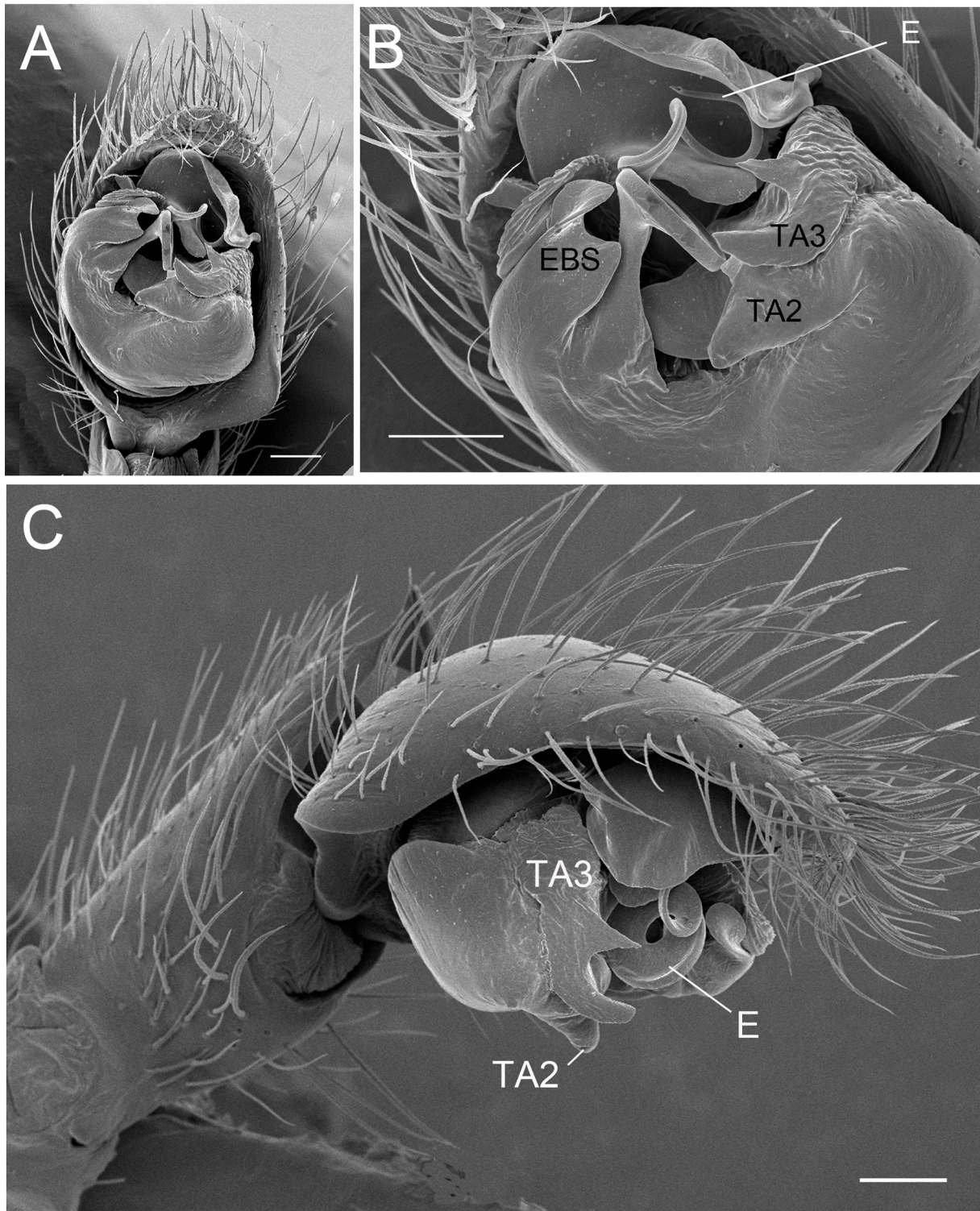
#### **Other material**

MOZAMBIQUE • 2 ♂♂; Niassa Region, Sanga Plateau; 12°24.0072 S, 35°20.0702 E; 16 Nov. 2016; montane forest; L. Geeraert and M. Jocqué leg.; pitfall for herpetology; RMCA\_ARA\_246548 • 2 ♂♂; Niassa Region, Sanga Plateau; 12°22.5802 S, 35°20.0132 E; 1724 m a.s.l.; 14 Nov. 2016;

forest; pitfall; L. Geeraert and M. Jocqué leg.; RMCA\_ARA\_246550 • 1 ♂; same collection data as for preceding; RMCA\_ARA\_246551 • 2 ♂♂; same collection data as for preceding; 18 Nov. 2016; RMCA\_ARA\_246552 • 2 ♂♂; same collection data as for preceding; RMCA\_ARA\_246553 • 1 ♂; Niassa Region, Chitagal Plateau; 12°35.495' S, 35°15.134' E; 1624 m a.s.l.; 8 Nov. 2016; L. Geeraert and M. Jocqué leg.; montane forest; pitfall; RMCA\_ARA\_246554 • 1 ♂; same collection data as for



**Fig. 1.** *Xevioso cepfi* sp. nov., holotype, ♂ (RMCA\_ARA\_245493). **A.** Habitus, ventral view. **B.** Habitus, dorsal view. **C.** Palp, retrolateral view. **D.** Palp, ventral view. Scale bars: A–B = 1 mm; C–D = 200  $\mu$ m.



**Fig. 2.** *Xevioso cepfi* sp. nov., ♂, paratype (RMCA\_ARA\_245487). **A.** Palp, ventral view. **B.** Palp, as preceding, detail. **C.** Palp, retrolateral view. Abbreviations: EBS = basal embolic sclerite; E = embolus; TA2, TA3 = tegular apophyses 2 and 3. Scale bars = 100  $\mu$ m.

preceding; RMCA\_ARA\_246549 • 1 ♂; same collection data as for preceding; 11 Nov. 2016; RMCA\_ARA\_246555 • 1 ♂; Niassa Region, Njesi Plateau; 12°49.5332, S, 35°11.1002 E; 24 Nov. 2016; L. Geeraert and M. Jocqué leg.; montane forest; pitfall with fence; RMCA\_ARA\_246556.

## Description

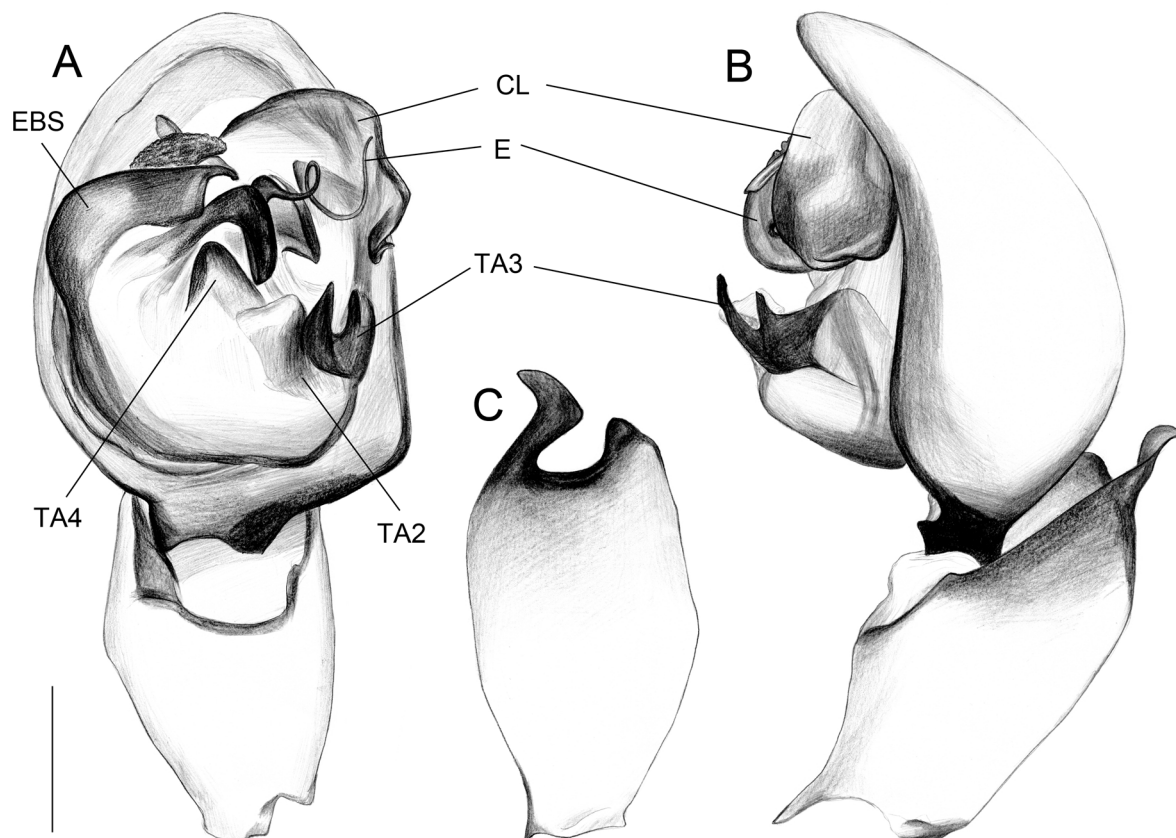
### Male holotype

TOTAL LENGTH. 4.60. Carapace: length 2.15, width 1.68, height 1.63.

COLOUR (Fig. 1A–B). Carapace light yellowish-brown, lighter posteriorly, shading to dark brownish-orange at pars cephalica, blackened around eyes and between AME. Co and Tr concolorous with posterior region of carapace, remainder of legs darkened to pale brownish-orange at tip of each metatarsus. Chelicerae darkest part of body, dark red-brown, with clypeus orange-brown. Sternum cream yellow. Dorsum of abdomen grey, venter pale grey, with some paler areas, pedicel concolorous with sternum.

CARAPACE. Margins weakly sinuate, with very sparse short setae. Carapace with highest point in cephalic area, 1.5 times higher than at fovea (1.63 vs 1.04).

EYES. ALE 0.11; AME 0.10; PLE 0.06; PME 0.06; ALE-AME 0.05; AME-AME 0.03; PME-PME 0.12.



**Fig. 3.** *Xevioso cepfi* sp. nov., holotype, ♂ (RMCA\_ARA\_245493). **A.** Palp, ventral view. **B.** Palp, retrolateral view. **C.** Palpal tibia, dorsal view. Abbreviations: EBS = basal embolic sclerite; E = embolus; CL = lateral ridge of conductor; TA2, TA3, TA4 = tegular apophyses 2, 3 and 4. Scale bars = 200  $\mu$ m.

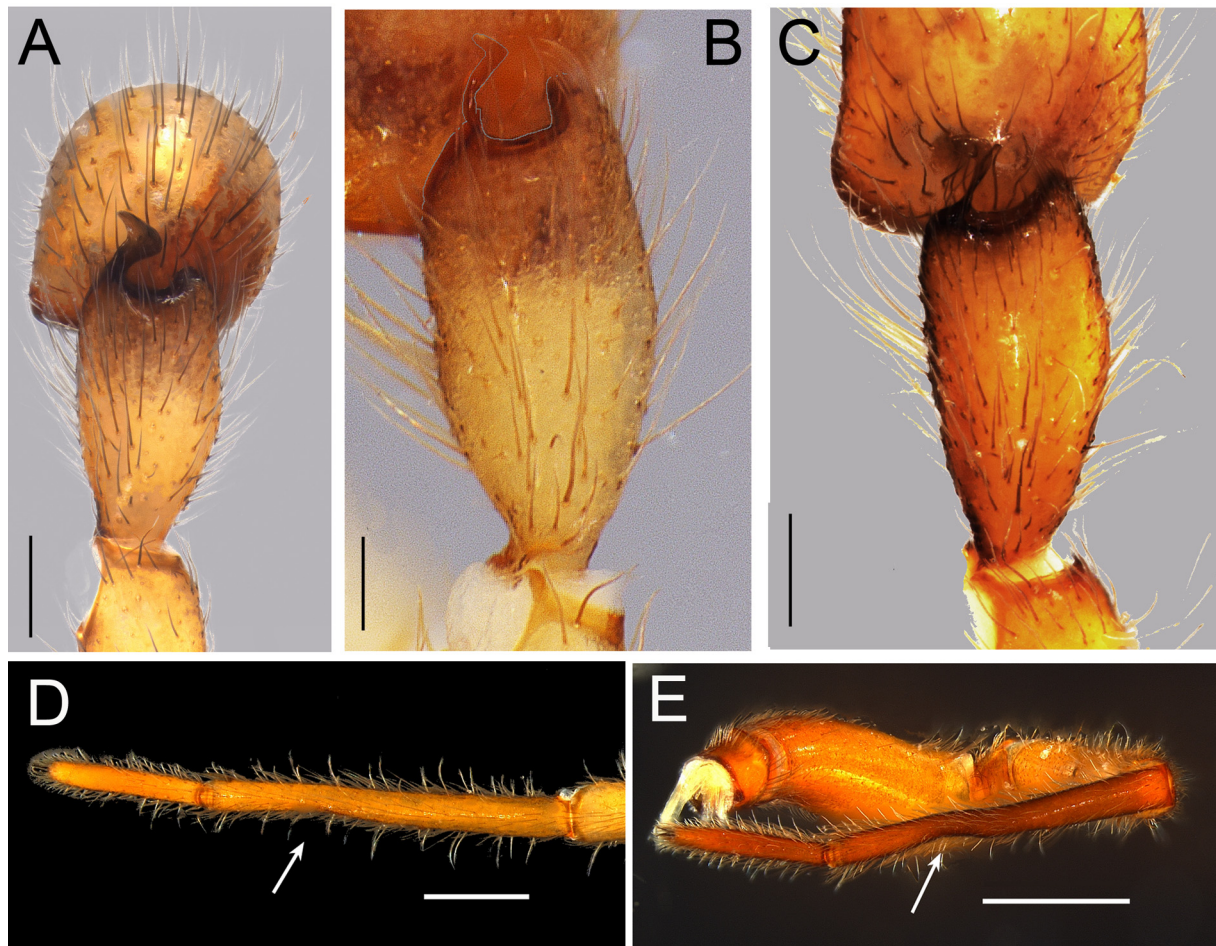
**CHELICERAE.** Promargin with six teeth, three smallest distally and three larger proximally, with the median of the larger teeth being largest. Retromargin with four small and one large tooth.

**ABDOMEN.** With short black setae, denser laterally and longest at posterior apex. Venter with dispersed setae, longest at posterior apex.

**LEGS.** Formula 1423, F I thicker, weakly undulated. P with small but distinct retrolateral process/protrusion. Mt I with very weak pl concavity  $\frac{2}{3}$  towards apex (fig. 4D).

LEG MEASUREMENTS.

	F	P	T	Mt	t	Total
<b>I</b>	2.52	0.88	2.24	2.04	0.87	8.55
<b>II</b>	1.88	0.72	1.52	1.42	0.84	6.38
<b>III</b>	1.68	0.68	1.24	1.32	0.75	5.67
<b>IV</b>	2.16	0.64	2.08	1.81	0.80	7.49



**Fig. 4.** **A, D.** *Xevioso cepfi* sp. nov., holotype, ♂ (RMCA\_ARA\_245493). **B, E.** *Xevioso jocquei* Griswold, 1990, holotype, ♂ (RMCA\_ARA\_156494). **C.** *Xevioso megcummingae* sp. nov., holotype, ♂ (RMCA\_ARA\_236654). **A–C.** Palpal tibia, dorsal view. **D–E.** Mt I, dorsal view. Scale bars: A = 200 µm; B–C = 100 µm; D–E = 0.5 mm.

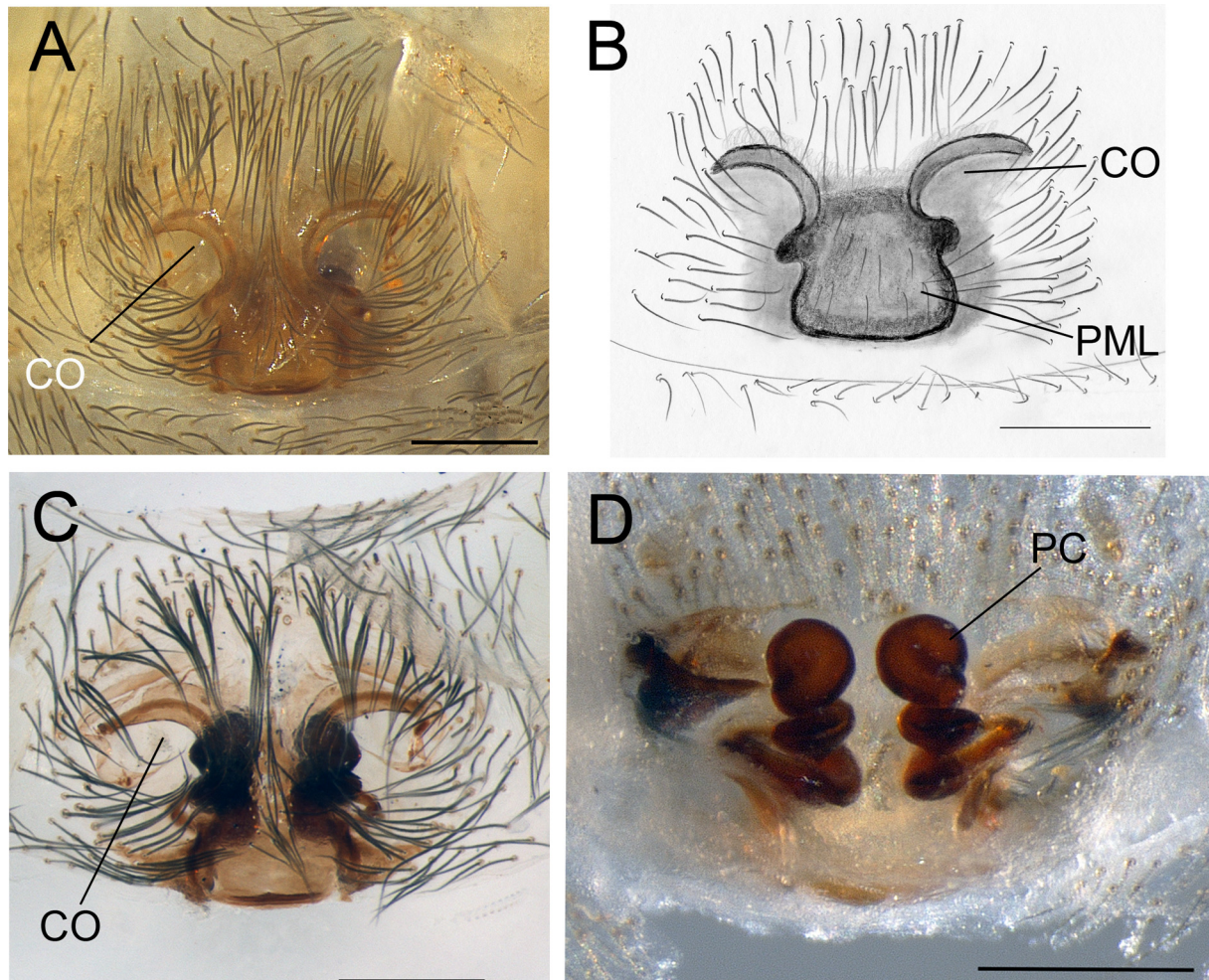
SPINATION. Leg I: F = pl1, T = v3, Mt = v4; Leg II: F = pl1, T = pl1 v2, Mt = pl1 r11 v3; Leg III: T = pl2 r12 v2; Leg IV: T = pl1 d2 r11 v3.

STERNUM (Fig. 1A). 1.2 long, 0.92 wide. Shield-shaped, with slightly sinuous lateral margins. Black setae longer at margins and without setae centrally. No precoxal sclerites.

PALP (Figs 1C–D, 2A–C, 3A–C, 4A). F with two short stout anterobasal thorns. T with strong, dark axle-shaped process and pronounced DP, delimiting concavity with narrow opening. Palpal bulb simple, not divided into basal and retrobasal lobes. Embolus broadest at base but tapered apically into slender corkscrew, with three coils. TA3 with two acutely pointed prongs, TA2 lobate with short, blunt tip. EBS tri-partite, EBA1 sub-quadrated with weak posterior point, EBA2 recurved and slender, EBA3 fine and serrated with apex curving dorsally. Conductor with rl transverse ridge, basocentral lobe distad of embolus, and lateral and apical fringe.

### Female paratype

TOTAL LENGTH. 4.45. Carapace length 2.04. Carapace width 1.45. Carapace height 1.12.



**Fig. 5.** *Xevioso cepfi* sp. nov., ♀, paratype (RMCA\_ARA\_245496), epigyne. **A–B.** Ventral view. **C.** Cleared, ventral view. **D.** Cleared, dorsal view. Abbreviations: CO = copulatory opening; PC = posterior chamber; PML = posterior median lobe. Scale bars = 200  $\mu$ m.



COLOUR. Carapace uniform, creamy yellow-brown. Clypeus from AME's darker, orange-brown, thin line around margin of clypeus black. Chelicerae substantially darker, a deep reddish brown. Legs concolorous with carapace, except leg I: darkening at Mt a deep orange. Abdomen grey with short black setae, venter paler grey, creamy at anterior margin with pedicel concolorous with carapace base.

CARAPACE. Margins very weakly sinuate, if at all. Sparse black setae reach highest abundance medially, anterior of the fovea.

EYES. ALE 0.08; AME 0.09; PLE 0.07; PME 0.06; ALE-AME 0.06; AME-AME 0.04; PME-PME 0.12

CHELICERAE. Promargin with four teeth, retromargin with six small teeth

ABDOMEN. Venter light grey to cream at anterior, with short black setae uniform throughout, getting only marginally longer at the posterior end.

LEGS. Formula 143? (missing leg II). F I undulates weakly  $\frac{2}{3}$  of length toward apex. As in males, distinct but small rl process/ protrusion at pa. Females lack pl concavity at the mt present in males.

LEG MEASUREMENTS.

	<b>F</b>	<b>P</b>	<b>T</b>	<b>Mt</b>	<b>t</b>	<b>Total</b>
<b>I</b>	1.73	0.72	1.60	1.34	1.01	6.40
<b>II</b>	–	–	–	–	–	–
<b>III</b>	1.40	0.57	0.93	0.91	0.63	4.44
<b>IV</b>	1.67	0.73	1.58	1.48	0.83	6.29

SPINATION. Leg I: F = pl1, T = v1, Mt = v3; Leg III: F = pl2 rl1 v1, Mt = 3disp, 4dw; Leg IV: T= rl1 v1, Mt = 4disp, 4dw.

STERNUM. Roughly shield-shaped, straight at anterior margin. Black setae at margins but without setae centrally. 1.10 long and 0.94 wide.

EPIGYNE (Fig. 5A–D). Posterior median lobe of epigyne twice as wide as long, widest at lateral midpoint. Vulva with spermathecae cylindrical, with external spiral of three turns. Anterior median duct of spermathecae converge slightly at anterior apex, towards touching from lateral. Dorsal posterior chambers face laterally.

*Xevioso mecummingae* sp. nov.

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Figs 4C, 6–8

**Diagnosis**

Males of *X. cummingae* sp. nov. can be distinguished from others in the genus by the following character combination: (1) Mt I modified, with strong and broad d process  $\frac{2}{3}$  towards apex, about double the height of Mt apex; (2) palpal T with dorsal hyaline process thin, slightly curved, appearing nail-like in rl view; (3) palpal DP broad and sub-triangular; (4) TA3 tegular processes short and blunt; TA1 absent. Females are recognized by the CO far apart and the longitudinal axis of the spermathecae diverging anteriorly.

### Etymology

The species name is a matronym in honour of Zimbabwean naturalist, Meg Cumming, collector of the type material.

### Material examined

#### Holotype

ZIMBABWE • ♂; Harare, Walmer Drive; 17°48.4802 S, 31°05.8202 E; 1535 m a.s.l.; 19 Oct. 2002; M. Cumming leg.; garden; RMCA\_ARA\_236654.

#### Paratype

ZIMBABWE • 1 ♀; same collection data as for holotype; 19 Apr. 2005; RMCA\_ARA\_236655.

#### Other material

MALAWI • 1 ♂; Viphya Plateau, Chikangawa; 11°522 S, 33°482 E; 1817 m a.s.l.; Oct. 1977–Feb. 1978; R. Jocqué leg.; young pine plantation; pitfall: RMCA\_ARA\_153025.

### Description

#### Male holotype

TOTAL LENGTH. 6.85. Carapace length 2.92. Carapace width 2.44. Carapace height 1.36.

COLOUR (Fig. 6A). Carapace light yellowish-orange, darkened anteriorly at pars cephalica, chelicerae deep reddish-brown, darkest part of the body; black pigment around eyes, PME without black pigment, AME's joined by dark pigment. Sternum light yellow, margins darkened to deep reddish-brown. Co and Tr I brownish-orange, darker than others, cream yellow. F I orange, to brownish-orange up to Mt; other legs light brownish-yellow to orange at Mt. Abdomen and venter cream to white entirely.

CARAPACE. Margin weakly sinuate. Short black setae dispersed in irregular and sparse patches. Fovea deeply concave, carapace flat throughout, clypeus height  $1.1 \times$  height of carapace at fovea.

EYES. ALE 0.10; AME 0.10; PLE 0.10; PME 0.08; AME-AME 0.04; PME-PME 0.17.

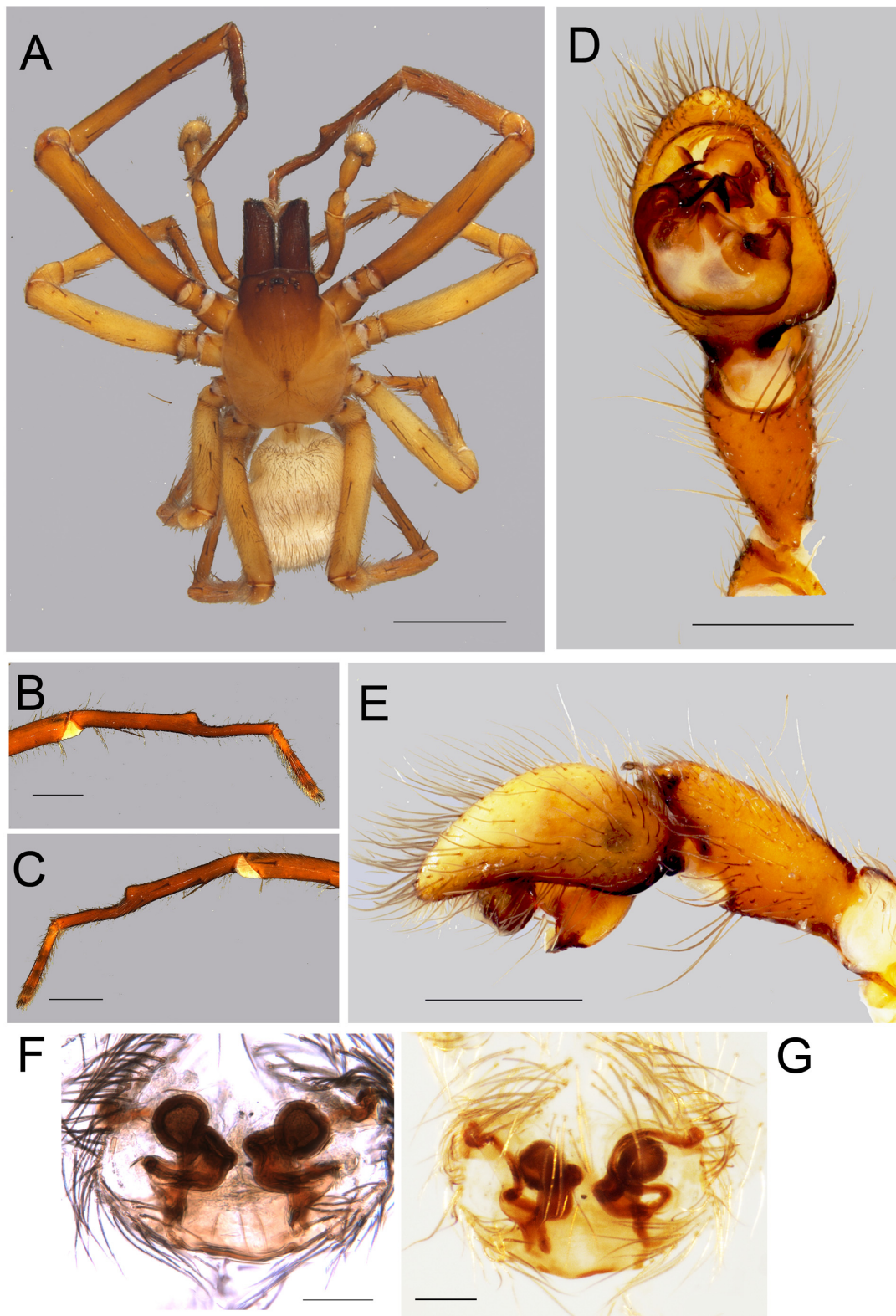
ABDOMEN. Black setae regularly spaced throughout (both dorsally and ventrally), setae longer posteriorly, reaching 0.4.

LEGS (Fig. 6B–C). Formula 1423, with leg III distinctly shortened. Leg I modified at metatarsus, with strong kink extending dorsally, creating metatarsal process at least twice as high as apical end of metatarsus.

#### LEG MEASUREMENTS.

	<b>F</b>	<b>P</b>	<b>T</b>	<b>Mt</b>	<b>T</b>	<b>Total</b>
<b>I</b>	3.68	1.21	3.72	3.16	1.31	13.08
<b>II</b>	2.85	1.08	2.52	2.60	1.30	10.35
<b>III</b>	2.68	0.91	2.18	2.28	0.93	8.98
<b>IV</b>	3.20	1.20	3.44	3.20	1.13	12.17

SPINATION. Leg I: F = pl1, T = pl2 r11 v1, Mt = pl2 v2; Leg II: F = pl1, T = pl2 r2 v5, Mt = pl1 d1 r14 v2; Leg III: F = pl1 d3 r11, T = d2 r12 v2, Mt = 3disp 6dw; Leg IV: F = pl1, T = pl2 r2 v3, Mt = 2d, 5dw.



**Fig. 6.** *Xevioso megcummingae* sp. nov. **A–E.** Male holotype (RMCA\_ARA\_236654). **F–G.** Male paratype (RMCA\_ARA\_236655). **A.** Male habitus, dorsal view. **B.** Mtl, prolateral view. **C.** Mtl, retrolateral view. **D.** Palp, ventral view. **E.** Palp, retrolateral view. **F.** Epigyne, ventral view. **G.** Epigyne, dorsal view. Scale bars: A = 1 mm; B–C = 0.5 mm; D–E = 200  $\mu$ m; F–G = 100  $\mu$ m.

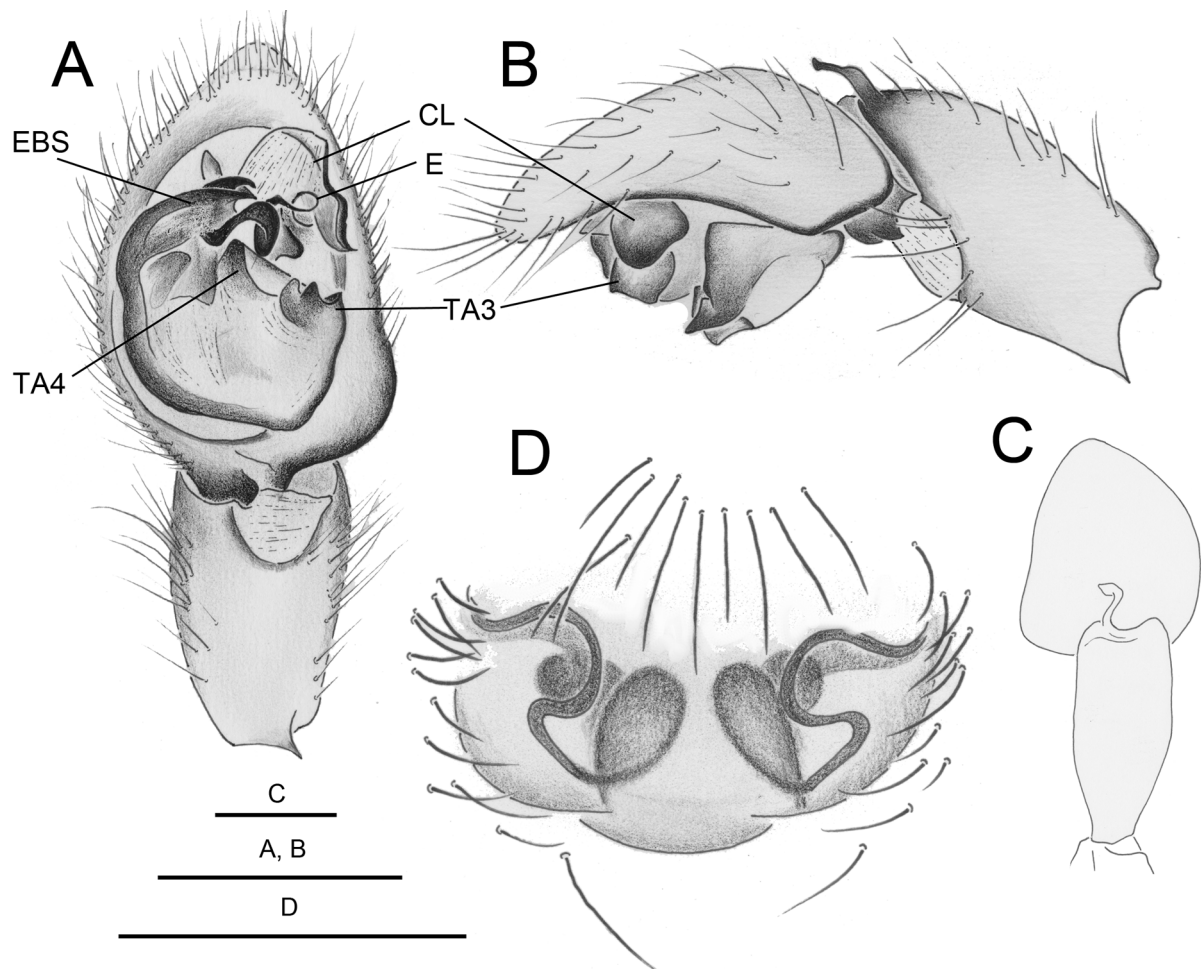
**STERNUM.** Roughly oval and distinctly jagged at coxae. 1.61 long and 1.32 wide. Black setae interspersed laterally, with very few medially.

**PALP** (Figs 4C, 6D–E, 7A–C). F with dorsal hyaline asetose process slender, curved at extremity, with broad DP delimiting widely open, shallow concavity (Figs 4C, 6E). Embolus turning three times, tapering to acutely pointed corkscrew apex; thickest just before first turn. Tegulum simple, without basal or retrobasal lobes. TA3 with two short, blunt projections; EBS poorly sclerotized, tripartite, EBA1 narrower at apex, almost touching embolus, EBA2 rounded.

#### Female paratype

**TOTAL LENGTH.** 5.18. Carapace length 2.19. Carapace width 1.51. Carapace height 1.30.

**COLOUR.** Carapace creamy yellow throughout, darkening to light-orange at clypeus dorsally. Chelicerae boss orange to brown, darkest part of body. Femora lightest, darkening to a deep orange-brown at metatarsi. Abdomen uniform light grey to cream.



**Fig. 7.** *Xevioso megcummingae* sp. nov. **A–C.** Holotype, ♂ (RMCA\_ARA\_236654). **D.** Paratype, ♀ (RMCA\_ARA\_236655). **A.** Palp, ventral view. **B.** Palp, lateral view. **C.** Palp, dorsal view. **D.** Epigyne, ventral view. Abbreviations: EBS = basal embolic sclerite; E = embolus; CL = lateral ridge of conductor; TA3, TA4 = tegular apophyses 3 and 4. Scale bars: A–C = 500 µm; D = 100 µm.

CARAPACE. Weakly sinuate with short black setae posterior of the fovea. Fovea moderately depressed.

EYES. ALE 0.07; AME 0.05; PLE 0.04; PME 0.07; ALE-AME 0.08; AME-AME 0.04; PME-PME 0.12

CHELICERAE. Strong, 1.30 long, seven teeth present on both promargin and retromargin, promargin with two larger proximal teeth, retromargin all teeth small. Endites with translucent subdecumbent setae.

ABDOMEN. Dorsum with very few setae anteriorly, denser on posterior part. Venter with minimal short fine setae.

LEGS. Formula 123? (legs IV are missing), without pl concavity on metatarsi I as in male.

LEG MEASUREMENTS.

	F	P	T	Mt	T	Total
<b>I</b>	2.13	0.81	1.91	1.62	0.82	7.29
<b>II</b>	1.81	0.66	1.37	1.20	0.71	5.75
<b>III</b>	1.30	0.45	1.05	1.22	0.74	4.76
<b>IV</b>	–	–	–	–	–	–

SPINATION. Leg I: F = pl1, T = pl2 v3, Mt = pl2 rl1 v5; Leg II: F = pl1 d1, T = pl2 v1, Mt = pl2 rl1 v3; Leg III: F = pl1 rl1, T = pl3 d1 rl1 v2, Mt = disp3 dw4.

STERNUM. 1.21 long, 0.91 wide. Shield-shaped; with some short black setae.

PALP. With dense procurved setae and toothless claw.

EPIGYNE (Figs 6F–G, 7D). PML of epigyne wider than long. Copulatory openings far apart, situated on lateral side of epigyne; spermathecae diverging anteriorly; fertilization duct leading medially and posteriorly from spermathecae.

**Variation**

The male specimen from Malawi (RMCA\_ARA\_153025) is smaller and paler than the holotype. Total length 3.12 (the abdomen has shrunk); carapace length 1.99, width 1.35, height 0.92.

*Xevioso jocquei* Griswold, 1990  
Figs 4B, E, 8

**Material examined**

MALAWI • holotype ♂; Mt Mulanje, Lichenya Plateau; 16°00' S, 35°30' E; 2000 m a.s.l.; 7–23 Nov. 1981; R. Jocqué leg.; seepage area with grassy vegetation; pitfalls; RMCA\_ARA\_156494.

**Key to the species of *Xevioso* (modified from Griswold 1990)**

Note: figures denoted ‘\*fig.’ refer to figures in Griswold (1990).

1. Males ..... 2
- Females ..... 12
  
2. Metatarsus I without dorsomedian projection ..... 3
- Metatarsus I with dorsomedian projection (\*figs 33, 44) ..... 5

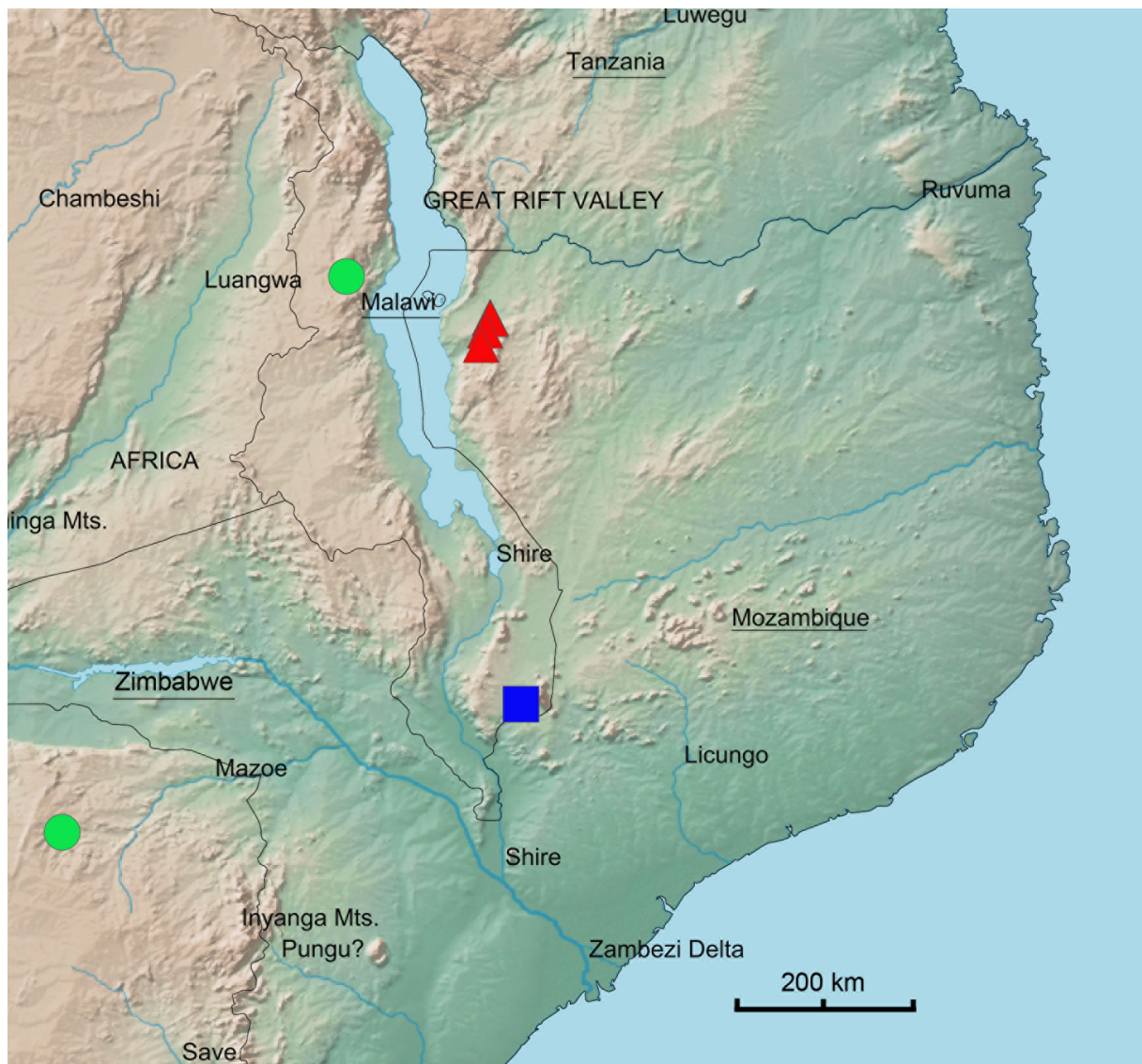
3. Tegulum (\*fig. 34a) divided into basal lobe and projecting TA3; TA 1 present; apex of EBS simple ..... *X. orthomeles* Griswold, 1990
  - Tegulum (\*fig. 46a) simple, without basal lobe, TA3 not protruding; TA1 absent; apex of EBS tripartite ..... 4
4. Modification of Mt I subtle, hardly discernable (Fig. 4D); TA3 with two sharp prongs (Figs 1C–D, 3A–B), dorsal apophysis of palpal tibia axe-shaped, delimiting rounded invagination with narrow opening (Figs 1C, 3B–C, 4A) ..... *X. cepfi* sp. nov.
  - Mt I clearly narrowed in center (Fig. 4E); TA3 with blunt prongs; dorsal apophysis of palpal tibia sinuous, delimiting oval invagination with broad opening (Fig. 4B) ..... *X. jocquei* Griswold, 1990
5. Tegulum (Figs 6D, 7A) simple, without basal lobe, TA3 not protruding; apex of EBS tripartite): apophysis of palpal tibia sinuous (Figs 4C, 7B–C) delimiting oval invagination with broad opening ..... *X. mecummingae* sp. nov.
  - Tegulum (\*fig. 34a) divided into basal lobe and projecting TA3 ..... 6
6. Palpal tibia with no more than 1 elongate apical process, DA unmodified; embolic spiral much narrower than width of cymbium; conductor without hook; metatarsus I with 1 distinct dorsal process ..... 7
  - Palpal tibia with 2 widely separated processes (\*fig. 37b): an elongate DA and acutely pointed median D process; embolus a broad spiral covering width of cymbium (\*fig. 37a); conductor with proximal median hook; metatarsus I with 2 distinct dorsal processes (\*fig. 33a) ..... *X. zuluana* (Lawrence, 1939)
7. Metatarsus I with an acute dorsal spur (\*fig. 40a–d); palpal tibia with DAS produced into a long, sharp point (\*fig. 41b); embolus making less than 1 full turn ..... 8
  - Metatarsus I dorsal projection broad and triangular; palpal tibia with DA rounded and unmodified (\*fig. 29c); embolus making more than 1 full turn (\*fig. 29b) ..... 9
8. Palpal tibia with hyaline D reduced to a vestige or lost, DAS extending far beyond margin of hyaline D (\*fig. 39b); TA3a very long, pointed (\*fig. 39c); TA 1 present, slender; proximal margin of conductor transverse, unmodified (\*fig. 39a); metatarsus I with fine spinules ..... *X. aululata* Griswold, 1990
  - Palpal tibia with hyaline D extending for full length of DA, reaching apex of DAS; TA3a short, conical (\*fig. 41c); TA1 absent; proximal margin of conductor with an acute, proximad-directed flange (\*fig. 41a); metatarsus I with stout spinules ..... *X. colobata* Griswold, 1990
9. Palpal tibia with hyaline D broad, margin gently curved or angled (\*fig. 45b); apex of EBS bifid (\*fig. 42a); embolus with lamella for much of length (\*fig. 45a); TAI slender and elongate (\*fig. 42c) ..... 10
  - Palpal tibia with hyaline D having a slender median flange (Df) projecting distally (\*figs 29c, 32b); apex of EBS simple (\*fig. 29b); embolus with lamella only at base; TA 1 broad (\*figs 29e, 32a) ... 11
10. Conductor with acute proximal flange (\*fig. 45c); palpal tibia with hyaline D angled (\*fig. 45b) .... *X. kulufa* Griswold, 1990
  - Conductor without proximal projection (\*fig. 42c); palpal tibia with hyaline D evenly curved (\*fig. 42b) ..... *X. lichmadina* Griswold, 1990
11. Tegulum with TA3a broad, short, conical, apex bifid (\*figs 32a, c) ..... *X. tuberculata* (Lawrence, 1939)
  - Tegulum with TA3a narrow, elongate, apex acutely pointed (\*figs 36a, c) ..... *X. amica* Griswold, 1990

12. Ratio of PML length to width greater than 1 ..... 13  
 – Ratio of PML length to width less than 1 ..... 14
13. Ratio of PML length to width greater than 2 (\*fig. 43a) ..... *X. lichmadina* Griswold, 1990  
 – Ratio of PML length to width less than 2 (\*fig. 43b) ..... *X. kulufa* Griswold, 1990
14. Epigynum simple, without paired lobes or secondary depressions; copulatory duct small, straight or curved and horn shaped ..... 15  
 – Epigynum with paired raised median lobes and shallow paired anterior depressions; copulatory duct very large, spherical, length nearly equal to that of spermathecal capsule (\*fig. 38b) .....  
 ..... *X. zuluana* (Lawrence, 1939)
15. Epigynum flat to convex, with lateral margins of PML curved outward posteriorly; spermathecae with spiral duct ..... 16  
 – Epigynum with transverse median ridge, lateral margins of PML straight; spermathecae with simple spherical chamber (\*figs 12d, 38c) ..... *X. aulutata* Griswold, 1990
16. Copulatory duct large, hornlike, expanded proximally ..... 17  
 – Copulatory duct small, ringlike ..... 19
17. Diameter of copulatory duct much greater than that of spiral spermathecal chamber (\*fig. 35e) .....  
 ..... *X. amica* Griswold, 1990  
 – Diameter of copulatory duct about equal to that of spiral spermathecal chamber ..... 18
18. Spiral spermathecal chamber almost touching medially with anterior bulbus spherical spermathecae (Fig. 6F–G). CO far apart ..... *X. mecummingae* sp. nov.  
 – Spiral spermathecal chamber not close to touching medially, without bulbus spherical spermathecae head (\*fig. 35d) ..... *X. orthomeles* Griswold, 1990
19. Spermathecal chamber with 4-5 turns, copulatory duct small and thin (\*fig. 39f) .....  
 ..... *X. tuberculata* (Lawrence, 1939)  
 – Epigyne with copulatory opening with distinct sinuation posteriorly (Fig. 5A). Spermathecal chamber with 3 turns (Fig. 5C), copulatory duct expanding widely, wider than spermathecae (Fig. 5B–C) ...  
 ..... *X. cepfi* sp. nov.

## Discussion

It is well known that the mountain fauna and flora of the South African mountains ranging from the Western Cape in the south-west to the Limpopo Province in the north, are unique and have a high proportion of endemic species (Axelrod & Raven 1978). The Limpopo appears to be a natural boundary for most of the southern organisms absent in tropical Africa. However, there are a number of elements that are typical of the Cape fauna occurring north of the Limpopo on inselbergs in Malawi and Mozambique, reaching their northernmost limit there. The geological background of this phenomenon is explained in Axelrod & Raven (1978) and Delvaux (2001). The cedars of the genus *Widdringtonia* Endl. are an outstanding botanical example, as they reach their northernmost distribution on Mt Mulanje (Malawi) (Pauw & Lindner 1997), a well-known large inselberg with an altitude of about 3000 m. It harbours numerous representatives of taxa with a southern African distribution (Strugnell 2002). Among these is *Sphaerotherium transzambeziacum* Jocqué, 1984, a pill millipede belonging to a family that otherwise occurs only south of the Zambezi River (Jocqué 1984). Two more inselbergs at about the same latitude just across the border in Mozambique are Mt Namuli and Mt Mabu, which have been inventoried for invertebrates, but only superficially (Timberlake *et al.* 2009, 2012).

It has been questioned whether these inselbergs are the northernmost high-altitude leftovers of a fauna that had a strong connection with the Cape fauna (Jocqué 1983, 1984). The case of *Xevioso*, which clearly has its center of distribution in eastern South Africa, is interesting in this context. The species *X. jocquei* was considered as an anomaly as far as its distribution is concerned, but it could be explained as a high altitude remnant of a once larger area. It now appears that two more species are found much further north in mountain areas in northern Mozambique and Malawi, on both sides of Lake Malawi, and that the genus has a much larger distribution (Fig. 8). *Xevioso cepfi* sp. nov. has been collected on all plateaus of the Mozambique Niassa Region at altitudes between 1600 and 1800 m a.s.l. A first hint of the geographic importance of these highlands was already suggested by the inventory of mammals (van Berkel *et al.* 2019) and reptiles (Bayliss *et al.* 2014). It has been corroborated by the find of a representative of the genus *Cicynethus* Simon, 1910 (*C. mossambicus* Jocqué & Henrard, 2018), widely separated from *C. acer* Jocqué & Henrard, 2018, its nearest relative in South Africa (Jocqué &



**Fig. 8.** Distribution. *Xevioso cepfi* sp. nov. (▲), *Xevioso jocquei* Griswold, 1990 (■), *Xevioso megcummingae* sp. nov. (●).



Henrard 2018). The find of *X. mecummingae* sp. nov. at quite a distance from the type locality, shows that the Viphya Mts in Central Malawi may also harbour more interesting endemics.

Our study confirms the importance of these remote altitudinal ranges for the understanding of distribution patterns of southern African taxa with a predilection for montane habitats.

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