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A NEW SPECIES OF THE GENUS *ZETORCHELLA* BERLESE, 1916 (ACARI: ORIBATIDA: CALOPPIIDAE) FROM ETHIOPIA, WITH A KEY TO SPECIES OF THE GENUS FROM AFROTROPICAL REGION

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Summary. The oribatid mite *Zetorchella arsiensis* Ermilov, **sp. n.** (Oribatida: Caloppiidae) is described from Ethiopia. A key to species of the genus *Zetorchella* Berlese, 1916 from the Afrotropical region is provided.

Key words: oribatid mites, taxonomy, morphology, Africa.

С. Г. Ермилов, Л. Б. Рыбалов. Новый вид рода *Zetorchella* Berlese, 1916 (Acari: Oribatida: Caloppiidae) из Эфиопии с определительной таблицей известных из Афротропической области видов рода // Дальневосточный энтомолог. 2023. N 469. С. 1-10.

Резюме. Из Эфиопии описан панцирный клещ *Zetorchella arsiensis* Ermilov, **sp. n.** (Acari: Oribatida: Caloppiidae). Дана определительная таблица известных из Афротропической области видов рода *Zetorchella* Berlese, 1916.

INTRODUCTION

The oribatid mite genus *Zetorchella* (Acari: Oribatida: Caloppiidae) was proposed by Berlese (1916) with *Chaunoproctus cancellatus* Pearce, 1906 as type species. So far, it consists of 26 species which are distributed in the pantropical and subtropical regions (Subías, 2022). The revised generic diagnosis was presented by Ermilov & N'Dri (2019).

Presently, four *Zetorchella* species have been recorded from Ethiopia (Ermilov *et al.*, 2010; Ermilov, 2016; Ermilov *et al.*, 2021), namely *Z. nortoni* Ermilov, Sidorchuk et Rybalov, 2010, *Z. pedestris* Berlese, 1916, *Z. robertbecki* Ermilov, Subías, Shtanchaeva et Friedrich, 2021, and *Z. vargai* (Balogh, 1959).

The main goal of this paper is to describe and illustrate a new species of *Zetorchella* from Ethiopia. Additionally, we update a key to species of this genus from the Afrotropical region.

MATERIAL AND METHODS

This work is based on oribatid mite materials collected from Ethiopia in the course of the Joint Russian-Ethiopian Biological Expeditions in 2021.

Specimens were mounted in lactic acid on temporary cavity slides for measurement and illustration. Body length was measured in lateral view, from the tip of the rostrum to the posterior edge of the notogaster. Notogastral width refers to the maximum width of the notogaster in dorsal view. Lengths of body setae were measured in lateral aspect. All body measurements are presented in micrometers. Formulas for leg setation are given in parentheses according to the sequence trochanter-femur-genu-tibia-tarsus (famulus included). Formulas for leg solenidia are given in square brackets according to the sequence genu-tibia-tarsus.

Drawings were made with a camera lucida using a Leica transmission light microscope "Leica DM 2500". For SEM microscopy alcohol preserved mites were dusted with gold and scanned with the aid of a TESCAN Mira3 LMU SEM microscope.

General morphological terminology used in this paper mostly follows that of F. Grandjean: see Trávě & Vachon (1975) for references, Norton (1977) for leg setal nomenclature, and Norton & Behan-Pelletier (2009) for overview.

Abbreviations. Prodorsum: *lam* = lamella; *tlam* = translamella; *slam* = sublamella; *Al* = sublamellar porose area; *ro*, *le*, *in*, *bs*, *ex* = rostral, lamellar, interlamellar, bothridial, and exobothridial seta, respectively; *tu* = tatorium; *D* = dorsophragma; *P* = pleurophragma. Notogaster: *Aa*, *A1*, *A2*, *A3*, *A4* = porose areas; *c*, *la*, *lm*, *lp*, *h*, *p* = setae; *ia*, *im*, *ip*, *ih*, *ips* = lyrifissures; *gla* = opisthonotal gland opening. Gnathosoma: *a*, *m*, *h* = subcapitular setae; *or* = adoral seta; *d*, *l*, *sup*, *inf*, *cm*, *ul*, *sul*, *vt*, *lt* = palp setae; ω = palp solenidion; *cha*, *chb* = cheliceral setae; *Tg* = Trägårdh's organ. Epimeral and lateral podosomal regions: *1a-1c*, *2a*, *3a-3c*, *4a-4c* = epimeral setae; *PdI*, *PdII* = pedotectum I, II, respectively; *dis* = discidium; *cir* = circumpedial carina. Anogenital region: *g*, *ag*, *an*, *ad* = genital, aggenital, anal, and adanal seta, respectively; *iad* = adanal lyrifissure; *p.o.* = preanal organ. Legs: *Tr*, *Fe*, *Ge*, *Ti*, *Ta* = trochanter, femur, genu, tibia, tarsus, respectively; *p.a.* = porose area; ω , ϕ , σ = solenidia; ϵ = famulus; *d*, *l*, *v*, *bv*, *ev*, *ft*, *tc*, *it*, *p*, *u*, *a*, *s*, *pv*, *pl* = setae.

DESCRIPTION OF NEW SPECIES

Zetorchella arsiensis Ermilov, sp. n.

<https://zoobank.org/NomenclaturalActs/F52F4DCE-0C94-43E1-A012-3A777D37EE57>

Figs 1–16

TYPE MATERIAL. Holotype – ♀, **Ethiopia**: Oromia Region, Arsi Zone, Arsi Mountains National Park, Mount Chilalo, 07°56′09.5″N, 039°11′54.7″E, 3177 m a.s.l., sifting litter under *Hypericum* sp., *Thyme* sp. and green mosses in heather bushes (*Erica arborea*), Berlese's funnels, 27.XI 2021, leg. L.B. Rybalov. Paratypes: 7♂, 4♀, same data as holotype.

TYPE DEPOSITION. The holotype is deposited in the collection of the Senckenberg Museum of Natural History, Görlitz, Germany; 11 paratypes are deposited in the collection of the Tyumen State University Museum of Zoology, Tyumen, Russia. All specimens are preserved in ethanol with a drop of glycerol.

DIAGNOSIS. Body length: 796–898. Interlamellar, epimeral and anogenital regions foveate; notogaster foveolate; genital plate striate. Interlamellar seta medium-sized, slightly phylliform, barbed. Bothridial seta comparatively short, clavate, barbed. Notogaster with sinuous ridges. All notogastral setae comparatively short, phylliform (dilated mediodistally), barbed. Epimeral and anogenital setae setiform, slightly barbed. With two pairs of adanal setae. Leg tarsus I with 19 setae (*l*'' absent).

MEASUREMENTS. Body length: 830 (holotype), 796–898 (11 paratypes); body width: 597 (holotype), 531–614 (11 paratypes).

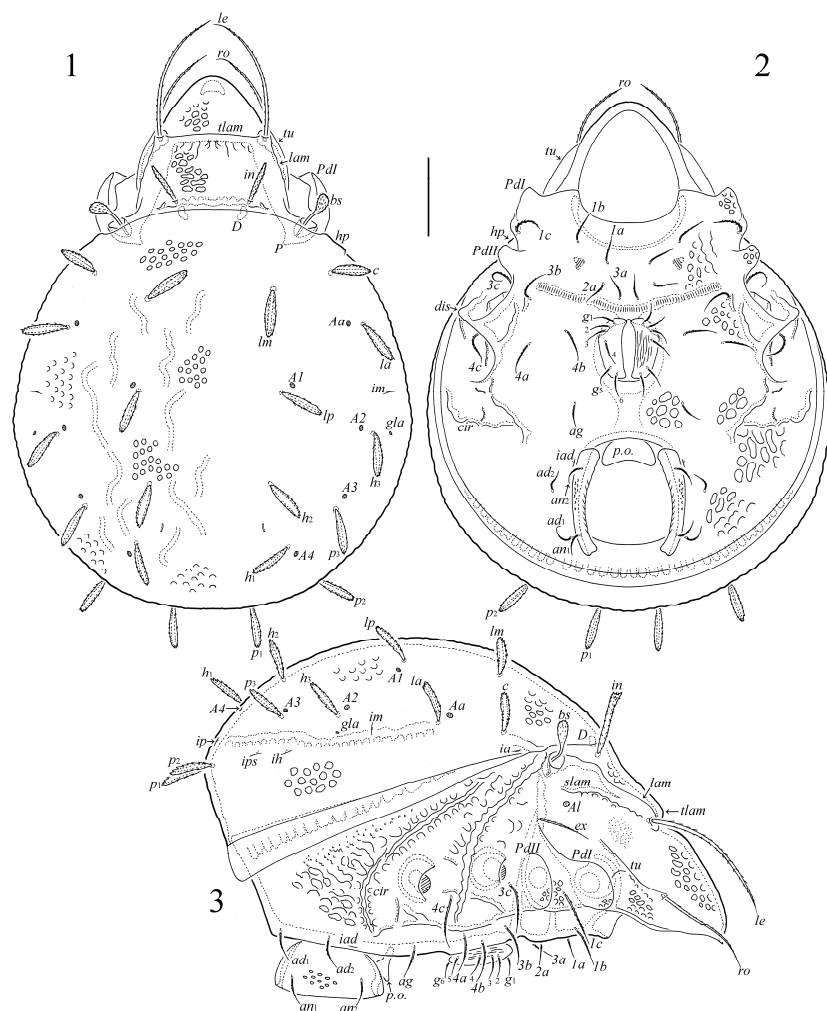
DESCRIPTION. Integument. Body color brown to dark brown. Body surface densely microgranulate. Anterior part of prodorsum foveate-reticulate. Interlamellar, epimeral and anogenital regions, subcapitular mentum, leg trochanters III, IV, and podosomal region between bothridium and acetabula III, IV foveate (cells or semi-cells of different form with strong ridge-like borders between them). Notogaster foveolate (rounded cells). Genital plate longitudinally striate. Leg femora I-IV microfoveate. Marginal region of ventral plate with numerous small tubercles forming often chain-like structures.

Prodorsum. Rostrum widely rounded. Lamella about 1/2 length of prodorsum. Prolamella absent. Sublamella slightly shorter than lamella. Sublamellar porose area rounded (6–8), located ventral to sublamella. Tutorium similar to lamella in length, ridge-like, reaching insertion of rostral seta. Rostral (135–149) and lamellar (180–192) setae setiform, barbed. Interlamellar seta (102–114) slightly phylliform and dilated distally, barbed. Exobothridial seta (69–73) setiform, thin, barbed. Bothridial seta (61–77) clavate, barbed, with stalk and head similar in length. Dorsejugal porose area not observed.

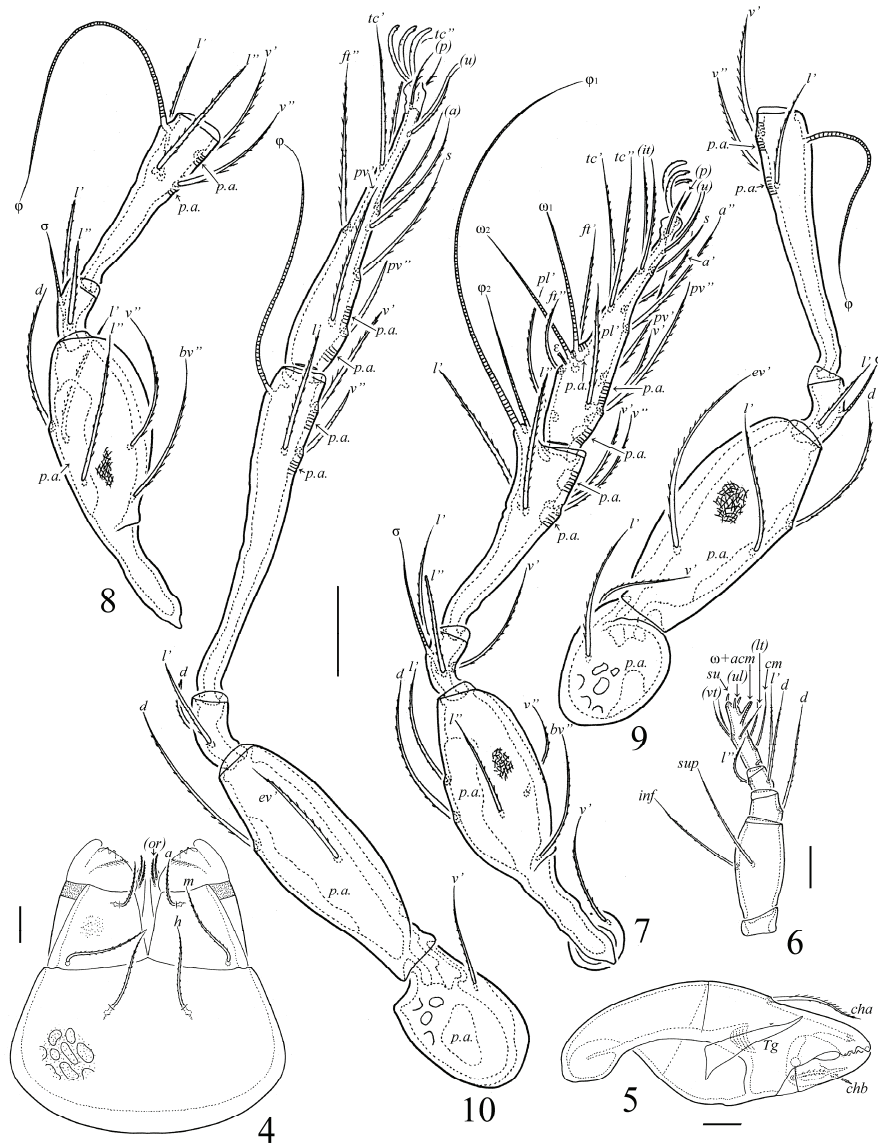
Notogaster. Anterior notogastral margin distinct, slightly convex medially. Humeral process slight, elongate quadrangular. Notogaster with some slightly developed (but well visible) sinuous ridges. Ten pairs of notogastral setae (61–77) phylliform

(dilated mediodistally), barbed. Five pairs of porose areas rounded (6–8). Opisthotal gland opening and all lyrifissures distinct.

Gnathosoma. Subcapitulum size: 180–205 × 139–164. Subcapitular (a : 30–32; m and h : 49–61) and adoral (16) setae setiform, barbed. Palp (135–151) setation: 0–2–1–3–9(+ ω). Postpalpal seta (8) spiniform, roughened. Chelicera (186–205) with two setiform, barbed setae (cha : 61–69; chb : 41–49).

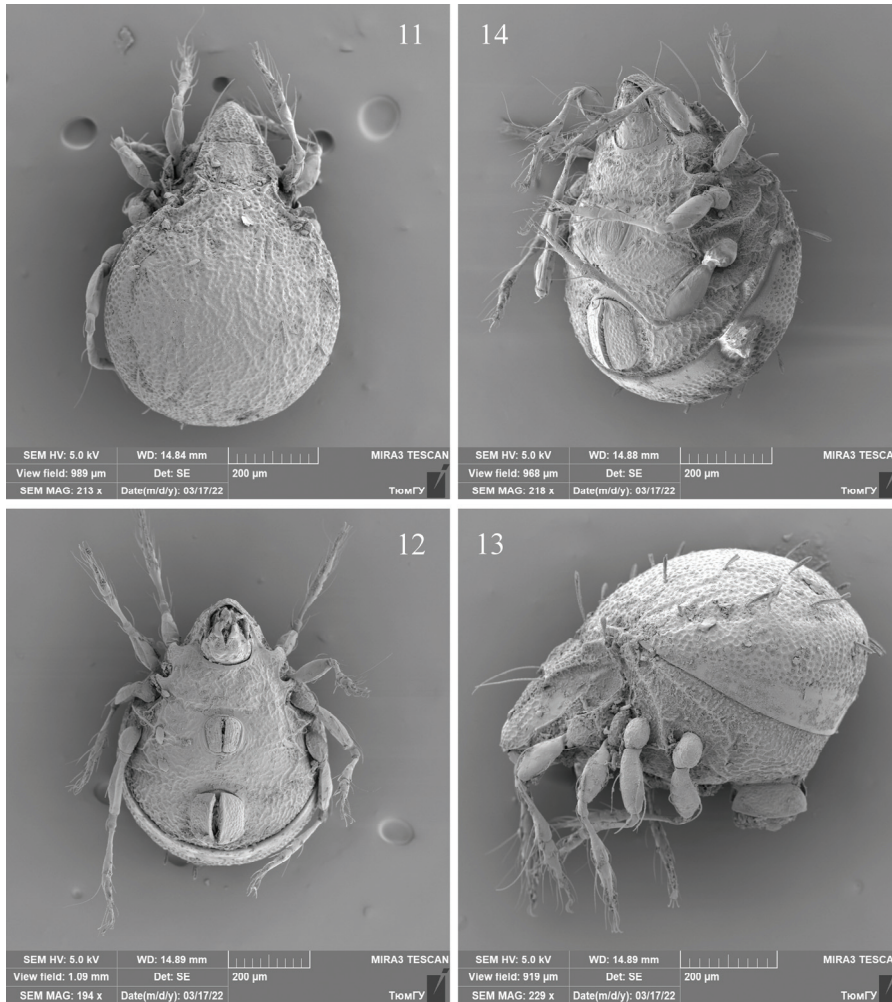


Figs 1–3. *Zetorchella arsiensis* Ermilov, sp. n., adult: 1 – dorsal view (legs not shown); 2 – ventral view (gnathosoma and legs not shown); 3 – right lateral view (gnathosoma and legs not shown). Scale bar = 100 μ m.



Figs 4–10. *Zetorchella arsiensis* Ermilov, sp. n., adult: 4 – subcapitulum, ventral view; 5 – chelicera, left, paraxial view; 6 – palp, left, antiaxial view; 7 – leg I, right, antiaxial view; 8 – leg II, without trochanter and tarsus, right, antiaxial view; 9 – leg III, without tarsus, right, antiaxial view; 10 – leg IV, left, antiaxial view. Scale bar 20 μm (4–6), 50 μm (7–10).

Epimeral and lateral podosomal regions. Epimeral setal formula: 3–1–3–3. Setae (*1a*, *2a*, *3a*: 41–49; *1c*, *3c*, *4c*: 65–73; others: 49–61) setiform, slightly barbed. Circumpedal carina sharply defined, originating from anogenital region, and then curving to approach circumgastric scissure asymptotically, ending below humeral process strong. Discidium strong, subtriangular.



Figs 11–14. *Zetorchella arsiensis* Ermilov, sp. n., adult, SEM micrographs: 11 – dorsal view; 12 – ventral view; 13 – lateral view; 14 – ventrolateral view.

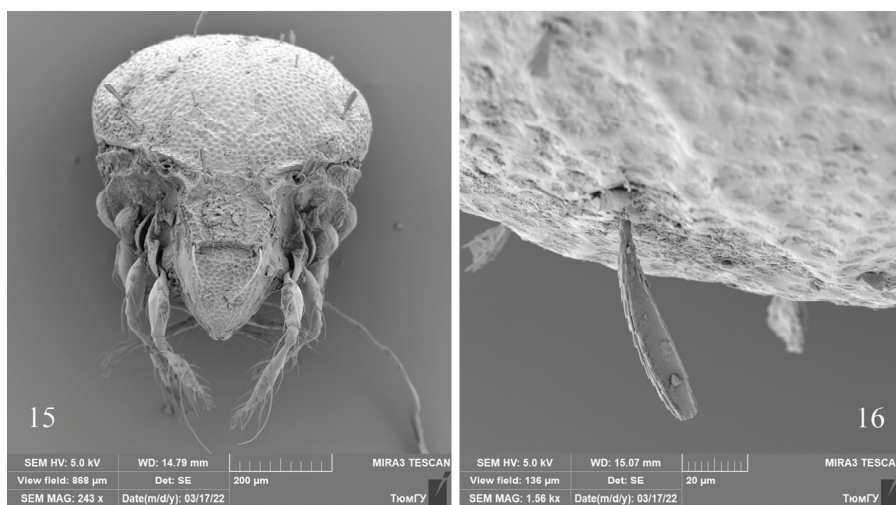
Anogenital region. Genital (32–36), aggenital (41–49), anal (32–36), and adanal (41–49) setae setiform, slightly barbed. Two pairs of adanal setae present; seta *ad*₁ thicker than *ad*₂ in some paratypes. Adanal lyrifissure located close and parallel to anal plate. Marginal porose area absent.

Table 1. Leg setation and solenidia of adult *Zetorchella arsiensis* Ermilov, sp. n.

Leg	Tr	Fe	Ge	Ti	Ta
I	v'	$d, (l), bv'', v''$	$(l), v', \sigma$	$(l), (v), \varphi_1, \varphi_2$	$(ft), (tc), (it), (p), (u), (a), s, (pv), v', (pl), \varepsilon, \omega_1, \omega_2$
II	v'	$d, (l), bv'', v''$	$(l), \sigma$	$(l), (v), \varphi$	$(ft), (tc), (it), (p), (u), (a), s, (pv), \omega_1, \omega_2$
III	l', v'	d, l', ev'	l', σ	$l', (v), \varphi$	$(ft), (tc), (it), (p), (u), (a), s, (pv)$
IV	v'	d, ev'	d, l'	$l', (v), \varphi$	$ft'', (tc), (p), (u), (a), s, (pv)$

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

Legs. Tridactylous. Median claw slightly thicker than lateral claws, all barbed on dorsal side; each lateral claw with small tooth ventrodistally. Tibia I with small dorsodistal apophysis bearing solenidia φ_1 and φ_2 . Dorsal porose area on tarsi I, II, dorsoparaxial porose area on femora I–IV and on trochanters III, IV, proximoventral porose area on tarsi I–IV, and distoventral porose area on tibiae I–IV well observed; proximoventral and distoventral porose areas divided into two parts. Formulas of leg setation and solenidia: I (1–5–3–4–19) [1–2–2], II (1–5–2–4–15) [1–1–2], III (2–3–1–3–15) [1–1–0], IV (1–2–2–3–12) [0–1–0]; homology of setae and solenidia indicated in Table 1. Famulus short, erect, slightly swollen distally, inserted between solenidium ω_2 and seta ft'' . Seta s on tarsus I eupathidial, located between setae u and a .



Figs 15, 16. *Zetorchella arsiensis* Ermilov, sp. n., adult, SEM micrographs: 15 – anterodorsal view; 16 – notogastral seta h_1 .

REMARKS. *Zetorchella arsiensis* Ermilov, sp. n. is morphologically most similar to the other Ethiopian species *Zetorchella robertbecki* Ermilov, Subías, Shtanchaeva et Friedrich, 2021 in having striate genital plates, two pairs of adanal setae and 10 pairs of phylliform notogastral setae. However, the new species differs from the latter by the larger body size (796–898 × 531–614 versus 481–614 × 348–464) and the presence of medium-sized bothridial seta similar to notogastral setae in length (versus bothridial seta long, about 1.7 length of notogastral setae), well-developed foveolae and slightly developed sinuous ridges on the notogaster (versus foveolae poorly observed; ridges completely absent), heavily foveate anogenital region (versus anogenital region slightly foveolate), and foveolate anal plate (versus anal plate foveate-reticulate).

DISTRIBUTION. Ethiopia.

ETYMOLOGY. The species name *arsiensis* refers to the place of origin, Arsi Mountains National Park.

Key to species of the genus *Zetorchella* known from the Afrotropical region

1. Notogaster without foveolae, but covered by the tuberculate cerotegument forming specific ornamentation; nine pairs of notogastral setae present (p_3 not developed); body length: 365–415. Distribution: Côte d'Ivoire *Z. cotedivoirensis* Ermilov, 2019
 - Notogaster with foveolae and without tuberculate cerotegument; ten pairs of notogastral setae present (p_3 developed) 2
2. Dorsal notogastral setae phylliform 3
 - Dorsal notogastral setae not phylliform 6
3. Bothridial seta shorter than dorsal notogastral setae, stalk shorter than head; notogastral setae p_2 and p_3 shorter and narrower than others; body length: 397–494. Distribution: Senegal *Z. rugosa* (Mahunka, 1992)
 - Bothridial and dorsal notogastral setae similar in length, stalk not shorter than head; notogastral setae p_2 and p_3 not shorter and not narrower than others 4
4. Interlamellar seta phylliform, similar in length to all notogastral setae; genital plate not striate; body length: 408–520. Distribution: Afrotropical region
 - *Z. pedestris* Berlese, 1916 (= *Chaunoproctus crinitus* Karpinen, 1966; = *Caloppia papillata* Balogh, 1958)
 - Interlamellar seta thickened or slightly phylliform, distinctly longer than all notogastral setae; genital plate longitudinally striate 5
5. Bothridial and notogastral setae slightly differs in length; notogaster with sinuous ridges; anogenital region heavily foveate; anal plate foveolate; body length: 796–898. Distribution: Ethiopia *Z. arsiensis* Ermilov, sp. n.
 - Bothridial seta distinctly longer than all notogastral setae; notogaster without sinuous ridges; anogenital region foveolate; anal plate foveate-reticulate; body length: 481–614. Distribution: Ethiopia *Z. robertbecki* Ermilov, Subías, Shtanchaeva et Friedrich, 2021
6. Bothridial seta bacilliform; body length: 785–830. Distribution: Zimbabwe
 - *Z. longipilosa* (Mahunka, 1973)
 - Bothridial seta clavate 7
7. Notogastral setae (except c) uniformly flattened, bilaterally densely serrated; body length: 564–630. Distribution: Ghana *Z. ghanaensis* Ermilov et Bąkowski, 2021
 - All notogastral setae not uniformly flattened, bilaterally densely serrated 8

8. Stalk of bothridial seta shorter than head; notogastral setae p_2 and p_3 bacilliform; body length: 394. Distribution: Madagascar *Z. semirugosa* (Mahunka, 2011)
- Stalk of bothridial seta longer than head; notogastral setae p_2 and p_3 setiform 9
9. Notogastral seta c longer than bothridial seta; body length: 837. Distribution: Afrotropical region *Z. vargai* (Balogh, 1959)
- Notogastral seta c shorter than bothridial seta 10
10. Notogastral seta c slightly shorter than bothridial seta and distinctly longer than notogastral setae p_2 and p_3 ; body length: 713–813. Distribution: Ethiopia *Z. nortoni* Ermilov, Sidorchuk et Rybalov, 2010
- Notogastral seta c distinctly shorter than bothridial setae and similar in length to notogastral setae p_2 and p_3 11
11. Anterior notogastral margin well-developed medially; notogastral setae rod-like; body length: 590–600. Distribution: Congo, India *Z. basilewskyi* (Balogh, 1958)
- Anterior notogastral margin not observed medially; notogastral setae bacilliform; body length: 465. Distribution: Afrotropical region, India *Z. minor* (Balogh, 1958)

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