

## **HYPOZETES ANDREII (ACARI, ORIBATIDA, TEGORIBATIDAE), A NEW SPECIES OF ORIBATID MITES FROM SOUTH AFRICA**

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**ABSTRACT:** A new oribatid mite species of the genus *Hypozetes* (Oribatida, Tegoribatidae) is described from soil in South Africa. *Hypozetes andreii* sp. n. differs from all other representatives of the genus by the presence of heavily and densely porose body surface. Distribution data of the new species are presented.

**KEY WORDS:** Tegoribatid mites, systematics, morphology, Ethiopian region.

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### **INTRODUCTION**

This work, being a part of our study of the oribatid mite fauna (Acari, Oribatida) of South Africa (e.g., Ermilov *et al.* 2017, 2018, 2019; Bayartogtokh *et al.* 2018; Ermilov and Hugo-Coetzee 2019; Niedbała *et al.* 2019), is based on material collected from the soil in the Franklin Game Reserve during an expedition conducted in October 2018. In the course of a taxonomic identification, we found one new species belonging to the genus *Hypozetes* Balogh, 1959 (Tegoribatidae). The main goal of the paper is to describe and illustrate this new species, which was named *Hypozetes andreii* sp. n.

*Hypozetes* was proposed by Balogh (1959) with *Hypozetes imitator* Balogh, 1959 as type species. The genus comprises nine species and one subspecies, which are distributed in the Tropical and Subtropical regions (Subías 2004, updated 2019). The generic diagnostic traits were listed by Balogh (1959), Balogh and Balogh (1992) and Behan-Pelletier (2001). The systematic placement, phylogenetic relationships and morphological features of *Hypozetes* are presented by Behan-Pelletier (2001). An identification key to many species is given in Mahunka (1987).

Earlier, the representatives of *Hypozetes* were not registered in South Africa; hence, the genus is recorded in this country for the first time.

### **MATERIALS AND METHODS**

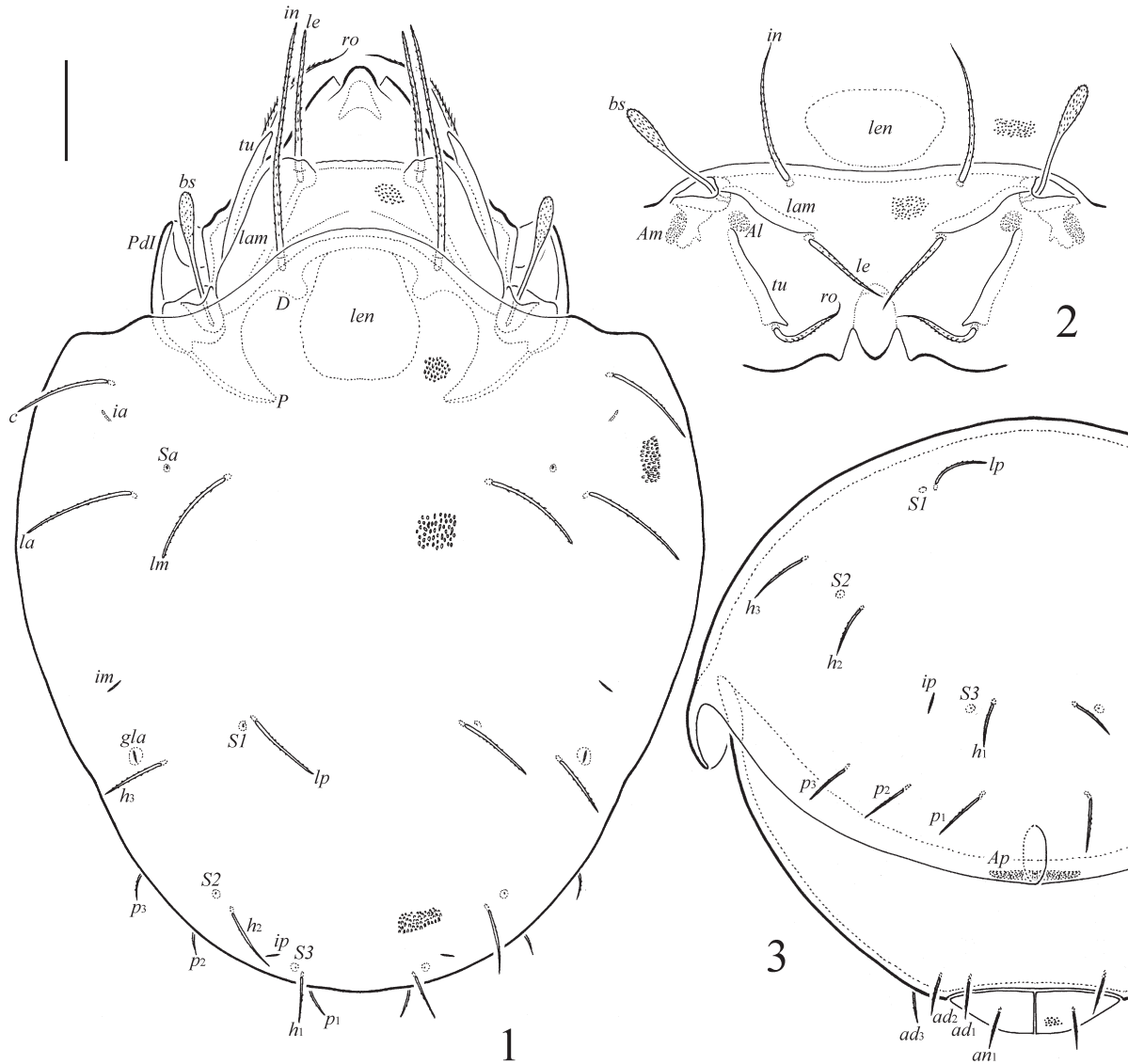
The specimens were mounted in lactic acid on temporary cavity slides for measurement and illustration. Body length was measured in lateral view from the tip of the rostrum to the posterior

edge of the notogaster. Notogastral width refers to the maximum width of the ventral plate in ventral view. All body measurements are presented in micrometers (µm). 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. Images were obtained with an AxioCam ICc3 camera using a Carl Zeiss transmission light microscope Axio Lab.A1. SEM micrographs were made with the aid of a JEOL JSM-6510LV SEM microscope.

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

The following abbreviations are used: *lam*—lamella; *Al*—sublamellar porose area; *tu*—tutorium; *ro*, *le*, *in*, *bs*—rostral, lamellar, interlamellar and bothridial setae, respectively; *bo*—bothridium; *D*—dorsophragma; *P*—pleurophragma; *len*—lenticulus; *c*, *da*, *dm*, *dp*, *la*, *lm*, *lp*, *h*, *p*—notogastral setae; *Sa*, *S1*, *S2*, *S3*—notogastral sacculi; *ia*, *im*, *ip*—notogastral lyrifissures; *gla*—opisthonotal gland opening; *a*, *m*, *h*—subcapitular setae; *or*—adoral seta; *d*, *l*, *v*, *cm*, *acm*, *ul*, *sul*, *vt*, *lt*—palp setae;  $\omega$ —palp and leg solenidion; *as*—axillary saccule; *cha*, *chb*—cheliceral setae; *Tg*—Trägårdh's organ; *Am*, *Ah*—humeral porose



Figs. 1–3. *Hypozetes andreii* sp. n., adult: 1—dorsal view (not shown: legs); 2—frontal view; 3—posterior view. Scale bar=50  $\mu$ m.

areas; *PdI*, *PdII*—pedotecta I and II, respectively; *la*, *lb*, *lc*, *2a*, *3a*, *3b*, *3c*, *4a*, *4b*—epimeral setae; *cus*—custodium; *dis*—discidium; *cp*—circum-pedal carina; *g*, *ag*, *an*, *ad*—genital, aggenital, anal and adanal setae, respectively; *iad*—adanal lyrifissure; *AP*—anal plate; *Ap*—postanal porose area; *po*—preanal organ; *Tr*, *Fe*, *Ge*, *Ti*, *Ta*—leg trochanter, femur, genu, tibia and tarsus, respectively; *pa*—leg porose area;  $\sigma$ ,  $\phi$ —leg solenidia;  $\epsilon$ —leg famulus; *ft*—leg seta.

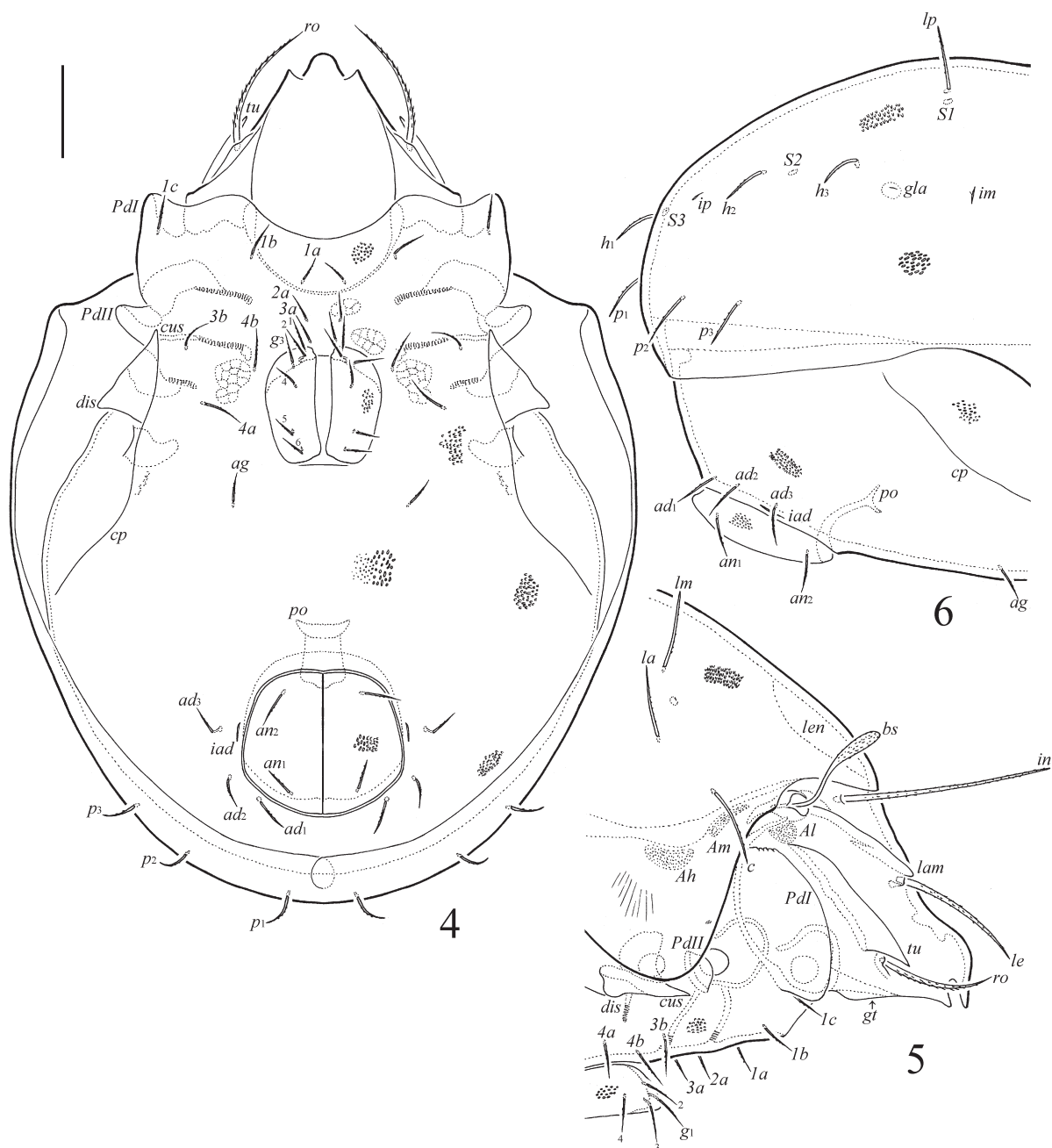
**SYSTEMATICS**

Superfamily **Achipterioidea**  
 Family **Tegoribatidae**  
 Genus ***Hypozetes* Balogh, 1959**  
 Type species *Hypozetes imitator* Balogh, 1959

***Hypozetes andreii* Ermilov, Hugo-Coetzee, Khaustov et Kontschán sp. n.**

(Figs. 1–24)

**Diagnosis.** Body size: 415–464  $\times$  265–315. Body surface heavily and densely porose. Rostrum tripartite, median part rounded, lateral parts triangular. Prodorsal setae long, setiform, barbed. Bothridial setae clavate, barbed. Sublamellar, humeral and postanal porose areas present. Posterior notogastral margin divided and overlapping medially. Lenticulus distinct. Notogastral setae of medium size, setiform, rigid, barbed. Four pair of notogastral sacculi developed. Genal teeth fused with prodorsal surface. Epimeral and anogenital setae short, setiform, barbed. Leg genera I and II



Figs. 4–6. *Hypozetes andreii* sp. n., adult: 4—ventral view (not shown: gnathosoma and legs); 5—anterior part of body, lateral view (not shown: gnathosoma and legs); 6—posterior part of body, lateral view. Scale bar=50  $\mu$ m.

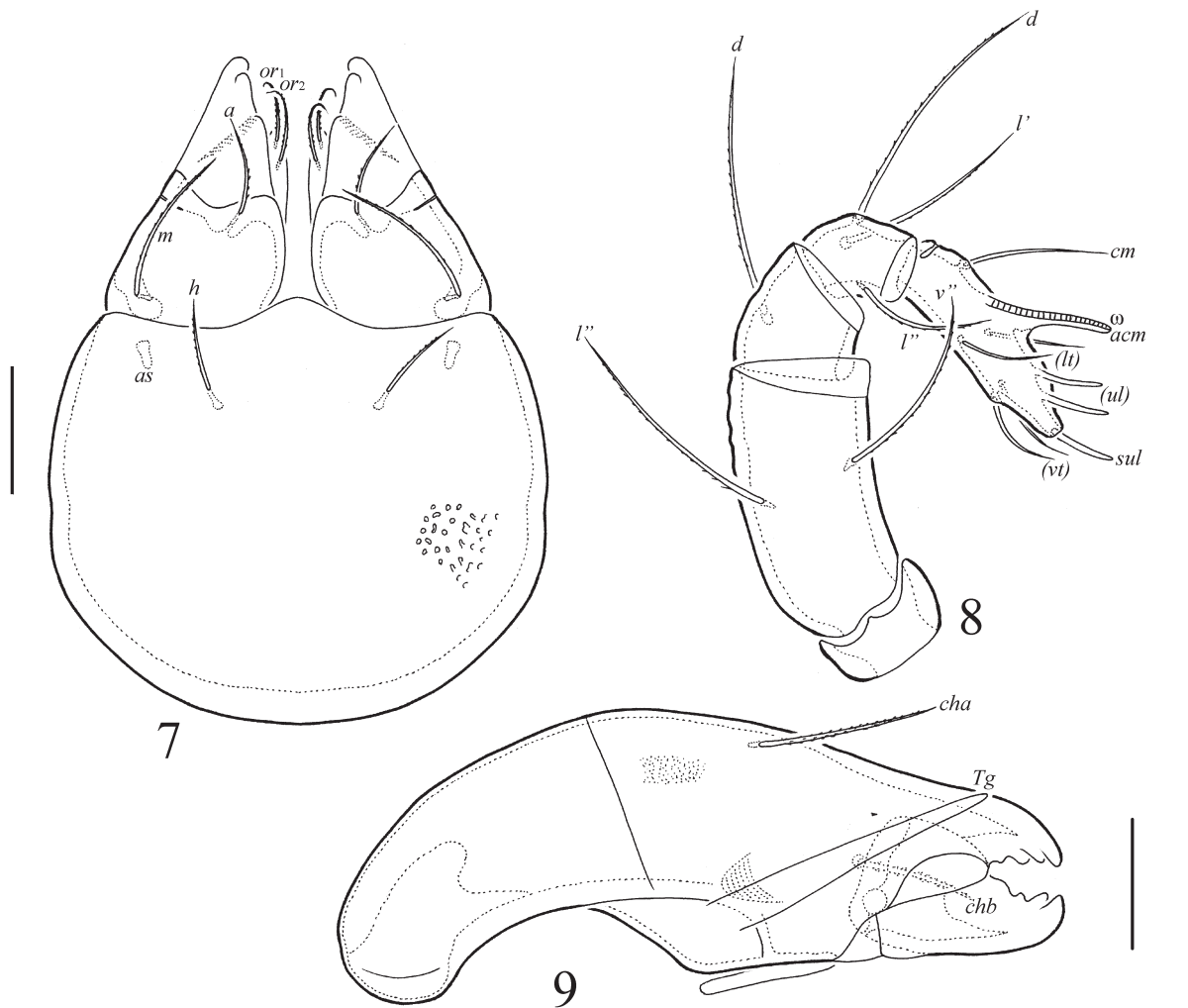
with triangular anteroventral process. Seta *l*' on tibiae I, II and genua I, II, as well as seta *l*' on tibiae III, IV and genua III, IV thick.

**Description.** Measurements. Body length: 415 (holotype, male), 415–464 (six paratypes, one female and five males); notogaster width: 265 (holotype), 265–315 (six paratypes).

Integument (Figs. 19–24). Body color light brown to brown. Body surface, including subcapitular mentum as well as genital and anal plates, heavily and densely porose, distinctly visible even

under low magnification (Figs. 21–23) under light microscope (poorly visible in SEM micrographs). Pores with minute openings (diameters up to 2) and small, slightly curved channels. Antiaxial sides of all leg femora and trochanters III, IV slightly striate.

Prodorsum (Figs. 1, 2, 5, 14, 16, 18, 19). Rostrum tripartite, with median rounded part, two lateral deep incisions and two lateral triangular parts. Lamellae 1/2 of the length of prodorsum, with short, rounded lamellar cusps. Sometimes transverse ridge developed anteriorly to lamellae. Rostral setae



Figs. 7–9. *Hypozetes andreii* sp. n., adult: 7—subcapitulum, ventral view; 8—palp, right, antiaxial view; 9—chelicera, left, paraxial view. Scale bars=20  $\mu$ m.

(73–82) setiform, barbed, directed anteromedially, located on lateral sides of prodorsum, close to tutorial cusps. Lamellar (73–82) and interlamellar (118–123) setae setiform, rigid, barbed; *le* inserted on prodorsal surface under lamellar cusps. Bothridial setae (65–69) clavate, barbed, with long stalk and long, elongate oval head. Exobothridial setae and their alveoli absent. Tutoria longer than lamellae, their cusps triangular. Sublamellar porose areas developed, poorly visible, located between bothridia and posterior part of tutoria. Dorsophragmata and pleurophragmata poorly visible. Dorsosejugal porose areas not evident.

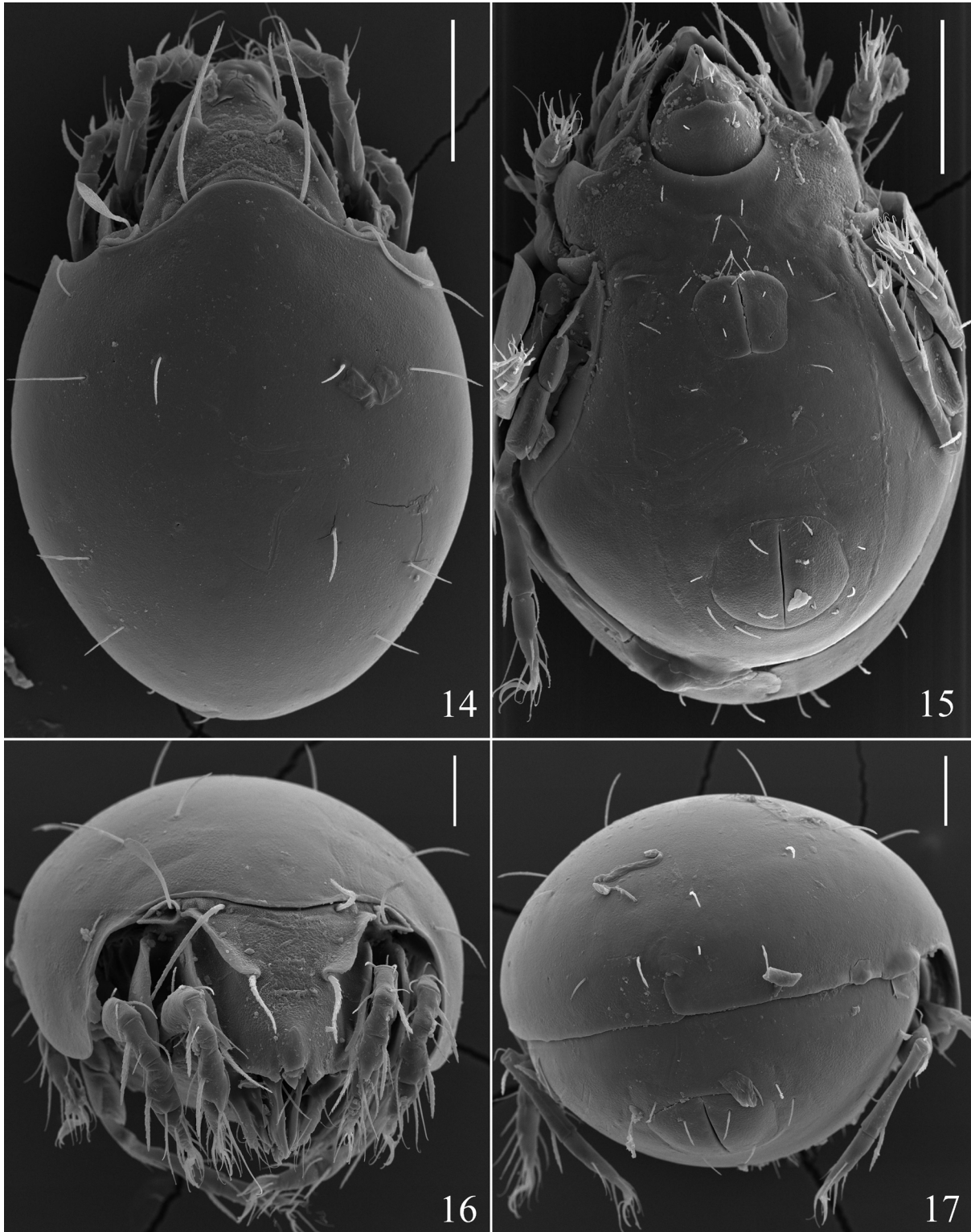
Notogaster (Figs. 1–6, 14, 16–18, 21, 22). Anterior margin convex medially, covering insertions of interlamellar setae. Posterior margin divided and overlapping medially. Posterior notogastral tectum present. Pteromorphs triangular, broadly rounded. Lenticulus distinct, light. Ten pairs of setiform,

rigid, barbed notogastral setae, *c*, *la*, *lm* and *lp* (41–49) longer than others (28–32). Four pairs of sacculi with minute openings and drop-like chambers. Circumgastric sigillar band and lyrifissures *ih*, *ips* not evident. Opisthonotal gland openings and lyrifissures *ia*, *im*, *ip* poorly visible.

Gnathosoma (Figs. 7–9, 15). Subcapitulum longer than wide (106–110  $\times$  82–86). Subcapitular setae setiform, barbed, *m* (28–32) longer and thicker than *a* (18–20) and *h* (18–20). Two pairs of adoral setae (14–16) setiform, barbed. Palps (length 73–77) with typical setation 0–2–1–3–9(+ $\omega$ ). Solenidion of palptarsi attached to setae *acm* mediolaterally. Postpalpal setae (6) spiniform, smooth. Axillary sacculi distinct, elongated. Chelicerae (length 118–123) with two setiform, barbed setae, *cha* (32–36) longer than *chb* (24–28). Trägårdh's organ of chelicerae elongate triangular.



Figs. 10–13. *Hypozetes andreii* sp. n., adult: 10—leg I, right, anti-axial view; 11—leg II, without tarsus, right, anti-axial view; 12—leg III, without tarsus, right, anti-axial view; 13—leg IV, left, anti-axial view. Scale bar=20  $\mu$ m.

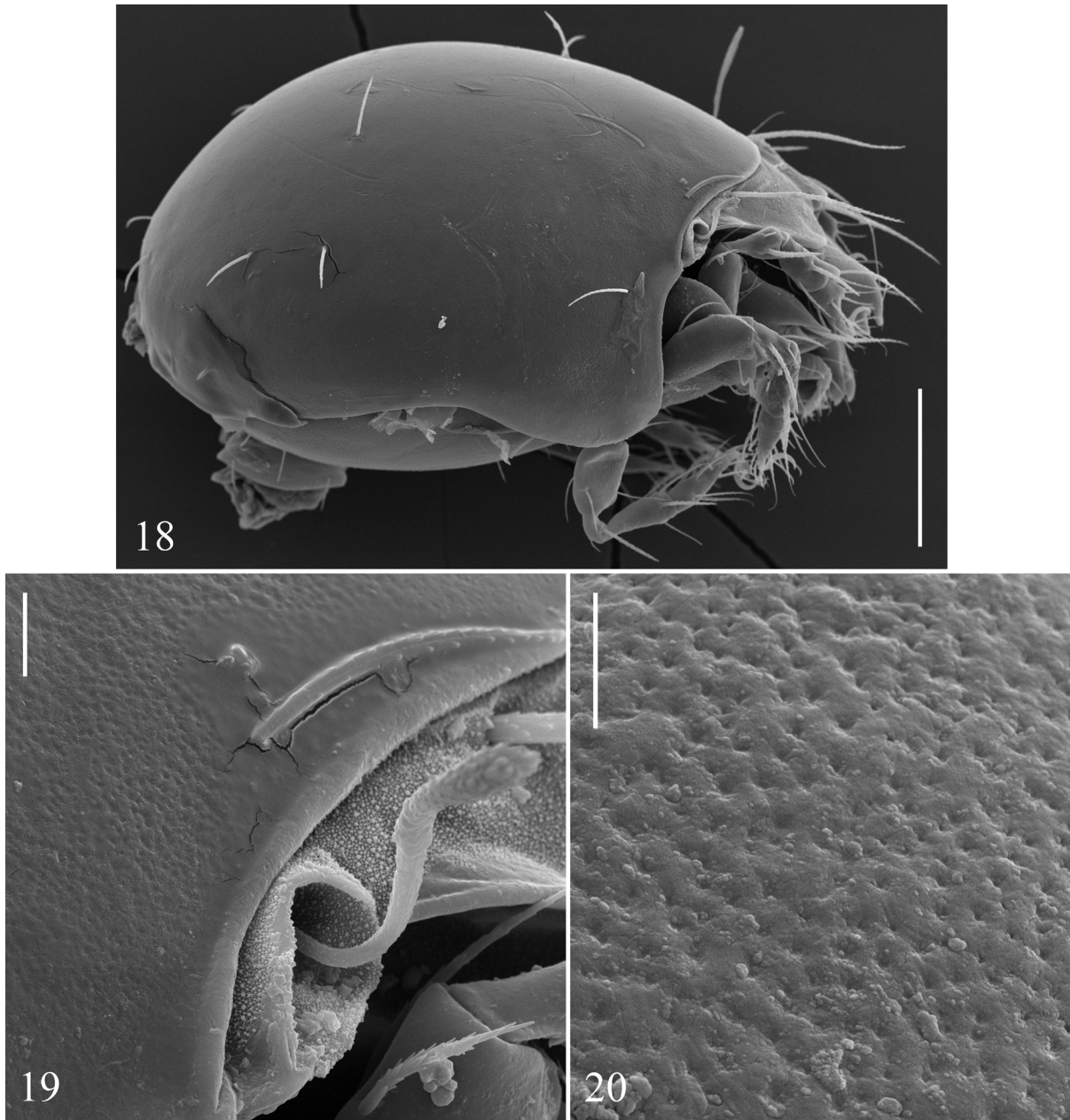


Figs. 14–17. *Hypozetes andreii* sp. n., adult, SEM micrographs: 14—dorsal view; 15—ventral view; 16—frontal view; 17—posterior view. Scale bars=100 μm (14, 15), 50 μm (16, 17).

Epimeral and lateral podosomal regions (Figs. 4, 5, 15). Genal teeth triangular, indistinctly bordered, fused with prodorsal surface. Humeral porose areas *Am* and *Ah* poorly visible, oval. Custodia with triangular, strong tips, reaching level of pedotecta II. Discidia triangular. Circumpedial ca-

rinae distinct. Epimeral setal formula: 3–1–2–2. Epimeral setae setiform, thin, barbed, *1a*, *2a* and *3a* (16–20) shorter than others (20–24).

Anogenital region (Figs. 3–6, 15, 17). Six pairs of genital ( $g_1$ – $g_3$ , 20–24;  $g_4$ – $g_6$ , 16–20), one pair of aggenital (20–24), two pairs of anal (20–24) and



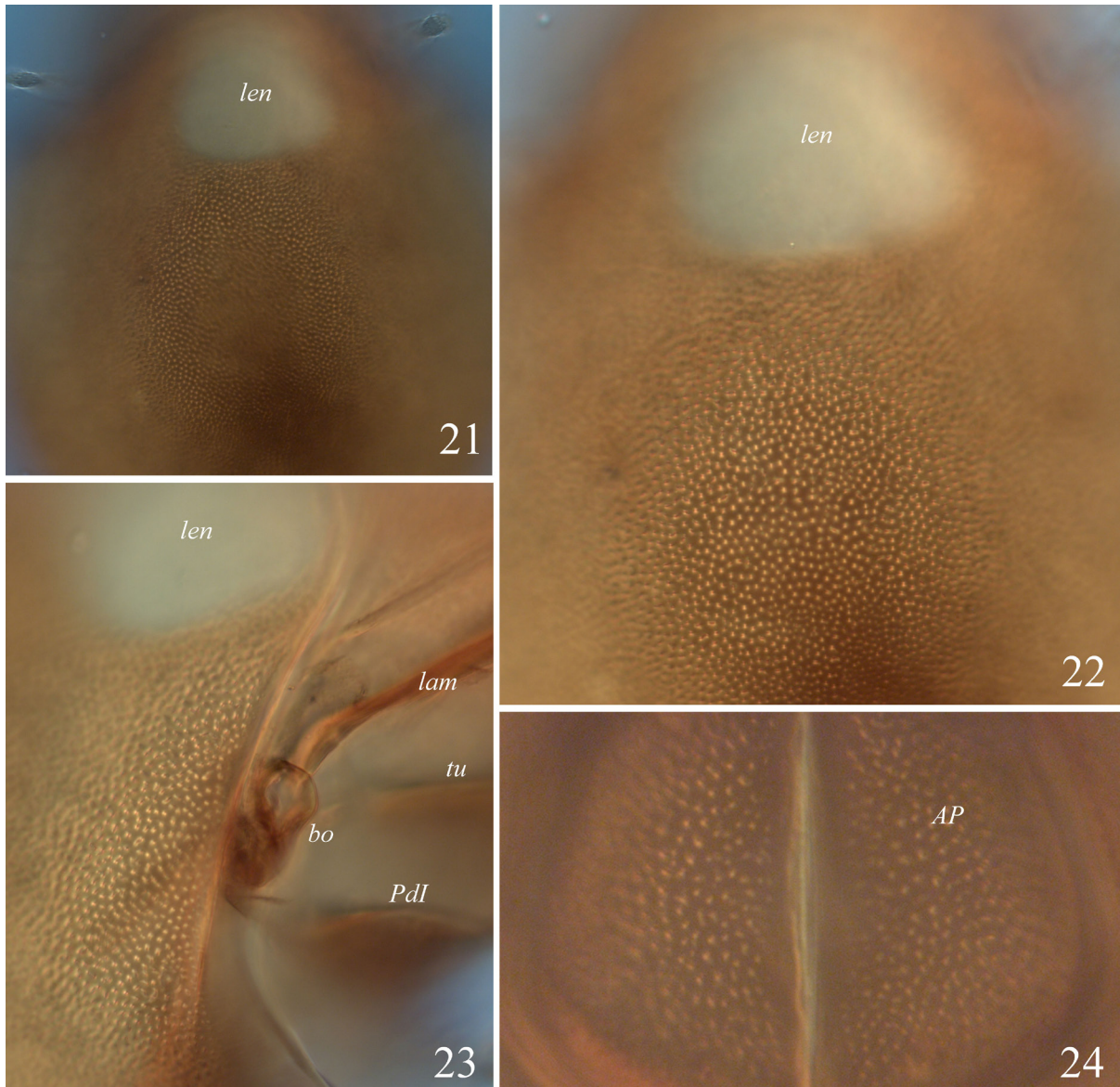
Figs. 18–20. *Hypozetes andreii* sp. n., adult, SEM micrographs: 18—lateral view; 19—bothridial seta, bothridial opening, humeral surface of notogaster, lateral view; 20—heavily porose surface of notogaster. Scale bars=100  $\mu\text{m}$  (18), 10  $\mu\text{m}$  (19), 5  $\mu\text{m}$  (20).

two pairs of adanal (20–24) setae setiform, thin, barbed. Adanal lyrifissures located close and parallel to anal aperture. Preanal organ elongate vase-like. Postanal porose area elongate oval.

**Legs** (Figs 10–13). Tridactylous, median claw distinctly thicker than laterals, all claws slightly barbed dorsally. Tibia I with anterodorsal apophysis. Genua I and II with triangular anteroventral process. Dorsoparaxial porose areas on femora I–IV and on trochanters III, IV distinctly visible. Posteroventral porose areas on tarsi small. Anteroventral porose areas on tibiae absent. Formulas of

leg setation and solenidia: I (1–5–3–4–19) [1–2–2], II (1–5–3–4–15) [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. Solenidium  $\phi$  on tibiae IV reduced to vestigial alveoli (visible in dissected specimens). Famulus and seta *ft*'' of tarsi I short, stick-like. Seta *l*'' on tibiae I, II and genua I, II, as well as seta *l*' on tibiae III, IV and genua III, IV thick.

**Material examined.** Holotype (male) and four paratypes (one female and three males): South Africa, Bloemfontein, Franklin Game Reserve on



Figs. 21–24. *Hypozetes andreii* sp. n., adult, images: 21–23—heavily porose surface of notogaster; 24—heavily porose surface of anal plates.

Naval Hill, 29°05'S, 26°14'E, in soil under bush vegetation, 13.X.2018 (collected by V.A. Khaustov, S.G. Ermilov, E.A. Hugo-Coetzee and A.A. Khaustov). Two paratypes (two males): South Africa, North West Province, near Klerksdorp, Faan Meintjes Nature Reserve, 26°42'S 26°42'E, soil, 16.X.2018 (V.A. Khaustov and S.G. Ermilov).

**Type deposition.** The holotype and one paratype are deposited in the collection of the National Museum Bloemfontein, South Africa. Five paratypes are deposited in the collection of Tyumen State University Museum of Zoology, Tyumen, Russia. All preserved in ethanol with a drop of glycerol.

**Etymology.** The species is named after the late Dr. Andrei V. Bochkov (1968–2018), a distinguished acarologist from Saint Petersburg, Russia, for his extensive contributions to our knowledge of mites.

**Remarks.** *Hypozetes andreii* sp. n. is morphologically most similar to *Hypozetes imitator* Balogh, 1959 from the Ethiopian region and India (see Balogh 1959) in the presence of three pairs of adanal setae and comparatively long notogastral setae including  $p_1$ – $p_3$ . We compared our specimens to specimens of *H. imitator* from the type series (Hungarian Natural History Museum, Hungary). The new species differs from the latter by the



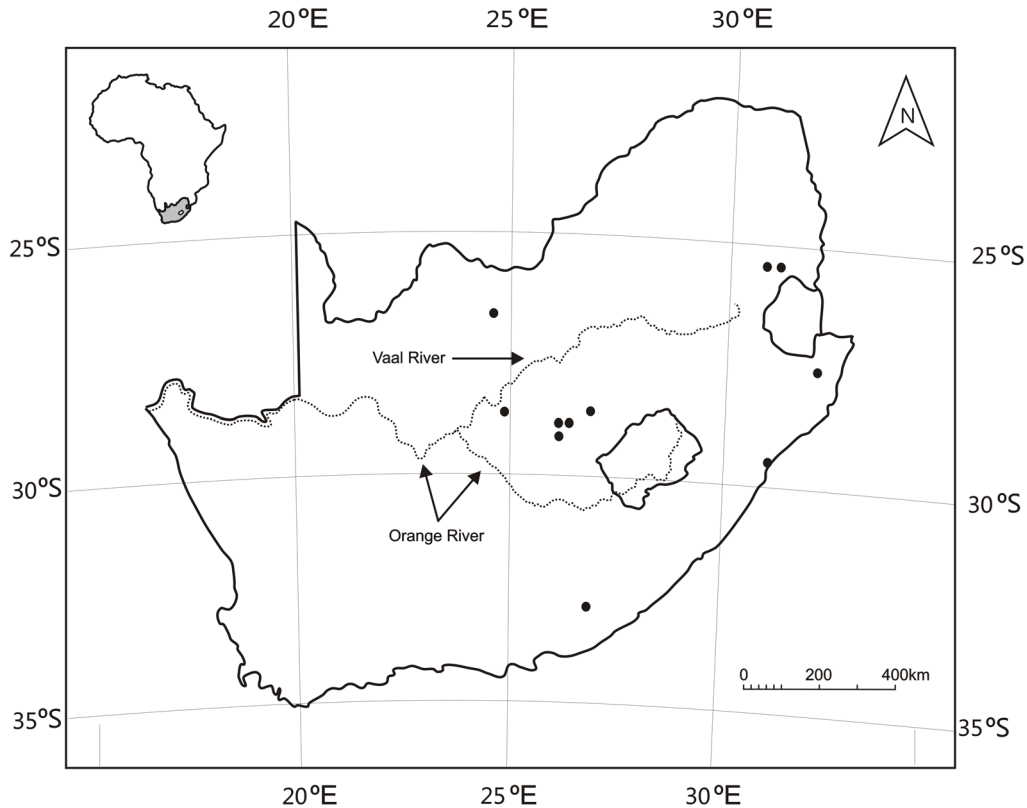


Fig. 25. Known distribution of *Hypozetes andreii* sp.n. in South Africa indicated by filled circles.

heavily and densely porose body surface (vs. smooth).

### DISTRIBUTION

(Fig. 25)

The following distribution data of *H. andreii* sp. n. was obtained from the Acarology Collection of the National Museum Bloemfontein (NMB): NMB accession number 1537.6, Mkuze, Kwa-Zulu Natal, 27°37'S 32°02'E, from grass; NMB 3829.2 Mount Edgecombe, La Mercy, Kwa-Zulu Natal, 29°38'S, 31°08'E, no habitat data; NMB 3615.14, Mbombela, Mpumalanga, 25°27'S, 31°04'E, underneath Kiaat and African beech trees; NMB 3613.9 Mbombela, Mpumalanga, 25°25'S, 30°55'E, grass litter in a grassland; NMB 3663.3 Graspan near Kimberley, Northern Cape, 28°35'S, 24°53'E, soil and litter underneath a social weaver bird nest on a pole; NMB 3800.13 Alice, Eastern Cape, 32°47'S, 26°49'E, grassland soil; NMB 3915.4, NMB 3916.1, Florisbad, Soutpan, Free State, 28°45'S, 26°03'E, grassland vegetation; NMB 4433.1 Erfenis Dam Nature Reserve, near Theunissen, Free State, 28°30'S 26°46'E, grass litter in grassland; NMB 4471.2, NMB 4473.2, NMB 4511.3 Glen Agricultural College, near

Bloemfontein, Free State, 28°56'S, 26°20'E, soil and grass litter in a natural field of long grass.

In this study, the new species was sampled in Bloemfontein and near Klerksdorp (see "Material examined" section for details). The habitats, from which the specimens were sampled, were 'soil under bush vegetation' and 'soil', respectively, but the general areas were grassland dominated.

According to Behan-Pelletier (2001), *Hypozetes* species, in general, occur in soils and sands associated with grasses and low-growing herbs. Our sampled habitats largely support this observation. Interestingly, *H. andreii* sp. n. was rarely encountered in samples, which may have been due to the sampling method. In particular, according to the observations by Behan-Pelletier (2001), *Hypozetes* species often move onto live grasses and low-growing plants. Since our samples were mostly taken from soil and litter and not from live grasses, a different sampling approach might produce more specimens of this genus.

### ACKNOWLEDGEMENTS

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Table 1

Leg setation and solenidia of *Hypozetes andreii* sp.n.

Leg	Tr	Fe	Ge	Ti	Ta
I	v'	d, (l), bv'', v''	(l), v', σ	(l), (v), φ <sub>1</sub> , φ <sub>2</sub>	(fi), (tc), (it), (p), (u), (a), s, (pv), v', (pl), ε, ω <sub>1</sub> , ω <sub>2</sub>
II	v'	d, (l), bv'', v''	(l), v', σ	(l), (v), φ	(fi), (tc), (it), (p), (u), (a), s, (pv), ω <sub>1</sub> , ω <sub>2</sub>
III	l', v'	d, l', ev'	l', σ	l', (v), φ	(fi), (tc), (it), (p), (u), (a), s, (pv)
IV	v'	d, ev'	d, l'	l', (v), φ	ft'', (tc), (p), (u), (a), s, (pv)

Note: Roman letters refer to normal setae, Greek letters to solenidia (except ε—famulus), single prime (') marks setae on the anterior and double prime (')—setae on the posterior side of a given leg segment. Parentheses refer to a pair of setae.