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Article

Two new species of oribatid mites (Acari, Oribatida) from the Afrotropical region

Sergey G. Ermilov[1*], Stefan Friedrich[2] and Dilian Georgiev[3, 4]

1. *University of Tyumen, Institute of Environmental and Agricultural Biology (X-BIO), Tyumen, Russia; E-mail: ermilovacari@yandex.ru*
2. *Ludwig-Maximilians-University Munich, Faculty of Biology, Biocenter LMU, Planegg-Martinsried, Germany; E-mail: friedrich@snsb.de*
3. *Department of General Animal Husbandry, Section Ecology, Faculty of Veterinary Medicine, Trakia University–Stara Zagora, Stara Zagora, Bulgaria; E-mail: dilyan.georgiev@trakia-uni.bg*
4. *Department of Ecology and Environmental Conservation, Faculty of Biology, Plovdiv University "Paisii Hilendarski", Plovdiv, Bulgaria; E-mail: diliangeorgiev@gmail.com*

[*] Corresponding author

ABSTRACT
We describe two new species of oribatid mites (Oribatida) based on adult males—*Gymnobodes schedeli* **sp. nov.** (Carabodidae) collected from rotten wood and humus under a tree in Zambia and *Galumna* (*Galumna*) *luisi* **sp. nov.** (Galumnidae) collected from detritus among *Cyperus papyrus* in Uganda. *Gymnobodes schedeli* **sp. nov.** differs from all species of the genus by the presence of a depression in the basal part of the prodorsum, and by the notogastral ornamentation/sculpturing. *Galumna* (*Galumna*) *luisi* **sp. nov.** differs from *G.* (*G.*) *incisa* by the body size, the morphology of the rostrum and notogastral porose areas *Aa* and *A3*, the presence of a rostral bulge and a long longitudinal fold having short lateral branches in the anteromedial part of the notogaster, the absence of a median pore, and the location of the notogastral lyrifissure *im* and leg famulus.

KEYWORDS: Afrotropical oribatid mites, *Galumna*, *Gymnobodes*, morphology, taxonomy.

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INTRODUCTION

This study is part of an ongoing investigation of the oribatid mite fauna of Zambia and Uganda (Ermilov 2012, 2020; Ermilov and Niedbała 2013). Sampled materials included representatives of two new species belonging to the genera *Gymnobodes* Balogh, 1965 (Carabodidae) and *Galumna* Heyden, 1826 (Galumnidae). Our goal is to describe these new species under the names *Gymnobodes schedeli* **sp. nov.** and *Galumna* (*Galumna*) *luisi* **sp. nov.**

The genus *Gymnobodes* was proposed by Balogh (1965), with *Carabodes fraterculus* Balogh, 1963 as type species. At present, the genus comprises five species collectively distributed in the Afrotropical and Neotropical regions (Ermilov and Yurtaev 2023). The generic characteristics, identification key, and summary of distribution and habitats of the known species of *Gymnobodes* are provided by Ermilov and Yurtaev (2023).

The genus *Galumna* was proposed by Heyden (1826), with *Notaspis alatus* Hermann 1804 as

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type species. At present, the nominate subgenus comprises about 190 species collectively having a cosmopolitan distribution (Subías 2022, online version 2024; personal data of first author). The generic characteristics are provided by Ermilov and Klimov (2017). An identification key to the known species of *Galumna* from the Afrotropical region initially has been published by Ermilov *et al*. (2018) and revised by Ermilov (2022).

Prior to this study, *Gymnobodes* was not registered in Zambia; two species of *Galumna* (*Galumna*)—*G.* (*G.*) *breviseta* Mahunka & Mahunka-Papp, 2009 and *G.* (*G.*) *lanceosensilla* Ermilov, Sidorchuk & Rybalov, 2011—have been registered in Uganda (Ermilov 2020).

METHODS

Observation and documentation – For measurement and illustration, specimens were mounted in lactic acid on temporary cavity slides. All measurements are in micrometers (µm); 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 in dorsal aspect; setal lengths were measured in lateral aspect. 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 DM 2500 transmission light microscope.

Terminology – Morphological terminology is mostly that of Grandjean (see references in Travé and Vachon 1975); also, see Norton and Behan-Pelletier (2009), Ermilov and Klimov (2017) for overview.

Abbreviations – *Prodorsum*: *rb* = rostral bulge; *lam* = lamella; *dep* = depression; *tlam* = translamella; *L* = lamellar line; *S* = sublamellar line; *N* = prodorsal leg niche; *lpr* = lateral prodorsal ridge; *E*, *T* = lateral ridges of body; *ro*, *le*, *in*, *bs* = rostral, lamellar, interlamellar, and bothridial setae, respectively; *Ad* = dorsosejugal porose area; *D* = dorsophragma; *P* = pleurophragma. *Notogaster*: *fo* = fold; *Aa*, *A1*, *A2*, *A3* = porose areas; *c*, *la*, *lm*, *lp*, *h*, *p* = setal alveoli or setae; *ia*, *im*, *ip*, *ih*, *ips* = lyrifissures; *gla* = opisthonotal gland opening. *Gnathosoma*: *a*, *m*, *h* = subcapitular setae; *or* = adoral seta; *as* = axillary saccule. *Epimeral and lateral podosomal regions*: *1a*, *2a*, *3a*, *3b*, *3c*, *4a*, *4b*, *4c* = epimeral setae; *PdI*, *PdII* = pedotecta I, II, respectively; *dis* = discidium; *cir* = circumpedal carina. *Anogenital region*: *g*, *ag*, *an*, *ad* = genital, aggenital, anal, and adanal setae, respectively; *iad* = adanal lyrifissure; *Ap* = postanal porose area; *po* = preanal organ. *Legs*: ω, φ, σ = solenidia; *e* = famulus; *d*, *l*, *v*, *bv*, *ev*, *ft*, *tc*, *it*, *p*, *u*, *a*, *s*, *pv*, *pl* = setae; *pa* = porose area.

TAXONOMY

Family Carabodidae
Genus *Gymnobodes* Balogh, 1965

Type species: *Carabodes fraterculus* Balogh, 1963

Gymnobodes schedeli sp. nov. (Figs. 1, 3–12)

http://zoobank.org/urn:lsid:zoobank.org:act:4892C9E8-75D1-4AD8-956C-B332ABB9CBF0

Type material

Holotype (male) and one paratype (one male): Republic of Zambia, North of Ndole at Lake Tanganyika, Ndole Bay Lodge (garden), 8° 28′ 39.5″ S, 30° 26′ 56.8″ E, 785 m a.s.l., rotten wood and humus at the basis of the trunk of a dead tree (Fig. 1), 04.x.2021 (F.D.B. Schedel).

Figures 1–2. Photos of the locations and habitats of oribatid mites – 1. *Gymnobodes schedeli* **sp. nov.** in Zambia; 2. *Galumna* (*Galumna*) *luisi* **sp. nov.** in Uganda.

Type deposition

The holotype and one paratype are deposited in the collection of the University of Tyumen, Museum of Zoology, Tyumen, Russia. All specimens are preserved in 70% solution of ethanol with a drop of glycerol.

Diagnosis

Body length: 330. Prodorsum and centrodorsal part of notogaster foveolate; humeral, lateral and posterior part of notogaster tuberculate. Rostral margin concave. Basal part of prodorsum with depression. Rostral and lamellar setae short, setiform, roughened; interlamellar seta minute, acicular; bothridial seta medium-sized, clavate, with slightly flattened, barbed head. All notogastral, epimeral, and anogenital setae minute, acicular. Palp tibia with two setae. Aggenital setae present. Leg seta *l′* absent on tibiae I, II; all tarsal setae *u* modified.

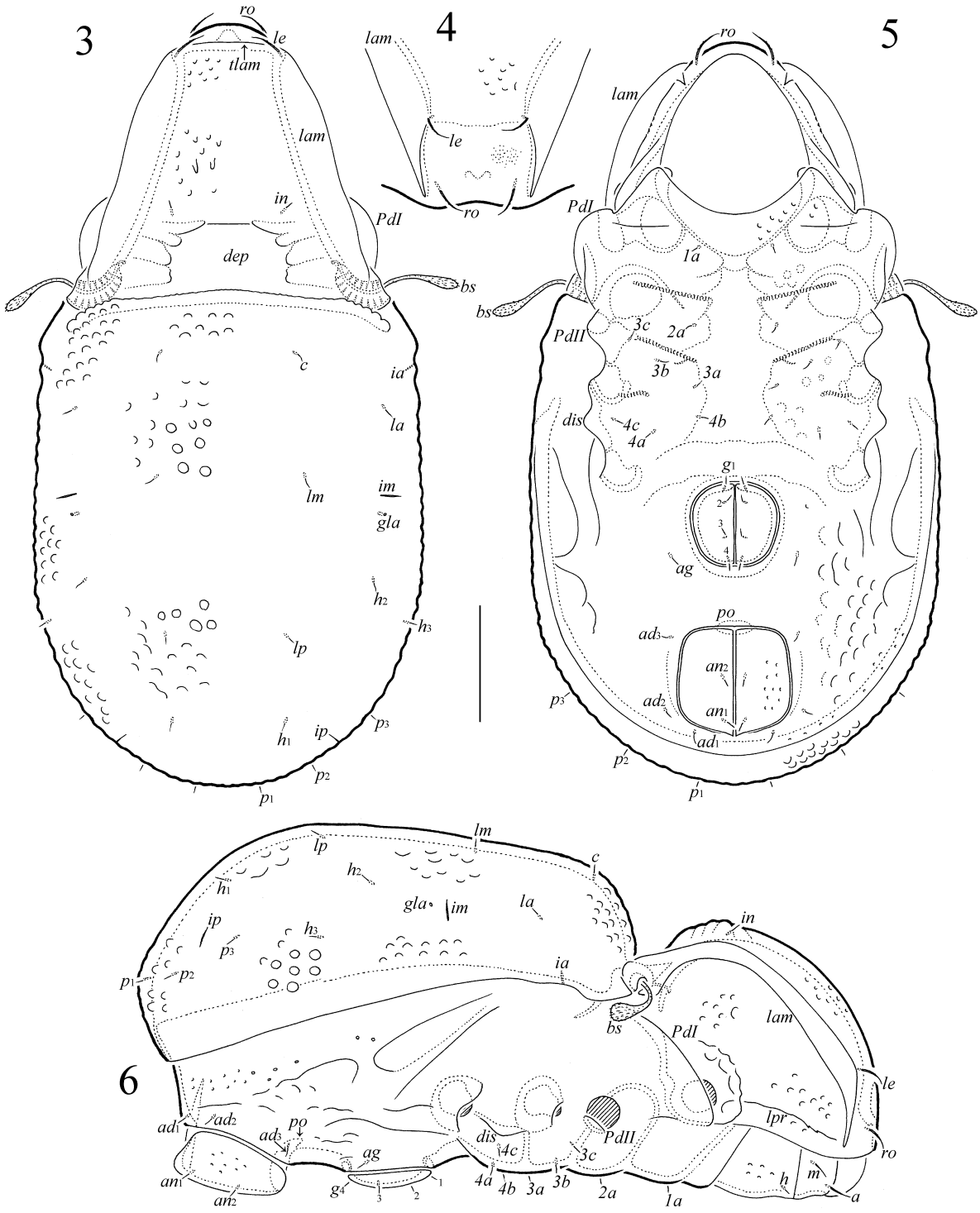
Description

Measurements – Body length: 330 (holotype), 330 (paratype); body width: 180 (holotype), 173 (paratype).

Integument (Figs. 3–12) – Body color light brown. Body with dense, microgranulate microsculpturing; additionally: prodorsum, subcapitular mentum, anal plate, centrodorsal part of notogaster, anterolateral part of epimere I foveolate (diameter of foveola up to 7); basal part of prodorsum with slight transverse ridges bordering depression; humeral, lateral, and posterior part of notogaster tuberculate (diameter of tubercle up to 7); lateral part of anogenital region partially with slight foveolae and depressions; antiaxial side of leg femora I–IV with some large foveolae and small, dense, simple and elongate tubercles versus trochanters III, IV only with tubercles.

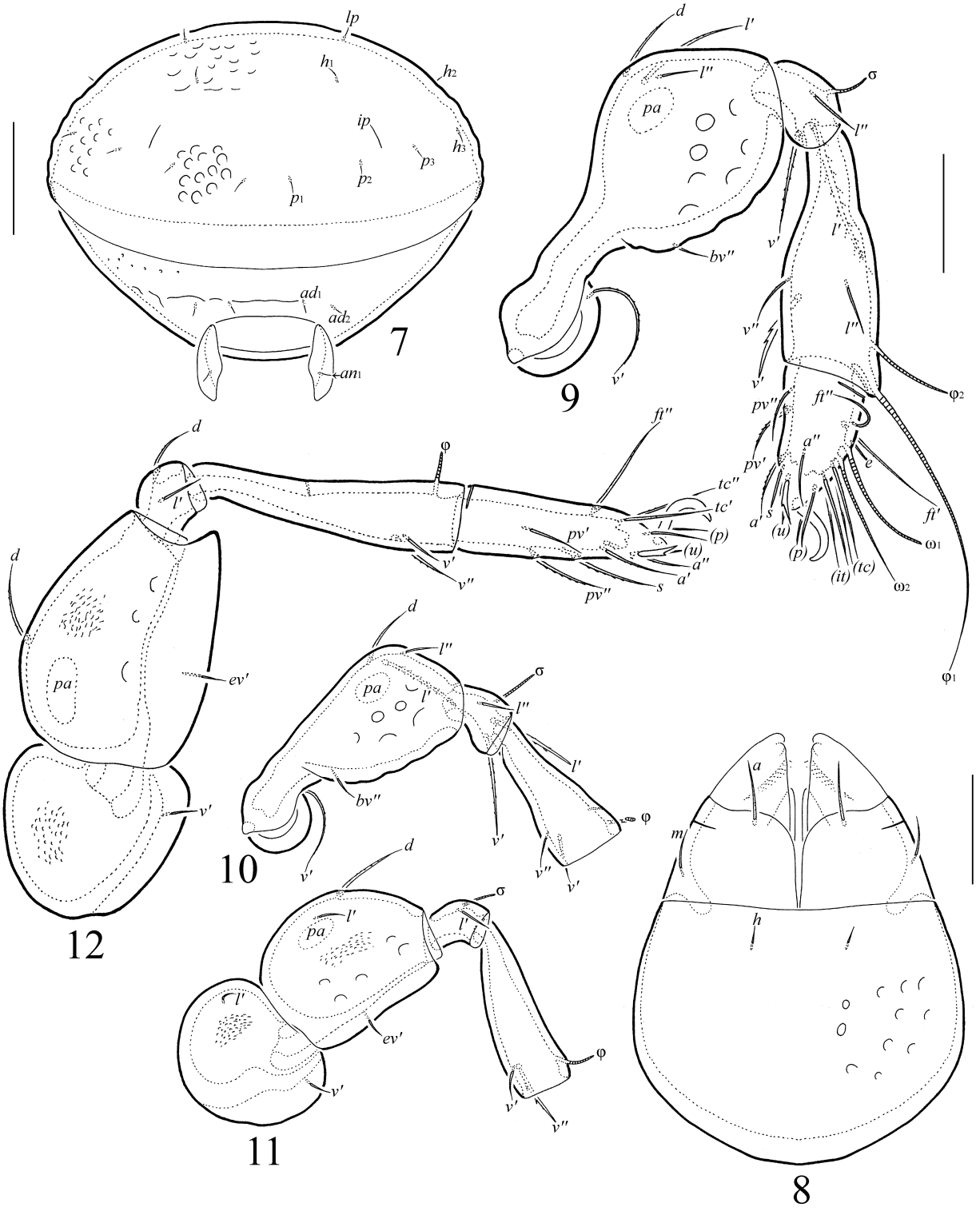
Prodorsum (Figs. 3, 4, 6) – Rostral margin slightly concave medially (visible in anterior aspect). Distal tooth-like process of lamella long, almost reaching rostral margin; translamella present (visible in dorsal aspect). Basal part of prodorsum with distinct depression. Lateral part of prodorsum with thin longitudinal ridge bearing some small teeth. Rostral and lamellar setae (15) setiform, roughened; interlamellar seta (4) acicular; bothridial seta (34–37) clavate, with slightly flattened, barbed head; exobothridial seta absent.

Notogaster (Figs. 3, 6, 7) – Anterior notogastral margin nearly straight. Humeral process distinctly developed, anteriorly triangular (visible in lateral aspect). All notogastral setae (4) acicular. Opisthonotal gland opening and lyrifissures *ia*, *im*, *ip* distinct; *ih*, *ips* not observed.



Figures 3–6. *Gymnobodes schedeli* **sp. nov.** (adult) – 3. Dorsal view; 4. Anterior part of prodorsum, anterior view; 5. Ventral view (gnathosoma and legs not shown); 6. Right lateral view (legs not shown).

Gnathosoma (Fig. 8) – Generally, similar to *Gymnobodes* (Ermilov and Yurtaev 2023). Subcapitulum size: 79 × 60; subcapitular setae *a* (11) and *m* (7) setiform, roughened; *h* (4) acicular. Palp length: 49; setation: 0–2–1–2–8(+ω); postpalpal seta (7) spiniform, roughened. Chelicera length: 94; setae (*cha*: 26; *chb*: 15) setiform, barbed.



Figures 7–12. *Gymnobodes schedeli* **sp. nov.** (adult) – 7. Posterior view; 8. Subcapitulum, ventral view; 9. Leg I, right, antiaxial view; 10. Leg II (tarsus not shown), right, antiaxial view; 11. Leg III (tarsus not shown), left, antiaxial view; 12. Leg IV, left, antiaxial view.

Epimeral and lateral podosomal regions (Figs. 5, 6) – Sternal region slightly depressed. Epimeral setal formula: 1–1–3–3; all setae (4) acicular. Discidium tubercle-like.

Anogenital region (Figs. 5–7) – Region between epimere IV and genital aperture depressed.

Anogenital formula:4–1–2–3; all setae (4) acicular. Adanal lyrifissure not observed.

Legs (Figs. 9–12) – Claw of each leg strong, smooth. Femora I–IV with dorsoparaxial porose area. Formulas of leg setation and solenidia: I (1–4–3–3–16) [1–2–2], II (1–4–3–2–15) [1–1–2], III (2–3–1–2–15) [1–1–0], IV (1–2–2–2–12) [0–1–0]; homology of setae and solenidia indicated in Table 1; seta *l′* absent on tibiae I, II; seta *s* of tarsus I eupathidial; all tarsal setae *u* modified (with cylindrical mediobasal part, distal spike and ventral tooth).

Table 1. Leg setation and solenidia of adult *Gymnobodes schedeli* **sp. nov.**

Leg	*Tr*	*Fe*	*Ge*	*Ti*	*Ta*
I	*v′*	*d, (l), bv″*	*(l), v′*, σ	*l″, (v)*, φ$_1$, φ$_2$	*(ft), (tc), (it), (p), (u), (a), s, (pv), e*, ω$_1$, ω$_2$
II	*v′*	*d, (l), bv″*	*(l), v′*, σ	*(v)*, φ	*(ft), (tc), (it), (p), (u), (a), s, (pv)*, ω$_1$, ω$_2$
III	*l′, v′*	*d, l′, ev′*	*l′*, σ	*(v)*, φ	*(ft), (tc), (it), (p), (u), (a), s, (pv)*
IV	*v′*	*d, ev′*	*d, l′*	*(v)*, φ	*ft″, (tc), (p), (u), (a), s, (pv)*

Note: *Tr*, *Fe*, *Ge*, *Ti*, *Ta* = trochanter, femur, genu, tibia, and tarsus, respectively. Roman letters refer to normal setae; Greek letters to solenidia; 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.

Comparison

Gymnobodes schedeli **sp. nov.** differs from all species of the genus in having of a strong depression in the basal part of the prodorsum (versus depression absent in other species), and the presence of foveolae in centrodorsal part of the notogaster (versus notogaster entirely tuberculate in other species).

Etymology

This species is named in honour of Dr. Frederic D.B. Schedel, the German zoologist and ichthyologist, who collected this new species.

Family Galumnidae
Genus *Galumna* Heyden, 1826
Subgenus *Galumna* (*Galumna*) Heyden, 1826

Type species: *Notaspis alatus* Hermann 1804

Galumna (*Galumna*) *luisi* sp. nov. (Figs. 2, 13–22)

http://zoobank.org/urn:lsid:zoobank.org:act:307C9C5C-50EC-4CD2-B9D2-C4B38B07A095

Type material

Holotype (male) and two paratypes (two males): Uganda, Buvi, Nortwest of Buvi Lodge, wetland at the shore of Lake Victoria, 0° 07′ 43.0″ N, 32° 26′ 44.0″ E, 1146 m a.s.l., detritus among *Cyperus papyrus* (Fig. 2), 26.vii.2022–1.viii.2022 (D. Georgiev).

Type deposition

The holotype and two paratypes are deposited in the collection of the University of Tyumen, Museum of Zoology, Tyumen, Russia. All specimens are preserved in 70% solution of ethanol with a drop of glycerol.

Diagnosis

Body length: 495–525. Rostrum protruding, rounded. Rostral region with strong bulge. Lamellar and sublamellar lines parallel, curving backwards at ventral end. Rostral, lamellar, and interlamellar

setae long, setiform, barbed; *in>le>ro*; bothridial seta long, lanceolate, with unilaterally dilated, barbed head having distal spike. Dorsosejugal porose area present. Dorsosejugal suture complete. Anteromedial part of notogaster with long longitudinal fold having short lateral branches. Four pairs of porose areas developed: *Aa* elongate oval, longitudinally oriented, located close to pteromorphal hinge; *A1* and *A2* nearly circular; *A3* elongate oval. Median pore absent. Opisthonotal gland opening located close and lateral to *A1*; lyrifissure *im* located between setal alveoli *lm* and *lp*. Epimeral setal formula: 1-0-1-2. All epimeral and anogenital setae short, setiform, roughened. Circumpedal carina medium-sized. Postanal porose area elongate oval. Leg famulus straight, inserted close and anterolateral to solenidion ω_1; solenidion of tibia IV inserted in anterior part of dorsal side of segment.

Description

Measurements – Body length: 495 (holotype), 525, 525 (paratypes); body width: 315 (holotype), 300, 330 (paratypes).

Integument (Figs. 13, 14, 16, 18, 19, 22) – Body color brown. Body slightly microgranulate microsculpturing, tubercles in rostral region and lateral part of epimere I larger; subcapitular mentum and antiaxial side of leg femora I–IV and trochanters III, IV partially with simple and elongate tubercles; laterobasal part of prodorsum slightly striate; anteromedial part of notogaster with long longitudinal fold having short lateral branches.

Prodorsum (Figs. 13, 14, 16) – Rostrum protruding, rounded. Rostral region with strong bulge. Lamellar and sublamellar lines parallel, curving backwards at ventral end; *L* thicker than *S*. Rostral (64–67), lamellar (90–97), and interlamellar (108–116) setae setiform, barbed; bothridial seta (108–116) lanceolate, with long, roughened stalk and short, unilaterally dilated, barbed head having distal spike. Dorsosejugal porose area elongate oval (22 × 7), transversely oriented, located posterior to insertion of interlamellar seta. Dorsophragma comparatively long, elongated longitudinally.

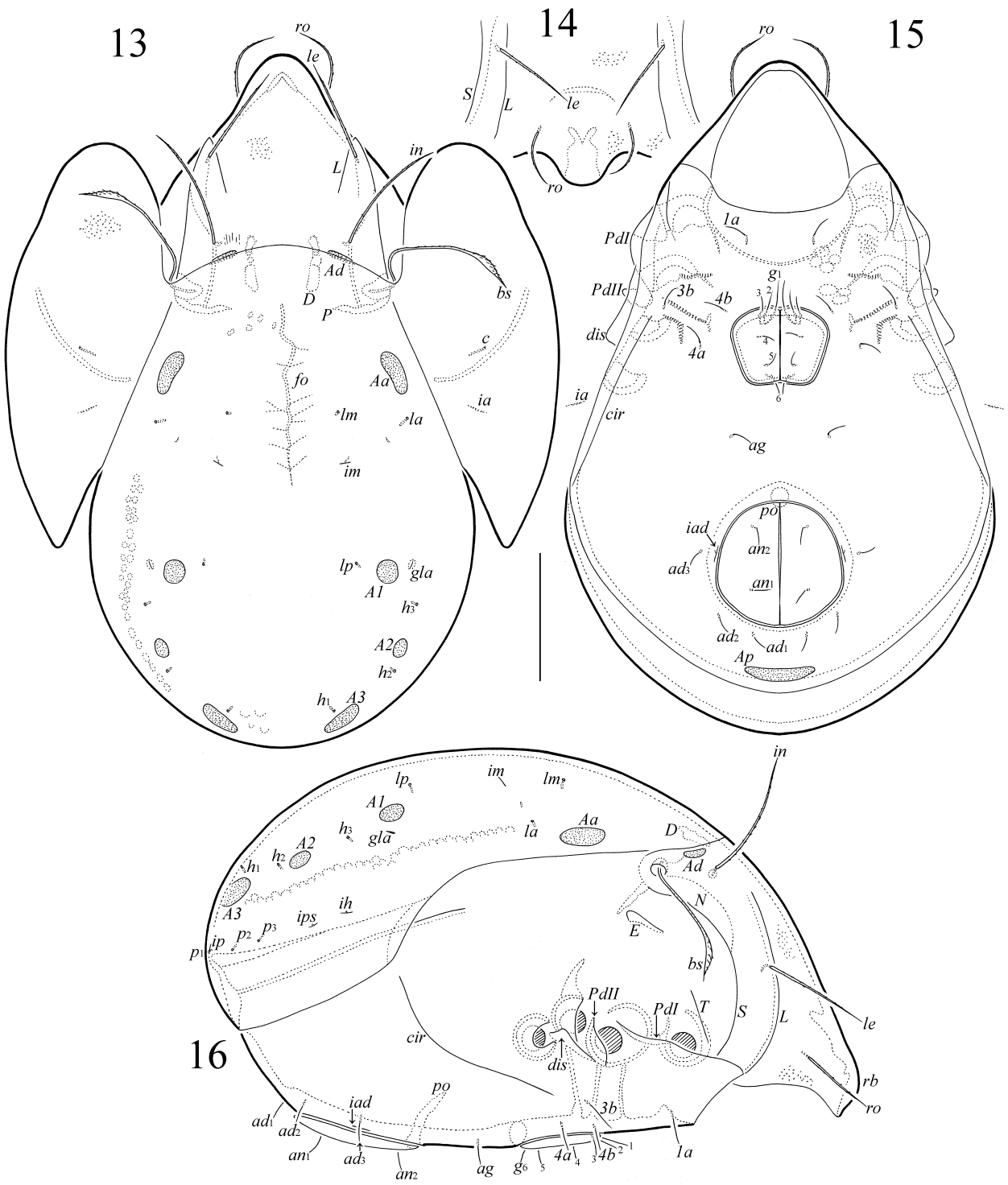
Notogaster (Figs. 13, 16, 17) – Dorsosejugal suture complete, simple. All notogastral setae represented by setal alveoli. Four pairs of porose areas developed: *Aa* (34–41 × 15–19) elongate oval, longitudinally oriented; *A1* (19–22) and *A2* (15–19) nearly circular; *A3* elongate oval (34–41 × 19–22); *Aa* close to pteromorphal hinge, located anterior to *la*. Median pore absent. Opisthonotal gland opening and all lyrifissures distinct: *gla* close and lateral to *A1*; *im* between *lm* and *lp*; *ip* lateral to p_1; *ih* and *ips* anterior to p_3.

Gnathosoma (Fig. 18) – Similar to *Galumna* (Ermilov 2022). Subcapitulum size: 127–131 × 105–112; subcapitular setae (*a*: 22–26; *m*: 13–15; *h*: 19–22) and both adoral setae (13–15) setiform, slightly barbed; *m* thinner than *a* and *h*. Palp length: 94; setation: 0-2-1-3-9(+ω); postpalpal seta (7) spiniform, smooth. Chelicera length: 150; setae (*cha*: 49; *chb*: 34) setiform, barbed.

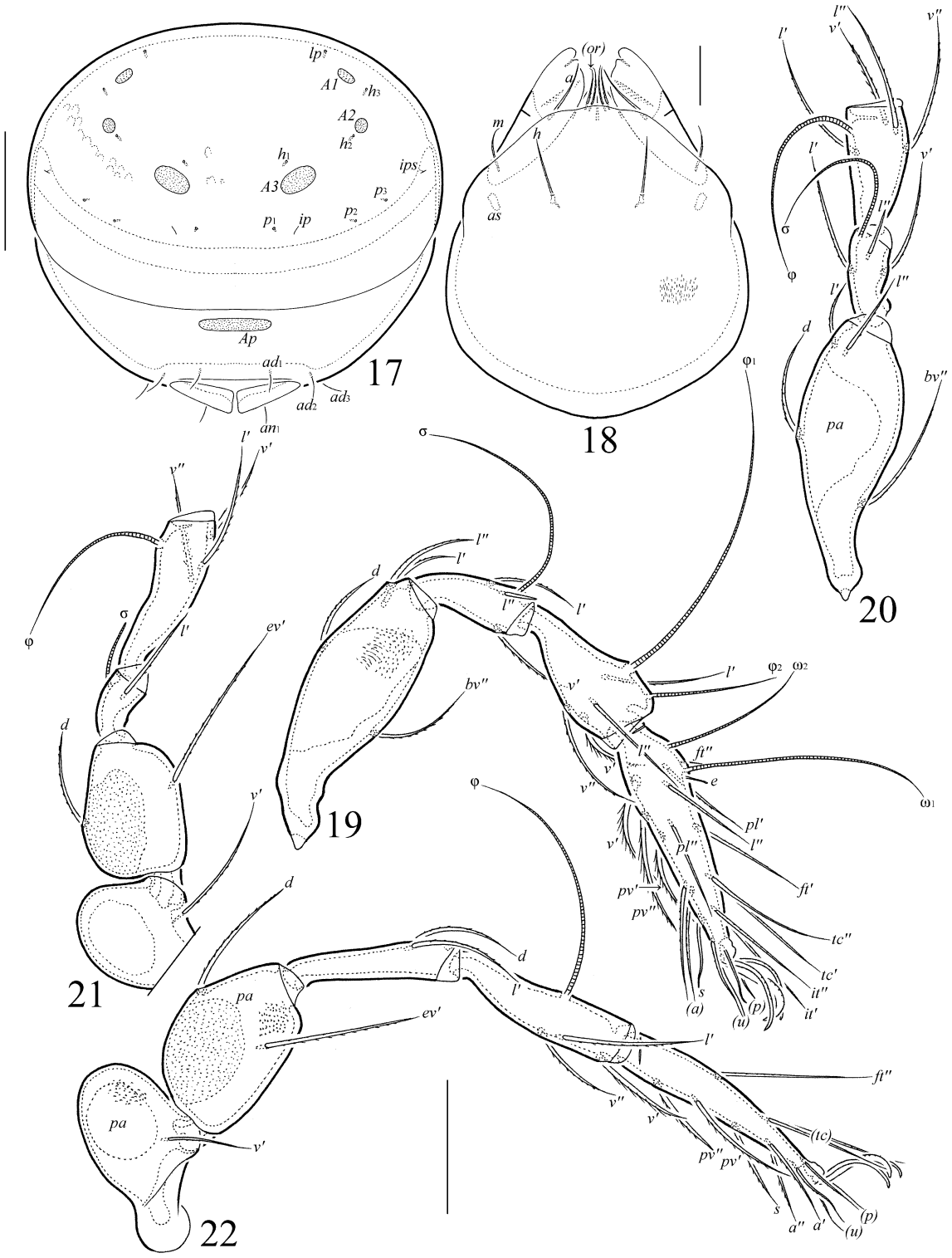
Epimeral and lateral podosomal regions (Figs. 15, 16) – Epimeral setal formula: 1-0-1-2; all setae (*1b*, *3b*: 26–30; *4a*, *4b*: 19–22) setiform, roughened. Circumpedal carina directed to insertion of seta *3b*, bit not reaching it.

Anogenital region (Figs. 15–17) – Anogenital formula: 6-1-2-3; genital (g_1: 22; g_2: 17–19; others: 13–15), aggenital (19–22), anal (19–22), and adanal (19–22) setae setiform, roughened; anterior edge of genital plate with three setae; aggenital setae equally distanced from genital and anal apertures; ad_1 and ad_2 posterior, ad_3 lateral to anal plate; distance ad_1–ad_2 shorter than ad_2–ad_3. Adanal lyrifissure located close and parallel to anal plate. Postanal porose area elongate oval (56–60 × 15–19).

Legs (Figs. 19–22) – Median claw distinctly thicker than lateral claws; all claws slightly barbed on dorsal side. Porose area on femora I–IV and on trochanters III, IV distinct; proximoventral porose area on all tarsi and distoventral porose area on all tibiae not observed. Formulas of leg setation and solenidia: I (1-4-3-4-20) [1-2-2], II (1-4-3-4-15) [1-1-2], III (1-2-1-3-15) [1-1-0], IV (1-2-2-3-12) [0-1-0]; homology of setae and solenidia indicated in Table 2; famulus straight, inserted close and anterolateral to solenidion ω_1; seta *s* of tarsus I eupathidial; solenidion of tibia IV inserted in anterior part of dorsal side of segment.



Figures 13–16. *Galumna* (*Galumna*) *luisi* **sp. nov.** (adult, gnathosoma and legs not shown) – 13. Dorsal view; 14. Anterior part of prodorsum, anterior view; 15. Ventral view (pteromorphs, gnathosoma, and legs not shown); 16. Right lateral view (pteromorph, gnathosoma and legs not shown).



Figures 17–22. *Galumna* (*Galumna*) *luisi* **sp. nov.** (adult) – 17. Posterior view; 18. Subcapitulum, ventral view; 19. Leg I (trochanter not shown), right, antiaxial view; 20. Leg II (tarsus and trochanter not shown), right, antiaxial view; 21. Leg III (tarsus and basal part of trochanter not shown), left, antiaxial view; 22. Leg IV, left, antiaxial view.

Comparison

Galumna (*Galumna*) *luisi* **sp. nov.** is morphologically similar to *Galumna* (*Galumna*) *incisa* Mahunka, 1982 (see also supplementary description in Ermilov and Rybalov 2019) from the Afrotropical region in main characteristics, e.g.: rostrum rounded; lamellar and sublamellar lines

parallel, curving backwards at ventral end; rostral, lamellar and interlamellar setae long, setiform, barbed; *in* longest, *ro* shortest; bothridial seta long, lanceolate; dorsosejugal porose area present; dorsosejugal suture complete; four pairs of notogastral porose areas; epimeral setal formula: 1-0-1-2; all epimeral and anogenital setae short; circumpedal carina medium-sized; postanal porose area elongate oval. We have numerous specimens of *G.* (*G.*) *incisa* from the different populations and locations of the Afrotropical region including Ethiopia, therefore, we could compare its morphology with *G.* (*G.*) *luisi*. The new species can easily be distinguished from *G.* (*G.*) *incisa* by the larger body size (length: 495–525 versus 456–482), the morphology of the rostrum (protruding versus non protruding), the presence (versus absence) of a strong rostral bulge and a long longitudinal fold having short lateral branches in anteromedial part of the notogaster, the morphology of the notogastral porose areas *Aa* and *A3* (clearly elongate oval versus circular), the absence (versus presence) of a median pore, and the location of the notogastral lyrifissure *im* (between setal alveoli *lm* and *lp*, distinctly distanced from them versus close and anterior to porose area *A1*) and leg famulus (close and anterolateral to solenidion ω_1 versus between solenidia ω_1 and ω_2).

Table 2. Leg setation and solenidia of adult *Galumna* (*Galumna*) *luisi* **sp. nov.**

Leg	*Tr*	*Fe*	*Ge*	*Ti*	*Ta*
I	*v'*	*d, (l), bv''*	*(l), v',* σ	*(l), (v),* φ_1, φ_2	*(ft), (tc), (it), (p), (u), (a), s, (pv), v', (pl), l'', e,* ω_1, ω_2
II	*v'*	*d, (l), bv''*	*(l), v',* σ	*(l), (v),* φ	*(ft), (tc), (it), (p), (u), (a), s, (pv),* ω_1, ω_2
III	*v'*	*d, ev'*	*l',* σ	*l', (v),* φ	*(ft), (tc), (it), (p), (u), (a), s, (pv)*
IV	*v'*	*d, ev'*	*d, l'*	*l', (v),* φ	*ft'', (tc), (p), (u), (a), s, (pv)*

Note: See Table 1 for explanations.

Etymology

This species is named in honour of the late Prof. Dr. Luis S. Subías, the Spanish acarologist, who previously identified this new species.

ACKNOWLEDGEMENTS

We thank Prof. Dr. Luis S. Subías for taxonomical identification assistance of both new species, Dr. Frederic D.B. Schedel (Munich, Germany) for sampling *Gymnobodes schedeli*, and two anonymous reviewers for valuable comments.

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دو گونهٔ جدید هرنای اوریباتید (Acari, Oribatida) از ناحیهٔ افروتروپیکال

سرگی جی. ارمیلوف[۱*]، استفان فردریش[۲] و دیلیان جوجویچ[۳،٤]

۱. دانشگاه تیومن، مؤسسه زیست‌شناسی زیست‌محیطی و کشاورزی (X-BIO)، تیومن، روسیه؛ رایانامه: ermilovacari@yandex.ru

۲. لودویگ-ماکسیمیلیان-دانشگاه مونیخ، دانشکدهٔ زیست‌شناسی، مرکز زیستی ال. ام. یو.، پلاگن-مارتینسرید، آلمان؛ رایانامه: friedrich@snsb.de

۳. گروه دامپروری عمومی، بخش بوم‌شناسی، دانشکدهٔ دامپزشکی، دانشگاه تراکیا-استارا زاگورا، استارا زاگورا، بلغارستان؛ رایانامه: dilyan. georgiev@trakia-uni.bg

٤. گروه اکولوژی و حفاظت محیط‌زیست، دانشکدهٔ زیست شناسی، دانشگاه پلوودیو «پیسی هیلندارسکی»، پلوودیو، بلغارستان؛ رایانامه: diliangeorgiev@gmail.com

* نویسندهٔ مسئول

چکیده

دو گونهٔ جدید از هرناهای اوریباتید (Oribatida) بر اساس نرهای بالغ توصیف می شوند – *Gymnobodes schedeli* **sp. nov.** (Carabodidae) از چوب پوسیده و خاکبرگ زیر یک درخت در زامبیا و *Galumna* (*Galumna*) *luisi* **sp. nov.** (Galumnidae) از پاپیروس قبرسی در اوگاندا جمع آوری شده است. گونهٔ *Gymnobodes schedeli* **sp. nov.** با وجود یک فرورفتگی در قسمت قاعده‌ای پرودورسوم و با تزئینات/نقوش نوتوگاستری با همهٔ گونه‌های این جنس متفاوت است. گونهٔ *Gymnobodes schedeli* **sp. nov.** نوامبر با *G. incisa* (*G.*) از نظر اندازهٔ بدن، ریخت‌شناسی خرطوم و نواحی متخلخل *Aa* و *A3* نوتوگاستری، وجود یک برآمدگی خرطومی و یک چین‌خوردگی طولی بلند که شاخه‌های پهلویی کوتاه در قسمت جلویی میانی نوتوگاستر دارد، نبود منفذ میانی و محل درزک نوتوگاستری *im* و و فامولوس پاها متفاوت است.

واژگان کلیدی: هرناهای اوریباتید افروتروپیکال، *Galumna*، *Gymnobodes*، ریخت‌شناسی، آرایه‌شناسی.

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