

Two new species of the genus *Trichogalumna* (Acari: Oribatida: Galumnidae) from China

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Original research

ABSTRACT

Two new species of oribatid mites of the genus *Trichogalumna* Balogh, 1960 (Acari: Oribatida: Galumnidae), *Trichogalumna pseudoohkuboi* **sp. nov.** and *Trichogalumna vittateata* **sp. nov.** are described from China based on adult morphology. *Trichogalumna pseudoohkuboi* **sp. nov.** can be distinguished from other closely related species by the very small porose areas *A2* and *A3* on the notogaster, the surface of gnathosoma with large granules, five pairs of epimeral setae and epimeral setal formula 1-0-2-2, wide granular band on notogaster with the central part extending forward, the base of pteromorphs smooth, the surface of notogaster porose areas without stripes and the surface of genital plate with stripes. *Trichogalumna vittateata* **sp. nov.** is characterized by notogaster with four pairs of very small porose areas, the presence of longitudinal stripes on prodorsum, and the surface of pteromorphs with distinct ridge-like stripes.

Keywords oribatid mites; taxonomy; morphology; *Trichogalumna*; new species; China

Zoobank <http://zoobank.org/F905CCC8-52CC-4C54-BBB6-8CFB841E797C>

Introduction

Among Galumnidae, *Trichogalumna* is a small genus that was established by Balogh with *Pilogalumna lunai* Balogh, 1958 as type species (Balogh 1960). The latest identification key of this genus was presented by Hagino *et al.* (2017). Subsequently, Ermilov and Starý (2018) and Bayartogtokh and Shimano (2019) increased the number species to 34, which are distributed in the Oriental, Palaearctic, New Tropical and African realms (Subías 2004, updated 2023). Only two species, *T. curva* and *T. nipponica* have been recorded from China, however, Norton and Ermilov (2017) showed that the distribution of *T. curva* in China is incorrect and that the distribution of *T. nipponica* in China needs to be verified. The main morphological generic characters of *Trichogalumna* were presented by Balogh (1960), Engelbrecht (1972), Ohkubo (1984), Balogh and Balogh (1992) and Ermilov and Klimov (2017).

During taxonomic identification of oribatid mites from China, we found two new species of the genus *Trichogalumna*, *T. pseudoohkuboi* **sp. nov.** and *T. vittateata* **sp. nov.** The main goal of this study is to describe and illustrate these two new species that were collected from soil in Hainan province and Yunnan province, China.

Received 12 July 2023
Accepted 06 November 2023
Published 21 November 2023

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Academic editor
Pfingstl, Tobias

<https://doi.org/10.24349/wwh6-l67r>

ISSN 0044-586X (print)
ISSN 2107-7207 (electronic)



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How to cite this article Hu Y. *et al.* (2023), Two new species of the genus *Trichogalumna* (Acari: Oribatida: Galumnidae) from China. *Acarologia* 63(4): 1197-1210. <https://doi.org/10.24349/wwh6-l67r>

Methods

Specimens were collected from: humus soil and deciduous leaves in Baisha County, Hainan province, and Gaoligongshan National Nature Reserve, Yunnan province. For more details, see the respective 'Material examined' sections.

Specimens were extracted by using Tullgren-funnels, and subsequently soaked in lactic acid and placed in a DHG Series Heating and Drying Oven "DHG-9013A" at 50 °C for 8 to 72 hours, with the time varying depending on the size of the specimen. Specimens were mounted in lactic acid on temporary cavity slides for identification and for measurement and illustration; draft drawing were made by using a light microscope (OLYMPUS PM-10AD) equipped with plotting instrument. The body length of adults 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. 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. For scanning electron microscopy, the specimens were treated to a fully dehydrated state and dried, coated with film using a rotation gold-plated-palladium alloy membrane, and observed under the JEOL JCM-6000 scanning electron microscope.

Terminology used follows that of Norton (1977), Norton and Behan-Pelletier (2009), Ermilov and Tolstikov (2015), and Ermilov and Klimov (2017). The following abbreviations are used: Prodorsum: lamellar line (*L*), sublamellar line (*S*), prodorsal leg niche (*N*); rostral setae (*ro*), lamellar setae (*le*), interlamellar setae (*in*), sensillus (*ss*), dorsophragmata (*D*), prodorsal porose area (*Ad*). Notogaster: notogastral setae (*c*, *la*, *lm*, *lp*, *h*-, *p*-series), notogastral lyrifissure (*ia*, *im*, *ip*, *ih*, *ips*), opisthonotal gland opening (*gla*). Gnathosoma: subcapitular setae (*h*, *m*), axillary sacculae (*sac*), cheliceral setae (*cha*, *chb*). Epimeral and lateral podosomal regions: pedotecta I, II (*Pd I*, *II*), epimeral setae (*1a*, *3b*, *3c*, *4a*, *4c*), discidium (*dis*). Anogenital region: adanal and anal setae (*ad*, *an*-series), genital setae (*g*₁–*g*₆), aggenital setae (*ag*), adanal lyrifissure (*iad*), postanal porose (*Ap*). Legs: leg trochanter, femur, genu, tibia, tarsus, respectively (*Tr*, *Fe*, *Ge*, *Ti*, *Ta*), leg solenidia (ω , σ , ϕ), leg famulus (ϵ), leg setae (*v*, *ev*, *bv*, *l*, *d*, *ft*, *tc*, *it*, *p*, *u*, *a*, *s*, *p**v*, *p**l*).

Descriptions of new species

Family Galumnidae Jacot, 1925

Trichogalumna pseudoohkuboi sp. nov.

Zoobank: 96BC1314-344D-433E-87E3-18032D49A239

(Figures 1–4)

Material examined

Holotype (female) and 13 paratypes (female): Baisha County (19°10'49"N, 109°27'28"E), Hainan province, 230 m, 19 Jun 2019, Yuanjie Liao, in soil.

Type deposition

The holotype and 13 paratypes are kept in 75%–99% ethanol and deposited in the Institute of Entomology, Guizhou University, Guiyang, China (GUGC).

Diagnosis

Body length 323–358 (holotype: 356) μ m, width of body 221–245 (holotype: 242) μ m; rostrum protruding. Rostral, lamellar and interlamellar setae setiform, interlamellar setae shortest and slender. Sensilla with slender stalk and enlarged spindle-shaped head covered with spinules.

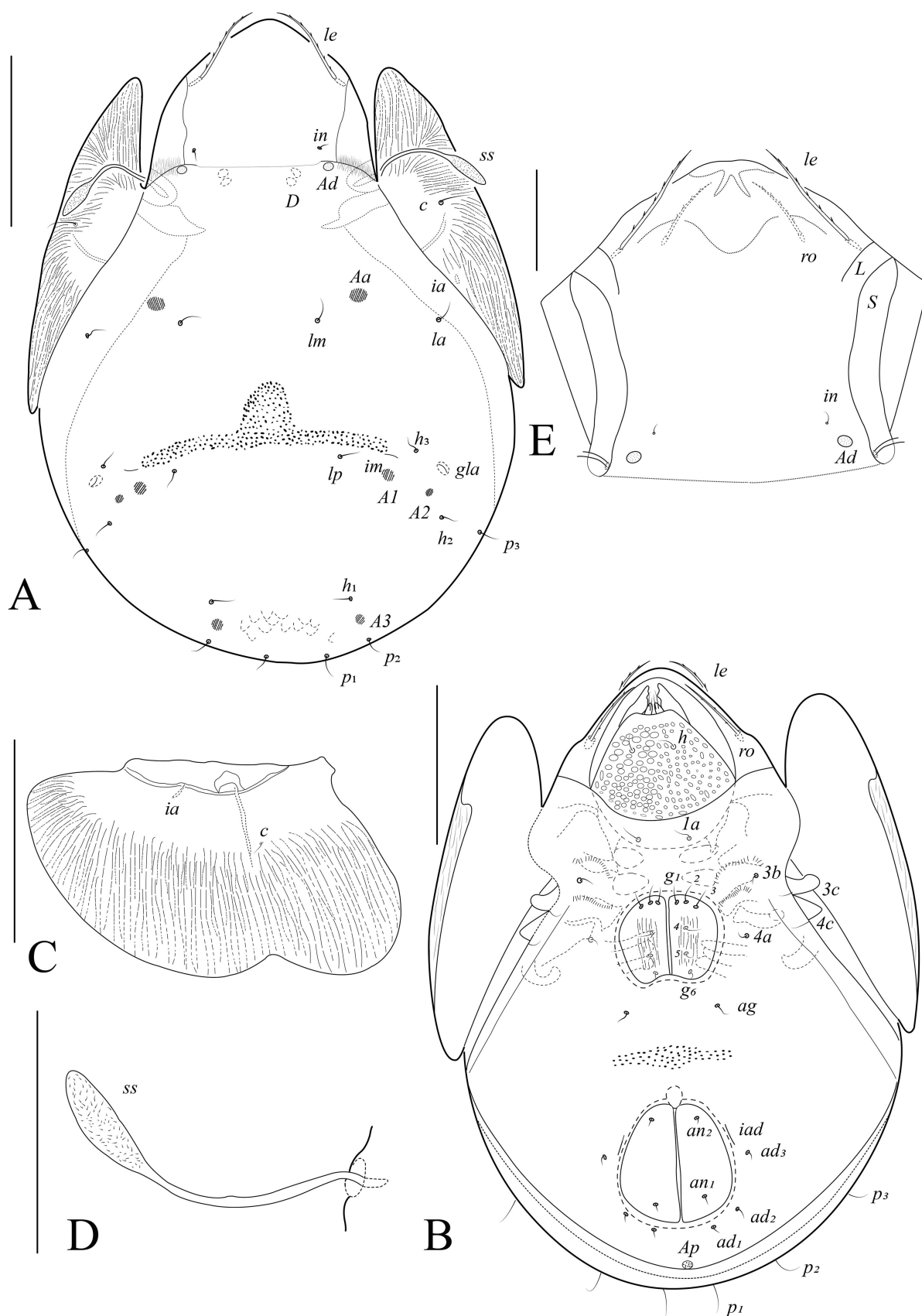


Figure 1 *Trichogalumna pseudoohkuboi* sp. nov., adult: A – Dorsal view; B – Ventral view; C – Pteromorpha, right; D – Sensillus, right; E – Dorsofrontal view of aspidosoma. Scale bars 100 μ m (A–B), 50 μ m (C–E).

Figure 2 *Trichogalumna pseudoohkubo* sp. nov., adult: A – Lateral view; B – Posterior view; C – Genital plate; D – Anal plate; E – Mentum, ventral view. Scale bars 100 μ m (A–B), 50 μ m (C–E).

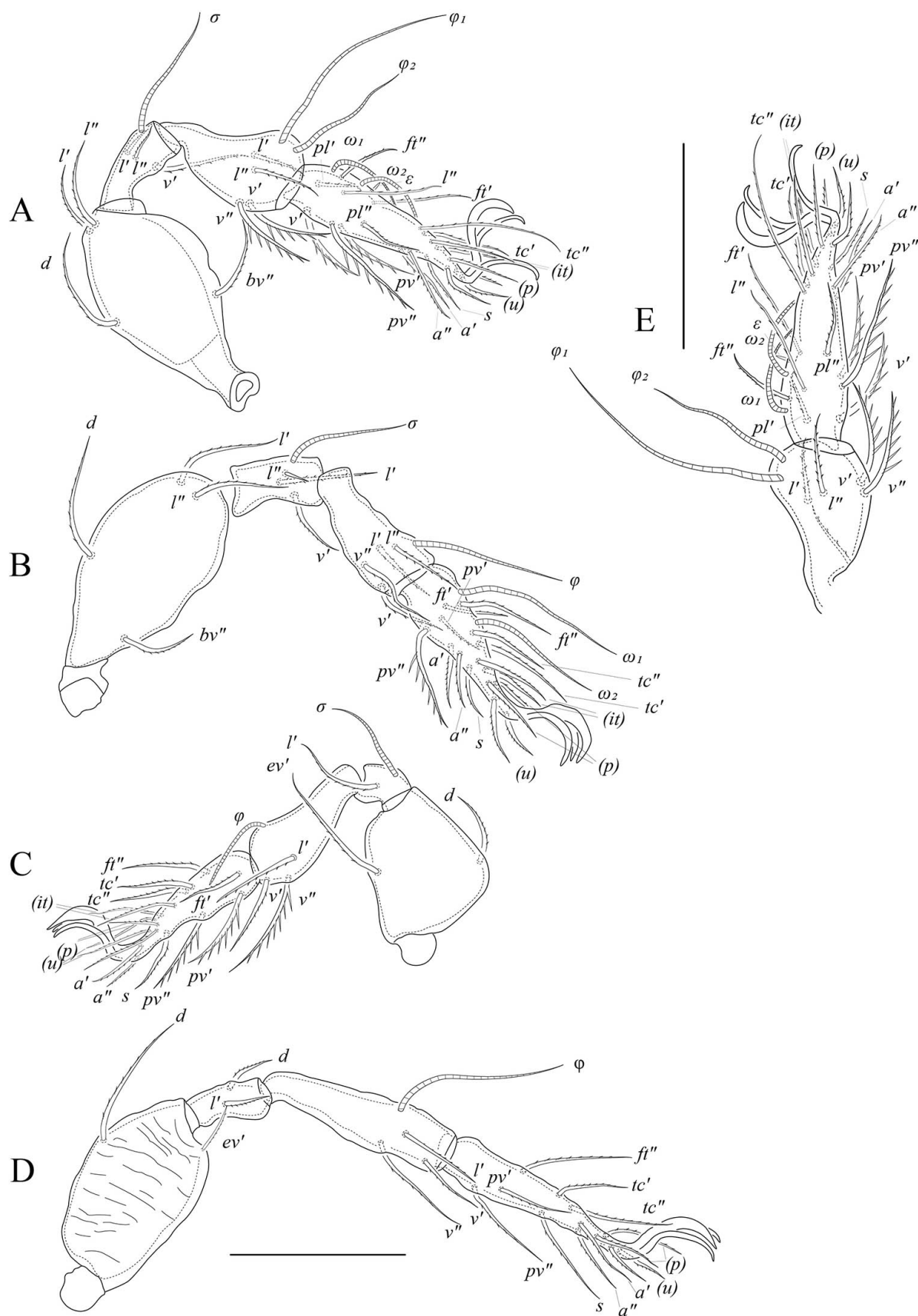


Figure 3 *Trichogalumna pseudoohkuboi* sp. nov., adult: A – Leg I, without trochanter, left, antiaxial view; B – Leg II, without trochanter, right, antiaxial view; C – Leg III, right, antiaxial view; D – Leg IV, without trochanter, right, antiaxial view; E – Tarsus and tibia of leg I, left, dorso-lateral view. Scale bar 50 μ m.

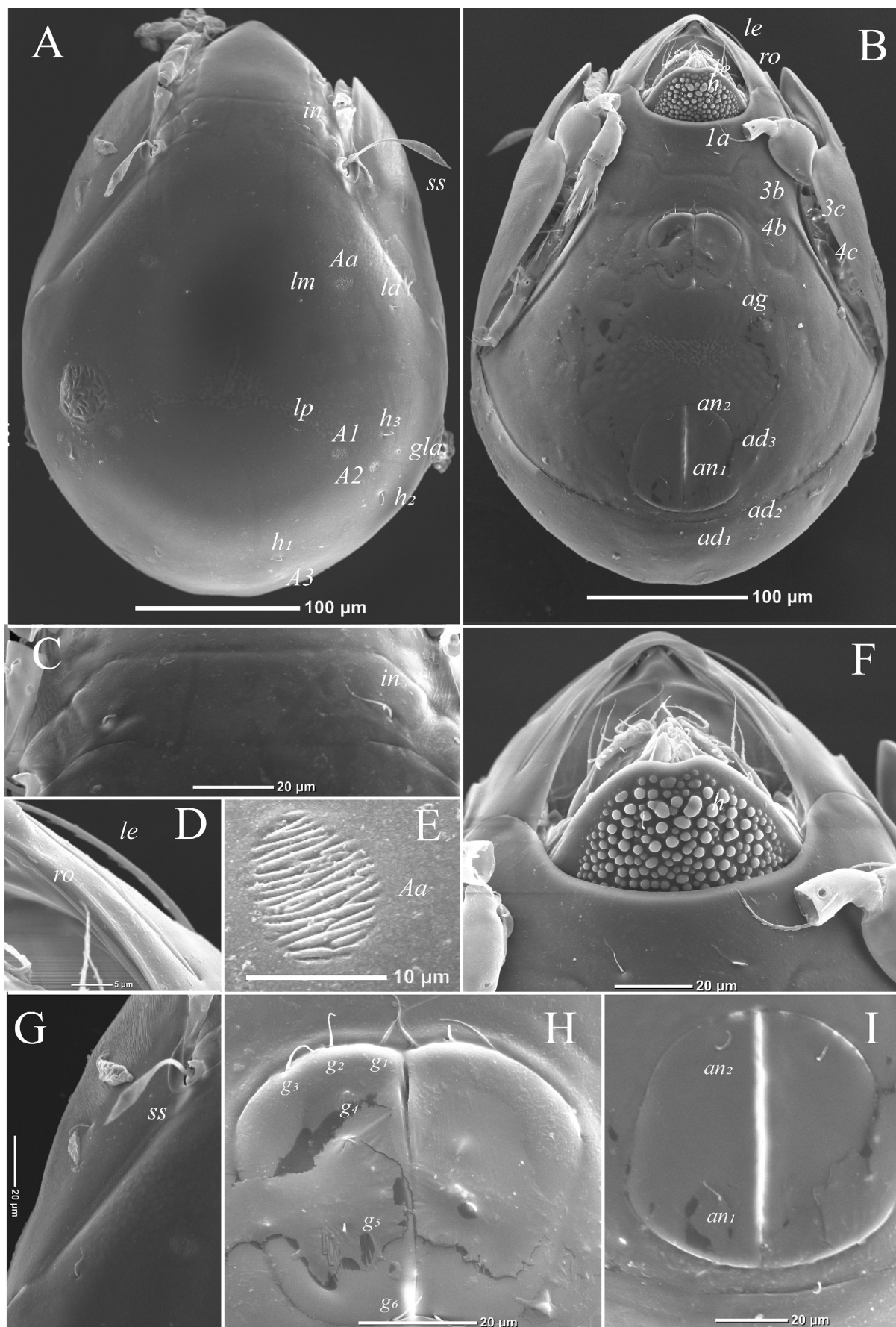


Figure 4 *Trichogalumna pseudoohkuboi* sp. nov., SEM. adult: A – Dorsal view; B – Ventral view; C – Dorsosejugal suture region; D – Rostral and lamellar setae; E – Pore area Aa; F – Subcapitulum; G – Sensilla and pteromorph; H – Genital plate; I – Anal plate.

Middle part of dorsosejugal suture complete, but weak; four pairs of notogastral porose areas, *A2* and *A3* very small; median pore absent. Genital, epimeral, anogenital and adanal setae short, setiform. All legs tridactylous. The surface of gnathosoma with large granules, five pairs of epimeral setae, epimeral setal formula 1-0-2-2, wide granular band on notogaster with central part extending forward, the base of pteromorphs smooth, the surface of notogaster porose areas and genital plate with stripes.

Description

Integument — (Figures 1–4). Coloration yellow to light brown. Middle of notogaster with a transverse band of particles which extends forward medially. The surface of pteromorphs with fringe, the base of pteromorphs smooth. The surface of prodorsum and anal plate smooth; the middle of genital plate with short smooth stripes. The surface of gnathosoma with large granules.

Prodorsum — (Figures 1A, 1D, 1E, 2A, 4A, 4C, 4D, 4G). Rostral (*ro*, 35–37), lamellar (*le*, 42–45) and interlamellar setae (*in*, 13–16) setiform, *in* shortest and slender; *le* roughened; *ro* not visible in dorsal view, clearly visible in lateral and ventral view, roughened; dorsosejugal porose areas (*Ad*, 4–6) small round, located postero-lateral to *in*; sensilla (*ss*, 70–75) with slender stalk and enlarged spindle-shaped head with spinules.

Notogaster — (Figures 1A, 1C, 2A, 2B, 4A, 4G, 4E). Four pairs of notogastral porose areas, *Aa* (5–7 × 8–10) largest, *A1* (6–8), *A2* and *A3* very small, surfaces with stripes; notogastral setae represented by ten pairs of well visible slender, smooth setae; lyrifissure *im* slender, located directly above and close to porose area *A1*; opisthonotal gland openings *gla* located laterally to porose area *A1*, antero-laterally to porose area *A2*; median pore absent.

Gnathosoma — (Figures 1B, 2E, 4B, 4F). Morphology of subcapitulum, palp and chelicera typical for genus (see Ermilov & Sary 2018); subcapitular setae short, setiform, smooth; palp setation: 0-2-1-3-9+1 ω ; axillary sacculs distinct; cheliceral setae setiform, barbed, *cha* longer than *chb*; Trägårdh's organ elongate triangular.

Epimeral and lateral podosomal regions — (Figures 1B, 2A, 4B). Five pairs of epimeral setae (*1a*, *3b*, *3c*, *4a*, *4c*) about 8–12, thin, smooth; epimeral setal formula 1-0-2-2; discidium broadly triangular; pedotectum II scalelike, subtriangular in ventral view.

Anogenital region — (Figures 1B, 2A, 2B, 2C, 2D, 4B, 4H, 4I). Six pairs of genital setae (8–12), setiform, short, smooth; *g*₁, *g*₂ and *g*₃ parallel to each other at the anterior edges of genital plates, the distance between *g*₅ and *g*₆ closer; one pair of thin aggenital setae (*ag*, 8–12 μ m) located between genital pore and anal pore, close to the genital pore, distance between *ag-ag* longer than genital pore width, equivalent to anal pore width; two pairs of anal setae (8–12) and three pairs of adanal setae (8–12) thin microsetae. Adanal lyrifissures *iad* slender, close to the lateral margin of the anterior half of the anal pore, located antero-medially to *ad*₃; postanal porose area *Ap* (6–8) subcircular.

Legs — (Figures 3A, 3B, 3C, 3D, 3E). Morphology of leg segments, setae and solenidia typical for *Trichogalumna* (Ermilov *et al.* 2011). All legs tridactylous. Median claw thickest, two lateral claws slender; 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 1.

Etymology

The name of the new species comes from the Latin word “*pseudo*”, which means “similar”. It means that the new species is very similar to *Trichogalumna ohkuboi* Hagino, Bayartogtokh & Shimano, 2017.

Remarks

This new species is extremely similar to *T. ohkuboi* Hagino, Bayartogtokh and Shimano, 2017 in having the transverse granular bands on notogaster and ventral plate, and the ornamentation of

pteromorphs and genital plate on central part comprising densely arranged striations. However, *T. pseudoohkuboi* **sp. nov.** differs from the latter species by the following characteristics: (1) notogaster porose areas *A2* and *A3* very small (versus notogaster porose areas *A2* and *A3* normal). (2) the surface of gnathosoma with large granules (versus gnathosoma surface smooth). (3) five pairs of epimeral setae and epimeral setal formula: 1-0-2-2 (versus seven pairs of epimeral setae, and epimeral setal formula: 2-0-3-2). (4) granular band on notogaster wide with central part extending forward (versus granular band on notogaster narrow).

Trichogalumna pseudoohkuboi **sp. nov.** is similar to *T. lineata* Ohkubo, 1984 in the ornamentation of pteromorphs comprising densely arranged striations, and the granular bands on notogaster and ventral plate. But the new species is distinguishable from *T. lineata* (Ohkubo 1984) by the following characteristics: (1) notogaster porose areas *A2* and *A3* very small (versus notogaster porose areas *A2* and *A3* normal). (2) the base of pteromorphs smooth (versus the base of pteromorphs with dense particle band). (3) the surface of gnathosoma with sporadic large granule (versus the surface of gnathosoma with dense small granules). (4) the surface of genital plate with stripes (versus the surface of genital plate smooth).

Trichogalumna vittateata sp. nov.

Zoobank: 83E7938A-86EE-47B5-AD5F-7309B455E232
(Figures 5–8)

Material examined

Holotype (female) and six paratypes (female): Gaoligongshan National Nature Reserve (24°35'36"N, 98°39'21"E), Yunnan province, 1600 m, 22 May 2016, Bin Li and Guoru Ren, deciduous leaves.

Type deposition

The holotype and six paratypes are kept in 75%–99% ethanol and deposited in the Institute of Entomology, Guizhou University, Guiyang, China (GUGC).

Diagnosis

Body length 290–310 (holotype: 294) μm, width of body 211–226 (holotype: 215) μm; rostrum widely rounded in dorsal view, but protruding in lateral view. Rostral, lamellar and interlamellar setae setiform. Sensilla with slender stalk and enlarged spindle-shaped head covered with spinules. Middle part of dorsosejugal suture absent; four pairs of notogastral porose areas, very small, and the surface with granules. Median pore absent. Ventral, genital, epimeral, anogenital and adanal setae short, setiform. The surface of gnathosoma with small granules; prodorsum with longitudinal stripes; the anterior and posterior portion of notogaster with longitudinal, thin striae, but with short strip particle protrusions in the middle; the surface of pteromorphs with distinct ridge-like stripes.

Table 1 Leg setation and solenidia of *Trichogalumna pseudoohkuboi* **sp. nov.** and *Trichogalumna vittateata* **sp. nov.**. 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.

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'', ε, 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)

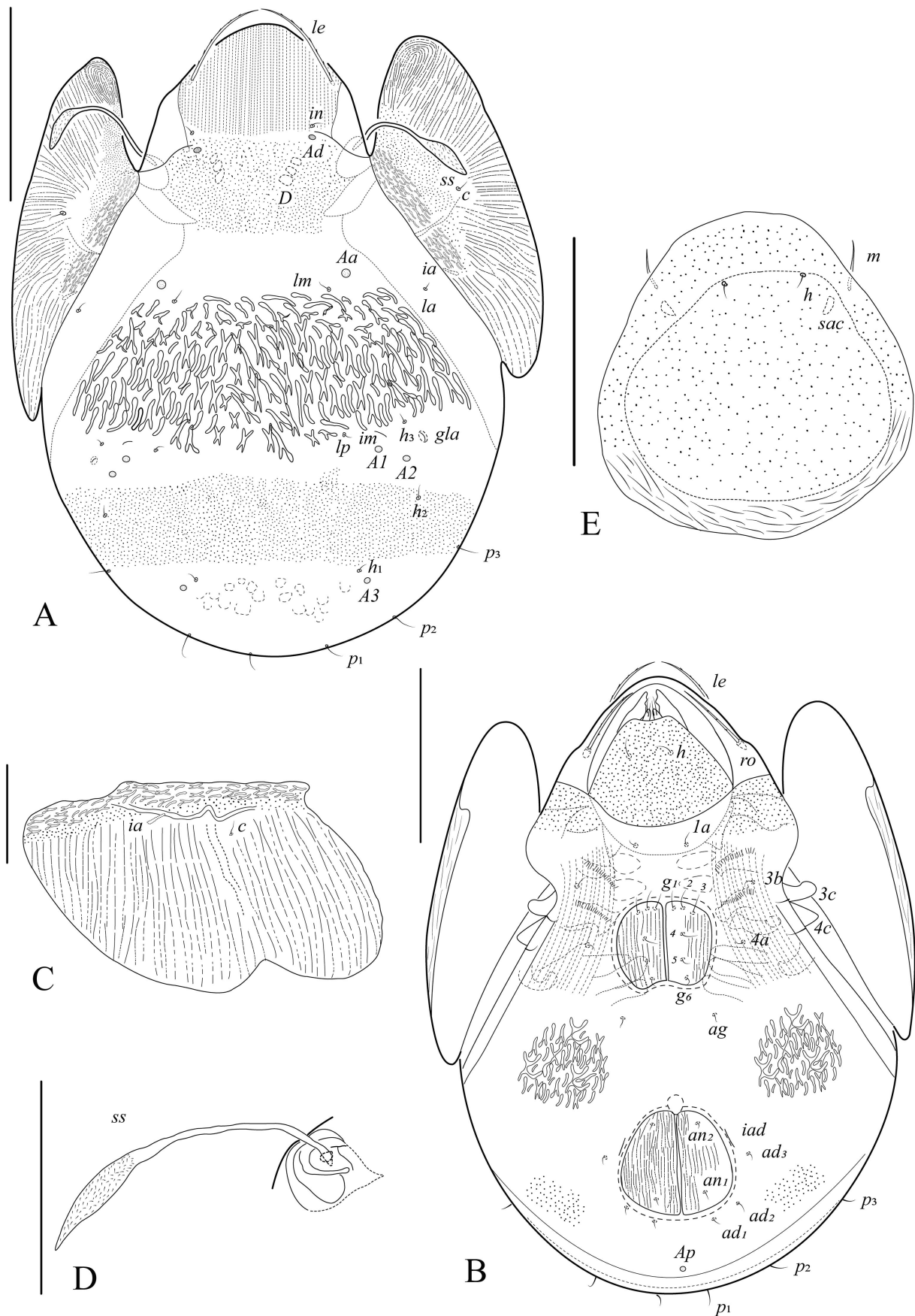


Figure 5 *Trichogalumna vittateata* sp. nov., adult: A – Dorsal view; B – Ventral view; C – Pteromorpha, right; D – Sensillus, right; E – Mentum, ventral view. Scale bars 100 µm (A–B), 50 µm (C–E).

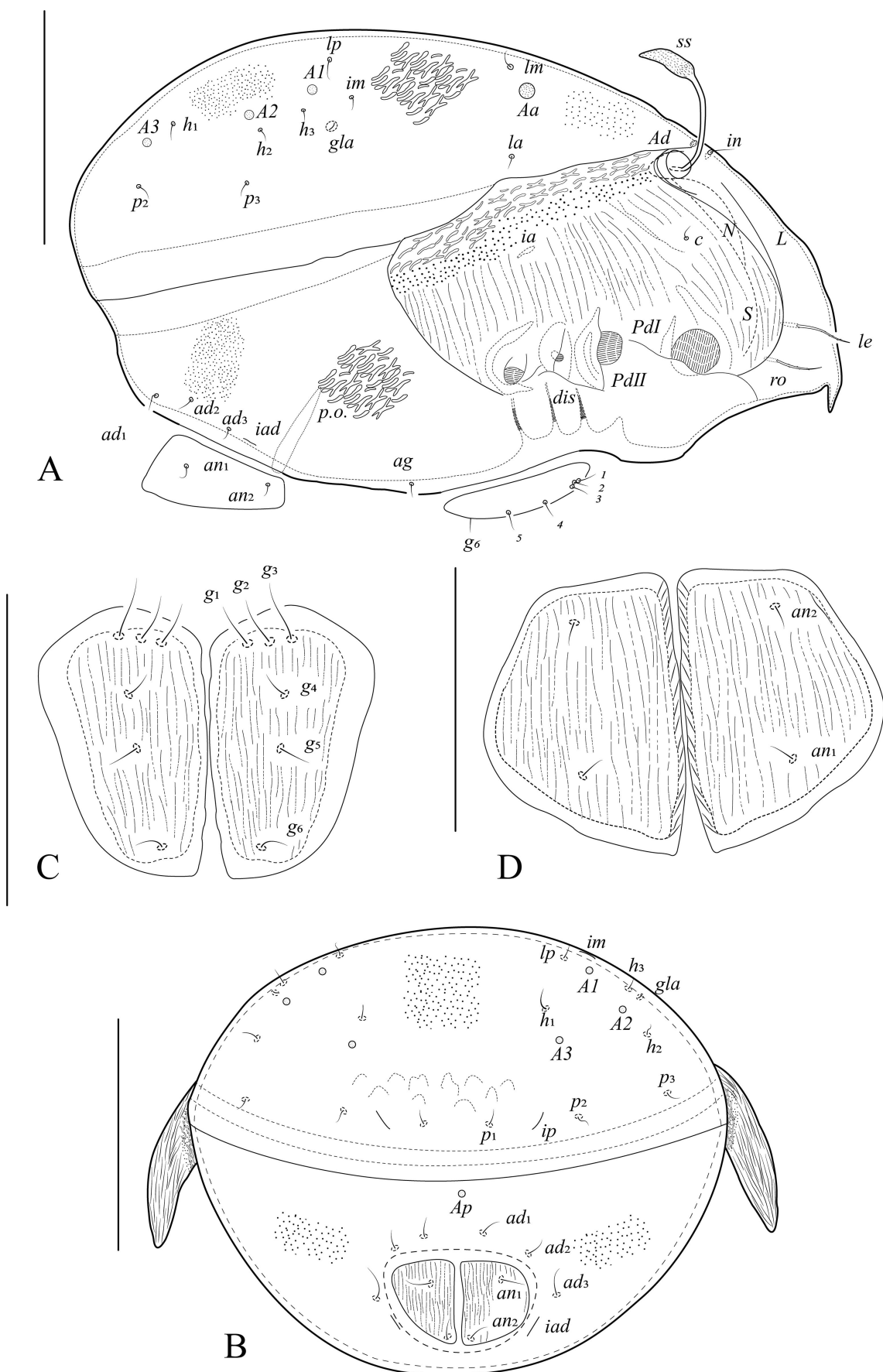


Figure 6 *Trichogalumna vittateata* sp. nov., adult: A – Lateral view; B – Posterior view; C – Genital plate; D – Anal plate. Scale bars 100 µm (A–B), 50 µm (C–D).

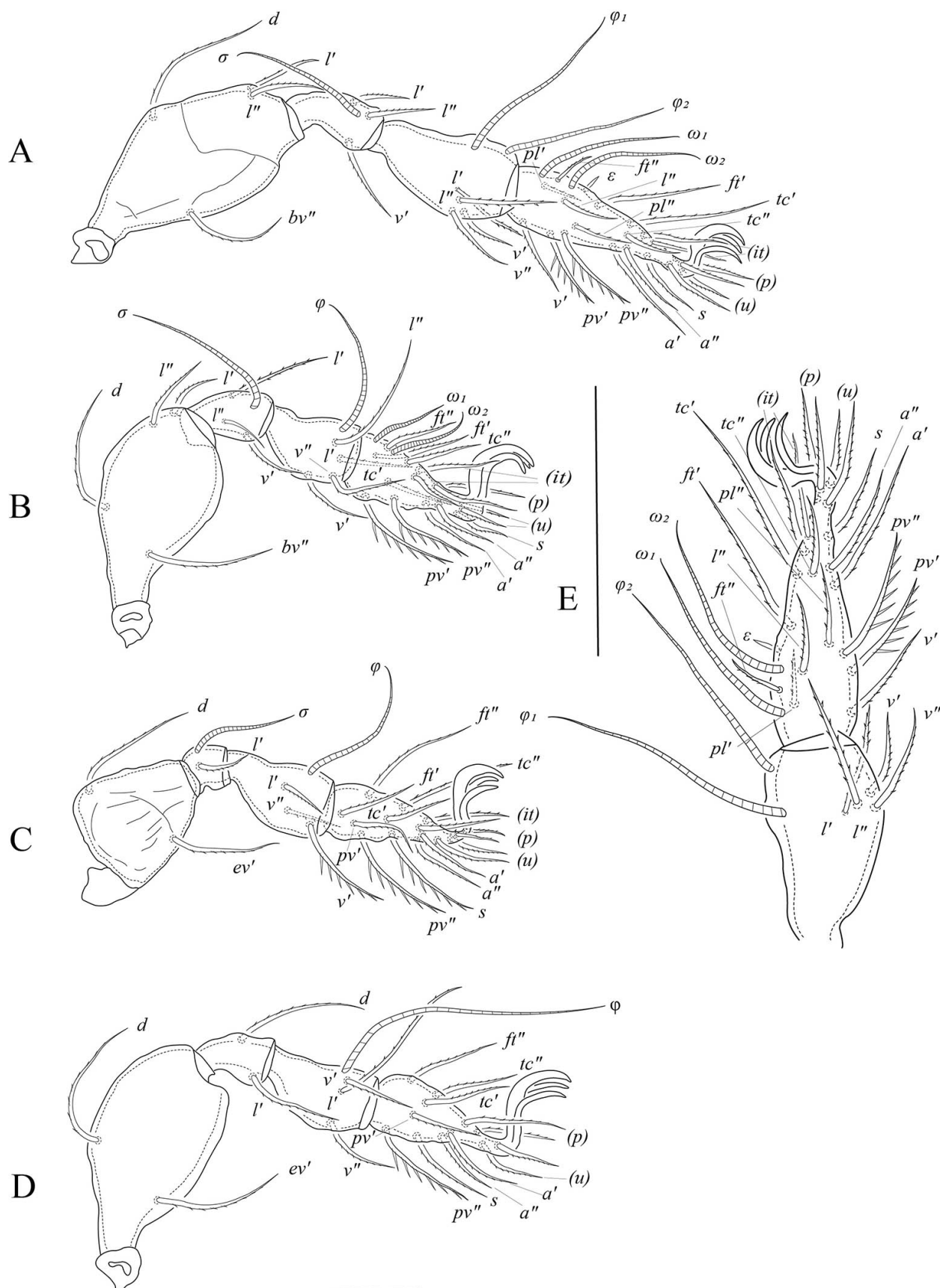


Figure 7 *Trichogalumna vittateata* sp. nov., adult: A – Leg I, without trochanter, right, antiaxial view; B – Leg II, without trochanter, right, antiaxial view; C – Leg III, right, antiaxial view; D – Leg IV, without trochanter, right, antiaxial view; E – Tarsus and tibia of leg I, right, dorso-lateral view. Scale bar 50 μ m.

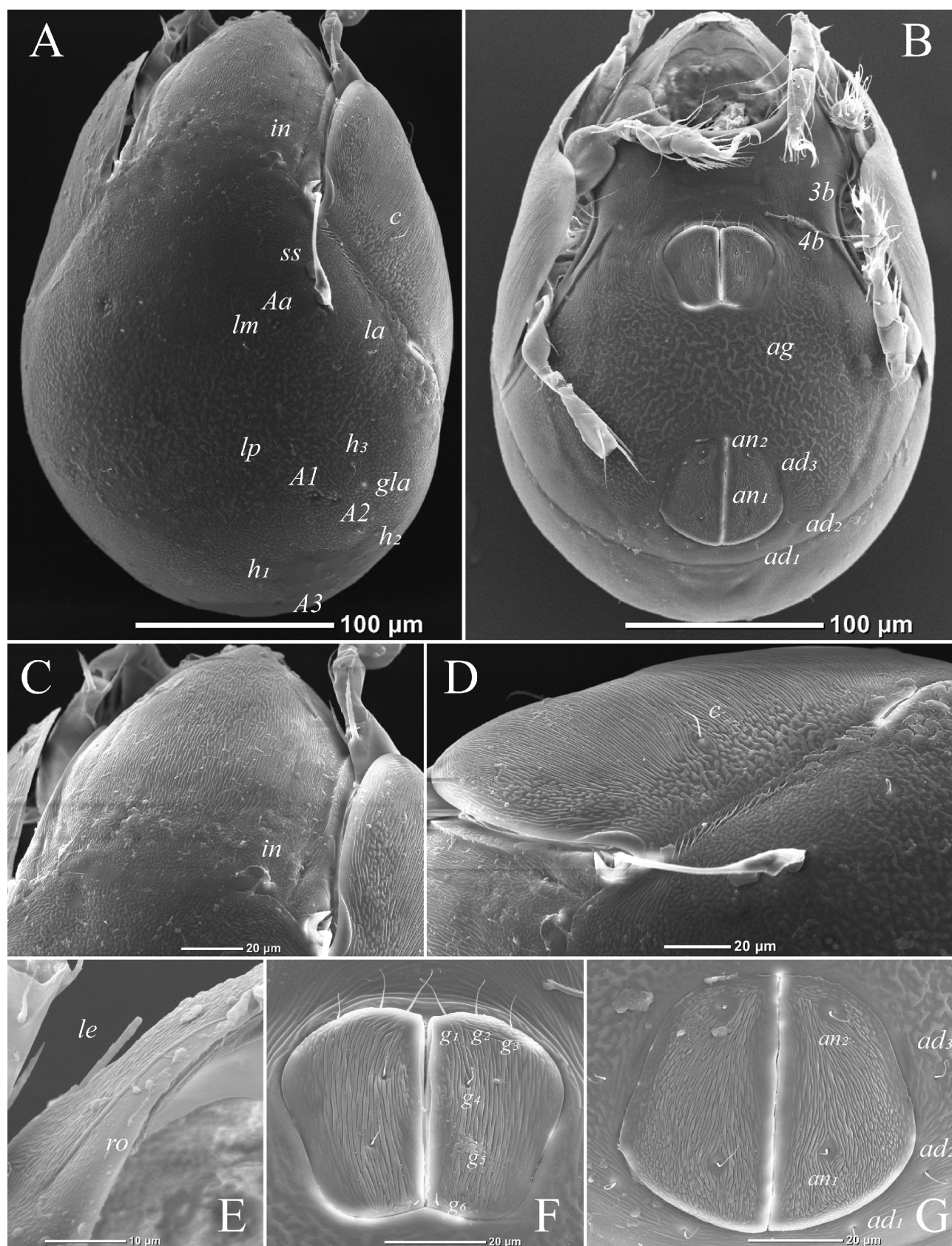


Figure 8 *Trichogalumna vittateata* sp. nov., SEM. adult: A – Dorsal view; B – Ventral view; C – Prodorsum; D – Pteromorph; E – Rostral seta; F – Genital plate; G – Anal plate.

Description

Integument — (Figures 5–8). Body color yellow to light brown. Prodorsum with longitudinal stripes; the anterior and posterior portion of notogaster with longitudinal, thin striae, but with short strip particle protrusions in the middle; the surface of pteromorphs with distinct stripes, and with particles and strip particles at the base; the surface of genital plate and anal plate with short stripes.

Prodorsum — (Figures 5A, 5D, 6A, 8A, 8C, 8D, 8E). Rostral (*ro*, 28–33) and lamellar setae (*le*, 40–45) setiform, and lamellar setae surface, roughened; rostral setae not visible in dorsal view, but clearly visible in side and ventral view, roughened; interlamellar setae (*in*, 5–8) short and slender; dorsosejugal porose areas (*Ad*, 4–5) small round, located postero-lateral to interlamellar seta; sensilla (*ss*, 50–55) with slender stalk and enlarged spindle-shaped head with spinules.

Notogaster — (Figures 5A, 5C, 6A, 6B, 8A, 8D). Middle part of dorsosejugal suture absent; four pairs of notogastral porose areas, very small (2–4), and their surfaces with granules. Notogastral setae represented by ten pairs of slender, smooth setae; lyrifissure *im* slender, located directly above and close to porose area *Al*; opisthonotal gland openings *gla* located laterally to porose area *Al*, antero-laterally to porose area *A2*; median pore absent.

Gnathosoma — (Figures 5B, 5E, 8B). The surface of gnathosoma with small granules; morphology of subcapitulum, palp and chelicera typical for genus, and same as those in other described species (see Ermilov & Stary 2018); subcapitular setae short, setiform, smooth; palp setation: 0-2-1-3-9+1 ω ; axillary sacculs distinct; cheliceral setae setiform, barbed, *cha* longer than *chb*; Trägårdh's organ elongate triangular.

Epimeral and lateral podosomal regions — (Figures 5B, 6A, 8B). Five pairs of epimeral setae (*1a*, *3b*, *3c*, *4a*, *4c*), smooth; epimeral setal formula 1-0-2-2; discidium broadly triangular; pedotectum II scalelike, subtriangular in ventral view.

Anogenital region — (Figures 5B, 6A, 6B, 6C, 6D, 8B, 8F, 8G). Six pairs of genital setae (5–7), setiform, short, smooth; g_1 , g_2 and g_3 parallel to each other at the anterior edges of genital plate, the distance between g_5 and g_6 closer; one pair of aggenital setae *ag* (4–8) located between genital pore and anal pore, close to the genital pore, the distance of *ag-ag* longer than genital pore width, equivalent to anal pore width, thin; two pairs of anal setae (4–8) and three pairs of adanal setae (4–8), represented as microsetae. Adanal lyrifissures *iad* slender, close to the lateral margin of the anterior half of the anal pore, located antero-medially to *ad*₃; postanal porose area *Ap* (2–4) small round.

Legs — (Figures 7A, 7B, 7C, 7D, 7E). Morphology of leg segments, setae and solenidia typical for *Trichogalumna* (Ermilov *et al.* 2011). All legs tridactylous. Median claw thickest, two lateral claw slender; 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 1.

Etymology

The name of the new species comes from the Latin word “*vittateata*”, which means “longitudinal stripe”. It refers to the longitudinal stripes on the prodorsum of the new species.

Remarks

The new species *T. vittateata* **sp. nov.** is similar to *T. mironovi* Ermilov and Stary, 2018 in the longitudinally striae on the genital plate, and the ornamentation on the median parts of notogaster and anogenital region comprising strong dense ridges of different form. But the new species is distinguishable by the presence of the following character states in combination: (1) notogaster with four pairs of porose areas (versus notogaster with two pairs of porose areas, *Aa*, *A2* absent). (2) the presence of longitudinal stripes on prodorsum (versus prodorsum with granules). (3) the surface of pteromorphs with distinct ridge stripes (versus the surface of pteromorphs without distinct ridge stripes).

Acknowledgements

We would like to express our gratitude to Yuanjie Liao, Bin Li and Guoru Ren (Institute of Entomology, Guizhou University, Guiyang of China) for provided samples. And many thanks to Gaoligongshan National Nature Reserve. This project was supported by the Program of Ministry of Science and Technology of the People's Republic of China (2015FY210300) and the Guizhou Province Science and Technology Innovation Talent Team Project (Qian Ke He Pingtai Rencai – CXTD [2021]004).

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