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**A NEW SPECIES OF THE GENUS *FLAGELLOZETES* BALOGH, 1970
(ACARI: ORIBATIDA: GALUMNIDAE) FROM TAIWAN**

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Summary. A new species of the genus *Flagellozetes* (Oribatida: Galumnidae) is described from Taiwan. *Flagellozetes* (*Cosmogalumna*) *sanqingi* Ermilov **sp. n.** differs from *F. (C.) ornatus* (Aoki, 1988) by the sculpturing of pteromorphs and genital plates and ornamentation of anal plates.

Key words: galumnid mites, systematics, morphology, new species, Oriental region.

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Резюме. Описан новый вид рода *Flagellozetes* (Oribatida: Galumnidae) из Тайваня. *Flagellozetes* (*Cosmogalumna*) *sanqingi* Ermilov **sp. n.** отличается от *F. (C.) ornatus* (Аоки, 1988) скульптурой птероморф и генитальных крышек и орнаментом анальных крышек.

INTRODUCTION

The genus *Flagellozetes* (Acari: Oribatida: Galumnidae) was proposed by Balogh (1970) with *Flagellozetes porosus* Balogh, 1970 as type species. The genus comprises three subgenera [*F. (Flagellozetes)* Balogh, 1970 (one species); *F. (Cosmogalumna)* Aoki, 1988 (13 species); and *F. (Variogalumna)* Mahunka, 1995 (one species)] (Ermilov & Klimov, 2017). Totally 15 species are distributed in the Oriental, Neotropical and southern Palaearctic regions (Subías, 2020). The generic and subgeneric diagnoses were presented by Ermilov and Klimov (2017). An identification key and data on distribution and habitats of known species of *Flagellozetes* were provided by Ermilov and Kalúz (2019).

During taxonomic identification of oribatid mites from Taiwan, we found a new species belonging to *Flagellozetes* (*Cosmogalumna*). The main goal of our paper is to describe and illustrate this new species.

At present, the oribatid mite fauna of Taiwan is briefly investigated, and only two species of *Flagellozetes* were registered (Ermilov & Liao, 2018): *Flagellozetes* (*Cosmogalumna*) *areticulatus* (Ermilov, Sandmann, Klarner, Widyastuti et Scheu, 2015) and *F. (C.) ornatus* (Aoki, 1988).

MATERIAL AND METHODS

Substrate samples containing oribatid mites were collected near Meihua Lake, Dongshan Township, Yilan County in Taiwan (Fig. 23). Mites were extracted from samples into 75% ethanol using Berlese's funnels with electric lamps in laboratory conditions during 10 days.

Specimens are distributed among three institutions: the National Taiwan University, Taipei, Taiwan (NTU); the Senckenberg Museum, Görlitz, Germany (SMG); the Tyumen State University Museum of Zoology, Tyumen, Russia (TSUMZ).

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 (behind pteromorphs). 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". Images were obtained with an AxioCam ICc3 camera using a Carl Zeiss transmission light microscope "Axio Lab.A1".

Morphological terminology used in this paper follows that of F. Grandjean (see Ermilov & Klimov, 2017 for review and application).

Follow abbreviations are used: Prodorsum: *PD* = prodorsum; *L* = lamellar line; *S* = sublamellar line; *N* = prodorsal leg niche; *E*, *T* = lateral ridges of prodorsum; *ro*, *le*, *in*, *bs* = rostral, lamellar, interlamellar, and bothridial setae, respectively; *bo* = bothridium; *Ad* = dorsosejugal porose area; *D* = dorsophragma; *P* = pleurophragma. Notogaster: *NG* = notogaster; *PT* = pteromorph; *c*, *la*, *lm*, *lp*, *h*, *p* = notogastral setal alveoli; *Aa*, *A1*, *A2*, *A3* = notogastral porose areas; *ia*, *im*, *ip*, *ih*, *ips* = notogastral lyrifissures; *gla* = opisthonotal gland opening. Gnathosoma: *SM* = subcapitular mentum; *a*, *m*, *h* = subcapitular setae; *or* = adoral seta; *d*, *l*, *inf*, *sup*, *cm*, *acm*, *ul*, *su*, *vt*, *lt* = palp setae; ω = palp and leg solenidium; *sac* = axillary sacculi; *cha*, *chb* = cheliceral setae; *Tg* = Trägårdh's organ. Epimeral and lateral podosomal regions: *1a*, *3b*, *4a* = epimeral setae; *PdI*, *PdII* = pedotecta I, II, respectively; *dis* = discidium; *cp* = circumpedial carina. Anogenital region: *GP* = genital plate; *AP* = anal plate; *g*, *ag*, *an*, *ad* = genital, aggenital, anal and adanal setae, respectively; *iad* = adanal lyrifissure; *po* = preanal organ; *Ap* = postanal porose area. Legs: *Tr*, *Fe*, *Ge*, *Ti*, *Ta* = leg trochanter, femur, genu, tibia, and tarsus, respectively; *pa* = leg porose area; ω , ϕ , σ = leg solenidia; ϵ = leg famulus; *d*, *l*, *v*, *ev*, *bv*, *ft*, *tc*, *it*, *p*, *u*, *a*, *s*, *pv*, *pl* = leg setae.

DESCRIPTION

Flagellozetes (Cosmogalumna) sanqingi Ermilov, sp. n.

<http://zoobank.org/NomenclaturalActs/C885B79C-E220-4D01-B9E3-B0840EA01617>

Figs 1–22

TYPE MATERIAL. Holotype – ♂; **Taiwan**: Yilan County, Dongshan Township, Meihua Lake, 24°38.516'N, 121°44.083'E, soil under fallen leave in forest, 10.III 2018, leg. J.-R. Liao & H.C. Lee (NTU). Paratypes: the same label as holotype, 12♂, 4♀ (two paratypes are deposited in the collection of the SMG; 14 paratypes are deposited in the collection of the TSUMZ). All specimens are preserved in ethanol with a drop of glycerol.

DIAGNOSIS. Body size: 315–332 × 232–249. Prodorsum densely tuberculate. Notogaster and anogenital region completely reticulate, with small cells. Pteromorph striate mediobasally and with short ridges distally. Genital plate with strong longitudinal ridges. Anal plate reticulate. Rostral and lamellar setae setiform, slightly barbed; *ro* longest, *le* inserted medial to *L*. Interlamellar seta minute. Bothridial seta long, clavate, smooth. Notogaster with four pairs of rounded porose areas. Median pore and oval postanal porose area present. Epimeral and anogenital setae short, setiform, smooth. Circumpedal carina long, reaching of anterior margin of ventral plate.

Figs 1–4. *Flagellozetes (Cosmogalumna) sanqingi* Ermilov sp. n., adult: 1 – dorsal view; 2 – ventral view (gnathosoma and legs not shown); 3 – lateral view (pteromorph, gnathosoma and legs not shown); 4 – posterior view. Scale bar 50 µm.

Figs 5–11. *Flagellozetes (Cosmogalumna) sanqingi* Ermilov **sp. n.**, adult: 5 – subcapitulum, ventral view; 6 – palp, left, paraxial view; 7 – chelicera, right, antiaxial view; 8 – leg I, without trochanter, right, antiaxial view; 9 – leg II, without trochanter and tarsus, right, ventroantiaxial view; 10 – leg III, without trochanter, right, paraxial view; 11 – leg IV, left, antiaxial view. Scale bar 20 μ m.

DESCRIPTION. Measurements. Body length 315 (holotype), 315–332 (16 paratypes); body width 232 (holotype), 232–249 (16 paratypes).

Integument (Figs 1–5, 8, 9, 11–14, 16–22). Body color brown. Body surface sparsely microporose and partially microtuberculate (visible under high magnification in dissected specimens). Prodorsum densely tuberculate (diameter tubercle up to 2). Basal part of lamellar line with several longitudinal stria. Notogaster completely reticulate, cells comparatively small. Marginal zone of notogaster densely tuberculate (diameter tubercle up to 2). Pteromorph striate mediobasally and with short ridges distally. Subcapitular mentum with dense short ridges and stria and with several long transverse stria basally. Anterior part of ventral plate slightly tuberculate, lateral part of all epimeres longitudinally striate and rugose. Broad transverse tuberculate band located anterior to genital aperture. Anogenital region completely reticulate, cells comparatively small. Genital plate with strong longitudinal ridges and some

Figs 12–14. *Flagellozetes (Cosmogalumna) sanqingi* Ermilov **sp. n.**, adult, microscope images: 12 – dorsal view; 13 – ventral view; 14 – lateral view.

lateral tubercles (diameter tubercle up to 4). Anal plate reticulate, many cells distinctly elongate. Antiaxial side of all leg femora and trochanters III, IV with tubercles and short ridges.

Prodorsum (Figs 1, 3, 12, 14–16). Rostrum rounded. Lamellar and sublamellar lines thin, parallel, curving backwards. Lateral structures *N* and ridges *E* and *T* poorly developed. Rostral (32–41) and lamellar (12–14) setae setiform, slightly barbed; *le* inserted medial to *L*. Interlamellar seta (2–4) setiform, thin, smooth. Bothridial seta (53–61) clavate, smooth, with

Figs 15–22. *Flagellozetes (Cosmogalumna) sanqingi* Ermilov **sp. n.**, adult, microscope images: 15 – part of prodorsum, lateral view; 16 – part of prodorsum, dorsal view; 17 – ornamentation of notogaster; 18 – ornamentation of notogaster and sculpturing of basal part of pteromorph; 19 – sculpturing of pteromorph; 20 – ornamentation and sculpturing of epimeral and anogenital regions; 21 – sculpturing of subcapitular mentum; 22 – ornamentation of anal plate.

long stalk and short, rounded distally head. Exobothridial seta absent. Dorsosejugal porose area (12–16 × 4) narrowly oval, transversely oriented, posterolateral to *in*. Dorsophragma distinctly elongate longitudinally.

Notogaster (Figs 1, 3, 4, 12, 14, 17, 18). Dorsosejugal suture complete, convex medially. With 10 pairs of microsetae (1) and four pairs of rounded porose areas (*Aa*, 8–12; *A1*, *A2*, *A3*, 4–8). Porose area *Aa* located close to pteromorph hinge, anterior to *la*. Median pore present in female and male, located below virtual line connected *A2*. Opisthonotal gland opening and all lyrifissures distinct; *gla* located anterolateral and close to *A2*, *im* between *lm* and *lp* (equal distanced from them), *ip* between *p*₁ and *p*₂ (closer to *p*₁), *ih* and *ips* close to each other between *p*₂ and *p*₃.

Gnathosoma (Figs 5–7). Subcapitulum size: 77–82 × 65–69. Three pairs of subcapitular setae setiform, *m* (4–6) smooth, *a* (16–20) and *h* (12–14) roughened; *a* thickest, *m* thinnest. Two pairs of adoral setae (8) setiform, barbed. Length of palp: 61–65. Postpalpal seta (2) spiniform. Length of chelicera: 92–98. Two cheliceral setae (*cha*, 30–32; *chb*, 22–24) setiform, barbed. Trägårdh's organ long, elongate triangular.

Epimeral and lateral podosomal regions (Figs 2, 3, 13, 14, 20). Anterior tectum of epimere I smooth. Epimeral setal formula: 1-0-1-1. Three pairs of epimeral setae (*3b*, 8–10; *1a*, *4a*, 4) setiform, thin, smooth. Pedotectum II rounded distally in ventral aspect. Discidium triangular. Circumpedial carinae long, thin, reaching of anterior margin of ventral plate.

Anogenital region (Figs 2–4, 13, 14, 20). Six pairs of genital, one pair of aggenital, two pairs of anal and three pairs of adanal setae similar in length (4), setiform, thin, smooth. Anterior edge of genital plate with three setae. Aggenital seta located between genital and anal apertures, closer to genital aperture. Adanal lyrifissure located close and parallel to anal plate. Adanal setae *ad*₁ and *ad*₂ posterior, *ad*₃ lateral to anal plate. Unpaired postanal porose area oval (12–16 × 6–8).

Table 1. Leg setation and solenidia of adult *Flagellozetes* (*Cosmogalumna*) *sanqingi* Ermilov sp. n.

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

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.

Legs (Figs 8–11). Median claw distinctly thicker than lateral claws, all slightly barbed on dorsal side. Porose area on all femora and on trochanters III, IV present, but poorly visible. 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]; homologies of setae and solenidia indicated in Table 1. Famulus on tarsus I inserted anterior to solenidion ω₁. Solenidion ω₁ on tarsus I, ω₁ and ω₂ on tarsus II and σ on genu III bacilliform, other solenidia setiform. Solenidion of tibia IV inserted in anterior part of the segment.

ETYMOLOGY. The species name *sanqingi* refers to three Taoist gods – The Three Pure Ones (Sanqing daozi). Because Sanqing Taoist Temple, the headquarters of the Taoist temples in Taiwan, stands on the type locality Meihua Lake.

REMARKS. *Flagellozetes* (*Cosmogalumna*) *sanqingi* Ermilov **sp. n.** is morphologically most similar to *Flagellozetes* (*Cosmogalumna*) *ornatus* (Aoki, 1988) from the Oriental region and Japan (Aoki, 1988; Hagino & Shimano, 2017) in having completely reticulate notogaster and anogenital region, unpaired median pore, four pairs of notogastral porose areas and in the absence of reticulate ornamentation on prodorsum and pteromorph. However, the new species differs from the latter by the presence of stria and short ridges on pteromorph (versus tuberculate), strong longitudinal ridges on genital plate (versus mostly tuberculate and partially slightly striate) and reticulate ornamentation on anal plate (versus tuberculate).

Fig. 23. Gathering place (Taiwan, Yilan County, Dongshan Township, forest substrate near Meihua Lake) of *Flagellozetes* (*Cosmogalumna*) *sanqingi* Ermilov **sp. n.** (the place of collection is indicated by a red circle).

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