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ORIBATID MITES (ACARI, ORIBATIDA) FROM TOHOKU (NORTHEAST JAPAN), COLLECTED AFTER A TIDAL WAVE IN 2011

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ABSTRACT — Each sample of about 200 cm³ was collected on June 27th 2011 by hand from the following three marked points after a large tidal wave (Tsunami) struck on March 11th 2011: Two specimens belonging to Masthermannia and Eupelops were collected from a sample A (about 188 m from sea); five specimens of four species belonging to Nothrus and Tectocepheus from sample B (about 5 m from sample A) were found; twenty-five specimens of Trhypochthonius, Scheloribates and Trichogalumna from sample C (about 20 m from sample B) were collected. One oribatid species of the Masthermannia genus from sample A was found to be identical to an undescribed species from Kumamoto Prefecture, which was studied together with the specimen from sample A.

KEYWORDS — Eupelops; Masthermannia; New species; Northeast Japan; Nothrus; Oribatid mite; Scheloribates; Tectocepheus; Trhypochthonius; Trichogalumna

INTRODUCTION

A large tidal wave (‘Tsunami’ in Japanese) (16.7 m, the highest wave) on the 11th March, 2011 struck the east coast of the Northeast (‘Tohoku’ in Japanese) in Japan. After the tidal wave, some oribatid mites were found from roadside. Nine oribatid species were found and described in the present work. Of a total of nine oribatid species including six species, new to science, three species of three families belong to the cohort Nothrina and six species of four families to the cohort Brachypylina. Of a total of seven families, the following four families are known from floored forests or seashore (Franklin et al. 2001, Fujikawa 2006, Halbert 1915; 1920): Nanhermanniidae Sellnick, 1928, Nothridae Berlese, 1896, Tectocephidae Grandjean, 1953[1954], and Phenopelopidae Petrovenkivich, 1955.

METHODS

Matsushima-cho of Miyagi Prefecture is located 38°36′18.88″N.; 141°05′40.42″E, about 6 m a.s.l. in the North-East coast, Japan (Fig. 1). Each sample of about 200 cm³ was collected by hand from the following three marked points at No. 10 Namiuchihama of Matsushima-cho on 27 June 2011 by Fujikawa T.: A, two specimens belonging to two oribatid genera and a single specimen of ant were collected from sample consisting of sands and soil beside unidentified plant; B, five specimens of four
FIGURE 1: Location of sampling plots.
oribatid species belonging two genera, and two specimens of two mesostigmatid species (NSMT-Ac 13609) from sand and humus of dandelion (species name unidentified); C, twenty-five specimens of three oribatid species of three genera, and five specimens of two mesostigmatid species (NSMT-Ac 13608) from humus and litter of giant goldenrod, Solidago gigantea Ait. var. leiophyla Fern (Fig. 2). It went on raining; on 26 June, 32.5 mm/day; on 27 June, 30.0 mm/day. One oribatid species from point A was found to be identical with an undescribed species of which specimens had been collected from the garden under no-tillage manner (Nakamura et al., 2003) since 2001 of Nagasato (32°12'5N.; 130°54'5E, about 195 m a.s.l.) at Asagiricho, Kumamoto Prefecture.

In the present work, those specimens from Kumamoto Prefecture were studied together with the specimen from point A in Miyagi Prefecture. After extracted with a modified Tullgren apparatus, animals were kept in lactic acid for cleaning during forty days and mounted on slide glasses.

The type series (NSMT-Ac 13608 to 13611 and 13625 to 13641) are deposited in the National Museum of Nature and Science, Tokyo, and topotypes together with sampling materials in Tohoku University, Miyagi Prefecture and National Agricultural Research Center for Kyushu Okinawa Region, Kumamoto Prefecture.

The notations and morphological expression of descriptions and figures are mainly based on Balogh and Mahunka (1983), Grandjean (1954a; 1954b), Hammen (1980; 1989), Mahunka and Zombori (1985) and Norton and Behan-Pelletier (2009). Number of tarsal claw(s) common to all legs. Setal formula of legs including famulus but excluding solenidia. Solenidiotaxy common to all examined species belonging to cohort Nothrina: I (1-2-2[exceptionally 3]), II (1-1-1[2][3]), III (1-1-0), IV (0[1]-1-0), and belonging to cohort Brachypylina: I (1-2-2), II (1-1-2), III (1-1-0), IV (0-1-0) except for IV (0-0-0) of Eupelops sp. [Right-left] means right and left legs of specimen could be studied. Other measurements (μm) in the description are according to holotype. Measurement of T-shaped seta is a total of two rami plus nozzle-like basal portion. The taxonomical grouping followed the systems proposed by Norton and Behan-Pelletier (2009), Subías (2004) and Weigmann (2006).
Cohort Nothrina Johnston, 1982
Nanhermanniidae Sellnick, 1928

Masthermannia multiciliata n.sp.
[Japanese name: Tamou-obaketsukinowadani]
(Figures 3 – 9)

Diagnosis — Body length, 407 – 500 μm; width, 200 – 286 μm. Integument of notogaster punctuated and irregularly alveolate with seven pairs of round elevations bearing dorsal seta(e); epimerata granulate; other surface punctulate. Rostral tip rounded. Notogaster with 13 pairs of T-shaped setae, 2 pairs of simple setae (p1 and p2) and 1 pair of virtual setae f1. Sensilli consisting of penicillate swollen head and smooth thin stem. Lateral margin of pedotectum 1 bearing more than 20 ciliary’s processes. Semicircular suture (ns) of ventral region short, not reaching the level of insertion of aggenital seta g3, or lyrifissure lh. Genito-anal setal formula: 9-2-2-3; all setae biramous. Subcapitulum diarthric, subcapitular setae: 1-2-1; setae h biramous. Epimeral setal formula: 4-2-3-4; all setae simple. Monodactylous.


Etyymology — After the numerous ciliary’s processes of pedotectum.

Measurements and body appearance — Body length (14 exs.): 407 (mean 450) 500 μm; width (11 exs.): 200 (229) 286 μm. Body colour light brown, Integument of prodorsum, ventral plate, subcapitular plate, genital plates, anal plates and legs punctulate; epimerata granulate; notogaster punctulate and irregularly alveolate with seven pairs of round elevations bearing one or three dorsal setae.

Prodorsum — Rostral tip widely rounded bearing smooth spiniform setae ro (ca. 33 μm) inserting far anterior on prodorsum and close to each other (Fig. 4A). Setae le (155 μm) and in (281 μm) T-shaped with dilated basal portion and long flagelliform distal portion (Figs. 3B, C). Setae le bearing a few acute projections, inserting on round elevations. Bothridia barrel-shaped, opening dorso-laterally. Sensilli (ss) (62 μm) consisting of penicillate swollen head and smooth thin stem. Setae cx1 (6 μm) and cx2 (3 μm) short, smooth, inserting at the basal portion of bothridium. Lateral margin of pedotectum 1 bearing more than 20 ciliary’s processes (7 – 12 μm). Posterobothridial condyles small acute (Fig. 3A). Relative lengths and distances: in-le:ss>ro>ex; (in-in: 66 μm) > (le-le: 21 μm) > (ro-ro: 14 μm).

Notogaster — Anterior margin straight, shorter than the width of the middle part of notogaster. Notogaster with 13 pairs of T-shaped setae (241 μm), 2 pairs of simple setae (p1 and p2) (73 μm), 1 pair of virtual setae f1 and seven pairs of round elevations; six elevations bearing each seta of cp, d1-2, e1-2 and f2; the last pair of posterior elevations bearing three setae h1-3. Virtual seta f1 present posterior to elevation bearing seta e1. Posterior projection of notogaster with truncate margin, bearing two pairs of setae p1 and p2 at corners. Lyrifissures long, remarkable; ia (20 μm) and ip (9 μm) aligned along lateral margin of notogaster, posterior to e3 and h3, respectively; im (9 μm) longitudinally anterior to e2; ih and ips situated ventrally (Fig. 4E); ih (12 μm) aligned transversely posterior to ag1; ips (16 μm) obliquely posterior to ag2.

Ventral region — Genital aperture (64 μm) anterior roughly triangle, posterior parabola in shape; anal aperture (84 μm) elliptical. Semicircular suture (ns) on ventral plate between genital and anal apertures, short, not reaching the level of insertion of aggenital seta ag1 or lyrifissure lh. Genito-anal setal formula: 9-2-2-3; all setae smooth, biramous (Fig. 3D). Genital (36 – 48 μm) and anal (17 μm) setae inserting at the inner margin of each plate (Figs. 4D-E). Setae ag1 inserting at level of insertion of g7; ag2 (91 μm) aligned in latero-posteriorly to genital aperture. All adanal setae (64 μm) aligned in adanal. Lyrifissures ian (19 μm) longitudinally anterior to
FIGURE 3: Masthermannia multiciliata **n.sp.**: A – Dorsal view; B – Lamellar seta with projection (arrow); C – Fine distal portion of T-shaped setae; D – Genital setae; E – Tarsus to genu of left leg I. (A, D, E: Paratype NSMT-Ac 13639; B: NSMT-Ac 13635, C: NSMT-Ac 13640).
FIGURE 4: Masthermannia multiciliata n.sp. (Holotype NSMT-Ac 13611): A – Rostral and right bothridial region; B – Claw at right tarsus I; C – Gnathosoma; D – Right anal plate region; E – Genital plates region.
FIGURE 5: Masthermannia multiciliata n.sp.: A – Right epimeral region (Paratype NSMT-Ac 13640); B – Ventral view of right pedotectum I (Paratype NSMT-Ac 13640); C – Left tarsus II (Paratype NSMT-Ac 13635); D – Chelicera (Paratype NSMT-Ac 13637).
FIGURE 6: *Masthermannia multiciliata* n.sp. (Nymph) (NSMT-Ac 13641): A – Part of prodorsam; B – Part of right notogaster; C – Right pedotectum I.
**FIGURE 7:** *Masthemannia multiciliata n.sp.* (Nymph) (NSMT-Ac 13641): A – Gnathosoma-right side of epimeral region; B – Right side of genito-anal region.
FIGURE 8: Masthermannia multiciliata n.sp. by the scanning electron microscopy (photos by Nakamura Y.-N., Ohgi Y. and Shirosaki T.).
Adult female: A – Dorsal view; B – Left legs I and II; C – Ventral view; D – Gnathosoma; E – Genital plates; F – Anal plates.
FIGURE 9: Masthermannia multiciliata n.sp. (photos by Nakamura Y.).

an2; iad (14 μm) inverse apoanal, located near anterior margin of anal aperture. Subcapitulum diarthric, subcapitular setae: 1-2-1; setae h (41 μm) smooth, biramous; a (16 μm), m1,2 (11 μm) smooth, simple (Fig. 4C). Epimeral setal formula: 4-2-3-4; all setae (11 - 65 μm) smooth, simple spiniform (Fig. 5A); 3b the longest, 1c the shortest. Sternal ridge, apodemata 1-4 and sj. distinct. Setae cha (8 μm) thick basally; chb (26 μm) long bacilliform (Fig. 5D). Tågårdh’s organ (31 μm) taeniform.

Legs — Monodactylous; claw (22 to 27 μm) smooth (Fig. 4B). Setal formula of legs: I (1-6-5-6-26), II (1-8-5-6-23), III (5-3-3-4-21), IV (1-3-3-4-19). Solenidiotaxy: I (1-2-2), II (1-1-3), III (1-1-0), IV (1-1-0).

Measurements (μm) of segments:

Holotype:
I ([41-46]-[84-80]-[54-52]-[39-41]-[93-86]),
II ([54-48]-[70-71]-[39-45]-[36-36]-[75-80]),
III ([71-?]-[61-59]-[32-27]-[36-36]-[61-57]),
IV ([71-?]-[71-63]-[38-30]-[41-41]-[71-80]).

Average value according to paratypes:
I ([45-45]-[79-83]-[49-54]-[46-45]-[85-92]),
II ([39-41]-[64-67]-[44-46]-[40-37]-[77-87]),
III ([60-62]-[56-64]-[33-31]-[31-36]-[66-62]),
IV ([62-60]-[72-67]-[37-37]-[38-45]-[75-75]).

On tarsus I (Fig. 3E), famulus ε (5 μm) spiniform situated lateral to seta t′c (19 μm), posterior to solenidion ω3; ω2 (20 μm) thin bacilliform, lateral to seta it′ (25 μm); ω1 (25 μm) thick bacilliform, narrow basally, posterior to seta ft′ (26 μm); laminate dorsal seta (29 μm) large, smooth, with longitudinally running nerve-like line. Tarsus II bearing short clavate ω1 (10 μm) and ω2 (8 μm) posterior, and long thin bacilliform ω3 (13 μm) at the basal portion of claw (Fig. 5B). On tibia I, solenidia ϕ (12 μm) and ϕ (12 μm) contiguously anterior to smooth entire seta d (14 μm); lateral setae (31 μm) broad, large bearing minute barbs. On genu I, σ (21 μm) thin bacilliform, contiguous to smooth entire seta d (28 μm) situated on a small apophysis; lateral setae (41 μm) minutely barbed, long, broad taeniform with truncate, serrate anterior margin.

Juvenile instar (Figs. 6 and 7)
A single tritonymph: length, 443 μm; width, 179 μm. Body surface wrinkled, light whitish-
yellow coloured without any ornamentation. Rostrum widely rounded bearing simple, smooth rostral setae (21 μm) laterally. Setae le (83 μm) and in (152 μm) T-shaped originating from apophysis (Fig. 6A). Sensillus lost. Lateral margin of pedotectum 1 bearing 8 ciliary’s processes (5 - 16 μm) (Fig. 6C). Posterobothridial conydes absent. Relative distances: (ro-ro) = (le-le) = (in-in). Gastronotum covered by ten pairs of large round elevations bearing T-shaped setae(e) (238 μm); eighteen pairs of notogastral setae recognized (Fig. 6B). Semicircular suture between genital and anal apertures absent. Distance (70 μm) between genital (40 μm) and anal (71 μm) apertures almost as long as the length of anal aperture. Genito-anal setal formula: 7-2-2-3; an12 (10 μm) short, smooth, thin, simple setiform; other setae lost. Seta h (40 μm) and ag (47 μm) smooth, biramous (Figs. 7A-B). Epimeral setal formula: 4-2-3-4; all setae (6 - 46 μm) smooth, simple spiniform; the longest 2, the shortest 2. Setal formula of legs: I (1-6-5-5-21), II (1-8-5-4-20), III (3-3-3-18), IV (1-3-3-4-16). Solenidiotaxy: I (1-2-2), II (1-1-2), III (1-1-0), IV (1-1-0). Measurements (μm) of segments: I ([30-32]-[57-59]-[45-36]-[36-39]-[68-59]), II ([36-36]-[54-63]-[39-32]-[32-30]-[52-50]), III ([36-39]-[45-36]-[18-23]-[21-26]-[41-50]), IV ([50-41]-[36-54]-[21-23]-[27-26]-[59-59]).

Remarks — The new species differs from all the species of the genus Masthermannia Berlese, 1913 by having (1) short semicircular suture between genital and anal apertures, not reaching the level of lyrifissure ih or insertion of aggenital seta ag1, and (2) biramous genital, aggenital, anal and posterior subcapitular setae. The new species is distinguished from M. nematophora (Grandjean, 1954) by number of the ciliary’s processes of lateral margin of pedotectum 1, shape of solenia on tarsus I of leg, and length of solenion on genu I of leg, from the original description of M. hirsuta (Hartman, 1949) by shape of ornaments on notogastral surface and shape of notogastral posterior region, and from M. hirsuta sensu Aoki (1980) by shape of notogastral posterior region, shape of genital setae, and number of setae on the last pair of median round elevations on notogaster.

Genus Masthermannia Berlese, 1913 Masthermannia Berlese, 1913, Redia, 9, p. 100, pl. 8, fig. 92; Hammen van der, 1959, Zool. Verh., (40), p. 81. Posthernmannia Grandjean, 1954, Rev. franc. Ent., 21, pp. 298-311, figs. 1-3. Members of the genus are very dirty and seem as if they are “mimicking small particles of earth” expressed by Balogh (1961) (Fig. 8).

Key to the species

1. Notogastral surface without foveolate ornament
   — Masthermannia extrema (Balogh, 1958)
   — Notogastral surface with foveolate ornament .. 2

2. Notogastral surface with ornament longitudinally
   — M. grandjeani (Balogh, 1958)
   — Notogastral surface with ornament not longitudinally.................. 3

3. Bothridium absent ...... M. runcifer Sellnick, 1959
   — Bothridium present .......................... 4

4. Leg tridactyious ......... M. saharaiensis Al-Assiuty, Bayoumi, Abdel-Hamid and Khalil, 1988
   — Leg monodactyious .......................... 5

5. Rostral setae T-shaped .................. M. ornatissima Pérez-Iñigo and Baggio, 1988
   — Rostral setae simple ......................... 6

   — Notogastral posterior margin concave or widely rounded .................. 7

7. Notogastral surface with angular foveolae ...... M. hirsuta (Hartman, 1949)
   — Notogastral surface with round foveolae ...... 8

8. Semicircular suture between genital and anal apertures extending beyond the level between lyrifissure ih and insertion of ag1 .......................... M. mammillaris (Berlese, 1904)
   — Semicircular suture between genital and anal apertures not extending beyond the level between
NOTHRIDAE BERLESE, 1896

Nothrus separatum n.sp.
[Japanese name: Suehiro-amimeonidani]
(Figures 10 – 11)

Diagnosis — Body length 807 \( \mu \)m; width 386 \( \mu \)m. Prodorsal surface punctulate and irregularly alveolate. Notogastral surface medially and laterally tuberculate; alveolate between medial and lateral portions. Rostral incision short. Sensilli long, rod-like bearing sparsely spins. Notogaster anteriorly broadly rounded, posteriorly roundish angular, with a pair of longitudinal ridges extending from \( c \)-series line to insertion of seta \( f_1 \). Of all notogastral setae, \( f_1 \) the longest. Solenidia \( \varphi_1 \) and \( \sigma \) longer than each dorsal seta. Genito-anal setal formula: 9-0-2-3. Subcapitulum diarthric, subcapitular setae: 1-2-1. Epimeral setal formula: 11[9]-5-6-5. Heterotridactylous.

Material examined — Holotype (Adult female) (NSMT-Ac 13634) from sand, soil and humus at point B.

Etymology — After longitudinal ridges on notogaster divergent posteriorly.

Measurements and body appearance — Body length 807 \( \mu \)m; width 386 \( \mu \)m. Body colour light brown. Prodorsal surface punctuate and irregularly alveolate. Notogastral surface medial and lateral portions of notogastral surface tuberculate; surface between medial and lateral portions alveolate.

Prodorsum — Rostral incision short (Fig. 10B). Transversal ridge distinct between insertions of setae \( r_0 \), and between those of setae \( l_e \). Setae \( r_0 \) (21 – 23 \( \mu \)m), \( l_e \) (45 \( \mu \)m) and \( in \) (50 \( \mu \)m) thick, short rod-like, closely barbed. Sensilli (179 \( \mu \)m) long, rod-like bearing sparsely spins (Fig. 10A). Bothridia cup-shaped, opening dorso-laterally. Setae \( ex \) (30 \( \mu \)m) barbed setiform inserting at the basal portion of bothridium. Lateral prosomatic mark (\( m \)) distinct antero-laterally to bothridium.

Notogaster — Anterior margin broadly rounded; posterior margin roundish angular; a pair of longitudinal ridges extending from \( c \)-series line to insertion of seta \( f_1 \), not joining posteriorly. Of all 16 notogastral setae, the longest \( f_1 \) (89 \( \mu \)m), the shortest \( c_2 = c_3 \) (39 \( \mu \)m). Lyrifissures \( ia \) aligned obliquely posterior to \( c_5 \); \( im \) longitudinally, between \( d_3 \) and \( c_5 \); \( ip \) perpendicular, postero-laterally to \( gla \); \( ih \) and \( ips \) situated ventrally (Fig. 11A). Relative distances: \( f_1-f_1: 571 \mu m > (c_1-c_1: 104 \mu m > (d_1-d_2: 89 \mu m) > (h_1-h_1: 75 \mu m) > (p_1-p_1: 68 \mu m) > (c_1-c_1: 54 \mu m) = (d_1-d_1) \).

Ventral region — Genito-anal setal formula: 9-0-2-3; all setae spiniform; anal setae sparsely barbed, other setae smooth (Fig. 11B). Genital (35 \( \mu \)m) and anal (24 \( \mu \)m) setae inserting at the inner margin of each plate. All analan setae (51 \( \mu \)m) aligned in adanal. Lyrifissures \( ani \) and \( adi \) aligned almost longitudinally at the level setae \( ad_3 \). Subcapitulum diarthric, subcapitular setae: 1-2-1; setae \( h \) (26 \( \mu \)m), \( A \) (40 \( \mu \)m), \( m_1 \) (20 \( \mu \)m), \( m_2 \) (14 \( \mu \)m) smooth spiniform. Epimeral setal formula: 11[9]-5-6-5; all setae (14 \( \mu \)m) thin, short, smooth setiform. Epimal borders distinct.

Legs — Heterotridactylous; claw (40 \( \mu \)m) sparsely, minutely dentate (Fig. 11F). Setal formula: I (1-9-5-6-26), II (1-9-5-5-26), III (4-6-5-5-22), IV (1-6-2). Measurements (\( \mu \)m) of segments: [Right-left] I ([71-61]-[164-164]-[89-89]-[79-82]-[148-154]), II ([71-71]-[136-136]-[71-75]-[61-68]-[125-125]), III ([71-71]-[100-100]-[64-61]-[61-57]-[129-139]), IV ([107-107]-[114-125]-[68-71]-[71-68]-[182-182]). All legs bearing one solenidion of all tibiae and genu contiguous to dorsal seta (Figs. 11D-E). On tarsus I (Fig. 11C), famulus \( \varepsilon \) (4 \( \mu \)m) spiniform situated antero-laterally to \( \omega _1 \) (35 \( \mu \)m), posterior to solenidia \( \omega _2 \); \( \omega _2 \) (16 \( \mu \)m), postero-laterally to \( \omega _3 \) (14 \( \mu \)m); \( \omega _2 \), \( \omega _3 \) thin bacilliform; \( \omega _1 \) thick bacilliform,
FIGURE 10: Nothrus separatus n.sp. (Holotype NSMT-Ac 13634): A – Principal setae: lamellar seta le, interlamellar seta in, notogastral seta c1, sensillus ss, exobothridial seta ex; B – Rostral region; C – Dorsal view.
FIGURE 11: Nothrus separatus n.sp. (Holotype NSMT-Ac 13634): A – Ventral view; B – Principal setae: Anterior (a), medial (m1,2), posterior (h) setae, epimeral seta (1a), genital (g), anal (an), and adanal (ad) setae; C – Solenidial region on right tarsus I; D – Solenidial region on left tibia I; E – Solenidial region on left genu I; F – Tip of right leg III.
Diagnosis — Average body length 587 \( \mu \text{m} \). Solenidia \( \varphi_1 \) and \( \sigma \) longer than each dorsal seta. On tibia I, solenidion \( \varphi_1 \) (39 \( \mu \text{m} \)) and \( \varphi_2 \) (16 \( \mu \text{m} \)) setiform, situated on every apophysis; \( \varphi_1 \) contiguous to smooth spiniform seta \( d(26 \mu \text{m}) \), inserting anterior to \( d \). On genu I, \( \sigma \) (21 \( \mu \text{m} \)) spiniform, contiguous to smooth cone-like seta \( d(10 \mu \text{m}) \) situated on a small apophysis.

Remarks — The new species is similar in shape of prodorsal and notogastral setae, and notogaster with one pair of longitudinal ridges to Notothrus discifer Hammer, 1961 and T. gracilis Hammer, 1961. However, the new species differs from those species in having the longest setae not \( h_2 \) or \( p_1 \), but \( f_1 \) of all notogastral setae, and longitudinal ridges not joining posteriorly.

**TRHYPOCHTHONIIDAE WILLMANN, 1931**

*Trhypochthonius triangulum* n.sp.

[Japanese name: Togari-montuskidani]

(Figures 12 – 14)

Diagnosis — Average body length 587 \( \mu \text{m} \); width 348 \( \mu \text{m} \). Prodorsal surface granulate; notogastral surface postulate of hexagonal pattern. Of all notogastral setae, the longest \( h_1 \). Solenidia \( \varphi_1 \) and \( \sigma \) shorter than each dorsal seta. Genito-anal setal formula: 7-0-1-3. Subcapitulum diarthric, subcapitular setae: 1-1-1. Epimeral setal formula: 3-1-3-3. Homotridactyle.

Material examined — Holotype (Adult female) (NSMT-Ac 13626) from sand, soil and humus at point C; 2 paratypes (NSMT-Ac 13625 and 13627): same data as holotype.

Etymology — After the shape of notogastral posterior region.

Measurements and body appearance — Body length (26 exs.) 464 (587) 629 \( \mu \text{m} \); width (27 exs.): 307 (348) 407 \( \mu \text{m} \). Body colour light yellowish brown. Prodorsal surface granulate; notogastral surface postulate with hexagonal pattern. All specimens female. Percentage of gravid females 89 % in total, having 1 to 4 eggs.

Prodorsum — Triangular in dorsal view (Fig. 12A). Rostrum rounded. Setae \( rv \) (80 \( \mu \text{m} \)) thin, barbed setiform inserting almost mid-distance between rostral anterior margin and insertion of lamellar setae. Setae \( le \) (71 \( \mu \text{m} \)) and \( in \) (95 \( \mu \text{m} \)) thick, long, densely barbed bacilliform. Sensilli (61 \( \mu \text{m} \)) with spiculate fusiform head and thin stem (Fig. 12B). Bothridia cup-shaped, opening dorso-laterally. Setae \( cx \) (4 \( \mu \text{m} \)) smooth minute cone-like, inserting at the basal portion of bothridium. Relative distances: (in-in: 100 \( \mu \text{m} \)) > (le-in: 70 \( \mu \text{m} \)) > (le-le: 50 \( \mu \text{m} \)) > (ro-ro: 43 \( \mu \text{m} \)) > (ro-le: 32 \( \mu \text{m} \)).

Notogaster — Notogaster anteriorly straight, posterior angular. Of all 16 notogastral setae including virtual \( f_1 \); the longest \( h_1 \) (77 \( \mu \text{m} \)), the shortest \( c_2 \) (18 \( \mu \text{m} \)). Setae \( p \) of series inserting ventrally (Fig. 13A). Lyrifissures \( ia \) aligned longitudinally posterior to \( c_\beta \); \( im \) obliquely between \( e_1 \) and \( gla \); \( ip \) perpendicular to notogastral outline, lateral to \( f_2; ih \) obliquely, anterior to \( cp \); \( ips \) ventrally seated at the level of the insertion of setae \( ad_2 \). Relative distances: \( (d_2-d_5: 177 \mu \text{m}) > (e_1-e_1: 143 \mu \text{m}) > (e_1-h_3: 136 \mu \text{m}) > (h_5-h_3: 121 \mu \text{m}) > (e_1-f_1: 107 \mu \text{m}) > (h_1-h_3: 102 \mu \text{m}) > (d_1-d_1: 98 \mu \text{m}) > (f_1-f_1: 95 \mu \text{m}) > (h_1-h_1: 93 \mu \text{m}) > (d_1-e_1: 88 \mu \text{m}) > (p_1-p_1: 79 \mu \text{m}) > (c_1-c_1: 73 \mu \text{m}) > (c_1-d_1: 54 \mu \text{m}) \).

Ventral region — Genito-anal setal formula: 7-0-1-3; all setae thin setiform; genital setae (32 \( \mu \text{m} \)) densely barbed; anal (29 \( \mu \text{m} \)) and adanal setae (30 – 36 \( \mu \text{m} \)) sparsely barbed (Fig. 13A). All adanal setae aligned in adanal. Lyrifissures \( ian \) and \( iad \) aligned obliquely at the level of anal anterior margin. Subcapitulum stenarthric, subcapitular setae: 1-1-1; setae \( h \) (13 \( \mu \text{m} \)), \( A \) (32 \( \mu \text{m} \)) sparsely roughened; \( m \) (3 \( \mu \text{m} \)) smooth, minute cone-like (Fig. 13E). Epimeral setal formula: 3-1-3-3; all setae (16 – 32 \( \mu \text{m} \)) thin, short, smooth setiform; \( e \) the longest; \( 1A = 2A \) the shortest. Epimeral borders distinct. Cheliceral setae \( cha \) (42 \( \mu \text{m} \)) long, barbed setiform; \( chb \) (17 \( \mu \text{m} \)) short, smooth, spiniform. Trägårdh’s organ (29 \( \mu \text{m} \)) thin.

Legs — Homotridactylos; claws (43 \( \mu \text{m} \)) dentate dorsally (Fig. 13B). Setal formula: I (1-5-5-5-19), II (1-5-5-5-17), III (2-4-3-4-12), IV (1-2-3-3-10). Soleniodiotaxy: I (1-2-3), II (1-1-2), III (1-1-0), IV (0-1-0). Measurements (\( \mu \text{m} \)) of segments according to holotype: [Right-left]

I[(50-?)-[86-?]-[41-?]-[27-?]-[66-?]-],

II[(?)-[73-?]-[41-?]-[27-?]-[63-?]-],
FIGURE 12: Trihypochthonius triangulum n.sp.: A – Dorsal view; B – Right bothridial region; C – Part of chelisera (A, C: Holotype NSMT-Ac 13626; B, Paratype NSMT-Ac 13625).
FIGURE 13: Trhypothonius triangulum n.sp.: A – Ventral view; B – Solenidial region on right tarsus I; C – Solenidial region on left tibia I; D – Solenidial region on genu I; E – Gnathosoma (A: Holotype NSMT-Ac 13626; B-E: Paratype NSMT-Ac 13625).

Figure 14: *Trhypochthonius triangulum* n.sp. by the scanning electron microscopy (photos by Nakamura Y.-N., Ohgi Y. and Shirosaki T.): A – Dorsal view; B – Right bothridium.

III([46-?-][63-?]-[36-36]-[27-29]-[63-61]), IV([54-50]-[68-63]-[34-43]-[29-36]-[84-80]). Measurements (average value: µm) of segments according to depressed paratypes: [Right-left] I([47-47]-[79-73]-[46-47]-[31-31]-[54-59]), II([47-39]-[70-71]-[34-43]-[29-36]-[58-54]), III([57-59]-[59-55]-[36-30]-[29-30]-[50-54]), IV([54-54]-[63-63]-[36-36]-[32-38]-[71-84]).

All legs bearing one solenidia of all tibiae and genua contiguous to dorsal seta (Figs. 13C-D). On tarsus I, famulus ε (14 µm) obtuse situated laterally to ω1 (25 µm) thick bacilliform; ω2 (25 µm) thin setiform inserting near the base of claws; ω3 (14 µm) situated lateral to famulus and posterior to ω2. Solenidia ϕ1 and σ shorter than each dorsal seta. On tibia I, solenidion ω1 (31 µm) setiform and ω2 (6 µm) spiniiform, situated on either side of seta d (55 µm) on common apophysis (Fig. 13C). On genu I, σ (12 µm) bacilliform, contiguous to barbed ensiform seta d (21 µm) situated on a small apophysis (Fig. 13D).

Remarks — The new species is similar in shape of notogaster, insertion of rostral setae, namely, almost mid-distance between rostral anterior margin and insertion of lamellar setae, and length of notogastral setae to *Trhypochthonius tectorum* (Berlese, 1896), *T. septentrionalis* Fujikawa, 1995 and *T. fujinitaensis* Fujikawa, 2000. The chelicerae of the new species are similar in appearance to those of *T. semovitussi* Szywilewska, 2004 and *T. sphagnicola* Weigmann, 1997. However, the new species differs from its congers in having smaller body size, solenidion ω1 located between famulus and seta ft on tarsus I, setiform solenidion ω2 on tarsus I, and sparsely barbed bacilliform dorsal seta on tibia I.

Cohort Brachypylina Hull, 1918
Tectocepheidae Grandjean, 1953 [1954]

*Tectocephus elegans* Ohkubo, 1981
[Japanese name: Kakoi-kuwagatadani]


Diagnosis — Rostrum with fence-like sclerotic ridge. Sensilli consisting clavate verrucose head and thin, smooth stem. Notogaster with four pairs of large hollows medially.

Material examined — One female (NSMT-Ac 13632): from point B; holotype slide NSMT-Ac 9204 bearing the label “*Tectocephus elegans* OHOKUBO, 1980" in the National Museum of Nature and Science, Tokyo.

Measurements — Body length 314 µm; width 214 µm. Body colour light brown.

Supplementary description — Notogastral surface covered with cerotegument of irregularly granulate. Measurements (µm) of segments of legs:

III([46-?]-[63-?]-[36-36]-[27-29]-[63-61]), IV([54-50]-[68-63]-[34-43]-[29-36]-[84-80]).
Nakamura K. et al.

[Right-left]:

Distribution — Oriental region.

Remarks — The present specimen differs from the holotype in shape of granules of cerotegument on notogastral surface.

_Tectocepheus velatus velatus_ (Michael, 1880)

[Japanese name: Kuwagatadani] (Figure 15A)


Material examined — One female (NSMT-Ac 13633): from point B; 11 exs. and 2 parts of body, slides Nos. 596-604 bearing the label "Tegeocranus velatus" in the Michael collection.

Measurements — Body length 336 µm; width 229 µm. Body colour light brown.


Distribution — Cosmopolitan.

Remarks — Three specimens from Matsushima-cho belonging to the genus _Tectocepheus_ have a body surface ornamented “as with a veil” (Michael, 1880), and the ornamentation has densely, dark, large granules (Fig. 15A). Lyrifissure im of the present specimen aligned transversely anterior to opisthontal gland gla.

_Tectocepheus acutus_ n.sp.

[Japanese name: Togari-kuwagatadani] (Figures 15B-G – 16)

Diagnosis — Average body length 282 µm; width 171 µm. Rostral anterior margin without incision, broadly rounded with rostral trowell. Lamellar cuspis with dents bilaterally to lamellar seta, not extending to level of rostral anterior margin. Setae in roughened rod-like. Sensilli with spine, clavate head and smooth, thin stem. Bothridia with deep...
FIGURE 15: A – Left of lyrifissure in region of Tectocephus velatus velatus (Michael, 1880) (NSMT-Ac 13633); B-G: Tectocephus acutus sp. nov. B – Dorsal view; C – Prodorsum; D – Solenidial region on left tarsus I and tibia I; E – Solenidial region on left genu I; F – Solenidial region on right genu III; G – Chelicera (B, F: Holotype NSMT-Ac 13630; C, C, E, G: Paratype NSMT-Ac 13631).
FIGURE 16: Tectoceheus acutus n.sp.: Ventral view (Paratype NSMT-Ac 13631).

Material examined — Holotype (Female) (NSMT-Ac 13630) from point B; 1 paratype (NSMT-AC 13631): same data as holotype.

Etymology — After long, sharply pointed apex on trochanter III.

Measurements and body appearance — Body length 279 – 286 µm; width 164 – 179 µm. Body colour light brown. Whole body surface covered with cerotegument; cerotegument irregularly dark granulate.

Prodorsum — Rostral anterior margin without incision, broadly rounded with rostral trowel (Fig. 15C). Rostral setae (16 µm) consisting of unilaterally spinose head and thick, smooth stem, inserting dorsally under lamellar cusps. Lamellar cusps with dents bilaterally to lamellar seta, not extending to level of rostral anterior margin; outer dent longer than inner dent. Inner sides of cuspsides straight. Setae le (33 µm) setiform minutely roughened, strongly curved inside. Setae in (7 µm) minutely roughened rod-like. Sensilli (46 µm) composed of thin, roughened stem and globular head bearing dark coloured spines. Setae ex (4 µm) smooth, short bacilliform. Bothridia opening antero-laterally, with deep incision, without swelling or projection.

Notogaster — Depressions and dorsosejugal scissure absent. Dorsophragmatic apophysis (hy) conspicuously long. Humeral region with small triangular projection (Fig. 15B). Ten pairs of notogastral setae short (4 – 7 µm) setiform, roughened throughout length. Lyriﬁssures ia aligned longitudinally or obliquely, lateral to setae; im obliquely, lateral to gla; ih, ip and psi perpendicular to notogastral outline. Relative distances: (h1-h2: 120 µm) > (h2-h3: 95 µm) > (p1-p2: 88 µm) > (h1-h3: 43 µm) > (im-lm: 34 µm) > (p1-p1: 18 µm).

Ventral region — Genital (31 µm) and anal (55 µm) apertures almost pentagonal in shape; distance (23 µm) between them appreciably shorter than half length of anal aperture. Genito-anal setal formula: 6-1-2-3; all setae smooth setiform (Fig. 16). Setae g1 and g2 (9 µm) not inserting at the same level at anterior margin of plates. Setae ag1 (8 µm) inserting latero-posterior to genital aperture. Setae ad1 and ad2 (10 µm) aligned in postanal position, ad3 (7 µm) in adanal; ad4 inserting almost at mid-distance between an1 and an2 (7 µm). Lyriﬁssures idd located along, near anterior margin of anal aperture with enclosed angle 120-140°. Sternal ridge indistinct. Epimeral borders 1-4, sj distinct. Epimeral setal formula: 3-1-3-3; setae smooth, short setiform (3 – 7 µm). Subcapitulum diarthric, subcapitular setae 3 pairs, A (14 µm), m (14 µm), and h (11 µm); setae thin smooth setiform. Cheliceral setae cha (23 µm), cbh (16 µm) thin, barbed setiform. Trägårdh’s organ short (14 µm), with a blunt apex (Fig. 15G).

Legs — Monodactylous; claw (21 µm) sparsely dentate dorsally. Setal formula: I (1-5-3-4-18), II (1-5-3-4-14), II (2-4-1-3-14), IV (1-2-2-3-10). Measurements (µm) of right segments according to depressed paratype: I (25-40-16-31-35), II (21-46-14-25-28), III (50-36-14-26-23), IV (51-43-21-?-?). Trochanter III – IV and femora III-IV bearing carina; trochanter III with long, sharply pointed apex (21 µm) bending to rostral side (Fig. 16). On tarsus I, famulus ε (9 µm) consisting of a ﬁne tip and expanded basal portion, situated antero-laterally contiguous to ω2; ω2 (31 µm) terminating in ﬁne tip; ω1 (21 µm) bacilliform situated posterior to ω2; f’ (8 µm), inserting posterior contiguous to ω1 (Fig. 15D). Solenidion ϕ2 (15 µm) originating from a small apophysis on the tip of tibia I; ϕ1 (65 µm) situated at the base of apophysis. On genu I, solenidion σ (18 µm) terminating in a ﬁne tip, longer than seta d (8 µm) (Fig. 15E). All solenidia on tarsus II, tibiae II-IV and genua II-III short rod-like (σIII: 7 µm), shorter than each dorsal setae (dIII: 11 µm) (Fig. 15F).

Remarks — The new species is similar to Tectocephus minor Berlese, 1903 in shape of dentate cusps and small enclosed angle of lyriﬁssure pair idd, however, the former is different from the latter in shape of bothridial ventral extension, long sharply
pointed carina on trochanter III, arrangement of genital setae, and solenidia of legs (Laumann et al., 2007; Nübel-Reidelbach, 1994). The new species is similar in shape of long sharply pointed carina on trochanter III, and shape, length and situation of solenidia, famulus and seta ft' on tarsus I to T. kumayaensis Nakamura et al., 2010. However, the new species differs from the latter in having a round rostrum, dentate cuspides, lyrifissures

**Phenopelopidae Petrunkevitch, 1955**

*Eupelops sp.*

(Figures 17 – 19)


Material examined — Female (NSMT-Ac 13610) from point A. The present specimen was the other half of only two specimens collected from the point A. Some conspicuous features were remarkable to be justified as a new species, however, the specimen is described only as *Eupelops* sp. in the present work, because of being rather damaged by preparing for study (body broken).

Measurements and body appearance — Body colour dark reddish-brown. Prodorsal surface granulate; granules dark, large, closely. Notogastral integument including pteromorphae covered with ornament of irregular broken angular insular lumps. Other surface, namely, lamellae, cuspides, genital-anal plates, subcapitulum, ventral plate and legs punctulate.

Prodorsum — Setae ro (63 μm) ciliate ensiform with narrow basal portion, inserting on lateral rostral margins at base of free tip of tutorium, extending for short distance anterior of rostral margin. Tutorium with sharply pointed apex, without dens (Fig. 17C). Tips of lamellar cusps terminating in a sharp point, anteroventrally arising lamellar setae (Fig. 17A). Setae le (41 μm), thick setiform with sparsely, unilaterally barbed distal portion, reaching anterior margin of rostrum. Setae in (157 μm) narrow phylliform, sparsely spiculate throughout length on dorsal side, smooth on ventral side (Fig. 17F). Bothridia opening dorsally. Sensilli (ss) (72 μm) rod-like without narrow apex, spiculate distally, smooth basally (Fig. 17D). Setae ex (3 μm) minute, smooth spiniform.

Notogaster — Anterior notogastral tectum broadly concave, projecting further anteriorly than anterior margin of movable pteromorphs, covering basal part of prodorsum (Fig. 17B). Notogastral setae bacilliform, spinose throughout their length, smooth basely, variable in length; the shortest c (29 – 30 μm) (Fig. 17E).

Ventral region — Genital (64 μm) and anal apertures (62 μm) roughly pentagonal in shape; distance (70 μm) slightly longer than length of each aperture (Fig. 18A). Genito-anal setal formula: 6-1-2-2; all setae short, smooth setiform. Setae g1, g2 (9 μm) inserting at the anterior margins of plates. Setae ag (11 μm) inserted latero-posteriorly to genital aperture, near one tenth-distance between genital and anal apertures. Setae an1 (7 μm) and an2 (9 μm) inserting near posterior inner and anterior outer margin of plates, respectively. Setae ad1 (8 μm) aligned in postanal position; ad2 (6 μm) latero-posteriorly; ad3 absent. Lyrifissures iad located along outline of aperture, posterior to the level of setae an2. Epimeral setal formula: 3-1-3-3; setae (9-19 μm) short, smooth setiform; 3c the longest (Fig. 18C). Pedipalpal setal formula: 0-2-1-3-9[1]. Subcapitulum setorial, subcapitular setae 3 pairs, a (24 μm), m (11 μm), and h (14 μm); all setae smooth, spiniform, terminating a fine tip (Fig. 18B). Chelicerae bearing two Trägårdh’s organs (69 μm) (Fig. 18D). Setae cha (17 μm) thin setiform; chb (4 μm) smooth cone-like.
FIGURE 17: Eupelops sp. (NSMT-Ac 13610): A – Right pteromorphal region; B – Anterior notogastral tectum; C – Right rostral region; D – Right bothridial region; E – Notogastral seta $c$; F – Interlamellar seta.
FIGURE 18: *Eupelops* sp. (NSMT-Ac 13610): A – Right genital-anal region; B – Anterior region of subcapitulum; C – Right discidium region; D – Chelicera.
FIGURE 19: Eupelops sp. (NSMT-Ac 13610): A – Tip of right tarsus I; B – Solenidial region on left tarsus I; C – Suprocoxal setal region; D – Solenidial region on right tibia I; E – Right genu I; F – Right trochanter III; G – Left trochanter IV.
Legs — Heterotridactylous; claws (51 μm) dentate dorsally (Fig. 19A) Setal formula: I (1-5-3-4-20), II lost, III (2-3-1-3-14), IV (1-2-2-4-12). Measurements (μm) of right segments: I (51-116-44-55-66), II lost, III (54-73-25-59-62), IV (56-71-43-86-71). Genu I, femur IV and trochanter III-IV bearing protrusion (Figs. 19E-G). Solenidiotaxy; I (1-2-2), II lost, III (1-1-0), IV (0-0-0), solenidion absent on tibiae IV. On tarsus I, famulus ε (15 μm) spiniform, contiguous to ω₁ situated anteriorly between solenidia ω₁ and ω₂; ω₁ (23 μm) bacilliform; ω₂ (45 μm) setiform; seta ft′ (3 μm) minute setiform inserting posteriorly, contiguous to ω₂ (Fig. 19B). On tibia I solenidion ϕ₂ (33 μm) situated laterally to ϕ₁ (broken) at the tip (Fig. 19D). Supracoxal setae recognizable (Fig. 19C).

Remarks — The present specimen has rod-like sensilli and concave anterior tectum of the notogastral integument such as found in Eupelops kumayaensis Nakamura et al., 2010, and shape of ornament on notogastral integument such as found in E. kumaensis Fujikawa, 2009. However, this specimen is different from congeners in (1) shape of rostral, lamellar region, (2) shape of tip of tutorium, (3) supracoxal setae thin, smooth, minute; setae thin smooth, minute; (4) number of anal setae, and (5) situation, length and shape of famulus and solenidia of legs.

**Scheloribatidae Grandjean, 1933**

_Scheloribates (Scheloribates) processus n.sp._

[Japanese name: Nobe-otohimedani]

(Figures 20 – 21)


Notogaster — Length as long as width; broadly triarched anteriorly, semicircular posteriorly. Dorsohypogastromata distinct. Ten pairs of notogastral setae present; setae thin smooth, minute; p₁ the longest (11 μm), other setae 9 μm. Four pairs of opening minute pores of sacculi present; Sa located longitudinally laterally to la, antero-laterally to lm; S₁ obliquely lateral to gla, antero-laterally to h₃; S₂ obliquely lateral to h; S₃ longitudinally between p₁ and p₂. Lyrifissures ia aligned obliquely antero-laterally to c; im transversely or obliquely antero-laterally to gla; ih perpendicular to notogastral outline; ip and ips situated ventrally. A number of light spots arranged peripherally on notogaster.

Ventral region — Genital (59 μm in length) and anal (91 μm in length) apertures with distance (107 μm) between them, roughly circular and square, respectively (Fig. 21A). Genito-anal setal formula 4-1-2-3; all setae thin, smooth, setiform except for genital setae thin, smooth, and setiform: genital setae (21 μm) sparsely minutely barbed (Fig. 20C). Se-
FIGURE 20: Scheloribates (Scheloribates) processus n.sp. (Holotype NSMT-Ac 13629): A – Dorsal view; B – Tip of rostral region; C – Principal setae: rostral seta ro, notogastral seta c, genital seta g, aggenital seta ag, anal seta an, adanal seta ad, epimeral seta 1a, anterior a, medial m, posterior h subcapitular setae.
FIGURE 21: Scheloribates (Scheloribates) processus n.sp. (Holotype NSMT-Ac 13629): A – Ventral view; B – Solenidion on left genu I; C – Left trochanter III region; D – Solenidia on left tibia I; E – Solenidial region on right tarsus I.
tae \( g_1 \) inserting at anterior margin of plates; setae \( g_2 \) at posterior margins. Setae \( g_7 (17 \ \mu m) \) inserting latero-posteriorly to genital aperture, near one third-distance between genital and anal apertures. Setae \( an_1 \) and \( an_2 (21 \ \mu m) \) inserting far from posterior and anterior margins of plates, respectively. Adanal setae (12 \( \mu m \) \( ad \)) aligned in postanal position; \( ad_2 \) latero-posteriorly to the aperture; \( ad_3 \) in preanal. Lyrifissures \( iid \) located longitudinally at the level of mid-distance between \( an_2 \) and anterior anal margin. Posterior anal locking-pieces indistinct. All epimeral borders distinct. All epimeral setal formula: 3-1-3-3; setae thin, smooth and setiform except for \( 3c \); \( 3c \) the longest (35 \( \mu m \)) bearing a few barbs; \( 1A \) the shortest (16 \( \mu m \)) (Fig. 21C). Subcapitulum diarthric, subcapitular setae 3 pairs: \( a \) (21 \( \mu m \)) unilaterally sparsely minutely barbed; \( m \) (15 \( \mu m \)) and \( h \) (31 \( \mu m \)) minutely barbed throughout the length.

**Legs —** Heterotridactylous; claws (39 \( \mu m \)) minutely dentate dorsally. Setal formula: I (1-5-3-4-19), II (1-5-3-4-16), III (2-3-1-3-14), IV (1-2-2-2-10). Measurements (\( \mu m \)) of segments of legs: [Right-left]: I([38-39]-[86-84]-[25-32]-[63-48]-[66-63]), II([36-32]-[86-80]-[18-21]-[48-41]-[54-52]), III([7-48]-[59-59]-[21-21]-[54-52]-[56-59]), IV([7-50]-[61-59]-[36-36]-[61-68]-[64-71]). Femora II-IV and trochanter III-IV bearing a small rounded carina. On tarsus I, famulus \( \varepsilon \) (6 \( \mu m \)) spiniiform, situated contiguously posterior to solenidion \( \omega_2 \); \( \omega_1 \) (54 \( \mu m \) setiform posterior to \( \omega_1 \); solenidion \( \omega_1 \) (25 \( \mu m \) bacilliform). Seta \( \beta' \) (30 \( \mu m \)) unilaterally sparsely barbed setiform, inserting posterior to \( \varepsilon \) (Fig. 21E). Solenidion \( \varphi_1 \) (107 \( \mu m \)) on tibia I situated contiguous to \( \varphi_2 \) (45 \( \mu m \)) originating from a small apophysis (Fig. 21D). Solenidion \( \sigma \) (63 \( \mu m \)) originating from a small apophysis (Fig. 21B).

**Remarks —** The new species differs from members of the genus Scheloribates (Scheloribates) Berlese, 1908 by having weakly protruding and bending rostral tip, fusiform sensilli, prolamella, long interlamellar setae extending in front of rostral anterior margin, and famulus contiguous, posterior to setiform solenidion \( \omega_2 \) and anterior to seta \( \beta' \) on tarsi I. The new species resembles in the shape of rostral tip, shape of sensilli, presence of prolamella and arrangement of famulus and solenidia such as found in S. (S.) azumaensis Enami et al., 1996, however, the former is different from the latter in shape of rostral extension, length of interlamellar setae, and distance of famulus and \( \omega_2 \). The new species is similar to S. (S.) shigeruus Fujikawa, 2011 in shape of prolamella and length of interlamellar setae, however, the former is different from the latter in shape of tip of rostrum, shape of sensilli, and arrangement of solenidia and famulus on tarsi I.

**Galumnidae Jacot, 1925**

**Trichogalumna trowella n.sp.**

[Japanese name: Hana-furisodedani]

(Figures 22 – 23)

**Diagnosis —** Body length 321 \( \mu m \); width 250 \( \mu m \). Pteromorphae lineate; other integument of body smooth. Rostrum broadly rounded with rostral trowel. Setae \( ro \), \( le \) and \( in \) short. Sensilli fusiform, composed barbed head and thin, smooth stem. Ten pairs of short notogastral setae, four pairs of porose areas, five pairs of lyrifissures present. Movable pteromorphs bearing short furrow, \( c \) and \( ia \). Pteromorphae notch distinct. Dorsoaphrophic apophysis (\( hy \)) small circular in shape. Genito-anal setal formula: 6-1-2-3. Epimeral setal formula: 3-0-3-3. Heterotridactyl Subcapitulum diarthric, subcapitular setae.

**Material examined —** Holotype (Female) (NSMT-Ac 13628) from litter and humus at the point C.

**Etymology —** After rostral trowel.

**Measurements and body appearance —** Body length 321 \( \mu m \); width 250 \( \mu m \). Body colour light brown. Integument on pteromorphae lineate; other body surface punctulate.

**Prodorsum —** Rostral tip broadly rounded with rostral trowel (Fig. 22A). Setae \( ro \) (21 \( \mu m \)) thin, short, smooth setiform, inserting on lateral margins of rostrum, not reaching rostral tip. Lamellar and sublamellar lines near each other actuate, parallel. Setae \( le \) (39 \( \mu m \)) short, setiform, minutely barbed through the length, inserting between lines L and L,
Figure 22: Trichogalumna trowella n.sp. (Holotype NSMT-Ac 13628): A – Dorsal view; B – Solenidial region of left leg I.
Figure 23: Trichogalumna trowella n.sp. (Holotype NSMT-Ac 13628): A – Anterior region of ventral side; B – Posterior region of ventral side; C – Left lateral side of epimerata.
extending for a short distance in front of rostral tip. Setae in (12 \( \mu m \)) short, thin, smooth setiform. Bothridia opening dorso-laterally. Sensilli (ss) (66 \( \mu m \)) composed of thin, long, smooth stem and expanded fusiform head bearing sparsely spicules. Setae ex (4 \( \mu m \)) short, smooth, setiform.

Notogaster — Ten pairs of short notogastral setae (4 \( \mu m \)), six pairs of porose areas, five pairs of lyrifissures present. Anterior notogastral margin absent. Movable pteromorphs bearing short furrow, c and \( \sigma \); pteromorphal notch distinct. Dorsophragmatic apophysis (\( \lambda y \)) small circle. Porose areas (major axis, minor axis: \( \mu m \)) Al (9,8) located outer lateral to insertion of \( \eta m \); Ad (9,6) posterior to Al; Aa (9,6) outer lateral to \( \eta m \); A1 (6,5) latero-posteriorly to \( \lambda p \) or \( \eta m \); A2 (7,6) latero-posteriorly to A1 or \( \sigma \)la; A3 (9,6) posterior to \( \eta h \). Distance between \( \lambda A1 \) and \( \lambda A2 \) about one-third as long as that between \( \lambda A2 \) and \( \lambda A3 \). Lyrifissures \( \lambda a \) on pteromorphae aligned almost parallel to the joint line between pteromorpha and notogaster; \( \eta m \) transversely latero-posteriorly to \( \lambda p \); \( \lambda \i \)h, \( \i p \) perpendicular to notogastral outline; \( \i p \) between \( \i p l \) and \( \i p 2 \); ?\( \i p \)s between \( \i p 2 \) and \( \i p 3 \). Opening \( \sigma \)la situated posterior to \( \eta h \). Relative distances: (\( \i p l-\i p \i m \): 38 \( \mu m \)) > (\( \i p m-\i p n \): 34 \( \mu m \)) > (\( \i p h-\i p h \): 29 \( \mu m \)) > (\( \i p l-\i p l \): 14 \( \mu m \)).

Ventral region — Genital (45 \( \mu m \)) in length) and anal (62 \( \mu m \min \) length) apertures almost trapezoid length of anal aperture slightly shorter than distance (66 \( \mu m \)) between genital and anal apertures (Figs. 23A-B). Genito-anal setal formula: 6-1-2-3; all setae short, thin, smooth setiform. Setae \( \i g 1 \) and \( \i g 3 \) (9 \( \mu m \)) aligned at the anterior margin of the plates; other setae longitudinally in a row at the median portion of the plates. Setae \( \i g 7 \) (7 \( \mu m \)) inserting posterior-lateral to genital aperture. Anal setae (5 \( \mu m \)) inserting far from anterior margin of anal plates. Setae \( \i a d 1 \) and \( \i a d 2 \) (4 \( \mu m \)) aligned in postanal position; \( \i a d 3 \) in analdsn, at the level of almost mid-distance along the anal aperture. Lyrifissures \( \i a d \) located longitudinally, antero-laterally to \( \i a d 3 \). Epimeral borders short. Epimeral setal formula: 3-0-3-3; setae short, thin, smooth setiform; \( \i b 1 \) (4 \( \mu m \)) the shortest, \( \i c 1 \) (24 \( \mu m \)) the longest (Fig. 23C). Subcapitulum bearing 3 pairs of setae; setae short, setiform; \( \i a \) (0.7 \( \mu m \)), \( \i m \) (11 \( \mu m \)) sparsely, minutely barbed; \( \i h \) (14 \( \mu m \)) roughened.

Legs — Heterotridactyl; claws (23 \( \mu m \)) minutely dentate. Setal formula: I (1-5-3-4-19), II (1-4-3-4-16), III (2-3-1-3-15), IV (1-2-2-3-12). Measurements (\( \mu m \)) of segments of left legs: I (25-46-25-39-55), II (31-75-21-25-36), III (49-45-16-36-39), IV (54-43-17-43-46). On tarsus I (Fig. 22B), famulus \( \i c \) (6 \( \mu m \)) obtuse, situated posterior to solenidia \( \omega 1 ; \omega 1 \) (24 \( \mu m \)) bacilliform; \( \omega 2 \) (29 \( \mu m \)) setiform, situated latero-posterior to \( \omega 1 ; \omega 1 \) (31 \( \mu m \)) smooth, setiform, inserting just lateral to \( \omega 1 \). On tibia I, solenidia \( \varphi 1 \) (86 \( \mu m \)), \( \varphi 2 \) (23 \( \mu m \)) setiform situated at anterior portion of the segment; \( \varphi 2 \) originating from a small apophysis; dorsal seta (34 \( \mu m \)) smooth setiform, inserting contiguous to \( \varphi 1 \). On genu I, \( \sigma \) (69 \( \mu m \)) longer than seta \( \i d \) (11 \( \mu m \)).

Remarks — The new species is very similar to Trichoagalumma chimaera Ohkubo, 1984 in ornamentation of the pteromorph integument, length of rostral and interlamellar setae, shape of sensilli and insertion of genital-anal setae. However, the former is different from the latter in having a round rostrum with rostral trowel, and the body surface is punctuate except for pteromorphae.

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