

Three new oribatid species (Acari: Oribatida) from a hollow of a camphor tree of the Kuma District, Kumamoto Prefecture, in southern Japan

Tokuko Fujikawa

Ueminami 1346-3, Asagiri-cho, Kumamoto, 868-0423 Japan

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Abstract The soil fauna living in a hollow camphor tree that was more than 800 years old at the Yatsushiro Shrine in the Kuma District, Kumamoto Prefecture, in southern Japan was investigated. Three new and six known oribatid species were collected. Of these nine species, the three new species are *Medioxyoppia trionus* n. sp., *Peloribates* (*Peloribates*) *yatsushiroensis* n. sp. and *Ceratozetes erupentus* n. sp.; five species were previously known: *Acrotrititia aokii* (Niedbala, 2000), *Acrotrititia ardua* (C. L. Koch, 1841), *Tectocephus cuspidentatus* Knülle, 1954, *Campachipteria distincta distincta* (Aoki, 1959), and *Oribatula* (*Oribatula*) *sakamorii* Aoki, 1970; and one additional and potentially new species was described as belonging to the genus *Epilohmannia*. Although this *Epilohmannia* sp. may prove to be a new species in the future, this paper did not designate it as a new species, because only a single specimen was found in the present survey.

Key words: *Ceratozetes*, *Epilohmannia* sp, *Medioxyoppia*, *Peloribates* (*Peloribates*), South Japan

Introduction

Higgins (1979) noted that some oribatid species may be valuable as indicator species for soil conditions; therefore, faunal surveys of any kind may provide valuable information providing answers to questions related to the many variations in morphological characteristics and ecological features shown by most oribatid species. In the present study, soil fauna living in a hollow of a camphor tree was surveyed at Yatsushiro City, Kuma District, Kumamoto Prefecture, Japan. Studied camphor tree was recognized as one of a larger old growth tree compared with the investigation of other trees (Nagao and Harada, 1995). A survey of the oribatid fauna from a camphor forest has been done (Harada and Aoki, 1997); however, the authors know of no record of oribatids from a hollow of a camphor tree, so the present finding of oribatids is the first record of these animals in this specific environment.

Methods

Study site: One big and old camphor tree, *Cinnamomum camphora* Sieb. is situated in the precincts of the Yatsushiro Shrine (Myōken-gū) (32°50'60"N; 130°64'02"E, about 8 m a.s.l.) at Yatsushiro-shi, Kumamoto Prefecture, Kuma District, South Japan (Fig. 1). The tree already existed there more than 828 years ago when the Shrine was founded in A.D.

1,186 (personal communication from the chief priest of the shrine, Mr. R. Kobayashi and the deputy chief priest, Mr. H. Kobayashi).

Sampling: Sample of about 1,000 cm³ was collected by hand-picking from deposit at bottom of the hollow of a tree on 1 March 2014. After extraction with a modified Tullgren apparatus, mites were kept in lactic acid for clearing during about 100 days, and then mounted on glass slides for microscopic investigation.



Fig. 1. Sampling site: a tree of *Cinnamomum camphora* Sieb. situated in the precincts of the Yatsushiro Shrine (Myōken-gū). Photo by Y. Nakamura.

Terminology and classification: The notations and morphological terminology are based on Balogh and Mahunka (1983), and about setal features and surface sculpturing after Mahunka and Zombori (1985). Genito-anal setal formula refers to genital, aggenital, anal and adanal setae. The given number of tarsal claws is common to all legs of a species. Setal formula of legs includes famulus but excludes solenidia. Measurements (μm) in the description are, for the most part, according to holotype. Unless indicated, body color of mites in the description relate to the specimens after clearing in lactic acid.

Description of new species

Supercohort Desmonomatides Woolley, 1973

Cohort Brachypylina Hull, 1918

Family Oppiidae Grandjean, 1951

Genus *Medioxyoppia* Subías, 1989

Medioxyoppia trionus n. sp.

[Japanese name: Myoken-tsubudani]

(Figs. 2 and 3)

Diagnosis

Body length 264 μm ; width 157 μm . Rostral tip angular in form. Lamellar ridge absent, but semicircular weak ridges present longitudinally, between interlamellar setae. Setae *le*, *in* and *ex* short; *ro* inserted near rostral tip; *le* far from *ro*; *ro*, *le*, *in* and *ex* ciliate or barbed. Bothridial setae *ss* fusiform, consisting of a pectinate distal half and thin, smooth stem. Anterior notogastral margin widely rounded with a small, angular, chitinous crista at humeral region. Ten pairs of notogastral setae, including setae *c*₂, short, ciliate throughout length. Genito-anal setal formula: 6or5-1-2-3. Epimeral setal formula: 3-1-3-3. Legs monodactylous.

Material examined

Holotype: Adult female (NSMT-Ac 13800), from deposit at bottom of hollow of the tree, *Cinnamomum camphora*, on 1 March 2014, T. Fujikawa leg. One paratype, adult female (NSMT-Ac 13801), same data as holotype. The type specimens are deposited in the National Museum of Nature and Science, Tokyo.

Description

Measurements and body appearance: Body length 264 μm ; width 157 μm . Body colour of live mites light, yellowish brown. Body surface smooth.

Prodorsum: Rostral tip angular in form, not pointed (Fig. 2A).

Rostral setae *ro* (24–26 μm) thin setiform, bearing several cilia unilaterally, inserted near rostral tip, extending in front of the rostrum for a distance equal to about half of their length. Lamellar ridges absent. Lamellar setae *le* (11 μm), minutely barbed along the whole length, nearer to interlamellar setae *in* than rostral setae; interspaces among setae *ro*, *le* and *in*: $(ro - le) = 3 \times (le - in)$. Semicircular indistinct ridges present longitudinally, between interlamellar setae; setae *in* (26 μm), sparsely ciliate throughout length. Bothridial setae *ss* (91 μm), fusiform, consisting of pectinate distal half and thin, smooth stem; pectinate with 7–8 branches becoming progressively longer from the base of the organ to the tip. Bothridia opening dorsally. Exobothridial setae *ex* (31 μm) sparsely ciliate throughout length.

Notogaster: Notogaster hemispherical in lateral view, with widely rounded anterior margin bearing a small, angular, chitinous crista at humeral region. Ten pairs of notogastral setae (17–26 μm), sparsely ciliate throughout length; *c*₂ inserted between crista. Lyrifissures. *ia* located obliquely, on crista; *im* almost transversely between *la* and *lm*; *ih* at the level of *la*; *ip* and *ips* almost parallel to periphery of notogastral posterior margin. Opisthonotal gland (*gla*) located anterior to *im*.

Ventral region: Genital aperture (25 μm in length) rectangular, and anal aperture (50 μm in length) almost elliptical in form; distance (50 μm) between them (Fig. 2B). Genito-anal setal formula: 6 or 5-1-2-3; all setae thin setiform, sparsely barbed throughout length; genital setae *g* (7–9 μm), variable in number: 5 at right side of holotype, and 6 at left side of holotype and both sides of paratype; aggenital setae *ag* (13 μm); anal setae *an*_{1,2} (16 μm); adanal setae *ad*_{1,3}, (7 μm), (11 μm) and (16–20 μm), respectively. Lyrifissures *iad* aligned longitudinally near lateral margin of anal aperture, at the level of anal setae *an*₁ and *an*₂. Setae *ad*₁ aligned in post-anal position; *ad*₂ in adanal, laterally to *iad*; *ad*₃ in preanal. Epimeral borders (I, II, sj and IV) and sternal ridge distinct at epimerata I and III + IV. Epimeral setal formula: 3-1-3-3; setae (11–27 μm); the longest *lb*, the shortest *3a*. Subcapitulum diarthric, subcapitular setae: 1-1-1; *a* (20–21 μm), *m* (20–27 μm) and *h* (23 μm), (Anterior, medial and posterior subcapitular setae, respectively); setae setiform, sparsely barbed.

Legs: Monodactylous; claws smooth, length of leg I (ca. 24 μm), II (ca. 20 μm), III (ca. 17 μm) and IV (ca. 17 μm) (Fig. 2C). Setal formula of legs including famulus but excluding solenidia: I (1-5-3-4-19), II (1-5-3-4-16), III (2-3-1-3-12), IV (1-3-2-3-10); measurements (μm) of left segments (trochanter to tarsus): I (14-65-16-39-59), II (14-59-14-24-43),

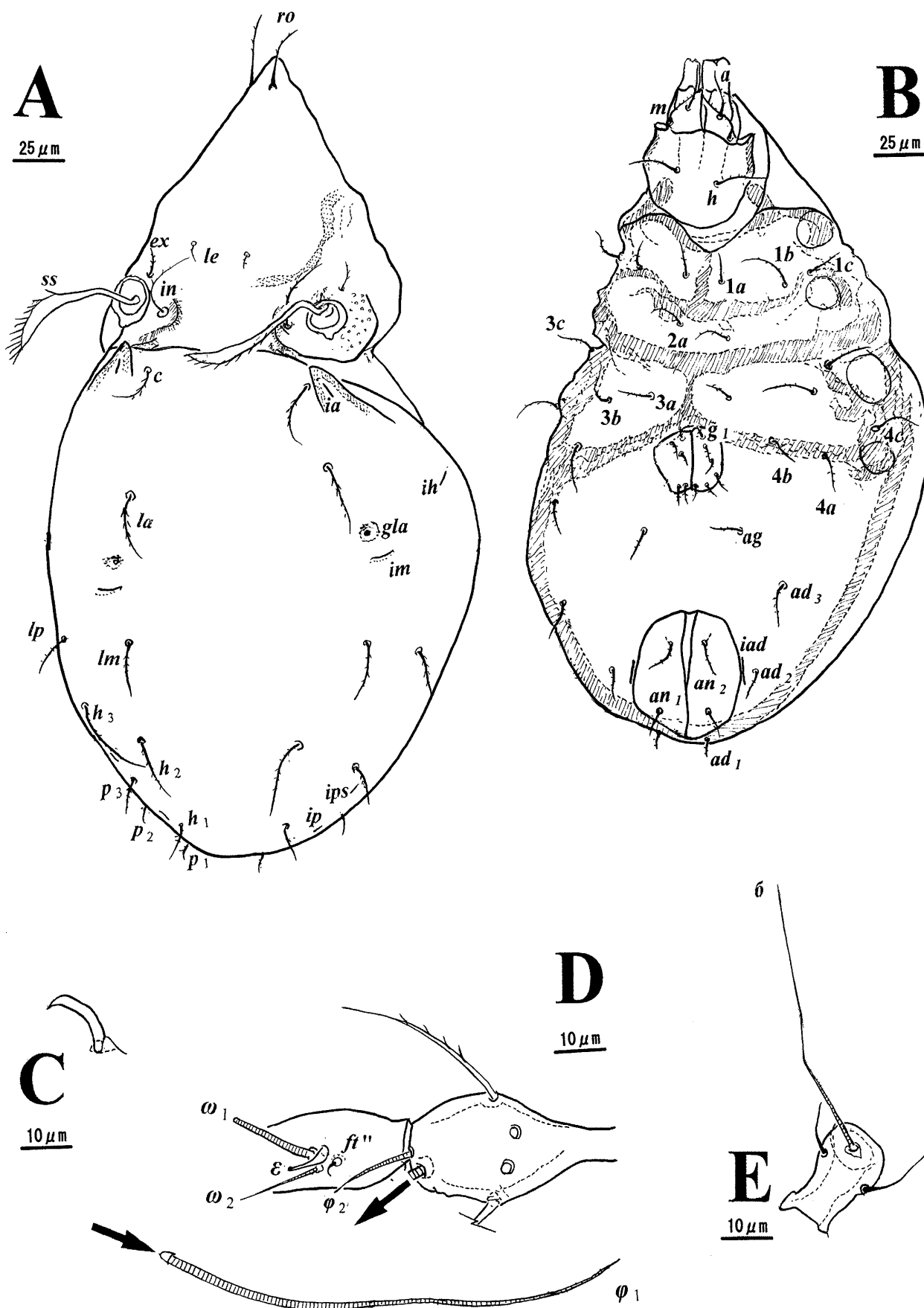


Fig. 2. *Meioxyoppia trionus* n. sp. A, B (NSMT-Ac 13800); C, D, E (NSMT-Ac 13801). A, Dorsal view; B, Ventral view; C, Claw of left tarsus II; D, Solenidial region of tarusus and tibia of leg I; E, Dorsal view of left genu I.

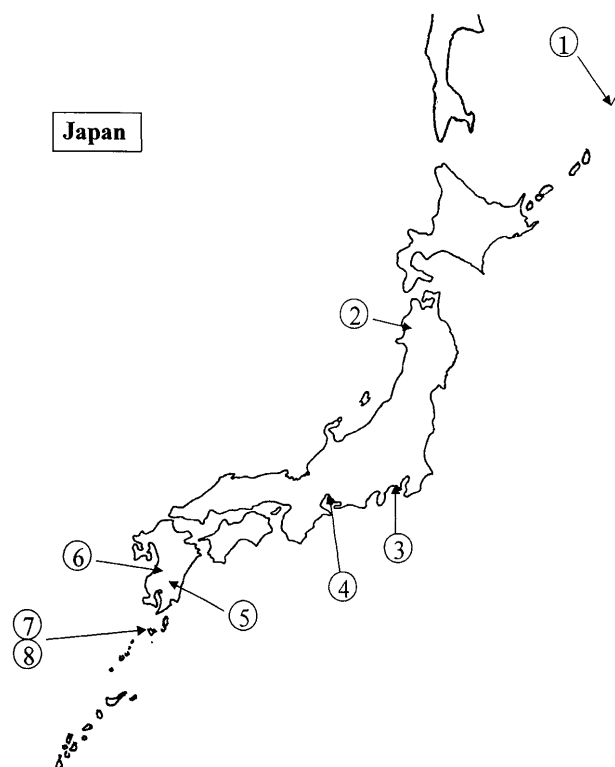


Fig. 3. Type localities of all members of the genus *Medioxyoppia*:

- ① *Medioxyoppia mastigophora* (Golosova, 1970); the Petrov Is. and the Kuril Is. ② *M. hamata* Fujikawa, 2003[2004]; Shirakami-sanchi World Heritage Area. ③ *M. acuta* (Aoki, 1984); Zushi City. ④ *M. nagoyae* Ohkubo, 1991; Nagoya City. ⑤ *M. nagasatoensis* Fujikawa, 2010; Asagiri-chō. ⑥ *M. trionus* n. sp.; Yatsushiro City. ⑦ *M. actirostrata* (Aoki, 1983); Amami-Oshima Is. ⑧ *M. yuwana* (Aoki, 1983); Amami-Oshima Is.

III (32-43-16-36-41), IV (43-61-18-45-59). Solenidiotaxy: I (1-2-2), II (1-1-2), III (1-1-0), IV (0-1-0). On tarsus of leg I, famulus ε (8 μ m) acuminate, not terminating in fine tip, situated just behind solenidion ω_1 . Solenidion ω_1 (16 μ m) thick bacilliform; ω_2 (15 μ m) thin setiform, situated lateral to famulus. On tibiae I, solenidia φ_1 (81 μ m) and φ_2 (15 μ m) setiform, without apophysis, situated close together at the tip of segment (Fig. 2D). On genu I, solenidion σ (46 μ m) without apophysis (Fig. 2E).

Remarks

The new species is distinguished from congeners of *Medioxyoppia* Subías, 1989, by its small body size, fusiform bothridial setae without a long, fine tip, small triangular crista with lyrifissure *ia*, setae *ro*, *le*, *in* and *ex* not smooth, setae *le* inserted far from the setae *ro*, as shown in the following key. Members of *Medioppiinae* Subías & Mínguez, 1985 have

crista and c_2 , but without lamellar costulae and translamella, while crista and c_2 are absent on members of *Multioppiinae* Balogh, 1983, and costulae or translamella are found on members of *Oxyoppiinae* Subías, 1989 (Balogh and Balogh, 1992). Therefore, *Oppia mastigophora* Golosova, 1970 and *Oxyoppia acuta* Aoki, 1984 are referred to as representatives of *Medioxyoppia* (Subías, 2004).

Key to the species of *Medioxyoppia*

Body length and width (in μ m) are shown according to the original description, together with type locality (Fig. 3).

- 1 – Notogaster bearing 12 setae ----- *Medioxyoppia mastigophora* (Golosova, 1970); 353 \times 153; the Petrov Is. and the Kuril Is.
 – Notogaster bearing 10 setae ----- 2
 2 – Adanal setae ad_3 inserted at the level between an_1 and an_2 ----- *M. yuwana* (Aoki, 1983); 340–368 \times 192–207; Amami-Oshima Is.
 – Adanal setae ad_3 inserted at preanal position ----- 3
 3 – Rostrum bearing median lobe-like prominence ----- *M. nagasatoensis* Fujikawa, 2010; 271–307 \times 164–186; Asagiri-chō.
 – Rostrum without median prominence ----- 4
 4 – Interlamellar region showing costulae forming an arch of flattened anterior part and indistinct medial part ----- *M. acuta* (Aoki, 1984); 362–395 \times 214–235; Zushi City..
 – Costulae forming an arch of flattened anterior part and indistinct medial part absent on prodorsum ----- 5
 5 – Bothridial setae *ss* weakly broadened and flattened distally like butterknife ----- *M. actirostrata* (Aoki, 1983); 440–480 \times 265–290; Amami-Oshima Is.
 – Bothridial setae *ss* not broadened and flattened distally like butterknife ----- 6
 6 – Bothridial setae *ss* thick setiform, not expanded medially ----- *M. hamata* Fujikawa, 2003[2004]; 371 \times 214; the Shirakami-sanchi World Heritage Area.
 – Bothridial setae *ss* fusiform ----- 7
 7 – Notogastral seta c_2 inserted on crista ----- *M. nagoyae* Ohkubo, 1991; 271–317 \times 145–175; Nagoya City.
 – Notogastral seta c_2 inserted beside crista ; lyrifissure *ia* situated on crista ----- *M. trionus* n. sp.; 264 \times 157; Yatsushiro City.

Etymology

Named after the sampling area, Myōken-gū. The word

“Myōken” is comprehended as “Dipper”, namely “*triōn ë s*” in Japan.

Family Haplozetidae Grandjean, 1936
Genus *Peloribates* (*Peloribates*) Berlese, 1908
Peloribates (*Peloribates*) *yatsushiroensis* n. sp.
[Japanese name: Yatsushiro-marukosodedani]
(Figs. 4–6)

Diagnosis

Body length 371–407 µm; width 307–336 µm. Whole body surface bearing alveoli. Prodorsum angular in form. Interlamellar seta long, extending half of their length in front of anterior rostral margin. Bothridial setae *ss* composed of weakly expanded head and long, thin stem, ciliate throughout length. Anterior notogastral margin widely rounded; nearly as long as wide. Fourteen pairs of notogastral setae ensiform, ciliate throughout length; c_1 as long as their mutual distance; relative distances: $(h_1 - h_1) > (c_1 - c_1)$. Pteromorphae movable with acute angle, but anterior margin not projecting out from anterior notogastral margin. Genito-anal setal formula: 5 or 4-1-2-3. Lyrifissure *iad* aligned in paraanal position. Adanal seta *ad*₃ inserted nearly, lateral to *iad*. Epimeral setal formula: 3-1-3-3. Tibia II bearing a sharp triangle projection at the anterior margin. Legs heterotridactylous.

Material examined

Holotype: Adult female (NSMT-Ac 13802) from deposit at bottom of hollow of the tree, *Cinnamomum camphora*, on 1 March 2014, T. Fujikawa leg. Six paratypes, adult female, same data as holotype. Holotype (NSMT-Ac 13802) and two female paratypes (NSMT-Ac 13803 and 13804) are deposited in the National Museum of Nature and Science, Tokyo.

Description

Measurements and body appearance: Body length 371–407 µm; width 307–336 µm. Whole body surface bearing alveoli. Body colour of live mites yellowish brown.

Prodorsum: Prodorsum angular in form. Rostral tip rounded, not pointed (Fig. 4). Rostral setae *ro* (66 µm) filiform, bearing cilia throughout length, inserted near lateral rostral margin, extending for a short distance in front of rostral anterior margin. Lamellar setae *le* (96 µm), thick setiform, ciliate throughout length, inserted laterally to prodorsum. Interlamellar setae *in* (114 µm), long spiniform, spiculate throughout length, extending for half length in front of anterior rostral margin.

Bothridial setae *ss* (85 µm), composed of weakly expanded head and long stem, spiculate throughout length. Bothridia opening antero-laterally. Exobothridial setae *ex* (ca. 10 µm) sparsely roughened, inserted at lateral base of bothridia.

Notogaster: Notogaster hemispherical in lateral view. Anterior notogastral margin widely rounded; nearly as long as wide. Fourteen pairs of notogastral setae (73 µm), ensiform, ciliate throughout length; c_1 as long as, or slightly shorter than their mutual distance; relative distances: $(h_1 - h_1) > (c_1 - c_1)$. Pteromorphae movable with acute angle, but anterior margin not projecting out from notogastral anterior margin. Four pairs of sacculi very small pits; *Sa* situated laterally, close to seta *dm*; *S*₁ laterally to *lm*; *S*₂ anteriorly to *h*₃; *S*₃ between *h*₃ and *p*₂. Lyrifissures. *ia* aligned obliquely on pteromorphae, laterally to c_2 ; *im* obliquely, postero-laterally to *la*; *ih* and *ip* almost parallel to periphery of notogaster, antero-laterally to *la* and anteriorly to *p*₁, respectively (Figs. 4 and 5); *ips* perpendicular to notogastral margin. Opisthonotal gland (*gla*) located antero-laterally to *la*.

Ventral region: Genital aperture (46 µm in length) rectangular, and anal aperture (59 µm in length) almost rectangular in form; distance (79 µm) between them. Genito-anal setal formula: 5 or 4-1-2-3; genital setae variable in number: 4 at the left side of holotype and 5 at the right side and at both sides of all paratypes; all setae thin setiform, sparsely barbed throughout length; genital setae *g* (17 µm) barbed throughout length; aggenital setae *ag* (26 µm) basely barbed; anal setae *an*₁ (17 µm) bearing a few barbs unilaterally; *an*₂ (21 µm), smooth; adanal setae *ad*₁₋₃, (17 µm), (16 µm) and (15 µm), respectively; *ad*₁ and *ad*₃ sparsely barbed throughout length; *ad*₂ sparsely barbed unilaterally. Lyrifissures *iad* aligned in paraanal position, at the level behind anal setae *an*₂. Adanal setae *ad*₁ inserted in postanal position; *ad*₂ latero-posteriorly to the aperture; *ad*₃ at the level of anal setae *an*₂. Epimeral setal formula: 3-1-3-3; setae (15–32 µm) variable in form and length; the longest *3c*, the shortest *1c*; *1a*, *3a*, *3c* and *4b* glabrous; other setae barbed throughout length. Epimeral borders (I, II, sj and IV) distinct. Sternal ridge indistinct. Subcapitulum diarthric, subcapitular setae: 1-1-1; *a* (17 µm), *m* (27 µm), and *h* (24 µm), (Anterior, medial and posterior subcapitular setae, respectively); setae setiform; *a* sparsely barbed throughout length; *m* basely, ciliate unilaterally; *h* ciliate unilaterally.

Legs: Heterotridactylous; claws smooth, with a length of legs I (27–29 µm), II (32–39 µm), III (25 µm) and IV (34–39 µm) (Fig. 9A). Setal formula: I (1-5-3-4-19), II (1-5-3-4-16), III (2-

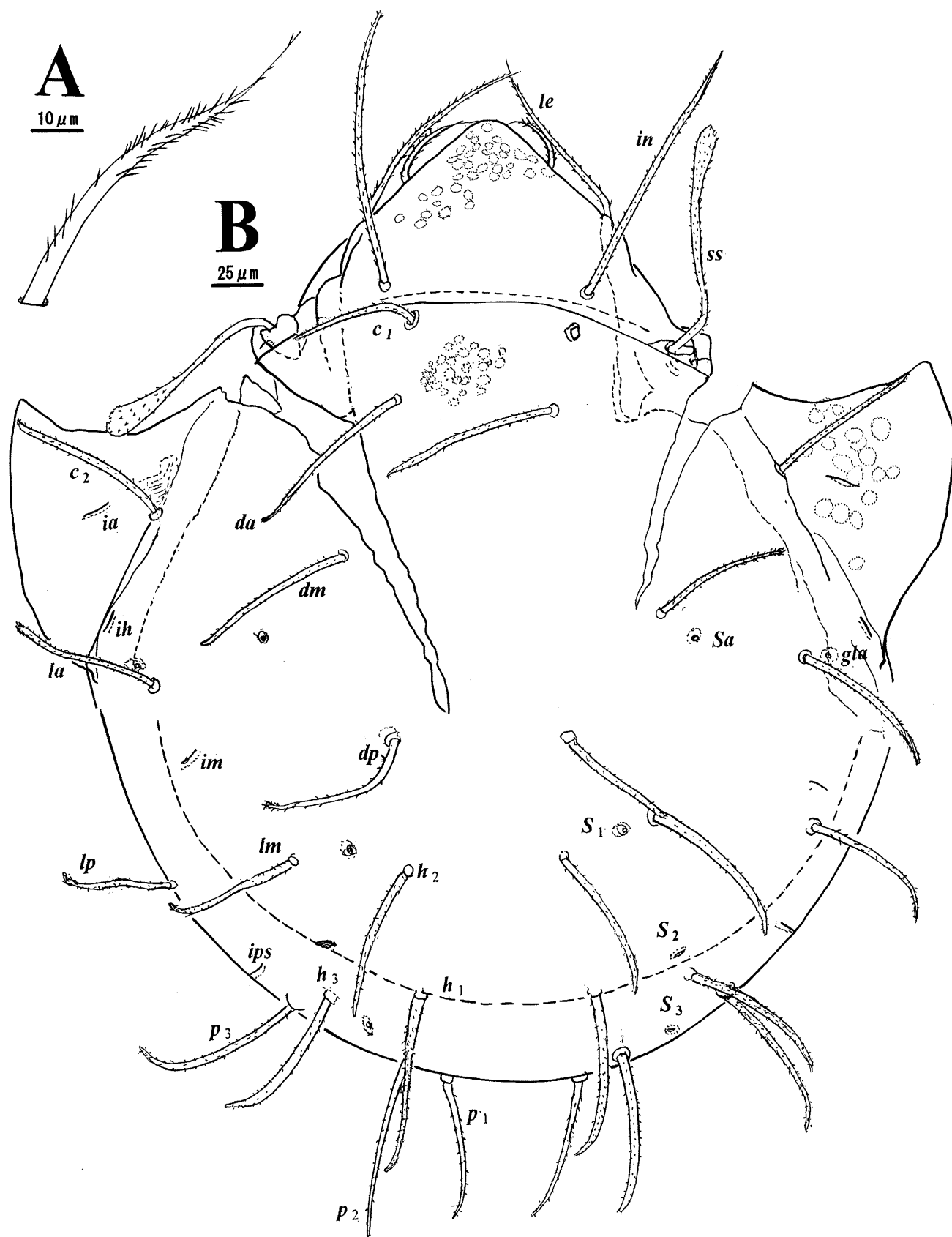


Fig. 4. *Peloribates* (*Peloribates*) *yatsushiroensis* n. sp. (NSMT-Ac 13802). A, Rostral seta; B, Dorsal view.

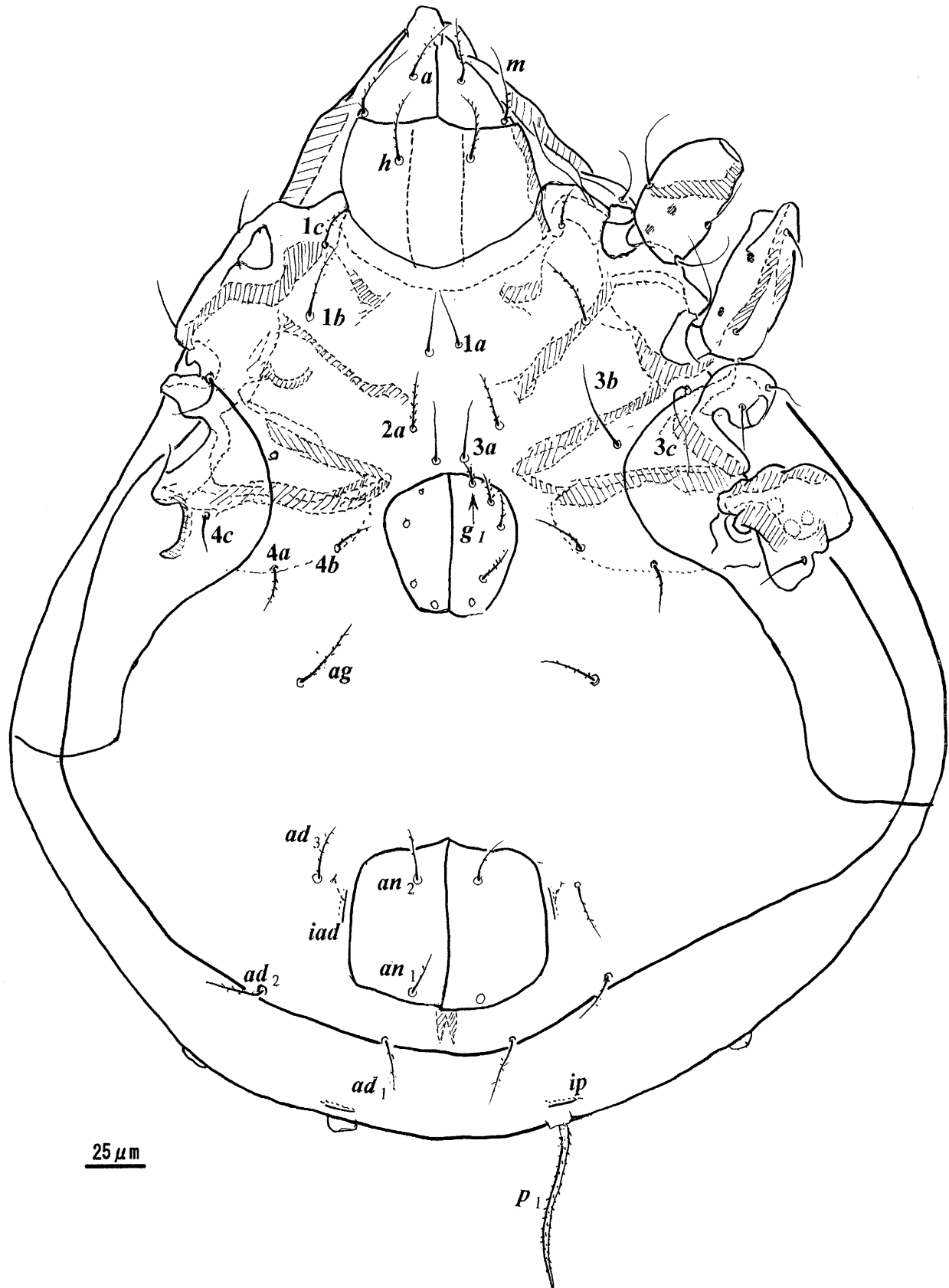


Fig. 5. *Peloribates (Peloribates) yatsushiroensis* n. sp. (NSMT-Ac 13802). Ventral view.

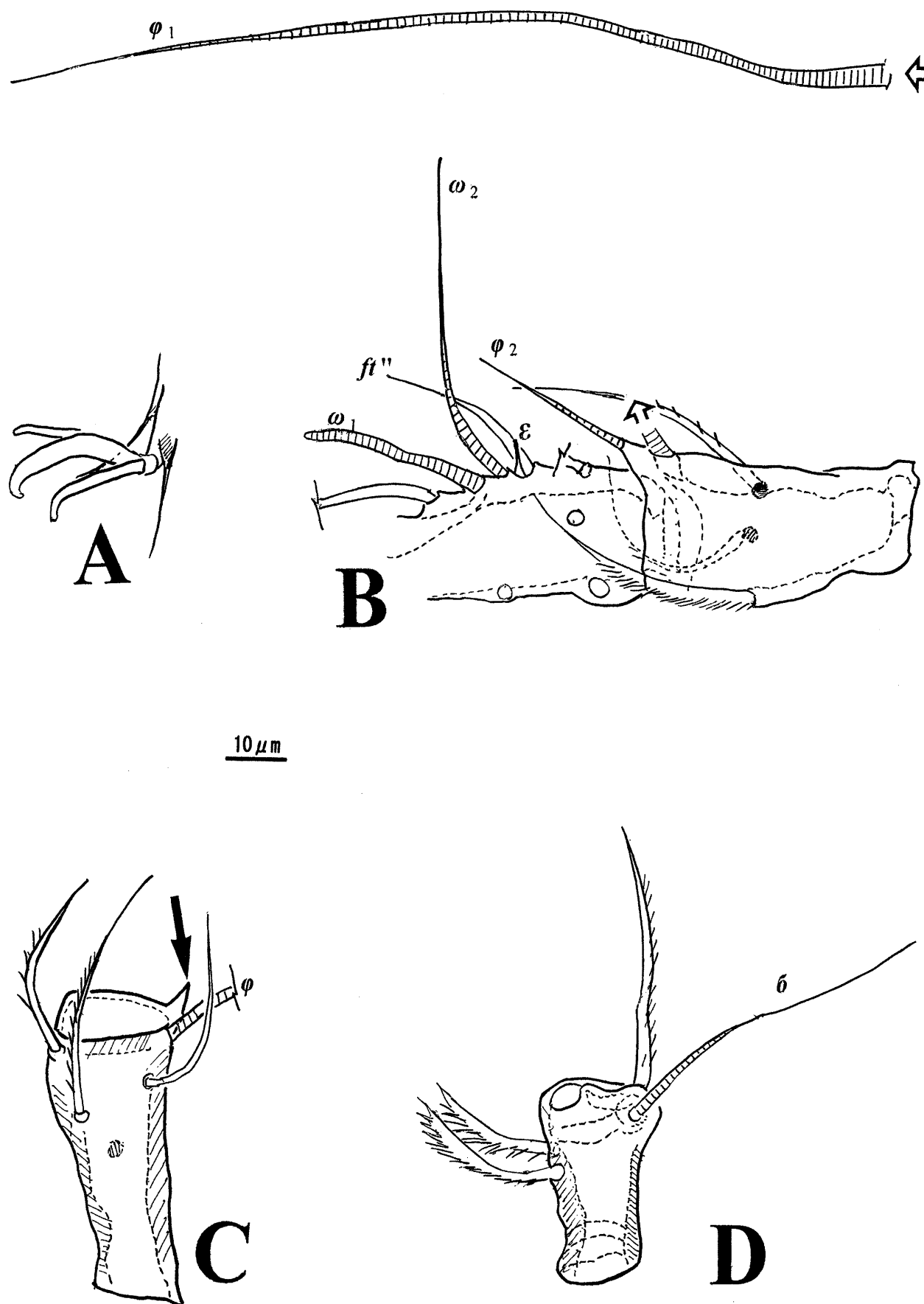


Fig. 6. *Peloribates (Peloribates) yatsushiroensis* n. sp. (NSMT-Ac 13802). A, Claws of right tarsus I; B, Solenidial region of tarsus and tibia of right leg; C, Right tibia II (arrow: projection); D, Right genu I.

2-1-3-14), IV (1-2-2-10). Tibia II bearing a sharp triangular projection at the anterior margin (Fig. 6C). Each of femora I and II bearing a small ridge. Solenidiotaxy: I (1-2-2), II (1-1-2), III (1-1-0), IV (0-1-0). On tarsus of leg I, famulus ε (6 μm) acuminate, not terminating in fine tip, situated just behind solenidion ω_2 . Solenidion ω_1 (28 μm) thick bacilliform; ω_2 (48 μm) thin setiform, situated posteriorly to ω_1 . On tibiae I, solenidia φ_1 (134 μm) and φ_2 (24 μm) setiform; φ_2 originating from apophysis at anterior margin of segment; φ_1 without apophysis, situated just behind apophysis of φ_2 (Fig. 6B). On genu I, solenidion σ (49 μm) without apophysis (Fig. 6D).

Remarks

The new *Peloribates* (*Peloribates*) species has setae in extending beyond the anterior rostral margin, notogastral setae without a pointed tip, $c_1 / (c_1 - c_1) = 0.6-1.0$, and $(h_1 - h_1) > (c_1 - c_1)$. The form of the pteromorphae, bothridial setae and notogastral setae of the new species is very similar in appearance to those of *Acutozetes izumiensis* Fujikawa, 2011 which was collected from rice fields with cranes flying nearby in the area of Izumi City about 45 km, southwest from Yatsushiro City (Fujikawa, 2011). However, the new species differs from *A. izumiensis* in having the anterior margin not projecting out from the anterior notogastral margin. Ohkubo *et al.* (2015) considered *Acutozetes izumiensis* to be a synonym of *Peloribates ominei* Nakatamari, 1985; however, the author believes this is a different species. Three members of the genus *Peloribates* (*Peloribates*), *P. formosus* Nakatamari, 1985, *P. haramachiensis* Aoki, 1999 and *P. kaszabi* Mahunka, 1988 have similar relative distances of h_1 to c_1 such as $(h_1 - h_1) > (c_1 - c_1)$ and as seen in the new species; however, they differ from the new species by the form of the rostrum, bothridial setae, pteromorphae, notogastral setae, and alveoli. Presence or absence data, form or situation of protrusions on tibia II may be useful characters for identifying as shown in some species (Bayartogtokh, 2000; Fujikawa, 2011).

Etymology

Named after the sampling area, Yatsushiro City.

Family Ceratozetidae Jacot, 1925

Genus *Ceratozetes* Berlese, 1908

Ceratozetes erupentus n. sp.

[Japanese name: Kezume-kobanedani]

(Figs. 7–10)

Diagnosis

Body length 700–779 μm ; width 429–471 μm . Body surface glabrous. Rostral tip trimucronate or concave. Lamella with cuspis (132 μm), and a small angular projection (7 μm) present at the outer lateral side of tip of cuspis. Setae *ro* and *le* extending for a short distance in front of rostral margin. Setae *in* reaching the tips of cuspidis. Bothridial setae *ss* composed of fusiform head and long, thin stem, ciliate throughout length. Tutorium squamose, terminating in a fine point. Eleven pairs of notogastral setae very minute, hardly visible. Four pairs of porose areas variable in size, form and appearance; *Aa* very long sideways; *A*₁ and *A*₂ going halves in light and dark; *A*₃ larger or longer than *A*₂. Pteromorphae immovable with acute angle, but anterior margin not projecting out from notogastral anterior margin. Genito-anal setal formula: 6-1-2-3. Adanal seta *ad*_{1,2} aligned in post anal position; *ad*₃ and lyrifissure *iad* in adanal position. Epimeral setal formula: 3-1-3-3. Lateral fine claws of heterotridactylous bearing a small, sharp projection at the ventral side.

Material examined

Holotype: Adult female (NSMT-Ac 13805) from deposit at bottom of hollow of the tree, *Cinnamomum camphora*, on 1 March 2014, T. Fujikawa leg. 19 paratypes, adult female, same data as holotype. Holotype (NSMT-Ac 13805) and two female paratypes (NSMT-Ac 13806 and 13807) are deposited in the National Museum of Nature and Science, Tokyo.

Description

Measurements and body appearance: Body length 700–779 μm ; width 429–471 μm . Body surface glabrous. Body colour of live mites light brown.

Prodorsum: Rostral tip trimucronate or concave (Figs. 7A and 8B); medial mucro (11 μm) shorter than lateral mucrones (21 μm) (Fig. 8A). Rostral setae *ro* (108–123 μm), setiform, plumose or spinose throughout length, originating from small apophysis, situated laterally to tutorium. Lamella and cuspis extending (132 μm) in front of bothridia; cuspis slender, bearing a small angular projection (7 μm) at the outer lateral side of tip; lamellar setae *le* (152–157 μm), ciliate throughout length, originating from tip of cuspis. Setae *ro* and *le* extending for a short distance in front of rostral margin. Setae *in* (214 μm) setiform, ciliate throughout length, reaching the tips of cuspidis. Bothridial setae *ss* (129–139 μm) composed of long, weakly expanded fusiform head and short, thin stem; head ciliate throughout length. Bothridia opening

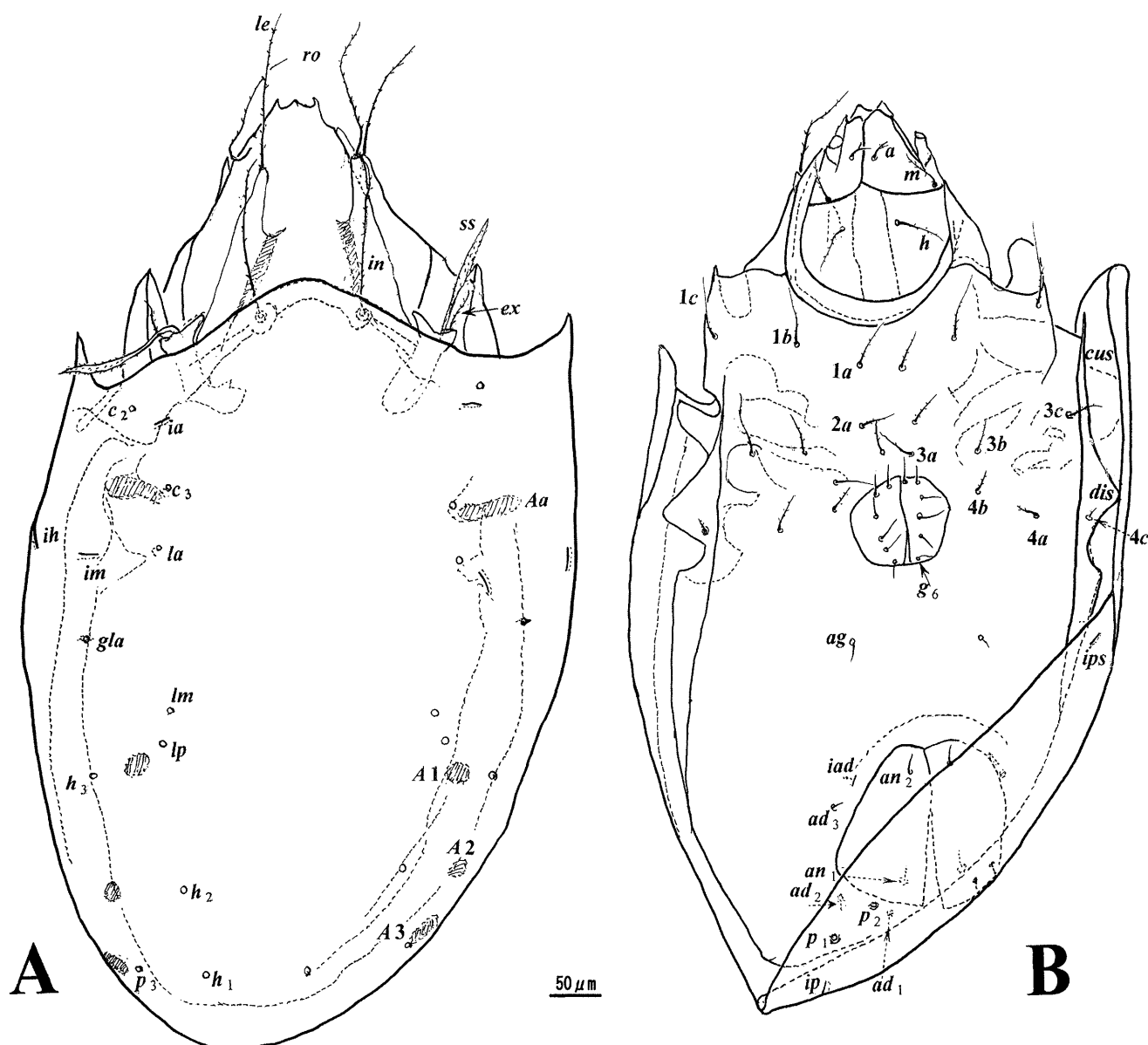


Fig. 7. *Ceratozetes erupentus* n. sp. A, Dorsal view (NSMT-Ac 13805); B, Ventral view (NSMT-Ac 13806).

antero-laterally. Exobothridial setae ex ($50\text{--}68 \mu m$), ciliate throughout length, inserted laterally to bothridia. Lyrifissures Ad present posteriorly to insertion of ex . Tutorium squamose; cusps ($71 \mu m$), terminating in a fine point.

Notogaster: Anterior notogastral margin protruding mid-dorsally. Pteromorphae immovable with acute angle, but anterior margin not projecting out from anterior notogastral margin. Notogaster with a peripheral ring of light areas of weak chitinisation with margin resembling the toothed blade of a saw (Fig. 8G). Eleven pairs of notogastral setae glabrous, very minute, hard visible; c_2 ($3 \mu m$), p_1 ($2 \mu m$) (Fig. 8C). Four pairs of porose areas variable in size, form and appearance (Fig. 9); Aa very long sideways of the major axis ($88\text{--}91 \mu m$)

and the minor axis ($14\text{--}21 \mu m$); A_1 of the major axis ($26\text{--}63 \mu m$) and the minor axis ($24\text{--}27 \mu m$) and A_2 of the major axis ($24 \mu m$) and the minor axis ($14 \mu m$) going halves in light and darkness; A_3 of the major axis ($31\text{--}49 \mu m$) and the minor axis ($12\text{--}16 \mu m$) larger or longer than A_2 . Porose areas Aa located near, laterally to c_3 ; A_1 postero-laterally to lp ; A_2 laterally to h_2 ; A_3 laterally to p_3 . Lyrifissures. ia aligned obliquely, postero-laterally to c_2 ; im obliquely or transversely, postero-laterally to la ; ih obliquely, antero-laterally to im ; ips almost parallel to periphery of notogaster, antero-laterally to h_3 ; ip obliquely, anteriorly to p_1 . Opisthonotal gland (gl_a) located postero-laterally to im .

Ventral region: Both genital aperture ($71 \mu m$ in length) and anal

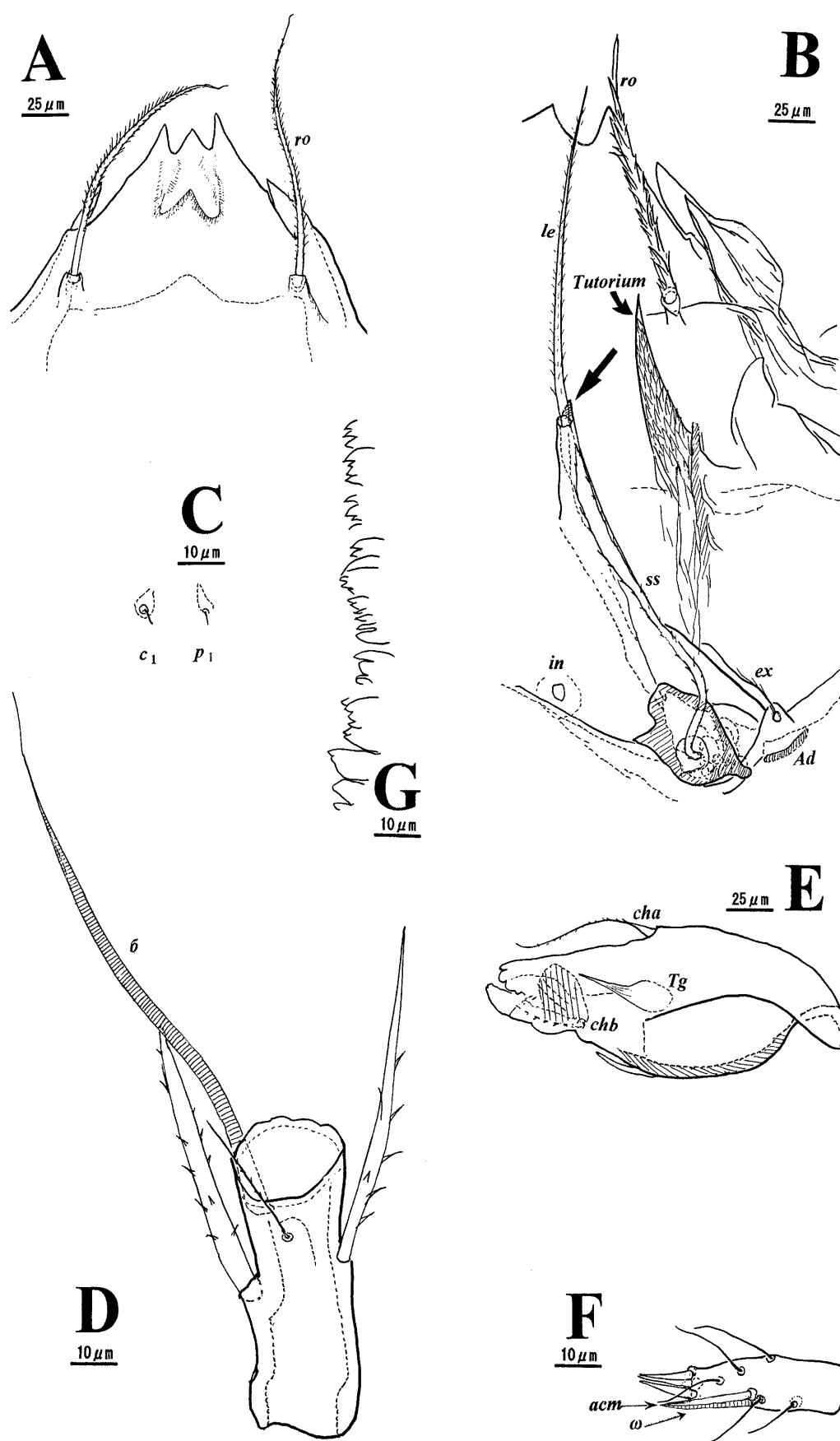


Fig. 8. *Ceratozetes erupentus* n. sp. A, B depressed specimens; C – G (NSMT-Ac 13807). A, Rostral region; B, Right side of prodorsum (arrow: projection); C, Setae, c_1 and p_1 ; D, Right genu I; E, Chelicera; F, Tarsus of pedipalp; G, Margin of peripheral ring of light areas of weak chitinisation on notogaster.

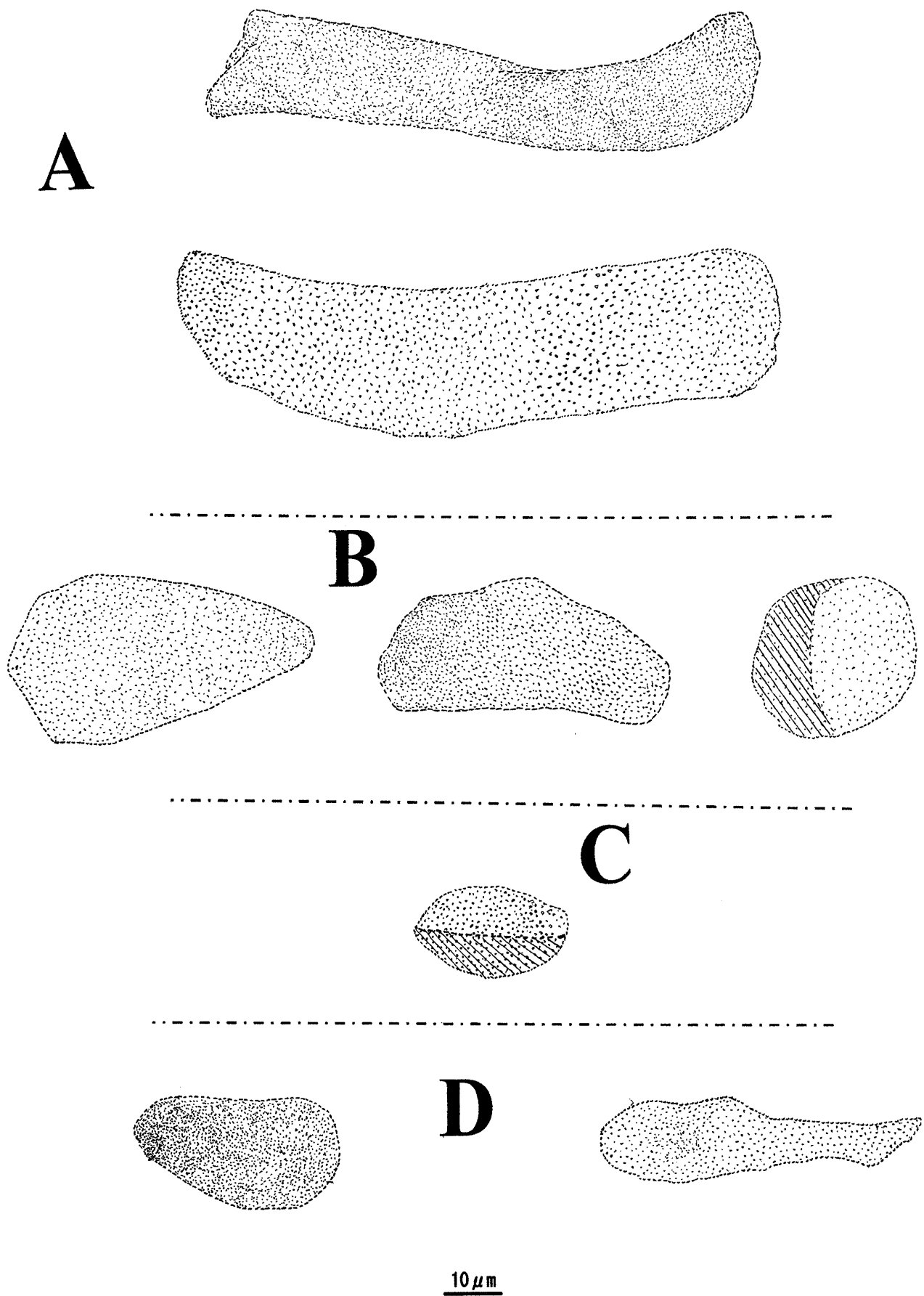


Fig. 9. *Ceratozetes erupentus* n. sp. (NSMT-Ac 13807). A, Porose areas Aa ; B, A_1 ; C, A_2 ; D, A_3 ;

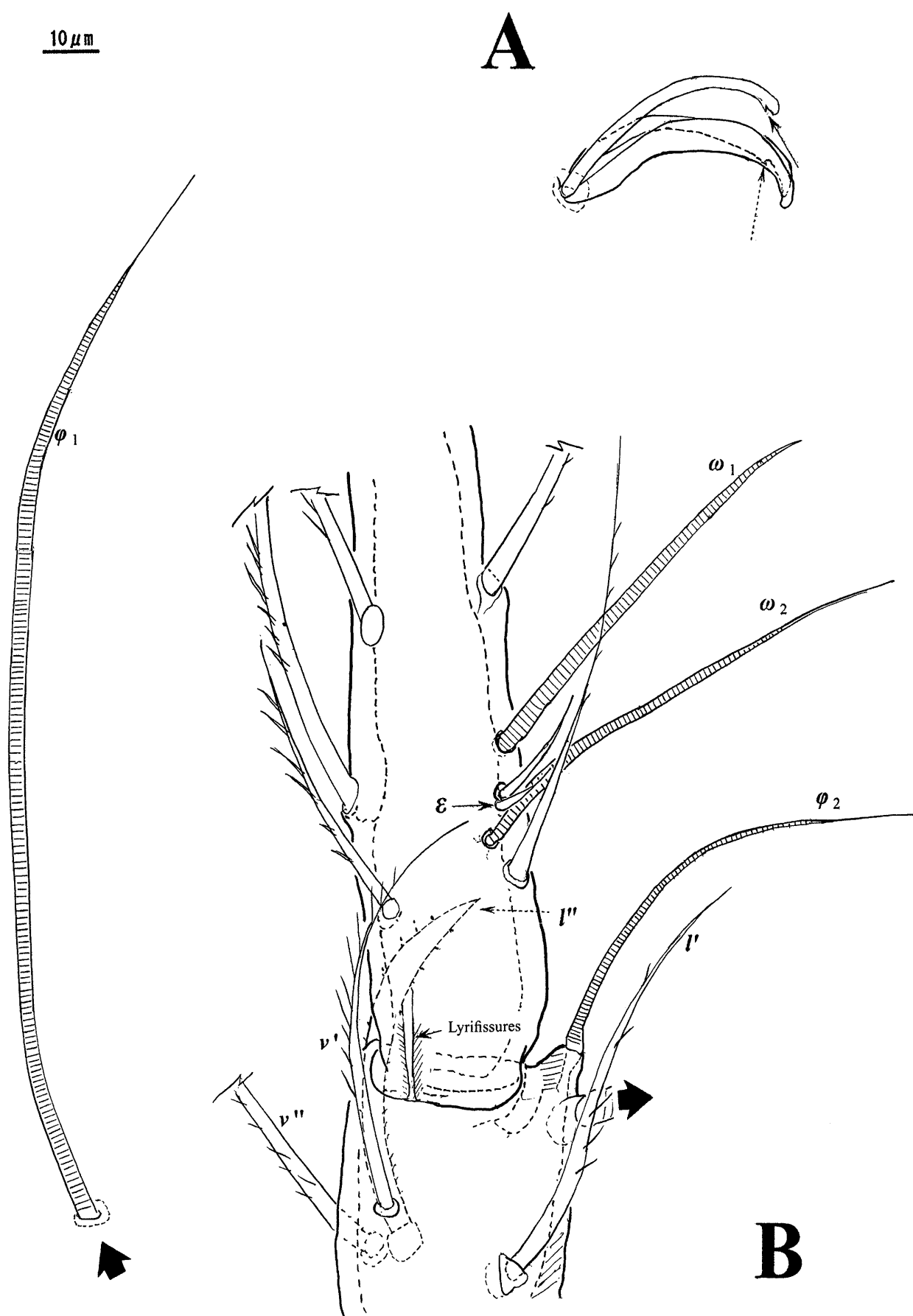


Fig. 10. *Ceratozetes erupentus* n. sp. A, Claw of left tarsus I (arrow: projection); B, Solenidial region of tarsus and tibia of right leg.

aperture (132 μm in length) almost rectangular in form; distance (146 μm) between them (Fig. 7B). Genito-anal setal formula: 6 or 5-1-2-3; a single specimen exceptionally, bearing 5 setae on right plate. All genito-anal setae thin, smooth setiform, of lengths genital setae *g* (28 μm), aggenital setae *ag* (15 μm), anal setae *an*₁ (9–14 μm), *an*₂ (9–15 μm), adanal seta *ad*₁ (7–8 μm), *ad*₂ (9 μm), and *ad*₃ (10 μm); *ad*₁, *ad*₂ inserted in postanal position; *ad*₃ in adanal, posterior to *iad*, at the level between *an*₁ and *an*₂. Lyrifissure *iad* in adanal position. Epimeral setal formula: 3-1-3-3; setae (26–39 μm); the longest *l*_c the shortest *l*_a. Epimeral border and sternal ridge indistinct. Subcapitulum diarthric, subcapitular setae: 1-1-1; *a* (32 μm) bearing a few barbs; *m* (43 μm), and *h* (46 μm), barbed throughout length. Chelicerae bearing thin, setiform setae *cha* (70 μm) and *chb* (36 μm); *cha* barbed throughout length; *chb* barbed unilaterally. Trägårdh's organ small (41 μm), lineolate, terminating in a long, fine tip (Fig. 8E). Pedipalpal setal formula 0-2-1-3-9[1]; *acm* and *ω* corne double (Fig. 8F).

Legs: Heterotridactylous; Lateral fine claws bearing a small, sharp projection at the ventral side (Fig. 10A); all claws smooth dorsally, length of leg I (25 μm), leg II (34 μm), leg III (29 μm) and leg IV (33 μm). Setal formula of legs: I (1-5-3-4-19), II (1-5-3-4-16), III (2-3-1-3-15), IV (1-2-2-3-10); measurements (μm) of segments (trochanter to tarsus): left I (39-79-28-54-78), right II (?-73-25-48-68), left III (52-61-24-50-60), left IV (47-68-28-65-73). Tarsal lyrifissure distinctly large, situated perpendicularly to posterior margin of segment (Fig. 10B). Tibiae I – III and genua I – IV bearing a very thick spiniform seta *l'*. Femora I – IV and trochantera III – IV bearing a thin, narrower leg fin. Solenidiotaxy: I (1-2-2), II (1-1-2), III (1-1-0), IV (0-1-0). On tarsus of leg I, famulus ε (ca. 11 μm) acuminate, with long, fine tip, situated just behind seta *ff'* (ca. 19 μm). Solenidion ω ₁ (ca. 66 μm) thick setiform; ω ₂ (ca. 71 μm) thin setiform, situated posteriorly to ε . On tibiae I, solenidia φ ₁ (ca. 166 μm) and φ ₂ (ca. 64 μm) setiform; φ ₂ originating from apophysis at anterior margin of segment; φ ₁ without apophysis, situated just behind apophysis of φ ₂. On genu I, solenidion σ (102 μm) without apophysis (Fig. 8D).

Remarks

The new species resembles *Ceratozetes fjellbergi* Behan-Pelletier, 1986, but differs from the latter in having a larger body size, tutorium squamose terminating in a fine point, four pairs of porose areas that are variable in size, form and appearance; tarsal lyrifissure distinct large, situated perpendicularly to posterior margin of segment, and with

lateral fine heterotridactylous claws bearing a small, sharp projections on the ventral side.

Etymology

The name refers to the projection at ventral side of lateral, fine claws.

Record of known species

Family Euphthiracaridae Jacot, 1930

Acrotrititia aokii (Niedbala, 2000)

[Japanese name: Aoki-himehesoirekodani]

Rhysotrititia aokii Niedbala, 2000, Genus (supplement), p. 151, figs. 483–487; Shimano, 2004b, Phytophaga, 14, p. 383.

Acrotrititia aokii: Subías, 2004, Graellsia, 60, p. 45.

Material examined

One adult female (NSMT-Ac 13809): from deposit at bottom of hollow of the tree, *Cinnamomum camphora*, on 1 March 2014, Y. Nakamura leg. Specimen is deposited in the National Museum of Nature and Science, Tokyo.

Measurements: Prodorsum: length 236 μm ; notogaster : length 386 μm , height 286 μm . Body colour light brown.

Distribution: Oriental region.

Acrotrititia ardua (C. L. Koch, 1841)

[Japanese name: Himehesoirekodani]

Hoplophora ardua C. L. Koch, 1841, Deutschlands Crustaceen, Myriapoden und Arachniden, fasc. 32, t. 15,

Rhysotrititia ardua: Märkel and Meyer, 1959, Zoologischer Anzeiger, Leipzig, 163, p. 329; Shimano, 2004b, Phytophaga, 14, p. 383.

Acrotrititia ardua: Subías, 2004, Graellsia, 60, p. 45; Niedbala, 2006, Annales Zoologici (Warszawa) 56, Supplement 1, p. 19.

Material examined

One adult female (NSMT-Ac 13808) from deposit at bottom of hollow of the tree, *Cinnamomum camphora*, on 1 March 2014, Y. Nakamura leg. Specimen is deposited in the National Museum of Nature and Science, Tokyo.

Measurements: Prodorsal length 250 μm ; notogaster: length 471 μm , height 357 μm . Body colour brown.

Distribution: Semicosmopolitan.

Family Tectocephidae Grandjean, 1953 [1954]

Tectocephus cuspidentatus Knülle, 1954

[Japanese name: Toge-kuwagatadani]

Tectocephus cuspidentatus Knülle, 1954, Zoologischer Anzeiger, Leipzig, 152, pp. 293–295, figs. 13 & 14; Nakamura et al., 2010, Acarologia, 50, pp. 450 & 451.

Tectocephus minor: Sellnick, 1928, Tiewelt Mitteleuropas, 3: p. 28.

Material examined

Two adult females (NSMT-Ac 13810): from deposit at bottom of hollow of the tree, *Cinnamonum camphora*, on 1 March 2014, T. Fujikawa leg. Specimens are deposited in the National Museum of Nature and Science, Tokyo.

Measurements: Body length 271–300 µm; width 186–200 µm. Body colour light brown.

Distribution: The northern hemisphere.

Family Achipteridae Thor, 1929

Campachipteria distincta distincta (Aoki, 1959)

[Japanese name: Yahazu-tsunobanedani]

Achipteridia distincta Aoki, 1959, Annotationes Zoologicae Japonenses., 32, pp. 160 & 161, fig. 3.

Campachipteria distincta distincta: Subías, 2004, Graellsia, 60, p. 168.

Material examined

Six adult females: from deposit at bottom of hollow of the tree, *Cinnamonum camphora*, on 1 March 2014, T. Fujikawa leg. One adult female (NSMT-Ac 13811) is deposited in the National Museum of Nature and Science, Tokyo.

Measurements: Body length 357–443 µm; width 286–321 µm. Body colour dark brown.

Distribution: East Asia.

ORIBATULIDAE Thor, 1929

Oribatula (Oribatula) sakamorii Aoki, 1970

[Japanese name: Sakamori-koitadani]

Oribatula sakamorii Aoki, 1970, Bulletin of the Institute of Environmental Science and Technology, Yokohama National University, 13, pp. 581–584, figs. 1–10; Fujikawa, 1983, Edaphologia, 29, p. 1, figs. 1–3; Subías, 2004, Graellsia, 60, p. 188,

Eporibatula sakamorii: Bayartogtokh and Aoki, 2000, Zoological Science, 17, pp. 1005–1009, figs. 35–42.

Material examined

Ten adult females and one adult male: from deposit at bottom of hollow of the tree, *Cinnamonum camphora*, on 1 March 2014, T. Fujikawa leg. One adult female (NSMT-Ac 13812) is deposited in the National Museum of Nature and Science, Tokyo.

Measurements: Female, body length 429–514 µm; width 250–343 µm. Male, body length 386 µm; width 236 µm. Body colour light brown.

Distribution: East Asia.

Unassigned individuals

Supercohort Mixonomatides Grandjean, 1969

Family Epilohmanniidae Oudemans, 1916 (1917)

Epilohmannia sp.

(Figs. 11–13)

In the present paper one specimen is described as *Epilohmannia* sp. Although it may prove in the future being representatives of new species, it was not designed as new species in the present paper because only a single specimen was found.

Diagnosis

Body length 750 µm; width 393 µm. Whole body surface finely granular with transversely running very fine lines like wrinkles. Rostral tip angular in form. Lamellar setae short, just reaching insertions of interlamellar setae. Bothridial setae ss long, thick setiform, spinose distally, smooth basely. Fourteen pairs of thin, sparsely ciliate notogastral setae, five pairs of lyrifissures present. Genito-anal setal formula: 8-12-3-3; ventral neotrichy present. Epimeral setal formula: 3-1-3-3; setae sparsely ciliate. All tarsi monodactylous.

Material examined

One adult female (NSMT-Ac 13799), from deposit at



Fig. 11. *Epilohmannia* sp. Dorsal view (NSMT-Ac 13799).



Fig. 12. *Epilohmannia* sp. Ventral view (NSMT-Ac 13799).

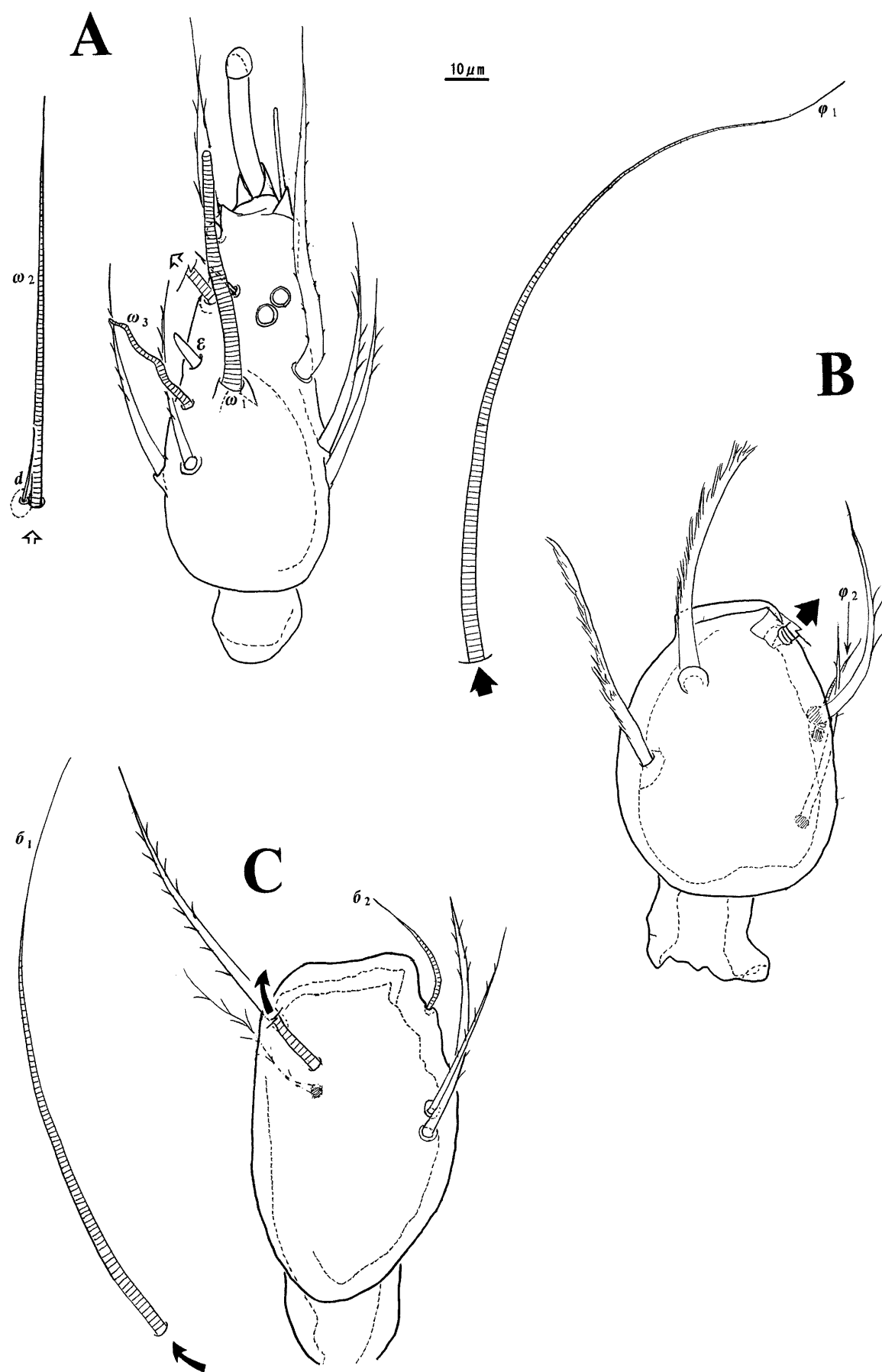


Fig. 13. *Epilohmannia* sp. (NSMT-Ac 13799). A, Solenidial region of right tarsus I; B, Right tibia I; C, Left genu I.

bottom of hollow of the tree, *Cinnamomum camphora*, on 1 March 2014, Y. Nakamura leg. The specimen is deposited in the National Museum of Nature and Science, Tokyo.

Discussion

The soil fauna from only hollow of tree has rarely been investigated. Norton and Behan-Pelletier (2009) introduced *Parhypochthonius aphidinus* reported by Grandjean, and *Micreremus brevipes* by Wunderle. In Japan, *Caenosamerus shirakamiensis* Fujikawa, 2002 has been recorded from *Fagus crenata*. *C. shirakamiensis* was regarded as a synonym of *C. spatiosus* Aoki, 1977 (Ohkubo *et al.*, 2015), however, it is considered to be a different species in this paper by presence or absence of notogastral rectangle formatations and hollows on humeral regions. It would be interesting to know in future whether the present oribatid fauna, especially those with remarkable characters such as squamose tutorium, porose areas A_1 and A_2 with half light and half dark, and lyrifissure situated longitudinally on tarsus I, depends on existing in camphor tree known to have camphor ($C_{10}H_{16}O$).

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摘要

藤川徳子（〒868-0423 熊本県球磨郡あさぎり町上南1346番地の3）：南日本球磨地方のクスの木の樹洞からの3新種を含むササラダニ相。

熊本県球磨地方にある八代神社には樹齢800年以上の楠木が存在する。その根元の樹洞から、9種類のササラダニ類を採集した。そのうちの3種類は、ミョウケンツブダニ *Medioxyoppia trionus* n. sp., ヤツシロマルコソデダニ *Peloribates (Peloribates) yatsushiroensis* n. sp. そして ケズメコバネダニ *Ceratozetes erupentus* n. sp. と命名し、新種として記載した。他の5種類は既知種 アオキヒメヘソイレコダニ、ヒメヘソイレコダニ、トゲクワガタダニ、ヤハズツノバネダニそしてサカモリコイタダニであった。もう1種類は新種としての特徴を持つが1個体だけの採集であったため、ハラミゾダニ属の一種として記載した。

キーワード：コバネダニ属、ハラミゾダニ属の一種、マルコ

ソデダニ属、南日本、ノゲツブダニ属

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