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# The Japanese Species of the Genus *Acerentulus* (Protura)

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**Abstract** The Japanese members of the proturan genus *Acerentulus* comprise three species and a subspecies, *A. kisonis* IMADATÉ, *A. keikoae* sp. nov. with subsp. *capillatus* nov., and *A. omoi* sp. nov. The new forms are described, and supplementary notes are given on *A. kisonis*. A key is provided to all of them.

The genus *Acerentulus* BERLESE is a representative assemblage of Palearctic acerentomids, being characterized by such features as the strong striae on the striate band of abdomen VIII, the presence of a terminal tuft of setae on the labial palpus, three setae, long subapical, shorter apical and very short median apical, on the second and third abdominal appendages, claviform *tI* sensilla on the foretarsus, simple structure of the canal of maxillary gland, the presence of two pairs of dorsal setae, A 2 and 4, on metathorax and of two posterior setae on abd. sternite VIII. It comprises twenty-seven species mostly known from Europe and North Africa, though relatively a few species are recorded from North and South Americas, Oceania and Asia.

Through my survey on the Japanese proturan fauna for these thirty years, records of the genus *Acerentulus* have been relatively rare as compared with other acerentomid genera, that is, the members of this genus have been found only at fifty-four collecting sites in temperate forests of the main island, Honshu, out of more than 1,800 sites for all the acerentomids recorded in the Japanese Islands.

In the present paper, I am going to deal with the taxonomic arrangement of the Japanese members of *Acerentulus* on the basis of my collection mentioned above. A close examination reveals that it comprises three species and one subspecies. One of them, *Acerentulus kisonis* was already known, while the others are new to science as will be described in the following lines.

The type specimens designated in the present paper are to be deposited in the collection of the National Science Museum (Nat. Hist.), Tokyo.

As to the data on the collecting sites such as vegetation, altitude, warmth index (month-degree), coexisting proturan species, etc. were given in IMADATÉ (1974), IMADATÉ and HARADA (1983, 1987), IMADATÉ and KINJO (1985) and IMADATÉ and NAKAMURA (in press).

I wish herewith to express my cordial thanks to Dr. A. SZEPTYCKI for his helpful advice in the course of my taxonomic study, to Professors J. AOKI, S. CHIBA, Drs. H. HARADA, K. ISHII, Mrs. N. KINJO, Professor K. MATSUOKA, Mr. K. MURAKAMI, Dr. Y. MURAKAMI, Mr. O. NAKAMURA, Drs. K. NEMOTO, K. NIIJIMA,

Messrs. J. OHNISHI, K. SATÔ, Dr. K. SÔMA, Mr. Y. SUMA, Professor H. TAMURA, Dr. S. TANAKA and Mr. S. WATARI for their kind co-operation, and to Dr. Shun-Ichi UÉNO for kindly reading the original manuscript and giving valuable criticism.

## *Acerentulus keikoae* sp. nov.

(Figs. 1–6)

*Specimens examined.* 1 ♀, 1 LII, Akasawa, Katsura, Ibaraki Pref., 1–VII–1977, collected by Keiko NIIJIMA; 1 ♀, 1 p♂, 1 mj, ditto, 3–VII–1977, collected by K. NIIJIMA; 1 ♂, ditto, 13–VII–1977, collected by K. NIIJIMA; 5 ♂, 10 ♀, 6 p♂, 14 mj, 3 LII, 3 LI, ditto, 9–VIII–1977, collected by K. NIIJIMA; 1 ♀, ditto, 9–VI–1978, collected by K. NIIJIMA; 1 LII, ditto, 12–VI–1978, collected by K. NIIJIMA; 1 ♀, 1 p♂, 2 LI, ditto, 27–VI–1978, collected by K. NIIJIMA; 2 ♀, 1 LI, ditto, 7–VIII–1978, collected by K. NIIJIMA; 1 ♀, 1 LII, ditto, 5–VI–1979, collected by K. NIIJIMA; 3 ♂, 1 ♀, 2 LII, ditto, 2–VIII–1979, collected by K. NIIJIMA; 1 ♀, 1 LI, ditto, 23–X–1979, collected by K. NIIJIMA; 1 mj, Kitayama, Katsura, Ibaraki Pref., 10–VIII–1977, collected by K. NIIJIMA; 1 ♀, ditto, 8–VIII–1978, collected by K. NIIJIMA; 3 LII, ditto, 22–X–1979, collected by K. NIIJIMA; 1 ♂, Mt. Nishikanasa-yama, Kinsagô, Ibaraki Pref., 5–VI–1979, collected by Hiroshi HARADA; 1 ♂, 1 ♀, Fukuoka, Utsunomiya, Tochigi Pref., 4–VI–1979, collected by H. HARADA; 26 ♂,

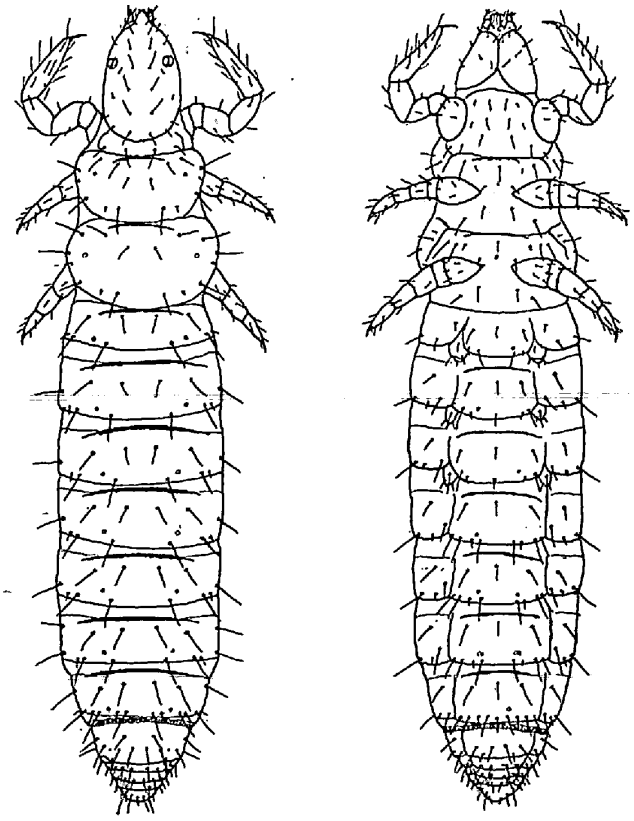

Fig. 1. *Acerentulus keikoae* sp. nov.; dorsal (left) and ventral (right) views.

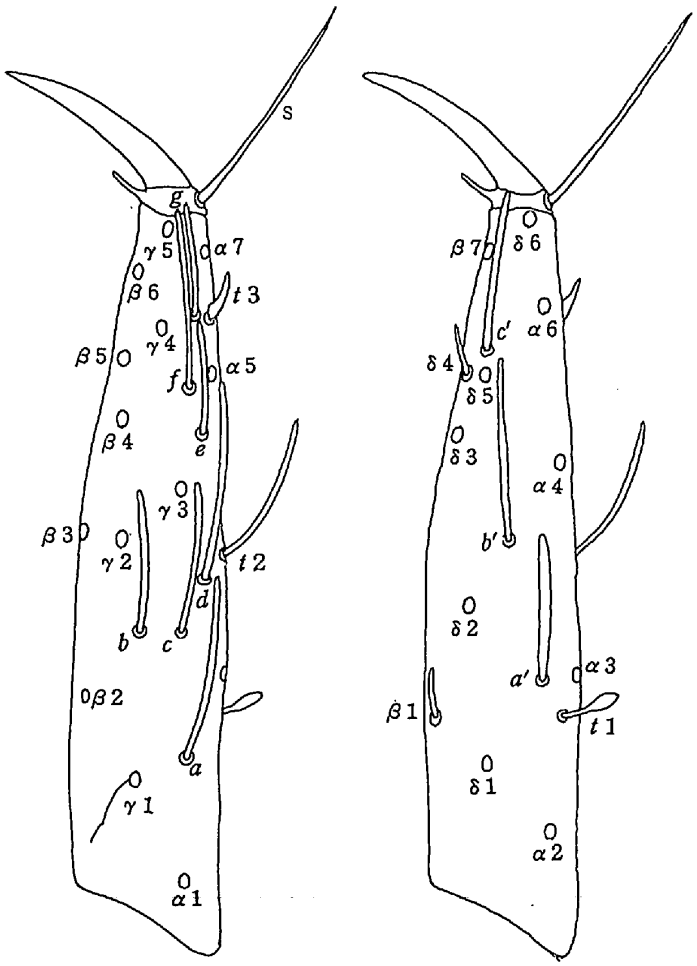


Fig. 2. *Acerentulus keikoae* sp. nov.; foretarsus, exterior (left) and interior (right) views. S, S-shaped seta.

34 ♀, 3 p♂, 33 mj, 29 LII, 10 LI, Tokorono, Nikkô, Tochigi Pref., 29–X–1982, collected by Kiyoshi ISHII; 17 ♂, 29 ♀, 3 p♂, 7 mj, 15 LII, Kirifuri, Nikkô, Tochigi Pref., 15–X–1982, collected by K. ISHII; 1 mj, Mt. Nakimushi-yama, Nikkô, Tochigi Pref., 29–X–1982, collected by K. ISHII; 1 p♂, 1 mj, Akanuma, Nikkô, Tochigi Pref., 2–XI–1982, collected by K. ISHII; 4 ♂, 2 ♀, 2 LII, 1 LI, Yunishikawa, Kuriyana, Tochigi Pref., 19–X–1980, collected by Shingo TANAKA; 1♂, 1 LII, Hashitatezawa, Kuriyama, Tochigi Pref., 19–X–1980, collected by S. TANAKA; 1 LII, Hitotsuishi, Kuriyama, Tochigi Pref., 31–X–1980, collected by Yutaka MURAKAMI; 3 ♂, 5 ♀, 2 mj, 2 LII, 2 LI, Nishikawa, Kuriyama, Tochigi Pref., 31–X–1980, collected by Y. MURAKAMI; 1 ♂, 1 p♂, 2 mj, Hirasawa, Kuriyama, Tochigi Pref., 31–X–1980, collected by Y. MURAKAMI; 2 ♂, 1 LII, Ikari, Fujiwara, Tochigi Pref., 14–XI–1980, collected by Gentaro IMADATÉ; 1 LII, Sannô-tôge, Tajima, Fukushima Pref., 14–XI–1980, collected by G. IMADATÉ; 3 ♂, Shirasaka, Shirakawa, Fukushima Pref., 8–XI–1981, collected by Keisuke NEMOTO.

Table 1. Chaetotaxy of *Acerentulus keikoae* sp. nov.

| | Larva I | | Larva II | | Maturus junior | | Imago | |
|---|---|---|---|---|---|---|---|---|
| | Formula | Primary setae | Formula | Secondary setae | Formula | Tertiary setae | Formula | Complementary setae |
| (Dorsal) | | | | | | | | |
| Thorax I | 4 | | 4 | | 4 | | 4 | |
| II–III | $\frac{4}{8}$ | A 2, M<br>P 1, 2, 3, 4 | $\frac{6}{12}$ | A 4<br>P 1a, 5 | $\frac{6}{16}$ | P 2a, 5a | $\frac{6}{16}$ | |
| Abdomen I | $\frac{0}{8}$ | P 1, 2, 3, 5 | $\frac{0}{10}$ | P 2a | $\frac{6}{10}$ | A 1, 2, 5 | $\frac{6}{10}$ | |
| II–V | $\frac{0}{10}$ | P 1, 2, 3, 4, 5 | $\frac{0}{14}$ | P 2a, 4a | $\frac{6}{14}$ | A 1, 2, 5 | $\frac{6}{14}$ | |
| VI | $\frac{0}{10}$ | P 1, 2, 3, 4, 5 | $\frac{0}{14}$ | P 2a, 4a | $\frac{8}{14}$ | A 1, 2, 4, 5 | $\frac{8}{14}$ | |
| VII | $\frac{0}{10}$ | P 1, 2, 3, 4, 5 | $\frac{0}{14}$ | P 2a, 4a | $\frac{8}{18}$ | A 1, 2, 4, 5<br>P 1a, 3a | $\frac{8}{18}$ | |
| VIII | $\frac{0–6}{6}$ | M 2, 3, 4<br>P 2, 3, 5 | $\frac{2–6}{8}$ | A 3<br>P 4 | $\frac{6–7}{8}$ | A 1, 5, M c | $\frac{6–8}{8}$ | M 1 (— M c) |
| IX | | | 8 | 1, 3, 4, 5 | 12 | 2, 3a | 12 | |
| X | | | | | 8 | 1, 3, 4, 5 | 12 | 2, 3a |
| XI | | | | | 6 | | 6 | |
| Telson | 9 | | 9 | | 9 | | 9 | |

Table 1 (Continued).

| | Larva I | | Larva II | | Maturus junior | | Imago | |
|---|---|---|---|---|---|---|---|---|
| | Formula | Primary setae | Formula | Secondary setae | Formula | Tertiary setae | Formula | Complementary setae |
| (Ventral) | | | | | | | | |
| Thorax I | 2–2 / 4 | A 1, M 1<br>P 1, 2 | 2–2 / 4 | | 4–4 / 6 | A 2, M 2<br>P 3 | 4–4 / 6 | |
| II | 3–2 / 2 | A c, 3, M<br>P 1 | 5–2 / 2 | A 2 | 5–2 / 4 | P 2 | 5–2 / 4 | |
| III | 3–2 / 2 | A c, 3, M<br>P 1 | 5–2 / 2 | A 2 | 7–2 / 4 | A 4<br>P 2 | 7–2 / 4 | |
| Abdomen I | 0 / 2 | P 1 | 3 / 2 | A c, 2 | 3 / 4 | P 2 | 3 / 4 | |
| II–III | 0 / 3 | P c, 3 | 1 / 5 | A c<br>P 2 | 3 / 5 | A 2 | 3 / 5 | |
| IV–VI | 1 / 4 | A c<br>P 2, 3 | 1 / 6 | P 1 | 3 / 8 | A 2<br>P 1a | 3 / 8 | |
| VII | 1 / 4 | A c<br>P 2, 3 | 1 / 6 | P 1 | 3 / 8 | A 2<br>P 1a | 3 / 9 | P c |
| VIII | 2 / 0 | 2 | 4 / 0 | 1 | 4 / 2 | P | 4 / 2 | |
| IX | | | 4 | | 4 | | 4 | |
| X | | | | | 4 | | 4 | |
| XI | | | | | 2 | 2 | 6 | 1, 3 |
| Telson | 8 | A, P 1, 2, 3 | 8 | | 6 | –A | 6 | |

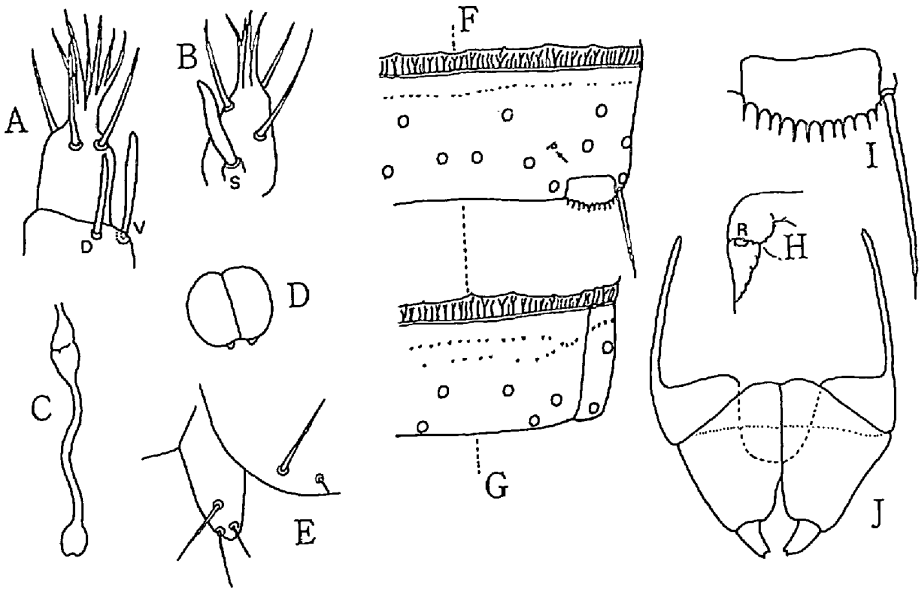


Fig. 3. *Acerentulus keikoae* sp. nov. —— A. Maxillary palpus; D, dorsal sensilla; V, ventral sensilla. B. Labial palpus; S, sensilla. C. Canal of maxillary gland. D. Pseudoculus. E. Abdominal appendage III. F. Abdomen VIII, dorsal view. Arrow shows integumental pore. G. Same, ventral view. H. Anteropleural part of abdominal tergite VII; R, rotary wheel. I. Comb on abd. terg. VIII. J. Female squma genitalis.

Body length 1,160–1,450 $\mu$m.

Head oval, 160–170 $\mu$m in dorsal view. Labrum slightly protruded, 10–12 $\mu$m in length. Additional setae absent (Fig. 6A). Maxillary palpus with two slender sensillae on penultimate segment, dorsal sensilla shorter and thinner than the ventral one (Fig. 3A). Labial palpus with a tuft of setae apically, and with a broad sensilla basally. Pseudoculus circular, with two small lids, PR=15–16. Canal of maxillary gland simple, bifid proximally (Fig. 3C).

Foretarsus (Fig. 2) 95–112 $\mu$m, claw slender, TR=3.1–3.4; empodium short, EU=0.11–0.13; S-shaped seta longer than the claw. Dorsal sensilla *t1* club-shaped, BS=0.35–0.41; *t2* thin; *t3* relatively long, lanceolate. Exterior sensilla *a* short, its apex slightly surpassing the base of *d*; *b* short, subequal to *c* in length, and at the same level as *c*, the apices of *b* and *c* reaching the base of $\gamma$ 3; *d* nearly reaching the base of *f*; *f* situated at about middle between *e* and *g*. Interior sensilla *a'* broad, reaching the base of *b'*; *b'* thin, at the same level as *t 2*, its apex not surpassing the base of *c'*; *c'* thin, surpassing the tarsus. Ventral seta $\beta$ 1 and interior seta $\delta$ 4 short, sensilla-like, about a half of $\delta$ 5 in length.

Chaetotaxy as shown in Table 1. Thoraces II–III each with two pairs of dorsal anterior setae, A 2 and 4. Abdominal tergites I–V each with three pairs of anterior setae, A 1, 2 and 5; terg. VI–VII with A 1, 2, 4 and 5; sternite VIII with two posterior setae. On abd. terg. I–VI P 1a absent; on terg. II–VI P 3 situated a little anterior to the other posterior setae. Dorsal P 1a and 2a on th. II–III and

P 2a on abd. terg. I extremely short, club-shaped, about 1 μm in length; dorsal P 5a on th. II–III minute, rudimentary; ventral A 2 and M 2 on th. I, ventral A 2 on th. II–III, dorsal P 5 on th. III, A 5 on abd. terg. I, P 2a and 4a on terg. II–VI, P 2 on stern. I–III, and P 1a on stern. IV–VI short and blunt, sensilla-like, about 4 μm, less than one-eighth the principal setae in length; P 1a, 2a, 3a and 4a on terg. VII and P 1a on stern. VI pointed and seta-like, about 7 μm, more than one-fifth the principal setae in length; on stern. VII, P c long, subequal to P 1 in length and shape. Dorsal P 1 and 2 on th. III 19–21 μm and 30–32 μm; 4 and 5 on abd. terg. IX 35 μm and 33–34 μm; 4 and 5 on terg. X 35–37 μm and 33–34 μm; P c and P 1 on stern. VII 22–26 μm and 23–27 μm; 1 and 2 on stern. IX 30–31 μm and 37 μm; 1 and 2 on stern. X 22 μm and 37 μm.

Integumental pores distinct. Th. II–III with a pair of dorsal pores posterior to A 4, and a single ventral pore posterior to A c; abd. terg. I–VI with a pair of pores anterolateral to P 1; terg. VII with a pair of pores anterolateral to P 1a; terg. VIII with a pair of pores at about middle between M 2 and M 3; stern. I with a single pore anterior to P c; stern. II–III with a single pore anterior to P c or one of P 1; stern. IV and VII with a single pore anterior to one of P 1; stern. V–VI with a pair of pores anterior to P 1. Pores on stern. VI usually doubled.

Abdominal appendages II–III each with three setae, the subapical one strong and the longest, the median apical one delicate (Fig. 3E). Small rotary wheels present on abd. IV–VII. On abd. VIII, striate band well developed, with distinct striae; comb consisting of twelve teeth of equal size, with posterior margin gently curved; an irregular row of minute granules visible a little distal to the striate band. Female squama genitalis with apically bipartite acrostylus (Fig. 3J).

Holotype: ♂, allotype: ♀, Akasawa, Katsura, Ibaraki Pref., 9-VIII-1977, collected by K. NIIJIMA.

*Preimago*. Integument well sclerotized. With the exception of genitalic ones, all the specific features are similar to those of the adults. Foretarsus 91–94 μm.

*Maturus junior*. On abd. terg. VIII, a central seta M c is found instead of M 1, and P c on stern. VII is lacking. Length of body 940–1,050 μm, foretarsus 75–89 μm, TR=3.2–3.4, BS=0.39–0.41.

*Larva II*. Foretarsal sensilla *b'* is absent. Ventral pores on th. III and those on abd. stern. I–III are invisible. Length of body 680–940 μm, foretarsus 68–77 μm, TR=3.0–3.1, BS=0.32–0.38.

*Larva I* (Figs. 4–5). Foretarsal sensilla *c'* is missing, and integumental pores present on abd. terg. IV–VIII only. Length of body 590–740 μm, foretarsus 56–61 μm, TR=3.0, BS=0.33–0.39.

*Notes*. Abnormalities in chaetotaxy are relatively rare. In one female from Nishikawa, the interior sensilla *b'* of the left foretarsus is distally displaced, being at about the same level as $\alpha 4$, though that of the right is normally situated at about the same level as *t 2*. In one male from Tokorono, asymmetric and extra occurrence of foretarsal sensillae and body setae are observed. They are: double *a* on

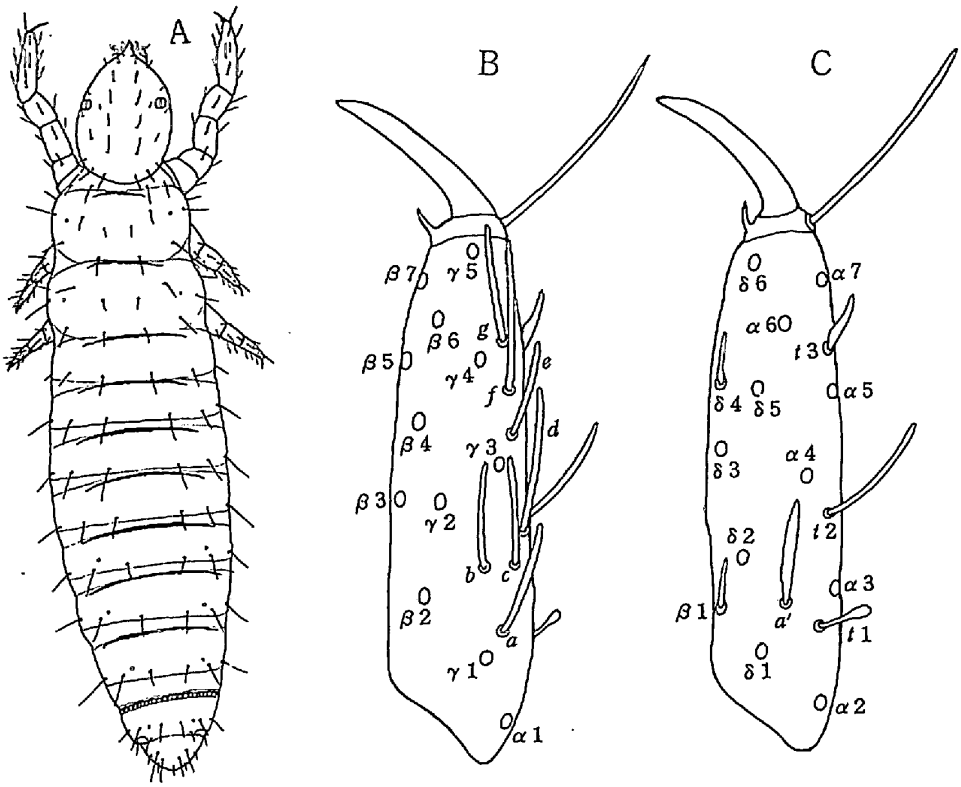


Fig. 4. *Acerentulus keikoae* sp. nov., larva I. —— A. Dorsal view. B. Foretarsus, exterior view. C. Same, interior view.

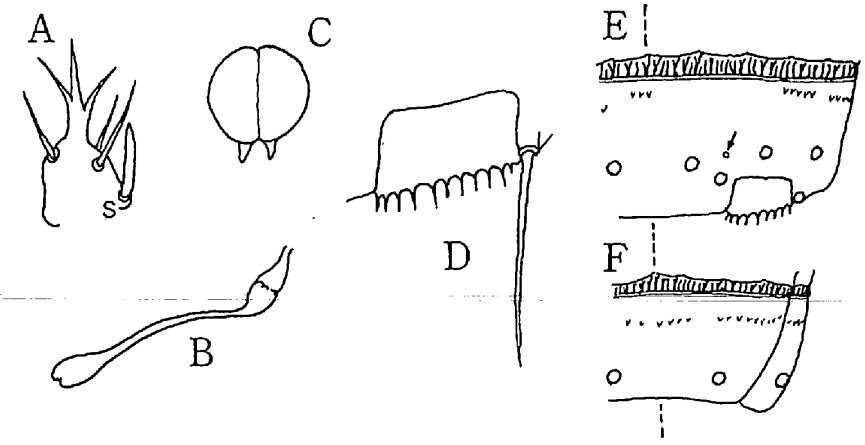


Fig. 5. *Acerentulus keikoae* sp. nov., larva I. —— A. Labial palpus; S, sensilla. B. Canal of maxillary gland. C. Pseudoculus. D. Comb on abd. terg. VIII. E. Abdomen VIII, dorsal view. Arrow shows integumental pore. F. Same, ventral view.

the left foretarsus, double *c* and *b'* on the right, double P 2a on the left side of abd. terg. III, IV, V and VII, double P 1a on both sides of terg. VII, double P 2 on the right side of terg. VIII, double 1 and 2 on the right side of terg. IX, double A c on stern. IV, double P 2 on the right side of stern. VII and double P on the right side of

stern. VIII. One male from Ikari has double P 2a on the right side of terg. V. One female from Akasawa has four anterior setae on stern. VI, a different female from the same locality has no P c on stern. VII. In one male from Shirasaka, M c is present on terg. VIII instead of M c. On stern. VIII, asymmetric absence of P is found in one female from Akasawa and one maturus junior from Tokorono. One larva II from Ikari has no ventral A c on th. III.

The present new species is named in honour of Dr. Keiko NIIJIMA, Forestry and Forest Products Research Institute, Tsukuba, who kindly submitted valuable materials from various places in Asia, including the type specimens of this new species, to my inspection for these twenty years.

*Acerentulus keikoae* sp. nov. is characterized by the position of foretarsal sensilla *b'*, which is situated at the same level as *t 2* and strikingly proximal to $\alpha$4, as well as by the relative length of sensillae *a*, *b* and *c*, viz., *a* is short with its apex slightly surpassing the base of *d*, *b* and *c* subequal in length to each other and their apices reaching the base of $\gamma$ 3. Thus it is similar to *A. cunhai* CONDÉ from Europe, but is discriminated by the relative length of foretarsal sensilla *a'* and *c'*, by the shape of the acrostylus of female squama genitalis and by the presence of P c on abdominal sternite VII.

*Distribution.* Japan (E. Honshu). The habitat of this form seems to lie in temperate forests, consisting of deciduous broadleaved trees and evergreen conifers, in the eastern part of Honshu. The main range of the warmth index is between 65 and 100 month-degrees, and the young larvae were usually found from June to November. Coexistence with other species of *Acerentulus* was known at only a single one of the 17 collecting sites, that is, with *A. kisonis* on the Sannô-tôge.

### *Acerentulus keikoae capillatus* subsp. nov.

(Fig. 6 B–D)

*Specimens examined.* 1 ♀, Hachiken, Uji, Kyoto Pref., 21–X–1975, collected by K. NIIJIMA; 2 ♀, 1 mj, Ishimaki, Toyohashi, Aichi Pref., 20–VII–1977, collected by K. NIIJIMA; 1 ♂, ditto, 4–X–1977, collected by K. NIIJIMA; 2 LII, 1 LI, ditto, 8–XII–1977, collected by K. NIIJIMA; 1 ♀, ditto, 14–VII–1978, collected by K. NIIJIMA; 1 ♀, Iwasaki, Toyohashi, Aichi Pref., 27–V–1977, collected by K. NIIJIMA; 1 p♂, 1 mj, ditto, 17–VI–1977, collected by K. NIIJIMA; 1 mj, ditto, 4–X–1977, collected by K. NIIJIMA; 1 LII, ditto, 22–VI–1981, collected by K. NIIJIMA.

The present new subspecies is closely similar to the nominotypical form, *A. keikoae keikoae*, with the exception of the presence of the additional setae on head as well as for the relative length of foretarsal sensilla *e*, through all the stages from larva I to imago. Although the difference between the present and nominotypical forms is not so wide, their distributional ranges are geographically separated from each other. The former is found in the central part of Honshu, while the latter at the Pacific side of eastern Honshu.

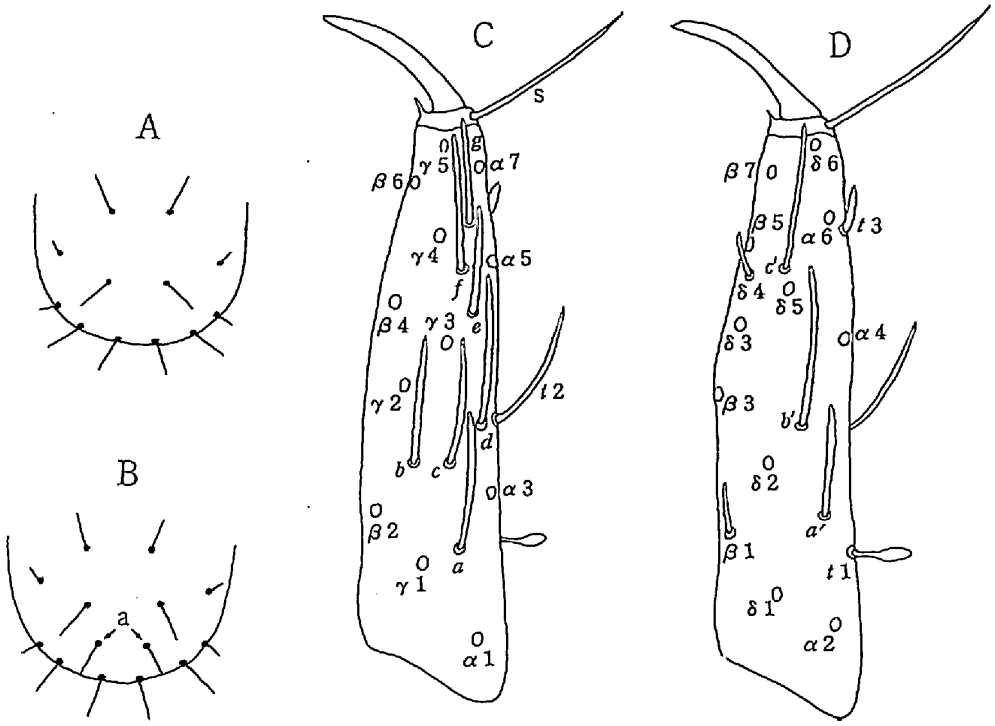


Fig. 6. —— A. *Acerentulus keikoae keikoae* sp. nov.; chaetotaxy of the posterior part of head. —— B–D. *Acerentulus keikoae capillatus* subsp. nov. B. Chaetotaxy of the posterior part of head; a, additional setae. C. Foretarsus, exterior view. S, S-shaped seta. D. Same, ventral view.

Body length 1,060–1,480 μm. Head with additional setae (Fig. 6 B). The position and shape of foretarsal sensillae are similar to those of the nominotypical form, but the exterior sensilla *e* is relatively long, the apex evidently surpassing the base of *g*. Foretarsus (Fig. 6 C–D) 104–116 μm (86 μm in preimago); TR=3.4–3.5; BS=0.40–0.45.

Such fundamental characteristics as thoracic and abdominal chaetotaxy, integumental pores, pectinated structures, etc. are not different from those of the nominotypical form through all the stages from larva I to imago.

Holotype. ♀, Ishimaki, Toyohashi, Aichi Pref., 20–VII–1977, collected by K. NIIJIMA.

*Maturus junior*. Length of body 780–840 μm, foretarsus 85–90 μm, TR=3.4–3.5, BS=0.41–0.43.

*Larva II*. Length of body 660–840 μm, foretarsus 68–73 μm.

*Larva I*. Length of body 620–700 μm, foretarsus 57–58 μm.

*Notes*. Abnormalities in chaetotaxy are found in only the specimens from Ishimaki, as follows: One larva II lacks one of P 2 on abd. stern. II, and one maturus junior has M 1, instead of M c, on terg. VIII. On terg. VI, P 3 is displaced posteriorly at the same level as the other posterior principal setae and three posterior

setae are present on stern. VIII in one female.

The subspecific name, *capillatus*, is derived from the presence of additional setae on the head.

*Distribution.* Japan (C. Honshu). The habitat of this subspecies is warm temperate forests consisting of such evergreen conifers as *Pinus densiflora* and *P. thunbergii*, in the central part of Honshu. The range of the warmth index is between 116 and 121. No coexistence with other forms of *Acerentulus* was found at any collecting sites. It is noticeable that such young ones as larvae I and II were collected not only in June, but also in December.

## *Acerentulus omoi* sp. nov.

(Figs. 7–10)

*Specimens examined.* 1 mj, Môtsû, Hiraizumi, Iwate Pref., 29–V–1980, collected by H. HARADA; 1 ♂, 3 ♀, 1 p♂, 1 mj, Matsuyashiki, Morioka, Iwate Pref. 27–IX–1980, collected by Kiyomasa MURAKAMI; 1 ♀, 1 p♂, Mt. Iwate-san, 1,720 m, Takisawa, Iwate Pref., 27–VI–1985, collected by Osami NAKAMURA; 1 ♂, 3 ♀, 2 mj, 1 LI, ditto, 1,500 m, 28–VI–1985, collected by O. NAKAMURA; 3 ♂, 3 ♀, 2 LI, ditto, 1,280 m, 28–VI–1985, collected by O. NAKAMURA; 1 LI, ditto, 1,080 m, 28–VI–1985, collected by O. NAKAMURA; 2 ♂, 2 mj, Gandou, Tamayama, Iwate Pref., 15–VIII–1984, collected by Noriko KINJO; 1 ♀, Jôhôji, Jôhôji, Iwate Pref., 14–XI–1976, collected by G. IMADATÉ; 1 ♀, Yuze, Hachimantai, Akita Pref., 11–X–1971, collected by G. IMADATÉ; 1 mj, Takkomori, Hinai, Akita Pref., 9–XI–1984, collected by G. IMADATÉ; 1 ♀, 1 mj, Mt. Iwaki-san, 500 m, Iwaki, Aomori Pref., 8–X–1970,

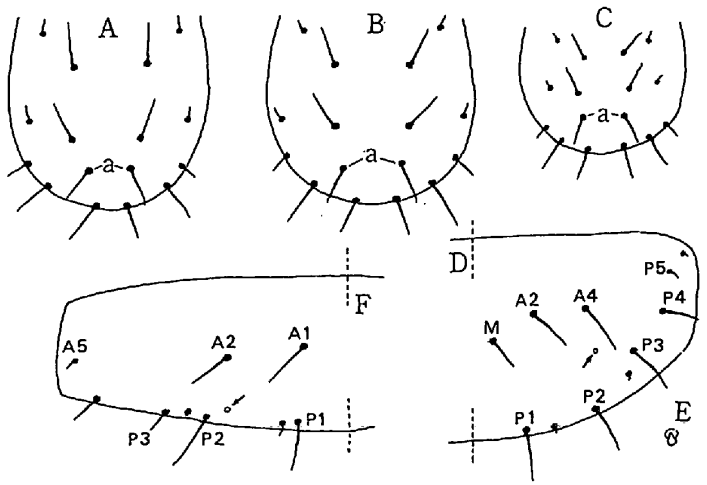


Fig. 7. —— A. *Acerentulus kisonis* IMADATÉ; chaetotaxy of the posterior part of head; a, additional setae. —— B–F. *Acerentulus omoi* sp. nov. B. Chaetotaxy of the posterior part of head; a, additional setae. C. Same, larva I. D. Dorsal chaetotaxy of thorax III. Arrow shows integumental pore. E. Dorsal P 1a on th. III. F. Chaetotaxy of abdominal tergite I. Arrow shows integumental pore.

Table 2. Chaetotaxy of *Acerentulus omoi* sp. nov.

| | Larva I | | Maturus junior | | Imago | |
|---|---|---|---|---|---|---|
| | Formula | Primary setae | Formula | Secondary and tertiary setae | Formula | Complementary setae |
| (Dorsal) | | | | | | |
| Thorax I | 4 | | 4 | | 4 | |
| II–III | 4/8 | A 2, M<br>P 1, 2, 3, 4 | 6/16 | A 4<br>P 1a, 2a, 5, 5a | 6/16 | |
| Abdomen I | 0/8 | P 1, 2, 3, 5 | 6/12 | A 1, 2, 5<br>P 1a, 2a | 6/12 | |
| II–V | 0/10 | P 1, 2, 3, 4, 5 | 6/16 | A 1, 2, 5<br>P 1a, 2a, 4a | 6/16 | |
| VI | 0/10 | P 1, 2, 3, 4, 5 | 6/16 | A 1, 2, 5<br>P 1a, 2a, 4a | 8/16 | A 4 |
| VII | 0/10 | P 1, 2, 3, 4, 5 | 8/18 | A 1, 2, 4, 5<br>P 1a, 2a, 3a, 4a | 8/18 | |
| VIII | 0–6/6 | M 2, 3, 4<br>P 2, 3, 5 | 6–7/8 | A 1, 3, 5, M c<br>P 4 | 6–8/8 | M 1 (−M c) |
| IX | | | 12 | 1, 2, 3, 3a, 4, 5 | 12 | |
| X | | | 8 | 1, 3, 4, 5 | 12 | 2, 3a |
| XI | | | 6 | | 6 | |
| Telson | 9 | | 9 | | 9 | |

Table 2 (Continued).

| | Larva I | | Maturus junior | | Imago | |
|---|---|---|---|---|---|---|
| | Formula | Primary setae | Formula | Secondary and tertiary setae | Formula | Complementary setae |
| (Ventral) | | | | | | |
| Thorax I | 2–2 / 4 | A 1, M 1<br>P 1, 2 | 4–4 / 6 | A 2, M 2<br>P 3 | 4–4 / 6 | |
| II | 3–2 / 2 | A c, 3, M<br>P 1 | 5–2 / 4 | A 2<br>P 2 | 5–2 / 4 | |
| III | 3–2 / 2 | A c, 3, M<br>P 1 | 7–2 / 4 | A 2, 4<br>P 2 | 7–2 / 4 | |
| Abdomen I | 0 / 2 | P 1 | 3 / 2(4) | A c, 2<br>(P 2) | 3 / 4 | P 2 |
| II–III | 0 / 3 | P c, 3 | 3 / 5 | A c, 2<br>P 2 | 3 / 5 | |
| IV–VI | 1 / 4 | A c<br>P 2, 3 | 3 / 8 | A 2<br>P 1, 1a | 3 / 8 | |
| VII | 1 / 4 | A c<br>P 2, 3 | 3 / 8(9) | A 2<br>P (c), 1, 1a | 3 / 9 | P c |
| VIII | 2 / 0 | 2 | 4 / 2 | 1<br>P | 4 / 2 | |
| IX–X | | | 4 | | 4 | |
| XI | | | 2 | 2 | 6 | 1, 3 |
| Telson | 8 | A, P 1, 2, 3 | 6 | (−A) | 6 | |

collecteds by Shigeo CHIBA; 1 ♀, 1 p♂, Futamata, Imabetsu, Aomori Pref., 16-VI-1974, collected by Hiroshi TAMURA.

Body length 1,030–1,410 μm.

Head oval, 145–158 μm in dorsal view. Labrum slightly protruded, 12–14 μm in length. Additional setae present (Fig. 7 B–C). Maxillary palpus with two slender sensillae on penultimate segment, dorsal sensilla thinner than the ventral one. Labial palpus with a tuft of setae apically, and with a broad sensilla basally (Fig. 8 D). Pseudoculus circular, with two small lids, PR=16–17. Canal of maxillary gland simple, bifid proximally.

Foretarsus (Fig. 9) 103–110 μm, claw slender, TR=3.5–3.7; empodium short, EU=0.14–0.18; S-shaped seta longer than the claw. Dorsal sensilla *t 1* club-shaped, BS=0.37–0.43; *t 2* thin; *t 3* relatively long, lanceolate. Exterior sensilla *a* short, its apex slightly surpassing the base of *d*; *b* medium-sized, subequal to *c* in length, and at the same level as *c*, the apices of *b* and *c* reaching the base of *e*; *d* moderately surpassing the base of *f*; *f* situated a little nearer to *e* than to *g*; *g* surpassing the tarsus. Interior sensilla *a'* a little broad, its apex not reaching the base of *b'*; *b'* thin, at about the same level as $\alpha$4, its apex evidently surpassing the base of *c'*; *c'* thin, shorter than *b'*. Ventral seta $\beta$1 and interior seta $\delta$4 short, sensilla-like, less than a half of $\delta$5 in length.

Chaetotaxy (Table 2) as in *A. kisonis*. On abd. terg. I–VI, P 1a present. Dorsal P 1a and 2a on th. II–III and P 2a on abd. terg. I extremely short, club-shaped, less than 2 μm in length; dorsal P 5a on th. II–III minute, rudimentary; ventral A 2, M 2 on th. I, ventral A 2 on th. II–III, dorsal P 5 on th. III, A 5 and P 1a on abd. terg. I, P 1a, 2a and 4a on terg. II–VI, P 2 on stern. I–III, and P 1a on stern. IV–VI short and blunt, sensilla-like, about 4 μm, less than one-eighth the principal setae in length; P 1a, 2a, 3a and 4a on terg. VII, and P c and 1a on stern. VII relatively long, pointed and seta-like, about 10 μm, more than one-fourth the principal setae in length. Dorsal P 1 and 2 on th. III 24–30 μm and 36–42 μm; 4 and 5 on abd. terg. IX 32–33 μm and 35 μm; 4 and 5 on terg. X 37–41 μm and 31–32 μm; P c and 1 on stern. VII 10 μm and 26–30 μm; 1 and 2 on stern. IX 19–22 μm and 38 μm; 1 and 2 on stern. X 16–18 μm and 38–40 μm.

The distribution of integumental pores is similar to that in *A. keikoae*, but abd. stern. V bears only a single pore anterior to one of P 1 and stern. VII bears a single pore anterior to P c or one of P 1. Usually, one of the pores on stern. VI is doubled and no pore is visible on stern. IV.

Abdominal appendages II–III each with three setae, the subapical one strong and the longest, the median apical one delicate. Small rotary wheels present on abd. V–VII. On abd. VIII, striate band well developed, with distinct striae; comb consisting of about fourteen small teeth with posterior margin moderately curved; an irregular row of minute granules visible a little distal to the striate band. Female squama genitalis with apically pointed acrostylus (Fig. 8 I).

Holotype: ♂, Gandou, Tamayama, Iwate Pref., 15-VIII-1984, collected by

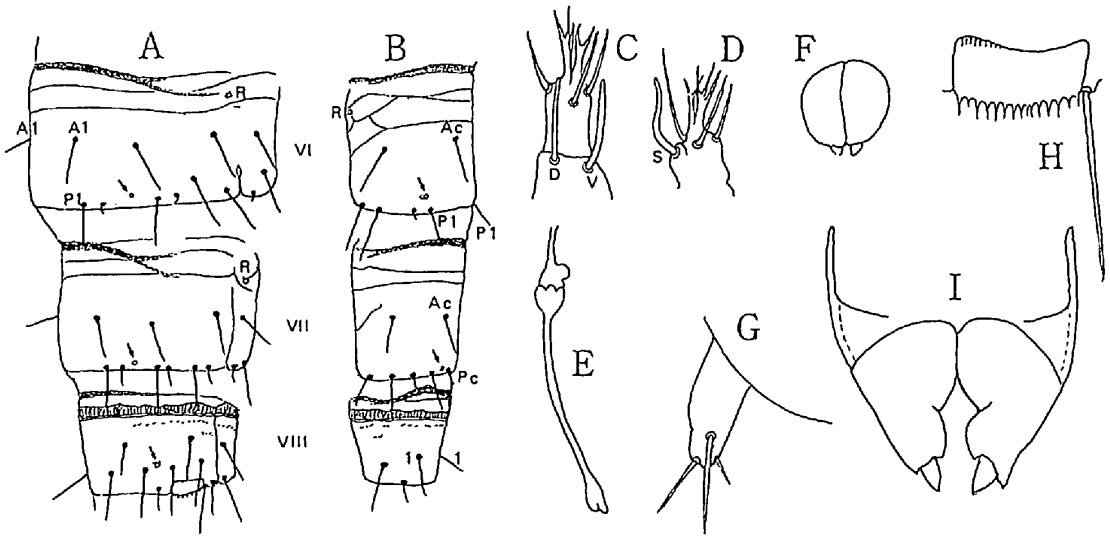


Fig. 8. *Acerentulus omoi* sp. nov. —— A. Chaetotaxy of abdominal tergites VI–VIII; R, rotary wheel. Arrows show integumental pores. B. Chaetotaxy of abd. sternites VI–VIII. C. Maxillary palpus; D, dorsal sensilla; V, ventral sensilla. D. Labial palpus; S, sensilla. E. Canal of maxillary gland. F. Pseudoculus. G. Abdominal appendages III. H. Comb on abd. terg. VIII. I. Female squama genitalis.

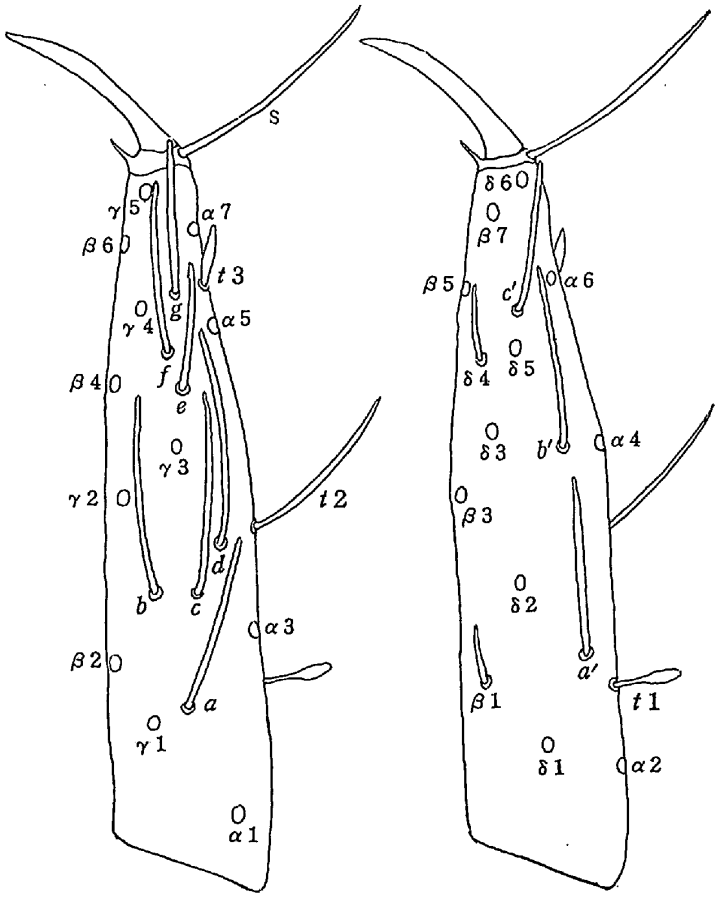


Fig. 9. *Acerentulus omoi* sp. nov.; foretarsus, exterior (left) and interior (right) views. S, S-shaped seta.

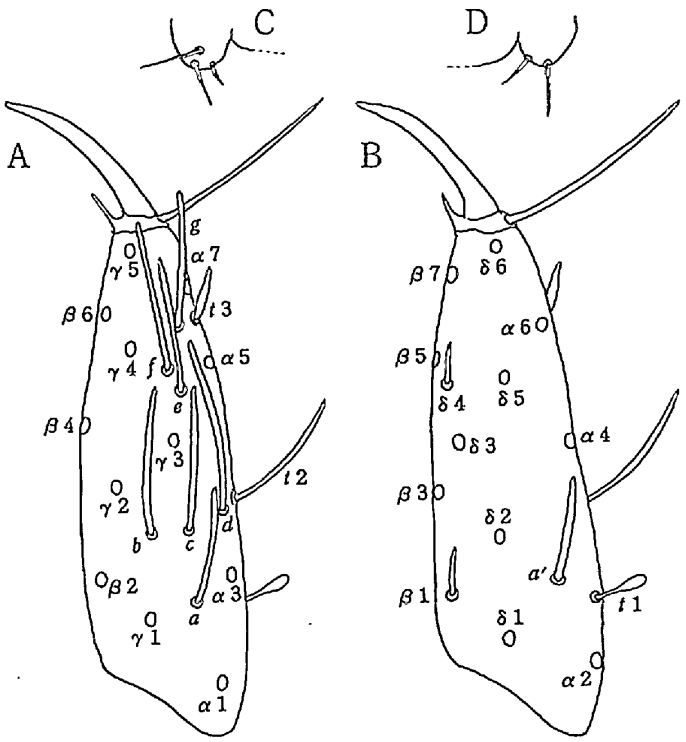


Fig. 10. *Acerentulus omoi* sp. nov., larva I. —— A. Foretarsus, exterior view. B. Same, interior view. C. Abdominal appendage III. D. Same, in an aberrant example from Mt. Iwate-san, 1,280 m alt.

N. KINJO; allotype: ♀, Mt. Iwate-san, 1,500 m, Takisawa, Iwate Pref., 28–VI–1985, collected by O. NAKAMURA.

*Preimago.* Body length 980–1,050 μm, head with additional setae, foretarsus 91–93 μm, TR=3.6, BS=0.44–0.47. P c on abd. stern. VII is absent in the specimen from Mt. Iwate-san, 1,720 m alt.

*Maturus junior.* Body length 810–980 μm, head with additional setae, foretarsus 80–89 μm, TR=3.3–3.6, BS=0.40–0.41. On abd. terg. VIII, instead of M 1, M c is found as in *A. keikoae.* On stern. VII, the specimen from Mōtsū has P c, but the other specimens have no P c. Ventral pore is often invisible on stern. I–IV.

*Larva I* (Fig. 7 C, 10). Body length 590–670 μm, head with additional setae, foretarsus 57–61 μm, TR=2.7–2.9, BS=0.38–0.39. Foretarsal sensillae *b'* and *c'* are absent, and integumental pores present on abd. terg. VI–VII only. Asymmetric absence of median apical seta on abd. appendage III is found in one specimen from Mt. Iwate-san, 1,280 m alt. (Fig. 10 D).

*Notes.* Abnormalities in chaetotaxy are frequent in the present species. In particular, asymmetric absence of such body setae as additional setae on head, dorsal P 1a, 2a on th. II–III, ventral A 2 on th. II, P 1a on abd. terg. I, A 1 on terg. II, A 2, P 1a on terg. III, A 2, 5, P 1a on terg. IV, P 1a on terg. V, A 2, 4, P 1a on

terg. VI–VII, P 1a on stern. VI, A 2, P 1a on stern. VII, P on stern. VIII or 1 on stern. IX, etc. are found in nearly half of the specimens examined.

The distributional range of this new species lies in the northern part of Honshu, which is known in ancient times as Michinoku. *Omoi* is traditionally linked with Michinoku in old Japanese poetry as a set phrase or epithet.

*Acerentulus omoi* sp. nov. is closely similar to *A. cassagnaui* NOSEK from Europe in the relative length of foretarsal sensillae *a*, *b*, *c*, *d* and in the position of *b'*, viz., *a* is short, its apex slightly surpassing the base of *d*, *b* and *c* subequal in length to each other, their apices reaching the base of *e*, *d* fairly surpassing the base of *f* and *b'* situated at the same level as $\alpha 4$. It is, however, distinguished from the latter by the position of foretarsal sensilla *f*, which is situated nearer to *e* than to *g*, by the position of *a'* slightly proximal to $\alpha 3$, by the presence of P c on abd. stern. VII as well as by the presence of P 1a on terg. II–III.

*Distribution.* Japan (N. Honshu). The main habitat of this species seems to lie in cool-temperate forests consisting of deciduous broadleaved trees in the northern part of Honshu. The range of the warmth index is between 26 and 93 month-degrees. At none of the collecting sites of *A. omoi*, coexistence with other species of the same genus was found. The collecting data from Yuze and Mt. Iwaki-san, 500 m in altitude, were erroneously recorded as those of *A. kisonis* in IMADATÉ (1974, pp. 22, 24 & 182).

### *Acerentulus kisonis* IMADATÉ, 1961

(Figs. 7A & 11)

*Acerentulus kisonis* IMADATÉ, 1961, Kontyû, Tokyo, **29**: 226–227.

*A. kisonis*: TUXEN, 1964, The Protura, Paris, 209–210. —— IMADATÉ, 1964, Bull. natn. Sci. Mus., Tokyo, **7**: 69–71; 1965, Bull. natn. Sci. Mus., Tokyo, **8**: 45, 58–60; 1974, Fauna Japonica, Protura, 177–183. —— RAMSAY & TUXEN, 1978, N. Z. J. Zool., **5**: 606. —— SZEPTYCKI, 1979, Pol. Pismo ent., **49**: 400.

Other references are omitted.

*New specimens examined.* 1 ♀, Matsuo, Iida, Nagano Pref., 14–V–1981, collected by Jun-ichi AOKI; 1 ♂, 2 ♀, Enmusubi-jinsha, Kiso, Nagano Pref., 21–V–1986, collected by G. IMADATÉ; 2 ♂, 4 ♀, Miyanohara, Azumi, Nagano Pref., 17–IX–1987, collected by G. IMADATÉ & Kiyoshi SÔMA; 2 ♀, 1 p♂, Sakaki, Hanishina, Nagano Pref., collected by Shigenobu WATARI & G. IMADATÉ; 1 ♀, Shirakabakohan, Chino, Nagano Pref., 9–VI–1974, collected by G. IMADATÉ; 1 ♀, Yokokura, Sakae, Nagano Pref., 22–VIII–1980, collected by H. HARADA; 2 ♂, 1 ♀, Nissato, Utsunomiya, Tochigi Pref., 4–VI–1979, collected by H. HARADA; 1 ♀, Sannô-tôge, Tajima, Fukushima Pref., 14–XI–1980, collected by G. IMADATÉ; 2 ♀, Terayama, Oga, Miyagi Pref., 26–V–1980, collected by H. HARADA; 1 ♂, 1 ♀, Yonezaki, Rikuzen-Takata, Iwate Pref., 21–XI–1976, collected by Kôji SATÔ; 1 ♂ 1 mj, Mt. Muroneyama, Murone, Iwate Pref., 16–VIII–1984, collected by N. KINJO; 1 ♂, Kunizakai-tôge, Kuzumaki, Iwate Pref., 24–VII–1980, collected by H. HARADA;

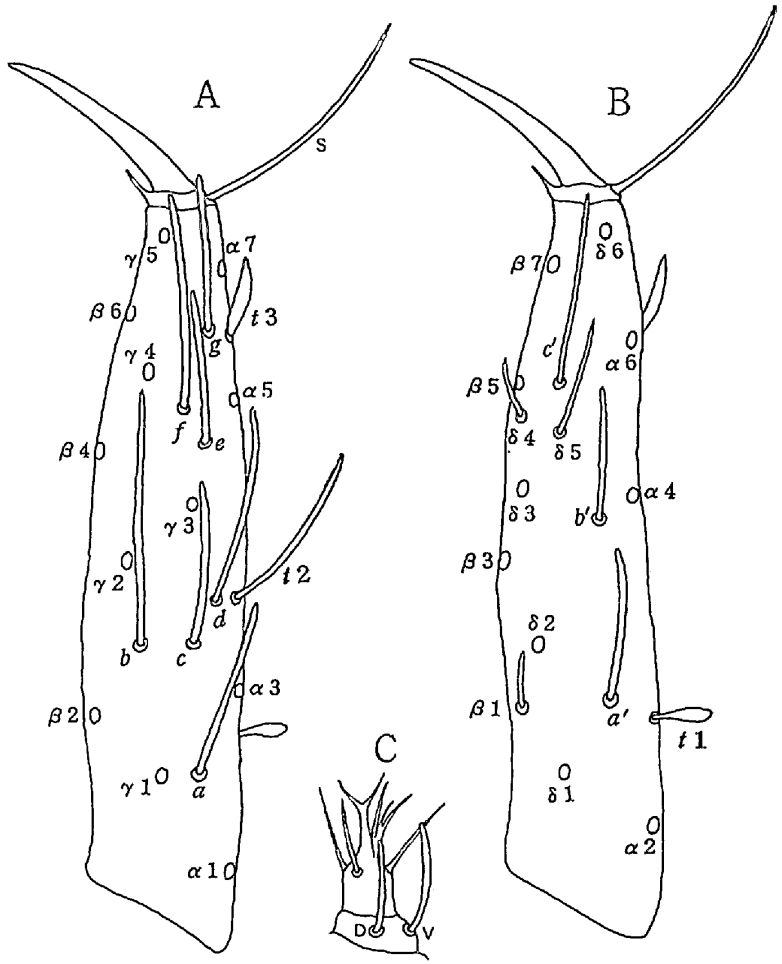


Fig. 11. *Acerentulus kisonis* IMADATÉ. —— A. Foretarsus, exterior view. S, S-shaped seta. B. Same, interior view. C. Maxillary palpus; D, dorsal sensilla; V, ventral sensilla.

1 ♀, 2 p♂, 4 mj, 3 LII, Sarukoshi-tôge, Karumai, Iwate Pref., 4–V–1976, collected by Yasuhiko SUMA; 1 ♂, 2 ♀, 1 LII, Tazawakohan, Tazawako, Akita Pref., 15–VIII–1982, collected by N. KINJO; 1 p♂, Ôhata, Shimokita, Aomori Pref., 2–V–1975, collected by Y. SUMA.

Supplementary notes on the characteristics, whose taxonomic meanings were newly emphasized by SZEPTYCKI, will be given in the following lines.

Head with additional setae (Fig. 7 A); labrum slightly protruded, 15–16 $\mu$m in length; maxillary palpus with two slender sensillae on penultimate segment, dorsal sensilla a little shorter and thinner than the ventral one (Fig. 11 C). S-shaped seta on foretarsus longer than the claw; exterior sensilla *f* nearer to *e* than to *g*; ventral seta $\beta$1 and interior seta $\delta$4 short, sensilla-like, about a half of $\delta$5 in length (Fig. 11 A–B).

Dorsal P 1a, 2a on th. II–III and P 2a on abd. terg. I extremely short, club-

shaped, less than 2 μm in length; dorsal P 5a on th. II–III minute, rudimentary; ventral A 2 and M 2 on th. I, ventral A 2 on th. II–III, dorsal P 5 on th. III, A 5 and P 1a on abd. terg. I, P 1a, 2a and 4a on terg. II–VI, P 2 on stern. I–III, and P 1a on stern. IV–VI short and blunt, sensilla-like, about 4 μm, less than one-eighth the principal setae in length; P 1a, 2a, 3a and 4a on terg. VII, P c and 1a on stern. VII pointed and seta-like, 7–9 μm, more than one-fifth the principal setae in length. Dorsal P 1 and 2 on th. III 23–25 μm and 33–36 μm; 4 and 5 on abd. terg. IX 29–33 μm and 30–34 μm; 4 and 5 on terg. X 34–36 μm and 26–29 μm; P c and 1 on stern. VII 7–9 μm and 26–27 μm; 1 and 2 on stern. IX 14–17 μm and 33–36 μm; 1 and 2 on stern. X 11–16 μm and 34–39 μm.

The distribution of integumental pores is not different from that in the preceding species, *A. omoi*. Small rotary wheels present on abd. V–VII and an irregular row of minute granules visible a little distal to striate band on abd. VIII, as in *A. omoi*.

*Maturus junior*. Head with additional setae. Integumental pores are as in the adult, but ventral pores on th. II–III are often indistinct.

*Larva II*. Head with additional setae. Integumental pores are indistinct with the exception of those on abd. terg. V–VIII and stern. V–VII.

*Notes*. In *A. kisonis*, abnormalities in chaetotaxy are rarer than in the other Japanese forms of the same genus. Of the specimens examined, only three examples are aberrant, viz., P c on abd. stern. VII is absent in one male from Sugadaira, P 3 on terg. VI is displaced posteriorly at the same level as the other posterior setae in one female from Sakaki and one of the additional setae on head is missing in one female from Terayama.

*Distribution*. Japan (C. and N. Honshu). This species dwells in warm temperate and temperate forests consisting of deciduous broadleaved trees and evergreen conifers. The range of the warmth index is relatively wide, from 54 to 115 month-degrees. Although this form has the same distributional range and habitat as *A. keikoae* and *A. omoi*, only one record of coexistence with *A. keikoae* is known at the Sannô-tôge out of the 23 collecting sites.

## Key to the Japanese Members of *Acerentulus*

Three species of *Acerentulus* have previously been reported from Asia. As mentioned in IMADATÉ (1974, p. 175), however, *A. prachedee* IMADATÉ from tropical Asia should be placed in *Australentulus*. And it is most probable that *A. shensiensis* CHOU et YANG from China is not a member of this genus, but a berberentomid. Thus, only three species and one subspecies known from Japan, inclusive of the new forms described in the present paper, can be regarded as true *Acerentulus* occurring in Asia.

1. Foretarsal sensilla *b* distinctly longer than *c*, its apex obviously surpassing the base of *e*; *b'* situated at the same level as $\alpha 4$; head with additional setae

.....*Acerentulus kisonis* IMADATÉ.

— Foretarsal sensilla *b* subequal to *c* in length..... 2.

2. Foretarsal sensilla *b* medium sized, its apex reaching the base of *e*; *b'* situated at the same level as $\alpha 4$; head with additional setae .....
.....*A. omoi* sp. nov.

— Foretarsal sensilla *b* short, its apex hardly reaching the base of $\gamma 3$; *b'* situated at the same level as *t 2* ..... 3.

3. Head without additional setae.....*A. keikoae keikoae* sp. nov.

— Head with additional setae.....*A. keikoae capillatus* subsp. nov.

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