The genus *Isotomiella* (Isotomidae: Collembola) in Japan, with descriptions of three new species

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**Abstract** Numerous specimens (307 individuals) of *Isotomiella* Bagnall, 1939 collected from various regions in Japan were examined. It revealed that they consist of three new species. *Isotomiella japonica* sp. nov. is closely related to *Isotomiella minor* (Schäffer, 1896), differing by the chaetotaxy on Abd. I and chaetae on anterior side of manubrium, and distributed in the northeast Japan. *Isotomiella tamurai* sp. nov. is closely related to *I. hirsuta* Bedos and Deharveng, 1994, differing by the chaetotaxy of Ant. IV, tibiotarsus and Abd. IV, and is common in the southwest Japan. *Isotomiella fujisana* sp. nov. is closely related to *I. hygrophila* Sterzyńska & Kaprů, 2001, differing by the chaetotaxy of Ant. I and Abd. IV, and distributed only in the mountainous regions above 1500 m alt. in Japan. Those three species were described here, putting stress on the chaetotaxy of them.

**Key words:** chaetotaxy, distribution, *Isotomiella japonica* sp. nov., *Isotomiella tamurai* sp. nov., *Isotomiella fujisana* sp. nov.

*Isotomiella minor* (Schäffer, 1896) has been thought to be distributed widely in Europe (Stach, 1947), U. S. A. (Christiansen & Bellinger, 1998) and Japan (Yosii, 1939, 1969, 1972; Aoki et al., 1976; Niijima, 1976; Suma, 1984, etc.). A lot of new species of *Isotomiella* Bagnall, 1939 have been added recently (Bedos & Deharveng, 1994; Deharveng & Suhardjono, 1994; Sterzyńska & Kaprů, 2001, etc.) and an identification key was provided by Kovac & Palacios-Vargas (2008). Potapov (2001) pointed out that data on the ecology of *I. minor* from Far East Russia and Japan might refer to its allies.

The genus *Isotomiella* Bagnall, 1939 in Japan has so far been considered to be composed of a single species, *Isotomiella minor* (Schäffer, 1896). In this study, however, we closely examined 307 individuals of *Isotomiella*, collected from various regions of Japan, resulting in findings of three new species. Those three new species are described here.

**Abbreviations**
- a0: unpaired chaeta on anterior chaetal line on the axis of tergites
- Abd. I-VI: abdominal segments I-VI
- Ant. I-IV: antennal segments I-IV
- F: furca
- L: body length
- m0: unpaired chaeta on middle chaetal line on the axis of tergites
- M; Md, Mdl, Ml: macrochaeta; dorsal, dorso-lateral, lateral macrochaeta
- p0, p: unpaired chaeta on posterior chaetal line on the axis of tergites, chaeta on the position next to p0
- s, S: sensory chaeta, large sensory chaeta
- sa, sp, spe, spi, spl, Spl, sv: s on anterior, posterior, post-external, post-internal, post-lateral tergites, large spl, sv on ventral tergites
- Scx-a, Scx-p: anterior, posterior furcal subcoxa
- Th. I-III: pro-, meso-, meta-thorax

*Isotomiella japonica* sp. nov.
[Japanese name: Yamato-menashi-tsuchi-tobimushi]
(Figs. 1A, 2, 3)

Body length 0.83 mm. Color totally white. Eyes and PAO absent. Abd. V and VI totally ankylosed. Habitus of *Isotomiella japonica* as in Fig. 1A. Integument dorsally without craters, with primary granules only. Integument channels obscure on Th. II. Pseudopora distinct on Abd. I and II.
Fig. 1. A, *Isotomiella japonica* sp. nov.; macrochaetae on Abd. I-IV and ciliated chaetae on precoxae and coxae. B, Habitus of *Isotomiella tamurai* sp. nov.
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Fig. 2. *Isotomiella japonica* sp. nov. A. Right lateral side of Th. II-Abd. I; B. Right lateral side of Abd. IV and V-VI.
Fig. 3. *Isotomiella japonica* sp. nov. A, Dorsal chaetotaxy of Abd. IV and V-VI; B, Ant. IV; C, Ant. I; D-I, Chaetotaxy of tibiotarsus, inside (D, F, H) and outside (E, G, I) of legs I (D, E), II (F, G), III (H, I); J, Anterior side of furca; K, Posterior side of dens; L, Mucro; M, Female genital plates and anal lobes.
Axial chaetotaxy of Th. II-Abd. IV: 20, 14 / 6, 6, 6, 6 (Fig. 2). Macrochaetae ciliated and erected; 1, 1 / 3, 3, 3, 4 on half-tergite of Th. II-Abd. IV (Figs. 1A, 2). Formula of s-chaetae: 3, 2 / 0, 0, 1, 3, 5 on half-tergite of Th. II-Abd. V (Fig. 2). On Th. II and III, a ciliated mesochaeta situated outside of the macrochaeta (Fig. 2A). On Abd. I, Md situated on the line next to the axial line: macrochaeta MdI rather short, MdI : Md = 0.75 (0.70-0.85), MdI : MI = 0.41 (0.37-0.45). All mesochaetae on Abd. I simple (Fig. 2A). Ciliated mesochaetae increasing in number from Abd. II to Abd. V-VI (Figs. 2B, 3A). Number of ciliated mesochaeta depending on specimens. On Abd. VI, aO and pO of smooth mesochaetae, mO a ciliated macrochaeta, pO a ciliated macrochaeta (Figs. 2B, 3A). Furcal subcoxa anteriorly with 16 chaetae, 3 of which are ciliated, furcal subcoxa posteriorly with 9 chaetae, 4 of which are ciliated (Fig. 2B). Spl of Abd. V long and blunt, Spl : claw III = 1.2 (1.1-1.2), M : Spl = 2.8 (2.7-3.3) (Figs. 2B, 3A).

Antennae long (L : Ant. = 3.6). Chaetae S1-S6 of Ant. IV subequal and ovoid-elongate; for supplementary S-chaetae of Ant. IV, 3-4 internal and 5-6 external (Fig. 3B). Ant. I with 18-21 ordinary smooth chaetae, none of them ciliated, and 2 unequal S-chaetae (S:s = 1.5-2.0) (Fig. 3C). Ant. I : II : III : IV = 7 : 11 : 10 : 18.

Legs without tenent hair (Figs. 3D-I). Six chaetae in the proximal whorl of tibiotarsus I, II (Figs. 3D-G) and 6-9 in III (Figs. 3H, I). Precoxae of legs I, II, III with 1, 3, 3 ciliated chaetae and coxae with 2, 3, 2 ciliated chaetae, respectively (Fig. 1A). Ventral tube with 4+4 distal, 3+3 anterior and 2+2 posterior chaetae. Tenaculum with 4+4 teeth and 1 chaeta. Furca long (L : F = 3.6). Manubrium with 2+2, 2+2, 1+1 anterior-distal, 3 lateral and 15+15 posterior chaetae; the distal 4 chaetae on anterior side of manubrium of almost the same thickness and the inside pair a little shorter than the outside (outside : inside chaeta = 1.18) (Figs. 2B, 3J). Dentes with 6 posterior (Fig. 3K) and 36 anterior chaetae (Fig. 3J). Micro tridentate (Fig. 3L). Genital plates in female with two chaetae each (Fig. 3M).

Males not found yet.

Holotype: Mt. Iwate, Takizawa Village, Iwate, Japan, 1770 m, 8-Sep.-1982, H. Harada leg. Paratype: 1 exp., same data as for holotype. Holotype (Type No. 3269, Kyushu Univ.) and 1 paratype are deposited in Entomological Laboratory, Faculty of Agriculture, Kyushu University.

Distribution: The species is common in lowlands and high altitude of the northeast Japan (Table 1; no.1-3, 5, 7-11, 15).

Remarks: The chaetotaxy of I. japonica is almost the same as for I. minor, differing by the following characters: Md on Abd. I situated next to the axial line and no chaetal line between them (a chaetal line consisting of two mesochaeta exists between the axial and Md chaetal lines in I. minor (refer to Deharveng, 1989)); the distal 4 chaetae on anterior side of manubrium are almost the same size (the outer pair of chaeta is the longest and the thickest in I. minor (refer to Stach, 1947)).

Isotomiella tamurai sp. nov

[Japanese name: Tamura-menashi-tsuchi-tobimushi]

(Figs. 1 B, 4, 5)

Body length 1.0 mm. Color totally white. Eyes and PAO absent. Abd. V and VI totally ankylosed. Habitus of Isotomiella tamurai as in Fig. 1B. Integument dorsally without craters, with primary granules only. Integument channels obscure on Th. II (Fig. 4A). Pseudopora distinct on Abd. I and II.

Axial chaetotaxy of Th. II- Abd. IV: 20, 14 / 6, 6, 6, 6 (Figs. 4A, C, D). Macrochaetae ciliated and erected; 1, 1 / 3, 3, 3, 4 on half-tergite of Th. II-Abd. IV (Figs. 1B, 4B, C, D). On Abd. I, macrochaeta MdI shorter than or subequal to the corresponding mesochaeta of posterior row (Fig. 4C), MdI : Md = 0.43 (0.32-0.52); MdI : MI = 0.35 (0.27-0.39). Ciliated mesochaetae several on Abd. IV; Abd. V-VI with most chaetae ciliated (Fig. 4D). On Abd. VI, aO of smooth, short and slender mesochaeta, mO of ciliated macrochaeta, pO of ciliated mesochaeta, pO of ciliated macrochaeta (Fig. 4D). Formula of s-chaetae of the minor-type: 3, 2 / 0, 0, 1, 3, 5 on half-tergite of Th. II-Abd. V (Figs. 4B-D). Spl on Abd. V thick and rather long (Spl : claw III = 1.1; M : Spl = 3.1-3.4) (Fig. 4D). Sa, spe and spi on Abd. V about 2 times as long as s-chaetae of Abd. IV and a half of Spl (Fig. 4D).

Chaetae of labrum 4 / 5, 5, 4 (Fig. 5C). Antennae long (L : Ant. = 3.4). Chaetae S1-S6 on Ant. IV subequal and ovoid-elongate; supplementary S-chaetae on Ant. IV thick, subcylindrical, of which 7-8 are internal and 8-10 external (Fig. 5A). Ant. I with about 20 ordinary smooth chaetae and 2 unequal S-chaetae (S:s = 2.0) (Fig. 5B). All chaetae on head smooth.

Six chaetae in the most proximal whorl of tibiotarsus I-III (Figs. 5D-I). Precoxae of legs I, II, III with 1, 2, 2 ciliated chaetae, respectively (Fig. 1B). Unguis plump without inner tooth (Figs. 5D-I). Unguiculus without tooth. Ventral tube
Fig. 4. *Isotomiella tamurai* sp. nov. A, Right dorsal side of Th. II; B, Right lateral side of Th. II and III; C, Right dorsal side of Abd. I; D, Dorsal chaetotaxy of Abd. IV and V-VI.
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Fig. 5. *Isotomiella tamurai* sp. nov. A, Ant. IV; B, Ant. I; C, Labial chaetae; D-I, Chaetotaxy of tibiotarsus, inside (D, F, H) and outside (E, G, I) of legs I (D, E), II (F, G) and III (H, I); J, Ventral tube; K, Anterior side of manubrium; L, Posterior side of dens; M, Anterior side of dens and mucro.
with 4+4 distal, 3+3 anterior and 2+2 posterior chaetae (Fig. 5J). Tenaculum with 4+4 teeth and 1 chaeta. Furcal subcoxa anteriorly with 17-18 chaetae (of which 2 are ciliated), posteriorly with 9-10 chaetae (of which 7 are ciliated). Furcal long (L : F = 3.2). Manubrium with 2+2, 2+2, 1+1 anterior-distal, 3 anterior-proximal and 4 lateral chaetae (Fig. 5K). Dens long and thin, with 6 posterior chaetae (Fig. 5L) and about 50 anterior chaetae (Fig. 5M), the most distal one being nearly twice as long as antero-distal one (Fig. 5M). Micro tridentate. Genital plates in female with two chaetae each.

Males not found yet.

**Holotype:** South slope of Mt. Tsukuba, Tsukuba City, Ibaraki, Japan, 800 m, 5-Nov.-1983, H. Sakayori, leg. **Paratype:** 1 exp., same data as for holotype. Holotype (Type No. 3270, Kyushu Univ.) and 1 paratype are deposited in Entomological Laboratory, Faculty of Agriculture, Kyushu University.

**Distribution:** The species is common in lowlands of southwest Japan (Table 1; No. 12-25).

**Remarks:** By the presence of 5+5 anterior-distal, 3 anterior-proximal and 4 lateral manubrial chaetae, *Isotomiella tamurai* is related to *I. hirsuta, I. madeirensis* da Gama, 1959, *I. michonae* Deharveng & Suhardjono, 1994, *I. inthrononensis* Bedos & Deharveng, 1994 and *I. barisan* Deharveng & Suhardjono, 1994. *I. inthrononensis* has 29-38 anterior chaetae on dens and *I. barisan* 40-45 (about 50 in *I. tamurai*). *I. michonae* has ciliated chaetae on Ant. 1 (absent in *I. tamurai*). Original description of *I. madeirensis* noted only anterior chaetotaxy of manubrium (da Gama, 1959). Bedos & Deharveng (1994) pointed out that *I. madeirensis* had 7 posterior chaetae on dens (6 in *I. tamurai*). Lee (1977) redescribed *I. madeirensis* from Korea and illustrated that the species with 44 anterior chaetae on dens. Further *I. tamurai* is closely related to *I. hirsuta*, which is distributed in high altitude of Thailand, differing by the following characters: larger number of supplementary S-chaetae on Ant. IV, being around 17 (8-10 in *I. hirsuta*), smaller number of chaetae in the most proximal whorl of tibiotarsus I and II, being 6 (7 in *I. hirsuta*); smaller number of ciliated mesochaetae on Abd. IV, being only several (most chaetae ciliated in *I. hirsuta*). The specimens collected from Tokyo are all *Isotomiella tamurai* sp. nov, which has been ever reported as *I. minor* by Aoki et al. (1976).

**Etymology:** The species is named after Dr. Professor emeritus Hiroshi Tamura of Ibaraki University who is one of the leading Japanese colembologists at present.

**Isotomiella fujisana** sp. nov

[Japanese name: Fuji-menashi-tsuchi-tobimushi] (Fig. 6)

Body length 0.7 mm. Color totally white. Eyes and PAO absent. Abd. V and VI totally ankylosed. Habitus entirely similar with that of *Isotomiella minor*. Integument dorsally without craters.

Axial chaetotaxy of Th. II-Abd. IV; 20, 14 / 6, 6, 6, 6. Macrochaetae ciliated and erected; 1, 1 / 3, 3, 3, 4 on half-tergite of Th. II-Abd. IV. Formula of s-chaetae of minor-type; 3, 2 / 0, 0, 1, 3, 5 on half-tergite of Th. II-Abd. V. Mesochaetae between spi and spe on Abd. IV smooth. Spi of Abd. V thick, rather long and about 3-4 times of sa, spe and spi chaetae, which are a little longer than s-chaetae of Abd. IV (Fig. 6A).

Antennae long (L : Ant. = 3.8). Chaetae S1-S6 on Ant. IV subequal and ovoid-longate; supplementary S-chaetae on Ant. IV subequal, of which 4 are internal and about 5 external (Fig. 6B). Ant. I with about 15 ordinary smooth chaetae, none of them ciliated, and 2 unequal S-chaetae (S:s = 2.4) (Fig. 6C). Ant. I : II : III : IV = 13 : 21 : 21 : 35.

Legs without tenent hair, with six chaetae in the most proximal whorl of tibiotarsus I and II (Figs. 6D, E), seven on III (Figs. 6F, G). Unguis plump without inner tooth (Figs. 6D-G). Ventral tube with 4+4 distal, 3+3 anterior and 2+2 posterior chaetae. Tenaculum with 4+4 teeth and 1 chaeta. Manubrium with 4+4 anterior-distal and 3+3 lateral chaetae (Fig. 6H). Dens long and thin, with 6 posterior chaetae (Fig. 6I) and 30-36 anterior chaetae (Fig. 6J). The most distal chaeta nearly twice as long as antero-distal chaeta (Fig. 6H). Basal hooks of dens normal. Micro tridentate.

Males not found yet.

**Holotype:** Mt. Fuji, Narusawa Village, Yamanashi, Japan, 2150 m, 9-Aug.-1974, K. Niijima leg. **Paratype:** 1 exp. same data as for holotype. Holotype (Type No. 3290, Kyushu Univ.) and 1 paratype are deposited in Entomological Laboratory, Faculty of Agriculture, Kyushu University.

**Distribution:** The species distributes in mountainous regions above 1500 m alt. in Japan (Table 1; No. 4-6, 10, 15).

**Remarks:** By the presence of 4+4 anterior-distal and 3 lateral manubrial chaetae, *Isotomiella fujisana* is closely related to *I. hygrophiha*, which lives in very wet sites of Poland, differing by the following characters: higher proportion of S : s on Ant. I, 2.4 (1.6 in *I. hygrophiha*); mesochaeta between spi and spe on Abd. IV smooth (ciliated in *I. hygrophiha*). The specimens collected from Mt. Fuji are almost *I. fujisana*, which has been
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**Fig. 6.** *Isotomiella fujisana* sp. nov. A, Dorsal chaetotaxy of Abd. IV and V-VI; B, Ant. IV; C, Ant. I; D-G, Chaetotaxy of tibiotarsus, inside (D, F) and outside (E, G) of legs I (D, E) and III (F, G); H, Anterior side of furca; I, Posterior side of dens.


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<th>Number of examined Individuals</th>
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Total: 23 235 49

* including a holotype and a palatype.
ever reported as *I. minor* by Niijima (1976).

**Etymology:** The species is named from Mt. Fuji-san, the highest mountain in Japan, where the species lives.

**Discussion**

*Isotomiella minor* from Japan was first reported by Yoshii (1939). The specimens were collected from Mt. Hyonosen, Tottori and Mt. Tsurugi, Tokushima, but he did not illustrate anterior view of manubrium. Yoshii reported *I. minor* from Shiga Hights, Nagano (Yoshii, 1969) and Hidaka mountains, Hokkaido (Yoshii, 1972) without any descriptions, but noted that ‘refer to Yoshii (1966) for details’. The description of *I. minor* collected from Himalaya (Yoshii, 1966) contains two types of manubrium anterior chaetotaxy. Both of them are different from those in Japan. Suma (1984) reported *I. minor* from the seashore of east Hokkaido, illustrating Ant. IV, claw of leg III, macro and habitus. On the other hand, it was desired that the records of *I. minor* from Japan should be re-examined.

Therefore we did have the re-examination and found that the *Isotomiella* fauna in Japan are composed of three species as summarized below. The specimens collected from the northeast Japan are very similar to *I. minor* except chaetotaxy of Abd. I and chaetae on anterior side of manubrium. The chaetotaxy of examined specimens were so stable that we described the form as *Isotomiella japonica* sp. nov. The specimens collected from the southwest Japan have almost the same characters with *I. hirsuta* Bedos & Deharveng, 1994 except chaetotaxy of Ant. IV, tibiotarsus and Abd. IV. Those characters were regarded as to be very stable and its intraspecific variation was null or very limited (Deharveng, 2004). Therefore, we described the species as *Isotomiella tamurai* sp. nov. The specimens collected from the mountainous regions are very similar to *I. hygrophila* Sterzyńska & Kaprus, 2001, except chaetotaxy of Ant. I and Abd. IV, so we describe the species as *Isotomiella fujisana* sp. nov.

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**References**


