



## Redescription of *Isotomiella alulu* and *I. delamarei* (Collembola: Isotomidae) with notes on the systematics of the genus and new records from the Neotropics

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### Abstract

*Isotomiella alulu* Christiansen & Bellinger, 1992 and *I. delamarei* Barra, 1968 are redescribed after the study of type material and comparison with related species in differential diagnosis. The systematic position of *I. delamarei* is specified with discussions of the systematics of the genus based on sensillar patterns of the species representatives. Two phyletic lineages are outlined within the genus represented by *I. minor* and *I. nummulifer* species groups. Diagnostic tables for *Isotomiella* species based on sensillar patterns and morphological characters of furcula are involved and a dichotomous identification key to the genus is provided. Notes on the systematics and distribution of *Isotomiella* species are added. New localities for *I. granulata*, *I. nummulifer* and *I. symetrimucronata* from the Neotropics (Mexico, Nicaragua) are given, and records of *I. minor* are confirmed for Northern and Central Mexico (Nearctic region).

**Key words:** *Isotomiella*, redescriptions, systematics, geographic distribution, identification key, new records

### Introduction

The genus *Isotomiella* Bagnall, 1939 may be easily recognized within the family Isotomidae by evident morphological characters, e. g. lack of pigment, eyes and postantennal organ. The antennal segment IV bears 6 ovoid sensilla and last 2 abdominal segments are fused. Stach (1947) considered *Isotomiella minor* (Schäffer, 1896) as very easy to distinguish and its distribution to be very wide in Europe with records from other continents (U.S.A., Hawaii, Japan, New Zealand). However, most of these records should be reviewed, since the characters used for species identification were the same as the generic attributes.

Several single descriptions appeared for new species, e. g. from Africa (Barra 1968), Asia (Rusek 1981), South America (Najt & Thibaud 1987) and Europe (Deharveng 1989). For the taxonomy of the genus papers by Deharveng & Oliveira (1990) and Oliveira & Deharveng (1990) were the most important. The authors provided new taxonomic characters and described valuable number of new species from the Amazonia. Subsequently, numerous new species have been added from Seychelles (Deharveng & Fjellberg 1993), Thailand (Bedos & Deharveng 1994), Indonesia (Deharveng & Suhardjono 1994), Melanesia (Yoshii 1995), Africa (Barra 1997, 2006), Poland (Sterzyńska & Kapruś 2001) and Brazil (Mendonça & Fernandes 2003a, b; Mendonça & Abrantes 2007).

According to the present data, the distribution of *Isotomiella minor* is limited to the Holarctic realm (Potapov 2001). The highest diversity of the genus is concentrated to the tropical zone where majority of known species (38 species of the total 46) are found. Thus, it is necessary to verify the older records of *I. minor* and *I. paraminor* from Central and South America (see Mari Mutt & Bellinger 1990 and Palacios-Vargas 1997).

We studied *Isotomiella* collection of the Laboratorio de Ecología y Sistemática de Microartrópodos, Facultad de Ciencias, UNAM (Mexico), which is mainly based on material from Central America. A study of types of *Isotomiella alulu* Christiansen & Bellinger, 1992 led us to the conclusion that this Hawaiian species has apparently wider geographic distribution, involving Mexico, Guatemala, Nicaragua and Ecuador. We made a redescription of the species since the original description was not sufficient for taxonomic comparison with the related species and added notes on the distribution of the species. Similarly, the position of considered „closely related“ *I. delamarei* Barra, 1968 within the genus was also unclear, and therefore we decided to redescribe this species based on the study of the type material as well.

The systematic position of *I. delamarei* is specified with discussion of the systematics of the entire genus based on sensillar patterns of the species representatives. Two phyletic lineages are outlined within the genus represented by *I. minor* and *I. nummulifer* species groups. Diagnostic tables for *Isotomiella* species based on sensillar pattern and morphological characters of furcula are involved in the paper, and a dichotomous identification key to the genus is provided.

The paper includes new records of five species from Mexico, Guatemala and Nicaragua. Some of the previously published data on distribution of *I. minor* in Central America are revised.

**Abbreviations used in the text.** Ant.—antennal segment; Th.—thoracic segment, Abd.—abdominal segment; Ti.—tibiotsarsus; *GIII*—unguis of the leg III; *Md*, *Mdl*, *Ml*—dorsal, dorso-lateral and lateral macroseta; *a0*, *m0*, *p0*—unpaired axial setae (anterior, medial, posterior) of Abd.V+VI tergum; *s*—sensillum, *ms*—microsensillum, nomenclature of sensilla (setae *s*) after Deharveng and Oliveira (1990).

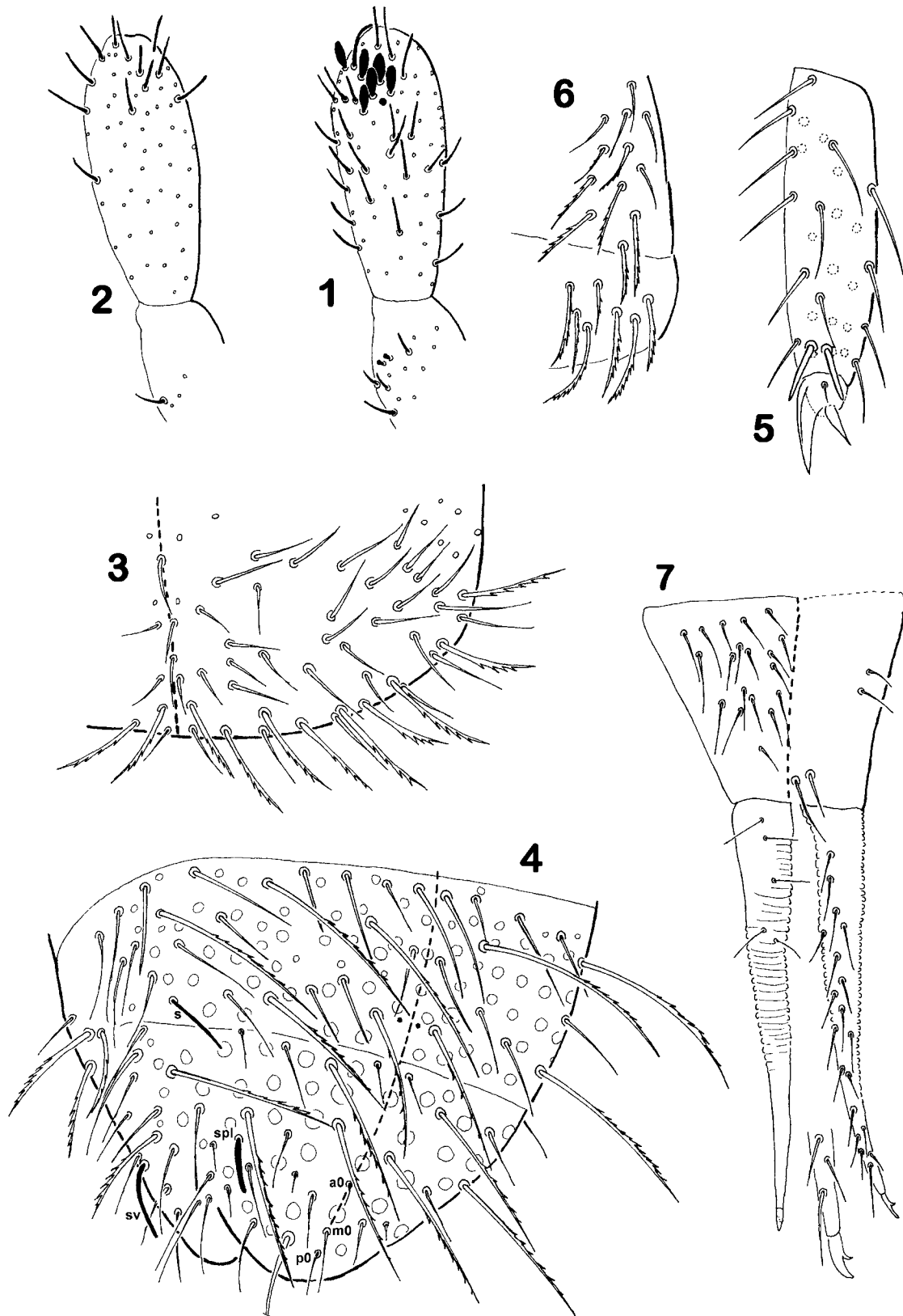
### ***Isotomiella alulu* Christiansen & Bellinger, 1992**

Figs 1–7

**Diagnosis.** Body length 0.8–1.0 mm. Integument with distinct craters from Abd.IV to Abd.VI. Ant. IV with 34–42 thin subcylindrical sensilla in addition to 6 ovoid ones. Posterior margin of head with ciliated setae. Axial setae pattern 22,14 (16)/6,6,6,6 by half-tergum from Th. II to Abd. IV. Vento-lateral area on Abd.II devoid of setae. Sensillar pattern 32/11212 by half-tergum from Th.II to Abd. V+VI; sensillum *spl* on Abd. V+VI 1.5 times of the length of unguis III. Ti.III with 2 strongly thickened apical spines. Subcoxae furcalis anterior/posterior with 10–12/7 setae; manubrium with two pairs of unequal ventro-distal setae; dens with 17–19 ventral and 5 dorsal setae. Mucro bidentate.

**Redescription.** Body length 0.8–1.0 mm (adult females). Colour white, habitus of *I. nummulifer* Deharveng & Oliveira, 1990. Integument from Abd. IV to Abd. VI dorsally with many distinct craters (Fig. 4), 1.0–1.5 times broader than diameter of macrosetae (1.5–5.5  $\mu$ m). Anterior abdominal segments with indistinct, or completely absent craters. Secondary granules and integumentary channels absent. Pseudopora distinct on Th. II.–Abd. IV.

Head. Labral setae pattern 4/554. Labrum with 4 anterior spinules, antero-lateral setae weakly thickened, setae in two distal rows (9) slightly thicker than those in proximal one (5). External lobe of maxilla with bifurcate palp, without ciliated setae and with 3 sublobal setae. Antennae (0.2 mm) 3.8–4.2 times shorter than body and apparently longer than head (0.16 mm). Length of Ant. I, II, III and IV as 26, 45, 45 and 85  $\mu$ m. Ovoid sensilla *S1–S6* of Ant. IV subequal (8  $\mu$ m); numerous supplementary thin sensilla present, 22–27 dorsal and 12–15 ventral (Figs 1 and 2). Ant. III organ with 2 small sensory rods, 3 short guard sensilla in position 1, 4 and 5 and additional sensillum *s'*. Ant. II with sensillum *s'*. Ant. I with 15–17 smooth ordinary setae, 2 basal microsetae and 2 unequal ventral sensilla: *S* (8  $\mu$ m) and *s* (5  $\mu$ m). Posterior margin of head with ciliated setae (Fig. 3), mesosetae *p1–p3* in p-row always ciliated, additional 2–3 setae in *pp*-row eventually ciliated (usually *pp2*, *pp4* and *pp6*).



**FIGURES 1–7.** *Isotomiella alulu* Christiansen & Bellinger, 1992: 1, Ant. IV and tip of Ant. III, dorsal view (full circle: position of long and narrow sensillum); 2, Ant. IV and tip of Ant. III, ventral view; 3, setal pattern of posterior part of head, dorsal view; 4, Abd. IV–VI, dorso-lateral view; 5, tibiotarsus, unguis and unguiculus of leg III; 6, subcoxae furcalis anterior and posterior; 7, furcula (left side in dorsal, right side in ventral view) and tip of dens with mucro in detail.

Terga. Axial setae pattern from Th. II to Abd. IV: 22,14(16)/6,6,6,6. Macrosetae long, ciliated, 1,2/2,3,4,4 by half-tergum from Th. II to Abd. IV. Both ciliated and smooth mesosetae present on terga: Th. II and III with 5–7 lateral setae ciliated, others smooth; Abd. I with most setae smooth; Abd. II and III with most dorsal setae ciliated, latero-ventral setae smooth; Abd. IV with most setae smooth, Abd. V+VI with dorsal setae smooth, some lateral setae ciliated. On Abd. II ventro-lateral area devoid of setae. Abd. V+VI with 7 microsetae („mesosetae *gl*“ after Deharveng & Oliveira 1990). Unpaired setae of Abd.V+VI: *a0* microseta (5 µm), *m0* and *p0* mesosetae (18 µm), all smooth. Mesoseta *p2* of Abd.VI slightly shorter than *p1* (23 and 26 µm respectively, Fig. 4), both smooth or indistinctly ciliated. Sensillar formula of the *nummulifer*-type: 32/11212 (*ms*: 12/00000; *s*: 20/11212) by half-tergum from Th.II to Abd. V+VI. Sensillum *sl3* on Th. II has migrated towards the anapleurum. Sensillum *spl* of Abd. V thick and long (18 µm). All posterior setae on anal valves smooth.

Appendages. Setae numbers from leg I to III (ciliated setae in parenthesis): anapleura 1(1), 2(1), 4(3); katapleura 1(1), 6(3), 7(3); coxae 2, 10(2), 12(2); trochantera 10, 10, 10; femora 20, 24, 26(0–3) and tibiotarsi 28, 28, 31–32. Ti. I with 7 setae in the proximal whorl. Ti. III with 2 strongly thickened apical spines (Fig. 5). No spine-like setae on femora, trochantera or pleura. Unguis and unguiculus (18 and 12 µm) of normal shape (not elongated), untoothed. Tubus ventralis with 4+4 distal, 3+3 anterior and 2+2 posterior setae. Retinaculum with 4+4 teeth and 1 seta on the rami. Subcoxae furcalis anterior with 10–12 setae (6–9 ciliated), subcoxae furcalis posterior with 7 setae (5–7 ciliated, Fig. 6). All setae on manubrium and dentes smooth. Manubrium (45 µm) with 2+2 unequal ventro-distal setae placed in transversal row, 2+2 lateral and 19–22 + 19–22 dorsal setae. Ventro-proximal setae on manubrium absent. Dens (125 µm) with 17–19 ventral (distal one distinctly longer) and 5 thin dorsal setae. Mucro (8 µm) bidentate (Fig. 7). Basal hooks of dens normal.

Only females known.

**Variability.** At the posterior margin of head *p1*–*p3* mesosetae of *p*-row are always ciliated (sometimes also *p5*, *p6* and *p7*). In *pp*-row 2 or 3 setae are ciliated (*pp2*, *pp4* or also *pp6*). One specimen from Ecuador with dorso-external sensillum in the middle of the Ant.IV clearly thicker than other ordinary dorsal sensilla.

**Type material.** Holotype (female) on slide Nr. 6738, Hawaii, Oahu Island, Manoa Falls Trail, ohia fern scrub forest, soil, 3.viii.1986, K. Christiansen lgt., 3 paratypes on slides (2 ex. Nr.6743, 1 ex. Nr. 6745) with the same collecting data. Type material kept in the Bishop Museum, Honolulu, Hawaii, U.S.A.

**Other material.** HAWAII. Oahu island: Aiea Loop Trail, forest in soil and under bark, 4.viii.1986, K. Christiansen lgt. (Nr. 6749a–3 ex., Nr. 6749b–3 ex., Nr. 6754–3 ex.); Haiku Stairs; scrub and grass, 5.viii.1996, K. Christiansen. lgt. (Nr. 6764–4 ex.); Manoa Falls Trail, litter, P. Bellingier lgt., 23.ix.1996 (Nr. 4766–4 ex.); Waahila Ridge Recreational Area (Honolulu), *Casuarina* grove, soil, 6.viii.1986, K. Christiansen.lgt. (Nr. 6770–4 ex.); Waianae Kai, 7.viii.1996, kukui grove, soil, K. Christiansen lgt. (Nr. 6784–3 ex.).

Kauai island: Hanalei Walley State Conservation Area, dry forest, under bark, 25.vii.1986, K. Christiansen lgt. (Nr. 6728–2 ex.); Kapaa, forest reserve, 26.ix.1980, litter under paper bark tree and moss on hau tree, 26.ix.1980, L.M. Goff lgt. (Nr. 5202–4 ex., Nr. 5207–6 ex.); Kapaa, cane field area, moss on paper bark tree, 26.ix.1980, L.M. Goff lgt. (Nr. 5203–1 ex.).

All specimens from Hawaii are kept on slides and deposited in the Bishop Museum, Honolulu, U.S.A., except slides Nr. 6728 and Nr. 6784 deposited at the Grinnell College, Grinnell, Iowa, U.S.A.

MEXICO. Chiapas, Biological Station Chajul, litter, 20.x.1993. G. Ríos and R. Villavicencio lgt. (1 ex.) Campeche: Actún Guachapil, seeds, guano and fruits, 22.3.1997, A. Ruiz lgt. (2 ex.) Veracruz: Grutas de Atoyac, soil, 6.xii.1981, V. Granados lgt. (1 ex.); Palma Sola, rotten trunk, 5.vi.1976, J. G. Palacios lgt. (1 ex.).

GUATEMALA. Alta Verapaz, tropical rain forest, soil, 1976, G. Kramer lgt. (1 ex.).

NICARAGUA. León, Izapa, soil and leaf litter, 16.vi.1986. J. G. Palacios lgt. (7 ex.).

ECUADOR. Los Tayos (Eastern foothills of S. Andes), seed deposit from oil bird faeces (*Steatornis caripensis*), 1.vii.1976. P. Ashmole lgt. (1 ex.).

**Discussion.** By the presence of 2+2 ventral manubrial setae and 2 mucronal teeth *Isotomiella alulu* Christiansen & Bellinger, 1992 is related to *I. spinifer* Deharveng & Oliveira, 1990, *I. nummulifer* Deharveng & Oliveira, 1990, *I. fellina* Mendonça & Fernandes, 2003 and *I. delamarei* Barra, 1968. Differential characters of the redescribed species and the closely related ones are listed in Table 1.

**TABLE 1.** Differential diagnosis of the *Isotomiella* species with 2+2 ventral manubrial setae and 2 mucronal teeth (Me, Ma—ciliated meso-, macrochaeta; mi, me, ma—smooth micro-, meso-, macrochaeta)

Character	<i>I. spinifer</i> Deharveng & Oliveira, 1990	<i>I. nummulifer</i> Deharveng & Oliveira, 1990	<i>I. alulu</i> Christiansen & Bellinger, 1992	<i>I. fellina</i> Mendonça & Fernandes, 2003	<i>I. delamarei</i> Barra, 1968
Body length (mm)	0.7–0.75	0.5–0.9	0.8–1.0	0.4–0.5	0.9–1.0
Labrum - antero-external spines	+	-	-	-	+
Ant.I - ordinary setae	15–16	16–18	15–17	16	16–17
Ant.IV - supplementary sensilla	3–4	10	34–42	9	8
Head - ciliated setae	-	+	+	?	-
Th.II–Abd.IV - axial chaetotaxy	20-22,14/6,6,6,6	22,14/4,4,4,6	22,14/6,6,6,6	20,14/4,4,4,6	18,12/6,6(8),8,8
Th.II–Abd.IV – macrochaetae	?	1,1/1,2,4,4	1,2/2,3,4,4	1,1/1,3,3,4	1,1/3,3,3,4
Th.II–Abd.V - sensilla	3,2/1,1,2,1,2	3,2/1,1,2,1,2	3,2/1,1,2,1,2	3,2/1,1,2,1,2	3,2/0,0,1,3,5
Abd.VI - setae a0, m0, p0	me, ma (Ma), me	mi, me, me	mi, me, me	mi, me, me	Me, Ma, Me
Ratio sensillum spl (Abd.V–VI) / GIII	1.1 -1.2	1.0	1.5	0.4	1.3
TiIII - thick tenent setae	+	+	+	-	-
Tubus ventralis - posterior/anterior/distal setae	2+2/3+3/ 4–6+4–6	2+2/3+3/4+4	2+2/3+3/4+4	5/3+3/4+4	5+5/3+3/2+2
Retinaculum - setae	1	1–3	1	1	1
Manubrium - ventral/lateral setae	1–2 / ?	2 / 2	2 / 2	2 / 2	2 / 0
Subcoxa furcalis anterior/poste- rior setae	7–9/6–7	10–15/7–10	10–12/7	12/7	5–9/6–8
Dens - ventral/dorsal setae	10–14/2	19–24/5	17–19/5	19–21/5	10–12/4
Ratio: dens/GIII	4.5	8.0–8.5	6.9	5.5–7.1	3.6
Cuticle ornamentation (Abd.IV– VI)	craters	craters	craters	-	-
Abd.II - setae in lateral field	?	?	absent	?	reduced

*I. alulu* is closely related to *I. nummulifer*, differing by the following characters: longer body: 0.9–1.0 mm (0.5–0.9 mm in *I. nummulifer*), high number of fine supplementary sensilla on Ant. IV: 34–42 (around 10 in *I. nummulifer*), axial setae pattern formula 22,14/6,6,6,6 by half-tergum from Th. II to Abd. IV (22,14/4,4,4,6 in *I. nummulifer*), macrosetae formula 1,2/2,3,4,4 by half-tergum from Th. II to Abd. IV (1,1/1,2,4,4 in *I. nummulifer*), the ratio of sensillum *spl* (Abd. V+VI) to *GIII*: 1.5 (1.0 in *I. nummulifer*), 19–22 dorsal setae on manubrium by half side (12–15 in *I. nummulifer*), and 17–19 ventral setae on dens (19–24 in *I. nummulifer*).

**Geographic distribution.** From the list of *I. alulu* localities provided in this paper indicates that the species is not endemic to the Hawaii Islands. Its distributional range is much greater, covering also Central and at least northern part of South America, most-probably majority of the Neotropical biogeographic region. Such an example of affinity of Hawaiian Collembola to the Neotropics is interesting, since Christiansen and Bell-

inger (1994) pointed out that Hawaiian fauna of Collembola appears to have been recruited primarily from North America and temperate Asia. However, it is also possible that *I. alulu* has pantropical distribution range similarly as closely related *I. nummulifer*. The species was cited previously as *Isotomiella minor* from Nicaragua (Maes & Palacios-Vargas 1988).

### ***Isotomiella delamarei* Barra, 1968**

Figs 8–11

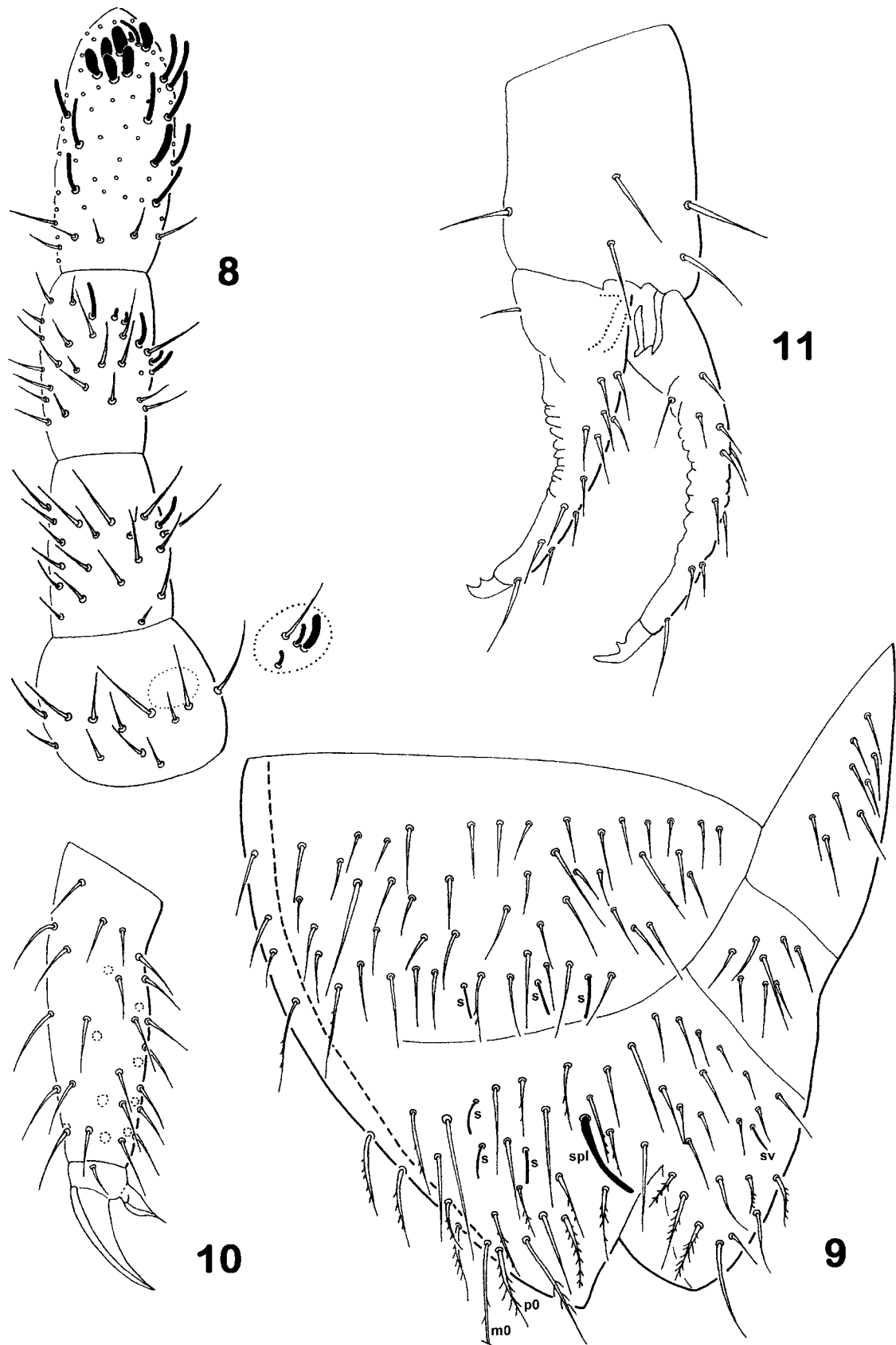
**Diagnosis.** Body length 0.9–1.0 mm. Ventral side of head with integumentary channels. Ant. IV with 3 dorso-internal and 5 dorso-external subcylindrical sensilla in addition to 6 ovoid ones. Posterior margin of head without ciliated setae. Axial setae pattern 18,12/6,6(8),8,8 by half-tergum from Th. II to Abd. IV. Sensillar pattern 32/00135 by half-tergum from Th. II to Abd. V+VI. Sensillum *spl* on Abd. V+VI 1.3 times of the length of unguis III. Ti. III with apical setae not thickened. Subcoxae furcalis anterior/posterior with 5–9/6–8 setae; manubrium with 2+2 ventro-apical setae; dens with 10–12 ventral and 4 dorsal setae; mucro strong, bidentate.

**Redescription.** Body length 0.9–1.0 mm (adult females). Colour white, habitus short and thick, similar to *I. alulu* and *I. nummulifer*. Integument of Abd. IV–VI dorsally without craters, with primary granules only. Integumentary channels limited to the ventral side of head. Pseudopora indistinct.

Head. Labral setae pattern 4/554. Labrum with 4 anterior spinules, 2 antero-lateral setae strongly thickened, chitinised and blunt. Axial seta of the second row neither thickened or sclerotized, other 6 labral setae of two distal rows moderately thickened, sclerotized and acuminate. External lobe of maxilla with bifurcate palp, without ciliated setae, and with 4 sublobal setae. Antennae (0.16 mm) 5.5 times shorter than body, shorter than head (0.19 mm). Length of Ant. I, II, III and IV as 24, 37, 40 and 59  $\mu\text{m}$ . Ovoid sensilla *S1-S6* of Ant. IV subequal (7  $\mu\text{m}$ ; Fig. 8). Supplementary sensilla of Ant. IV subcylindrical, 3 dorso-internal and 7 dorso-external of which the one located at 1/2 the length of the segment clearly thicker than others. Ant. III organ with 2 small sensory rods, 3 short guard sensilla in position 1, 4 and 5 and an additional microsensillum *s'*. Ant. II with sensillum *s'*. Ant. I with 16–17 smooth ordinary setae, 2 basal microsetae and 2 unequal ventral sensilla *S* (8  $\mu\text{m}$ ) and *s* (4  $\mu\text{m}$ ). Ciliated setae on posterior margin of head absent.

Terga. Axial setae pattern from Th. II to Abd. IV: 18,12/6,6(8),8,8. Macrosetae rather long, weakly ciliated, 1,1/3,3,3,4 by half-tergum from Th. II to Abd. IV. On Th. II to Abd. III only smooth mesosetae present. On Abd. I macrosetae of the different length: *Md* 18  $\mu\text{m}$ , *Mdl* 24  $\mu\text{m}$  and *Ml* 30  $\mu\text{m}$ ; length of mesosetae of the posterior row 17–18  $\mu\text{m}$ . On ventro-lateral part of Abd. II several setae of anterior rows absent. Abd. IV bearing ciliated setae in the posterior row. On Abd. V+VI macro- and mesosetae weakly ciliated, others smooth. Unpaired setae of Abd. V+VI: *a0* strongly ciliated mesoseta (17  $\mu\text{m}$ ), *m0* smooth macroseta (33  $\mu\text{m}$ ) and *p0* strongly ciliated mesoseta (24  $\mu\text{m}$ ); the distance between *m0* and *p0* very short (4  $\mu\text{m}$ ). Sensillar formula of the *minor*-type: 32/00135 (*ms*: 10/00000; *s*: 22/00135) by half-tergum from Th. II to Abd. V+VI. Sensillum *sl3* on Th. II in normal position (not migrated towards anapleurite). Sensillum *spl* of Abd. V long (28  $\mu\text{m}$ ), with thick basal part gradually narrowing towards its apex; sensilla *sa*, *spi*, *spe* shorter than sensilla of Abd. IV (9–10  $\mu\text{m}$  and 10–13  $\mu\text{m}$ , respectively); sensillum *sv* short (8  $\mu\text{m}$ ; Fig. 9). Ventral anal valves each with 6 posterior setae of which one medial is smooth macroseta, others strongly ciliated mesosetae. Dorsal anal valve with 7 posterior setae of which *p1* is weakly ciliated macroseta, others strongly ciliated mesosetae (incl. *p0*).

Appendages. Setae numbers from leg I to III (ciliated setae in parenthesis): anapleura 1(1), 2(1–2), 2; katapleura 1(1), 5(4), 6(1–2); coxae 2, 10(2), 12(2); trochantera 10, 10, 10; femora 22, 23, 24 and tibiotarsi 26, 28, 30. Proximal whorl of Ti. I with 7 setae. On Ti. III no tenent hairs or thickened apical setae (Fig. 10). No spine-like setae on femora, tibiotarsi, coxae or pleura. Unguis and unguiculus (22 and 11  $\mu\text{m}$ ) of normal shape



**FIGURES 8–11.** *Isotomiella delamarei* Barra, 1968: 8, right antenna in dorsal view with position of ventral sensilla on Ant. I.; 9, Abd. IV–VI (dorso-lateral view) with subcoxae furcalis anterior and posterior; 10, tibiotarsus, unguis and unguiculus of leg III; 11, furcula, ventro-lateral view (dens and mucro on the right side from the lateral view).

(not elongated); untoothed. Tubus ventralis with 5+5 distal, 3+3 anterior and 2+2 posterior setae. Retinaculum with 4+4 teeth and 1 seta on the rami. Subcoxae furcalis anterior with 5–9 setae (0–1 ciliated), subcoxae furcalis posterior with 6–8 setae (0–3 ciliated). Furcula short (0.15 mm) not reaching tubus ventralis. All setae on manubrium and dentes smooth. Manubrium (58 µm) with 2+2 ventro-distal setae placed in two longitudinal rows, ventro-proximal and lateral setae absent (Fig. 11). Dorsal setae on manubrium and dentes thin, ventral setae thicker. Dens short (80 µm), with 4 dorsal setae and 10–12 ventral setae of which distal strong one reaching the tip of mucro distinctly longer (20 µm) than the anteapical seta (8 µm). Mucro rather long (11 µm), bidentate with well developed apical tooth. Basal hooks of dens very strong.

Only females known.

**Type material.** Holotype (female) on slide (IPA9-AN4), Gabon, Ipassa Plateau, primary forest, litter, 27.vi.1966 J.A. Barra lgt.; 3 paratypes on slides (IPA1-AVCT3, IPA5-E4, IPA7-VM6), *ibid.* 7.v., 7.vi. and 17.vi.1966. Type material kept in the Laboratoire de Zoologie, Université Louis Pasteur, Strasbourg, France.

**Other material.** 1 specimen on slide (IPA7-VM6), *ibid.*, 17.6.1966.

**Discussion.** By the presence of 2+2 ventral manubrial setae and 2 mucronal teeth *I. delamarei* Barra, 1968 is related to *I. spinifer* Deharveng & Oliveira, 1990, *I. nummulifer* Deharveng & Oliveira, 1990, *Isotomiella alulu* Christiansen & Bellinger, 1992 and *I. fellina* Mendonça & Fernandes, 2003. Differential characters of the redescribed species and the closely related ones are listed in Table 1.

The principal difference between *I. delamarei* and above mentioned species is the number of sensilla on segments Th.II–Abd.V (3,2/0,0,1.3.5) that clearly indicates its phylogenetic affinity to *I. minor* species group.

## New records of *Isotomiella* species

### *Isotomiella granulata* Oliveira & Deharveng, 1990

**Localities.** MEXICO. Campeche, Municipio del Holpechén, San Antonio Yaxé, Actún Guachapil cave, 105 m alt., guano, seeding and decomposing fruits, 22.iii.1997, A. Ruiz lgt. (6 ex.), *ibid.* guano, 26.v.1997, J. Palacios lgt. (2 ex.); Guerrero, Gruta Acuitlapán, 12.xii.1981, J. Palacios lgt. (1 ex.); Jalisco, Chamela, soil, 24.vii., 22.ix. and 22.xi.1991 and 12.xi.1992, J. A. Gómez lgt. (7 ex.); Quintana Roo, Akumal, Actún Chen I, roots and bark, 23.vii.1997, J. Aguilar lgt. (1 ex.), *ibid.* Actún Chen II, excrements and roots, 24.v. and 22.vii. 1997, J. Palacios lgt. (9 ex.). NICARAGUA. Nagarote, León, soil 30 m from the bank of lake, 24.vi.1986, J. Palacios lgt. (1 ex.).

### *Isotomiella cf. granulata* Oliveira & Deharveng, 1990

**Locality.** MEXICO. Hidalgo, Presa El Tejocotal, bosque, litter, 25.xi.1979, J.L.Redondo lgt. (2 ex.).

**Remarks.** Species is similar to *I. granulata*, with only one internal ciliated seta on Ant. I, lateral side of Abd. II without complete set of setae, cuticle without distinct secondary granulation.

### *Isotomiella minor* (Schäffer, 1896)

**Localities.** MEXICO. Estado de Mexico, Valle de Bravo, litter, 3.xi.1979, C. Cramer lgt. (1 ex.); Distrito Federal, Xitle, 2900 m alt., soil, 18.i.1992, V. Vidal lgt. (1 ex.); Hidalgo, La Estanzuela, Pachuca, soil, 25.x.1997, J. Palacios lgt. (1 ex.); Morelos, Cueva de San Juan Tepoztlán, 20.x.1978, J. Palacios lgt. (1 ex.); Hidalgo, Derrame del Chichinautzin, mesophilous forest, rodent nest in *Quercus* tree, 29.vi.1980, T. Pérez lgt. (3 ex.);



Tamaulipas, Gómez Farías, Rancho El Cielo, soil, 10.v.1985, J. Palacios & J. Najt lgt. (1 ex.); Veracruz, Cascada del Xico, soil, 21.vii.1977, J. Palacios lgt. (1 ex.).

**Remarks.** We confirm the records of *Isotomiella minor* for Estado de Mexico, Distrito Federal, Hidalgo, Morelos, Tamaulipas, and Veracruz cited in the Catalogue of the Mexican Collembola (Palacios-Vargas 1997). However, some of Jalisco, Colima, Guerrero, Chiapas, and San Luis Potosí have to be corrected according to the new information we present here. Still some old records of Chihuahua and Yucatán should be confirmed.

### ***Isotomiella nummulifer* Deharveng & Oliveira, 1990**

**Localities.** MEXICO: Campeche, Holpechén, Actún-Kin, litter and soil, 15.x.1996, A. Ruiz lgt. (1 ex.); Campeche, Xtacumbilxunaan, soil and seeds, 29.xii.1996, A. Ruiz lgt. (1 ex.); *ibid.* guano, 27.5.1997, J. Palacios lgt. (1 ex.); Quintana Roo, Akumal, Actún Chen I, soil, 23.vii.1997, J. Palacios lgt. (2 ex.); *ibid.* Actún Chen II, roots, 24.v.1997, J. Palacios lgt. (1 ex.); Tamaulipas, Gómez Farías, Rancho El Cielo, 1.120m alt., litter, 8.v.1985, J. Palacios & J. Najt (1 ex.); Veracruz, Cascadas del Xico, soil, 21.vii.1977, J. Palacios lgt. (1 ex.).

### ***Isotomiella symetrimucronata* Najt & Thibaud, 1987**

**Localities.** NICARAGUA. Matagalpa, Selva Negra, coffee field, litter, 23.vi.1986, J. Palacios lgt. (1 ex.). MEXICO. Campeche, Municipio de Holpechén, Actún Guachapil, seeds germinating on guano, 22.iii.1997, A. Ruiz lgt. (1 ex.); Campeche, Xtacumbilxunaan, 25 m alt., soil and seeds, 29.xii.1996, A. Ruiz lgt. (2 ex.); Chiapas, Montes Azules, Chajul, disturbed forest, bark of trees, 10.ix.1993, G. Rios & R. Villavicencio lgt. (1 ex.); *ibid.* litter, 15.ix.1993, G. Rios & R. Villavicencio lgt. (3 ex.); Chiapas, Tapachula, 26.ix.1978, J. Solberón lgt. (1 ex.); Colima, Isla Socorro, 700 m alt., litter and soil, 16.x.1977, J. Palacios lgt. (2 ex.); Guerrero, Gruta de Acuitlapán, 1500 m alt., in front of cave, litter, 21.vi.1980, G. Morales lgt. (1 ex.); *ibid.* 19.vii.1980, J. Palacios lgt. (1 ex.); Jalisco, Chamela, 107 km north of Chamela, 600 m alt., litter, 11.i.1985, F. Mata lgt. (1 ex.); Quintana Roo, Akumal, Actún Chen II, litter, 23.vii. 1997, L. Cutz lgt. (1 ex.); San Luis Potosí, Nr. 1615 (1 ex.); Tamaulipas, Gómez Farías, Rancho El Cielo, 1120 m alt., litter, 8.v.1985, J. Palacios & J. Najt lgt. (3 ex.); Veracruz, Jilotepec, coffee field with *Inga leptoloba*, 1300 m alt.,litter, 14.v.1988, N. García lgt. (1 ex.); Veracruz, Los Tuxtlas, tropical rain forest, litter, 28.xi.1992, R. Salmerón lgt. (1 ex.); Veracruz, Palma Sola, tropical forest, 200 m alt., 1.ix.1976, P. Lavelle lgt. (1 ex.).

### **Notes to systematics of the genus *Isotomiella***

Deharveng and Oliveira (1990) proposed two provisional species groups within the genus *Isotomiella* based on the morphology and setal patterns of furcula: *I. minor*-group and *I. delamarei*-group. The second group of species was characterized by a short furcula, 1+1 or 2+2 ventral manubrial setae and two mucronal teeth. Later Potapov (2001) added more specifications for both species groups involving another set of characters (sensillar pattern, presence of integumentary canals, setal pattern of maxillary outer lobe, geographic distribution).

In Arthropleona patterns of sensilla (setae *s*) on tergites are generally very stable and reflect phyletic relationships (Deharveng 1979, 2004). Deharveng & Oliveira (1990) and Oliveira & Deharveng (1990) used this useful taxonomic tool for the first time in the genus *Isotomiella* to characterize particular species. We propose to use sensillar patterns as the principal character for distinguishing between *Isotomiella* species groups that

apparently represent different phyletic lineages. Redescription of *I. delamarei* enabled us to specify clearly its systematic position within other species of the genus. The type of sensillar patterns indicates close systematic relation of *I. delamarei* to the species of *minor*-group. Therefore we suggest to sort *Isotomiella* species in the following two species groups using also additional characters proposed by Potapov (2001):

**TABLE 2.** Sensillar patterns in *Isotomiella* species groups.

<i>Isotomiella nummulifer</i> -group		<i>Isotomiella minor</i> -group	
32/11112	<i>annae</i> Deharveng & Suhardjono, 1994	21/00212	<i>proxima</i> Mendonça & Fernandes, 2003
32/11152	<i>bidentata</i> Delamare-Deboutteville, 1950 sensu Mendonça & Abrantes, 2007	32/00012	<i>distincta</i> Mendonça & Fernandes, 2003
32/11212	<i>alulu</i> Christiansen & Bellinger, 1992 <i>canina</i> Mendonça & Fernandes, 2003 <i>fellina</i> Mendonça & Fernandes, 2003 <i>nummulifer</i> Deharveng & Oliveira, 1990 <i>quadriseta</i> Deharveng & Oliveira, 1990 <i>spinifer</i> Deharveng & Oliveira, 1990	32/00125	<i>sodwana</i> Barra, 1997
32/12325	<i>dupliseta</i> Deharveng & Oliveira, 1990	32/00135	<i>amazonica</i> Oliveira & Deharveng, 1990 <i>arlei</i> Oliveira & Deharveng, 1990 <i>barisan</i> Deharveng & Suhardjono, 1994 <i>barivierai</i> Deharveng, 1989 <i>barrana</i> Mendonça & Abrantes, 2007 <i>brevidens</i> Bedos & Deharveng, 1994 <i>cribrata</i> Deharveng & Suhardjono, 1994 <i>deforestai</i> Deharveng & Suhardjono, 1994 <i>delamarei</i> Barra, 1968 <i>dubia</i> Deharveng & Suhardjono, 1994 <i>edaphica</i> Bedos & Deharveng 1994 <i>granulata</i> Oliveira & Deharveng, 1990 <i>hirsuta</i> Bedos & Deharveng, 1994 <i>hygrophila</i> Sterzyńska & Kapruś, 2001 <i>insulae</i> Barra, 2006 <i>inthanonensis</i> Bedos & Deharveng, 1994 <i>leksawasdii</i> Bedos & Deharveng 1994 <i>michonae</i> Deharveng & Suhardjono, 1994 <i>minor</i> (Schäffer, 1896) <i>sensillata</i> Oliveira & Deharveng, 1990 <i>similis</i> Oliveira & Deharveng, 1990 <i>spinosa</i> Deharveng & Fjellberg, 1993 <i>symetrimucronata</i> Najt & Thibaud, 1987 <i>thiollayi</i> Deharveng & Suhardjono 1994 <i>unguiculata</i> Deharveng, 1989
32/11215	<i>digitata</i> Deharveng & Oliveira, 1990		

### **minor-group**

- sensillar pattern: sensilla absent on Abd. I–II terga (majority of species with sensillar formula 32/00135 for half-tergum from Th. II to Abd. IV);
- ventral side of manubrium usually with 3+3 to 5+5 setae or more;
- mucro usually tridentate;
- external lobe of maxilla with 4 sublobal setae.

### **nummulifer-group**

- sensillar pattern: sensilla present on Abd. I–II terga (numerous species with sensillar formula 32/11212 for half-tergum from Th. II to Abd. IV);
- ventral side of manubrium usually with 1+1 to 2+2 setae;
- mucro usually bidentate or falcate;
- external lobe of maxilla with 3 sublobal setae.

There are several “problematic” species in both groups showing similar morphological features: smaller body size (0.3–0.5 mm), less differentiated body setae, shortened furcula with reduced setal pattern, mucro rudimentary, falcate or bidentate. These characters are of adaptive significance associated with the microhabitats where these species are found, i. e. deeper soil layers, or interstitial substratum. *I. annae* Deharveng & Suhardjono, 1994 serves as a good example within *nummulifer*-group. On the other hand, *I. proxima* Mendonça & Fernandes, 2003, *I. distincta* Mendonça & Fernandes, 2003, *I. sodwana* Barra, 1997 and *I. barrana* Mendonça & Abrantes, 2007 represent such species within *minor*-group. Systematic affiliation of *I. barrai* Deharveng et Oliveira, 1990 remains unclear due to unknown presence of sensilla on terga Abd.I–II. The existence of these specialized *Isotomiella* species outlines parallel regressive evolution in two different phyletic lines within the genus.

The sensillar pattern of *Isotomiella* species is given in Table 2, but the following species are omitted because of insufficient original descriptions: *I. aluminum* Yoshii, 1995, *I. ciliata* Cardoso, 1969, *I. falcata* Mendonça et Fernandes, 2003, *I. gracilimucronata* Rusek, 1981, *I. madeirensis* Gama, 1959, *I. muscorum* (Schäffer, 1900) and *I. paraminor* Gisin, 1942. *I. barrai* Deharveng et Oliveira, 1990 is not listed in Table 2 because of unclear number of sensilla (3,1–?/?212?). Table 3 summarizes the principal morphological characters of the furcula in particular species.

**TABLE 3.** List of *Isotomiella* species with character of mucro and setal pattern of furcula

	mucro	dens		manubrium		
		ventral	dorsal	distal	lateral	proximal
<i>barrai</i>	reduced	2	1	1+1	0	0
<i>proxima</i>	reduced	2	1	1+1	0	0
<i>annae</i>	falciform	15	3	1+1	1-2	0
<i>falcata</i>	falciform	6	1	1+1	0	0
<i>digitata</i>	2-dentate	6	1	1+1	0	0
<i>distincta</i>	2-dentate	6	1	1+1	0	0
<i>delamarei</i>	2-dentate	10–12	4	2+2	0	0
<i>quadriseta</i>	2-dentate	10–13	4	1+1	2	0
<i>spinifer</i>	2-dentate	10–14	2	1–2 + 1–2	?	0
<i>canina</i>	2-dentate	12–13	4	1+1	2	0

...continued

TABLE3 continued...

<i>sodwana</i>	2-dentate	15	6	1+1	0	0
<i>bidentata</i>	2-dentate	12–20	5	1+1	1	0
<i>dupliseta</i>	2-dentate	16–17	6	1+1	2	0
<i>alulu</i>	2-dentate	17–19	5	2+2	2	0
<i>fellina</i>	2-dentate	19–21	5	2+2	2	0
<i>nummulifer</i>	2-dentate	24–25	5	2+2	2	0
<i>aluminumor</i>	2-dentate	36	5	5+5	?	?
<i>spinosa</i>	3-dentate	9–10	3	3–5 + 3–5	3	0
<i>brevidens</i>	3-dentate	12–14	4	1+1	0–2	0
<i>deforestai</i>	3-dentate	15–19	5	2–4 + 2–4	2–3	0
<i>barrana</i>	3-dentate	16	6	1+1	1	0
<i>dubia</i>	3-dentate	24–28	6	5+5	3	0
<i>edaphica</i>	3-dentate	27–28	5	4+4	1–2	0
<i>leksawasdii</i>	3-dentate	28–32	5	4–5 + 4–5	3	2–3
<i>thiollay</i>	3-dentate	29–32	6	5+5	3–4	0
<i>inthanonensis</i>	3-dentate	29–38	6	5+5	3–4	2–3
<i>hygrophila</i>	3-dentate	32–36	6	4+4	3	0
<i>minor</i>	3-dentate	> 36	6	5(6) + 5(6)	3	0
<i>barivierai</i>	3-dentate	35–39	6	5+5	3	0
<i>cribrata</i>	3-dentate	37–41	6	5+5	3	0
<i>symetrimucronata</i>	3-dentate	(39–)41–43	6	5+5	4	0
<i>unguiculata</i>	3-dentate	40–44	6	5+5	3	0
<i>barisan</i>	3-dentate	40–45	5	5+5	3–4	3–4
<i>insulae</i>	3-dentate	40–48	6	5+5	4	0
<i>amazonica</i>	3-dentate	41–43	6	5+5	4	2–3(4)
<i>similis</i>	3-dentate	44–47	6	5+5	(3)–4	0
<i>michonae</i>	3-dentate	45–51	6	5+5	3–4	2–3
<i>hirsuta</i>	3-dentate	47–54	6	5+5	4	2–4
<i>arlei</i>	3-dentate	52–63	6	5+5	4	0
<i>granulata</i>	3-dentate	54–62	6	5+5	4	0
<i>sensillata</i>	3-dentate	66–79	6	6+6	4	0
<i>muscorum</i>	2-dentate	?	?	?	?	?
<i>paraminor</i>	3-dentate	?	?	5+5	4	8
<i>madeirensis</i>	3-dentate	?	7	5+5	4	1–3
<i>gracilimucronata</i>	3-dentate	?	?	4+4	2	0
<i>ciliata</i>	3-dentate	?	?	5+5	?	1

## Identification key to the genus *Isotomiella*

- 1 Mucro rudimentary or falciform .....2  
 - Mucro bi- or tridentate .....5  
 2 Mucro rudimentary .....3  
 - Mucro falciform .....4  
 3 Sensilla *S*<sub>1–6</sub> on Ant. IV small; Th. II–III with 2 and 1 sensilla respectively; *spl* sensillum on Abd.V+VI shorter than G III ..... *proxima* Mendonça & Fernandes, 2003; Brazil  
 - Sensilla *S*<sub>–6</sub> of Ant.IV normal; Th. II–III with 3 and 1(2) sensilla respectively; *spl* sensillum on Abd.V+VI 3 times longer than GIII ..... *barrai* Deharveng & Oliveira, 1990; Brazil  
 4 Dens with 6 ventral and 1 dorsal seta; manubrium with 1+1 ventro-distal setae, lateral setae on manubrium absent..... *falcata* Mendonça & Fernandes, 2003; Brazil  
 - Dens with 15 ventral and 3 dorsal setae; manubrium with 1+1 ventro-distal and 1-2 lateral setae .....  
 ..... *annae* Deharveng & Suhardjono, 1994; Sumatra  
 5 Mucro bidentate ..... 6  
 - Mucro tridentate.....18  
 6 Dens with 6 ventral and 1 dorsal seta; manubrium with 1+1 ventro-distal setae .....7  
 - Dens with at least 10 ventral and 4 dorsal setae; manubrium with 1+1 or more ventro-distal setae ..... 8  
 7 Ti III with 2 cuticular digitations; sensillar formula: 3<sup>?</sup>/00012.....  
 ..... *distincta* Mendonça & Fernandes, 2003; Brazil  
 - Ti III with 4 cuticular digitations; sensillar formula: 32/11215.....  
 ..... *digitata* Deharveng & Oliveira, 1990; Brazil  
 8 Dens with 10–14 ventral and 2–4 dorsal setae .....9  
 - Dens with at least 15 ventral and 5–6 dorsal setae .....12  
 9 Dens with 10–14 ventral and 2 dorsal setae, manubrium with 1–2 + 1–2 ventro-distal setae, 2 strong labral spines, Ti III with 2 strong distal setae ..... *spinifer* Deharveng & Oliveira, 1990; Brazil  
 - Dens with 10–13 ventral and 4 dorsal setae, manubrium with 1+1 or 2+2 ventro-distal setae ..... 10  
 10 Manubrium with 1+1 ventro-distal setae, sensillar formula: 32/11212..... 11  
 - Manubrium with 2+2 ventro-distal setae, sensillar formula: 32/00135..... *delamarei* Barra, 1968; Gabon  
 11 T iII and III with 1 distal spine ..... *canina* Mendonça & Fernandes, 2003; Brazil  
 - Tibiotarsi without modified setae ..... *quadriseta* Deharveng & Oliveira, 1990; Brazil  
 12 Manubrium with 1+1 ventro-distal setae, dens with up to 17 ventral setae .....13  
 - Manubrium with 2+2 or more ventro-distal setae, dens with 17–36 ventral setae ..... 15  
 13 Lateral seta on manubrium absent, dens with 15 ventral and 6 dorsal setae, sensillar formula: 32/00125...  
 ..... *sodwana* Barra, 1997; South Africa  
 - Manubrium with 1 or 2 lateral setae, sensillar pattern different.....14  
 14 Manubrium with 1 lateral seta, dens with 5 dorsal setae, Ti III with 2 strong distal setae, sensillar pattern: 32/11152 ..... *bidentata* Delamare Deboutteville, 1950; Central Africa, Brazil  
 - Manubrium with 2 lateral setae, dens with 6 dorsal setae, Ti III distal setae normal, sensillar pattern: 32/12325 ..... *dupliseta* Deharveng & Oliveira, 1990; Brazil  
 15 Manubrium with 2+2 ventro-distal setae, dens with 17–25 ventral and 5 dorsal setae.....16  
 - Manubrium with 5+5 ventro-distal setae, dens with 36 ventral and 5 dorsal setae, sensillar pattern unknown ..... *aluminum* Yoshii, 1995; Melanesia  
 16 Axial setae pattern of Abd. I–IV: 4,4,4,6..... 17  
 - Axial setae pattern of Abd. I–IV: 6,6,6,6, macrosetae pattern Th. II–Abd.IV: 1,2/2,3,4,4,19–22 dorsal setae on manubrium by half side.....  
 ..... *alulu* Christiansen & Bellinger, 1992; Hawaii, Central and South America.

17	Ant. IV sensilla <i>SI-6</i> normal, macrosetae pattern Th. II–Abd. IV: 1,1/1,2,4,4.....	
	..... <i>nummulifer</i> Deharveng & Oliveira, 1990; probably Pantropical	
-	Ant. IV sensilla <i>SI-6</i> very reduced, macrosetae pattern Th. II–Abd. IV: 1,1/1,3,3,4 .....	
	..... <i>fellina</i> Mendonça & Fernandes, 2003; Brazil	
18	Dens with up to 14 ventral and 3–4 dorsal setae .....	19
-	Dens with more than 14 ventral and 5–7 dorsal setae .....	20
19	Dens with 9–10 ventral and 3 dorsal setae, manubrium with 3–5 + 3–5 ventro-distal and 3 lateral setae....	
	..... <i>spinosa</i> Deharveng & Fjellberg, 1993; Seychelles	
-	Dens with 12–14 ventral and 4 dorsal setae, manubrium with 1+1 ventro-distal and 0–2 lateral setae.....	
	..... <i>brevidens</i> Bedos & Deharveng, 1994; Thailand	
20.	Manubrium with less than 5+5 ventro-distal setae, dens with 15–36 ventral setae .....	21
-	Manubrium with 5+5 or more ventro-distal setae, dens with 24–79 ventral setae.....	24
21	Manubrium with 1+1 ventro-distal and 1 lateral seta, dens with 16 ventral and 6 dorsal setae.....	
	..... <i>barrana</i> Mendonça & Abrantes, 2007; Brazil	
-	Manubrium with 2–4 + 2–4 ventro-distal setae .....	22
22	Manubrium with 2–4 + 2–4 ventro-distal and 2–3 lateral setae, dens with 15–19 ventral and 5 dorsal setae	
	..... <i>deforestai</i> Deharveng & Suhardjono, 1994; Sumatra	
-	Manubrium with 4+4 ventro-distal setae, dens with 27–36 ventral and 5–6 dorsal setae .....	23
23	Manubrium with 1–2 lateral setae, dens with 27–28 ventral and 5 dorsal setae .....	
	..... <i>edaphica</i> Bedos & Deharveng 1994; Thailand	
-	Manubrium with 3 lateral setae, dens with 32–36 ventral and 6 dorsal setae .....	
	..... <i>hygrophila</i> Sterzyńska & Kapruś', 2001; Poland	
24	Manubrium with 5+5 ventro-distal setae .....	25
-	Manubrium with 6+6 ventro-distal and 4 lateral setae, unpaired ventro-proximal setae on manubrium	
	absent, dens with 66–79 ventral setae, ciliated setae on Ant. I present .....	
	..... <i>sensillata</i> Oliveira & Deharveng, 1990; Brazil	
25	Dens with 5 dorsal setae .....	26
-	Dens with 6–7 dorsal setae .....	27
26	Dens with 28–32 ventral setae, manubrium with 4–5 + 4–5 ventro-distal, 2-3 unpaired ventro-proximal	
	and 2–3 lateral setae .....	<i>leksawasdii</i> Bedos & Deharveng, 1994; Thailand
-	Dens with 40–45 ventral setae, manubrium with 5 + 5 ventro-distal, 3–4 unpaired ventro-proximal and 3-	
	4 lateral setae .....	<i>barisan</i> Deharveng & Suhardjono, 1994; Sumatra
27	Unpaired ventro-proximal setae on manubrium present.....	28
-	Unpaired ventro-proximal setae on manubrium absent.....	33
28	Manubrium with around 8 ventro-proximal and 4 lateral setae, ciliated setae on Ant. I absent .....	
	..... <i>paraminor</i> Gisin, 1942; Central Europe, Mediterranean	
-	Manubrium with 2–4 ventro-proximal setae manubrium .....	29
29	Dens with 7 dorsal setae, manubrium with 1–3 ventro-proximal and 4 lateral setae .....	
	..... <i>madeirensis</i> Gama, 1959; Madeira	
-	Dens with 6 dorsal setae .....	30
30	Dens with 29–38 ventral setae, manubrium with 3–4 lateral and 2–3 ventro-proximal setae.....	
	..... <i>inthanonensis</i> Bedos & Deharveng, 1994; Thailand	
-	Dens with more than 40 ventral setae .....	31
31	Dens with 41–43 ventral setae, manubrium with 2–3(4) ventro-proximal and 4 lateral setae.....	
	..... <i>amazonica</i> Oliveira & Deharveng, 1990; Brazil	
-	Dens with 45–54 ventral setae.....	32
32	Dens with 45–51 ventral setae, manubrium with 2–3 ventro-proximal and 3–4 lateral setae, ciliated setae	

on Ant. I present .....	<i>michonae</i> Deharveng & Suhardjono, 1994; Sumatra	
- Dens with 47–54 ventral setae, manubrium with 2–4 ventro-proximal and 4 lateral setae, ciliated setae on Ant. I absent.....	<i>hirsuta</i> Bedos & Deharveng, 1994; Thailand	
33 Dens with 24–32 ventral setae .....		34
- Dens with 35–62 ventral setae .....		35
34 Dens with 24–28 ventral setae, manubrium with 3 lateral setae, anapleurum-katapleurum- coxa on the leg I with 1,1,2 setae .....	<i>dubia</i> Deharveng & Suhardjono, 1994; Sumatra	
- Dens with 29–32 ventral setae, manubrium with 3–4 lateral setae, anapleurum-katapleurum- coxa on the leg I with 1,3,2(3) setae .....	<i>thiollayi</i> Deharveng & Suhardjono 1994; Sumatra	
35 Axial setae pattern Abd. I–IV: 6,6,6,6–8.....		36
- Axial setae pattern Abd. I–IV: 8–9,8,7–9,6, tubus ventralis with 2–3 + 2–3 posterior setae, unguis narrow and elongated.....	<i>unguiculata</i> Deharveng, 1989; France	
36 Tubus ventralis with 1+1 posterior seta, dens with 35–39 ventral setae, manubrium with 3 lateral setae, unguis narrow and elongated.....	<i>barivierai</i> Deharveng, 1989; France	
- Tubus ventralis with 2+2 or 3+3 posterior setae.....		37
37 Abd. I with lateral field devoid of setae, dens with 41–43 ventral setae, Ant. I setae smooth .....	<i>symetrimucronata</i> Najt & Thibaud, 1987; probably Pantropical	
- Abd. I without lateral field devoid of setae .....		38
38 Tubus ventralis with 2+2 posterior setae .....		39
- Tubus ventralis with 3+3 posterior setae, dens with 52–63 ventral setae, manubrium with 4 lateral setae, ciliated setae on Ant. I present.....	<i>arlei</i> Oliveira & Deharveng, 1990; Brazil	
39 Manubrium with 3 lateral setae .....		40
- Manubrium with 4 lateral setae .....		41
40 Dens with 37–41 ventral setae, ciliated setae on Ant. I present .....	<i>cribrata</i> Deharveng & Suhardjono, 1994; South-East Asia	
- Dens with more than 36 ventral setae, ciliated setae on Ant. I absent ...	<i>minor</i> (Schäffer, 1896); Holarctic	
41 Ciliated setae on Ant. I present, dens with 54–62 ventral setae, integument with apparent granules.....	<i>granulata</i> Oliveira & Deharveng, 1990; Brazil, Mexico	
- Ciliated setae on Ant. I absent .....		42
42 Ant. IV with 8 supplementary sensilla, sensillum <i>spl</i> (V):G III=0.9, Abd. II–III with all ventro-lateral mesosetae smooth.....	<i>similis</i> Oliveira & Deharveng, 1990; Brazil	
- Ant. IV with 10 supplementary sensilla, sensillum <i>spl</i> (V):G III=1.2, Abd. II–III with ciliated ventro-lateral mesosetae.....	<i>insulae</i> Barra, 2006; Socotra	

The following species are not included in the key since insufficient information on the principal characters in original descriptions:

*I. gracilimucronata* Rusek, 1981 from Iraq with tridentate mucro, 4+4 ventro-distal and 2 lateral setae on manubrium classifies this species close to *I. edaphica* Bedos & Deharveng, 1994 described from Thailand,

*I. ciliata* Cardoso, 1969 from Mozambique with tridentate mucro, 5+5 ventro-distal and 1 ventro-proximal seta on manubrium,

*I. muscorum* (Schäffer, 1900) from Germany with bidentate mucro.

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