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STUDIES ON PHILIPPINE COLLEMBOLA, II. SUBORDER ARTHROPLEONA: Hypogastruridae and Isotomidae¹

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One new species, *Isotomurus parabalteatus*, is described, illustrated, and discussed in relation to the Nearctic *Isotomurus palustris balteatus* (Reuter). Four other species, 3 of which are new Philippine records, are further described.

Suborder ARTHROPLEONA Boerner 1901 sensu Salmon 1964

Members of this suborder include all elongate forms possessing chewing mouthparts, both mandibles and maxillae being present. The mandibles always have well-developed molar areas. The head is prognathous or obliquely so, and the body segments are usually distinct. Except in some genera of Hypogastruridae, the unguiculus is present. Clavate tenent hairs are more often present than not.

The suborder is divided into two large superfamilies (Salmon 1964) mainly based on the relative proportions of the body segments, presence of setae on Th I, presence or absence of postantennal organ and body scales, and the nature of the body cuticle.

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Key to Philippine Superfamilies of Arthropleona

- All body segments similar; Th I dorsally setaceous, distinct, and not concealed by Th II; postantennal organ usually present, but not in *Xenylla*; integument granulate, tuberculate, or both; anal spines present; scales absent; antennae short **Hypogastruroidea** Salmon
- Body segments dissimilar; Th I without setae, reduced and usually concealed by Th II dorsally; postantennal organ absent, except in Isotomidae; integument smooth; anal spines rarely present; body scales present or absent; antennae often long **Entomobryoidea** Womersley

Superfamily HYPOGASTRUROIDEA Salmon 1964

The presence of pseudocelli on the body segments is diagnostic for family Onychiuridae under Hypogastruroidea. However, since this family has not been known to occur in the Philippines, the character mentioned is tentatively set aside. Of the two families in this superfamily, only one is represented in the Philippines.

Family HYPOGASTRURIDAE Boerner 1913

This family is distinct in having no pseudocelli but possessing well-developed eyes. Ant III sense organ is simple, composed only of a pair of sensory rods in a cuticular fold or groove, without cuticular papillae. The postantennal organs are usually present, but not in *Xenylla*. Members of this group are often darkly pigmented and are sluggish in their movements.

This large family of about 30 genera (Salmon 1964) is represented in the Philippines by a single genus and species, although future collections may possibly include other genera.

Genus XENYLLA Tullberg

Xenylla Tullberg, 1869: 11; Folsom, 1916: 495; Mills, 1934: Womersley, 1939: 91; Maynard, 1951: 51; Salmon, 1964: 107. Type species: *X. maritima* Tullberg, 1869, by Stach, 1949.

This genus is distinguished from other genera of the family by a combination of the following characters: postantennal organ absent; eyes 4+4 or 5+5; unguiculus absent; furcula short, not reaching ventral tube; anal spines, 2; body pigmented, usually mottled.

(1) *Xenylla sensilis* Folsom (Fig. 1)

Xenylla sensilis Folsom, 1932: 54, pl. 1, figs. 5-13; Handschin, 1938: 139; Zimmerman, 1948: 48, figs. 13 a-i; Stach, 1949: 205. *Cotypes*: Hawaii, in the Illinois State Natural History Survey, Urbana, Illinois, U.S.A.; *homoeotypes* designated, in the Department of Entomology, University of the Philippines.

Eyes 5+5; Ant III sense organ without minute conical setae; Ant IV with 5 short, stout, blunt sensory setae; unguis laterally granulate, with an

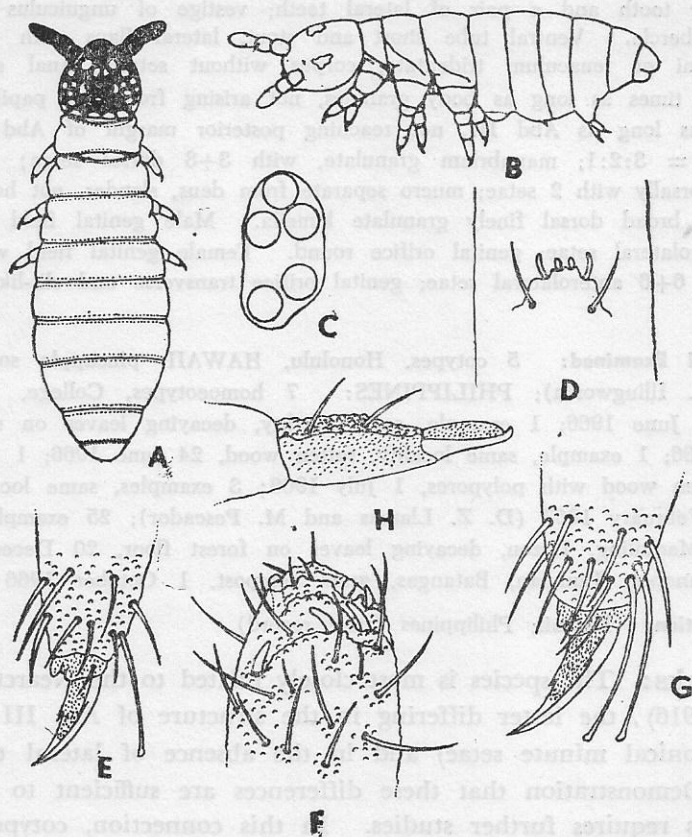


Fig. 1. *Xenylla sensilis* Folsom: A. Habitus, female, dorsal aspect, showing color mottling only on head, 80 x. B. Habitus, female, lateral aspect, color omitted, 73 x. C. Right eyes. D. Ant III sense organ, lateral aspect. E. Fore claw, lateral aspect. F. Apex of Ant IV. G. Hind claw, lateral aspect. H. Dens and mucro, lateral aspect.

inner tooth and a pair of lateral teeth; vestige of unguiculus appearing as a tubercle; mucro and dens distinctly separate; dorsal lamella of mucro broad, minutely granulate.

General Description: Body length 0.61-1.12 mm. Color mottled bluish or bluish gray; legs bluish gray; ventral surface, ventral tube, and furcula pale. Eyes 5+5, on bluish-black eye-patches. Antennae bluish to bluish gray, about 2/3 as long as head; Ant III sense organ consisting of 2 short sensory rods, 2 blunt curving sensory setae, and 2 simple posterior guard setae; Ant III fused dorsally with Ant IV; Ant IV with an apical end-bulb in a deep pit, and 5 short, stout, blunt sensory setae. Head sparsely setaceous. Body oligochaetotic, setae simple arranged in transverse rows as follows: Th II, III, Abd IV, each with 3 rows; Th 1, 1; Abd I — III, V, each with 2. Setae sensuales plain, 2 to 2-1/2 times as long as normal setae, 1+1 on each segment from Th II to Abd V, situated on posterior row (p) of setae from the mesal line as follows: p-4 on Th II, III, Abd IV; p-6 on Abd I — III; p-3 on Abd V. Legs short, stout, sparsely setaceous; clavate tenent hair formula = 1, 2, 2; pretarsus with a basal seta on each side; unguis with a

middle inner tooth and a pair of lateral teeth; vestige of unguiculus appearing as a simple tubercle. Ventral tube short and stout, lateral flaps with 3+3 to 4+4 setae. Rami of tenaculum tridentate, corpus without seta. Anal spines minute, about 1-1/2 times as long as body granules, not arising from any papillae. Furcula short, 3/4 as long as Abd III, not reaching posterior margin of Abd II. Man.:dens:mucro = 3:2:1; manubrium granulate, with 3+3 dorsal setae; dens similarly granulate, dorsally with 2 setae; mucro separate from dens, slender, not hooked apically, and with a broad dorsal finely granulate lamella. Male genital field rounded with 10+10 anterolateral setae; genital orifice round. Female genital field with 1 antero-medial and 6+6 anterolateral setae; genital orifice transverse and slit-like or crescent-shaped.

Material Examined: 5 cotypes, Honolulu, HAWAII, pineapple soil, 4 October 1928 (J. F. Illingworth); PHILIPPINES: 7 homoeotypes, College, Laguna, grass compost, 20 June 1966; 1 example, same locality, decaying leaves on sandy soil, 12 February 1966; 1 example, same locality, rotten wood, 24 June 1966; 1 example, same locality, rotten wood with polypores, 1 July 1966; 3 examples, same locality, decaying leaves, 30 February 1967 (D. Z. Llamas and M. Pescador); 25 examples, Mudspring Area, Mt. Maquiling, Luzon, decaying leaves on forest floor, 20 December 1965; 5 examples, Janopol, Tanauan, Batangas, grass compost, 1 October 1966 (N. Ramos).

Distribution: Hawaii; Philippines (new record).

Remarks: The species is most closely related to the Nearctic *X. welchi* Folsom (1916), the latter differing in the structure of Ant III sense organ (with 2 conical minute setae) and in the absence of lateral teeth on the unguis. Demonstration that these differences are sufficient to separate the two species requires further studies. In this connection, cotypes of *sensilis* are in poor condition and proved useful only in checking the legs and mucrones. Judging from existing literature, many other species of *Xenylla* are difficult to separate that a generic revision is certainly essential. Until then, *X. sensilis* and *X. welchi* are retained as distinct species.

Superfamily ENTOMOBRYOIDEA Womersley 1934

The separation of the families of Entomobryoidea is mainly based on a combination of the following characters: relative proportional lengths of the last four abdominal segments, presence or absence of postantennal organ and body scales, presence or absence of a basal groove on inner edge of unguis, and the relative lengths of the manubrium and dens. Other characters used by Salmon (1964) which I think are variable to a considerable extent and therefore of doubtful value are presence or absence of dorsal crenulation on the dentes, length of antennae, and presence or absence of furcula (absence of this last structure is limited only to some genera of Isotomidae).

Of the 5 families recognized by Salmon (1964), only 2 are represented in the Philippines.

Key to Philippine Families of Entomobryoidea

- Hind leg with a trochanteral organ; Abd IV at least twice as long as Abd III; inner edge of unguis with a basal groove; furcula always present, well developed; dens always much longer than manubrium; postantennal organ absent **Entomobryidae** Schaeffer*
- Hind leg without a trochanteral organ; Abd IV subequal to or never more than 1-1/2 times as long as III; inner edge of unguis without basal groove; if furcula is present, dens may be longer than, equal to or shorter than manubrium; postantennal organ usually present **Isotomidae** Boerner

Family ISOTOMIDAE Boerner 1913

Members of this family are recognized by the following characters: Abd IV subequal to or not more than 1½ times as long as Abd III; hindleg without trochanteral organ; inner edge of unguis without a basal groove; Th II not concealing Th I, despite reduced condition of latter; postantennal organ often present, usually elliptical or oval but never possessing vesicles or lobes; antennae 4-segmented, relatively short; stiff plain seta opposite tenent hair of hind tibiotarsus absent; rami of tenaculum tri- or quadridentate, corpus with variable number of setae; body scales absent; last 2 or 3 abdominal segments sometimes ankylosed; furcula present or absent.

Four genera are presently recorded, each being represented by a single species.

Key to Philippine Genera** of Isotomidae

1. Body heavily pigmented; eyes varying from 6+6 to 8+8, usually situated on dark eyepatches; mucro separate from dens, the mucronal teeth well developed and varying from 2 to 4 2
 Body entirely white, except on eyes; eyes reduced, varying from 1+1 to 5+5, on reduced individual eyespots; mucro fused with dens, mucronal teeth reduced, usually 2 in number **Folsomides** Stach
2. Eyes 8+8; body color purplish or bluish gray; dens at least twice as long as manubrium, strongly crenulate on dorsal surface; anteapical mucronal tooth without hood or lamella 3
 Eyes 6+6; body color bluish gray, seldom purplish; dens relatively stout and shorter than manubrium, its dorsal surface with several coarse crenulations; anteapical mucronal tooth with well-developed lamellae extending to base of dens and appearing hood-like **Paristoma** Bagnall
3. Abd V and VI ankylosed; postantennal organ distinctly notched anteromedially; body usually mottled purplish, without any bands; dens with several dorsal setae and ventral spiny setae; mucro bidentate **Isotomina** Boerner
 Abd V and VI distinctly separate; postantennal organ not notched; body usually with purplish dorsal bands (at least for Philippine forms); dens with numerous dorsal and ventral setae; mucro quadridentate **Isotomurus** Boerner

* Entomobryidae will be treated elsewhere.

** This key is not entirely exclusive for Philippine species.

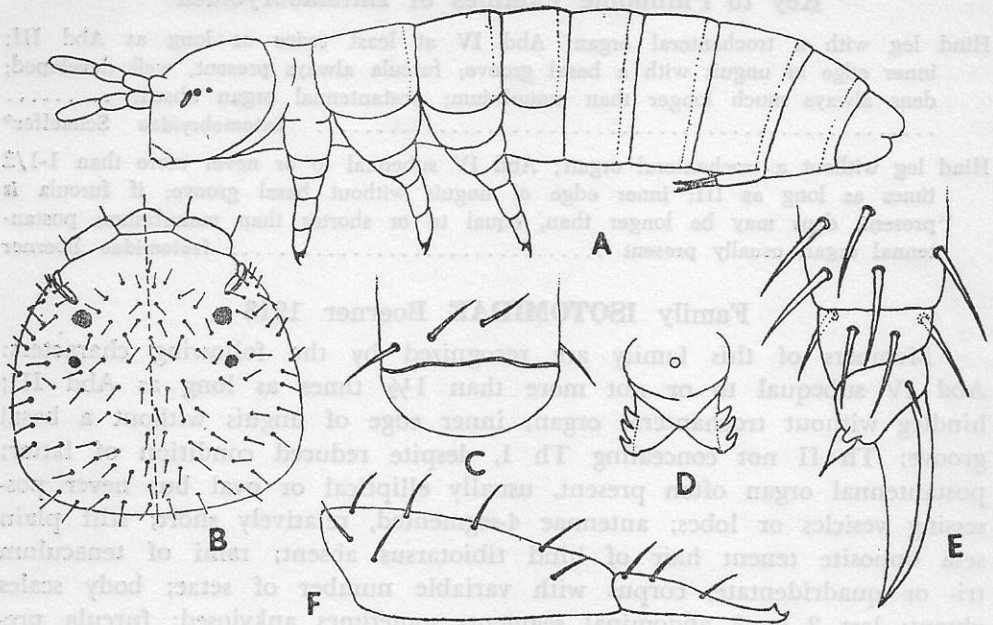


Fig. 2. *Folsomides exiguus* Folsom: A. Habitus, lateral aspect, 182 x. B. Head showing eyepatches, postantennal organs, and dorsal chaetotaxy. C. Lateral flap of ventral tube. D. Tenaculum, anterior aspect, showing setal socket. E. Hind claw, lateral aspect. F. Manubrium and mucrodens, lateral aspect.

Genus FOLSOMIDES Stach

Folsomides Stach, 1922: 17; Womersley, 1939: 142; Salmon, 1964: 122. Type species: *F. parvulus* Stach, 1922; monotypy.

(2) *Folsomides exiguus* Folsom

(Fig. 2)

Folsomides exiguus Folsom, 1932: 58, pl. 4, figs. 42-47; Womersley, 1935: 214, figs. 4 a-d; Womersley, 1939: 143, figs. 51 x-z; Stach, 1947: 99; Zimmerman, 1948: 53, figs. 18 a-f; Yosii, 1959: 18, figs. 10 B-E. *Cotype*: Hawaii, in the Illinois State Natural History Survey, Urbana, Illinois; *homoeotypes*, in the Department of Entomology, University of the Philippines.

Eyes 2+2 on individual blackish patches, the anterior patches almost twice as large as posterior ones; manubrium with 4+4 dorsal, 1+1 posterolateral, and 2+2 anterolateral setae; setae on distal part of tibiotarsus subequal in length.

General Description: Body length 0.6 — 0.78 mm. Ground color white. Eyes 2+2 on individual granular blackish patches, anterior pair slightly larger than posterior pair. Head bearing simple uniform setae dorsally and ventrally; antennae fairly setaceous, 2/3 to 3/4 as long as head; Ant III sense organ composed of 2 sensory rods in a deep groove; Ant IV with 8 — 9 blunt, curving, sensory setae, apical end-bulb absent; distance of anterior eye to posterior eye about 4/5 the length of post-antennal organ. Postantennal organ long, narrowly elliptical, thickly chitinized at

posterior margin, 6 times as long as broad, about 4 times as long as diameter of anterior eye, prominently notched medially at anterior margin, and closely guarded posteriorly by 4 simple setae. Labrum with smooth margin, bearing setae arranged as 5, 5, 4 from the base; setae on 2 distal rows arising from papillae; prelabral setae smooth, 1+1. Body polychaetotic, setae simple and fairly uniform except for several longer setae occurring on Abd I — VI, those on last 2 segments being longest, twice as long as common setae. Transverse rows of setae arranged on segments as follows: Th II, 6 rows; Th III and Abd IV, 4 each; Abd I-III, V, VI, 3 each. Th II:III = 1.3:1. Legs short, sparsely setaceous; clavate tenent hair absent; setae on tibiotarsus nearly equal; tibiotarsi subsegmented distally; unguis stout, without teeth; hind unguiculus lanceolate-acuminate, about 1/5 the length of unguis, fore and middle unguiculi slightly shorter and simply pointed. Abdominal segments distinct, subequal. Ventral tube short, lateral flaps with 3+3 setae, posterior surface with 1+1 setae. Rami of tenaculum tridentate, strongly hooked, corpus with a short anterior seta. Furcula weakly developed, attached to boundary of Abd IV and V, barely reaching posterior half of Abd III. Man.: mucro-dens = 1.5: 1 (8 examples). Manubrium with 4+4 dorsal, 2+2 anterolateral, and 1+1 posterolateral setae; dens distinctly separate from manubrium, with 3 dorsal setae; mucro fused with dens, bidentate, the apical tooth hooked and antepical tooth slightly directed anteriorly. Female genital orifice transverse, slit-like, with thickened anterior and posterior margins, both margins having 1 pair of fine setae. Male genital orifice not observed.

Material Examined: HAWAII: 1 cotype, Honolulu, sugarcane soil, 25 March 1925 (R. Zwaluwenburg). PHILIPPINES: 7 homoeotypes, Mudspring Area, Mt. Maquilang, Luzon, decaying leaves on forest floor, 13 March 1966; 1 example, same locality, decaying fruits and inflorescence of *Ficus* sp. on ground, 3 July 1966; 8 examples, College, Laguna, rotting wood with polypores, 1 July 1966; 2 examples, same locality, banks of Molawin Creek, soil and leaves, 30 February 1967 (D. Llamas and M. Pescador).

Distribution: Hawaii; Australia; Malaya; Philippines (new record).

Remarks: The specimens seem to fit *Folsomides exiguus*. With respect to the manubrium, it was originally illustrated as having 4 dorsal setae presumably on each side. It was later redescribed as having 6+6 (Yosii, 1959), as in the case of the type species *F. parvulus* Stach from Hungary. On the other hand, Philippine forms constantly possess 7+7 manubrial setae, such difference being perhaps a case of local variation. Unfortunately the only existing cotype is in such poor condition that only the unequal eyes and patches are discernible. Whether the number of manubrial setae is indeed species-specific is not certain. So far the only known characters which separate *exiguus* from *parvulus* are the unequal eyes and the absence of an unusually long seta corresponding to the tenent hair on the tibiotarsus. Otherwise, these species appear identical. Yosii (1959) in fact suspected that *exiguus* may in reality be a mere local race of *parvulus*. However, no existing evidence favoring this contention is available to this time and it would seem in order to better retain them as separate species until proven otherwise.

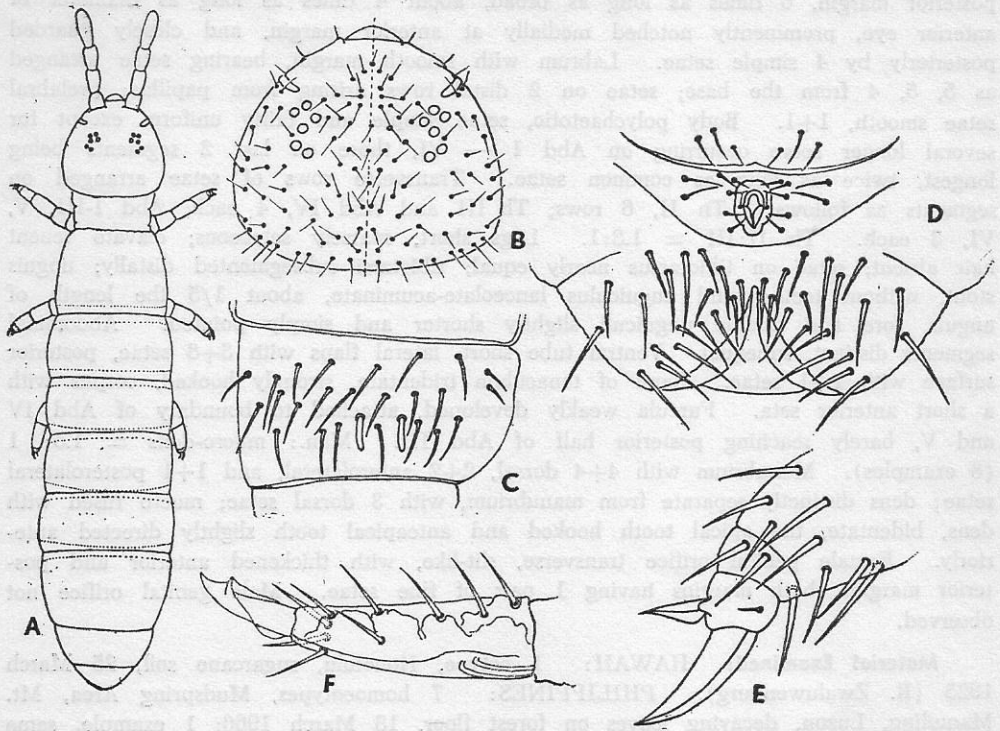


Fig. 3. *Parisotoma canituda* Salmon: A. Habitus, dorsal aspect, color mottling omitted, 176 x. B. Head showing eyes, postantennal organs, and dorsal chaetotaxy. C. Abd V, lateral aspect, showing chaetotaxy and knobbed pair of sensory setae (drawn from holotype). D. Male genital field and anal lobes, ventral aspect. E. Hind claw, lateral aspect. F. Dens and mucro, dorsolateral aspect.

Genus *PARISOTOMA* Bagnall

Parisotoma Bagnall, 1940: 171 (See Salmon 1964, for synonymy). Type species: *Isotoma notabilis* Schaeffer, 1896; by Bagnall, 1940.

(3) *Parisotoma canituda* Salmon

(Fig. 3)

Parisotoma canituda Salmon, 1951: 133, figs. 11 — 14. *Holotype*: Malaya, in Salmon's collection; *Paratypes*, in the National Museum of Singapore; *homoeotypes*, in the Department of Entomology, University of the Philippines.

Mucro bidentate, the anteapical tooth hollow anteriorly with lamellae extending to lateral bases of mucro and assuming a hood-like appearance; Abd V with 2+2 lateral, knobbed sensory setae on last row of setae; dens with 4 — 6 dorsal crenulations, bearing 8 — 9 setae in a fixed pattern.

General Description: Body length 0.6 — 0.76 mm. Ground color purplish or bluish gray, mottled with white spots on head and body segments, pale ventrally and on body appendages; antennae bluish gray. Eyes subequal, on bluish-black eyepatches. Postantennal organ elliptical, at least twice as long as broad, 3 times as long as diameter of an eye; anterior margin strongly thickened, medially notched

or not; closely guarded by 2 posterior setae. Antennae subequal to or slightly shorter than head; Ant III sense organ of 2 short sensory rods arising from individual grooves; Ant IV bearing 4 curved, blunt, as well as several curved pointed sensory setae, apical end-bulb prominent. Labrum with usual rows of setae, those on last 2 distal rows arising from individual papillae, labral margin smooth; prelabral setae plain, 2+2. Head with uniform simple setae dorsally and ventrally. Body polychaetotic, setae simple and generally subequal. Transverse rows of body setae dorsally as follows: Th I, 0; Th II, Abd IV, 6 rows each; Th III, 4; remaining segments, 3 each. Th II and III subequal. Legs short, sparsely setaceous; tibiotarsus subsegmented at distal 1/4; clavate tenent hair absent; pretarsus with a basal seta; unguis short, untooth; unguiculus half as long as unguis, lanceolate and strongly pointed apically, outer margin straight, inner margin curved. Ventral tube short, apical sacs rounded, lateral flaps with 3+3 setae, posterior surface with 1+1 distal setae; rami of tenaculum quadridentate; corpus with one anterior seta. Abd V with 2+2 lateral, knobbed sensory setae on last row of setae. Furcula short, reaching only posterior margin of Abd II; man.: dens: mucro = 3.9: 2.6: 1 (1 example); manubrium with 9+9 dorsal setae; dens with 4-6 coarse dorsal crenulations, bearing 6 dorsal (4 in original description), 1 dorsolateral (versus Salmon's 2 posterolateral), and 2 ventral subapical (versus Salmon's 2 anterolateral) setae; mucro separate from dens (fused in original description), bidentate, the anteapical tooth larger than apical one and having prominent outer and inner lamellae extending to lateral bases of mucro, giving mucro a hood-like appearance.

Female genital orifice transverse, slit-like, anterior and posterior margins each with 1+1 fine setae; area anterior to orifice with 3+3 setae. Male genital orifice somewhat longitudinally ovate, left and right thickenings each with 1 seta; genital field with 7+7 lateral setae, 2 outer pairs longer than inner pairs (1 example). Anal area bilobed with about 18+18 setae (4 examples).

Material Examined: *Holotype*, McRitchie Reservoir, Singapore, MALAYA, in fibrous roots and dead vegetation, 22 October 1949 (M. Tweedie). PHILIPPINES: 6 homoeotypes, College, Laguna, rotting wood with polypores, 1 July 1966; 4 examples, same locality, banks of Molawin Creek, decaying leaves (D. Llamas and M. Pescador); 3 examples, Mudspring Area, Mt. Maquiling, Luzon, leaves above fissures from mudspring pool, 13 March 1966; 2 examples, same locality, rotten log, 3 July 1966; 2 examples, RNAS, Guinobatan, Albay, grass compost, 20 August 1966; 8 examples, same locality, decaying leaves, same date.

Distribution: Malaya; Philippines (new record).

Remarks: This is the only known Oriental species of the genus. Salmon noted 8 dental setae on his Malayan specimens as situated on fixed areas of the dens, in contrast to the 9 setae situated differently in Philippine examples. The numerical difference is very likely a local variation, the difference in setal positions merely a matter of interpretation depending upon the appropriate orientation of the structure concerned. The mucro, originally described as being "completely fused" turned out to be the contrary upon examination of the holotype. The existence of the paired knobbed sensory setae on Abd V is very likely to be highly specific, having been observed in the holotype and the Philippine specimens regardless of sex.

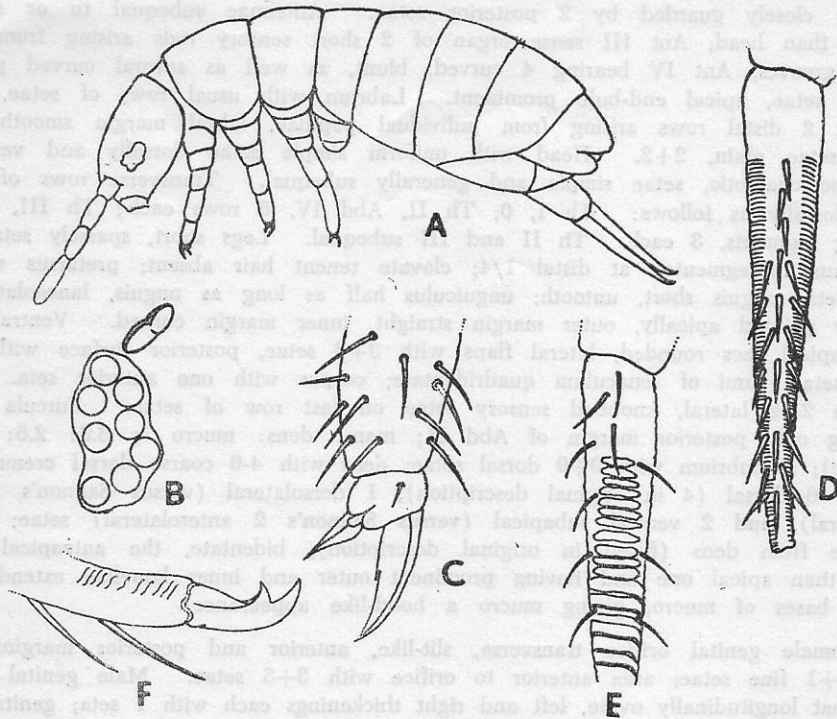


Fig. 4. *Isotomina lombokensis* (Schoett): A. Habitus, lateral aspect, 79 x. B. Right eyepatch and postantennal organ. C. Hind claw, lateral aspect. D. Dens, ventral aspect. E. Proximal part of dens, dorsal aspect. F. Mucro and apex of dens, lateral aspect.

Genus ISOTOMINA Boerner

Isotomina Boerner, 1903: 140 (See Salmon 1964, for synonymy). Type species: *I. agreni* Boerner, 1903.

The genus includes roughly about 33 world species (Salmon 1964) only 2 being Oriental. Gisin (1960) based his separation of European species primarily on the number of eyes, presence or absence of body color, shape and structure of postantennal organ, and presence or absence of an apical end-bulb on Ant IV. However, most non-European species have not been described that adequately to ensure exact determinations.

(4) *Isotomina lombokensis* (Schoett) (Fig. 4)

Isotoma lombokensis Schoett, 1901: 321, figs. 21 — 25; Handschin, 1925: 267. Type. Lombok, unknown.

Proisotoma lombokensis, Handschin, 1928: 266; Handschin, 1930: 413.

Isotomina lombokensis, Stach, 1947: 269.

Eyes 8+8; postantennal organ broadly elliptical, anterior margin thickly chitinized and strongly notched medially, the posterior margin weakly chitinized and notched; unguis with an inner tooth at proximal half; dental

setae arranged in a fixed pattern, ventrally and from the base with 1, 1, 1, 3, 3, 2, 3, 2, 3, 2, 3 spiny setae in that sequence, dorsally with 3 basal, 4 outer, and 3 inner plain setae; antepical tooth of mucro slightly concave anteriorly; body color mottled bluish gray to gray.

General Description: Body length 0.7 — 1.2 mm. Color mottled bluish gray to gray; legs lightly pigmented; ventral tube, tenaculum, furcula, and venter pale. Antennae as long as or slightly longer than head; Ant III sense organ of 2 sensory rods in a groove; Ant IV with an apical end-bulb. Head densely setaceous; labrum with usual number of setae, setae on distal 2 rows arising from papillae, labral margin smooth. Eyes 8+8 on blackish patches. Postantennal organ broadly elliptical, anterior side thickly chitinized and strongly notched, the posterior margin weakly so. Body polychaetotic, setae plain and generally uniform with some slightly longer on abdominal segments. Transverse rows of body setae arranged irregularly as follows: Th II, Abd IV, 7-8 rows each; Th III, 6 Abd I-III, 4 each; Abd V-VI, 5-6. Th II and III subequal or Th II slightly longer. Clavate tenent hair absent; unguis with a minute middle inner tooth (2 specimens over 1 mm long); unguiculus lanceolate, half as long as unguis. Lateral flaps of ventral tube with 4+4 setae (1 specimen). Rami of tenaculum quadridentate, corpus with 1 anterior seta. Furcula well-developed but reaching only midpoint of Abd II; manubrium distally with 1+1 ventral setae; dens twice as long as manubrium, strong dorsal crenulations extending laterally and ventrolaterally, dorsal surface with 3 basal, 4 outer, and 3 inner plain setae, the ventral surface with 24 setae arranged from the base as 1, 1, 1, 3, 3, 2, 3, 2, 3, 2, 3 (4 specimens); antepical tooth of mucro slightly concave anteriorly.

Material Examined: 2 examples, Sto. Tomas, Batangas, decaying leaves of *Cocos nucifera*, 1 October 1966 (N. Ramos); 5 examples, College, Laguna, at banks of Molawin Creek, sand and decaying leaves of *Bambusa* sp., 12 February 1966; 2 examples, Mudspring Area, Mt. Maquiling, Luzon, soil and decaying leaves, 20 December 1966; 2 examples, same data, 20 December 1965.

Distribution: Lombok; Philippines (previously recorded by Handschin, 1930).

Remarks: Although the type has not been examined, the material is very likely *Isotomina lombokensis*. The presence of an inner unguis tooth, contrary to that originally observed by Schoett, was evident only in specimens over 1 mm long, below which no such tooth occurs. In this regard, Schoett probably used immature forms when describing this species which explains the absence of such structure.

I. lombokensis is closely allied to the widespread *I. thermophila* (Axelson), differing consistently from the latter in the presence of a postero-median notch on the postantennal organ, more dorsal dental setae, and perhaps in the number and arrangement of ventral dental setae. Whether *lombokensis* should be definitely recognized as a species or merely a race of *thermophila* cannot now be determined.

Genus ISOTOMURUS Boerner

Isotomurus Boerner, 1903: 171; Folsom, 1937: 70; Womersley, 1939: 148; Maynard, 1951: 121. Type species: *Isotoma palustris* Mueller, 1776; by Boerner, 1903.

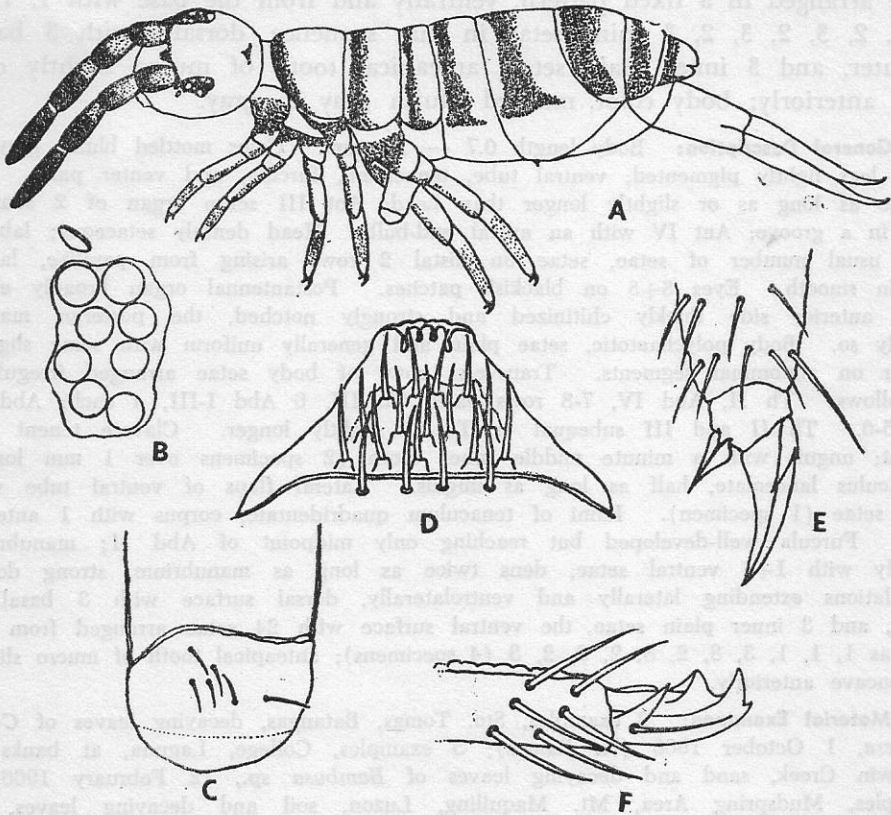


Fig. 5. *Isotomurus parabalteatus*, new species: A. Habitus, lateral aspect, head oriented dorsolaterally, 55 x. B. Left eyepatch and postantennal organ. C. Lateral flap of ventral tube. D. Labrum, dorsal aspect. E. Hind claw, lateral aspect. F. Apex of dens and mucro, lateral aspect.

As previously mentioned by Yosii (1963), this is one of the most problematic genera under Isotomidae. One complicated problem centers on the *Isotomurus palustris*-complex which includes some 14 different forms, races or subspecies recognized by Salmon (1964). Whether they all are conspecific or interspecific, has not been exhaustively investigated. Yosii and Lee (1963) and Yosii (1963), in an initial attempt to separate these subspecies, raised 3 in this complex to species level mainly based on the following characters: body color pattern, shape of unguis and unguiculus, presence or absence of inner ungual tooth, number of setae on the lateral flaps of the ventral tube, and structure of labral margin. Whether all of these characters are indeed reliable needs further study.

(5) *Isotomurus parabalteatus*, new species (Figs. 5, 6 D-E)

Isotomurus palustris balteatus (nec Reuter 1876): Handschin, 1930: 413 (misidentification).

Isotomurus balteatus (nec Reuter 1876): Yosii and Lee, 1963: 3, fig. 2 A-G.

Th II to Abd VI each with a dorsal transverse purplish band on anterior area of segment, bands extending laterally; lateral flap of ventral tube with 5+5 to 6+6 setae; unguis stout, inner tooth absent; dens dorsally with fine short setae on proximal half, ventrally with numerous spine-like setae; Abd IV with 1+1 long, finely and densely ciliate setae almost reaching posterior margin of Abd V; Abd V similarly with 1+1 long such setae extending to posterior margin of Abd VI.

General Description: Yosii and Lee (1963), using Korean examples, described this species as *balteatus* as follows:

"Body length up to 1.6 mm. Ground color whitish, with broad violet bands along anterior margin of each body segment. Furthermore, lateral margins of th. II — abd. II are narrowly banded. Antennae pigmented. Legs and furcula pale. Ant./head as 5:4. Ant. ratio as 15:25:27:36. Ant IV subapically with a slender conical papilla. Ant. III-organ is two blunt rods in separate grooves. No accessory setae present. Postantennal organ elliptical, without median constriction and as large as an eye in diameter. Eyes 8+8, upon black eyepatches. Labrium with usual number of 4/5, 5, 4 setae and distal margin has 2+2 longitudinal streaky ridges. Unguis without inner tooth, but with a pair of prominent lateral and one dorsal teeth connected by a dorsal ledge. Unguiculus acute, with rounded inner margin and untoothed. Tenent hair one, slender and setaceous. Large setae of tibiotarsus lightly ciliated. Others smooth. Ventral tube has lateral flaps with 5-6 small setae each. Furcula well extended man: d as 3:5. Manubrium hirsute on all sides, but without modified setae. Terminal thickening with one spine each. Dentes ventrally hirsute, dorsally hirsute upon proximal 1/2. Mucro quadridentate; outer basal tooth as large as others. No mucronal seta observed. Body setae are brownish, simple, except those upon abd. V, VI, which are densely ciliated. s. s. not observed. Rami tenaculi 4-dentate, corpus with 3 setae."

As supplement to Yosii and Lee's description, the following characters are added for the species:

Head dorsally with an anterior irregular transverse purplish band terminating at posterior edges of antennal bases and at anterior ends of eyepatches; an irregular purplish patch situated posteromedially from the eyes and near posterior head margin. Ant III sense organ of 2 curving sensory rods in a common groove. Legs lightly diffused with purplish pigment, more prominently so on precoxae and coxae. Abd VI completely purplish in 2 specimens. Middle and hind tibiotarsi with long ciliate setae on posterior surface; on middle tibiotarsus, 2 such setae adjacently situated at proximal 1/3; on hind tibiotarsus, 3 such setae, 1 at proximal 1/4, 1 almost halfway, and 1 at distal 1/5, this last seta only half as long as the preceding 2. Setae sensuales on Abd II, III, IV as 2+2, 2+2, 1+1, respectively. Abd IV laterally with at least 1+1 long, densely ciliated setae arising near anterior margin of segment and extending up to posterior margin of Abd V, Abd V similarly with 1+1 such setae reaching posterior margin of Abd VI. Dorsal setae of dens fine and short, ventral setae more spine-like. Basal seta of mucro well developed arising from base of basal outer tooth and extending to base of antepical tooth.

Holotype. Mudspring Area, Mt. Maquilang, Luzon, decaying leaves on forest floor, 20 December 1966, in the Department of Entomology, University of the Philippines.

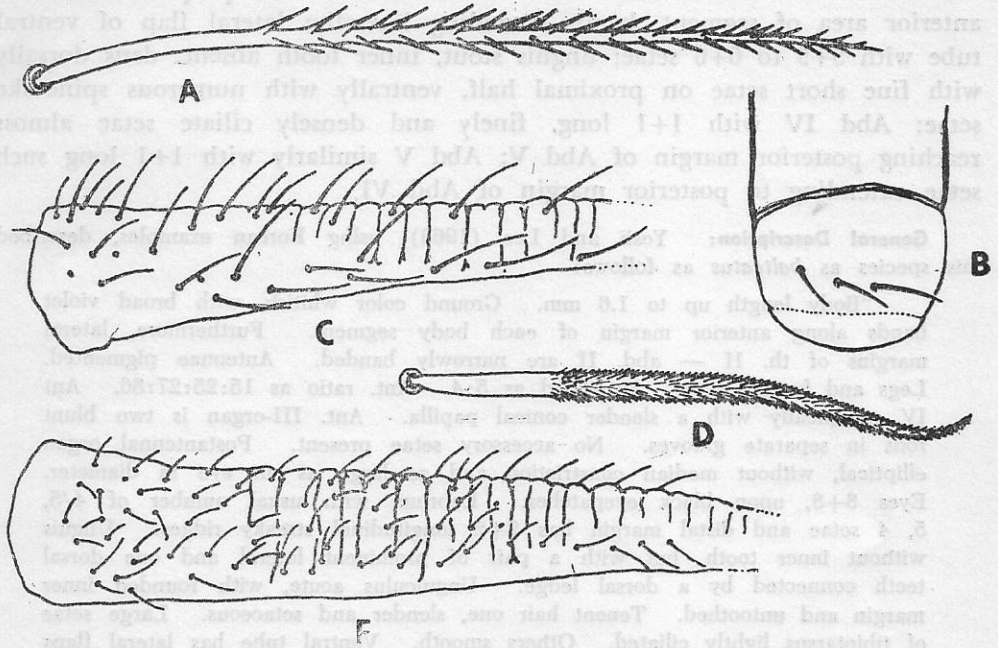


Fig. 6. *Isotomurus palustris balteatus* (Reuter): A. Modified seta on Abd IV, 1000 x. B. Lateral flap of ventral tube. C. Proximal part of dens, dorsal aspect. *I. parabalteatus*: D. Modified seta on Abd IV, 1000 x. E. Proximal part of dens, dorsal aspect (specimen of same size as in *balteatus*).

Paratypes. 5 examples, same data as above, 20 December 1965, 13 March 1966, 20 December 1966; 2 examples, Pili, Camarines Sur, subterranean ant's nest, 19 August 1966.

Distribution: Philippines; Korea.

Remarks: The specimens recorded by Handschin (1930) from Mt. Maquiling as *Isotomurus palustris balteatus* (Reuter) are now referred to *parabalteatus*. Also, judging from Yosii and Lee's description and illustrations of Korean examples referred to as *balteatus*, there is little doubt that the Korean specimens belong to *parabalteatus*. This latter species can be easily and has perhaps been confused frequently with *balteatus* merely on the basis of similarity in body color pattern. The examination of several specimens of *balteatus* from the United States (through the generous loan by Dr. Christiansen) definitely made clear certain distinct differences existing between this Nearctic form and the Philippine examples (the latter having been confirmed by Yosii as *balteatus*). It is very likely then that the Korean forms were unsurprisingly confused with *balteatus* of the Palearctic and Nearctic regions. As a result, *balteatus* (fig. 6 A-C) is presently retained in its former level, that is, as a subspecies of *palustris*. As will be seen in the tabulated data, the grounds for erecting a new species are perhaps justified in the different characters compared.

Character	<i>I. palustris</i> <i>balteatus</i>	<i>I. parabalteatus</i>
Body length	0.98 — 1.2 mm.	1.07 — 1.26 mm.
Setae on lateral flap of ventral tube	3+3	5+5 to 6+6
Modified long setae on Abd IV-VI	finely serrate	densely ciliate
Body setae	nearly half as wide	nearly twice as wide
Tenacular setae on corpus	4	5-6
Dens — dorsal setae	fine; twice as long	finer; half as long
— ventral setae	fine; not spine-like	more spine-like

Among the characters compared, the number of setae on the lateral flap of the ventral tube, the nature of the modified setae on Abd IV-VI and length of dorsal setae of dens are perhaps diagnostic for *parabalteatus* when recognizing it from *balteatus*. Other characters will probably prove useful for separating it from other known species.

The species is so named since it resembles *Isotomurus palustris balteatus* in body color pattern and other characters.

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REFERENCES

- Bagnall, R. S.** 1940. Notes on British Collembola. *Ent. Mon. Mag.* 76: 163-174.
- Boerner, C.** 1901. Vorläufige Mitteilung über einige neue Aphorurinen und zur Systematik der Collembola. *Zool. Anz.* 24: 1-15.
- . 1903. Ueber neue Altweltliche Collembolla, nebst Bemerkungen zur Systematik der Isotominen und Entomobryinen. *S. B. Ges. naturf. Berlin* 1903,: 129-182.
- . 1913. Die Familien der Collembolen. *Zool. Anz.* 41: 315-322.
- Folsom, J. W.** 1916. North American Collembolous insects of the sub-families Achorutinae, Neaurinae, and Podurinae. *Proc. U.S. Nat. Mus.* 50: 477-525.
- . 1932. Hawaiian Collembola. *Proc. Hawaii. Ent. Soc.* 8(1): 51-92.
- . 1937. Nearctic Collembola or springtails of the family Isotomidae. *Bull. U.S. Nat. Mus.*, No. 168: 1-144.
- Gisin, H.** 1960. Collembolenfauna Europas. *Ed. Mus. Hist. nat., Geneva*: 1-312.
- Handschin, E.** 1925. Beiträge zur Collembolenfauna der Sundainseln. *Treubia* 6: 225-270.
- . 1928. Collembolen aus Java nebst einem Beitrag Zu einer Monographie der Gattung *Cremastocephalus*. *Treubia* 10: 245-270.

- _____. 1930. Philippine Collembola, II. *Philipp. Jour. Sci.* 42: 411-428.
- _____. 1938. Checklist of the Collembola of Oceania. *Ent. Mon. Mag.* 74: 139-147.
- Maynard, E. A.** 1951. The Collembola of New York State. 339 pp., Comstock Publ. Co., Ithaca, N.Y.
- Mills, H. B.** 1934. A monograph of the Collembola of Iowa. Monograph No. 3, Div. Ind. Sci., Iowa State College: 1-143.
- Salmon, J. T.** 1951. Some Collembola from Malaya. *Proc. Roy. Ent. Soc. Lond.* B 20 (11-12): 131-142.
- _____. 1964. An index to the Collembola. *Roy. Soc. New Zealand Bull.* 7, 1-3: 1-651.
- Schoett, H.** 1901. Apterygota von Neu Guinea and Sunda-Inseln. *Termes Fuzetek* 24: 317-331.
- Stach, J.** 1922. Apterygoten aus dem nord westlichen Ungarn. *Ann. Mus. Nat. Hungarici* 19: 1-75.
- _____. 1947. The Apterygotan fauna of Poland in relation to the world fauna of this group of insects. Family: Isotomidae. *Pol. Acad. Sc. & Lett., Cracow*: 1-488.
- _____. 1949. The Apterygotan fauna of Poland in relation to the world fauna of this group of insects: Families Neogastruridae and Brachystomellidae. *Acta. Mon. Musei. Hist. Nat. Poland*: 1-341.
- Tullberg, T.** 1869. Om skandinaviska Podurider af Unterfamiljen Lipurinae. *Akad. Afhandl. Upsala*: 1-20.
- Womersley, H.** 1934. Collembola — Arthropleona of Australia, II: Entomobryoidea. *Trans. Roy. Soc. Sth. Austr.* 58: 86-138.
- _____. 1935. On some new records and species of Australian and New Zealand Collembola. *Trans. Roy. Soc. Sth. Austr.* 59: 207-218.
- _____. 1939. Primitive insects of South Australia. 322 pp., Government Printer: Adelaide.
- Yosii, R.** 1959. Studies on the Collembolan fauna of Malay and Singapore, with special reference to the genera: *Lobella*, *Lepidocyrtus* and *Callyntrura*. *Contr. Biol. Lab. Kyoto Univ.* 10: 1-65.
- _____. 1963. On some Collembola of Hindukush, with notes on *Isotoma* Bourlet and its allies. Results Kyoto Univ. Sci. Exped. Karakoram and Hindukush, 1955, Vol. IV. *Insect Fauna of Afghanistan and Hindukush*, Art. 1: 3-42.
- _____. and **C. Lee.** 1963. On some Collembola of Korea, with notes on the genus *Ptenothrix*. *Contr. Biol. Lab. Kyoto Univ.* 15: 1-37.
- Zimmerman, E. C.** 1948. Collembola in "Insects of Hawaii," 2: 43-71.