7. On some Collembola from India, Burma, and Ceylon; with a Catalogue of the Oriental Species of the Order.

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[Received May 20, 1911: Read November 7, 1911.]

(Plates VI.–XII. and Text-figures 14 & 15.)

Contents.

I. Introductory Remarks.

During the last decade the Collembola have attracted a considerable amount of attention both from morphologists and systematists. Collections of these primitive insects have been studied from various regions of the world. Hitherto, however, I am not aware that any species of the Order have been known and recorded from the Indian Empire. The present paper is intended as a small contribution towards a knowledge of the Collembola of that extensive region.

I am indebted to Dr. N. Annandale for handing over to me for examination the specimens contained in the collections of the Indian Museum, and to Mr. E. E. Green for forwarding me two species from Ceylon. In addition to the species received from the above two sources, I have myself collected a number of examples in several parts of India, from Allahabad in the "plains" up to an altitude exceeding 12,000 feet in the Himalayas. The area thus worked over lies within two zoo-geographical regions. The collecting, however, has only been done during casual intervals, and generally when I was occupied in searching for other forms of animal life. I wish to acknowledge the facilities for consulting entomological literature that were afforded me by the libraries attached to the Indian Museum, Calcutta, and the Agricultural Research Institute, Pusa.

Altogether 571 specimens of Collembola have been examined and from among these, 4 genera and 27 species are described as new, and 3 species were already known.

* Communicated by A. E. Shipley, M.A., F.R.S., F.Z.S.

A.—Palæarctic Species.

Entomobrya crassa, sp. n.
Isotoma siva, sp. n.
Tomocerus vulgaris Tullb.
Sinella montana, sp. n.
Seira frigida, sp. n.

B.—Oriental Species.

Xenylla obscura, sp. n.
Achorutes armatus Nicolet.
Pseudachorutes anomalus, sp. n.
Neanura corallina, sp. n.
N. intermedia, sp. n.
N. pudibunda, sp. n.
Isotoma nigropunctata, sp. n.
Heteromurieus cercifer, gen. et sp. n.
Isotomurus palustris Müll.
Lepidocyrtus robustus, sp. n.
Entomobrya kali, sp. n.
E. kali var. *lutea*, nov.
Seira brahma, sp. n.
Pseudosira indra, sp. n.
Dicranocentroides fasciculatus, gen. et sp. n.
Cremastocephalus montanus, sp. n.
C. indicus, sp. n.
Paronella börneri, sp. n.
P. travancorica, sp. n.
P. gracilis, sp. n.
P. phaenolepis, sp. n.
P. insignis, sp. n.
Idiomerus pallidus, gen. et sp. n.
Cyphoderus simulans, sp. n.
Pseudocyphoderus annandalei, gen. et sp. n.
Sminthurides appendiculatus, sp. n.

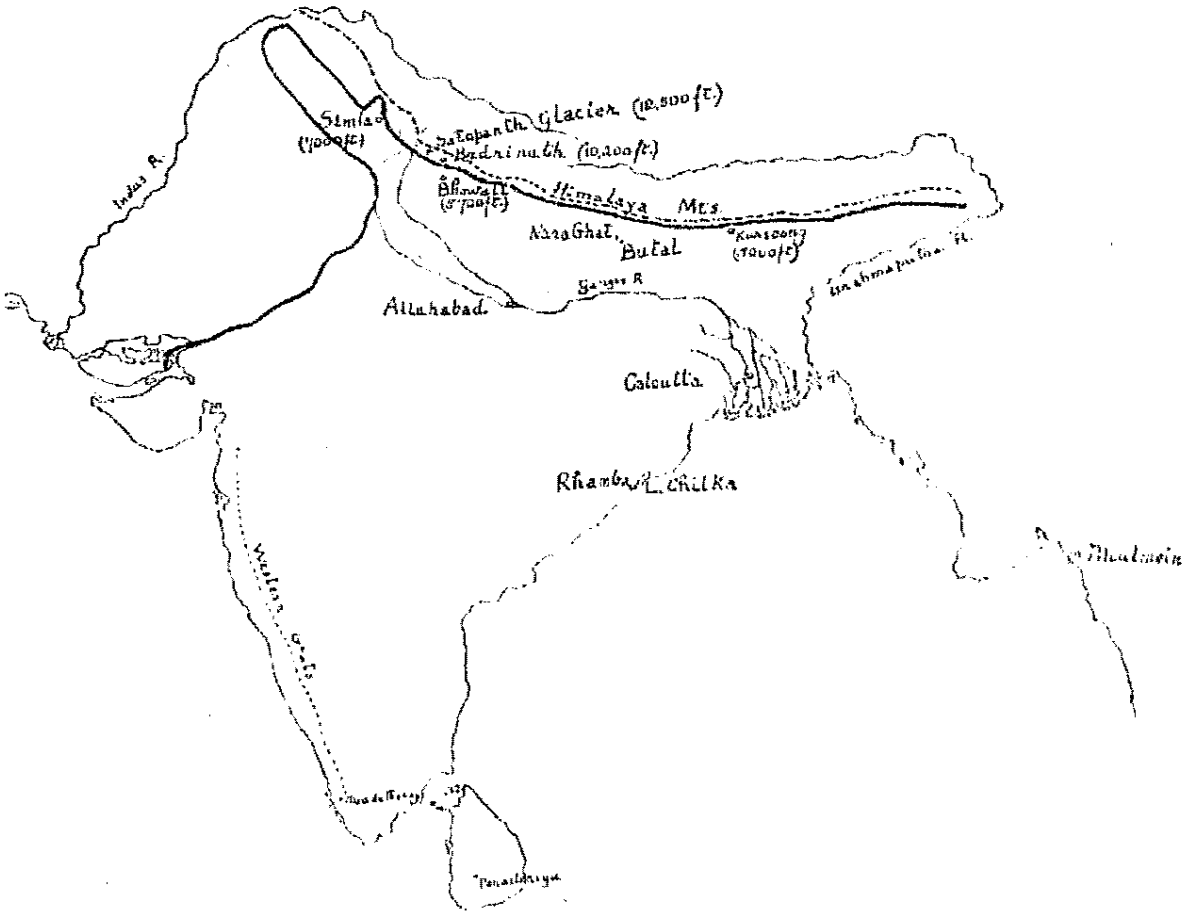
The fact that so large a proportion of the species are new is scarcely remarkable, owing to the great diversities of climate and soil found in the various areas from which the specimens were obtained; *vide* text-fig. 14, p. 82.

The limits of the northern boundary of the Oriental zoo-geographical region are difficult to define owing to the fact that members of the Oriental fauna penetrate, in places, for long distances up into the hot confined valleys of the Himalayas; while, on the other hand, the Palæarctic fauna descends the southern slopes of that range to within the limits of forest growth. As Blanford* remarks, above the limit of forests the fauna is purely Palæarctic, all the Oriental types having disappeared. The forest

* "The Distribution of Vertebrate Animals in India, Ceylon, and Burma." Phil. Trans. Roy. Soc. vol. 194, 1901, p. 347.

limits in the E. Himalayas may extend up to an elevation of 14,000 feet, while in the W. Himalayas it attains in places an altitude no higher than 9000 feet.

Text-fig. 14.



Map showing the localities from which the Collembola treated in this paper were obtained. Mountains are represented by the dotted lines. The thick line represents the boundary between the Oriental and Palæarctic regions according to Blanford (Phil. Trans. Roy. Soc. B, vol. 194, 1901).

The Palæarctic Collembola considered in the present paper were all obtained from around Badrinath, and the country north of that locality, in British Garhwal. They were met with at elevations varying from 10,200 feet to over 12,000 feet, and at a minimum elevation of 500 feet above the limits of forests. None of the species obtained from this area were found in the Oriental region, either among the lower slopes of the Himalayas or from "tropical India." These Palæarctic forms are all referable to well-known genera.

Among the Oriental Collembola it has been found necessary to create four new genera, i. e.: *Heteromuricus*, *Dicranocentroides*, *Idiomerus*, and *Pseudocyphoderus*. The remaining species belong to genera whose range extends into at least one other zoogeographical region.

Among the new forms described the most remarkable is *Heteromuricus cercifer*, gen. et sp. n. It is unique among Collembola in

possessing a median cercus to the fifth segment of the abdomen. A new sub-family—the Heteromuricinæ—has been created for its reception. A second new genus, *Pseudocyphoderus*, with a single species, occurs in nests of Termites near Lake Chilka.

In no instance has a new genus been created unless I had at my disposal at least five specimens, and many of the new species have only been founded after an examination of a series of twenty or more examples. At least nine apparently new species, and two new genera, have been left undescribed owing to there being, in these particular instances, only one or at the most two specimens of each at my disposal. A few years' experience with the Collembola is sufficient to teach that, apart from colour and size, such structural features as the number of teeth to the claws of the feet, and the relative lengths of the antennal joints, frequently cannot be relied upon for specific purposes, unless several specimens are at hand for comparison.

Unless definitely stated otherwise, the descriptions have been drawn up from specimens preserved in alcohol. In this connection, it is important to take into account the fact that a variable amount of contraction of parts frequently takes place. The relative lengths of the trunk segments, and the joints of the antennæ, are difficult to represent with complete numerical correctness, owing to the contraction (or telescoping) that takes place in many instances from this cause. However, in almost every instance the numerical ratios given in this paper have only been arrived at after having made a series of measurements on several specimens. These measurements were obtained by the aid of a Leitz drawing apparatus and a Zeiss micrometer. In all cases the measurement of the relative lengths of the trunk segments has been taken along the mid-dorsal line of the body.

As regards the terminology employed, I have in every instance used the word *body* to denote the whole insect, excluding, of course, the appendages, and the word *trunk* to mean the thorax and abdomen. As regards the configuration of the *furcula*, I have described that organ in the extended attitude, projecting backwards. The terms *dorsal* and *ventral* and *anterior* and *posterior* are used with reference to the organ in that position. The use of these terms in this connection has been made solely for purposes of description, without any reference to their being of morphological value.

The measurements of the length of the different species refer to the body only, and do not include either the antennæ or furcula.

Owing to the fact that it has not been possible in India to consult certain Papers of the earlier zoological literature, a few of the references to the original descriptions of genera and species have been quoted on the authority of Tullberg's "Sveriges Podurider"; these are denoted thus †.

The majority of the specimens are to be found in the collection of the Indian Museum, Calcutta, and the reference numbers to

that collection are quoted in each case. Wherever material has allowed, a series of co-types has also been deposited in the Natural History Department of the British Museum, South Kensington. Such species are indicated thus *.

II. Description of the Species.

Sub-order ARTHROPLEONA Börn.

Fam. Poduridæ Lbk.

Sub-fam. Hypogastrurinæ Börn.

Genus Xenylla Tullb.

†*Xenylla* Tullberg, "Om Skand. Podurider af underfam. Lipurinæ," Akad. Afh. Upsala, 1869, p. 11.

*Xenylla obscura, sp. n. (Pl. VI. figs. 5–9.)

Dentes furculæ cum mucronibus tibiæ longitudine æquales. Spinæ anales parvæ, arcuatæ, papillis crassis affixæ. Pili clavati in tibiis nulli. Long. ·75 mm.

Head.—The *eyes* as in other species of the genus.

Legs.—The *claws* of the feet all similar, unarmed. Near the apex of each tibia is a slender tapering seta (fig. 9); *tenent hairs* absent.

Furcula.—The *dens* and *mucro* together equal to the tibia in length—a little longer than the manubrium. The *mucrones* not fused with the dentes, slender, and very slightly curved at their apices (figs. 5 & 7).

Hamula.—A little shorter than the dens; the *rami* tri-dentate, the innermost tooth the largest (fig. 8).

Anal Spines.—Small and stout, curved. The papillæ from which they arise small and short (fig. 6).

Coloration.—Leaden purple with a number of small irregular yellowish markings on the dorsal aspect of the head and trunk. The legs, furcula, and ventral aspect of the body pale, almost white. The eyes on a black patch on each side of the head.

Length ·75–1 mm.; average length ·75 mm.

Eighteen specimens from Simla, altitude *circa* 7000 ft., where they were found floating in large numbers on the surface of pools of a stream (*N. Annandale*, May 11th, 1908).

No. $\frac{4300}{16}$ Indian Museum Coll.

This species is a little smaller than most species of the genus. It resembles *Xenylla humicola* (O. Fabr.) Tullb. in having the mucro free and not fused up with the dens, though the separation in *X. humicola* is rather more marked when viewed from the dorsal aspect than in the present species. From *X. humicola* it is further distinguished—(*a*) by the absence of tenent hairs from

the extremity of the tibia; (*b*) in the combined length of the dens and mucro not exceeding that of the tibia; and (*c*) in the anal spines being larger and more strongly curved. *X. grisea* Axels. and *X. maritima* Tullb. differ from *X. obscura* in having the mucro and dens fused together, and in the anal papillæ being larger. *X. brevicauda* Tullb. and *X. nitida* Tullb. are both easily separable from the present species on account of their having a much smaller furcula.

Sub-fam. Achorutinæ Börn.

Genus Achorutes Templ.

Achorutes Templeton, "Thys. Hib.," Trans. Ent. Soc. Lond. vol. i. 1835, p. 96 (*ad partem*).

Achorutes Schött, "Zur Syst. und Verbreit. Pal. Collem.," Kongl. Svensk. Vet.-Akad. Handl. 1893, vol. xxv. p. 80.

Achorutes armatus Nicolet.

Syn. 1842. *Podura armata* Nicolet, Rech. pour servir à l'hist. des Podur. p. 57, pl. v. fig. 6.

† 1847. *Achorutes armatus* Nicolet, Essai s. classif. de l'ordre des Thys. p. 378.

One hundred and forty specimens, Peradeniya, Ceylon (*E. E. Green*, 1905).

I have compared these specimens with European examples of *Achorutes armatus* and find that they agree in all details of structure. In a letter dated Nov. 2nd, 1907, Mr. E. E. Green remarks that "this little species appears occasionally in vast numbers on the silt left in ditches after rains. It could then be collected by the bucketful. It has a peculiarly unpleasant odour of its own, which it has communicated to the spirit in which it has been preserved."

It has been previously recorded from the Oriental region by Oudemans ‡ from Sumatra.

Sub-fam. Neanurinæ Börn.

Genus Neanura Macgillivray.

† *Anoura* Gervais, Une quinz. d'espèces des Ins. Apt., 1842, p. 45.

† *Anura* Nicolet, Essai s. classif. de l'ordre des Thys., 1847, p. 386.

Neanura Macgillivray, "A Cat. Thys. N. America," Can. Ent. xxiii. 1891, p. 267.

* Neanura corallina, sp. n. (Pl. VII. figs. 23–26.)

Latera corporis parvis tuberibus instructa. Unguiculus inermis.

‡ Apterygota des Indischen Arch., in Max Weber's 'Zool. Ergebnisse einer Reise in Niederl.-Ostind.' Hft. i. p. 89.

Organa postantennalia desunt. Ocelli in utroque latere capitis 2. *Color coralium. Long.* 2–2·3 *mm.*

Head.—Broader than long, somewhat triangular in form (fig. 23). The *eyes* two in number on either side, situated at the base of a rounded dorsal tubercle which is surmounted by a central seta (fig. 25). *Post-antennal organs* wanting.

Antennæ.—Approximately equal in length to the head; the joints related to one another in length as 8 : 11 : 7 : 9. The articulation between the third and fourth joints imperfectly developed, and only visible on the ventral aspect. A small trilobed *sense-organ* at the apex of the terminal joint (fig. 24).

Trunk.—The *segments* mutually related in length as 6 : 8 : 9 : 8 : 8 : 8 : 8 : 6 : 4. The three thoracic segments each provided with a pair of small, dorso-lateral hemispherical protuberances, surmounted by setæ. The first three abdominal segments have each a similar pair of protuberances, together with a larger protuberance placed externally to the latter (fig. 23). The lateral margins of the fourth abdominal segment produced into a series of three such protuberances; the fifth and sixth abdominal segments each with a pair of similar bodies, only larger and dorso-lateral in position. The *cuticle* investing the body and appendages ornamented with minute closely-set tubercles (fig. 25).

Legs.—Short and stout, sub-equal in size; the hind pair of tibiæ as long as the femora, the tibiæ of the first and second pairs of legs shorter than the femora (fig. 26). The *claws* alike, large and stout, slightly curved and minutely tuberculated; teeth wanting.

Coloration.—Bright coral-red when alive (*Green*), but the pigment is completely soluble in alcohol, giving the latter a pinkish-orange colour.

Length 2–2·3 mm.

Fifty-two examples from Peradeniya, Ceylon, 1500 ft., where it is common under stones, logs of wood, and dead leaves (*E. E. Green*).

No. $\frac{4386}{16}$ Indian Museum Coll.

The relative lengths of the joints of the antennæ and legs exhibit considerable diversity in alcohol specimens owing to the variable amount of contraction undergone.

NEANURA PUDIBUNDA, sp. n. (Pl. VI. figs. 10–12.)

Organum postantennale ellipticum, inchoatum. Ocelli in utroque latere capitis 3. *Unguiculus superior uno dente armatus, inferior inchoatus. Color coccineus. Long.* 1·5–2·25 *mm.*

Head.—Somewhat broader than long, triangular. *Eyes* spherical, three on each side. The *post-antennal organs* rudimentary and appear to be represented by a patch of modified cuticle close to the outer side of each group of eyes (fig. 10).

Antennæ.—In length very nearly equal to the head; the articulation between the third and fourth joints imperfectly

developed, and only noticeable on the ventral aspect. The second joint the longest; the fourth joint with a small trilobed apical *sense-organ* (fig. 10).

Trunk.—The *segments* related to one another in length as 4 : 7 : 7 : 6 : 6 : 6 : 6 : 7 : 6, and provided with lateral tufts of long setæ. The postero-lateral margins of the fifth abdominal segment produced into a setigerous protuberance on either side; the sixth abdominal segment with a pair of such protuberances on each side (fig. 12).

Legs.—Short and subequal. The *superior claw* provided with a single tooth on the inner margin near the base. The *inferior claw* probably represented in a vestigial condition by a small basal process (fig. 11).

Coloration.—Scarlet when alive (*Annandale*); specimens in alcohol are white.

Length 1·5–2·25 mm.

Eight specimens taken on bats'-dung in total darkness in the Khayon Caves, near Moulmein, Lower Burma (*N. Annandale*, March 7th, 1908).

No. $\frac{4385}{16}$ Indian Museum Coll.

Dr. Annandale informs me that the Khayon Caves are of no great extent, though their inner parts are quite dark. There are no features about *Neanura pudibunda* that point to its being a true cave form, and most probably it is only a recent migrant thither.

* NEANURA INTERMEDIA, sp. n. (Pl. VI. figs. 13, 14; Pl. VII. fig. 20.)

Tubera corporis desunt. Unguiculus inermis. Organa post-antennalia nulla. Ocelli in utroque latere capitis 2. *Color coralium. Long.* 2 *mm.*

This species differs from *Neanura corallina*, sp. n. in the absence of dorso-lateral protuberances from the body, and in possessing longer setæ to the antennæ. From *Neanura pudibunda*, sp. n. it differs in the number of the eyes and in the absence of the tooth from the inner margin of each of the claws of the feet (fig. 14).

It resembles *Neanura corallina* very closely in the important structural features of the claws of the feet, the number of the eyes, and the absence of post-antennal organs. It resembles *Neanura pudibunda* in possessing two pairs of terminal setigerous protuberances to the abdomen, in the absence of the dorso-lateral protuberances from the abdomen, in the length and general disposition of the setæ on the antennæ (fig. 13), and in the general form of the body. It is thus intermediate in its characters between the two preceding species of the genus, though it differs from both in the above mentioned features.

Colour.—Coral-red; in alcohol specimens quite white.

Length 2 mm.

Eleven specimens from near Bhowali, Naini Tal District, in

the Himalayan foot hills of Kumaon, *circa* 5000 ft. It is very local, and occurs under damp loose bark and in decaying stems of *Euphorbia* (*A. D. Imms*, July 1909).

No. $\frac{4389}{16}$ Indian Museum Coll.

A Key to the three Species of the Genus *Neanura*.

A. Ocelli two on each side of the head. No post-antennal organs.
  1. Body without dorso-lateral protuberances ..... *N. intermedia.*
  2. Dorso-lateral protuberances present ..... *N. corallina.*
B. Ocelli three on each side of the head. Post-antennal organs present ..... *N. putibunda.*

Oudemans * has described a single species of this genus (*N. fortis*) from the Oriental region, where it occurs in Java, Sumatra, and Saleyer.

Genus Pseudachorutes Tullb.

Pseudachorutes Tullberg, "Fört. öfver Sv. Podurider," Öfvers. Kongl. Vet.-Akad. Förhandl. xxvii. 1871, p. 155.

Pseudachorutes Börner, "Das System der Collembolen," Mitt. Naturhist. Mus. Hamburg, xxiii. 1906, p. 164 (= ? *Gnathocephalus* Macg.).

Pseudachorutes anomalus, sp. n. (Pl. VI. figs. 1–4.)

Corpus tuberculatum. Tumores utriusque organi post-antennalis 17. *Unguiculus inermis. Pili clavati in tibiis nulli. Antennarum articulus quartus duobus precedentibus longior. Long.* 1–1·25 *mm.*

Head.—The *eyes* eight in number on each side. *Post-antennal organs* oval in form, each with seventeen tubercles (fig. 2).

Antennæ.—The joints related in length to one another as 5 : 6 : 4 : 11; the third and fourth joints partially fused together; a small tri-lobed *apical sense-organ*, and a second sense-organ situated a short distance below the apex of the antenna. Invested with a few short slender hairs; the cuticle tuberculated.

Trunk.—Almost entirely glabrous, only a few odd scattered hairs being present. The cuticle uniformly tuberculated (fig. 2).

Legs.—Short and stout; the cuticle not tuberculated. A few scattered setæ on the femora and basal joints, and a double circlet of setæ near the distal extremity of each tibia. The *claws* similar on each pair of legs, large and stout, more than one half the length of the tibia, unarmed (fig. 3). *Tenent hairs* absent.

Furcula.—Short and stout (fig. 4), not quite reaching up to the apex of the abdomen; the cuticle uniformly tuberculated. The *manubrium* and *dentes* about equal in length, and each approximately two and a half times the length of the mucro. The *mucro*

* Oudemans in Weber's 'Zool. Ergeb. einer Reise in Niederland.-Ostind.' Hft. i. p. 91.

(fig. 1) large and blade-like, its surface partially sculptured with small tubercles similar to those found elsewhere; at its apex is a rounded curved tooth.

Coloration.—In alcohol specimens dull brick-red above and pale dirty cream-colour beneath; the antennæ somewhat darker than the rest of the body and with a purplish suffusion. The legs and furcula whitish.

Length 1–1·25 mm.

Two specimens taken on the surface of water at Kurseong, E. Himalayas, 5000 feet (*N. Annandale*, July 4th, 1908).

No. $\frac{4395}{16}$ Indian Museum Coll.

This species differs from Tullberg's original diagnosis of the genus in having the cuticle of the whole of the body and appendages, with the exception of the legs, tuberculated.

Family Entomobryidæ D. T.

Sub-fam. Isotominæ Schäff.

Genus Isotoma Bourlet.

Isotoma Bourlet, Mém. sur les Podures, 1839, p. 23 (*ad partem*).

Isotoma siva, sp. n. (Pl. VI. figs. 16–18; Pl. VII. fig. 19.)

Setosa. Segmentum quartum abdominis triplo longius quam tertium. Antennæ capite duplo longiores; articulus quartus tertio fere duplo longior. Ocelli 12 : 6 *in utroque latere capitis. Organum postantennale nullum. Dentes mucronum tres, unus post alterum inserti. Long.* 1·25–1·5 *mm.*

Head.—Slightly longer than broad, as long as the thorax (fig. 19). The *eyes* six in number on each side (fig. 18); *post-antennal organs* wanting.

Antennæ.—In average length measuring ·5 mm.; the joints related to one another proportionately in length as 5 : 8 : 8 : 14.

Trunk.—The *segments* related to one another in length as 9 : 8 : 5 : 7 : 7 : 20 : 5 : 1 (fig. 19). Invested with plumose hairs.

Legs.—Sub-equal, clothed with plumose hairs; the claws to each of the pairs similar. The *superior claw* elongate and greatly acuminate, with two extremely minute teeth near the apex, and a third tooth near the base. The *inferior claw* unarmed. A single very long *tenent hair* in relation with each foot (fig. 16).

Furcula.—Approximately equal in length to the antennæ; clothed with plumose hairs. The *dentes* one half longer than the *manubrium*. The *mucrones* small, tridentate; provided with a prominent, upwardly directed terminal tooth, and immediately in front of it is a second tooth pointing obliquely forwards, and in close relation with the latter is a backwardly directed spiniform tooth (fig. 17).

Coloration.—When alive dull reddish with a purplish tinge. In alcohol specimens dull brick-red, with the head paler and inclining to yellowish. The antennæ and legs dark purplish; the furcula white. The eyes on a black patch on each side of the head, the two eye-patches united together by a transverse black band situated just behind the points of origin of the antennæ (fig. 19).

Length 1·25–1·5 mm.

Five specimens taken under stones along the edge of a mountain stream at Badrinath, Garhwal Himalaya, 10,300 ft. (*A. D. Imms*, May 27th, 1910).

No. $\frac{8605}{16}$ Indian Museum Coll.

ISOTOMA NIGROPUNCTATA, sp. n. (Pl. VII. figs. 27–29.)

Setosa. Segmentum quartum abdominis fere triplo longius quam tertium. Ocelli 4 : 2 *in utroque latere capitis. Dentes furculæ manubrio longiores; mucrones tridenticulati. Long.* 1·5–2 *mm.*

Head.—The *eyes* two in number on each side, placed one behind the other. The *post-antennal organs* very small, annular (fig. 27). Situated on the dorsal aspect of the head are large curved setæ, ciliated along one side at their apices.

Antennæ.—Slightly longer than half the total length of the head and trunk; the joints related to one another in length as 3 : 6 : 6 : 11.

Trunk.—The *segments* related respectively in length as 6 : 5 : 3 : 4 : 5 : 13 : 3 : 1. A prominent "collar" of setæ along the anterior border of the mesothorax, similar to those occurring on the head. A few scattered setæ over the general surface of the body, and a tuft of plumose hairs at the apex of the abdomen.

Legs.—The claws of the feet similar on each pair of legs (fig. 28). The *superior claw* slender, strongly curved and acuminate; armed with one large tooth towards the base, and a minute tooth immediately in front of the latter. The *inferior claw* linear and acuminate, unarmed. No *tenent hairs*; in the position occupied by them is a slender tapering seta.

Furcula.—Slender, the *dentes* related in length to the *manubrium* as 5 : 4. The *mucrones* (fig. 29) tridentate, armed with a slender curved terminal tooth, in front of the latter is a shorter and stouter vertical tooth, and at the base of the mucro is a slender backwardly directed spiniform tooth. Arising from the dens, at a distance from the apex equal to three times the length of the mucro, are several long compound (plumose) hairs. These extend backwards, parallel with the long axis of the furcula, reaching nearly to the apex of the mucro (fig. 29).

Coloration.—Straw-coloured with a slight brownish tinge; the legs and spring whitish. When viewed under an $\frac{1}{8}$ in. objective deposits of fine brown granules are seen beneath the cuticle, and to these the brownish tinge owes its origin. The deposits are for the most part arranged segmentally in transverse bands. The

eyes densely pigmented, appearing as two black dots on each side of the head.

Length 1·5–2 mm.

Three examples, taken under stones at the edge of a spring in the Kurseong District, E. Himalayas, 4700 feet (*N. Annandale*, March 25th, 1910).

No. $\frac{8603}{16}$ Indian Museum Coll.

This species is readily distinguishable from *Isotoma quadrioculata* Tullb. by the fact that the dentes are much longer than the manubrium, and that the mucrones are tridentate.

Sub-fam. Tomocerinæ Schäff.

Genus Tomocerus Nicolet.

Tomocerus Nicolet, Rech. p. serv. à l'hist. des Podur., 1841, p. 67.

Tomocerus vulgaris Tullb.

Syn. 1871. *Macrotoma vulgaris* Tullberg, "Fört. öfver Sv. Podurider," Öfvers. Kongl. Vet.-Akad. Förhandl. xxvii. p. 149.

1893. *Tomocerus vulgaris* Schött, "Zur Syst. und Verbreit. Palæarc. Coll.," Kongl. Svenska Vet.-Akad. Handl. xxv. p. 41.

A form closely resembling the type species and differing only in the following points:—

a. Smaller in size.

b. Ten instead of 12–16 spines to the dentes.

c. The basal tooth of the mucro larger and more pointed than is represented in Tullberg's figure of *T. vulgaris* *.

Length 3 mm.

Two specimens, taken under stones near the edge of a mountain stream at Badrinath, Garhwal Himalaya, 10,300 feet (*A. D. Imms*, May 27th, 1910).

No. $\frac{8612}{16}$ Indian Museum Coll.

In both examples the antennæ possessed only three joints, which were related to one another in length as 7 : 12 : 70. The antennæ themselves measured 2·2 mm. long.

On account of the small size of the specimens and their possessing only three joints to the antennæ, instead of the normal number of four, I believe that they are immature individuals of the above species. They are probably to be regarded as a Himalayan variety of the same, but this point cannot be definitely determined until adult specimens have been discovered.

Sub-fam. Heteromuricinæ, sub-fam. nov.

This sub-family is characterised by the presence of a median cercus to the fifth abdominal segment.

* Sveriges Podurider, pl. iv. fig. 9.

Genus HETEROMURICUS, gen. nov.

Mesonotum non prominens. Segmentum abdominale quartum quam tertium paullo longius. Antennæ quinque articulos habent. Ocelli 16 : 8 *in utroque latere capitis. Organa postantennalia carent. Segmentum abdominale quintum medio cereo instructum. Cutis squamosa.*

The presence of a single median cercus to the fifth abdominal segment separates this genus from other known genera of Collembola. In possessing five-jointed antennæ, and in the body being scaled, it shows perhaps closer relations with *Heteromurus* Wankel than with any other genus.

* HETEROMURICUS CERCIFER, sp. n. (Pl. VIII. figs. 49–51; Pl. IX. figs. 52–54.)

Antennarum articulus quartus longissimus, quam tertius duplo longior. Cercus segmento abdominali tertio longitudine æqualis. Unguiculus superior duobus minutis dentibus armatus; unguiculus inferior lanceolatus, acuminatus, inermis. Mucrones dentibus duobus atque seta spiniforme una instructi. Long. 2 *mm.*

Head.—Inclined at an angle of 45° with the long axis of the body; invested with scales and scattered setæ. The *eyes* eight in number on each side; *post-antennal organs* wanting.

Antennæ.—Equal in length to the furcula; five-jointed (fig. 52), the joints respectively related in length as 1 : 10 : 12 : 25 : 14. The basal joint small and annular, provided with a whorl of short spine-like setæ; the second and third joints scaled; the fourth and fifth joints clothed with closely-set whorls of short, curved hairs.

Trunk.—Densely clothed with *scales* (figs. 51 and 52); the scales at the hinder extremity of the body, surrounding the base of the cercus, larger than those found elsewhere. The *segments* mutually related in length as 6 : 6 : 5 : 6 : 8 : 12 : 4 : 1. Arising from the dorsal aspect of the fifth abdominal segment is a prominent median *cercus* (figs. 50 and 52) nearly equal in length to the third abdominal segment. The cercus densely clothed with scales, and provided ventrally with long slender setæ, possibly sensory. Along the anterior border of the mesothorax is a "collar" or "frill" of stout setæ, and a tuft of similar setæ at the extremity of the abdomen,

Legs.—Sub-equal; the two basal joints clothed with setæ, the remaining joints scaled down to the claws; interspersed among the scales are numerous hairs and setæ (fig. 49). The *superior claws* of the feet with two small teeth along the inner margin (in five specimens one or other of the teeth were absent). The *inferior claws* large, lanceolate and acuminate, unarmed; those of the third pair of legs a little longer than the corresponding claws of the preceding pairs.

Furcula.—Slender, reaching forwards to the ventral tube; densely clothed ventrally with scales. The *dentes* related in

length to the *manubrium* as 4 : 3. The *mucrones* small, armed with a curved terminal tooth, a single dorsal tooth and a basal spiniform tooth (fig. 54).

Coloration.—Ground-colour of the body and furcula varies from whitish to dull ochre-yellow; the legs, antennæ, and cercus bluish-violet. The eyes on a black patch on each side of the head. The ground-colour of the body varies according to whether the specimens have been denuded of their scales or not.

Length varying from 1·5–2·5 mm. (excluding cercus); average length 2 mm.

Thirteen specimens, taken under dead leaves at Calcutta (*Indian Museum Collector*, Jan. 14th–20th, 1908, and Feb. 18th, 1910).

No. $\frac{4445}{16}$ Indian Museum Coll.

Sub-fam. Entomobryinæ Schäff.

Genus Isotomurus Börn.

Isotomurus Börner, "Neue altw. Collem., nebst Bemerk. z. Syst. der Isotom. und Entomob.," Sitz. Gesell. naturf. Freunde zu Berlin, 1903, p. 129.

* Isotomurus palustris Müll. (Pl. VI. fig. 15; Pl. VII. figs. 21, 22.)

† Syn. 1776. *Podura palustris* Müller, Zool. Dan. Prodr., Havniæ, p. 184.

1873. *Isotoma palustris* Lubbock, Monogr. Coll. and Thys. p. 169.

Head.—The *eyes* eight in number on each side (fig. 22).

Antennæ.—A little longer than the thorax, the joints related proportionately in length as 4 : 8 : 9 : 9 (in one example they were related as 3 : 6 : 7 : 8).

Trunk.—Clothed with plumose hairs. The third abdominal segment a little longer than the fourth.

Furcula.—As long as, or a little longer than the antennæ; reaching to the ventral tube. The *dentes* approximately twice the length of the *manubrium*.

Coloration.—Ochre-yellow, either with or without a few small irregular scattered black markings on the dorsal aspect, which coalesce in some specimens to form blotches. The antennæ and furcula paler; the antennæ in two examples tinged with purple.

Length 2 mm.

Ten specimens, taken on the surface of water at Calcutta ‡ (*Indian Museum Collector*, Sept. 1st, 1908, and Sept. 22nd, 1909).

No. $\frac{4393}{16}$ Indian Museum Coll.

The specimens agree in all essential details of structure with European forms of the species.

‡ *I. palustris* has been previously recorded from the Oriental region by Börner, from Java.

Genus Lepidocyrtus Bourlet.

Lepidocyrtus Bourlet, Mém. s. les Podurelles, 1839, p. 15.
Lepidocyrtus Börner, "Das System der Coll.," Mitt. Naturhist. Mus. Hamburg, 1906, xxiii. pp. 164 and 174. [Including *Pseudosinella* Schäff. and *Acanthurella* Börn.]

Lepidocyrtus robustus, sp. n.

Segmentum abdominale quartum, thoracem, et segmentum abdominale primum longitudine æquans. Unguiculus superior dentibus duobus parvis armatus; unguiculus inferior lanceolatus, inermis. Long. 3·6 *mm.*

Antennæ.—Three times longer than the head, the joints related to one another in length as 2 : 3 : 3 : 4.

Trunk.—The *segments* related respectively as 16 : 6 : 4 : 5 : 4 : 26 : 2 : 1. The fourth abdominal segment six times the length of the preceding segment.

Legs.—The claws similar on each of the pairs of legs; the *superior claw* armed with two small teeth situated respectively from the base and apex of the claw, at distances equal to one third the length of the latter. The *inferior claw* lanceolate, unarmed. A single *tenent hair* in relation with each foot.

Furcula.—The *dentes* very nearly twice the length of the *manubrium*; the *mucrones* tridentate, similar to the typical form found in the genus.

Coloration.—The ground colour yellowish, the appendages paler. The third joint of the antennæ with an apical suffusion of violet-black, the fourth joint almost white with a slight basal suffusion of violet. The eyes on a black patch on each side of the head; a purplish lateral suffusion on each side of the head behind the eye-patch. An extensive suffusion of the same colour on either side of the mesothorax, and a broad conspicuous band of similar colour along the distal portion of the fourth abdominal segment. The femora of the hind pair of legs almost entirely violet.

Length 3·6 mm. (including the head).

One example, taken under dry leaves and stones on the edge of a jungle stream, Maddathoray, W. base of W. Ghats, Travancore, S. India (*N. Annandale*, November 18th, 1908).

No. $\frac{8611}{16}$ Indian Museum Coll.

This species is closely allied to *L. maximus* Schött *, from the Kamerun. It is separable, however, on account of the great size of the fourth abdominal segment; in the inferior claws of the feet being lanceolate, with its lower margin curved instead of being straight; and in the stouter tenent hair.

* "Insektenfauna von Kamerun: Collembola," Bihang till K. Sv. Vet.-Akad. Handl., Bd. 19, Afd. iv. no. 2, p. 11, pl. iii.

Genus ENTOMOBRYA Rondani.

† *Entomobrya* Rondani, Dipterol. Ital. Prodr. vol. iv.
Degeeria Nicolet, Rech. p. s. à l'hist. d. Podur., 1842, p. 70.
Entomobrya Börner, "Das Syst. Coll.," Mitt. Naturhist. Mus. Hamburg, 1906, xxiii. p. 164. [Including *Homidia* Börner and *Sinella* Brook.]

* ENTOMOBRYA KALI, sp. n. (Pl. VII. fig. 33; Pl. VIII. figs. 34–36.)

Antennæ truncum longitudine fere æquantes. Segmentum abdominale quartum plus dimidia trunci parte occupans. Mucrones denticulis duobus atque seta spiniforme una instructi. Flava; anteriore parte capitis, marginibus segmenti secundi thoracis, segmentis secundis tertiisque abdominis, et fascia transversa posteriore quarti, nigris. Long. 1·75–2 *mm.*

Head.—Slightly longer than broad; clothed with short, scattered plumose hairs and a dorsal tuft of very long, stout setæ, ciliated along one side at their apices. The *eyes* eight in number on each side.

Antennæ.—Usually very nearly equal in length to the body excluding the head, but in some specimens they exceed the length of the body. Four-jointed, densely clothed with hairs, dispersed among which are slender setæ. The joints related to one another in length as 5 : 6 : 6 : 11; the ring-like basal joint, typically present in the genus *Entomobrya*, is absent.

Trunk.—Fusiform, clothed with short, curved plumose hairs, scattered among which are slender setæ. The thorax and first two abdominal segments provided dorsally with very long, stout setæ, ciliated along one side at their apices (fig. 36); a tuft of similar setæ at the apex of the abdomen. The trunk *segments* related proportionately in length as 11 : 5 : 3 : 6 : 6 : 45 : 5 : 1 (fig. 34).

Legs.—Clothed with hairs among which are slender setæ. The *superior claws* moderately slender and bidentate along the inner margin (fig. 33); the teeth situated respectively from the apex of the claw at a distance equal to one quarter and one half the total length of the latter. The *inferior claws* a little more than half the length of the superior claws, acuminate and sharply pointed, the margins without any teeth. A single *tenent hair* in relation to each foot.

Furcula.—As long as the trunk excluding the mesothorax; densely clothed with hairs, dispersed among which are slender setæ. The *dentes* a little longer than the *manubrium*, very slender, and each is provided with a double row of small peg-like spines along the proximal half of its inner aspect. The *mucrones* tridentate, with a curved terminal tooth, a stout erect conical middle tooth, and an oblique acicular posterior tooth (fig. 35).

Coloration.—Light ochre-yellow marked with patches of violet-black. The eyes on a large irregular black area on each side; a

small violet-black patch between the bases of the antennæ and frequently prolonged into a narrow streak on each side to unite with the eye-patch. A triangular area of the same colour on the middle of the hind border of the mesothorax, and a slight suffusion on each side near the outer margin of that segment. The metathorax and the first abdominal segment entirely yellow; the second abdominal segment violet-black, with the exception of a narrow irregular yellow area along its anterior margin; the third abdominal segment entirely deep violet-black; the posterior half of the fourth abdominal segment densely suffused with violet-black; the fifth and sixth abdominal segments yellow. The first and second joints of the antennæ yellow, the second joint in most specimens with a slight violet suffusion at its apex; the third and fourth joints purplish.

Length 1·75–2 mm.

Fifty-one specimens taken under dead leaves in Calcutta, where it appears to be very plentiful (*Indian Museum Collector*, January 16th, 17th, 18th, and 20th, 1908, and February 18th, 1910).

Nos. $\frac{4383}{16}$ and $\frac{4384}{16}$ Indian Museum Coll.

In all the individuals examined the colour pattern was found to be very constant, practically no variation being observed. In specimens that had been kept in alcohol for two years, the ground colour is much paler and cream-coloured. The long, stout setæ (fig. 36) fall off very readily in alcohol specimens, and very many specimens have lost them altogether. In many cases the antennæ are very much shrivelled in alcohol, and in a large proportion of the specimens the tenent hair is either broken or lost from one or more of the legs.

ENTOMOBRYA KALI LUTEA, var. nov.

This differs from the typical form in having the fourth abdominal segment entirely yellow.

One specimen taken among low herbs and grass at Simla *circa* 7000 ft. (*N. Annandale*, May 12th, 1908).

No. $\frac{8614}{16}$ Indian Museum Coll.

ENTOMOBRYA CRASSA, sp. n. (Pl. VII. figs. 30, 31.)

Segmentum tertium abdominis quartum longitudine fere æquans. Mucrones denticulis duobus atque seta spiniforme una instructi. Color flava-viridis. Long. 1·5 *mm.*

Head.—The *eyes* eight in number on each side (fig. 31); the *post-antennal organs* wanting.

Antennæ.—The joints mutually related in length in the proportion of 4 : 6 : 6 : 9.

Trunk.—Provided with pilose hairs of various lengths. The *segments* related to one another in length as 8 : 7 : 4 : 5 : 8 : 10 : 3 : 2.

Legs.—Clothed with pilose hairs among which are a few stouter

setæ. The *superior claw* of each foot slender and acuminate, with a small tooth situated at the middle of the inner margin. In some examples there is a second, and much smaller tooth, placed half way between the former tooth and the apex of the claw. The *inferior claw* of each foot slender and tapering, a little more than half the length of the superior claw, unarmed. A single very slender *tenent hair* to each foot.

Furcula.—·7–·9 mm. long; the *manubrium* one half the length of the *dens*. The *mucro* $\frac{1}{50}$ mm. long (fig. 30), tridentate, with a slender, curved terminal tooth, a vertical and somewhat stouter tooth anterior to the latter, and a minute backwardly directed spiniform tooth.

Coloration.—When alive, dull dark green to the naked eye. In alcohol specimens, pale greenish yellow suffused with dark indigo-blue. The eyes on a black patch on each side of the head, the two patches joined together by a transverse band, which passes across the head just behind the bases of the antennæ. On the middle of the dorsal side of the head is a prominent black sagittate marking thus ↓, with its apex directed backwards. The antennæ and legs darker than the body, somewhat purplish in colour. The furcula yellowish white.

Length varying from 1·5–1·8 mm.

Six examples, taken in ants' nests under stones about half a mile below the base of the Satopanth Glacier, Garhwal Himalaya, 12,500 ft. (*A. D. Imms*, May 25th, 1910).

No. $\frac{8600}{16}$ Indian Museum Coll.

This species differs from typical members of the genus *Entomobrya*, and resembles the genus *Orchesella*, in the very short fourth abdominal segment. It agrees with the genus *Entomobrya* in the characters of the antennæ and furcula, in the eyes, and in the absence of post-antennal organs. *Entomobrya anomala* Carpenter * similarly possesses a relatively short fourth abdominal segment. The latter species, however, may ultimately be separated into a new genus on account of its possessing six-jointed antennæ.

Genus Seira Lubbock.

Seira Lubbock, "Notes on the Thysanura," pt. iv., Trans. Linn. Soc. 1870, vol. xxvii, p. 279, pl. 45 (= *Ptenura*, Templ., Börn.).

Sira Tullberg, "Sveriges Podurider," Kongl. Svensk. Vetensk.-Akad. Handl. 1872, vol. x, p. 41, pl. vi.

Seira frigida, sp. n. (Pl. VIII. figs. 41, 42.)

Unguiculus superior tridentiformis; denticuli perparvi, ita collocati ut unus post alterum insertus sit. Unguiculus inferior lanceolatus, inermis. Mucrones breves, bidentati. Articulo quarto

* "On two new Irish species of Collembola," Sci. Proc. Roy. Dublin Soc. vol. xi. (n. s.) 1906, p. 40, pl. ii.

antennarum primum et secundum longitudine æquante. Tibiæ pilis clavatis singulis instructæ. Long. 2·5 *mm.*

Head.—As long as the combined length of the meso- and metathorax. The *eyes* as usual in the genus.

Antennæ.—Equal in length to the furcula (in some examples slightly shorter than that organ). The joints related to one another in length as 5 : 8 : 9 : 13.

Trunk.—Invested with scales, among which are prominent curved setæ, ciliated at their apices along one side, and disposed in the following manner : a prominent "frill" or "collar" along the anterior border of the mesothorax, and a second group of such setæ near the posterior margin of that segment. A few scattered setæ on the metathorax, and a tuft of similar but shorter setæ at the extremity of the abdomen. The *segments* related to one another in length as 8 : 6 : 5 : 5 : 5 : 23 : 5 : 3.

Legs.—The claws of the feet similar on all pairs of legs (fig. 41). The *superior claws* moderately slender, slightly curved at their extremity, and armed with three minute teeth along the inner margin. The *inferior claws* lanceolate, entire, slightly curved at their apices. A *single tenent hair* in relation to each foot.

Furcula.—In length measuring ·8 mm. ; the *manubrium* related to the *dentes* in length as 13 : 19—or approximately as 2 : 3. The *dentes* without ventral scales ; slightly curved upwards at their apices (fig. 42). The *mucrones* only imperfectly separated off from the dentes, armed with a prominently curved terminal tooth and a basal spiniform tooth. The latter directed backwards in an oblique fashion, almost reaching to the apex of the mucro (fig. 42).

Coloration.—Dirty yellowish white, marked with irregular patches of blue-black disposed in the following manner :—A prominent patch on either side of the head enveloping each eye-group, and united by a transverse band, which crosses the head immediately behind the bases of the antennæ. A slender Y-shaped marking on the middle of the dorsal aspect of the head. A pair of irregular lateral patches on the metathorax and on the first three abdominal segments; the third abdominal segment with a median unpaired patch near its posterior border. The fourth abdominal segment marked with several irregular lateral and median areas partially confluent with one another, and varying in different specimens ; a short transverse band near the posterior end of the segment. The fifth abdominal segment with a pair of prominent lateral patches near its posterior margin. The sixth abdominal segment with a pair of small lateral spots.

The legs, antennæ, and furcula yellowish white, similar to the ground colour of the body. The antennæ and legs conspicuously marked with blotches of blue-black ; in one very dark example these markings on the antennæ were confluent, the latter appearing entirely blue-black.

Length varies from 2·1–2·8 mm.

Four specimens, taken in ants' nests under stones on a mountain side a short distance below the base of the Satopanth Glacier, Garhwal Himalaya, *circa* 12,300 ft. (*A. D. Imms*, May 27th, 1910).

No. $\frac{8608}{16}$ Indian Museum Coll.

In one example the lateral blue-black markings on the metathorax and the first abdominal segment, together with the median posterior patch on the third abdominal segment, were entirely absent.

SEIRA BRAHMA, sp. n. (Pl. VIII. figs. 43, 44.)

Unguiculus superior bidenticulatus; unguiculus inferior lanceolatus, inermis. Articulus quartus antennarum longissimus, secundus et tertius inter se longitudine sub-æquales. Mucrones breves tridentati. Tibiæ pilis clavatis singulis instructæ. Long. 1·5 *mm.*

Head.—The *eyes* eight in number on each side, the anterior four in each group the largest. No *post-antennal organs* present.

Antennæ.—A little longer than half the length of the body, the joints related in length to one another as 3 : 8 : 8 or 9 : 14.

Legs.—The claws of the feet similar on each of the pairs of legs (fig. 43). The distal extremity of each tibia provided with a single extremely slender *tenent hair*. The *superior claws* armed with two small teeth, one of which is situated from the base at a distance equal to one third the total length of the claw. The other tooth is situated at a similar distance from the apex of the claw. The *inferior claws* lanceolate and unarmed.

Furcula.—Reaching to the ventral tube; slender. The *dentes* related in length to the *manubrium* as 6 : 5; tapering to their extremities. The *mucrones* tridentate, armed with a curved upwardly directed terminal tooth, a median tooth slightly inclined in a forward direction, and a backwardly directed basal spiniform tooth (fig. 44).

Coloration.—Ground colour pale yellowish dusted over with indigo-blue, the insect appearing slate-grey under a hand-lens. The antennæ indigo-blue, the legs and furcula whitish. The intersegmental areas of the body yellowish. The eyes on a black patch on each side of the head.

Length 1·5 mm.

Five examples, taken crawling up the surface of whitewashed walls in a bungalow at Allahabad (*A. D. Imms*, September 20th, 1907).

No. $\frac{8601}{16}$ Indian Museum Coll.

Genus PSEUDOSIRA Schött.

Pseudosira Schött, "Insektenfauna von Kamerun: Collembola," Bihang till K. Svensk. Vet.-Akad. Handl. 1893, Bd. 19, Afd. iv, p. 10, taf. ii. figs. 1–11.

Pseudosira Börner, "Das Syst. Coll.," Mitt. Naturhist. Mus. Hamburg, 1906, xxiii. p. 164 (including *Mesira* Stscherbakow [= *Lepidocyrtinus* Börner]).

* Pseudosira indra, sp. n. (Pl. VII. fig. 32 ; Pl. VIII. figs. 37–40.)

Unguiculus superior tridenticulatus; denticuli perparvi, ita collocati ut unus post alterum insertus sit. Unguiculus inferior lanceolatus, inermis. Mucrones breves, falciformes. Tibiæ pilis clavatis singulis instructæ. Articulo quarto antennarum longissimo, primum et secundum longitudine æquante. Long. 1·5 *mm.*

Head.—A little longer than the mesothorax; clothed with scales, among which on the dorsal aspect are long stout setæ, ciliated along one side at the apex. The *eyes* eight in number on each side; no post-antennal *organs* (fig. 37).

Antennæ.—As long as, or, in some examples, a little longer than the furcula. The joints related respectively in length as 4 : 7 : 7 or 8 : 11. The first two joints clothed with scales, the third and fourth joints clothed with small hairs.

Trunk.— Clothed with scales of somewhat variable shape, but for the most part oval or linear-oval. The scales are finely and faintly striated, with a relatively long, and very slender pedicel (fig. 40). Setæ (fig. 39), similar to those found on the head, form a kind of "frill" or "collar" along the anterior edge of the mesothorax; a few are also scattered over the general surface of the body, and there is a terminal tuft at the extremity of the abdomen. The trunk *segments* mutually related in length as 7 : 5 : 4 : 4 : 6 : 15 : 3 : 1.

Legs.—All the feet similar; the distal extremity of each tibia provided with a single *tenent hair*. The *superior claws* slender and acuminate, armed with three small teeth along their inner margin. The *inferior claws* linear and acuminate, aciculur, unarmed (fig. 38).

Hamula.—The *corpus* with a median stout anterior seta placed in front of the rami. Each *ramus* quadridentate.

Furcula.—Slender, reaching to the ventral tube. The *manubrium* somewhat shorter than the dentes; scaled. The *dentes* clothed ventrally with scales. The *mucrones* hook-shaped (fig. 32).

Coloration.—Greyish white when denuded of the scales; when the greater number of the scales are present the ground colour appears markedly brown. The antennæ tinged with violet, a slight violet suffusion on the mesothorax, and some small lateral patches of the same colour on either side of the abdomen. The furcula white. The eyes on a black patch on each side of the head.

Length varies in different examples from 1·25–2 mm.

Five specimens on the surface of the pool in the "compound" of the Indian Museum, Calcutta (*A. D. Imms*, December 31st, 1909). The specimens were apparently immature.

No. $\frac{8602}{16}$ Indian Museum Coll.

Thirty specimens taken under dead leaves and at the bases of the leaves of a palm tree, in the "compound" of the Indian Museum, Calcutta (*Indian Museum Collector*, July 28th, 1909, and March 18th and 21st, 1910).

No. $\frac{4448}{16}$ Indian Museum Coll.

The antennæ of this species are very variable; in three specimens the second and third antennal joints were equal in length; one example possessed only three joints to the antennæ; and another specimen had three joints to the right antenna and four to the left. These anomalies are most likely to be explained as being due to the results of regeneration after an injury. The specimens were in each case, so far as could be ascertained, quite mature.

Pseudosira indra does not agree fully with the diagnosis of the genus given by Schött. The chief points of difference are: (*a*) the presence of teeth to the superior claws of the feet; (*b*) the relative length of the joints of the antennæ; and (*c*) the great length of the fourth abdominal segment. As Schött erected the genus on a single specimen only, some of his generic characters will, I believe, prove to be of nothing more than specific value.

Börner * separates *Pseudosira* from *Seira* principally by the fact that the dentes are scaled ventrally in the former and not so in the latter genus. This character along with the hook-like mucro renders the genus *Pseudosira* easy of recognition.

Genus Sinella Brook.

Sinella Brook, "On a new genus of Collembola allied to *Degeeria*," Journ. Linn. Soc., Zool. xvi. 1882, p. 541.

Sinella montana, sp. n. (Pl. VIII. fig. 48; Pl. IX. figs. 56, 57.)

Ocelli nulli. Unguiculus superior denticulis quattuor armatus. Mucrones furculæ dente uno atque seta spiniforme uno instructi. Omnino alba. Long. 2 *mm.*

Head.—The *eyes* and *post-antennal organs* absent.

Antennæ.—Measuring ·9 mm. long; the joints related respectively in length as 8 : 13 : 13 : 26; the terminal joint tapering somewhat distally. Clothed with pilose hairs; setæ are present among the hairs on the first three joints, and on the proximal portion of the fourth joint.

Trunk.—Clothed with short pilose (compound) hairs, among which, on the head and mesothorax, are numerous large erect setæ similar to those of *Sinella curviseta* Brook (fig. 57*a*). The extremity of the abdomen provided with longer compound hairs (fig. 57 *b*). The *segments* related to one another in length as 15 : 10 : 5 : 11 : 11 : 32 : 7 : 5.

* Das System der Collembolen, pp. 164 and 174.

Legs.—*Superior claws* of the feet elongate and acuminate, with two large slender proximal teeth; in front of the latter are two minute teeth, the distal one extremely small and situated just behind the apex of the claw. The *inferior claws* flattened, bifid at their apex; resembling those of *Sinella höfti* Schäff. (fig. 48). *Tenent hairs* absent, their place being occupied by a slender tapering seta. The legs are clothed with plumose compound hairs similar to those found on the trunk, and among them, on the inferior surface of the tibiæ, are spine-like setæ (fig. 48).

Furcula.—Equal in length to the antennæ; the *manubrium* related in length to the dentes as 2 : 3; clothed on its dorsal aspect with long plumose hairs. The *mucrones* resembling those of *S. höfti*; provided with a single stout and prominently curved terminal tooth, and a basal backwardly directed spiniform tooth (fig. 56).

Coloration.—Entirely white.

Length in adult examples 2 mm.; in young specimens 1–1·5 mm.

Two adult specimens and four young specimens; taken in an ants' nest under stones on a mountain-side near Badrinath, Garhwal Himalaya, *circa* 10,300 ft. (*A. D. Imms*, May 27th, 1910).

No. $\frac{8606}{16}$ Indian Museum Coll.

This species is closely allied to *Sinella höfti* Schäff., but differs in the claws of the feet. It is readily separable from *S. myrmecophila* Reuter, which similarly occurs in ants' nests, by the characters of the mucro and feet.

The young examples differ from adult specimens chiefly in having the first antennal joint proportionately shorter.

Genus Dicranocentroides, gen. nov.

Mesonotum non prominens. Segmentum abdominale quartum longius dimidia parte trunci. Antennæ dimidia corporis parte longiores, quadriarticulatæ. Ocelli 16 : 8 *in utroque latere capitis. Furcula latitudine apici fere æqualis. Dentes spinosi; mucrones lati denticulis armati. Cutis squamosa.*

This genus agrees with *Dicranocentrus* Schött in the dentes being armed with simple spines, and in the length of the antennæ. With *Campylothoracx* Schött it agrees in the great length of the fourth abdominal segment, in the form of the furcula, which scarcely tapers in width up to the apex, and in the form of the mucrones. It is separable from the latter genus on account of the thorax not being flexed upon itself, and the relative shortness of the antennæ.

*Dicranocentroides fasciculatus, sp. n. (Pl. VIII. figs. 45–47; Pl. IX. figs. 55 & 55 *a*; Pl. X. fig. 68.)

Antennæ articulo ultimo omnium longissimo; ceteris inter se

longitudine æqualibus. Unguiculus superior duobus dentibus armatus; unguiculus inferior lanceolatus. Mucrones lati denticulis quinque. Long. 2·5–3·5 *mm.*

Head—Equal in length to the mesothorax. The *eyes* eight in number on each side; *post-antennal organs* absent.

Antennæ.—Slightly longer than half the total length of the body (including the head). The first three joints subequal in length, the terminal joint a little longer than the preceding ones. The first two joints clothed with long and conspicuous, erect, almost black setæ; the joints in consequence appearing greatly swollen to the naked eye, and like "bottle brushes" when viewed under the low power of the microscope (fig. 68).

Trunk.—Clothed with both hairs and scales with many transitional structures between the two (fig. 47). The *segments* related to one another in length as 12 : 5 : 4 : 5 : 5 : 44 : 4 : 2; the fourth abdominal segment longer than half the total length of the trunk.

Legs.—Long, the third pair longest of all and extending to the apex of the abdomen. A single long *tenent hair* in relation with each foot. The *superior claw* of the first and second pairs of legs long, and gradually tapering to a point (fig. 45), armed with two teeth along its inner margin; one tooth situated at a distance from the base of the claw equal to one third of the total length of the claw, the second tooth placed at the same distance from the apex of the claw. The *inferior claw* lanceolate and acuminate, unarmed, but in occasional specimens its inner margin shows minute rudimentary serrations. The superior claw of the third pair of legs slightly broader than that of the preceding pair; the inferior claw with a minute tooth at its base on the inner margin.

Ventral Tube.—Long and cylindrical, the vesicles bilobed (fig. 68).

Furcula.—Reaching to the ventral tube; clothed ventrally with scales. The *dentes* scarcely narrowing to their apices, a little longer than the *manubrium*, armed with a longitudinal row of short stout lanceolate spines along the middle of the inner lateral margin of each (fig. 46). Towards the apex of the dens the spines become replaced by stout setæ. The *mucrones* with two large terminal teeth, two smaller dorsal, sub-apical teeth, and a lateral tooth (fig. 55).

Coloration.—Seen with the naked eye when alive, it appears black with a conspicuous yellow band across the abdomen. It varies from very deep purple-brown to black, with an extremely variable arrangement of the colour-pattern. In the majority of individuals, the base of the metathorax, and the first and second abdominal segments are pale yellow suffused with purplish brown. The first two joints of the antennæ are similar to the ground colour of the body, the third and fourth joints vary from yellow to dark violet. At the base of each joint, in five out of the six specimens, there is a narrow transverse band of pale

yellow. The legs and furcula vary from pale dirty yellow, with purplish or violet suffusions, to deep purple.

Length 2·5–3·5 mm.

Six specimens, taken under damp dead leaves, chiefly of *Quercus*, in forest at Bhowali, Himalayan foot-hills of Kumaon, *circa* 5700 ft. (*A. D. Imms.* October 23rd, 1909).

No. $\frac{4394}{16}$ Indian Museum Coll.

Genus Cremastocephalus Schött.

Cremastocephalus Schött, "North American Apterygogenea," Proc. Cal. Acad. Sci. 2nd ser. vol. vi. 1896, p. 175.

Cremastocephalus Schäffer, "Collembola des Bismarck-Archipels," Arch. f. Naturgesch., 1898, p. 406.

Cremastocephalus indicus, sp. n. (Pl. IX. figs. 58, 59.)

Ocelli 16 : 8 *in utroque latere capitis. Unguiculus superior duobus parvis dentibus armatus; unguiculus inferior inermis. Prætarsi pilis clavatis singulis instructi. Mucrones furculæ trilobati. Long.* 1·5 *mm.*

Head.—The *eyes* eight in number on each side; the *post-antennal organs* absent.

Antennæ.—Long and slender, equal to the combined length of the trunk and furcula. The joints related proportionately in length as 5 : 7 : 4 : 7. The two basal joints armed with long slender setæ.

Trunk.—Densely covered with fine hairs and slender setæ. The *segments* mutually related in length in the proportion of 16 : 7 : 7 : 13 : 1 : 50 : 7 : 2.

Legs.—The *superior claws* moderately stout, armed with two minute teeth (fig. 58): in 15 per cent. of the specimens one or other of these teeth was absent. The *inferior claws* broad, obliquely truncated distally, unarmed. A single, very stout, *tenent hair* to each foot arising from the prætarsus.

Furcula.—Reaching to the ventral tube. The *manubrium* related in length to the *dentes* in the proportion of 8 : 11. The *mucrones* (fig. 59) quadrangular, with the distal border trilobed; in some specimens the lobes appeared to be worn down and absent. A single small *scale-like appendage* at the apex of each dens on the dorsal side.

Coloration.—Ground colour varying from cream colour to yellow. The eyes on a conspicuous black patch on either side of the head. The lateral margins of the thorax and first abdominal segment edged with indigo-blue; a few scattered patches of the same colour over the rest of the abdomen. The antennæ suffused distally with violet; the legs and furcula white.

The coloration, however, is extremely variable, and a detailed description of the various forms that occur would occupy considerable space. In several instances almost all traces of the indigo-blue markings were absent; this reduction of the colour-

pattern is more evident in the Allahabad specimens. On the other hand, in several of the Bengal specimens the markings are much enlarged and intensified.

Length varying from 1 mm. to 1·75 mm.; average length 1·5 mm.

Twenty-five specimens, taken at night crawling up the surface of a whitewashed outer wall of a bungalow, illuminated by electric light, Allahabad (*A. D. Imms*, September 22nd, 1907).

No. $\frac{4449}{16}$ Indian Museum Coll.

Twenty-six specimens, taken under dead leaves, Calcutta; for the most part poorly preserved (*Indian Museum Collector*, Jan. 1st, 16th, and 18th, 1908).

CREMASTOCEPHALUS MONTANUS, sp. n. (Pl. IX. fig. 60.)

Ocelli 16 : 8 *in utroque latere capitis. Unguiculus superior duobus parvis dentibus armatus; unguiculus inferior inermis. Prætarsi pilis clavatis singulis instructi. Mucrones furculæ tribus dentibus armati. Long.* 2–2·5 *mm.*

Head.—The *eyes* eight in number on each side; *post-antennal organs* absent.

Antennæ.—The first two joints related proportionately in length as 5 : 7; the remaining joints missing in the specimens examined.

Trunk.—The *segments* related in length in the proportion of 5 : 3 : 3 : 4 : 1 : 15 : 2 : 1. Clothed with fine hairs and slender setæ.

Legs.—The *superior claws* moderately stout, armed with two small teeth; one tooth situated from the base of the claw at a distance equal to one third the length of the claw; the other placed at a similar distance from the apex. The *inferior claws* broad, resembling those of *C. indicus* (fig. 58), only slightly more acuminate; unarmed. A single *tenent hair* to each foot very stout, and arising from the prætarsus.

Furcula.—The *mucrones* inclined at an angle of 30° with the *dentes*, tridentate (fig. 60). At the apex of each dens is a *scale-like appendage*, equal in length to the mucro.

Coloration.—Straw-coloured inclining to yellow. The lateral margins of the thorax and the first segment of the abdomen edged with dark violet. A few dorso-lateral markings of the same colour over the rest of the abdomen, and a proximal and distal suffusion to each of the tibiæ. The two basal antennal joints inclining to pale yellow; the furcula white.

Length 2–2·5 mm.

Three examples, taken among damp soil under stones and leaves at Kurseong, E. Himalayas, 5000 ft. (*F. H. Gravely*, March 25th, 1910).

No. $\frac{8608}{16}$ Indian Museum Coll.

Cremastocephalus montanus is closely related to the preceding species (*C. indicus*), but can be readily separated by the form of

the mucro. In *C. montanus* the mucro is relatively short, prominently tridentate, and the scale-like appendage is equal in length to that organ. In *C. indicus* the mucro is longer, is not toothed but merely lobed, and the scale-like appendage is considerably shorter.

Genus Paronella Schött (*sens. lat.*).

Paronella Schött, "Insektenfauna von Kamerun: Collembola," Bihang till K. Sv. Vet.-Akad. Handl., Bd. 19, Afd. iv. p. 14, taf. iv.

Paronella Schäffer, "Die Collembola des Bismarck-Archipels," Arch. f. Naturgesch. 1898, p. 408. (Including *Trichorypha* Schött, *loc. cit.* p. 16, taf. v.)

Schäffer described *Paronella dahlii* from the Bismarck Arch., which is intermediate in its characters between *Paronella* and *Trichorypha*. I have, therefore, followed him by including Schött's two genera in the single genus *Paronella*. Schött states that the ocelli are four in number on each side in *Paronella*, but, nevertheless, figures eight in a group! This latter number obtains in *Paronella dahlii*.

*Paronella börneri, sp. n. (Pl. X. figs. 70–74; Pl. XI. figs. 75, 76.)

Segmentum abdominale quartum dimidiam trunci partem occupans. Antennæ corpore longiores. Ocelli 16 : 8 *in utroque latere capitis. Unguiculus superior denticulis tribus* (*vel duobus*) *instructus; unguiculus inferior inermis. Mucrones lati. Long.* 3·5 *mm.*

Head.—Longer than broad, approximately equal in length to the thorax; inclined at an angle of 45° with the longitudinal axis of the body. A group of strongly chitinised setæ between the eyes and directed forwards towards the bases of the antennæ. The *eyes* eight in number on each side (fig. 74); *post-antennal organs* absent.

Antennæ.— Very long, the length apparently varying according to age, and sometimes exceeding that of the body and furcula taken together. The first two joints sub-equal in length, the first joint provided with a number of very long slender setæ on its inner and ventral aspects. The third joint a little more than one half the length of the second. The fourth joint long and slender; variable, but usually equal to the combined length of the first two joints; slightly but irregularly annulated, and densely clothed with setose pile. (*Vide* fig. 75.)

Trunk.—Elongate fusiform in shape, straight (fig. 75). The *segments* related proportionately in length as 7 : 3 : 2 : 4 : 1 : 21 : 2 : 1, or in other examples as 8 : 4 : 3 : 5 : 2 : 21 : 2 : 1; the fourth abdominal segment occupying from $\frac{1}{2}$ to $\frac{2}{4}\frac{1}{8}$ of the total length of the trunk. An abundant covering of scales, hairs, and setæ (fig. 73).

The *scales* lanceolate, the hairs finely plumose (compound). Groups of strongly chitinised curved setæ are present along the anterior border of the mesothorax, forming a "frill" or "collar," and at the extremity of the abdomen.

Legs.—Long and slender; the tibiæ divided by means of a movable joint into a longer proximal and a shorter distal segment. The femora of the first pair provided with several extremely elongate slender (sensory ?) setæ along their inner aspect (fig. 76). The *superior claws* straight, as long as the width of the distal joint of the tibia at the base (fig. 71); armed with two teeth along the inner margin—one tooth situated at a distance from the base of the claw equal to approximately one third the total length of the latter, the second tooth situated at a similar distance from the apex of the claw. In many examples there is a minute tooth placed between the distal tooth and the apex of the claw. The *inferior claws* straight and acuminate. In relation with each foot is a single stout *tenent hair*, broadly expanded at its apex. *Pseudonychia* long.

Ventral Tube.—Moderately long, cylindrical. The vesicles were retracted in all the specimens examined.

Hamula.—Situated on the anterior third of the fourth abdominal segment. The *corpus* somewhat mammilated, armed with a stout, median backwardly directed *spine*. The *rami* short and stout, each provided with four small teeth (fig. 72).

Furcula.—Long and slender, as long as the trunk-region. The *dentes* parallel-sided or only very slightly tapering towards their apices, clothed with numerous long hairs. The *dentes* related in length to the *manubrium* as 27 : 22. The *mucrones* stout and broad, wedge-shaped in sectional area; armed with two large apical teeth, a lateral inside tooth, and a row of three dorsal teeth (fig. 70). The distal extremity of the mucro armed with a very stout rod-like *seta* on its inner side towards the ventral aspect. At the base of each mucro on the dorsal aspect of the dens is a *scale-like organ** (fig. 70).

Coloration.—The ground colour varying from dirty cream colour to yellow, with indigo or violet-black markings disposed in the following manner:—A lateral area on either side of the head embracing the eye-group; a few small patches at the bases of the antennæ; and irregular lateral markings on each of the thoracic and abdominal segments which, however, are scarcely visible dorsally. On the dorsal aspect of the fourth abdominal segment are a few bilaterally symmetrical markings, and a lateral patch on either side of the fifth segment. The femora marked with a distal band of violet; a small proximal band and a more extensive distal band of the same colour on the first joint of the tibia. A pale violet suffusion on the second (or distal) joint of the latter (fig. 76).

The general colour pattern, however, is very variable, and for

* Termed by Schäffer "Schuppenförmiger Anhang."

this reason it has only been possible to describe it in a general fashion. The markings on the legs are an exception, being remarkably constant.

Length varying from 2–4·5 mm.; average length 3·5 mm.

Twenty-seven specimens from Nara Ghat, in the Terai, Nepal (*Indian Museum Collector*, February 25th and 26th, 1908); and two immature specimens from Butal, also in the Terai, Nepal, taken by the same collector (February 12th, 1908).

Nos. $\frac{4381}{16}$ and $\frac{4382}{16}$ Indian Museum Coll.

This species shares the characters of the genera *Paronella* and *Campylothorax*. It resembles the latter genus, and differs from typical members of *Paronella* in the great size of the fourth abdominal segment. It is readily separated from *Campylothorax* by the fact that the metathorax is straight and not curved upon itself.

PARONELLA TRAVANCORICA, sp. n. (Pl. IX. figs. 62–66; Pl. X. fig. 67.)

Segmentum abdominale quartum $\frac{2}{5}$ *partem trunci occupans. Antennæ corpore breviores. Ocelli* 16 : 8 *in utroque latere capitis. Unguiculus superior denticulo uno armatus; unguiculus inferior acuminatus, inermis. Mucrones lati, rectangulares. Long.* 3·5–4·5 *mm.*

Head.—Clothed with scales. The *eyes* eight in number on each side (fig. 64); *post-antennal organs* absent.

Antennæ.—A little shorter than the body. The joints related in length as 7 : 8 : 6 : 15 (fig. 67). The basal joint clothed with setæ and acuminate scales; the distal three-fourths of the terminal joint slightly and irregularly annulated.

Trunk.—Clothed with scales and scattered setæ. The *scales* (fig. 66) linear or linear-oval in shape. A group of strongly chitinised setæ forming a kind of "collar" or "frill" along the anterior border of the mesothorax, and a tuft of similar setæ at the extremity of the abdomen. The *segments* mutually related in length as 10 : 5 : 3 : 5 : 5 : 22 : 4 : 1; the fourth abdominal segment occupying two-fifths the total length of the body (fig. 67).

Legs.—Sub-equal. A single *tenent hair* at the distal extremity of each tibia. The *superior claws* of the feet (figs. 62 and 63) nearly straight, broad at the base; a single minute tooth on the inner margin near the base of the claw. In two specimens, on the first pair of legs, there was present a minute tooth situated in front of the first tooth, and separated from it by a distance equal to one third the total length of the claw. The *inferior claw* lanceolate and acuminate, unarmed. *Pseudonychia* large.

Ventral Tube.—Long, with highly protrusible bilobed vesicles; the anterior lobe of each four times the length of the posterior lobe (fig. 67).

Hamula.—The *corpus* with a stout median anterior seta

situated anterior to the rami. The *rami* armed with four small teeth.

Furcula.—Reaching to the ventral tube; clothed with long setæ (fig. 67). The *mucrones* quadrangular, armed with four terminal teeth and a small lateral tooth on each side (fig. 65).

Coloration.—Purple-brown, somewhat paler in the mid-dorsal region. The head and first joint of the antennæ darker than the rest of the body. The first and second antennal joints with a distal band of cream-colour, the third and fourth joints entirely cream-coloured with a slight purplish suffusion. The basal joints of the legs, together with the femora, purplish brown; the femora with their apices cream-coloured. The tibiæ cream-coloured with a proximal and distal band of purple. The ventral tube suffused with purple. The furcula pallid with light purple suffusions.

Length varying from 3·5–4·5 mm.

Four specimens, taken among dry leaves and stones on the edge of a jungle-stream at Maddathoray, W. base of W. Ghats, Travancore, S. India (*N. Annandale*, November 18th, 1908).

No. $\frac{4388}{16}$ Indian Museum Coll.

* Paronella gracilis, sp. n. (Pl. XI. figs. 77, 78.)

Segmentum abdominale quartum segmentis præcedentibus tribus duplo longius. Antennæ corpore longiore. Ocelli 16 : 8 *in utroque latere capitis. Unguiculus superior denticulis tribus (vel duobus) instructus; unguiculus inferior inermis. Mucrones lati. Long.* 5 *mm.*

Head.—Considerably longer than broad. The *eyes* eight in number on each side; *post-antennal organs* absent.

Antennæ.—Longer than the body, in some cases as long as the combined length of the body and furcula. In full-grown examples they vary from 6·5–7·5 mm. in length. The relative lengths of the joints varying from the proportion of 15 : 15 : 10 : 27 to 17 : 16 : 10 : 30. Densely clothed with hairs; on the basal joint lanceolate scales are present among the hairs.

Trunk.—Clothed with small lanceolate *scales*, among which are numerous hairs; a "fringe" of setæ along the anterior border of the mesothorax. The segments related proportionately in length as 9 : 6 : 4 : 5 : 2 : 22 : 2 : 1. The fourth abdominal segment double the length of the three preceding segments.

Legs.—Long and slender, clothed with slender, elongate setæ. The tibiæ divided by a joint into proximal and distal portions, related respectively in length in the proportion of 2 : 1. A single long stout *tenent hair* in relation with each foot. The *superior claws* moderately slender, straight (fig. 77); armed with two teeth, one placed at a distance from the base equal to one-third the total length of the claw, the other placed at a similar distance from the apex. Between the distal tooth and the apex of the claw is a minute tooth which, however, is not always present.

The *inferior claws* markedly acuminate, unarmed. *Pseudonychia* large, projecting laterally.

Ventral Tube.—1·75 mm. long, slender, cylindrical. The vesicles each subdivided into a long anterior lobe and a shorter posterior lobe.

Furcula.—Reaching to the ventral tube; average length 2·25 mm. The *dentes* slightly tapering towards their extremities; related in length to the manubrium in the proportion of 7 : 5. The *mucrones* (fig. 78) complex, wedge-shaped when viewed in section; armed with a prominent terminal tooth, and a small ventral tooth applied to the base of the latter; two lateral teeth on the inner side of the mucro. The dorsal edge of the mucro provided with four teeth. The apex of the dens provided with a *scale-like organ* on the dorsal side, and a stout rod-like *seta* on its inner aspect.

Coloration.—The ground colour varying from cream to pale yellow, darkening according to the number of scales present. The eyes on a black patch on each side of the head. The antennæ a little darker than the ground colour of the body, inclining in some examples to pale brown; the basal joint longitudinally streaked with violet-black. Body-markings varying from violet-black to almost black, giving the insect a mottled appearance to the naked eye. The sides of the head and the lateral margins of the thorax and first abdominal segment violet-black. A few lateral markings of the same colour on the remaining abdominal segments. The only dorsal marking is a narrow irregular transverse streak crossing the head behind the bases of the antennæ. The femora marked with a distal band of violet; the proximal tibial joint with both proximal and distal bands of the same colour; the distal tibial joint with a violet suffusion across the middle.

In very pale examples the body-markings are entirely absent, only the legs retaining the usual coloration. In very dark specimens the markings along the sides of the trunk are confluent, and are united by transverse bands crossing the two thoracic segments, and each of the first three segments of the abdomen.

Length varying from 5–5·5 mm.

Twenty-two examples, taken among damp dead leaves in forest of rhododendron and oak at Bhowali, Himalayan foot-hills of Kumaon, 5700 ft. (*A. D. Imms*, October 18th–23rd, 1909).

No. $\frac{4380}{16}$ Indian Museum Coll.

* PARONELLA PHANOLEPIS, sp. n. (Pl. X. fig. 69; Pl. XI. fig. 79.)

Unguiculus superior duobus parvis dentibus armatus; unguiculus inferior lanceolatus, inermis. Mucrones lati, quattuor apicalibus et tribus dorsalibus denticulis armati. Denticuli dorsales ita collocati ut unus post alterum insertus sit. Articulus quartus

antennarum secundo et tertio longitudine æquus, vel paullo longior. Setæ corporis longæ, in fasciis instructæ. Long. 3·5 *mm.*

Head.—Invested with scales and provided with a prominent dorsal tuft of large sub-erect setæ. The *eyes* eight in number on each side; no *post-antennal organs.*

Antennæ.—Varying in length from 4 to 4·5 mm.; the joints very variable in length. The first two joints sub-equal; the fourth joint at least as long as the combined length of the second and third joints. The exact numerical proportions in the length of the antennal joints of four typical specimens were 50 : 50 : 32 : 89; 55 : 54 : 37 : 95; 53 : 54 : 34 : 88; and 51 : 51 : 35 : 86. The two proximal joints clothed with scales and hairs, the distal joints entirely clothed with hairs of various lengths.

Trunk.—The *segments* related proportionately in length as 14 : 9 : 6 : 11 : 6 : 37 : 5 : 2. Clothed with small lanceolate *scales* densely packed together; in the mid-dorsal line the scales are considerably larger and oblong-ovate in shape. A prominent investiture of large and very conspicuous sub-erect *setæ* with curved extremities disposed in the following manner:—A "collar" along the anterior margin of the mesothorax, a few scattered setæ of similar type on the dorsal aspect of the segment and a group near the posterior border. Similar groups are situated near the posterior margins of the metathorax and the first two abdominal segments. The third abdominal segment with a few scattered setæ only. The fourth abdominal segment with a conspicuous tuft of longer and more slender setæ about the middle of its dorsal aspect, and a fringe of similar setæ, directed backwards, along its posterior and postero-lateral margins. The fifth and sixth abdominal segments densely clothed with setæ and partially concealed by them.

Legs.—The femora and basal joints scaled. The tibiæ distinctly separated into proximal and distal joints; the former related in length to the latter as 19 : 7 on the third pair of legs, and as 17 : 7 on the first pair of legs; clothed with hairs and setæ of various lengths. The *superior claws* of the feet lanceolate and acuminate, armed with two small teeth (fig. 69); one tooth situated at a distance from the base of the claw equal to one third the total length of the latter, the second tooth situated at a similar distance from the apex of the claw. The *inferior claws* lanceolate and acuminate, unarmed. *Pseudonychia* large, at least one half the length of the inferior claw. A single stout *tenent hair* to each foot.

Furcula.—In length varying from 2·5 to 2·75 mm.; the ratio of the *length* of the manubrium to that of the *dens* varying from 11 : 12 to 3 : 4; in the majority of examples, however, the ratio is as 4 : 5. The *mucro* large and somewhat plate-like; armed with an outer and inner apical tooth, each provided with a slender lateral tooth prolonged down the mucro in the form of a ridge. The inner apical tooth is continuous at its base with the dorsal plate-like portion of the mucro. The latter bears two large

backwardly directed teeth, situated just behind the inner apical tooth, and a small acicular tooth near to the base of the mucro. At the apex of the dens, on its inner aspect, is a small *scale-like organ* (fig. 79).

Coloration.—Colour when alive leaden purple (in some specimens almost black) with a slight metallic sheen. The antennæ and legs purple-black. The furcula greyish white. In alcohol specimens the colour is purple-black when but few of the scales have been lost. In the majority of cases the specimens become denuded of a large proportion of the scales, and the body-colour then appears mottled and streaked with shades of brown and purple-black.

Length varying from 3–3·75 mm.

Thirteen examples, taken on the inside walls of an old bungalow, probably residing in decaying beams and rafters; Bhowali, Himalayan foot-hills of Kumaon, *circa* 5700 ft. (*A. D. Imms*, June 12th–29th, 1910).

No. $\frac{8607}{16}$ Indian Museum Coll.

Perfect examples of this species are easily recognised by the conspicuous tufts of sub-erect setæ; in alcohol specimens the latter fall off with extreme readiness and are usually absent.

In five of the specimens the two distal antennal joints are lemon-yellow, and very conspicuous in consequence. Whether this is a sexual or varietal difference I am unable to say.

* Paronella insignis, sp. n. (Pl. XI. fig. 80; Pl. XII. figs. 81 & 82.)

Unguiculus superior uno dente armatus; unguiculus inferior aculeatus, inermis. Mucrones lati, duobus denticulis apicalibus et tribus denticulis dorsalibus armati. Denticuli dorsales ita collocati ut unus post alterum sit insertus. Long. 3·7 *mm.*

Head.—A little longer than the mesothorax; covered with scales, among which are a few scattered setæ. The *eyes* eight in number on either side; *post-antennal organs* absent.

Antennæ.—Very long and slender, exceeding 5 mm. in length. The joints mutually related in length in the proportion of 17 : 13 : 23.

Trunk.—Elongate, linear, clothed with scales. The *scales* small and broadly lanceolate; a tuft of *setæ* at the extremity of the abdomen. The *segments* related in length as 10 : 8 : 5 : 6 : 5 : 22 : 3 : 2 (fig. 80).

Legs.—All the legs similar; the tibiæ distinctly divided into proximal and distal portions by a definite joint. The proximal portion a little more than twice the length of the distal portion (*i. e.*, as 15 : 7). The *superior claws* (fig. 81) of the feet slender and tolerably long, armed with a single tooth situated at a distance from the apex of the claw equal to one third the length of the claw. In some examples there is also a rudimentary tooth placed at a similar distance from the base of the claw.

The *inferior claws* nearly as long as the superior claws, unarmed; their distal portion abruptly narrowed, becoming acicular. A single long stout *tenent hair* in relation to each foot.

Ventral Tube.—Long and cylindrical, emitting a pair of elongate vesicles, each of the latter subdivided into a longer and shorter lobe (fig. 80).

Furcula.—As long as the abdomen; the *manubrium* related in length to the *dens* as 10 : 13. The *mucro* (fig. 82) broad and flattened, inclined at an obtuse angle with the long axis of the dens; armed with an outer and inner terminal tooth and a row of three sharply pointed teeth along its dorsal edge, situated one behind the other. The apex of the dens provided with stout elongate setæ slightly longer than the mucro (fig. 82).

Coloration.—The ground colour varying from light yellow to brown-yellow with markings of brownish purple. The antennæ purplish; the posterior half of the head, together with the lateral and anterior margins of the mesothorax, and the first three abdominal segments, suffused with brownish purple. The fourth abdominal segment suffused with the same colour along its sides, and along its anterior and posterior margins. A broad transverse band of similar colour crosses the middle of the segment, but is interrupted in the mid-dorsal line. The eyes on a black patch on each side of the head. The furcula and ventral tube yellowish white. The legs with the tibial joints almost entirely dark purple except for a whitish suffusion at the apex of their distal joint. The femora suffused with purple, especially towards their apices.

Length. Average length measures 3·7 mm.

Five examples, taken from among dry leaves and stones along the edge of a jungle-stream at Maddathoray, W. base of W. Ghats, Travancore, S. India (*N. Annandale*, November 18th, 1908).

No. $\frac{8610}{16}$ Indian Museum Coll.

In none of the five specimens were the antennæ perfect, except in the case of the example figured on Pl. VI. The number of joints (3) is exceptional among Collembola, and it is not unlikely that the antenna has been injured and has not regenerated the full number of joints (4). Such examples are known to be not infrequent in *Tomocerus*, *Orchesella*, and other genera.

Genus IDIOMERUS, gen. nov.

Mesonotum prominens, conicus. Ocelli 16 : 8 *in utroque latere capitis; organa postantennalia carent. Antennæ quinque-articulatæ; articulis basalis perparvus, ultimus longissimus. Cutis squamosa.*

This genus is easily recognisable by the remarkable form of the mesonotum, which projects upwards in the form of a cone above the level of the rest of the body (text-fig. 15).

* IDIOMERUS PALLIDUS, sp. n. (Pl. IX. fig. 61.)

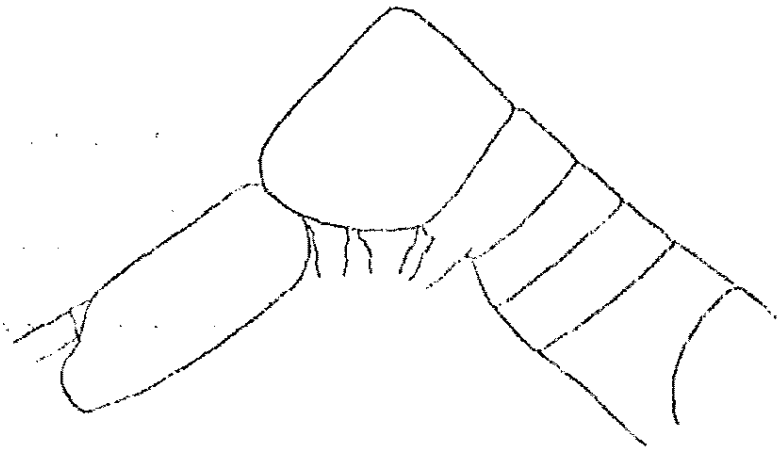
Segmentum abdominale quartum fere dimidium partem trunci occupans. Unguiculus superior duobus parvis dentibus armatus; unguiculus inferior lanceolatus, inermis. Mucrones lati. Long. 3·5–5 *mm.*

Head.—Longer than broad, equal to the combined length of the metathorax and first three abdominal segments; clothed with scales. The *eyes* eight in number on each side; the *post-antennal organs* absent.

Antennæ.—Five-jointed, a little longer than the body. The basal joint small, and concealed (text-fig. 15); the terminal joint the largest, variable in length. The relative lengths of the joints are as 1 : 24 : 21 : 17 : 32.

Trunk.—Clothed with scales; a "collar" of long setæ along the anterior margin of the mesothorax, and a tuft at the extremity of the abdomen. The segments related to one another in length in the proportion of 16 : 6 : 4 : 5 : 4 : 36 : 4 : 1. The fourth abdominal segment occupying a little less than half the length of the trunk, equal to the total length of the preceding trunk-segments.

Text-fig. 15.



Outline figure of *Idiomerus pallidus*, showing the characteristic shape of the mesonotum.

Legs.—The legs sub-equal; a single *tenent hair* at the apex of each tibia. The *superior claws* moderately slender, acuminate; armed with two minute teeth, inserted one behind the other on the inner margin. The *inferior claws* lanceolate and acuminate, unarmed. The *pseudonychia* large. The *tibiæ* biarticulate, the proximal and distal portions related to one another in length in the proportion of 15 : 7.

Ventral Tube.—Long and cylindrical.

Hamula.—Closely resembling that of *Paronella börneri* (Pl. X. fig. 72); the *corpus* carrying a stout median seta between and in front of the *rami*. The *rami* each armed with four small teeth.

Furcula.—Reaching to the ventral tube, clothed ventrally with lanceolate scales. The *dentes* only slightly tapering distally: the

manubrium related in length to the dentes in the proportion of 26 : 29. The *mucrones* broad (fig. 61), armed with three large rounded terminal teeth, a lateral tooth on the outer side, and an erect dorsal tooth with a spiniform tooth at its base.

Coloration.—The ground colour varying from a dirty cream-colour to light yellow, with the furcula and ventral tube paler. A few small purple-black markings on the head between the eyes, and around the bases of the antennæ. A longitudinal stripe of the same colour along the greater part of the length of the last pair of femora. In two specimens the other femora were similarly streaked. The eyes on a black patch on either side of the head.

In specimens retaining their full complement of scales the ground colour appears darker and inclined to a brownish tinge.

Length varying from 3·5–5 mm.

Five examples, taken among dry leaves and stones along the edge of a jungle-stream at Maddathoray, W. base of W. Ghats, Travancore, S. India (*N. Annandale*, November 18th, 1908).

No. $\frac{4387}{16}$ Indian Museum Coll.

In one example out of the five the upper claw of the feet was devoid of teeth, and in a second specimen there was only a single tooth present. The mucrones, however, supply much more constant specific characters.

Genus Cyphoderus Nicolet.

Cyphodeirus Nicolet, Rech. pour serv. à l'hist. des Podur., Neuchâtel, 1841, p. 63 (*ad partem*).

Cyphoderus Tullberg, "Fört. öfver Sv. Podur.", Öfvers. Kongl. Vet.-Akad. Förhandl. xxvii. 1871, p. 150.

Cyphoderus simulans, sp. n. (Pl. XII. figs. 90, 91.)

Omnino albus. Ocelli nulli. Unguiculus superior uno magno et duobus parvis dentibus instructus. Long. 1 *mm.*

Head.—The *eyes* and *post-antennal organs* absent.

Antennæ.—Four-jointed, the joints related respectively in length as 2 : 7 : 3 : 10; the terminal joint slender and tapering distally. The length of the antenna is approximately half the total length of the thorax and abdomen.

Trunk.—Closely resembling *C. albinus* Nic.

Legs.—All similar. The *superior claw* long, provided with a very large basal tooth and two small distal teeth; the *inferior claw* bidentate at the apex, the ventral tooth being considerably shorter than the dorsal; a single very slightly curved *tenent hair* (fig. 90).

Furcula.—In length slightly exceeding the antennæ. The *mucrones* (fig. 91) very long and slender, and when viewed dorsally, quite straight; the terminal and dorsal teeth similar to those of *C. albinus*. The *manubrium* and *dentes* clothed ventrally

with scales; the dentes provided with a double row of six large scales, which are somewhat spear-shaped with a prominent mid-rib; to the inner side of each mucro is a large terminal scale (fig. 91).

Coloration.—When alive, white (*Annandale*); in alcohol, pale dirty cream-colour.

Length 1 mm.

Four specimens on bats' dung in total darkness in the Khayon Caves near Moulmein, Burma (*N. Annandale*, March 7th, 1908).

No. $\frac{4446}{16}$ Indian Museum Coll.

The absence of eyes and pigmentation are characteristics of a true cave-dwelling animal. Dr. Annandale informs me, however, that the Khayon Caves are of no great extent, though their inner parts are quite dark.

Cyphoderus simulans is readily distinguished from *C. albinus* Nic.† in possessing a somewhat longer superior claw to the feet, with two small additional teeth. The latter, however, are difficult to detect on account of their delicacy and transparency.

Genus Pseudocyphoderus, gen. nov.

Mesonotum non prominens. Segmentum abdominis quartum quintuplo longius quam tertium. Antennæ dimidiam partem corporis æquantes, infra caput insertæ. Mucrones minuti. Manubrium biarticulatum. Ocelli et organa postantennalia carent. Squamis et setis instructus.

This genus may be readily separated from *Cyphoderus* Nic., and *Cyphoderodes* Silvestri‡, by the fact that the mouth and frontal region of the head are completely ventral in position, and consequently, the points of insertion of the antennæ are situated on the ventral aspect of the head.

*Pseudocyphoderus annandalei, sp. n. (Pl. XII. figs. 87–89.)

Antennæ articulis tribus ultimis inter se longitudine sub-æqualibus. Unguiculus superior quadridentatus; unguiculus inferior bifidus. Dentes dimidiam partem manubrii æquantes; quinque squamis externis, tribus internis, et una squama terminali instructi. Mucrones quadridentati, dentes ita collocati ut unus post alterum insertus sit. Long. 1 mm.

Head.—Considerably broader than long, the facial region, together with the mouth, almost entirely ventral in position. The *eyes* and *post-antennal organs* absent.

Antennæ.—Arising from the ventral surface of the head, four-jointed, the joints related to one another in length as 6 : 14 : 14 : 13.

Trunk.—Densely covered with small scales, among which are some short scattered hairs of variable length. The head and trunk segments related respectively in length as 15 : 12 : 7 : 4 : 4 :

† *Vide* Börner, "Zur Kenntnis der Apterygoten-Fauna von Bremen und der Nachbardistrikte," Abh. Nat. Ver. Bremen, Bd. xvii. p. 71, fig. 28.

‡ In "Termitenleben auf Ceylon," von K. Escherich, Jena 1911, p. 214.

5 : 26 : 2 : 2. The fourth abdominal segment at least five times as long as the preceding segment.

Legs.—Provided with short straight setæ. The *superior claw* of the third pair of legs stout and thick, except at the apex where it becomes swollen and membranous (fig. 87); one large acicular tooth situated at the middle of the inner margin, a minute tooth immediately in front of the former, and a small tooth close to the apex of the claw on either side. The *inferior claw* wide and plate-like, bifid. The claws of the first and second pairs of legs smaller and somewhat shorter. A single *tenent hair* in relation to each foot.

Furcula.—Moderate in size, stout, ·4 mm. long, scaled ventrally. When closed up beneath the abdomen the mucrones reach to the anterior border of the fourth abdominal segment. The *manubrium* divided imperfectly into proximal and distal portions (fig. 88). The *dentes* just about half the length of the manubrium, short and stout; each provided along its outer aspect with a dorsal row of five very large scales, a row of two similar scales along the inner side, and a small terminal scale just beneath the mucro (figs. 88 and 89). The proximal inner scale equal in length to the proximal outer scale; the outer and inner apical scales longest of all, the inner slightly longer than the outer. The *mucro* very small and armed with four teeth (fig. 89); a very small terminal tooth, and three dorsal teeth situated one behind the other; the posterior and middle teeth of the row curved and pointed, the anterior (or proximal) tooth blunt and rounded.

Coloration.—In alcohol, white.

Length 1–1·15 mm.

Twelve specimens taken from a nest of Termites at Rhamba, south end of Lake Chilka, N.E. Madras (*N. Annandale*, March 3rd, 1910). The Termite has been subsequently identified by Prof. Silvestri as *Termes redemanni* Wasm.

No. $\frac{4447}{16}$ Indian Museum Coll.

Sub-order SYMPHYPLEONA Börn.

Fam. SMINTHURIDÆ Lbk.

Sub-fam. SMINTHURIDINÆ Börn.

Genus SMINTHURIDES Börn.

† *Sminthurus* (*Smynthurus*) Latreille, Hist. Nat. 1804, T. viii. p. 79 (*ad partem*).

Sminthurides Börner, "Zur Kennt. der Apteryg.-Fauna von Bremen," Abh. Nat. Ver. Bremen, 1901, Bd. xvii. p. 91.

* SMINTHURIDES APPENDICULATUS, sp. n. (Pl. XII. figs. 83–86.)

Articulus ultimus antennarum longissimus, vix annulatus. Pili clavati in tibiis nulli. Unguiculi superiores inermes; unguiculi inferiores in setam longam prolongati. Unguiculi inferiores

pedum posteriorum etiam tribus appendicibus filiformibus instructi. Mucrones furculæ lati, laminati. Long. ·5–·75 mm.

Antennæ.—Slender, the joints related to one another in length as 8 : 11 : 22 : 32 ; the terminal joint only with slight indications of annulation (fig. 83).

Trunk.—The abdomen provided dorsally with a few short, curved, scattered hairs.

Legs.—The first and second pairs similar (fig. 85) ; the *superior claws* very long, at least two and a half times as long as the breadth of the tibia, slightly curved at their apices, unarmed. The *inferior claw* approximately one fifth longer than the superior claw, setiform and whip-like, usually with a minute tooth on its ventral aspect towards the base. The *superior claws* of the third pair of legs shorter and smaller than those of the preceding pairs ; the *inferior claws* whip-like, armed at about the middle of their length with a group of three filiform dorsal appendages, and a small tooth situated close to the latter on the ventral surface (fig. 84). No *tenent hairs* to the feet. The tibiæ of the third pair of legs provided with three apical *sense organs* (?) on the inner side (fig. 84).

Ventral Tube.—Very short, without elongate vesicles.

Furcula.—The *dentes*, without their mucrones, equal in length to the abdomen ; slightly curved ventralwards. The *mucrones* very large (fig. 86), at least as wide as the maximum width of the dens, lamellate.

Coloration.—Ground colour leaden, the legs and spring paler. The eyes on a black patch on each side of the head. The antennæ dark leaden coloured with a purplish suffusion. A pale yellow dorsal area on the head, bearing a small bluish-purple patch between the eyes. The trunk indigo-blue dorsally, with small pale yellow markings.

Length varying from ·5–·75 mm.

Twenty-one specimens taken on the surface of water at Calcutta (*Indian Museum Collector*, January 9th, 21st, and 22nd, 1908).

Nos. $\frac{4391}{16}$ and $\frac{4392}{16}$ Indian Museum Coll.

III. A Catalogue of the Oriental Collembola.

In defining the area comprised within the Oriental region, I have followed Blanford * in taking for its northern boundary the limits of forest growth in the Himalayas ; while as regards the south-eastern boundary, I have followed the later views that are well summarised by Pelseneer † and supported by the results of the "Siboga" expedition. Pelseneer proposes the name of "Weber's Line" for the south-eastern boundary, which is regarded as passing east of Timor and through the Banda and Molucca Seas.

* "The Distribution of Vertebrate Animals in India, Ceylon, and Burma." Phil. Trans. Roy. Soc. vol. 194, 1901, p. 347.

† "La Ligne de Weber, Limite Zoologique de l'Asie et de l'Australie." Bull. Belg. Acad. 1904.

With the small amount of knowledge of Oriental Collembola at one's disposal it is impossible to make any generalisations. Two features, however, stand out as notable:—(1) The paucity of the members of the Sub-order Symphypleona, which is represented by only three genera, and as many species, out of a total of fifty-three species of Oriental Collembola. (2) The relative preponderance among species of the genus *Paronella*.

Sub-order ARTHROPLEONA Börn.

Fam. PODURIDÆ Lbk.

Sub-fam. HYPOGASTRURINÆ Börn.

1. *Xenylla obscura*, sp. n. India (W. Himalayas).

Sub-fam. ACHORUTINÆ Börn.

2. *Protanura kræpelini* Börn. Java. (Börner; Mitt. Naturhist. Mus. Hamburg, 1906, xxiii. p. 169.)
3. *Oudemansia cærulea* Schött. Thousand Islands. (Schött; Ent. Tidskr. 1893, p. 172.)
4. *Achorutes lipaspis* Börn. Java. (Börner; Mitt. Naturhist. Mus. Hamburg, 1906, xxiii. p. 170.)
5. *A. hirtellus* Börn. Java. (Börner; *loc. cit.* p. 170.)
6. *A. armatus* Nic. Sumatra. (Oudemans; Zool. Ergeb. einer Reise in Niederl.-Ostind., Hft. i. p. 89.) Ceylon.
7. *A. crassus* Oud. Sumatra. (Oudemans; *loc. cit.* p. 90.)
8. *Ceratameria* (*Schöttella*) *maxima* Schött. Java. (Börner; Mitt. Naturhist, Mus. Hamburg, 1906, xxiii. p. 167.)

Sub-fam. NEANURINÆ Börn.

9. *Pseudachorutes anomalus*, sp. n. India. (E. Himalayas.)
10. *Neanura corallina*, sp. n. Ceylon.
11. *N. pudibunda*, sp. n. Lower Burma.
12. *N. intermedia*, sp. n. India (W. Himalayas).
13. *N. fortis* Oud. Java, Sumatra, and Saleyer. (Oudemans; Zool. Ergeb. einer Reise in Niederl.-Ostind., Hft. i. p. 91.)

Sub-fam. ONYCHIURINÆ Börn.

14. *Onychiurus* (*Lipura*) *fimetarius* Burm. Sumatra. (Oudemans; *loc. cit.* p. 90.)

Fam. ENTOMOBRYIDÆ D. T.

Sub-fam. ISOTOMINÆ Schäff.

15. *Isotoma crassicornis* Schött. Sumatra. (Schött; Ent. Tidskr. 1893, p. 172.)
16. *I. nigropunctata*, sp. n. India (E. Himalayas).

Sub-fam. TOMOCERINÆ Schäff.

17. *Tomocerus* (*Macrotoma*) *montanus* Oud. Sumatra. (Oudemans; Zool. Ergeb. einer Reise in Niederl.-Ostind., Hft. i. p. 91.)

Sub-fam. HETEROMURICINÆ, sub-fam. nov.

18. *Heteromuricus cercifer*, gen. et sp. n. India (Bengal).

Sub-fam. ENTOMOBRYINÆ Schäff.

19. *Isotomurus* (*Isotoma*) *palustris* Müll., India (Bengal). Sub.-sp. *tricuspis* Börn. Java. (Börner; Mitt. Naturhist. Mus. Hamburg, 1906, xxiii. p. 173.)
20. *Lepidocyrtus robustus*, sp. n. India (Travancore).
21. *L. braueri* Börn. Seychelles. (Börner; Mitt. Naturhist. Mus. Hamburg, 1906, xxiii. p. 176.)
22. *L. javanus* Börn. Java. (Börner; *loc. cit.* p. 176.)
23. *L. variabilis* Oud. Sumatra and Java. (Oudemans; Zool. Ergeb. einer Reise in Niederl.-Ostind., Hft. i. p. 84.)
24. *L. javanicus* Oud. Java. (Oudemans; *loc. cit.* p. 85.)
25. *Entomobrya kali*, sp. n. India (Bengal). Var *lutea* nov. India (W. Himalayas).
26. *E. florensis* Oud. Flores. (Oudemans; *loc. cit.* p. 86.)
27. *E. longicornis* Oud. Sumatra and Java. (Oudemans; *loc. cit.* p. 87.)
28. *Seira* (*Sira*) *annulicornis* Oud. Java. (Oudemans; *loc. cit.* p. 87.)
29. *S. sumatrana* Oud. Sumatra. (Oudemans; *loc. cit.* p. 88.)
30. *S. brahma*, sp. n. India (United Provinces).
31. *Pseudosira indra*, sp. n. India (Bengal).
32. *Dicranocentroides fasciculatus*, gen. et sp. n. India (W. Himalayas).
33. *Heteromurus tenuicornis* Börn. Java. (Börner; Mitt. Naturhist. Mus. Hamburg, 1906, xxiii. p. 177.)
34. *H. tetracantha* Börn. Java. (Börner; *loc. cit.* p. 177.)
35. *H.* (*Templetonia*) sp. ? Java. (Oudemans; Zool. Ergeb. einer Reise in Niederl.-Ostind., Hft. i. p. 89.)
36. *Cremastocephalus celebensis* Schäf. Celebes. (Schäffer; Archiv f. Naturges., 1898, p. 407.)
37. *C. montanus*, sp. n. India (E. Himalayas).
38. *C. indicus*, sp. n. India (United Provinces and Bengal).
39. *Paronella tarsata* Börn. Java. (Börner; Mitt. Naturhist. Mus. Hamburg, 1906, xxiii. p. 177.)
40. *P. setigera* Börn. Java. (Börner; *loc. cit.* p. 178.)
41. *P. börneri*, sp. n. Nepal.
42. *P. travancorica*, sp. n. India (Travancore).
43. *P. gracilis*, sp. n. India (W. Himalayas).
44. *P. phanolepis*, sp. n. India (W. Himalayas).
45. *P. insignis*, sp. n. India (Travancore).

46. *Idiomerus pallidus*, gen. et sp. n. India (Travancore).
47. *Cyphoderus simulans*, sp. n. Burma.
48. *C. javanus* Börn. Java. (Börner ; *loc. cit.* p. 180.)
49. *Pseudocyphoderus annandalei*, gen. et sp. n. India (N.E. Madras).
50. *Cyphoderodes ceylonicus* Silv. Ceylon. (Silvestri ; in Termit. auf Ceylon von E. Escherich, 1911, p. 245.)

Sub-order SYMPHYPLEONA Börn.

Fam. SMINTHURIDÆ Lbk.

Sub-fam. SMINTHURIDINÆ Börn.

51. *Sminthurides appendiculatus*, sp. n. India (Bengal).

Sub-fam. CORYNEPHORIINÆ Abs.

52. *Corynephoria jacobsoni* Abs. Java. (Absolon ; Entom. Ztg. Wien, 26, 1907, p. 338.)

Sub-fam. DICYRTOMINÆ Börn.

53. *Ptenothrix gracilicornis* Schäff., subsp. *gibbosa* Börn. Java. (Börner ; Mitt. Naturhist. Mus. Hamburg, 1906, xxiii. p. 185.)

IV. A SUMMARY OF GENERAL CONCLUSIONS.

1. Four genera and twenty-seven species of Collembola are described as new, and three species belonging to as many genera were already known. Out of a total of thirty-one species, five are Palæarctic, and were obtained above the limits of forest-growth in the Himalayas. The remaining species are Oriental.

2. The Palæarctic species are all referable to well-known genera, and were not met with in the Oriental region.

3. Among the Oriental species it has been found necessary to erect four new genera, i. e. :—*Idiomerus*, *Dicranocentroides*, *Heteromuricus*, and *Pseudocyphoderus*. The remaining species all pertain to genera whose range extends into at least one other zoo-geographical region.

4. Among the new forms discovered, the most remarkable is *Heteromuricus cercifer*, gen. et sp. n. It is unique among Collembola in possessing a median cercus to the fifth abdominal segment. A new sub-family—the Heteromuricinæ—is proposed for its reception. *Pseudocyphoderus* gen. nov., with a single species, is described from the neighbourhood of Lake Chilka, where it occurs in Termites' nests.

5. The total number of Collembola known from the Oriental region amounts to fifty-three species comprised within twenty-seven genera. Of these only three genera, each with a single species, are members of the sub-order Symphypleona.

V. EXPLANATION OF THE PLATES.

The figures were made with a Leitz drawing apparatus under various magnifications. Wherever arrows are represented they indicate the direction of the anterior end of the body.

Plate VI.

Pseudachorutes anomalus, sp. n.

Fig. 1. The right mucro viewed from the lateral aspect.
2. The eyes and post-antennal organ of the right side.
3. The right foot of the first pair of legs.
4. An outline figure of the furcula seen from the dorsal side.

Xenylla obscura, sp. n.

Fig. 5. An outline figure of the dorsal aspect of the furcula.
6. A dorso-lateral view of the anal spines and their papillæ.
7. The mucro and apical portion of the dens of the left side viewed from the inner aspect.
8. The hamula.
9. The right leg of the first pair.

Neanura pudibunda, sp. n.

Fig. 10. The antenna, eyes, and post-antennal organ of the left side.
11. The left foot of the third pair of legs.
12. The insect viewed from the dorsal side.

Neanura intermedia, sp. n.

Fig. 13. The left antenna seen from the dorsal aspect.
14. The left foot of the first pair of legs.

Isotomurus palustris Müll.

Fig. 15. The mucro, together with the apex of the dens; right side.

Isotoma siva, sp. n.

Fig. 16. The left foot of the first pair of legs.
17. The mucro and apex of the dens of the left side; viewed from the outer side.
18. The eyes of the right side.

Plate VII.

Isotoma siva (continued).

Fig. 19. The insect seen from above.

Neanura intermedia (continued).

Fig. 20. The eyes of the left side.

Isotomurus palustris (continued).

Fig. 21. The right foot of the first pair of legs seen from the inner side.
22. The eyes and post-antennal organ of the right side.

Neanura corallina, sp. n.

Fig. 23. The insect viewed from above.
24. The left antenna seen from the ventral aspect.
25. The eyes of the left side.
26. The third leg, left side.

Isotoma nigropunctata, sp. n.

Fig. 27. The eyes and post-antennal organ of the right side.
28. The right foot of the third pair of legs seen from the inner aspect.
29. The apex of the dens of the right side together with the mucro.

Entomobrya crassa, sp. n.

Fig. 30. The mucro and distal portion of the dens of the right side.
31. The eyes of the right side.

Pseudosira indra, sp. n.

Fig. 32. The left mucro together with the apical portion of the dens, viewed from the inside.

Entomobrya kali, sp. n.

Fig. 33. The right foot and apex of tibia of the third pair of legs; inside view.

Plate VIII.

Entomobrya kali (continued).

Fig 34. The insect viewed from above. (The specimen figured has lost the longer setæ from the body.)
35. The left mucro and apical portion of the dens; inside view.
36. Typical setæ from the mesothorax.

Pseudosira indra (continued).

Fig. 37. The eyes of the right side.
38. The right foot of the third pair of legs.
39. A typical seta from the anterior margin of the mesothorax.
40. A typical body-scale.

Seira frigida, sp. n.

Fig. 41. The left foot of the third pair of legs.
42. The mucro and apex of the dens of the left side; inside view.

Seira brahma, sp. n.

Fig. 43. The left foot of the third pair of legs.
44. The left mucro and apical portion of the dens; viewed from the inside.

Dicranocentroides fasciculatus, gen. et sp. n.

Fig. 45. The right foot of the first pair of legs.
46. A portion of the inner aspect of the dens showing the characteristic spines.
47. Hairs from various regions of the body. (*a*) From the apical joint of the antenna. (*b*) From the tuft on the second antennal joint. (*c*) An acuminate hair from the legs.

Sinella montana, sp. n.

Fig. 48. The right foot and apex of the tibia; third pair of legs. *Sp.*, Spine-like setæ.

Heteromurieus cercifer, gen. et sp. n.

Fig. 49. The right foot of the third pair of legs.
50. The cercus viewed laterally.
51. One of the larger body-scales.

Plate IX.

Heteromurieus cercifer (continued).

Fig. 52. The insect viewed from the right side. (The head is inclined at a greater angle with the trunk than is represented.)
53. The eyes of the right side.
54. The left mucro viewed from the outer aspect.

Dicranocentroides fasciculatus (continued).

Fig. 55. The left mucro viewed from the outer side. *d.*, dens; *l. t.*, lateral tooth.
55 *a*. Body-scales.

Sinella montana (continued).

Fig. 56. The right mucro seen from the outside.
57. (*a*) A seta from the mesothorax. (*b*) A seta from the extremity of the abdomen.

Cremastocephalus indicus, sp. n.

Fig. 58. The right foot of the third pair of legs.
59. The apex of the dens with the mucro of the left side: inner aspect.

Cremastocephalus montanus, sp. n.

Fig. 60. The apex of the dens with the mucro of the left side; inner aspect.

Idiomerus pallidus, gen. et sp. n.

Fig. 61. The right mucro viewed from the outer side.

Paronella travancorica, sp. n.

Fig. 62. The left foot of the second pair of legs; inside view. *ps.*, pseudonychium; *t.h.*, tenent hair.
63. The left foot of the second pair of legs viewed from above. *ps.*, pseudonychium; *t.h.*, tenent hair.
64. The eyes of the right side.
65. The left mucro seen from its outer aspect.
66. Body-scales.

PLATE X.

Paronella travancorica (continued).

Fig. 67. The insect seen from the right side.

Dicranocentroides fasciculatus (continued).

Fig. 68. The insect seen from the right side. (The legs have been drawn too short, the hind pair should reach almost to the extremity of the abdomen.)

Paronella phanolepis, sp. n.

Fig. 69. The left foot of the first pair of legs.

Paronella börneri, sp. n.

Fig. 70. The mucro and apex of the dens viewed from the outer side: right side. *d.*, dens; *m.*, mucro; *s. o.*, scale-like organ.
71. The foot and distal extremity of the tibia of the first pair of legs.
72. The hamula. The apex of the organ is directed towards the hinder end of the animal. *c.*, corpus; *r.*, ramus; *s.*, seta.
73. Hairs and scales. (*a*) From the anterior border of the mesothorax. (*b*) From the fore leg. (*c*) From the general surface of the body.
74. The eyes of the right side.

PLATE XI.

Paronella börneri (continued).

Fig. 75. The insect viewed from above.
76. Entire leg of first pair.

Paronella gracilis, sp. n.

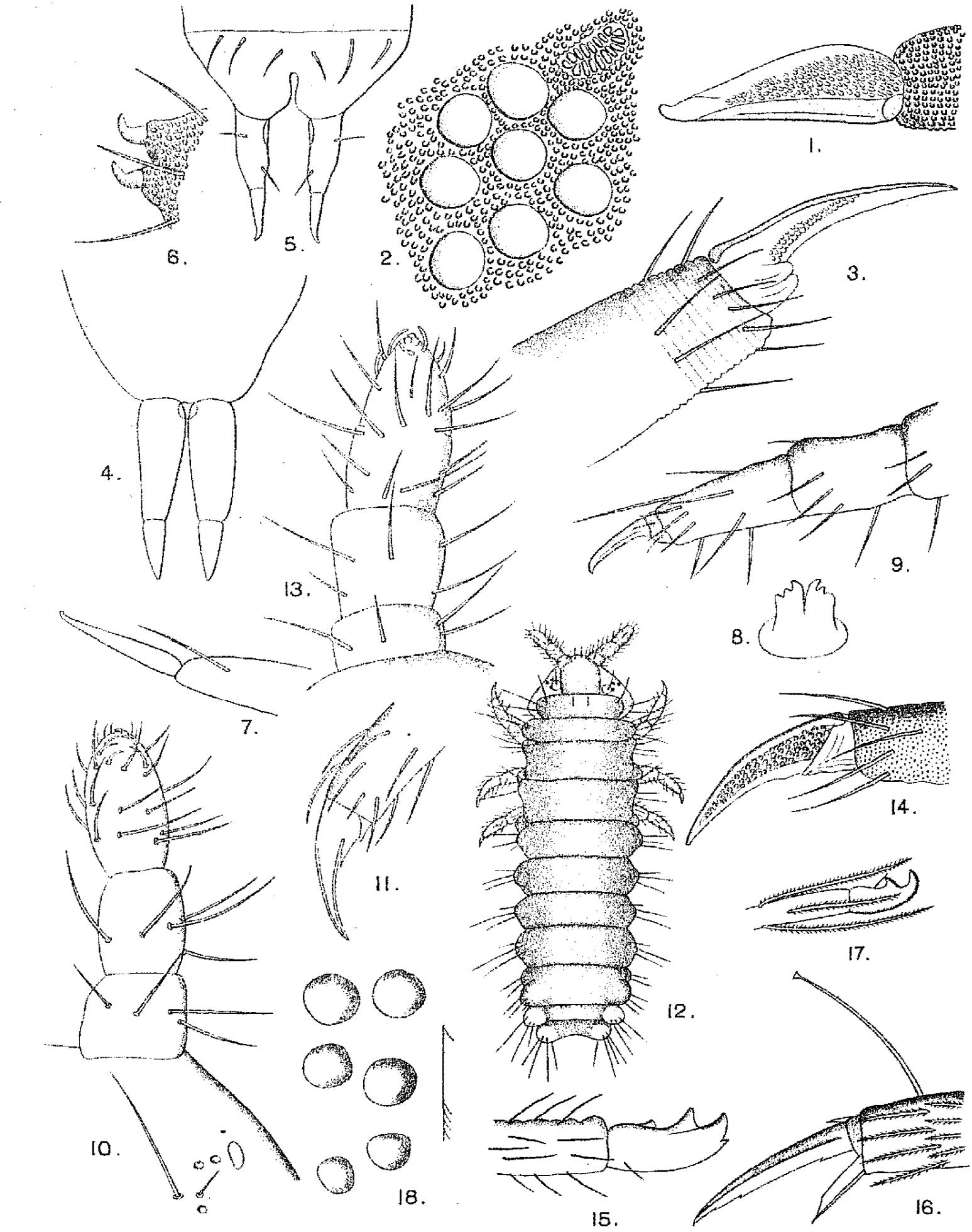
Fig. 77. The left foot of the first pair of legs seen from the inner side.
78. The left mucro seen from the inner side.

Paronella phanolepis (continued).

Fig. 79. The right mucro seen from the outer side.

Paronella insignis, sp. n.

Fig. 80. The insect viewed from the left side.



A.D. Imms ad nat. del.

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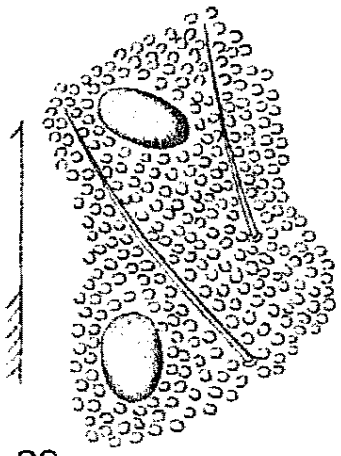

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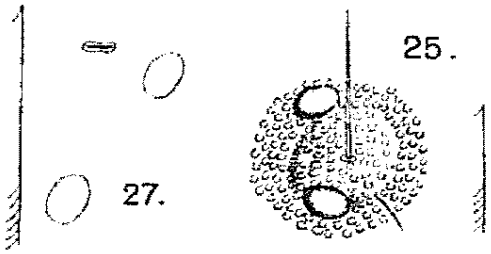

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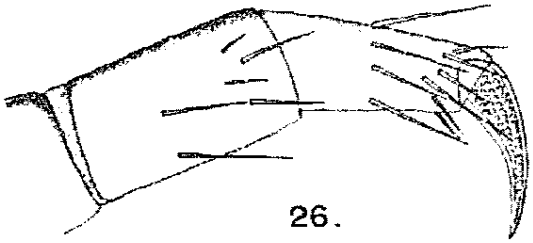

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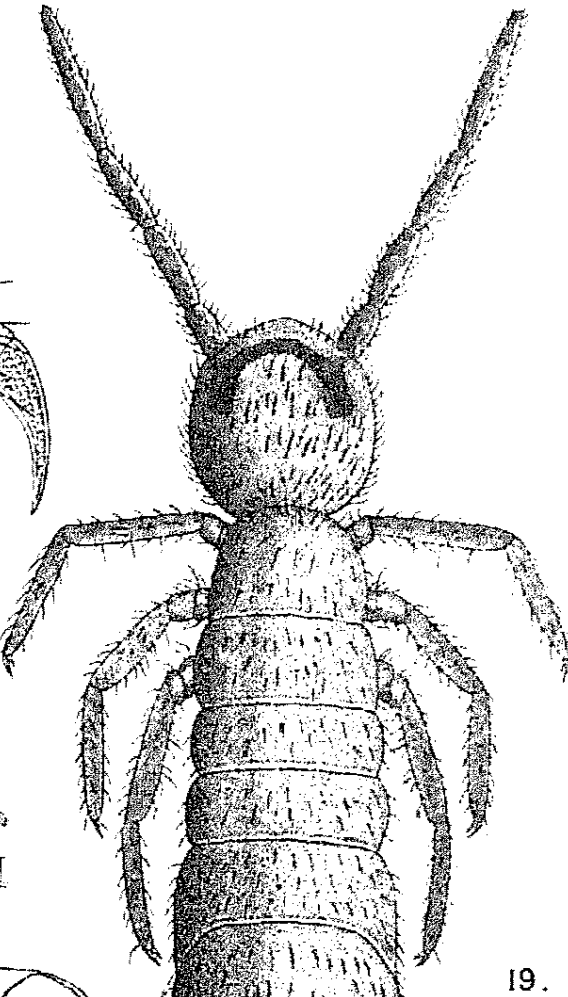

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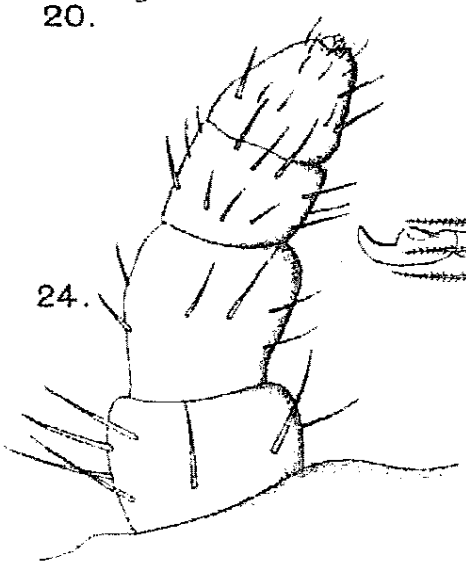

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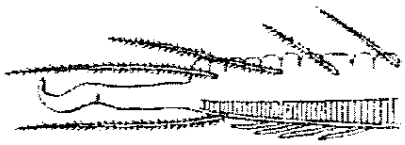

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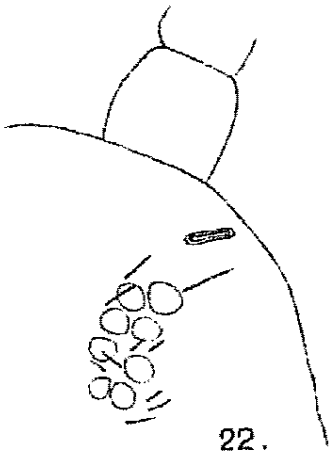

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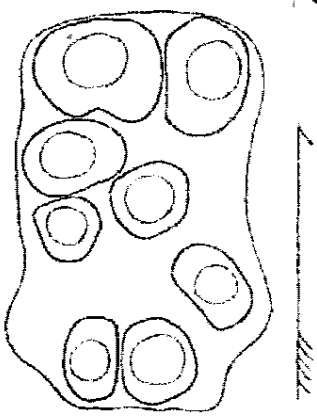

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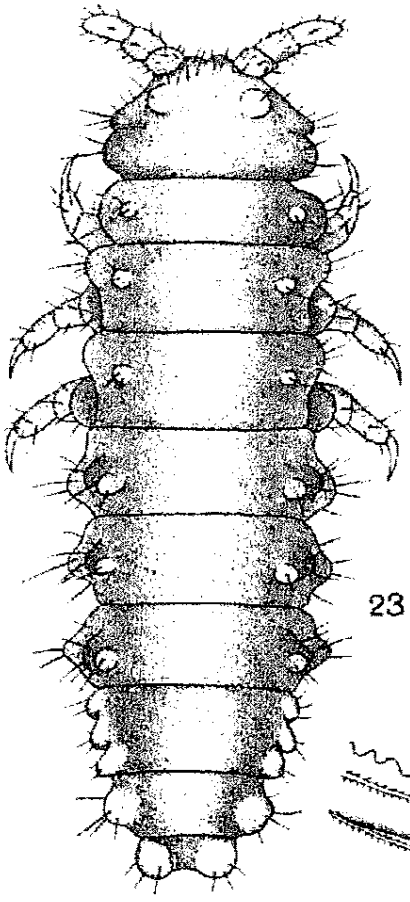

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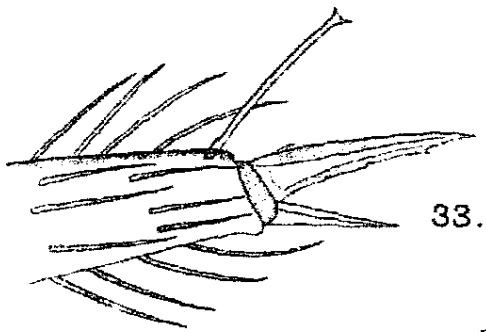

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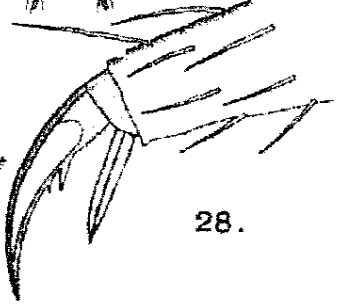

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A.D. Imms ad nat. del.

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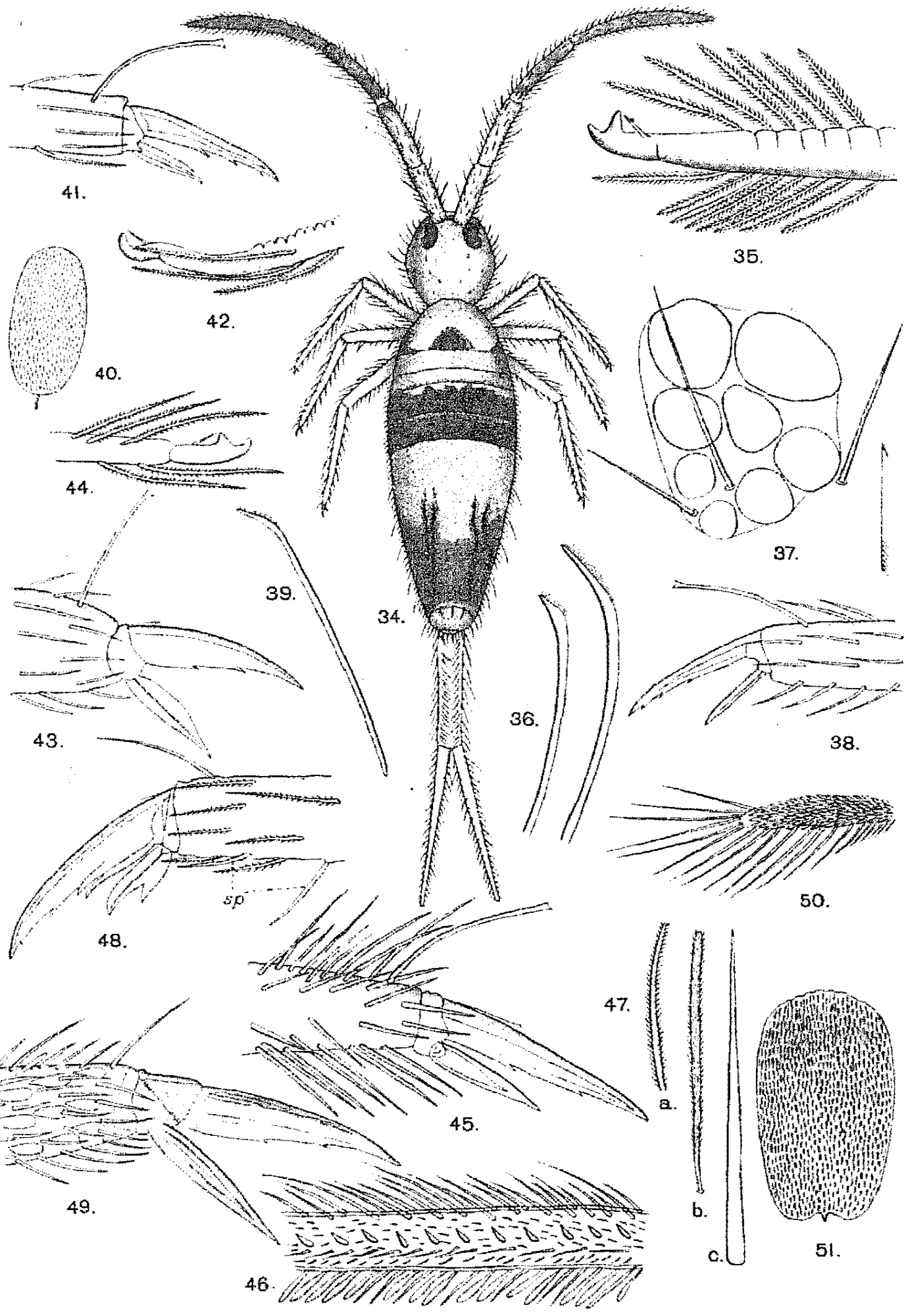
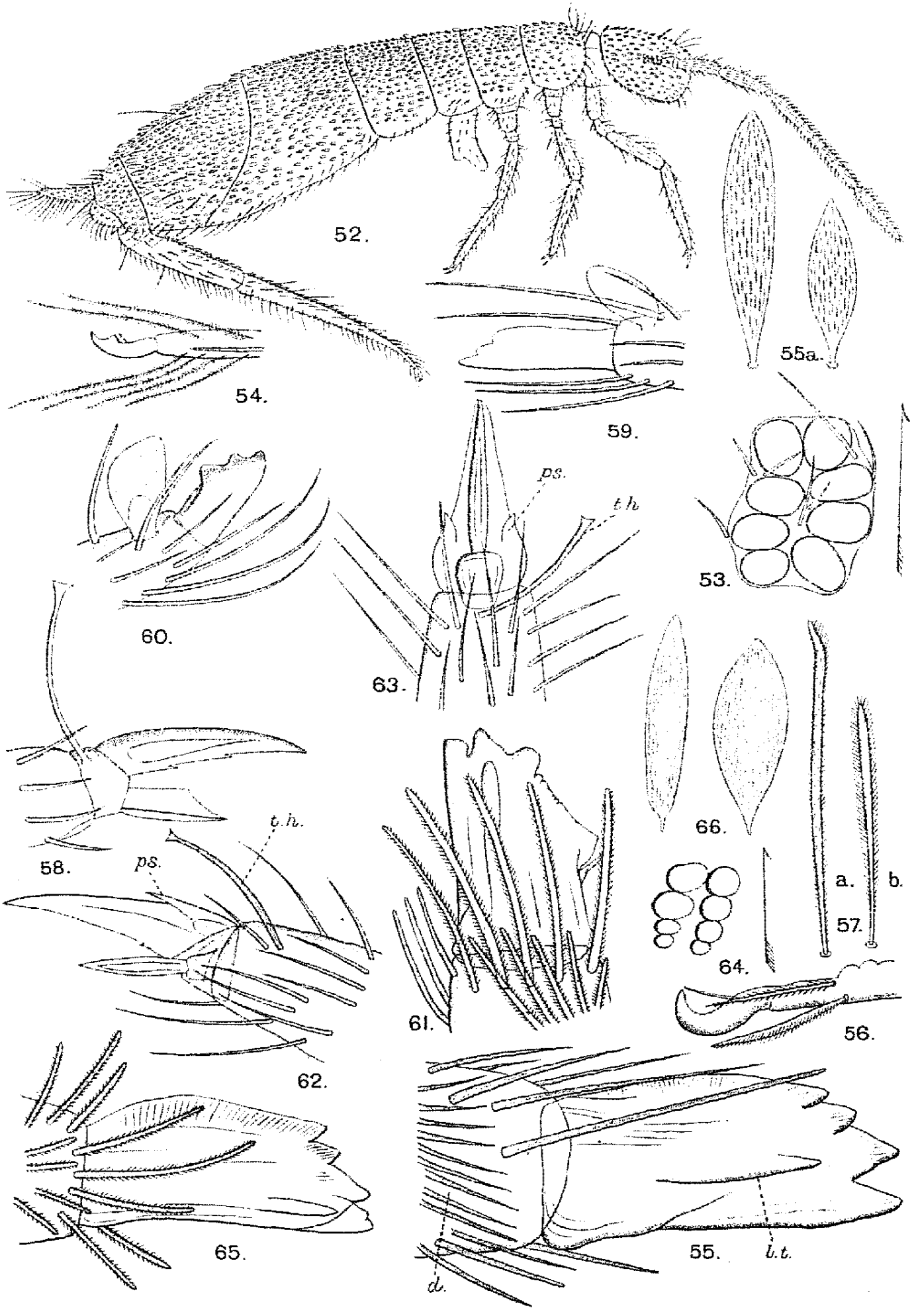
ORIENTAL COLLEMBOLA.



A. D. Imms ad nat. del.

E. Wilson, Cambridge.

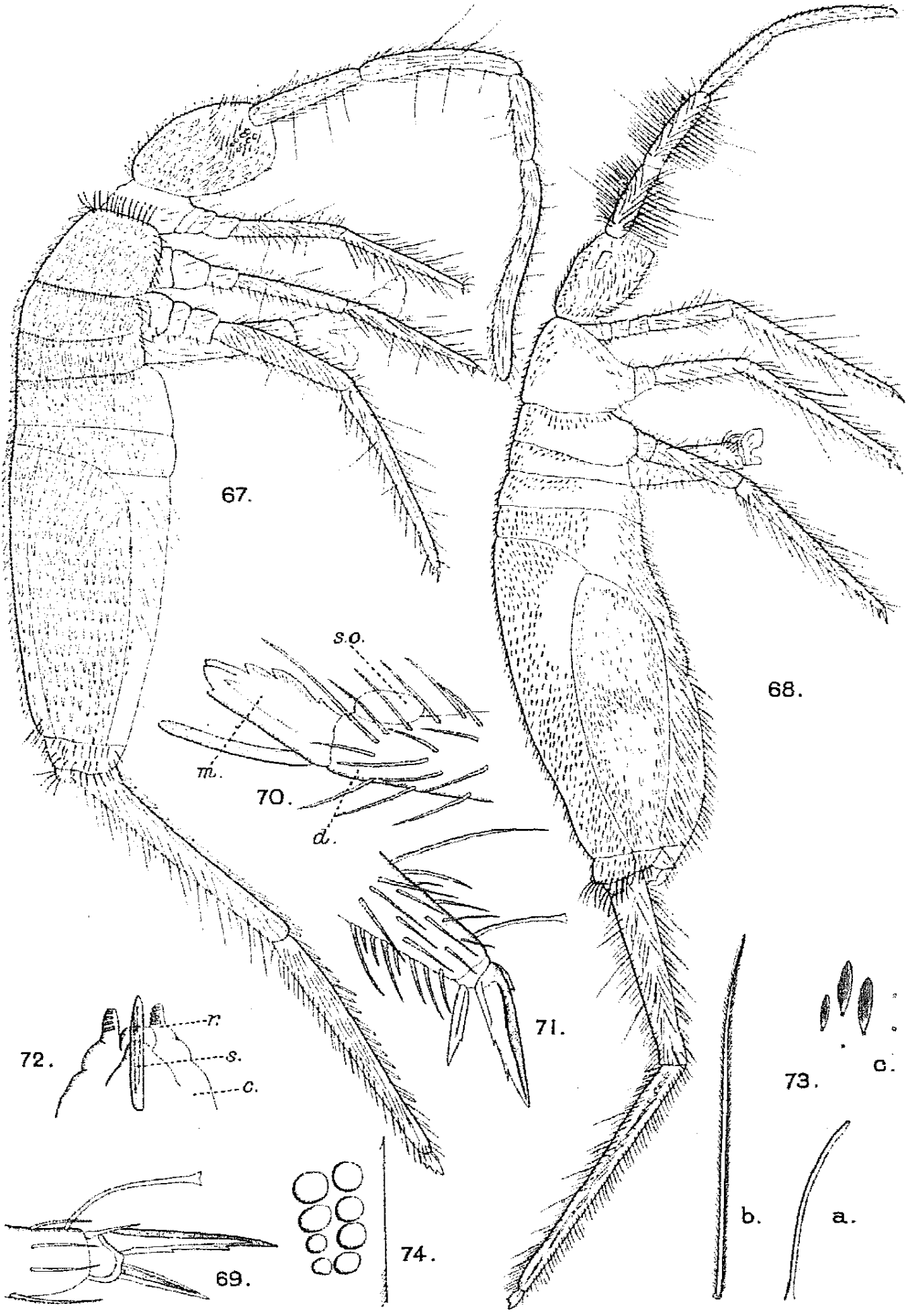
ORIENTAL COLLEMBOLA.



A. D. Imms ad nat. del.

E. Wilson, Cambridge.

ORIENTAL COLLEMBOLA.



A.D.Imms ad nat.del.

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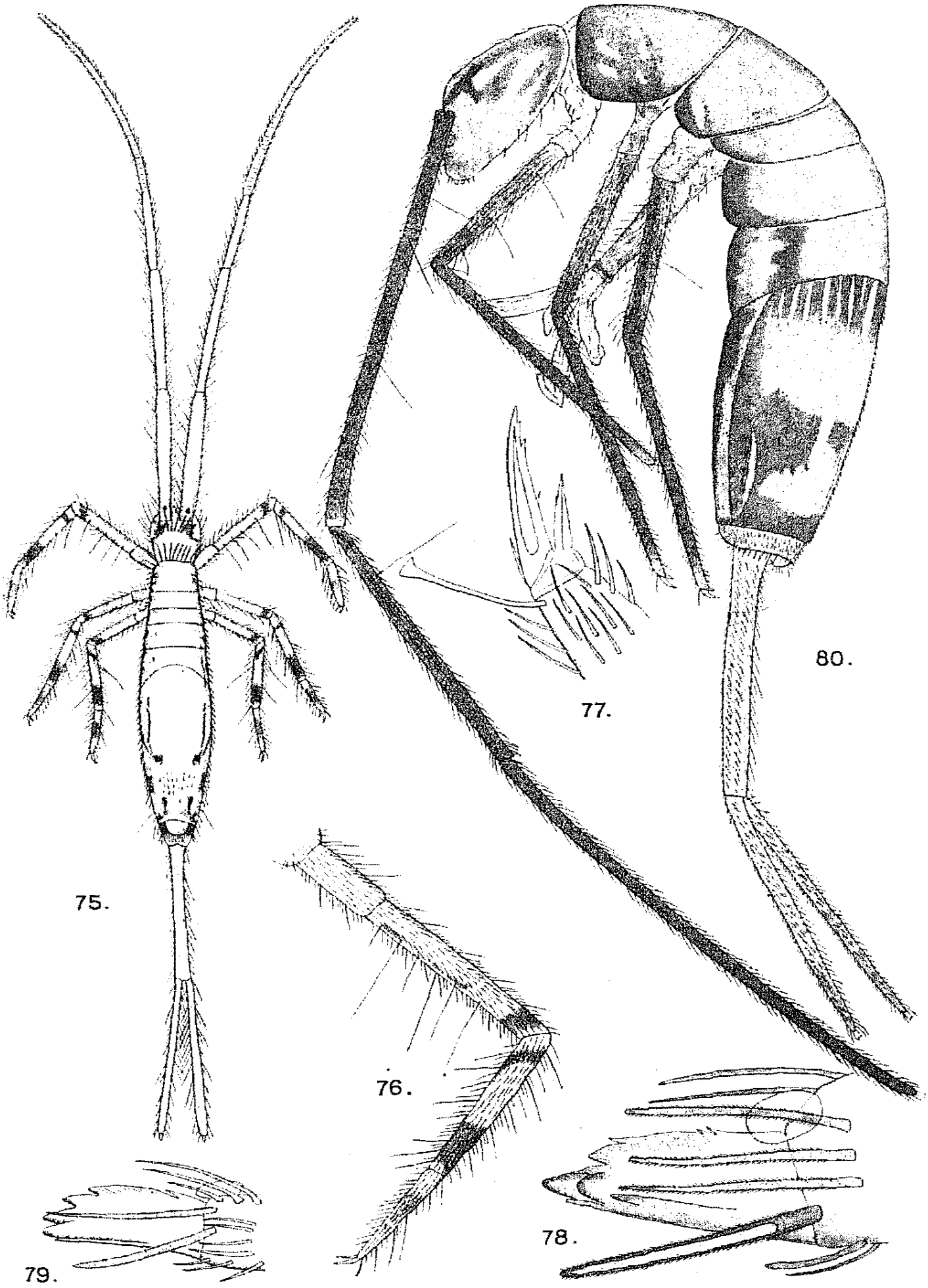
ORIENTAL COLLEMBOLA.



A.D. Imms ad nat. del.

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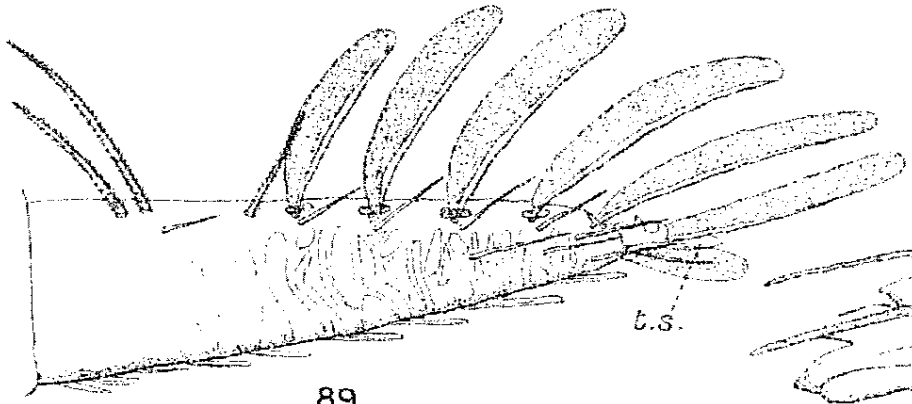
ORIENTAL COLLEMBOLA.



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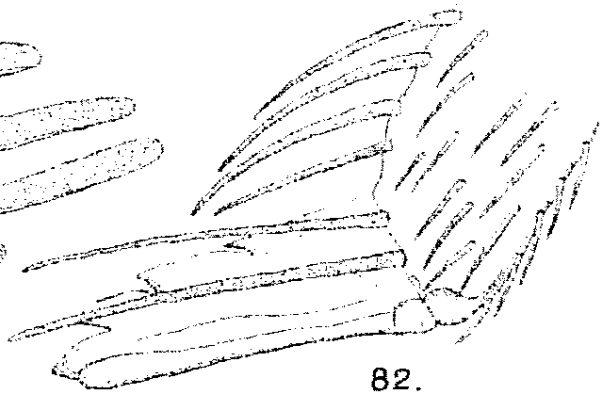

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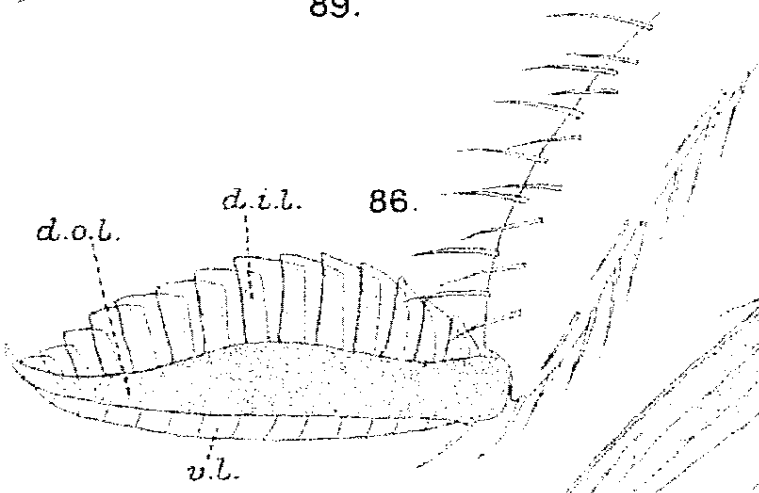

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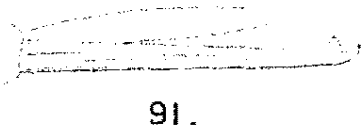

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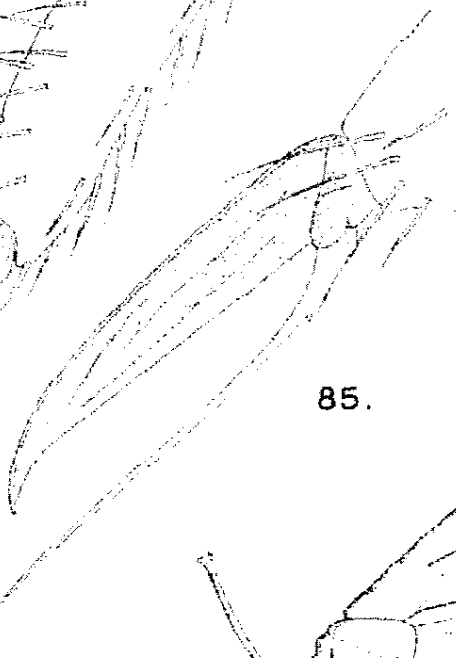

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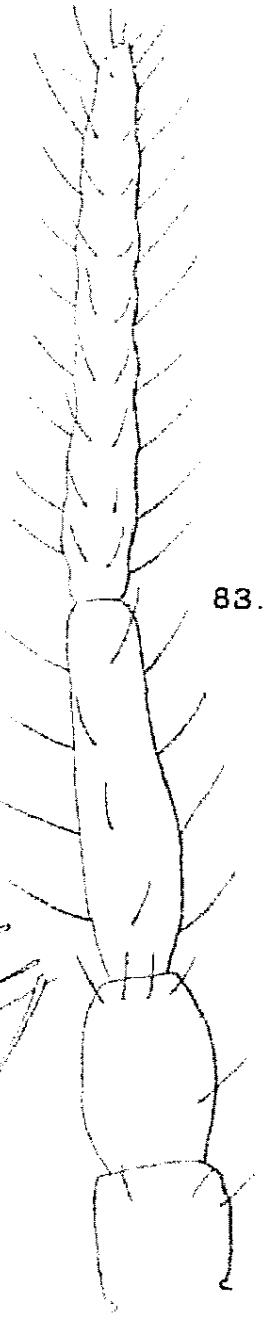

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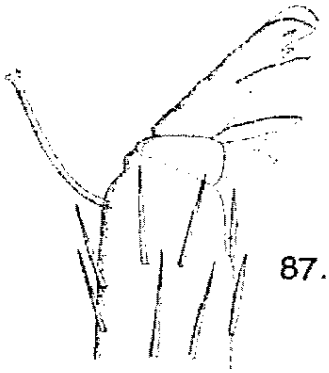

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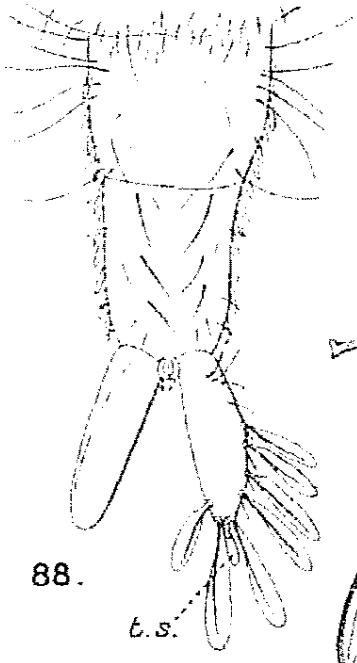

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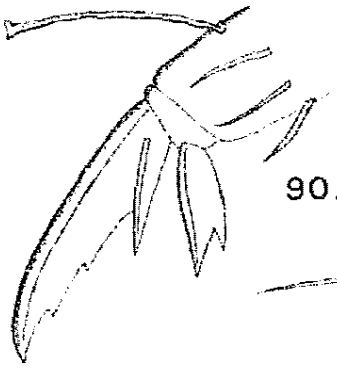

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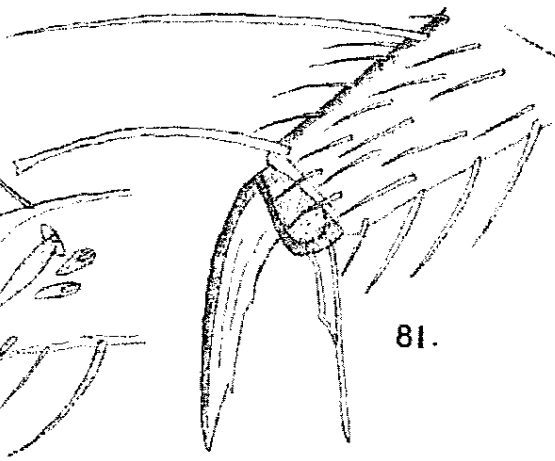

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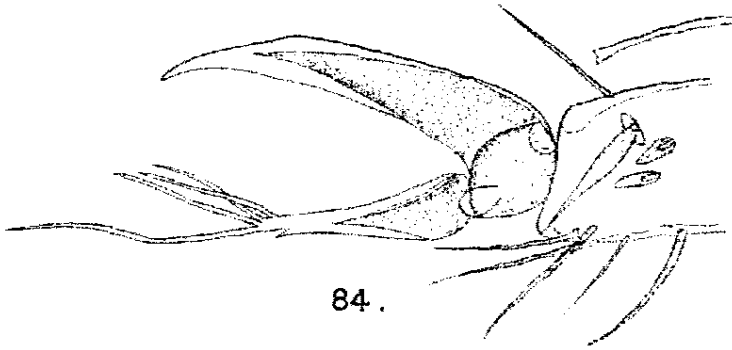

84.

A. D. Imms ad nat. del.

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PLATE XII.

Paronella insignis (continued).

Fig. 81. The right foot of the third pair of legs, seen from the outer aspect.
82. The right mucro seen from the outer aspect.

Sminthurides appendiculatus, sp. n.

Fig. 83. The left antenna seen from the inner side.
84. The left hind foot, inner side.
85. The left foot of the first pair of legs seen from the inner side.
86. The right mucro seen from its outer aspect. *d. i. l.*, dorsal inner lamella; *d. o. l.*, dorsal outer lamella; *v. l.*, ventral lamella.

Pseudocyphoderus annandalei, gen. et sp. n.

Fig. 87. Foot of third pair of legs.
88. The furcula viewed from the dorsal side. *t. s.*, terminal scale.
89. The left dens and mucro from the outer side. *t. s.*, terminal scale.

Cyphoderus simulans, sp. n.

Fig. 90. The left foot of the second pair of legs.
91. The left mucro seen from its outer aspect.

8. Ontogenetical Transformations of the Bill in the Heron (*Ardea cinerea.*) By Prof. P. P. SUSHKIN, C.M.Z.S., Kharkov, Russia.

[Received June 3, 1911: Read November 7, 1911.]

(Plate XIII.*)

The birds of the subfamily Ardeinæ are known to have a conical, pointed, spear-shaped bill with a simple rhamphotheca. The curious fact that these features are acquired only in a late post-embryonic stage seems to have attracted little attention. I have been able to trace a gradual development of these features in a series of embryos and young birds of *Ardea cinerea*, collected and generously presented to me by one of my friends, Mr. J. G. Sobolev, of Moscow.

In an embryo, in which the feather-papillæ on the back have just assumed a conical shape (length of the gape about 12 mm.), the bill is straight and rather slender, the tip of the upper jaw is conspicuously swollen (not only owing to the presence of the so-called egg-tooth), and the culmen is *concave*; a furrow runs from the nostril to the base of the swollen tip (Pl. XIII. fig. 1).

In an embryo about one day before hatching (length of gape 22 mm.) the form of the bill has already changed; it is thicker, its swollen tip is not so prominent and is slightly hooked, and the culmen is not so concave. The horny sheath of the bill is manifesting itself; the covering of the tips of both jaws is thicker and more solid, and the covering of the tip of the upper jaw is marked off by a raised area; a furrow anterior to the nostril, and a space

* For explanation of the Plate see p. 126.