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The systematics of Philippine Collembola : suborders Arthropleona and Nearthropleona.

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THE SYSTEMATICS OF PHILIPPINE COLLEMBOLA:
SUBORDERS ARTHROPLEONA AND NEOARTHROPLEONA

A Thesis Presented

by

VICTOR DELA PAZ GAPUD

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THE SYSTEMATICS OF PHILIPPINE COLLEMBOLA:
SUBORDERS ARTHROPLEONA AND NEOARTHROPLEONA

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INTRODUCTION

The order Collembola is one of the neglected insect orders in the Philippines. The Philippine fauna is known only through Handschin (1926; 1930) who recorded 8 previously described Oriental species and 10 new ones. However, most of these have remained practically unknown, being cited only with respect to distribution in faunistic studies of other Oriental countries.

Since most species of Collembola are minute and easily overlooked, their economic significance may be greater than we now realize. Their importance as pests of Philippine crops can be ascertained only through intensive research. In some European countries, in the United States, in Australia, and Japan, the destructive potential of these insects has been documented by several workers. About 30 species have been recorded on various plants, particularly on vegetables and cereals (Womersley, 1939). Some have been observed to feed on either foliage or roots (Flor, 1930; Folsom, 1932, 1933; Ingram, 1931; Krjukova, 1932; Paclt, 1956; Spencer and Stracener, 1929, 1930; Tomaszewski, 1949; Wolcott, 1948; Womersley, 1939). Several species are known to damage cultivated mushrooms heavily (Thomas, 1931, 1932, 1939; Folsom, 1933).

Folsom (1933) has given us a good description of collembolan foliage feeding. Specimens usually attacked cotyledons and young leaves of seedlings. Feeding in great numbers, they tended to aggregate around holes previously produced by flea beetles or other chewing insects, enlarging the holes in the process. In other cases, they made the holes themselves, the damage being comparable to that caused by other small chewing insects. Since their propensity for reproduction in a short

period of time is so great, especially in the tropics, their potential as pests of Philippine crops should be thoroughly investigated.

The intent of the present work is to provide an improved base for future works on Philippine Collembola by redescribing, mostly from personally collected material, the Philippine species recorded and described by Handschin; recording and redescribing other species not previously known to occur in the country; describing any new species; and providing keys, illustrated descriptions, and distribution and habitat records of the known Philippine species. Since this study covers only the suborders Arthropleona and Neoarthropleona, the three symphypleonid species described by Handschin are not included.

MATERIALS AND METHODS

Samples such as soil, decaying leaves, grass, twigs, and other plant materials were collected from various parts of the country, placed in separate plastic bags, and later transferred to Berlese funnels for extraction of the desired insects. After 24 to 48 hours the extracted specimens were tentatively sorted under the microscope into genera and placed in vials of 95% alcohol. Occasionally specimens were collected in the field with a camel's hair brush and placed directly in alcohol.

From the vials, the insects were transferred into distilled water to dilute the alcohol in their bodies. Lightly pigmented and non-pigmented forms were mounted directly in Hoyer's medium on microscope slides. Deeply pigmented specimens were first immersed in warm 50% lactic acid to remove most body pigments, the time of treatment varying according to the species. They were then rinsed in water and mounted. The slide mounts

were heated rapidly over an alcohol flame to facilitate clearing as well as to remove any air trapped between cover slip and slide. Mounted specimens were kept in a drier for a week for further clearing and to allow the medium to solidify. The mounts were then sealed at the edges of the cover slips with nail polish and returned to the drier for at least a day.

The main objection to the use of Hoyer's medium for mounting and preserving specimens is its impermanence. However, this medium has certain advantages over others more nearly permanent in that it acts as a clearing medium, a mounted specimen can be removed and remounted without breakage, and its relatively low refractive index makes it excellent for examining minute body structures. Although Canada balsam is considered to be more dependable and long-lasting, it is of little use for Collembola due to its relatively higher refractive index and its shrivelling effect on mounted specimens. Even if specimens do not shrivel, their bodies do not flatten sufficiently so that minute structures can be observed. Thus, details on the ventral surface of the body are barely visible when the specimen is viewed dorsally. Salmon (1951a, 1951c, 1954) introduced polyvinyl alcohol as a long-lasting medium with a refractive index as good as that of Hoyer's. However, this medium has been found to crack in time and even cause shrinking of specimens. For these reasons I have used Hoyer's medium for mounting and examining the specimens. The types are preserved temporarily in this medium until a better one is discovered.

The specimens were studied, described, and figured with the use of a phase-contrast microscope. A projectoscope proved indispensable in drawing the habitus or general body appearance for each species. Linear and grid

types of ocular micrometers were used for details and measurements. In detail drawings not oriented with the cephalic end towards the top of the plate, an arrow indicates the anterior end.

Seven of the 11 available types of 11 species were borrowed from museums for verification. However, except for the holotype of Parisotoma canituda Salmon (1951b), types were in such very poor condition that many diagnostic characters were no longer observable. Hence, most of the species were determined through the aid of available literature. Dr. R. F. Yosii of Japan has been kind enough to confirm many of my determinations. Four neotypes and five homoeotypes were designated and will be deposited either in the Department of Entomology, UPCA, Philippines, or in the Museum of Comparative Zoology at Harvard University, Cambridge, Massachusetts.

GENERAL EXTERNAL ANATOMY OF THE COLLEMBOLA

Collembola, commonly known as springtails, are relatively small, usually less than 3 mm. long, rarely attaining a length of 10 mm (Maynard, 1951). The soft and thinly sclerotized body integument is either smooth or granulate. Members of the suborders Arthropleona, Neoarthropleona, and Metaxypleona are elongate, those of the suborder Symphypleona being subglobose.

The head is usually prognathous but in some cases hypognathous. The antennae, often pigmented, and with 4 to 6 segments, are situated directly anterior to the eyepatches. They may be shorter than, equal to, or longer than the head, in some groups even as long as or longer than the whole body (Pl. XXIX-A). Several special structures of taxonomic value are located on the third and fourth antennal segments. Annulation

in these segments is restricted to a few genera of Entomobryidae. The third segment almost always bears a distal sense organ basically composed of two curving or straight sensory rods lying in a groove. The fourth segment may possess one or several round papillate apical knobs or end-bulbs (Pl. VI-A) as well as slightly bent, rod-shaped, subapical sensory setae (Pl. VII-D).

Posterior to the antennae is a pair of postantennal organs usually bearing one or more peripheral or central lobes (Pl. I-B). In Isotomidae, these organs are simple oval to elliptical structures devoid of lobes (Pl. X-B). In other groups, they are modified to contain sensory rods, lobes, cones, or papillae, all of which are important in separating families, genera, or even species. Entomobryids entirely lack such organs.

Posterior to the postantennal organs is a pair of eyepatches, each member of the pair bearing one to as many as eight eyes (ommatidia of some authors). Guthrie (1906) observed that the collembolan eyes followed a basic S-pattern within the eyepatch. In species possessing one, two, or three eyes on each side, this pattern does not apply. Whatever the number, the arrangement of eyes does not appear to have any taxonomic value.

The mouthparts, deeply recessed within the anterior part of the head, are situated either apically or ventrally and subapically. They may be adapted for chewing or sucking, according to the suborder. The shape and structure of the mandibles and maxillae in suctorial forms are diagnostic at the family, generic, and species levels. In these forms, the labrum and labium, appearing as plates, frequently form a buccal cone enclosing the rest of the mouthparts. In chewing species the mandibles and maxillae are basically the same regardless of the taxon, and no buccal cone is formed.

As in other insects, the thorax is 3-segmented, but the sclerites are weakly developed. In the subglobose symphypleonids the thoracic segments fuse with each other and with the abdomen to form a composite body. In some groups, reduction of the prothorax into a largely membranous segment is accompanied by development of a prominent mesonotum which often conceals the pronotum and sometimes the posterior margin of the head. The legs are generally 5- to 6-segmented, bearing 1 or 2 precoxae as basal segments. Tibia and tarsus have fused to form a composite tibiotarsus.

Several structures on the legs are diagnostic at the family, generic, and species levels. The trochanteral organ (Pl. XV-C), a group of small spiny setae on the outer side of the hind trochanter, is found only in Entomobryidae. These setae vary in number between and within species according to age and size of specimens, but often remain constant within a certain size or age level. The femoral organ, another group of specialized setae situated on the hind leg, has so far been found to occur only in a very few paronelline species (Pl. XXXII-A). The tibiotarsus often bears one or more clavate tenent hairs (Pl. IX-G), specialized setae occurring near the anterior base of the unguis. In some cases, the tenent hair is pointed or entirely absent. The function of this seta has not been thoroughly studied although it is suspected that it aids in supporting the legs when at rest. The unguis (claw) is a simple solid structure with one or more teeth (dentitions), the basal or proximal teeth often paired and sometimes modified into large wing-like structures (Pl. XXVIII-D). The inner side of the unguis may or may not have a basal groove. The unguiculus (empodial attachment or inferior claw) may or may not be present; if present, it is either truncate, lanceolate, or acuminate.

The collembolan abdomen is basically 6-segmented, some segments being fused in certain genera. In *Symphyleona*, ankylosis of all segments occurs, the last two forming an anal papilla. In forms exhibiting distinct segmentation, the relative lengths of the third and fourth abdominal segments are diagnostic for some families and genera.

Three specialized structures occur on the ventral surface of the abdomen. The ventral tube (collophore), a bilobed tubular structure, arises from the first abdominal segment (Pl. XII-A; XXI-G), and has a pair of eversible sacs at its apex. Several speculations have been made as to the possible function of this organ, i.e., for respiration, blood pressure, adhesion (Maynard, 1951). Recently, Pedigo (1967) observed in Lepidocyrtus cyaneus f. cinereus Folsom that the ventral tube functions primarily as a cleaning and grooming device. Whether his findings hold true for all species is not known.

The tenaculum (retinaculum or clasping organ), which arises from the third abdominal segment, consists of a basal part, the corpus which often bears an anterior seta, and a distal pair of dentate or barbed appendages, the rami which are either tridentate or quadridentate. This organ holds the furcula beneath the body when the insect is at rest, and releases it for propulsion by means of its adduction muscles.

The furcula (furca or springing organ) is appended to the fourth or fifth abdominal segment (Pl. X-A, F). It has a fused base, the manubrium, a pair of elongate, crenulate or smooth structures, the dentes, and an apical pair of small structures, the mucrones. The mucrones usually appear hook-like with a variable number of teeth, but sometimes assume a boat-shaped appearance. It is because of the springing property of the

furcula and its almost caudal position that the Collembola came to be known as "springtails." The leaping behavior in these insects probably serves as an efficient escape mechanism from predators.

Since most species of Collembola do not possess external genitalia, determination of sex is extremely difficult. In some species, however, sexual dimorphism is shown by color intensity variation or modification of certain body setae. In a very few forms, a simple genital plate or field occurs in males or in both sexes on the ventral surface of the fifth abdominal segment. The male plate is generally more rounded than that of the female; both bear fine setae of varying sizes. The male genital orifice is rounded while the female orifice is slit-like or crescent-shaped and transverse.

The body of a collembolan may possess setae of different types, i.e., simple smooth, simple ciliate, serrate, medially expanded and ciliate, long and pubescent, stout flexed ciliate, or long filiform ciliate setae. In Entomobryidae, several long filiform ciliate setae (setae sensuales) occur in pairs on the second, third, and fourth abdominal segments. They are often accompanied by minute ciliate setae, the accessory microchaetae. The more common setae, however, are pointed and may or may not be ciliate, occurring on body segments as well as appendages.

Other than setae, the body may be covered by apically pointed or rounded scales which appear either hyaline or brownish. In Entomobryidae, the abundance of body scales is inversely proportional to the denseness of large body setae (macrochaetae). Hence when the body is polychaetotic scales do not usually occur.

In studying structures of Collembola, particularly those involving numerical figures, e.g., setae on ventral tube or trochanteral organ, head and body chaetotaxy, unguis teeth, etc., specimens of the same age or size must be used. At such levels, these characters appear relatively constant intraspecifically but may vary interspecifically. Mature specimens are undoubtedly preferable to use since they possess fully developed structures, although younger forms are useful for studying the changes these structures undergo before reaching maturity.

EXPLANATION OF TERMS AND ABBREVIATIONS

Abd I, Abd II, etc. - first abdominal segment, second abdominal segment, etc.

Anal spines - spines found on posterior area of sixth abdominal segment, as in Xenylla.

Ant I, Ant II, etc. - first antennal segment, second antennal segment, etc.

Body length - the measurement taken from tip of labrum of the head, when in natural position, to posterior end of sixth abdominal segment, furcula excluded.

Dens (dentes) - a member of a pair of parallel pieces arising from distal end of manubrium, forming the second or middle part of the furcula.

Femoral organ - a group of specialized spatulate setae on the hind femur, as in Pseudoparonella.

Furcula - the structure attached ventrally to the fourth or fifth abdominal segment and used for leaping. The furcula in normal position lies against the ventral surface of the body; its dorsal and ventral

surfaces are designated from this position. For convenience, drawings show the furcula extended, with the true ventral side assuming a dorsal position and vice versa.

Macrochaetae - large, strongly ciliated setae usually flexed apically and sparsely distributed on thoracic and abdominal segments almost always in a fixed pattern, as in Seira, Alloscopus, Aphysa, etc.

Man. - manubrium.

Manubrium - the basal unpaired part of the furcula appended ventrally to the abdomen and bearing the dentes at its distal end.

Microchaetae - accessory minute ciliate setae accompanying the setae sensuales; may appear simply pointed or medially expanded.

Mucro (mucrones) - a member of a pair of small separate pieces joined to the distal end of the dens; comprises the third part of the furcula.

Postantennal organ (PAO) - a usually oblong or elliptical sensory structure, existing in pairs and situated posterior to the antennal bases and anterior to the eyes; may or may not contain sensory lobes, cones, rods, papillae, etc.

Precoxa - the basal segment of the leg just before the coxa.

Seta sensuality (setae sensuales) - a long, slender, filiform, ciliate, wavy sensory seta usually situated on the second, third, and fourth abdominal tergites, and usually accompanied by accessory microchaetae; in Neanura, the setae sensuales are non-ciliated and relatively short, are situated on thoracic as well as abdominal tergites, and are without microchaetae.

Tenaculum - a small clasping organ attached ventrally to the third abdominal segment; it holds the furcula in resting position under the abdomen.

Th I, Th II, etc. - first thoracic segment, second thoracic segment,
etc.

Tenent hair - a specialized seta usually clavate or swollen apically,
situated at the anterior aspect of the distal area of the tibio-
tarsus.

Tibiotarsus - fused tibia and tarsus of the leg.

Trochanteral organ - a group of small spiny setae on the outer side of
the hind trochanter; found only in Entomobryidae.

Unguis - the superior, larger, or outer claw of the leg.

Unguiculus - the inferior, smaller, or inner claw of the leg; also called
empodial appendage.

Ventral tube - a tube consisting of a fused pair of appendages, situated
on the ventral surface of the first abdominal segment, also called
collophore.

The lengths of segments or body regions are expressed as ratios
using abbreviations, such as Ant I:III:III:IV for the relative lengths
of antennal segments, or Ant:head for the ratio of antennal length to
head.

SYSTEMATICS OF COLLEMBOLA Lubbock, 1870

The taxonomy of the order as a whole is still not well understood.
Boerner's systematic concept (1906; 1913) has generally been accepted
as basic for the group. Since the order now contains about 3,000 world
species and more are discovered annually, changes have been necessary
to fit many of these into subgroupings. In the past the classification
of springtails was based mainly on anatomical similarities without

regard for certain fundamental phylogenetic relationships. Many characters previously used to separate genera or species or even families were either difficult to see or to assess. The proportional lengths of abdominal and antennal segments, the body color pattern, the nature of body setae, the trochanteral organ, and the general body appearance, which were considered diagnostic for many species and genera, have been found to vary within some species with respect to age or size. The recent recognition of sexual dimorphism in some groups adds to the difficulty of placing genera and species within Boerner's system.

Salmon in 1964 proposed a new classification for the whole order based on certain clearly defined phylogenetic concepts. Accepting the theory that insects probably evolved from myriapod-like ancestors close to Symphyla, he further hypothesized that the possible ancestral insect possessed a prognathous head with chewing mouthparts and that any change in the orientation of the long axis of the head and type of mouthparts were later developments in Collembola. The shifting of the head into a hypognathous condition was followed by the fusion of thoracic and abdominal segments. As far as Collembola are concerned, Salmon's hypothesis seems reasonable and may be substantiated by existing forms. Hence, using as basic characters, head orientation with respect to mouthparts, body shape and segmentation, and type of mouthparts, he erected the suborders Nearthropleona and Metaxypleona intermediate between the two already existing suborders, Arthropleona and Symphypleona. Salmon's system stabilized the systematics of the order to a great extent, although his concepts need further development at all levels.

Three of the four suborders of Collembola are represented in the Philippines, the suborder Metaxypleona Salmon (1964) being absent. Of the remaining suborders, only Arthropleona and Neoarthropleona are covered in this paper. The two suborders include 26 known Philippine species, 10 of which are recorded for the first time in the country. Of the 10 species, one is described as new. The following scheme of classification is adapted from Salmon (1964). An asterisk after a species indicates its first record in the Philippines.

Order COLLEMBOLA Lubbock

Suborder NEOARTHROPLEONA Salmon

Family NEANURIDAE Boerner

Ceratrimeria Boerner

maxima (Schoett)

pulchella Handschin

Neanura MacGillivray

hirtella (Boerner)*

bakeri (Handschin)

perfusa (Denis)*

reducta new species*

Suborder ARTHROPLEONA Boerner

Superfamily HYPOGASTRURCIDEA Salmon

Family HYPOGASTRURIDAE Boerner

Xenylla Tullberg

sensilis Folsom*

Superfamily ENTOMOBRYOIDEA Womersley

Family ISOTOMIDAE Boerner

Folsomides Stachexiguus Folsom*Isotomurus Boernerbalteatus (Reuter)Isotomina Boernerlombokensis (Schoett)Parisotoma Bagnallcanituda Salmon*

Family ENTOMOBRYIDAE Boerner

Subfamily ENTOMOBRYINAE Schaeffer

Entomobrya Rondaniproxima FolsomAcanthurella Boernerlepidornata HandschinLepidocyrtus Bourlet(Acrocyrtus Yosii)parvidentatus Schaefferbrunneus Handschin(Ascocyrtus Yosii)coerulecinctus Handschinindicus Handschin*(Lepidocyrtus)vestitus Handschin

Alloscopus Boerner

tetracanthus Boerner*

tenuicornis Boerner

Seira Lubbock

terrestris (Folsom)*

schaefferi (Schoett)

Subfamily CYPHODERINAE Boerner

Cyphoderus Nicolet

javanus Boerner*

hozawai Konoshita

Subfamily PARONELLINAE Boerner

Aphysa Handschin

longicornis (Oudemans)

Pseudoparonella Handschin

setigera (Boerner)

Key to Philippine Suborders

1. Head prognathous or obliquely prognathous; body segments distinct, the body generally elongate; mouthparts either chewing or sucking.....2
- Head hypognathous; body segments fused to form one solid structure, the body subglobose; mouthparts chewing.....Symphypleona Boerner
2. Mouthparts suctorial, the mandibles and maxillae usually styliiform and enclosed in a buccal cone; mandibles without molar area; unguiculus and clavate tenent hair absent.....Nearthropleona Salmon

Mouthparts chewing, not cone-shaped; mandibles and maxillae not styliform, the former with molar area; unguiculus and clavate tenent hair often present.....Arthropleona Boerner

Suborder NEOARTHROPLEONA Salmon, 1964:103

Mouthparts generally suctorial, usually projecting anteriorly in a buccal cone; mandibles and maxillae often styliform when both are present, the former always without molar area; maxillae, if mandibles are absent, not styliform; unguiculus and clavate tenent hair absent.

(Salmon, 1964).

The suborder is represented in the Philippines by a single family. Salmon (1964) recognized six families primarily on the basis of the structure of the mandibles and maxillae, i.e., shape, presence or absence of lamellae, and shape and number of teeth. Furthermore, the presence or absence of integumentary tubercles or bosses, as well as of paratergal swellings, is similarly diagnostic. Based on these characters alone, the family limits in the suborder still appear to be unstable.

Family NEANURIDAE Boerner

Neanurinae Boerner, 1941a:428; Folsom, 1916:478; James, 1933:92; Mills, 1934:19; Salmon, 1941:306.

Neanuridae, 1956:427 (placed on Official List of Family Group Names in Zoology, Opinion 435); Salmon, 1964:109.

Mandible with one or more teeth, situated apically or subapically, or both, often tridentate; maxilla styliform, usually with two slender shafts, one sometimes bearing two apical crochet-like hooks; body stout,

with paratergal swellings, integumentary tubercles or bosses, or integumentary furrows; integument granulate.

Key to Philippine Genera

Furcula present; eyes 8 on each side; postantennal organ well-developed; body broad and flat with distinct paratergal swellings, without tubercles; body color often bluish or purplish, not decolorized in alcohol.....Ceratrimeria Boerner

Furcula absent; eyes 2 or 3 on each side; postantennal organ rudimentary and without any lobes, or absent; body broad bearing dorsal, dorso-lateral, and lateral tubercles, without paratergal swellings; body often reddish or reddish orange, becoming whitish in alcohol.....Neanura MacGillivray

Genus CERATRIMERIA Boerner

Schoetella Schaeffer, 1896:175.

Ceratrimeria Boerner, 1906:167; Handschin, 1942b:280.

Type species: Ceratrimeria maxima (Schoett), Handschin (1942b).

Body broad and flat, with paratergal swellings; eyes 8 + 8; post-antennal organ well-developed, with 12-30 lobes arranged as an ellipse; furcula well-developed; Abd VI reduced, apically rounded.

The known distribution of Ceratrimeria appears to support the concept of continental displacement (Denis, 1931; Womersley, 1937; Salmon, 1949). The fact that different species have been recorded from the Ethiopian, Oriental, and Australian regions, and that most of them are isolated in forest areas high up in mountain ranges, suggest that the only likely

means by which they could have attained their present distribution is through the displacement of land masses. These sluggish creatures most probably started out from a common stock in the Oriental region and because of geographical isolation gave rise to distinct but very closely related species. Further studies on the taxonomy and distribution of these highly specialized and localized insects will certainly contribute to our knowledge of continental displacement.

The Oriental region contains four species of Ceratrimeria which are so closely related that they are extremely difficult to separate. Previously the number of teeth on the unguis was considered diagnostic for species (Womersley, 1937). However, I find that three of these species possess identical structures on the unguis and therefore this organ seems of doubtful value for separating these species. Likewise, the number of lobes on the postantennal organ does not appear to differ significantly in Oriental species. In body color, three are similar, the fourth differing in the presence of white spots on the body dorsum. Characters which have not been used, such as the structure of the mandible and maxilla, body chaetotaxy, and the shape and form of the mucro, might prove useful in future studies.

The genus is represented in the Philippines by two species. Separation of these is fortunately easy, since one exhibits a distinct body color pattern, a rare phenomenon within the genus.

Key to Philippine Species

Body entirely dark bluish; mucro with 2 dorsolateral lamellae and slightly hooked apically; antennae entirely deep bluish.....maxima (Schoett)

Body dark purplish with 9 large whitish dorsal spots in fixed positions; mucro without dorsal lamella, not hooked apically; Ant IV whitish.....pulchella Handschin

CERATRIMERIA MAXIMA (Schoett)

Plate I

Schoetella maxima Schoett, 1901:318, figs. 1-5. Type: New Guinea, paratypes, in the Swedish Museum of Natural History, Stockholm, Sweden (not seen).

Ceratrimeria maxima, Boerner, 1906:167; Schoett, 1917:5, figs. 4-6; Handschin, 1925:266; Handschin, 1926:449, fig. 1; Handschin, 1928:265; Handschin, 1930:42, pl. I, figs. 1-3; Denis, 1931:100; Womersley, 1933:57; Womersley, 1937:378; Womersley, 1939:117, fig. 47 A-C; Handschin, 1942b:279; Stach, 1949:60.

DIAGNOSTIC FEATURES:

Mucro strongly concave dorsally, bearing 2 dorsolateral lamellae, its apex slightly hooked; antennae subequal to head in length, entirely deep bluish.

GENERAL DESCRIPTION:

Body length 1.2-3.4 mm. Color dark bluish, except for whitish dorsal integumentary pores, setal sockets, intersegmental lines, legs, furcula, and body sternum. Body oligochaetotic, the macrochaetae distributed on segments as follows: Th I 0; Th II and III, 2 + 2 each; the rest of the segments, 1 + 1 each. Antennae and head subequal in length;

Ant III and IV fused, Ant I:II:III-IV = 1:1.5:3; Ant III sense organ consisting of 2 curving sensory rods in a deep groove guarded posteriorly by 2 plain setae; Ant IV with 3 apical end-bulbs. Buccal cone long, reaching beyond anterior margin of head; mandible with 2 apical and 2 subapical teeth, one subapical tooth being minute; maxilla styliform without teeth. Eyes on dark bluish to bluish black eyepatches. Post-antennal organ twice the diameter of an eye, bearing 16-17 lobes arranged in an ellipse (3 examples). Tibiotarsus annulate on distal half; unguis with an inner tooth at midpoint and 2 pairs of lateral teeth, a pair at distal $2/5$, the other at distal $1/5$. Ventral tube not observed. Rami of tenaculum tridentate. Furcula stout and dorsally granulate; dens three times as long as mucro, dorsally with 8 setae; mucro strongly concave dorsally with 2 dorsolateral lamellae and a small apical hook.

MATERIAL EXAMINED:

Three examples, Australia, det. by Schoett, 1921; Philippines: 2 examples, College, Laguna, rotten wood from forest area, 24-VI-66 (Coll. 51); 2 examples, same locality and habitat, 8-VII-66 (Coll. 113); 2 examples, Mudspring Area, Mt. Maquiling, Luzon, from wet decaying leaves on forest floor, 3-VII-66 (Coll. 90).

DISTRIBUTION:

New Guinea; Australia; Java; Sumatra; Philippines.

DISCUSSION:

The specimens at hand agree well with the original description and figures of C. maxima as well as with the Australian examples of this

species, except in the number of lobes on the postantennal organ. Existing papers indicate that the number of these lobes may vary according to locality. Schoett (1901) mentioned 18 on his New Guinea type specimens, while other workers gave the following figures: 19-24 in Java examples (Handschin, 1926b), 12-15 in Philippine forms (Handschin, 1930), and 25-30 in Australian specimens (Womersley, 1939). My material bears 16-17 lobes, not corresponding exactly with any of the preceding figures. Whether this character variation is specific or subspecific is not certain; further investigation is required. For the moment, I am inclined to believe that this is merely a case of local variation and hence consider my specimens to be C. maxima, since there is no other known difference to justify species separation. Future studies on the structure of the mouthparts and body chaetotaxy of these forms might indicate whether they are in fact one species, or more than one.

CERATRIMERIA PULCHELLA Handschin

Plate II

1926a:235, pl. 1, figs. 1-6; Denis, 1931:100; Womersley, 1937:378; Handschin, 1942:280. Type: Philippines, destroyed; neotype now designated, to be deposited in the Department of Entomology, UPCA, Philippines.

DIAGNOSTIC FEATURES:

Body dark purplish, dorsum bearing 9 large white spots in fixed positions; Ant IV whitish; mucro without dorsal or dorsolateral lamellae, concave dorsally, not hooked apically.

GENERAL DESCRIPTION:

The species was originally described as:

"Length 2.5 mm. Body color above dark purple, marked with nine large white spots, two are on the lateral and posterior parts of the head, two lateral on the median parts of Th II and Abd II, two on the sides of Abd IV, and a median one on Abd V. The conus of the mouthparts, the fourth joint of the antennae, the legs, and all sternal parts of the body beneath... entirely ivory white. On the legs only a small triangular spot at the base of the subcoxae remains purple. The antennae are four-jointed and lie underneath the head at the side of the conus of the mouthparts. Fourth joint of antenna with simple bristles; third with apical antennal organ, composed of a pair of curved papillae and two short guard setae. Postantennal organ composed of 27 lobes in a deep groove; several of the tubercles in a middle row... The unguis is simple, without teeth either on the inner or on the outer margin. Unguiculus absent. Mucrones a third as long as the dentes. The granulation of the skin of the latter continues on to the inner lamella of the mucro. Mucro simple, not hooked apically, subtriangular in form." From one specimen at hand, several characters are added:

Unguis with basal inner tooth and 2 pairs of minute lateral teeth, one pair at proximal $1/3$ and the other at about distal $1/3$. Body macrochaetae distributed on segments as follows: Th I, 0; Th II, III, Abd I-IV, 2 + 2 each; Abd V, 1 + 1.

MATERIAL EXAMINED:

Holotype, Mt. Maquiling, Luzon (Coll., C. F. Baker), completely

destroyed; neotype, Mudspring Area, Mt. Maquiling, Luzon, from decaying leaves on forest floor, 13-III-66 (Coll. 38).

DISTRIBUTION:

Philippines.

DISCUSSION:

The single specimen agrees with the original description and figures of Ceratrimeria pulchella, except that it has inner and lateral teeth on the unguis. These structures were possibly overlooked by Handschin because of their minute size and his inadequate material. In his study of C. maxima (1926b) he mentioned a similar situation in which the lateral unguis teeth are inconspicuous at lateral view but become visible when the unguis is viewed from its posterior (inner) aspect. Therefore it seems very probable that the unguis teeth were actually present in Handschin's pulchella. The collection of more material of this species will certainly clarify the matter. Since other characters which are diagnostic for C. pulchella are present in the specimen at hand, there is little doubt in my mind about its identity.

Lack of adequate material of C. pulchella prevented the preparation of a habitus drawing or examination of certain important structures, i.e., postantennal organ, mandible, and maxillae, necessary for a complete redescription.

C. pulchella has been known only from a single specimen, the holotype, which has been examined and found to be completely destroyed. The specimen in my collection is now designated as neotype. The fact that

the species has not otherwise been encountered indicates that it is rare and possibly restricted to certain microhabitats which need further exploration.

Genus NEANURA MacGillivray

Achorutes Templeton, 1835:96.

Blax Koch, 1840:359.

Anoura Gervais, 1842:XLVII.

Achoreutes Templeton, 1842:306.

Anura Tullberg, 1869:4.

Neanura MacGillivray, 1893:314.

Biclavella Willem, 1902:10.

Lobella Boerner, 1906:168.

Biloba Stach, 1951:6.

Propeanura Yosii, 1956:46.

Type species: Neanura muscorum (Templeton), MacGillivray, 1893.

Furcula absent; eyes 2 + 2 or 3 + 3, undivided; Ant III and IV fused; Ant IV with 3 apical end-bulbs; postantennal organ, if present, rudimentary; body broad, usually with 8 rows of tubercles on Th II - Abd IV, often with 6 rows on Th I and Abd V; head frequently with 10 to 12 tubercles; mandible distally with 3 to 7 teeth; maxillae untoothed, sometimes minutely hooked apically; Abd VI entirely visible from above, posteriorly bilobed.

Neanura is closely related to Bilobella Caroli (1912), but the latter has only 2 large tubercles on Abd V and Abd VI is entirely or

partially concealed by Abd V from above. The separation of these two genera on the basis of the concealed Abd VI should be restudied, since such a character is difficult to interpret especially with slide-mounted specimens. Murphy (1965) considered Bilobella as a subgenus of Neanura, probably for this reason.

The genera Achorutes, Anoura, Achoreutes, Anura, Blax, and Biloba have been invalidated for various reasons and placed on the Official List of Rejected Generic Names by the International Commission on Zoological Nomenclature (1956; 1958). Lobella is considered a subgenus of Neanura by many authors, while Propeanura is not well understood and has been placed as a synonym by Salmon (1964).

The Oriental region contains about 14 species of Neanura, most of which are inadequately described and poorly represented in existing collections. Recently new characters have been used to separate the well-known species, i.e., number and shape of teeth and other structures on the mandible and maxilla, number and arrangement of head and body tubercles, number and arrangement of body setae as well as their types. The body tubercles, for instance, may be variously developed, some fusing to form larger tubercles, and still others becoming reduced or lost, being represented only by the setae. Body setae may be ciliated, serrate, or plain; they may appear blunt or pointed apically, or even strongly broadened and flattened apically. The nature of the reticulation on the tubercles is probably the most difficult character to interpret and has brought about confusion in the concept of Neanura (Salmon, 1968). Hence, the taxonomy of this genus is currently undergoing revision (Yosii, 1968). With further investigations of inadequately known species,

phylogenetic relationships within the genus will be better understood.

Four species of Neanura are known to occur in the Philippines.

Key to Philippine Species

1. Eyes 3 + 3, usually pigmented; body tubercles weakly reticulate, the granules forming rows radiating from base of major seta of tubercle; body setae smooth or faintly serrate, tapering apically.....2
- Eyes 2 + 2, not pigmented; body tubercles strongly reticulate without any definite pattern; body setae distally broadened and strongly serrate.....N. hirtella (Boerner)
2. Body setae smooth without serrations, sharply pointed apically; unguis without inner tooth.....N. bakeri (Handschin)
- Body setae faintly serrate, blunt apically; unguis with inner tooth.....3
3. Head with 11 prominent tubercles; frontal tubercle bearing 3 strong setae, the postantennal tubercles each with 2 strong setae; mandible with 6 distal teeth; all body tubercles well developed.....N. perfusa (Denis)
- Head with 10 tubercles; frontal tubercle absent, represented by 2 fine setae; postantennal tubercles reduced, each with 1 seta; mandible with 5 distal teeth; dorsointernal and dorsoexternal tubercles on Th I absent, each represented by a seta; dorsointernal tubercles on Th II - Abd IV reduced, each with a strong seta.....N. reducta new species

NEANURA HIRTELLA (Boerner)

Plates III, IV

Achorutes hirtellus Boerner, 1906:170; Handschin, 1925:266; Handschin, 1926:452, fig. 3; Handschin, 1928:266; Handschin, 1929:236; Womersley, 1933:65, fig. 7 a-c; Denis, 1934:120; Handschin, 1938:140; Denis, 1948:207, fig. 8. Type: Java, unknown; hypotype in the Laboratory of Zoology, Faculty of Sciences, Dijon, France (not seen).

Neanura hirtellus, Carpenter, 1935:369.

Lobella (Propeanura) hirtella, Yosii, 1959b:11, fig. 7.

Propeanura hirtella, Yosii, 1959b:17.

Neanura hirtella, Salmon, 1964:286.

DIAGNOSTIC FEATURES:

Body setae broadened distally and strongly serrate; body tubercles strongly reticulate without definite pattern; eyes 2 + 2, unpigmented; head with 9 tubercles, the postantennal and frontal tubercles being fused; ocular tubercle with a fine seta as well as 2 serrate setae, one apically pointed, the other apically broadened; Abd IV with 6 tubercles, Abd V with 4.

GENERAL DESCRIPTION:

Body length 1.7 - 2.3 mm. Color entirely reddish in living forms, whitish in alcohol. Antennae 4/5 as long as head; Ant III sense organ with 2 sensory rods in a deep groove and 2 posterior guard setae; Ant IV with 8 curving, blunt sensory setae. Eyes 2 + 2, unpigmented;

postantennal organ absent. Mandible with 2 apical and 2 subapical teeth; maxilla styliform, untoothed. Head and body tubercles well developed, bearing strongly serrate and distally broadened setae, several smooth setae in fixed positions; all tubercles strongly reticulate but without definite pattern. Head with 9 tubercles, their corresponding setae distributed as follows: fused frontal and post-antennal tubercles with 3 pairs of setae, the median pair being smooth; ocular tubercles 1 + 1, each with 3 setae, 2 serrate with 1 apically pointed and the other distally broadened, and 1 minute and smooth; dorsolateral and lateral tubercles fused (1 + 1), each with 6 serrate and 3 minute, plain setae; 2 pairs of posterior tubercles, the inner pair with 1 + 1 setae, the outer with 2 + 2 setae. Body tubercles and setae arranged and tabulated as follows:

<u>Segment</u>	<u>Number of tubercles</u>	<u>Number and arrangement of setae including setae sensuales (s.)</u>
Th I	3 + 3	1,2,1
II	4 + 4	3,s+3,3+s,3
III	4 + 4	3,s+4,3+s,3
Abd I	4 + 4	2,3+s,2,2
II	4 + 4	2,3+s,2,2
III	4 + 4	2,3+s,2,2
IV	4 + 4	2,2+s,3,5
V	2 + 2	3,s+4
VI	1 + 1	5

Smooth pointed setae distributed singly on each lateral tubercle from Th I to Abd III, 2 on each lateral tubercle of Abd IV and 3 on Abd V tubercle. Unguis laterally granulate, with one inner tooth at proximal 1/4. Lateral flap of ventral tube with 3 + 3 plain setae.

Male genital field and orifice round, the field bearing 24 + 24 anterolateral and 4 anteromedian setae. Female genital field more depressed, appearing ovate, with 11 + 11 anterolateral and 2 anteromedian setae; genital orifice transverse, slit-like.

MATERIAL EXAMINED:

1 example, Guinobatan, Albay, grass compost, 20-VIII-66 (Coll. 126); 7 examples, same locality, decaying bracts and roots of banana, 20-VIII-66 (Coll. 130); 5 examples, same locality and date, decaying leaves (Colls. 134 and 136); 7 examples, Pili, Camarines Sur, grass compost, 19-VIII-66 (Colls. 149 and 150).

DISTRIBUTION:

Java; South India; Australia; Indo-China; Marquesas and Society Islands; Singapore; Philippines.

DISCUSSION:

There is little doubt that the material is Neanura hirtella, since the type of setae and the nature of the tubercles found in this species are unique. The present redescription, however, varies slightly from that of Yosii (1959b) in that the seventh median seta on the fused postantennal and frontal tubercles is absent in the Philippine examples. Also in exception to Yosii's count of 3 + 3 tubercles on Abd IV in his Malayan examples, the Philippine specimens possess 4 + 4 tubercles. This stated difference is not difficult to explain since the fourth pair of tubercles is strongly lateral and might easily be overlooked. Yosii also described the mandible as

"tricuspidate and with some distal teeth" without specifying the actual number of teeth, nor did he illustrate these structures in his figure of the mandible. The existing differences may well be attributed to local variation and do not seem a justifiable basis for erecting a new species.

NEANURA BAKERI (Handschin)

Achorutes bakeri Handschin, 1926:236, Pl. I, figs. 7, 8; Handschin, 1930:412. Holotype: Philippines (pieces only), in the Natural History Museum, Basel, Switzerland.

Neanura bakeri, Yosii, 1959:18.

DIAGNOSTIC FEATURES:

Body setae smooth and sharply pointed apically; body tubercles especially prominent dorsolaterally and laterally; unguis without inner tooth, but with a tooth-like inner lamella.

GENERAL DESCRIPTION:

This species was originally described as follows:

"Length, 2 to 3 millimeters. Color entirely white. Body with segmental humps, especially pronounced on the sides and dorsolaterally; each with long, stiff, naked bristles; all setae without special structure. Antennae short, four-jointed, fourth joint with somewhat excentric, retractile, subapical papilla, and 6 to 7 olfactory setae on the outer side; the sense organ on third joint of normal structure, as in other species of the genus. Mouthparts for sucking. Three unpigmented eyes on each side, two close together just before the

outer bristle hump, which bears the third eye on its back. A sort of postantennal organ before the first two eyes, the surface of which shows a fine granulation of the epidermis. Skin grossly tuberculated. Tubercles on the humps arranged in lines, running toward the apical bristles. Claw without teeth, but basally with a fine toothlike lamella. Unguiculus and tenent hairs absent."

MATERIAL EXAMINED:

Holotype: Mt. Maquiling, Luzon, 1924 (Coll., C. F. Baker).

DISTRIBUTION:

Philippines.

DISCUSSION:

The holotype of Neanura bakeri is in such poor condition, being fragmented, that the only conspicuous remaining structures are the long, smooth and sharply pointed setae, presumably of both head and body. This species definitely requires further studies as the original description is very inadequate. The body chaetotaxy, the number and arrangement of head and body tubercles, and the structure of the mouthparts are entirely unknown. Unfortunately, N. bakeri is not represented in my collection and no other example of this species is known to exist.

Although N. bakeri was originally described as possessing unpigmented eyes, there is good reason to believe that the eyes are indeed pigmented. In many of my specimens of Neanura, the pigments on the eyes have faded or dissolved entirely during the clearing process, a phenomenon which probably occurs in many species of Neanura.

In spite of the lack of knowledge of this species, the type of setae and the prominent dorsolateral and lateral tubercles seem unique and at the moment sufficient to retain it as a distinct species.

NEANURA PERFUSA (Denis)

Plates V, VI

Lobella perfusa Denis, 1934:119; Denis, 1948:204, fig. 7. Type:

Indo-China, in the Laboratory of Zoology, Faculty of Sciences, Dijon, France (not seen).

Biloba perfusa, Stach, 1951:32.

Neanura perfusa, Salmon, 1964:269.

DIAGNOSTIC FEATURES:

Head with 11 tubercles, the frontal and postantennal tubercles well developed and not fused; mandible with 4 apical and 2 subapical teeth; maxilla crochet-like, apex with 2 minute hooks; body setae blunt and weakly serrate, uniquely arranged on well-developed body tubercles; eyes 3 + 3, pigmented.

GENERAL DESCRIPTION:

Body length 1.95 - 3.1 mm. Color entirely reddish-orange when living, turning whitish in alcohol. Antennae $3/5$ as long as head; Ant III sense organ consisting of 2 sensory rods, posterior guard setae not observed; Ant IV with 9 blunt curving sensory setae (8 examples). Eyes blackish, 3 on each side, 2 of which lie anterior to the ocular tubercle, the other at posterior edge of tubercle; post-antennal organ rudimentary, appearing as a simple oval smooth area

just anterior to the outer anterior eye. Mandible with 4 apical and 2 subapical teeth; maxilla crochet-like with 2 minute apical hooks. Head and body tubercles well developed with strong setae appearing almost smooth but actually faintly serrate; tubercles weakly reticulate, the granules forming rows which radiate from the bases of major setae in straight lines. Head with 11 tubercles, their corresponding setae distributed as follows; 2 prominent postantennal tubercles, each with 2 setae; frontal tubercle, 3 setae; 2 ocular tubercles each with 1 strong and 2 minute setae (varying in length according to size of specimen); 2 dorsolateral tubercles, each with 1 minute and 3 strong setae; 2 lateral tubercles, 3 setae each; posterior tubercles 2 + 2, external pair with 3 setae each, inner pair with 1 seta each. Body tubercles and setae, including setae sensuales, arranged and tabulated as follows:

<u>Segment</u>	<u>No. of Tubercles</u>	<u>Number and Arrangement of Setae</u>
Th I	3 + 3	2, 2, 1
II	4 + 4	3, s+4, 4+s, 2
III	4 + 4	3, s+4, 4+s, 2
Abd I	4 + 4	2, 3+s, 2, 2+s
II	4 + 4	2, 3+s, 2, 2+s
III	4 + 4	2, 3+s, 2+s, 2
IV	4 + 4	2, 2+s, 3, 2+s
V	3 + 3	3, s, 4
VI	1 + 1	6

Smooth pointed setae situated singly on each lateral tubercle from Th I to Abd V, at least 2 on tubercle of Abd VI. Unguis basally with lateral serrations up to one half of its length, with one basal inner tooth. Lateral flap of ventral tube with 5 + 5 minute setae. Male genital field round with 13 + 13 setae, median setae absent; genital orifice similarly rounded. Female genital field more depressed, bearing 14 + 14 setae, genital orifice transverse, slit-like.

MATERIAL EXAMINED:

5 examples, College, Laguna, rotten wood on forest floor, 24-VI-66 (Coll. 49); 3 examples, same locality, rotten wood with polypores, 1-VII-66 (Coll. 63); 5 examples, same locality, rotten log, 8-VII-66 (Coll. 115); 4 examples, Mudspring Area, Mt. Maquiling, Luzon, decaying leaves from forest floor, 3-VII-66 (Coll. 90).

DISTRIBUTION:

Indo-China; Annam; Philippines.

DISCUSSION:

Although the type was not examined, there is sufficient evidence that the Philippine examples represent N. perfusa. The well-developed postantennal and frontal tubercles, the structure of the maxilla, the number of tubercles on Abd V, and the well-developed body tubercles, which are diagnostic of the species, are all observed in the present material. Although the mandible was originally described as having 5 distal teeth, the additional tooth could have been overlooked since it lies directly above the most apical tooth,

when viewed laterally. The typical body setae, although appearing smooth under high power phase, as originally described, are revealed as finely or weakly serrate under oil immersion. It is not surprising that this minute character, if present on the type, was not observed.

NEANURA REDUCTA new species

Plates V, VI

DIAGNOSTIC FEATURES:

Frontal tubercle of head absent; dorsointernal and dorsoexternal tubercles on Th I absent; dorsointernal tubercles of Th II-Abd IV each bearing only 1 well-developed seta; mandible with 3 apical and 2 subapical teeth, the apical ones with a basal lobe-like structure which tapers and extends to base of most apical tooth; maxilla crochet-like, with 2 minute apical hooks; body chaetotaxy constant and unique; tibiotarsus annulate distally.

GENERAL DESCRIPTION:

Body length 1.6 - 2.5. Living color entirely reddish orange, whitish in alcohol. Antennae slightly more than $3/5$ as long as head; Ant III sense organ as in Neanura perfusa; Ant IV with 6 blunt curving sensory setae. Eyes 3 + 3 darkly pigmented (decolorized when cleared in Hoyer's), two anterior to ocular tubercle and 1 just at posterior edge of tubercle. Postantennal organ rudimentary and represented by a simple smooth oval area anterior to anterior eyes. Mandible with 3 apical and 2 subapical teeth, the apical teeth with a basal lobe-like structure which tapers upward and extends to base of

most apical tooth; maxilla crochet-like with 2 minute apical hooks. Dorsal tubercles of head and body with fewer setae than in Neanura perfusa; typical body setae finely serrate (clearly seen under oil immersion) and apically blunt; granules of body tubercle radiate from base of major seta, not forming any reticulation. Head with 10 tubercles, the frontal tubercle absent and represented by two minute setae, other tubercles having the following setal arrangement: 2 antennal tubercles, 1 each; 2 ocular tubercles, each with 1 strong and 1 minute setae; 2 dorsolateral tubercles each with 1 minute and 2 larger setae, 3 minute setae lying adjacent to each tubercle; 2 + 2 posterior tubercles each with 1 strong seta. Body tubercles and setae, including setae sensuales, as follows:

<u>Segment</u>	<u>No. of tubercles</u>	<u>No. and arrangement of setae</u>
Th I	1 + 1	1, 1, 1
II	4 + 4	2, s+2, 2+s, 2
III	4 + 4	2, s+2, 2+s, 2
Abd I	4 + 4	2, 2+s, 2, 2
II	4 + 4	2, 2+s, 2, 2
III	4 + 4	2, 2+s, 2, 2
IV	4 + 4	2, 2+s, 3, 4+s
V	3 + 3	3, s, 5
VI	1 + 1	5

Smooth pointed setae singly distributed on lateral tubercles from Th I to Abd IV, at least one on dorsolateral tubercle of Abd V, and at least 2 on Abd VI tubercle. Tibiotarsus slightly annulated distally; unguis with lateral serrations up to proximal half, and a basal

inner tooth. Lateral flap of ventral tube with 4 + 4 setae. Male genital field round, bearing 17 + 17 setae, genital orifice irregularly rounded (4 examples). Female genital field subelliptical, with 13 + 13 to 14 + 14 setae, genital orifice transverse, slit-like (5 examples).

Holotype: Female, College, Laguna, decaying leaves and fruits of *Chaulmoogra* tree on ground, 8-VII-66 (Coll. 112), in the Department of Entomology, UPCA, Philippines.

Paratypes: 2 females, 1 male, 1 with sex unknown, College, Laguna, 1-VII-66 and 30-I-66, rotten wood with polypores and decaying leaves (Colls. 17, 62, and 112), in the Department of Entomology, UPCA, Philippines; 1 female, 1 male, 2 with sex unknown, Mudspring Area, Mt. Maquiling, Luzon, decaying leaves on forest floor and decaying fruits of *Ficus* sp., 3-VII-66 (Coll. 84, 102), in the Museum of Comparative Zoology at Harvard University, Cambridge, Massachusetts.

DISTRIBUTION:

Philippines.

DISCUSSION:

This species differs significantly from any known species in the Oriental region. It is distinguished from *N. perfusa* in the reduced body setae, the absence of a frontal tubercle on the head, absence of dorsal and dorsolateral tubercles on Th I, the structure of the mandible, and possibly in the reticulation of the male and female genital fields. It differs from *N. guadalcanarae* Yosii (1960) of the Solomon Islands in the body chaetotaxy, the shape and structure of mandible and maxilla,

and in the number of head tubercles. The latter species has less than 10 head tubercles and an untoothed maxilla. From all other species, N. reducta can readily be separated by the number and arrangement of head and body tubercles and setae, the structure of the mandible and maxilla, and perhaps the unique reticulation of the male and female genital fields. The reticulation of the genital fields probably shows a certain degree of specificity and should prove interesting for future studies in this genus.

The species has been named in recognition of the reduced body tubercles and setae.

Suborder ARTHROPLEONA Boerner

1901b:700; Boerner, 1913:318; Mills, 1934:7; Womersley, 1939:83; Salmon, 1941:285; Gisin, 1944:130; Maynard, 1951:20; Salmon, 1964:103.

Mouthparts chewing, mandible and maxilla both present; mandible always with molar area; head prognathous or obliquely prognathous; body elongate with most segments distinct; unguiculus and clavate tenent hair usually present.

The suborder is divided into two large superfamilies based on the relative proportions of the body segments, the presence or absence of setae on the prothorax, the presence or absence of postantennal organ and body scales, and on the nature of the body cuticle.

Key to Philippine Superfamilies

All body segments similar; Th I dorsally setaceous, distinct, and not concealed by Th II; postantennal organ usually present; integument granulate, tuberculate, or both; pseudocelli and anal spines usually present; scales absent; antenna short.....Hypogastruroidea Salmon

Body segments dissimilar; Th I not setaceous, reduced, and usually concealed by Th II; postantennal organ absent, except in Isotomidae; integument smooth; pseudocelli absent, anal spines rarely present; body scales present or absent; antennae often long.....Entomobryoidea Womersley

Superfamily HYPOGASTRURIDEA Salmon 1964:103

Of the two families in this superfamily, only one is represented in the Philippines.

Family HYPOGASTRURIDAE Boerner 1913:318

Body without pseudocelli; Ant III sense organ simple, composed of a pair of sensory rods in a cuticular fold or groove, without cuticular papillae; postantennal organ and eyes usually present.

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

Genus XENYLLA Tullberg

1869:11; Folsom, 1916:495; Mills, 1934:15; Womersley, 1939:91;

Maynard, 1951:51; Salmon, 1964:107.

Type species: X. maritima Tullberg, 1869, Stach, 1949.

Eyes 4+4 or 5+5; postantennal organ absent; unguiculus absent; furcula short, not reaching ventral tube; anal spines 2; body pigmented.

XENYLLA SENSILIS Folsom

Plate IX

1932:54, pl. 1, figs. 5-13; Handschin, 1938:139; Zimmerman, 1948:48, figs. 13a-i; Stach, 1949:205. Cotypes: Hawaii, in the Illinois State Natural History Survey, Urbana, Illinois, U. S. A.; homoeotypes designated in the Department of Entomology, UPCA, Philippines and the Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.

DIAGNOSTIC FEATURES:

Eyes 5 + 5; Ant III sense organ without minute conical setae; Ant IV with 5 short, stout, blunt sensory setae; unguis laterally granulate, with an inner tooth and a pair of lateral teeth; vestige of unguiculus appearing as a tubercle; mucro and dens distinctly separate from each other; dorsal lamella of mucro broad, minutely granulate.

GENERAL DESCRIPTION:

Body length 0.61-1.12 mm. Color mottled bluish or bluish gray; legs bluish gray; ventral surface, ventral tube, and furcula pale. Eyes on bluish-black eyepatches. Antennae bluish to bluish gray, about 2/3 as long as head; Ant III sense organ consisting of 2 sensory rods,

2 blunt curving sensory setae, and 2 posterior guard setae; Ant III dorsally fused with Ant IV; Ant IV with an apical end-bulb in a deep pit, and 5 short, stout, blunt sensory setae (Pl. IX-F). Head sparsely setaceous. Body oligochaetotic, setae simple arranged in transverse rows as follows: Th II, III, Abd IV, each with 3 rows; Th I, 1; Abd I - III, V, each with 2. Setae sensuales plain, 2 to 2 1/2 times as long as normal setae, 1 + 1 on each segment from Th II to Abd V, arranged on posterior row of setae from the mesal line as follows: p-4 on Th II, III, Abd IV; p-6 on Abd I-III; p-3 on Abd V. Legs short, stout, sparsely setaceous; clavate tenent hair formula = 1, 2, 2; pretarsus with 2 basal setae, one on each side; unguis with a middle inner tooth and a pair of lateral teeth; vestige of unguiculus appearing as a simple tubercle. Ventral tube short and stout, lateral flap with 3 + 3 to 4 + 4 setae. Rami of tenaculum tridentate, corpus without any seta. Anal spines minute, about 1 1/2 times as long as body granules, not arising from papillae. Furcula short, 3/4 as long as Abd III, not reaching posterior margin of Abd II. Man.:dens:mucro = 3:2:1; manubrium granulate, with 3 + 3 dorsal setae; dens similarly granulate, dorsally with 2 setae; mucro separate from dens, slender, straight, not hooked apically, and with a broad dorsal lamella, the lamella being finely granulate. Male genital field rounded with 10 + 10 anterolateral setae; genital orifice rounded. Female genital field with 1 anteromedian and 6 + 6 anterolateral setae; genital orifice transverse and slit-like or crescent-shaped.

MATERIAL EXAMINED:

5 cotypes, Honolulu, HAWAII, pineapple soil, 4-X-28 (J. F. Illingworth); PHILIPPINES: 7 homoeotypes, College, Laguna, grass compost, 20-VI-66 (Coll. 39); 1 example, same locality, decaying leaves on sandy soil, 12-II-66 (Coll. 27); 1 example, same locality, rotten wood, 24-VI-66 (Coll. 56); 1 example, same locality, rotten wood with polypores, 1-VII-66 (Coll. 64); 3 examples, same locality, decaying leaves, 30-II-67 (Coll. 166, D. Llamas and M. Pescador); 26 examples, Mudspring Area, Mt. Maquiling, Luzon, decaying leaves on forest floor, 20-XII-65 (Coll. 164); 5 examples, Janopol, Tanauan, Batangas, grass compost, 1-X-66 (Coll. 149, N. Ramos).

DISTRIBUTION:

Hawaii; Philippines.

DISCUSSION:

The material seems to agree well with Xenylla sensilis and has been confirmed by Yosii as such. The cotypes, however, are in poor condition and proved useful only in checking the legs and mucrones. The species is most closely related to the Nearctic X. welchi Folsom (1916), the latter differing in the structure of the Ant III sense organ and in the absence of lateral teeth on the unguis. Demonstration that these differences are sufficient to separate the two species requires further studies. Furthermore, since other species of Xenylla are extremely difficult to separate, a full generic revision is essential. Until then, X. sensilis and X. welchi should be retained as distinct species.

Superfamily ENTOMOBRYOIDEA Womersley

1934:88; Womersley, 1939:134; Salmon, 1964:103.

The separation of the families of Entomobryoidea is based on a combination of the following characters: the relative lengths of the last four abdominal segments, the presence or absence of the post-antennal organ and body scales, the presence or absence of a basal groove on the inner edge of the unguis, and the relative lengths of the manubrium and the dens. Other characters used by Salmon (1964), such as the presence or absence of crenulation on the dens, the length of the antennae, and the presence or absence of the furcula, do not seem to present a clear demarcation among the families, which share these characters to a limited extent.

Of the 5 currently recognized families comprising the superfamily Entomobryoidea, 2 are represented in the Philippines by 19 known species.

Key to Philippine Families

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

Family ISOTOMLIDAE Boerner

1913:319; Folsom, 1937:7; Womersley, 1939:135; Salmon, 1964:119.

Abd IV subequal to or not more than 1 1/2 times as long as Abd III, hind leg without trochanteral organ; inner edge of unguis without a basal groove; Th II never concealing Th I; postantennal organ often present; antennae always 4-segmented, relatively short; stiff plain seta opposite clavate tenent hair of hind tibia absent; rami of tenaculum tri- or quadridentate, corpus with variable number of setae; body scales absent; last 2 or 3 abdominal segments sometimes ankylosed; furcula present or absent.

Only four genera of this family are known to occur in the Philippines, each being represented by a single species.

Key to Philippine Genera

1. Body heavily pigmented; eyes varying from 6 to 8 on each side, usually situated on dark eyepatches; mucro separate from dens, the mucronal teeth well-developed and varying from 2 to 4.....2
 Body entirely white, except on eyes; eyes reduced, varying from 1 to 5 on each side, usually on reduced individual blackish eyepatches; mucro fused with dens, mucronal teeth reduced, usually 2 in number.....Folsomides Stach
2. Eyes 8 + 8; body color purplish or bluish gray; dens at least twice as long as manubrium, strongly crenulate on dorsal surface; anteapical mucronal tooth without hood.....3
 Eyes 6 + 6; body color bluish gray, seldom purplish; dens relatively stout and shorter than manubrium, its dorsal surface

- with several coarse crenulations; antepical mucronal tooth with well-developed sides extending to base of dens and appearing hood-like.....Parisotoma Bagnall
3. Abd V and VI fused; postantennal organ distinctly notched anteromedially; body usually mottled purplish, without any bands; dens with several dorsal setae and ventral spiny setae; mucro bidentate.....Isotomina Boerner
- Abd V and VI distinctly separate; postantennal organ not notched; body usually with purplish dorsal bands or longitudinal bands, never completely pigmented; dens with numerous dorsal and ventral setae; mucro quadridentate...Isotomurus Boerner

Genus FOLSOMIDES Stach

1922:17; Womersley, 1939:142; Salmon, 1964:122.

Type species: F. parvulus Stach, 1922:17, monotypy.

FOLSOMIDES EXIGUUS Folsom

Plate X

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

DIAGNOSTIC FEATURES:

Eyes 2 + 2 on individual blackish patches, the anterior patches almost twice as long as the posterior ones; dens with 4 dorsal, 1

posterolateral, and 2 anterolateral setae; setae on distal part of tibiotalarsus subequal in length.

GENERAL DESCRIPTION:

Body length 0.6-0.78 mm. Ground color white. Eyes 2 + 2 on individual granular blackish spots, anterior pair slightly larger than posterior pair. Head bearing simple uniform setae dorsally and ventrally (Fl. X-B); antennae fairly setaceous, $2/3-3/4$ as long as head; Ant I:II:III:IV = 1:1.8:1.8:3; Ant III sense organ composed of 2 sensory rods situated in a deep groove; Ant IV with 8-9 blunt curving, sensory setae, apical end-bulb absent; distance of anterior eye to posterior eye about $4/5$ the length of PAO. PAO long, narrowly elliptical, thickly chitinized at posterior margin, 6 times as long as broad, about 4 times as long as diameter of anterior ommatidium, prominently notched medially at anterior margin, and closely guarded posteriorly by 4 simple setae. Labrum with smooth margin, bearing setae arranged as 5,5,4; setae on 2 distal rows arising from papillae, prelabral setae smooth, 1 + 1. Body polychaetotic, setae simple and fairly uniform in length except for several longer setae occurring on Abd I - VI, those on last 2 segments being longest, twice as long as preceding setae. Transverse rows of setae arranged on segments as follows: Th II, 6 rows; Th III and Abd IV, 4 each; Abd I - III, V and VI, 3 each. Th II:III = 1.3:1. Legs short, sparsely setaceous; clavate tenent hair absent; setae on tibiotalarsus nearly equal; tibiotalarsi subsegmented distally; unguis stout, without teeth; hind unguiculus lanceolate-acuminate, about $1/5$ the length of unguis, fore and middle

unguiculi slightly shorter and simply pointed. Abdominal segments distinct, subequal; Abd I:II:III:IV:V:VI = 1.3:1.5:1.6:1.8:1.1:1 (9 examples). Ventral tube short, lateral flap with 3 + 3 setae, posterior surface with 1 + 1 setae. Rami of tenaculum tridentate, strongly hooked, corpus with one short seta. Furcula weakly developed, attached to boundary of Abd IV and V, barely reaching posterior half of Abd III. Man.:mucro + dens = 1.5:1 (8 examples). Manubrium with 4 + 4 dorsal, 2 + 2 basal lateral, and 1 + 1 distal dorsolateral setae; dens separately attached to manubrium, with 3 dorsal setae; mucro indistinctly joined to dens, bidentate, the apical tooth hooked and the anteapical tooth directed anteriorly. Female genital orifice transverse, slit-like, with thickened anterior and posterior margins, both margins bearing a pair of fine setae. Male genital orifice not observed.

MATERIAL EXAMINED:

1 cotype, Honolulu, Hawaii, sugarcane soil, 25-III-25 (R. Zwaluwenburg); PHILIPPINES: 7 homoeotypes, Mudspring Area, Mt. Maquiling, Luzon, decaying leaves on forest floor, 13-III-66 (Coll. 37); 1 example, same locality, decaying fruits and inflorescence of Ficus sp., 3-VII-66 (Coll. 86); 8 examples, College, Laguna, rotting wood with polypores, 1-VII-66 (Coll. 64); 2 examples, same locality, banks of Molawin Creek, soil and leaves, 30-II-67 (Coll. 166, D. Llamas, M. Pescador).

DISTRIBUTION:

Hawaii; Australia; Malaya; Philippines.

DISCUSSION:

The specimens seem to fit Folsomides exiguus (confirmed by Yosii) except in the number of manubrial setae. Originally illustrated as having 4 dorsal setae, the manubrium was later redescribed with 6 (Yosii, 1959b), as in the case of the type species F. parvulus Stach of Hungary. On the other hand, the Philippine examples constantly possess 7 setae, such difference being perhaps a case of local variation. Unfortunately the only existing cotype is in such very poor condition that only the unequal eyes are discernible. Whether the number of manubrial setae is indeed species-specific has not been investigated. To date, the only known reliable characters separating exiguus from parvulus are the unequal eyes and the absence of an unusually long seta corresponding to the tenent hair on the tibiotarsus. Otherwise, these species appear identical. Yosii (1959b) in fact commented that exiguus may actually be just a local race of parvulus. If the distinguishing characters of exiguus can be shown to exist within populations of parvulus, then the former will have to be considered a synonym. Until that time, these species would be better retained as separate although very closely related.

Genus ISOTOMURUS Boerner

1903:171; Folsom, 1937:70; Womersley, 1939:148; Maynard, 1951:121.

Type species: I. palustris (Mueller), Boerner, 1903:171.

Due to the highly unstable concept of Isotomurus, Yosii (1963a, 1963b) made initial attempts to revise the genus by using the structure of the labral margin, the number of setae on the lateral flap of the ventral tube, the shape of the unguis and unguiculus, and the body color pattern. Although he did not use the number of setae on the tenaculum, his descriptions and figures of this character differed significantly in 6 of the species he studied, so that its specific value is worth considering. It must be noted, however, that numbers of setae tend to vary according to age and size, with most specimens reaching a certain maturity level at which they become constant. Whenever possible, mature specimens must be used, especially when comparing closely related species.

The problematic Isotomurus palustris-complex contains 14 subspecies (Salmon, 1964) other than the typical form, all of which differ mainly in body color pattern. Using more recently discovered characters, Yosii (1963a, 1963b) raised three subspecies to specific level, only one of which occurs in the Philippines.

ISOTOMURUS BALTEATUS (Reuter)

Plate XI

Isotoma balteata Reuter, 1876:82. Type: Unknown.

Isotoma palustris balteata, Schoett, 1894:66, pl. V, fig. 10; Dalla Torre, 1895:10; Reuter, 1895:26; MacGillivray, 1896:48; Schaeffer, 1896:186; Schoett, 1896:184; Schaeffer, 1898:402; Scherbakow, 1898:58; Absolon, 1901:108; Krausbauer, 1902:40; Philiptschenko, 1905:4.

Isotomurus palustris balteata, Axelson, 1907:131; Linnaniemi, 1912: 189; Zwaluwenburg, 1926:18; Handschin, 1929:73; Kseneman, 1932: 20; James, 1933:98; Mills, 1934:55; Womersley, 1935:94; Brimley, 1938:15; Kseneman, 1938:16; Womersley, 1939:149; Stach, 1947: 460; Grindbergs, 1958:198; Grindbergs, 1960:46.

Isotomurus palustris balteatus, Handschin, 1930:413; Stach, 1930:292; Bonet, 1931:382; Folsom, 1932:63; Handschin, 1932:479; Denis, 1933:242; Schubert, 1935:199; Folsom, 1937:76; Mills, 1938:15; Uchida, 1938:8; Arle, 1939:127; Yosii, 1939:366, fig. 11; Handschin, 1942:404; Zimmerman, 1948:56; Maynard, 1951:123, pl. XII, fig. 222; Uchida, 1957:42.

Isotomurus balteatus, Yosii, 1963a:3, fig. 2 A-G.

DIAGNOSTIC FEATURES:

Th II to Abd VI each with a dorsal transverse purplish band on the anterior area of the segment, the bands extending laterally; lateral flap of ventral tube with 5-6 setae on each side; corpus of tenaculum with 10-12 setae; unguis not slender, without inner tooth.

GENERAL DESCRIPTION:

Yosii (1963a) redescribed this species as follows:

"Body length up to 1.6 mm. Ground color whitish, with broad violet bands along anterior margin of each body segment. Furthermore, lateral margins of th. II-abd. II are narrowly banded. Antennae pigmented. Legs and furcula pale. Ant./head as 5:4. Ant. ratio as 15:25:27:36. Ant IV subapically with a slender conical papilla. Ant. III-organ is two blunt rods in separate grooves. No accessory

setae present. Postantennal organ elliptical, without median constriction and as large as an eye in diameter. Eyes 8 + 8, upon black eyepatches. Labrum with usual number of 4/5,5,4 setae and distal margin has 2 + 2 longitudinal streaky ridges. Unguis without inner tooth, but with a pair of prominent lateral and one dorsal teeth connected by a dorsal ledge. Unguiculus acute, with rounded inner margin and untoothed. Tenent hair one, slender and setaceous. Large setae of tibiotarsus lightly ciliated. Others smooth. Ventral tube has lateral flaps with 5-6 small setae each. Furcula well extended, mand as 3:5. Manubrium hirsute on all sides, but without modified setae. Terminal thickening with one spine each. Dentes ventrally hirsute, dorsally hirsute upon proximal 1/2. Mucro quadridentate: outer basal tooth as large as others. No mucronal seta observed. Body setae are brownish, simple, except those upon abd.V,VI, which are densely ciliated s.s. not observed. Rami tenaculi 4-dentate, corpus with 6 setae."

From my Philippine material, his description is supplemented as follows:

Body length 1.3-1.8 mm. Head dorsally with an anterior transverse purplish band terminating at posterior edges of antennal bases and anterior end of eyepatches; a small, irregular purplish patch occurring posteromedially from the eyepatches and near posterior margin of head. Legs lightly diffused with purplish pigment, the color most prominent on precoxae and coxae. Abd VI completely purplish in 2 specimens. Setae sensuales on Abd II-IV usual for the genus (2,2,2 on each side of each segment). Corpus of tenaculum with 10-12 setae (in 2 specimens

examined). Basal seta of mucro well-developed, situated at the outer lateral area, extending to the base of antepical tooth.

MATERIAL EXAMINED:

2 examples, Mudspring Area, Mt. Maquiling, Luzon, decaying leaves from forest floor, 13-III-66 (Coll. 37); 2 examples, same locality and habitat, 20-XII-66 (Coll. 163); 2 examples, same locality and habitat, 28-XII-66 (Coll. 164); 1 example, Pili, Camarines Sur, subterranean ants' nest, 19-VIII-66 (Coll. 151); 1 example, BPI, Baguio, Mt. Province, 4-II-67 (Coll. 176, M. Pescador).

DISTRIBUTION:

Cosmopolitan.

DISCUSSION:

The determined examples of Isotomurus balteatus have been confirmed by Yosii. When Yosii redescribed this species from Malayan examples (1963a), he did not observe the basal mucronal seta which is actually present but is easily detached during mounting. Its presence is indicated by the existing setal socket.

On the basis of the characteristic body color pattern, the number of setae on the lateral flap of the ventral tube, and the shape of the unguis, Yosii (1963a) raised Isotomurus palustris balteatus to specific level. He recognized that this species is very close to the typical I. palustris, differing only in the foregoing characters. The separation seems justified because these characters appear to be unique for balteatus. However, the Philippine specimens possess more

setae on the tenaculum than the Malayan examples, a difference attributable perhaps to varying sizes or ages of the specimens described. Further studies should be made on the extent of variation expressed by the tenacular setae.

Genus ISOTOMINA Boerner

Isotomina Boerner, 1903:140.

Hemisotoma Bagnall, 1949:94.

Type species: I. agreni Boerner, 1903.

The genus includes about 33 world species only 2 of which are Oriental. Gisin (1960) based his separation of European species on the number of eyes, the presence or absence of body color, the shape and structure of the postantennal organ, and the presence or absence of an apical end-bulb on Ant IV. However, most non-European species have not been described adequately so that their exact determinations are extremely difficult. The whole genus therefore needs revision.

ISOTOMINA LOMBOKENSIS (Schoett)

Plate XII

Isotoma lumbokensis Schoett, 1901:321, figs. 21-25; Handschin, 1925:

267. Type: Lombok, unknown.

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

Isotomina lumbokensis, Stach, 1947:269.

DIAGNOSTIC FEATURES:

Eyes 8 + 8; postantennal organ broadly elliptical, anterior side thickly chitinized and strongly notched medially, the posterior side being weakly chitinized and notched; unguis with an inner tooth at proximal 1/2; dental setae arranged in a fixed pattern, ventrally and from the base with 1,1,1,3,3,2,3,2,3,2,3 spiny setae in that sequence, dorsally with 3 basal, 4 outer, and 3 inner plain setae; antepical tooth of mucro slightly concave anteriorly; body color mottled bluish gray to gray.

GENERAL DESCRIPTION:

Body length 0.7-1.2 mm. Color mottled bluish gray to gray; legs lightly pigmented; ventral tube, tenaculum, furcula, and venter pale. Antennae as long as or slightly longer than head; Ant III sense organ consisting of 2 sensory rods in a groove; Ant IV with an apical end-bulb; Ant I:II:III:IV = 1:2:2:3. Head densely setaceous; labrum with usual number of setae (4/5,5,4), the setae on distal 2 rows arising from papillae, labral margin smooth; eyes 8 + 8 on black eyepatches; postantennal organ broadly elliptical, anterior side thickly chitinized and strongly notched, the posterior side weakly chitinized and notched. Body polychaetotic, setae plain and generally uniform with some slightly longer on abdominal segments. Transverse rows of setae arranged irregularly on segments as follows: Th II and Abd IV, each with 7-8 rows; Th III, 6; Abd I-III, 4 each; Abd V + VI, 5-6. Th II:III = 1.25:1. Clavate tenent hair absent; pretarsus with 1 basal seta on each side; unguis

with a minute middle inner tooth; unguiculus lanceolate, $1/2$ as long as unguis. Lateral flap of ventral tube $4 + 4$ (in one specimen examined). Rami of tenaculum quadridentate, corpus with one anterior seta. Abd I:II:III:IV:V + VI = 1:1.2:1.2:1.4:1.1. Furcula well-developed but reaching only midportion of Abd II; dens 2 times as long as manubrium, strong dorsal crenulations extending laterally and ventrolaterally, dorsal surface with 3 basal, 4 outer, and 3 inner plain setae, the ventral surface with 24 setae arranged from the base as 1,1,1,3,3,2,3,2,3,2,3 (4 specimens examined); anteapical tooth of mucro slightly concave anteriorly.

MATERIAL EXAMINED:

2 examples, Sto. Thomas, Batangas, decaying coconut leaves, 1-X-66 (Coll. 146, N. Ramos); 5 examples, College, Laguna, at banks of Molawin Creek, sand and decaying bamboo leaves, 12-II-66 (Coll. 10); 2 examples, Mudspring Area, Mt. Maquiling, Luzon, soil and decaying leaves, 20-XII-66 (Coll. 163); 2 examples, same locality and habitat, 20-XII-65 (Coll. 164).

DISTRIBUTION:

Lombok; Philippines.

DISCUSSION:

Although the type has not been examined, the material is undoubtedly Isotomina lombokensis. Schoett's original description mentioned the absence of teeth on the unguis. However, an inner tooth is present in the larger Philippine examples, but definitely

absent in specimens less than 1 mm. long. Although Schoett did not mention the measurements of his specimens, it is very possible that he used immature forms. In all other aspects, the Philippine examples fit I. lombokensis.

The species lombokensis was originally described under Isotoma and later transferred to Proisotoma. However, the species can not be a Proisotoma, mainly because the fifth and sixth abdominal segments of lombokensis are fused, a character diagnostic of Isotomina (Stach, 1947). In Proisotoma these segments are never fused.

I. lombokensis is very closely related to the widespread I. thermophila, differing in the presence of a postero-median notch on the postantennal organ, more dorsal setae on dentes, and perhaps in the number and arrangement of ventral setae of the dentes. These characters seem to be consistent in the Philippine material, although their diagnostic value has not been thoroughly studied in other species. Whether lombokensis should rank as a species or is merely a subspecies of thermophila cannot now be determined.

Genus PARISOTOMA Bagnall

Parisotoma Bagnall, 1940:171.

Holurotoma Bagnall, 1949:89.

Parisotomodes Bagnall, 1949:88.

Type species: P. notabilis (Schaeffer), Bagnall, 1940:171.

The genera Holurotoma and Parisotomodes have been placed as synonyms of Parisotoma since the characters used diagnostic for

these taxa do not seem sufficient for their separation. Parisotoma is represented by 12 species, only one in the Oriental region.

PARISOTOMA CANITUDA Salmon

Plate XIII

1951:133, figs. 11-14. Holotype: Malaya, in Salmon's collection; paratypes in the National Museum of Singapore; homoeotypes, in the Department of Entomology, UPCA, Philippines.

DIAGNOSTIC FEATURES:

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

GENERAL DESCRIPTION:

Body length 0.6-0.76 mm. Ground color purplish or bluish gray, mottled with white spots on head and body segments, pale ventrally and on body appendages; antennae bluish gray. Eyes on bluish-black eyepatches. Postantennal organ elliptical, at least twice as long as broad, 3 times as long as diameter of an eye; anterior margin strongly thickened, medially notched or not; closely guarded by 2 posterior setae. Antennae subequal to or slightly shorter than head; Ant I:II:III:IV = 1:1.6:1.4:2.5; Ant III sense organ of 2 short sensory rods arising from individual sockets; Ant IV bearing 4 curved, blunt, as well as several curved pointed sensory setae, apical end-

bulb prominent. Labrum with usual rows of setae, those on last 2 distal rows arising from individual papillae, labral margin smooth; prelabral setae plain, 2 + 2. Head with uniform simple setae dorsally and ventrally. Body polychaetotic, setae simple and generally subequal. Transverse rows of setae on body dorsum distributed as follows: Th I, 0; Th II and Abd IV, each with 6 rows; Th III, 4; the rest of the segments, 3 each. Th II:III = 1:1 or 1.3:1. Legs short, sparsely setaceous; tibiotarsi subsegmented at distal 1/4; clavate tenent hair absent; pretarsus with a basal seta; unguis short, untoothed; unguiculus half as long as unguis, lanceolate and strongly pointed at apex, outer margin straight, inner margin curved. Abd I:II:III:IV:V:VI = 1.6:1.6:1.6:2:1.2:1; ventral tube short, apical sacs rounded, lateral flap with 3 + 3 setae, the posterior surface bearing 1 + 1 distal setae; rami of tenaculum quadridentate, corpus with one anterior seta. Abd V with 2 + 2 lateral, knobbed sensory setae on last row of setae. Furcula short, reaching only posterior margin of Abd II; man.:dens:mucro = 3.9:2.6:1; manubrium with 9 + 9 dorsal setae; dens with 4-6 coarse dorsal crenulations, bearing 6 dorsal (only 4 in original description), 1 dorsolateral (versus Salmon's 2 posterolateral), and 2 ventral subapical (versus Salmon's 2 anterolateral) setae; mucro separate from dens (fused in original description), bidentate, the anteapical tooth larger than apical one and having prominent outer and inner lamellae extending to lateral bases of mucro, giving mucro a hood-like appearance.

Female genital orifice transverse, slit-like, anterior and posterior margins each with 1 + 1 fine setae; area anterior to

orifice with 3 + 3 similar setae. Male genital orifice longitudinal, somewhat ovate, left and right thickenings each with one seta; genital field with 7 + 7 setae, 2 outer pairs almost twice as long as inner pairs (1 example). Anal area bilobed with about 18 + 18 setae (4 examples).

MATERIAL EXAMINED:

Holotype, McRitchie Reservoir, Singapore, MALAYA, in fibrous roots and dead vegetation, 22-X-49 (M. Tweedie); PHILIPPINES: 6 homoeotypes, College, Laguna, rotting wood with polypores, 1-VII-66 (Coll. 64); 4 examples, same locality, banks of Molawin Creek, on decaying leaves (Coll. 166, D. Llamas and M. Pescador); 3 examples, Mudspring Area, Mt. Maquiling, Luzon, above fissures from mudspring pool, 13-III-66 (Coll. 35); 2 examples, same locality, rotten log, 3-VII-66 (Coll. 101); 2 examples, RNAS, Guinobatan, Albay, grass compost, 20-VIII-66 (Coll. 121); 8 examples, same locality, from decaying leaves, 20-VIII-66 (Coll. 136).

DISTRIBUTION:

Malaya; Philippines.

DISCUSSION:

The Philippine specimens differ slightly from the original description of P. canituda in the number and arrangement of dental setae and in the separated dens and mucro. Salmon noted 8 dental setae on his specimens, situated on fixed areas of the dens. Philippine examples differ in having 9 setae, perhaps merely a local variation.

Regarding setal position, the difference between Salmon's description and the present redescription lies only in the interpretation, depending upon the lateral or dorsal orientation of the specimens. Since the arrangement of the setae seems to be fairly specific, the exact positions of these structures must be determined.

The mucro was originally described as being "completely fused" with the dens. However, on examination, the holotype shows a suture between these structures.

Despite these differences, there is no doubt that the material is Parisotoma canituda. All specimens, as well as the type, possess knob-like sensory setae on Abd V, structures previously overlooked and perhaps unique for this species. Both sexes have these peculiar setae, the only known sexual difference being expressed in the genital field and orifice.

Family ENTOMOBRYIDAE Schaeffer 1896:177

Abd IV usually at least 2 times as long as Abd III (except in Alloscopus); trochanteral organ of hindleg present; inner edge of unguis usually with a basal groove; Th II usually concealing Th I; postantennal organ absent; antennae 4- to 6-segmented, often much longer than head; stiff plain seta opposite clavate tenent hair present on hind tibiotarsus; rami of tenaculum quadridentate, corpus with 1 basal seta; body scales present or absent; body segments never ankylosed; furcula well developed, the dens being always longer than manubrium; flexed body setae often present.

Following Salmon's concept, the family is divided into 3 sub-families which are easily separated by the presence or absence of dorsal crenulation on dens and of specialized dorsal dental scales, and by the form, shape, and size of the mucro.

Key to Philippine Subfamilies

1. The dens long, slender and tapering, with well-developed dorsal crenulations; mucro extremely short, at most 1/20 as long as dens, its teeth usually curving vertically, basal spine of mucro present or absent.....Entomobryinae Schaeffer
The dens long but only slightly tapering, not crenulated; mucro otherwise.....2
2. Dens dorsally with specialized ciliated scales, seldom with spines, and with several setae, ventrally scaled or with spiny setae; mucro slender, usually about 1/2 as long as dens, with a variable number of teeth; eyes and body pigment absent.....Cyphoderinae Boerner
Dens dorsally without specialized scales, usually with spines, bearing numerous setae, ventrally scaled and without spiny setae; mucro stout and short, never more than 1/10 as long as dens; eyes well developed; body usually pigmented.....
.....Paronellinae Boerner

Subfamily ENTOMOBRYINAE Schaeffer 1896:177

This subfamily is a large group, having 52 listed genera (Salmon, 1964), 4 of which occur in the Philippines. In most cases, the taxonomy of these genera is very poorly understood. For instance,

Seira Lubbock (1870), Lepidocyrtinus Boerner (1903), and Drepanocyrtus Handschin (1924) are considered by Salmon as distinct genera and yet they differ only in minor aspects. The use of annulation of the fourth antennal segment and nature of striations on body scales for separating these genera do not seem valid since these structures vary among individuals of a species according to age, as well as among closely-related species. Consequently, Yosii (1959a) placed Lepidocyrtinus and Drepanocyrtus as synonyms of Seira. Several other genera are probably in a similar situation, so that until the subfamily is revised, the actual number of genera cannot be stated.

Key to Philippine Genera

1. Body scales apically rounded; achaetotic or oligochaetotic; eyes varying from 1 + 1 to 8 + 8; antennae with 4 or 5 segments; unguis with 1 pair of lateral teeth; unguiculus with or without wing-like outer tooth; dental spines present or absent; dens ventrally scaled; macro falciform.....2
 - Body scales absent; dorsally with many long, flexed, as well as pointed, ciliate setae; eyes usually 8 + 8; antennae always 4-segmented; unguis with 2 pairs of lateral teeth; unguiculus without outer tooth; dental spines absent; dens not scaled ventrally; macro bidentate, usually with a basal spine; pigmented species.....Entomobrya Rondani
2. Dental spines present; unguis and unguiculus with or without wing-like teeth.....3
 - Dental spines absent; unguis and unguiculus without wing-like teeth.....4

3. Antennae 4-segmented, not annulate; eyes 8 + 8; unguis and unguiculus without wing-like teeth; mucro bidentate, always with a basal spine; pigmented species.....Acanthurella Boerner
- Antenna 5-segmented, the 5th segment distinctly annulate; eyes 1 + 1; unguis and unguiculus with wing-like teeth; mucro bidentate, without basal spine; body pigment absent.....Alloscopus Boerner
4. Mucro falciform, basal spine absent; Ant IV faintly or not at all annulate.....Seira Lubbock
- Mucro bidentate, with 1 basal spine; Ant IV never annulate.....Lepidocyrtus Bourlet

The diagnostic characters in the generic key clearly separate the Philippine genera from the remaining genera of Entomobryinae.

Genus ENTOMOBRYA Rondani

Degeeria Nicolet, 1841:384 (in part).

Mydonius Gistel, 1848:9 (in part).

Entomobrya Rondani, 1861:40.

Parentomobrya Dahl, 1912:424.

Type species: E. (Degeeria) muscorum (Nicolet), 1842:75; Boerner, 1903:178.

Degeeria and Mydonius were invalidated and rejected by the International Commission of Zoological Nomenclature, Opinion 440 (1957; 1958), the former on the basis of homonymy and the latter on

the basis of priority. Parentomobrya was placed as a junior synonym of Entomobrya by Salmon (1964).

Entomobrya is a very large group containing about 176 species, 27 of which are Oriental. Taxonomic revision of the group has been initiated by Christiansen (1958) for Nearctic species and South (1961) for British species. Other than these works, knowledge of this group is insufficient. The body color variation is useful for distinguishing species to a certain extent (Christiansen, 1958) as long as the range of variation is properly studied. Christiansen contended that in spite of color variation within a species, a basic pattern exists in both light-colored and dark-colored forms. Other characters currently used for separating species are the presence or absence of an apical end-bulb on Ant IV, the type of body setae present, the number and shape of the setae on the male genital field, and possibly the number of setae on the trochanteral organ. A more reliable comparison of species can be arrived at only if the specimens used are of the same size or age level. Structures tend to be more consistent in mature or larger specimens than in immature forms.

The genus contains a single Philippine species.

ENTOMOBRYA PROXIMA Folsom

Plates XIV, XV

1924:507, pl. 2, figs. 12-15; Handschin, 1926:455; Handschin, 1928; 246; Handschin, 1932:480; Womersley, 1937:205; Yosii, 1965:33.

Syntype: Sumatra, in the Museum of Comparative Zoology at Harvard University, Cambridge, Massachusetts (pieces only);

homoeotypes in the Department of Entomology, UPCA, Philippines and in the Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.

DIAGNOSTIC FEATURES:

Th II - Abd VI with bluish to bluish-gray dorsal and lateral bands, the lateral bands running along the whole length of each segment, the dorsal bands varying in width and sometimes lost on Th II, III, and Abd I; dorsal band of Abd IV with a pair of pale irregular spots; labral margin with a pair of tubercles each bearing 2-4 minute apical papillae; male dorsally with numerous medially expanded type 5 setae on body segments; pale genital field with 17 stout setae, 4 of which are about 1 1/2 times as broad as the others.

GENERAL DESCRIPTION:

Female: Body length 1-1.48 mm. Ground color creamy white with bluish pigmentation distributed as follows: antennae; anterior, lateral and posterior margins of head; eyes on bluish-black eyepatches; dorsal and lateral bands on Th II-Abd VI, the dorsal bands varying in width and sometimes absent on Th II, III, and Abd I; dorsal band of Abd IV on posterior 1/2 and bearing a pair of irregular pale spots; similar pale spots present on dorsal bands of Th II, III, Abd II, and Abd III, if the bands are present. Legs lightly pigmented on all segments. Five types of setae on head and body distributed as follows: type 1 setae, slightly flexed (Pl. XIV-D) apically, several on head, about 5 + 5 anterolaterally on Th II, and about 3 + 3 anterolaterally on Th III; type 2 setae, long and pubescent, on Abd IV; type

3 setae (lasiotrichia or setae sensuales) extremely slender and densely ciliated, 1 + 1 on posterior area of head just posterior to the eyepatches, 2 + 2 each on Abd II, III, IV, without accessory microchaetae; type 4 setae,* on Abd V and VI; type 5 setae short, ciliate and apically pointed throughout head and body segments. Antennae about twice as long as head; Ant II with 1 small sensory rod; Ant II sense organ consisting of 2 hyaline sensory rods in a shallow groove, accompanied by 2 minute slightly cone-shaped setae (Pl. XV-A). Ant IV with 2 apical end-bulbs, existing setae of 4 kinds: fine, smooth, erect setae distributed as far as distal 1/4 of Ant II; fine, smooth, curving setae occurring up to base of Ant III; several larger, curving, sensory setae on distal half; ciliate pointed setae also present on other antennal segments. Head as long as broad. Labral margin with 2 + 2 tubercles each bearing 3 apical papillae, sometimes 4 on outer pair of tubercles; labral setae 5,5,4 from base, prelabral setae smooth, 2 + 2. Th II not overlapping posterior margin of head; Th II:III = 1.5:1. Legs bearing common setae of type 5; trochanteral organ composed of 13 setae, 5 posterior, 1 apical, 5 ventral and 2 anterior (Pl. XV-C); clavate tenent hair well-developed, slightly longer than or as long as unguis (5:4); unguis with usual number of teeth for the genus (4 inner and 2 lateral pairs); unguiculus lanceolate, 2/3 as long as unguis, one outer lamella serrate on its edge at least on the forelegs. Abd III:IV = 1:2.3. Furcula well-developed; man:dens:mucro = 21:27:1; manubrium dorsally with many long ciliate setae; dens with 2 dorso-lateral rows of slender ciliate setae; manubrium and dens ventrally with

*Slightly blunt ciliate setae in females of E. proxima.

small, dense, smooth setae; mucro separate from dens, basal spine sometimes absent (present in Folsom's description). Genital orifice transverse, slit-like, with the thickened anterior and posterior margins, each margin bearing 2 minute setae.

Male: Differing from the female in the following characters: Th II, III, Abd I never with dorsal bands (Pl. XIV-A); type 5 setae occurring in 2 forms, one representing the common ciliated setae, the other with the setae medially expanded and appearing foliate (Pl. XIV-G, Pl. XV-E), these latter setae distributed on segments as follows: Th II, 14 + 14 foliate setae; Th III, 21 + 21; Abd I, 13 + 13; Abd II, 12 + 12; Abd III, 8 + 8; Abd IV, 17 + 17; Abd V, 3 + 3; Abd VI, 2 + 2. On hindleg, femur with about 7 expanded ciliate setae on anterior surface, tibiotarsus with about 8 similar setae. Genital field oval, with a circular orifice surrounded by papillae and 17 stout setae; all genital setae slightly foliate, the third and fourth pairs from the base being longer than and about 1 1/2 times as broad as other setae.

MATERIAL EXAMINED:

1 syntype (pieces only), Fort de Koch, SUMATRA, from nest of one of the Sciuridae, Feb., 1921 (J. Folsom); 1 example, no locality and habitat data, 11-XII-21, in the Museum of Natural History at Basel, Switzerland; PHILIPPINES: homoeotypes, 16 females and 3 males, College, Laguna, underneath leaf sheaths of living banana plants, 1-XI-66 (Coll. 152), in the Department of Entomology, UPCA, Philippines and in the Museum of Comparative Zoology, Harvard University, Cambridge,

Massachusetts; 3 examples, same locality underneath leaf sheaths of sugar cane, 31-II-67 (Coll. 167, D. Llamas).

DISTRIBUTION:

Sumatra; Philippines.

DISCUSSION:

Except for slight differences in the structure of the mucro and the unguis, the Philippine material fits Entomobrya proxima; the determination was confirmed by Yosii. The mucro was originally described as having a basal spine which is absent in the present material. Yosii (1965) redescribed the species as bearing a basal spine on the mucro, which however is lacking in his figure. Whether the presence or absence of the spine is expressed in populations as individual variation is not known. On the other hand, the unguis was originally said to have 3 inner teeth but was redescribed by Yosii (1965) as actually possessing 4 teeth, 2 of which are paired and proximal in agreement with the Philippine material. Yosii also mentioned each tubercle on the labral margin as bearing 2 papillae, in contrast to the 3 or 4 papillae observed in the Philippine examples. The number of papillae on each tubercle perhaps varies according to size or age.

The Philippine material of E. proxima exhibits an unusual form of body color pattern variation. The darker colored forms (Pl. XIV-B) are mostly females while the lighter colored forms (Pl. XIV-A) are all males, the other lighter colored forms (Pl. XIV-C) being mixed. This remarkable form of sexual dimorphism is supplemented by

the development in males of type 5 body setae (see description) into large, foliaceous setae. Furthermore, the male hind femora and hind tibiotarsi have similar but narrower foliate setae.

Entomobrya proxima very closely resembles the Nearctic E. assuta Folsom (1934) and at the moment can be separated from the latter only by the presence of the modified foliaceous setae on the body segments. Since the Oriental species still require reinvestigation, E. proxima is at present distinguished by the color pattern and its variation and by the presence of foliate body setae in the male.

The syntype of E. proxima was useful only in verifying the structure of the furcula, the only discernible part of the specimen.

Genus ACANTHURELLA Boerner

Acanthurella Boerner, 1906:176.

Acanthocyrtus Handschin, 1925:236.

Type species: A. braueri Boerner, 1906.

The genus Acanthurella very closely resembles Lepidocyrtus, differing only in the presence of 1 or two dorsal rows of spines on the dens. It includes about 13 species, 6 of which are strictly Oriental, 5 Australian and 2 Ethiopian. Most of these species are known from inadequate descriptions. A single species is represented in the Philippines.

ACANTHURELLA LEPIDORNATA Handschin

1930:416, pl. 2, figs. 20-23. Type: Philippines, lost.

DIAGNOSTIC FEATURES:

Dental spines 4 + 4; unguis with 3 inner teeth; unguiculus strongly truncate; body scales with a characteristic pattern.

GENERAL DESCRIPTION:

The species was originally described in German and is translated here as follows:

"Length up to 2 mm. Color yellowish, body covered with large oval scales, the scales forming a characteristic pattern. The dense scales are dark violet and the rest are hyaline. The dentes are only scaled dorsally, the legs and antennae without scales. Distal area of Ant II and up to Ant IV dark blue. Eyepatches dark blue with 8 + 8 ommatidia. Between the eyepatches is a trapezoidal formation of scales. Dark scales appear as a patch on Th II, 2-3 median rows on posterior margin of Th II, Abd I, and III. On Th II-Abd I, the last row is interspread in the center by light-colored scales, Abd III with only one row. On Abd IV is found a row of scales at anterior and posterior margins, both joined by a longitudinal row on each side to form a quadrangular pattern. Single scales mark the lateral corners of Th II-Abd I. The setae are especially pronounced at the extremities. They are feathered. Abd III:IV = 8:24. Ant III sense organ normal. Claw with 3 inner teeth. Unguiculus with strong edges, truncate at inner side. The tenent hair does not reach the length of the claw. The dentes are crenulate, the crenulation gradually weakening before the mucro. Mucro bidentate with basal spine. Base of dens with 4 strong inner teeth."

DISTRIBUTION:

Philippines.

DISCUSSION:

Acanthurella lepidornata is not represented in my collection. Populations of this species probably occur in highly specific habitats. Although the original description is inadequate, there is good reason to believe that the stated diagnostic characters are unique. However, the arrangement of body scales cannot be readily accepted as diagnostic because scales are easily detached from the body during mounting or with long periods of preservation in alcohol. The exact pattern of the scales, if any, must be verified from freshly collected specimens.

Genus LEPIDOCYRTUS Bourlet

Lepidocyrtus Bourlet, 1839:391.

Paidium Koch, 1840:356.

Type species: L. curvicollis Bourlet, 1839, Gisin, 1951, monotypy.

The taxonomy of Lepidocyrtus is completely in chaos and until a complete revision of the group is made, exact identification of species will continue to be extremely difficult (Yosii, 1968). Several workers have attempted to stabilize the concept of the genus. Yosii (1959b) investigated numerous characters that may prove useful for species separation and suggested that the chaetotaxies of the coxae, the trochanteral organ, the anterior and posterior surfaces of the ventral tube, and of the manubrium are probably species-specific. In

the Philippine species, however, the setae on both anterior and posterior surfaces of the ventral tube and on the coxae vary considerably even among specimens of the same size level and therefore do not seem reliable as species characters.

Gisin (1964a) advanced the use of body chaetotaxy which is not applicable, however, for achaetotic Oriental species such as those from the Philippines. In addition, Gisin (1964b) and Snider (1967) studied the number and arrangement of accessory microchaetae accompanying setae sensuales on Abd II-IV. Since the microchaetae are minute and are easily removed during mounting, their exact number and location even on the basis of the sockets are so difficult to determine that one is liable to overlook most if not all of them. In spite of this, Gisin and Snider concluded that these structures may aid in the identification of problematic and closely related species.

Gisin (1964b) studied the labial plate of 7 species of Lepidocyrtus and observed that although the existing number of setae did not vary significantly (10+10 to 11 + 11 for the genus), the ratio of ciliate to smooth setae varied constantly for each species. Several setae in at least one species were reduced and much shorter than the rest. However, Philippine species apparently do not possess any ciliate setae, although more specimens need to be studied before the use of these setae can be disregarded completely in identifying these species.

The number and type of setae on the lateral flap of the ventral tube is probably diagnostic for Philippine species, although they could be studied in only 3 of the 5 species. Ciliate and smooth setae

appear to vary in numerical ratio for each of these, a condition which probably holds true for the other species.

The structure of the basal lobes on the dentes is proving to be useful in grouping Philippine species into subgenera. Yosii's subgeneric concept (1959b) is adopted here.

Key to Philippine Subgenera

1. Basal lobe of dens with a paired accessory apparatus.....2
 Basal lobe of dens without accessory apparatus...Lepidocyrtus Yosii
2. Dorsal accessory apparatus slightly blunt or sharply
 pointed.....Acrocyrtus Yosii
 Dorsal accessory apparatus apically rounded.....Ascocyrtus Yosii

Subgenus ACROCYRTUS Yosii 1959b:23

Key to Philippine Species

Dorsal accessory apparatus of basal lobe of dens blunt apically;

Th II overlapping posterior margin of head; apical tooth

of mucro about 1 1/2 times longer than anteapical tooth.....

.....L. parvidentatus Schaeffer

Dorsal accessory apparatus leaf-shaped and sharply pointed; Th II

not overlapping posterior margin of head; anteapical and

apical teeth of mucro subequal.....L. brunneus (Handschin)

LEPIDOCYRTUS (ACROCYRTUS) PARVIDENTATUS Schaeffer

1898:417, figs. 27-29; Schoett, 1901:324; Handschin, 1926:237, pl. 2, figs. 9, 10; Handschin, 1930:414, pl. 1, fig. 14, pl. 2, fig. 15; Womersley, 1937:206. Type: Bismarck Archipelago, unknown.

DIAGNOSTIC FEATURES:

Dorsal accessory apparatus of basal lobe of dens straight on its sides, apically blunt; Th II overlapping posterior margin of head; apical tooth of mucro about $1\frac{1}{2}$ times as long as anteapical tooth; unguis with a pair of middle inner teeth, an inner tooth at distal $\frac{1}{4}$, and a pair of lateral teeth; unguiculus lanceolate; body entirely light purple.

GENERAL DESCRIPTION:

Body length 1.84 - 2.7 mm. Color light purple; antennae deep purplish, lighter on proximal areas of Ant I and II; head light purplish dorsally and ventrally, a darker narrow transverse band situated between eyepatches. Eyes (8 + 8) on deep bluish-black eyepatches. Ventral tube and legs lightly pigmented. Body densely scaled throughout, typically achaetotic. Antennae about $1\frac{1}{2}$ times as long as head; Ant I and II dorsally scaled; Ant IV without apical end-bulb, with normal ciliate setae, as well as numerous fine erect and fine curving setae, distributed as far as distal $\frac{1}{2}$ of Ant II. Labral margin with 2 pairs of ovate tubercles, the outer more than twice as large as the inner pair; labral setae 5,5,4 from the base, prelabral setae smooth, 2 + 2. Th II overlapping posterior margin of head; Th II:III = 2.3:1. Legs setaceous, scaled on all segments; coxal setae 9-10, 10/14, 15-17; trochanteral organ composed of 30-47

spiny setae. Tenent hair weakly clavate, slender, only about $1/2$ as long as unguis; unguis stout, with a pair of middle inner teeth, an inner tooth at distal $1/4$, and a pair of lateral teeth at less than proximal $1/4$; unguiculus lanceolate-acuminate on fore and middle legs, and strongly lanceolate on hindlegs, $3/5$ as long as unguis, on the forelegs one outer lamella minutely serrate at the edge. Abd III:IV = 1:4. Ventral tube setaceous without ciliate setae; lateral flap not observed. Rami of tenaculum quadridentate, corpus with 1 basal seta. Man:dens:mucro = 20:22:1; manubrium ventrally and laterally scaled, dorsally setaceous with at least 10 + 10 stout, ciliate dorsolateral setae, the median terminal setae at venter 3 + 3; mucronal apical tooth about $1\ 1/2$ times as long as anteapical tooth.

MATERIAL EXAMINED:

5 examples, College, Laguna, rotten wood, 24-VI-66 (Coll. 52);
3 examples, same locality, rotten wood with polyporous fungi,
1-VII-66 (Coll. 61 and 70); 1 example, same locality and habitat,
2-VII-66 (Coll. 73); 2 examples, same locality, decaying leaves and
fruits of *Chaulmoogra* on ground, 8-VII-66 (Coll. 109).

DISTRIBUTION:

Bismarck Archipelago; New Guinea; Philippines.

DISCUSSION:

The material fits the redescription by Handschin (1930) of *L. parvidentatus* in all aspects. Added are characters such as the labrum, trochanteral organ, and the setae on the manubrium, not previously

described. The species is closely allied to L. (A.) ralumensis Schaeffer (1898) and L. (A.) solomonensis Yosii (1960) both of the Solomon Islands. Both species differ from parvidentatus in having equal mucronal teeth. In addition, solomonensis is separated from parvidentatus in not having Th II extended over the posterior margin of the head. Whether these 3 are specifically distinct is not known. Under the circumstances, L. parvidentatus is temporarily retained as a separate species until proven otherwise.

LEPIDOCYRTUS (ACROCYRTUS) BRUNNEUS (Handschin) new combination

Plate XVII

Acanthurella brunnea Handschin, 1930:416, figs. 16-19. Type:

Philippines, lost; neotype designated, to be deposited at UPCA, Department of Entomology, Philippines.

DIAGNOSTIC FEATURES:

Th II not overlapping posterior margin of head; accessory apparatus of basal lobe of dentes appearing foliate, sharply pointed apically; mucronal teeth subequal; unguis with a pair of middle inner teeth, an inner tooth at distal 1/4 and a pair of lateral teeth at proximal 1/4; Abd IV light purplish laterally and ventrolaterally.

GENERAL DESCRIPTION:

The species was originally described in German and is translated here as follows:

"Body length 2-3 mm. Color yellowish brown to orange. Body segments are remarkably covered with dense, large, round, brown scales,

likewise occurring on the legs and antennal bases. Distal area of Ant I, Ant II - Ant IV entirely bluish. Eyepatch black. Buccal parts and frontal margin of head pruinous blue, the tibiotalpi are bluish. The hairy condition is especially prominent on the extremities. Claw slender, with 2 inner teeth, basal outer tooth present. Unguiculus $\frac{3}{4}$ the length of claw, slender, its two lamellae joining towards the tip, not truncate. Tenent hair normally formed, opposite it a pointed seta. Mucro that of Lepidocyrtus, with 2 teeth and a basal spine. Furcula at the base of the dentes similarly with 2 large, distinct, spine-like lamellae, other spines absent. Dentes crenulate; crenulation not separate. One small specimen showed light bluish pigmentation on the abdomen and legs."

With one specimen at hand, the species is further described as follows:

Labral margin with 2 pairs of ovate tubercles, the outer pair about 4 times as long and wide as the inner pair; labral setae as 5,5,4 from the base, prelabral setae smooth, 2 + 2. Th II not overlapping posterior margin of head; Th II:III = 2.8:1. Legs light purplish on all segments; unguis with a pair of middle inner teeth, an inner tooth at distal $\frac{1}{4}$, and a pair of lateral teeth; unguiculus lanceolate-acuminate, $\frac{2}{3}$ as long as unguis on foreleg, about $\frac{4}{5}$ as long on hindleg, one outer lamella minutely serrate on its margin on the foreleg, Abd III:IV = 1:5.4; Abd IV laterally and ventrolaterally light purplish. Man.:dens:mucro = 12.5:12.2:1; mucronal teeth sub-equal.

MATERIAL EXAMINED:

Neotype, Mudspring Area, Mt. Maquiling, Luzon, from rotten log, 26-VIII-66 (Coll. 101).

DISTRIBUTION:

Philippines.

DISCUSSION:

The single specimen fits the original description of L. brunneus in all aspects. Obviously, this species is not common and until more material is obtained a complete description is not possible.

Previously described under Acanthurella, the species is now transferred to the subgenus Acrocyrtus of Lepidocyrtus based on the absence of true dental spines and on the presence of the pointed accessory apparatus on the basal lobe of the dentes. Handschin (1930) interpreted these structures as spine-like lamellae and illustrated them as such. Judging from his figure, these structures can hardly be considered as spines, which are diagnostic for Acanthurella.

Since not enough material is available, it would seem premature to compare brunneus with other species of the subgenus. So far as known, the foliate and sharply pointed accessory apparatus on the dens has not been observed in any other forms. A bluntly pointed type of accessory apparatus seems to be shared by many members of the subgenus Acrocyrtus. For this main reason, brunneus is retained here as a separate species.

The holotype of L. brunneus has been lost, as was confirmed by Handschin through Salmon (1968), and a neotype has now been designated.

Subgenus ASCOCYRTUS Yosii, 1959b:23

Key to Philippine Species

Prelabral setae ciliate; bluish to dark purplish dorsal bands on Th II, Abd II, III, and IV, each extending laterally to form lateral bands; similarly colored lateral bands present on the rest of the segments.....L. coeruleocinctus Handschin

Prelabral setae smooth; dorsal bands on body absent; narrow purplish lateral bands present on Th II, III, Abd IV, and V, present on Abd I-III as weak vertical streaks.....
L. indicus Handschin

LEPIDOCYRTUS (ASCOCYRTUS) COERULEOCINCTUS Handschin

Plate XVIII

Lepidocyrtus coeruleocinctus Handschin, 1930:413, pl. I, figs. 9-11.

Type: Philippines, lost; neotype, in the Department of Entomology, UPCA, Philippines.

DIAGNOSTIC FEATURES:

Prelabral setae ciliate; bluish to dark purplish dorsal bands on Th II, Abd II, III, and IV extending laterally to form lateral bands; similarly pigmented lateral bands present on the rest of the segments; unguis with 4 inner teeth, 2 occurring in a pair; unguiculus truncate; lateral flap of ventral tube with 12+12 smooth setae, ciliate setae absent; distal area of dens with several slightly expanded ciliate setae.

GENERAL DESCRIPTION:

Body length 0.64-1.26 mm. Ground color creamy white with bluish to purplish pigmented bands distributed as follows: dorsal bands on Th II, Abd II, III, and IV, extending laterally to form lateral bands (Pl. XVIII-E): lateral bands on the rest of the segments, the band on Abd I extending dorsolaterally. Head similarly pigmented anteriorly and laterally, a darker patch situated between the antennal bases; antennae purplish, paler on first two segments. Legs purplish, the tibiotarsi only lightly pigmented. Manubrium light purplish. Body scales distributed throughout body; macrochaetae absent. Antennae about 1 1/2 times as long as head; Ant I and proximal 1/2 of Ant II dorsally scaled; Ant IV with an apical end-bulb, several fine erect, as well as fine curving setae present, the curving setae sometimes occurring as far as distal half of Ant III. Eyes (8 + 8) on deep purplish eyepatches. Labral margin with 2 pairs of unequal tubercles, the outer pair twice as broad as the inner pair; labral setae arranged as 5,5,4 from the base, prelabral setae ciliate, 2 + 2. Th II slightly overlapping posterior margin of head; Th II:III = 1.5:1 (3 examples). Coxal setae arranged as 6-7, 5/7, 7 (2 examples). Trochanteral organ in one specimen (0.64 mm. long) composed of 8 spiny setae. Clavate tenent hair well-developed, about 4/5 as long as unguis. Pretarsus with one minute seta. Unguis with a pair of lateral teeth and 4 inner teeth, a pair at proximal 1/3, 1 at distal 1/4, and 1 at distal 1/8; unguiculus strongly truncate, 3/4 as long as unguis. Abd III:IV = 1:3.6 (Pl. XVIII-B). Lateral flap of ventral tube with 12 + 12 smooth setae, ciliate setae absent. Man.:dens:mucro =

17:19:1 (1 specimen); dorsal manubrial setae ciliate but not stout, ventral scales present, ventral median terminal setae 2 + 2; dens dorsolaterally with at least 3 + 3 slightly expanded, ciliate setae at distal 1/5 (Pl. XVIII-H); mucronal teeth subequal.

MATERIAL EXAMINED:

Neotype and 2 other examples, College, Laguna, banks of Molawin Creek, wet sand and decaying bamboo leaves, 12-II-66 (Coll. 12 and 28); 4 examples, same locality and habitat, 30-II-67 (Coll. 166, M. Pescador and D. Llamas); 2 examples, Mudspring, Mt. Maquiling, Luzon, decaying leaves on forest ground, 13-III-66 (Coll. 37); 1 example, same locality and habitat, 3-VII-66 (Coll. 90); 2 examples, same locality, rotten wood, 3-VII-66 (Coll. 101); 2 examples, same locality and habitat, 25-V-68 (Coll. 178, D. Llamas); 1 example, RNAS, Guinobatan, Albay, 20-VIII-66 (Coll. 124).

DISTRIBUTION:

Philippines.

DISCUSSION:

The Philippine examples agree well with L. coeruleocinctus except in the structure of the unguis. The unguis was originally mentioned as bearing only one pair of proximal inner teeth. The 2 additional distal inner teeth occurring in specimens that are over 1 mm. long are inconspicuous or absent in individuals less than 1 mm. Hence these structures were probably overlooked by Handschin because of their minute size or their complete absence in immature specimens.

The color pattern of L. coeruleocinctus varies considerably according to age. A more defined pattern is usually exhibited by specimens less than 1 mm. long, such pattern becoming lost in larger individuals where the pigments tend to fuse and cover the body almost entirely (Pl. XVIII-E).

LEPIDOCYRTUS (ASCOCYRTUS) INDICUS Handschin

Plate XIX

Lepidocyrtus indicus Handschin, 1929:242, figs. 9-11. Type: India, lost.

DIAGNOSTIC FEATURES:

Prelabral setae smooth; narrow purplish lateral bands present on Th II, III, posterior half of Abd IV, and Abd V, present on Abd I-III as weak narrow vertical streaks; unguis with 4 inner teeth; unguiculus truncate; lateral flap of ventral tube with 7 + 7 to 9 + 9 smooth and 11 + 11 to 15 + 15 ciliate setae; distal area of dens without expanded setae.

GENERAL DESCRIPTION:

Body length 1.0-2.38 mm. Ground color creamy white; narrow purplish bands on lateral areas of Th II, III, posterior 1/2 of Abd IV, and Abd V, weak vertical and narrow purplish streaks on lateral areas of Abd I-III; manubrium purplish only at base. Antennae light purplish on first 2 segments, intensifying towards the fourth segment. Head with purplish anterior margin; a deep purplish spot situated between the antennal bases, which is accompanied by a

faint purplish band terminating at anterior end of each eyepatch. Eyes (8 + 8) on deep purplish eyepatches. Body scales brownish on dorsum, paler on the sternum and furcula. Macrochaetae absent. Antennae setaceous, about $1\frac{1}{2}$ times as long as head; Ant I and proximal $\frac{1}{2}$ of Ant II dorsally scaled; besides regular ciliate setae, fine curving, plain setae are concentrated on distal half of Ant IV, fine erect plain setae distributed on all segments, but most numerous on Ant IV. Labral margin with 2 pairs of ovate tubercles, the outer pair slightly more than twice as large as the inner pair; labral setae arranged as 5,5,4 from the base, prelabral setae smooth. Th II strongly overlapping posterior margin of head; Th II:III = 1.7-2.5:1. Coxal setae arranged as 7-8, 4/8, 13 (in 4 specimens). Trochanteral organ composed of about 40 spiny setae (5 specimens more than 2 mm.). Clavate tenent hair well-developed, $\frac{3}{4}$ as long as unguis. Pretarsus with a basal seta; unguis with a pair of lateral as well as 4 inner teeth, a middle pair, 1 at distal $\frac{1}{4}$, and 1 at distal $\frac{1}{6}$; unguiculus truncate, about $\frac{3}{5}$ as long as unguis, one outer lamella serrate on its edge on the foreleg and middle leg, smooth on the hindleg. Abd III:IV = 1:3. Lateral flap of ventral tube with 7 + 7 to 9 + 9 smooth and 11 + 11 to 15 + 15 ciliate setae (5 examples of more than 1.5 mm.). Man.:dens:mucro = 15:16:1 (12 examples); manubrial setae ciliate, normal, ventral and lateral scales present, ventral median terminal setae 3 + 3; distal area of dens without slightly expanded setae, the existing setae being long, slender and pubescent; mucronal teeth subequal.

MATERIAL EXAMINED:

7 examples, College, Laguna, grass compost, 20-VI-66 (Colls. 40 and 41); 1 example, same locality, rotten wood, 24-VI-66 (Coll. 52); 2 examples, same locality and habitat, 1-VII-66 (Coll. 70); 1 example, same locality, decaying leaves and fruits of *Chaulmoogra* tree, 8-VII-66; 3 examples, same locality, underneath leaf sheaths of sugar cane, 24-VI-66 (Coll. 55); 7 examples, same locality and habitat, 6-VIII-66 (Coll. 118); 1 example, same locality, rotten branch of *Spathodea campanulata*, 24-VI-66; 2 examples, same locality, underneath leaf sheaths of banana, 1-XI-66 (Coll. 152); 1 example, Tuntungin, College, Laguna, decaying coconut husks, 6-XI-66 (Coll. 154); 1 example, CSNAS, Pili, Camarines Sur, decaying leaves and grass, 19-VIII-66 (Coll. 139); 4 examples, RNAS, Guinobatan, Albay, decaying leaves, 20-VIII-66 (Coll. 140).

DISTRIBUTION:

India; Philippines.

DISCUSSION:

The specimens agree with the original description of *Lepidocyrtus indicus* in every aspect, although the accessory apparatus on the dental lobe, the labrum, ventral tube, and trochanteral organ were not described. This is the first record of the species since its discovery.

L. indicus comes closest to *L. scaber* Ritter (1911) from India. Based on Yosii's redescription (1959b; 1966), *scaber* differs in the presence of lateral bands only on Th II and III, 3 inner teeth on the

unguis, a lesser number of setae on the trochanteral organ (about 25), and the ciliate condition of the prelabral setae. However, the similarities between these two species in labral margin, number of coxal setae, numerical ratio of smooth and ciliate setae on the lateral flap of the ventral tube, and number of median terminal setae on the venter of the manubrium are remarkable. In spite of the close resemblance, they are considered to be distinct, perhaps belonging to the same species-group.

Subgenus LEPIDOCYRTUS Yosii, 1959:23

LEPIDOCYRTUS (LEPIDOCYRTUS) VESTITUS Handschin

Plate XX

Lepidocyrtus vestitus Handschin, 1930:414, pl. I, figs. 12, 13.

Type: Philippines, lost; neotype, in the Department of Entomology, UPCA, Philippines.

DIAGNOSTIC FEATURES:

Body entirely creamy white, except the eyepatches and antennae which are dark purplish; labral margin with 2 pairs of rounded subequal tubercles; unguis with 4 inner teeth; unguiculus truncate; apical tooth of mucro almost twice as long as anteapical tooth.

GENERAL DESCRIPTION:

Body length 0.78-1.45 mm. Ground color entirely creamy white except the eyepatches and antennae which are dark purplish, Ant I and II only lightly pigmented. Antennae setaceous, 1.8 times as long as head (1 example); Ant I and proximal half of Ant II with dorsal

scales; Ant IV with an apical end-bulb; fine erect plain setae distributed on all segments. but more numerous on Ant IV; fine curving smooth setae occurring on Ant IV, sparsely on Ant III. Eyes (8 + 8) on dark eyepatches. Labral margin with 2 pairs of rounded subequal tubercles; labral setae arranged as 5,5,4 from base, prelabral setae not observed. Th II overlapping posterior margin of head; Th II:III = 2:1 (4 examples). Coxal setae not observed. Trochanteral organ (in one example) composed of 36 spiny setae. Clavate tenent hair well-developed, about $\frac{3}{5}$ as long as unguis. Pretarsus with 1 minute seta. Unguis with a pair of lateral teeth, and 4 inner teeth, a pair at about proximal $\frac{1}{4}$, 1 at midpoint and 1 at distal $\frac{1}{4}$; unguiculus truncate, about $\frac{2}{3}$ as long as unguis, without any serrate lamella. Abd III-IV = 1:3 (3 examples). Lateral flap of ventral tube (1 example) with 10 + 10 smooth and 7 + 7 ciliate setae. Man.:dens:mucro = 18:20:1 (2 examples); dorsal manubrial setae normal, ciliate, the ventral scales present; median terminal setae on venter of manubrium not observed; distal area of dens without expanded setae, the setae long, slender, and pubescent; apical tooth of mucro almost twice as long as anteapical tooth.

MATERIAL EXAMINED:

Neotype and 4 other examples, College, Laguna, grass compost, 20-VI-66 (Coll. 40); 2 examples, same locality, banks of Molawin Creek, sandy soil and decaying leaves, 12-II-66 (Coll. 27).

DISTRIBUTION:

Philippines.

DISCUSSION:

The examples at hand agree with the brief original description and figures of Lepidocyrtus vestitus Handschin. Observations on the structure of the labral margin, the setae on the lateral flap of the ventral tube, and the trochanteral organ setae are added in the present redescription.

Lepidocyrtus vestitus closely resembles L. (Asocyrtus) dahlii Schaeffer (1898) of the Solomon Islands in absence of body pigment, structure of the labral margin, and number of inner unguual teeth. However, dahlii differs in the lanceolate condition of the hind unguiculus, the number and combination of smooth and ciliate setae on the lateral flap of the ventral tube (8 + 8 to 9 + 9 smooth and 21 + 21 to 22 + 22 ciliate setae), the number of setae on the trochanteral organ (24 in specimens about 1.7 mm. long), the presence of a rounded accessory apparatus on the dental lobe, and the subequal mucronal teeth.

Since the holotype of L. (L.) vestitus is lost, a neotype has been designated.

Genus ALLOSCOPUS Boerner

1906:177; Handschin, 1928:267.

Alloscopus is a very small group containing only 2 species which are strictly Oriental, both occurring in the Philippines. It is most closely related to the genus Ptenura Templeton (1842), the latter differing in the variable number of eyes (0 to 8 on each

eyepatch), the absence of dental spines, and the presence of the basal spine on the mucro.

Key to Philippine Species

- Dental spines ranging from 4 + 4 to 7 + 7; a basal pair of wing-like teeth present on the unguis.....A. tetracanthus Boerner
- Dental spines not less than 20 + 20; only one basal wing-like tooth present on the unguis.....A. tenuicornis Boerner

ALLOSCOPUS TETRACANTHUS Boerner

Plates XXI, XXII

Heteromurus (Alloscopus) tetracantha Boerner, 1906:177; Handschin, 1925:266. Type: Java, unknown.

Alloscopus tetracantha, Yosii, 1959b:38, fig. 22 A-F; Yosii, 1960:27.

DIAGNOSTIC FEATURES:

Dental spines varying from 4 + 4 to 7 + 7; unguis with a basal pair of inner wing-like teeth in addition to the middle inner tooth.

GENERAL DESCRIPTION:

Yosii (1959) redescribed the species from Malayan material as follows:

"Body length up to 1.6 mm. Whitish on all parts of the body. Ant./Head as 20:9. Ant. I is basally subdivided. Ant. segm. ratio... as 1:4:7:10:10. Ant. II and III with many hyaline scales. Distal half of Ant. IV and whole length of Ant. V are distinctly annulated.

Terminal end-bulb is not present. Ant III-organ is a pair of sensory rods distally on Ant. IV. Head without eyes, but one example from Penang has a reddish brown spot at the place. Th. II is not hanging over the head. Abd. III/IV as 6:7. Legs are scaled until to the femur and tibiotarsus is not scaled. Posterior ridge of each tibiotarsus has some finely ciliated, erected setae together with many common feathered ones. Tenent hair is spiny and short. Unguis broad, dorsally carinate and with a pair of winged ventral teeth well developed. Lateral teeth seemingly present. Unguiculus lanceolate and with a prominent outer tooth. Trochanteral organ of the hind foot composed from about 15 small setae. Furca well developed. Dens is subsegmented proximally as in case of A. tenuicornis Boerner (Handschin 1925). A row of 4(-6) short spines is located at the place on its inner side. Distally, dentes are finely annulated gradually diminishing in the smooth portion. Mucro is bidentate and without basal spine in all examples examined. Scales of the body are hyaline, rounded but a little more roughly sculptured than in Lepidocyrtus. Ventral side of the dentes is also with rounded, hyaline scales. Feathered setae of brushed type are restricted to the antennal bases. Chaetotaxy of each tergite examined in one example from Singapore is symmetrical as in Fig. A, which must have taxonomic meaning. Ventral tube is poorly haired, especially on its posterior face as in Fig. E and F. ."

From the Philippine examples, the following characters are added:

Labral margin with 2 pairs of tubercles, each tubercle giving rise to a well-defined, slightly curved spinule; labral setae 5,5,4

from the base, the prelabral setae smooth, 2 + 2. Macrochaetae of the head arranged in a fixed pattern as shown in Pl. XXI-B (in 15 examples examined), the most conspicuous of which are 13 setae forming a transverse row just posterior to and between the eyes; 1 + 1 setae sensuales situated posterior to the transverse row of macrochaetae, followed by 1 + 1 posterior macrochaetae. Eyes 1 + 1 on faint, brownish orange eyespots (14 examples). Chaetotaxy of body in 12 examples examined in fixed pattern (Pl. XXI-C). Ventral tube with few setae, all of which are plain; anterior surface with 7 + 7 setae, posterior surface having 6 + 6 setae, and the lateral flap with about 11 + 11 minute setae (in 8 examples examined); dental spines varying from 4 + 4 to 7 + 7, but mostly 5 + 5 (20 examples); median terminal setae on ventral surface of manubrium 1 + 1.

MATERIAL EXAMINED:

1 example, College, Laguna, banks of Molawin Creek, sandy soil and decaying leaves, 12-II-66 (Coll. 25); 1 example, Mudspring, Mt. Maquiling, Luzon, from wood in association with termites, 13-III-66 (Coll. 36); 4 examples, same locality, decaying fruits and inflorescence of Ficus sp. on ground, 3-VIII-66 (Coll. 86); 7 examples, same locality, from soil sample just below rotten wood, 25-V-68 (Coll. 178, D. Llamas); 2 examples, same locality, decaying leaves on forest ground, 3-VII-66 (Coll. 101); 4 examples, College, Laguna, rotten wood, 1-VII-66 (Colls. 70, 73); 4 examples, CSNAS, Pili, Camarines Sur; decaying leaves and grass, 19-VIII-66 (Coll. 139); 3 examples, RNAS, Guinobatan, Albay, decaying leaves, 20-VIII-66 (Coll. 140); 2 examples, Gingoog, Misamis

Oriental, Mindanao, soil samples from cultivated areas, 8-I-67
(Coll. 156 and 158, A. Nadal).

DISTRIBUTION AND DISCUSSION:

Java; Malaya; Philippines.

The Philippine material undoubtedly represents Alloscopus tetracanthus; the determination was confirmed by Yosii. From Malayan examples (Yosii, 1959b), it differs only in the number of setae on the ventral tube and in the addition of 1 + 1 macrochaetae on Th III. The species is widely distributed in the Philippines, from the northern to the southern parts of the country.

ALLOSCOPUS TENUICORNIS Boerner

Heteromurus (Alloscopus) tenuicornis Boerner, 1906:177; Handschin, 1925:244, figs. 36-40; Handschin, 1926:460. Type: Java, unknown.

Alloscopus tenuicornis, Handschin, 1928:267; Handschin, 1930:422.

DIAGNOSTIC FEATURES:

Dental spines no less than 20 + 20; unguis with only 1 basal inner wing-like tooth in addition to the inner tooth at distal 1/3.

GENERAL DESCRIPTION:

The species was redescribed by Handschin in German (1925) and is translated here as follows:

"Body size 1.5-2 mm. Color yellowish, except a single reddish-pigmented ocellus on each side. Ant. I:II:III:IV:V = 3:6:9:12:17, about 2 1/2 times as long as diagonal of head. The last antennal

segment is strongly annulated, every annulation supporting a whorl of setae. Ant. III with typical antennal organ, distal area likewise annulated. Head with 1 + 1 ocelli. The body segments are almost equal in length (12:11:8:11:11:16:6:4). Claws slender with 2 inner teeth, at 1/3 and 2/3 from the base. The basal tooth is especially strongly developed. Outer tooth and thin seta above unguiculus hair are likewise present. Unguiculus lanceolate, with a lamellar outer tooth. Clavate tenent hair on tibiotarsus could not be observed. The dentes are subdivided with a small base and a long pronged piece. The basal area of dens with a row of about 20 strong spines, several spines are found in a transverse row on the small base. Dentes strongly crenulate, crenulation gradually diminishing before the division of the mucro. Mucrones bidentate, without basal spine. The body clothing consists of scales, setae on Th II-ABD IV flexed... The scales are almost round, hyaline and finely pubescent."

DISTRIBUTION:

Java, Philippines.

DISCUSSION:

Although A. tenuicornis has been reported from the Philippines (Handschin, 1930), it does not occur in my collection. The species must be restudied with respect to characters such as the labrum, ventral tube setae, unguis teeth, head and body chaetotaxy, and variation in number of dental spines. At present, it is distinguished from tetracanthus in having a single basal wing-like inner tooth on the unguis and more dental spines. Until proven otherwise, however, tenuicornis is recognized as a distinct species.

Genus SEIRA Lubbock

Seira Lubbock, 1870:279

Sira Tullberg, 1872:40; Boerner, 1903:178.

Pseudosira Schoett, 1893:176.

Lepidocyrtinus Boerner, 1903:179.

Calistocyrtus Ritter, 1911:391.

Drepanocyrtus Handschin, 1924:17.

Dimantinum Paclt, 1959:55.

Afroseira Yosii, 1959a:10.

Type species: Seira domestica (Nicolet, 1842), Lubbock, 1870:277.

The preceding synonymy is adopted from Salmon (1964) and Yosii (1959a).

The concept of Seira is currently in a confused state and badly needs revision. The genus is relatively large, consisting of 67 species, 16 of which occur in the Indo-Malayan subregion of the Oriental region. However, these species have been poorly studied and are known primarily from inadequate original descriptions and figures. The body color pattern has always been considered diagnostic for Seira at the species level. Although some body parts may lose their pigment, the basic pattern, usually appearing as lateral or dorsal bands on body segments, is constant for each species. Yosii (1959a, 1960, 1966) recently found the body chaetotaxy to be fairly constant in each species. The setal pattern, however, appears to vary according to age, a factor that must be carefully considered. Also, chaetotaxy is certainly not an absolute species criterion as will be mentioned

again in the discussion of the Philippine species. Other characters recently used at the species level are the structure of the labrum and the setal pattern of the ventral tube. The number and type of setae on the lateral flap of the ventral tube and dorsal head chaetotaxy are probably diagnostic and might prove to be of value in separating species.

The genus Seira is represented in the Philippines by 2 species.

Key to Philippine Species

- Body with bluish to deep purplish lateral bands on Th II-Abd VI, the bands on Th III, Abd I-III extending dorsally but not meeting mesally; legs light purplish, except for the uncolored hind tibiotalpi; all setae of lateral flap of ventral tube smooth.....
S. terrestris (Folsom)
- Body with deep purplish dorsal transverse bands on Th II and III; posterolateral purplish patch on Abd IV present; coxae and precoxae partially purplish, the rest of the leg segments unpigmented; both ciliate and smooth setae present on lateral flap of ventral tube.....S. schaefferi (Schoett)

SEIRA TERRESTRIS (Folsom)

Plates XXIII, XXIV

Drepanocyrtus terrestris Folsom, 1932:69, figs. 97-102, pl. 10, figs.

103-104; Zimmerman, 1948:62, figs. 29 a-i; Uchida, 1955:205, fig.

2. Cotypes: Hawaii, in the Illinois State Natural History Survey, Urbana, Illinois, U.S.A.; homoeotypes in the Department of Entomology, UPCA, Philippines.

Seira terrestris, Yosii, 1960:17.

DIAGNOSTIC FEATURES:

Th II-Abd VI each with a lateral bluish to deep purplish band on each side, the bands on Th III, Abd I-III extending dorsally but not meeting mesally; legs light purplish except the hind tibiotarsi; all setae of lateral flap of ventral tube smooth (12 + 12 to 13 + 13); manubrium and dens without modified setae; head and body chaetotaxy arranged in a unique pattern as shown in Pl. XXIII-B, D.

GENERAL DESCRIPTION:

Body length 1.5-2.3 mm. Ground color creamy white with bluish to deep purplish bands on lateral areas of Th II-Abd VI, those on Th III, Abd I-III extending dorsally but not meeting mesally. Antennae deep blue with lighter tinge on bases of Ant I-III. Head with a purplish irregular anterior band between the eyepatches, terminating at anterior ends of eyepatches and at antennal bases, anteromedially with a deep bluish patch between the antennal bases. Eyes (8 + 8) on deep bluish eyepatches. Legs slightly purplish except the hind tibiotarsi which are creamy white; ventral tube and corpus of tenaculum similarly pigmented. Scales occurring on Ant I and proximal half of Ant III, and throughout the body, except the dorsal surface of furcula. Body oligochaetotic, macrochaetae apically flexed, arranged on head and Th II-Abd III in a fixed pattern (Pl. XXIII-B and D); frontal row of setae on head not flexed but are pointed apically. Antennae almost twice as long as head; densely setaceous; fine erect setae sparsely distributed on Ant IV and distal half of Ant III; fine curving setae

numerous on Ant IV, sparsely occurring on Ant III and distal half of Ant II; Ant IV with 2 apical end-bulbs, slightly annulate. Labral margin with 2 + 2 small tubercles, each tubercle bearing a spinule; labral setae arranged as 5,5,4 from the base, prelabral setae ciliate, 2 + 2. Th II not overlapping posterior margin of head; Th II:III = 2-3:1 (5 examples). Legs setaceous; trochanteral organ not observed; tibiotarsi weakly subsegmented at distal 1/3; tenent hair strongly clavate, about 4/5 as long as unguis, unguis with a pair of lateral teeth as well as 4 inner teeth, 1 middle pair, 1 at distal 1/4 and 1 at distal 1/8; unguiculus lanceolate, about 1/2 as long as unguis, 1 outer lamella minutely serrate on the first 2 pairs of legs. Abd III:IV = 1:3-3.8 (5 examples). Ventral tube sparsely setaceous, anterior surface with 3 + 3 long, pubescent, 2 + 2 shorter stout ciliate, and 1 + 1 finely ciliate setae; lateral flaps with 12 + 12 to 13 + 13 smooth setae, ciliate ones absent (3 examples). Setae sensuales on Abd II-IV arranged as 2 + 2, 3 + 3, 2 + 2, respectively, each seta sensuality accompanied by fine, ciliate microchaetae (Pl. XXIII-D). Man.:dens:mucro = 46:74:1 (1 example); manubrium and dens dorsally with ciliate setae, modified setae absent; at least one pubescent, subapical seta of dens reaching tip of mucro.

MATERIAL EXAMINED:

6 cotypes, Honolulu, Hawaii, 1921 (Folsom); 2 homoeotypes, College, Laguna, underneath leaf sheaths of sugar cane, 6-VIII-66 (Coll. 118); 6 examples same locality, grass compost, 20-VI-66 (Colls. 40 and 42); 3 examples, same locality, UPCA library toilet on urinating

bowls and sink, 7-XI-66 (Coll. 165); 5 examples, Faculty Village, College, Laguna, indoors running across table and kitchen sink, 2-XI-66 (Coll. 153); 3 examples, Tuntungin, College, Laguna, decaying coconut husks, 6-XI-66 (Coll. 154).

DISTRIBUTION:

Hawaii; Marcus Island; Philippines.

DISCUSSION:

The examples fit Seira terrestris as described and illustrated by Folsom (1932), although the structure of the labrum, the head and body chaetotaxy, and number of setae on the ventral tube were not mentioned. Due to the aged condition of 8 mounted cotypes examined, the chaetotaxy could not be checked. However, the body color pattern was faintly shown in other unmounted cotypes. The antennae, unguis and unguiculus, and furcula were also observable and do not differ from these structures found in the Philippine specimens. In spite of the inadequate original description and poor types there is little doubt concerning the identity of the present material.

Seira terrestris resembles S. lateralis Yosii (1966) from Bombay in having the same basic body setal pattern, but differs in having more setae. The distinction seems to be doubtful, since the description of lateralis was based on immature specimens as Yosii himself mentioned. As in other species the setae undoubtedly increase in number as the individual increases in body size. Furthermore, the lateral bands of lateralis differ from those of terrestris only in that they do not extend dorsally. Since body color eventually becomes more intensified

in mature forms of many entomobryids, this phenomenon may well be true for lateralis. Lastly, the presence of only 1 inner unguual tooth in lateralis may again be attributable to the immature condition of the specimens used, as in Lepidocyrtus (Ascocyrtus) coeruleocinctus Handschin. For these reasons, S. lateralis is probably identical to S. terrestris. However, until mature examples of lateralis can be examined, the two are tentatively retained as distinct but very closely related species.

S. terrestris differs greatly in all aspects from S. oceanica Yosii (1960) of New Caledonia except for an almost identical body chaetotaxy. Body chaetotaxy in Seira may serve well for grouping species.

SEIRA SCHAEFFERI (Schoett)

Plates XXV, XXVI

Lepidocyrtus schaefferi Schoett, 1901:323, figs. 31-34; Salmon, 1964:

527. Type: New Guinea, unknown.

Calistocyrtus indicus Ritter, 1911:391, figs. 44-46. Type: India,

unknown; New synonymy.

Lepidocyrtinus schaefferi, Handschin, 1928:249; Handschin, 1930:417,

pl. 3, figs. 24-27; Pierce, 1934:198.

Pseudosira indica, Bonet, 1930:260, fig. 5.

Seira schaefferi, Yosii, 1960:17.

Seira indica, Yosii, 1966:365, fig. 22.

DIAGNOSTIC FEATURES:

Abd II and III dorsally with deep purplish transverse bands which extend laterally; posterolateral purplish patch on Abd IV, similar patches on coxae and precoxae present or absent, all other body and leg segments unpigmented; both ciliate and smooth setae present on lateral flap of ventral tube; head and body macrochaetae arranged in a unique pattern (Pl. XXV-B and C).

GENERAL DESCRIPTION:

Body length 1.7 mm. Ground color yellowish, with deep purplish pigmentation distributed on body parts as follows: antennae, lighter only at bases of first two segments; on head, a narrow transverse band at frontal area terminating at posterior edges of antennal bases, and a separate quadrangular patch anteromedially situated between the eyepatches; eyes (8 + 8) on deeply pigmented eyepatches; coxae and precoxae only partially patched with purple; a narrow dorsal transverse band on posterior 1/3 of Abd II, a dark band covering entire dorsum of Abd III, both bands extending laterally; a small posterolateral patch on Abd IV. Body scales of two types, distributed as follows (observed in freshly-caught specimen): brownish scales on first three antennal segments, posterior half of Th II, III, Abd I, II, IV, and on all leg segments and entire dorsum of Abd III; hyaline scales on head, anterior half of Th II, III, Abd I, II, and IV, on ventral tube, and on ventral surface of abdomen, manubrium, and dentes. Body oligochaetotic, the macrochaetae flexed on head and body segments (Th II-Abd III) arranged as shown in Pl. XXV-B and C, the frontal row on head with apically

pointed unflexed setae. Antennae 2.4 times as long as head; densely setaceous; fine curving as well as erect smooth setae on Ant IV and distal half of Ant III; Ant IV with 2 apical end-bulbs. Labral margin with 2 pairs of weakly-formed tubercles, each tubercle giving rise to an apical spinule; labral setae arranged as 5,5,4 from the base, prelabral setae ciliate, 2 + 2. Th II slightly overlapping posterior margin of head; Th II:III = 1.8:1. Legs with scales from the coxae to the apex of tibiotalarsi, densely setaceous; trochanteral organ not observed; tibiotalarsi not subsegmented; tenent hair strongly clavate, about $\frac{4}{5}$ as long as unguis; unguis with a pair of lateral teeth and 4 inner teeth, 1 middle pair, 1 at distal $\frac{1}{4}$, and 1 at distal $\frac{1}{8}$; unguiculus lanceolate, about $\frac{1}{2}$ as long as unguis. Ventral tube, anterior surface not observed; lateral flap with 8 + 8 smooth and 7 + 7 ciliate setae, posterior surface with 1 + 1 smooth distal setae. Abd III:IV = 1:3. Man.:dens:mucro = 20:30:1; manubrium dorsally with ciliate setae, as well as 2 + 2 stout, ciliate setae at distal area, ventrally with 6 + 6 median terminal setae; dens dorsally with 1 + 1 stout, ciliate, basal setae (Pl. XXV-D); at least 1 long, pubescent dental seta reaching beyond mucro.

MATERIAL EXAMINED:

2 examples, College, Laguna, Philippines, 24-IX-66, from cultivated plot of *Ipomoea batatas* L. (Coll. 108).

DISTRIBUTION:

New Guinea; Java; Philippines; India.

DISCUSSION:

The Philippine material agrees well with Seira schaefferi. When Schoett described the species under Lepidocyrtus, he mentioned the falciform mucro but did not regard it as of generic value. In 1928, Handschin recognized the significance of this character and transferred schaefferi to Lepidocyrtinus Boerner. Yosii (1959a), however, found no significant differences between Lepidocyrtinus and Seira. Hence he placed Lepidocyrtinus as a junior synonym of Seira and suggested the transfer of schaefferi to the latter genus (1960).

When compared with the description and figures of Calistocyrtus indicus (1911), Seira schaefferi appears to be identical. Yosii (1966) redescribed indicus and transferred it to the genus Seira, recognizing Bonet's transfer of this species to the genus Pseudosira as unjustified.

Except for the number of setae on the lateral flap of the ventral tube, and the pigmentation on coxae and precoxae, the Philippine material agrees with Yosii's redescription of indicus. Yosii illustrated indicus as lacking pigmentation on the coxae and precoxae of the legs, in contrast to the original description and figure of this species. Such a difference in the color pattern may have been caused by decolorization in alcohol. Yosii stated himself that the color on the legs was variable in his Indian examples. He further described the lateral flap of the ventral tube as having 1 + 1 larger and 2 + 2 smaller setae, contrary to the condition seen in the present examples. I suspect that this difference can be attributed to age and size of specimens. However, the body chaetotaxy is

identical to that of indicus. Unfortunately, in redescribing indicus, Yosii did not describe the chaetotaxy of the head; thus, a full comparison is not possible. In spite of these differences, which I regard as minor, I am placing indicus as a new synonym of schaefferi on the basis of priority.

Subfamily CYPHODERINAE Boerner, 1913:321

The subfamily Cyphoderinae consists of about 10 genera most of which are still unstable. Christiansen (1957), for instance, commented on the need to reinvestigate the genus Serroderus which he considered to be a subgenus of Cyphoderus. It is tentatively treated here in that manner.

Only one genus is represented in the Philippines.

Genus CYPHODERUS Nicolet

Cyphoderus Nicolet, 1841:381. Type species: C. albinus Nicolet, Boerner, 1903:180, by selection.

Cyphodurus Nicolet, 1841:384 (Misspelling).

Cyphodeirus Nicolet, 1842:63 (Misspelling).

Beckia Lubbock, 1870:279.

Dens 2 to 5 times as long as mucro which is elongate with several teeth (no less than 2); scaled ventrally, dorsally with 2 rows of ciliate specialized foliate scales increasing in size from base to apex; claw and unguiculus both with well-developed wing-like teeth.

In spite of the revisions of Cyphoderus undertaken by Handschin (1942a) and Delamare-Deboutteville (1948), the concept of this genus

is still not clearly defined. This is an extremely difficult group to work on, considering the high degree of variability of certain characters, particularly the mucro and the dens, in many species. The best solution to this problem would probably be studies of populations of each species concerned, where the extent of variation in characters can be observed and better understood. So far, characters that have been recognized as species-specific are structure of the mucro, relative lengths of the distal dental scales in relation to the mucro, length of the mucro in relation to the dens, the number of dorsal dental scales, and the number and arrangement of teeth on the mucro.

Two species of Cyphoderus are known to occur in the Philippines.

Key to Philippine Species

- Mucro about $1/2$ as long as dens; unguis with a pair of unequal but well-developed basal inner wing-like teeth as well as an inner middle tooth; if mucro is tridentate, the dorsal dental scales on the inner row are only 2, if mucro is multidentate, the inner scales are 6.....C. hozawai Kinoshita
- Mucro about $2/5$ as long as dens; unguis with only 1 well-developed basal wing-like inner tooth, the other reduced into a ridge-like structure, a small inner middle tooth also present; dorsal dental scales on inner row always 5.....C. javanus Boerner

CYPHODERUS JAVANUS Boerner

1906:180; Boerner, 1913:58; Handschin, 1928:267; Delamare-Deboutteville, 1948:344; Yosii, 1966:381, fig. 32 A-H. Type: Java, unknown.

DIAGNOSTIC FEATURES:

Unguis with 1 well-developed basal inner wing-like tooth, the other tooth reduced into a ridge-like structure, a small inner middle tooth; dens dorsally with an inner row of 5 modified scales and an outer row of 6 similar scales, the inner distal scale subequal in length to the mucro; dens with a dorsomedian row of 4 smooth setae; mucro about $2/5$, as long as dens, with 2 well-developed teeth.

GENERAL DESCRIPTION:

The species was redescribed by Yosii (1966) as follows:

"Body length about 1.7 mm. Totally white. Ant./head as 12:7. Ant. ratio as 2:7:4:10. Ant. IV without end-bulb, but richly beset with slender, curving sensory setae beside usual ciliate ones. Such sensory setae are present also upon ant. III and II (distal). Labrum with setae arranged as 4/5,5,4, prelabral setae smooth. The first row of labral setae slender, the inner pair of the second row is stout and thick compared to others. A thick ledge of inverted U-form is the margin of distal smooth area to form a median intrusion. Distal labral margin without any structures. Mesonotum moderately developed. Tenent hair of all legs slightly dilated on apex. Unguis stout, with a pair of inner proximal and one distal teeth. The former is not equally developed, posterior one is obscure and converted to a ridge-like thickening, while the anterior one is strongly developed, almost

cuspidate in form. In fore- and mid-legs it is a little shorter than and on hind-legs subequal to unguiculus in length. An unpaired inner distal tooth distinctly present. Unguiculus is lanceolate and with a broad outer tooth. Trochanteral organ is composed of about 16 short setae in L-arrangement. Ventral tube elongate, curving forward distally. Anterior face with 2 + 2 slender, ciliated setae. Posterior face has 7(2 + 2, 1, 1 + 1) setae in a fixed pattern and lateral flap has 2 setae each... Furca in ratio as 8:5:2. Manubrium is ventrally scaled and without setae, dorsal side with many ciliated setae. Dentes not converging distally, with 6 outer and 5 inner scales. Basally one smooth and two ciliated setae in a transverse row, then a dorsal row of 4 smooth setae, 3 of which are attached to the proximal three scales of the outer row. Mucro subequal to the distal outer scale in length, bidentate apically and with a slight lateral ledge. Integument is smooth, body setae achaetotic and no large setae are existing. S.s. filiform, 2,3,2 upon Abd II-IV and their accessory setae are ciliated."

MATERIAL EXAMINED:

18 examples, CSNAS, Pili, Camarines Sur, from subterranean ant nest, 19-VIII-66 (Coll. 151); 3 examples, CLSU, Munoz, Nueva Ecija, grass compost and soil with ants, 26-VIII-66 (Coll. 144); 2 examples, College, Laguna, grass compost, 20-VI-66 (Coll. 40); 2 examples, same locality, soil sample at base of Spathodea campanulata, 21-VI-66 (Coll. 45); 3 examples, RNAS, Guinobatan, Albay, decaying leaves and soil, 20-VIII-66 (Colls. 135 and 136).

DISTRIBUTION:

India; Java; Malaya; Formosa; Japan; Philippines.

DISCUSSION:

The material agrees with C. javanus in all aspects except in the trochanteral organ, the setae of which vary from 16 to 19, a difference most likely attributable to the age of the specimens used.

C. javanus is closely related to the almost cosmopolitan C. albinus (Nicolet, 1841) and to the neotropical C. similis Folsom (1927), differing from both primarily in the number of unguis teeth. The unguis in albinus lacks a distal inner tooth and has the ridge-like structure greatly reduced and hardly conspicuous. The same structure in similis has a well-developed ridge-like thickening on the inner base and 2 distal inner teeth. In addition its outer row of dorsal dental scales contains 7 scales. Since the teeth of the unguis and the number of dental dorsal scales have been regarded as highly specific, C. javanus is retained as a separate species closely allied to albinus and similis.

CYPHODERUS HOZAWAI Kinoshita

Pl. XXVIII

Cyphoderus hozawai Kinoshita, 1917:41, fig. 1; Uchida, 1938:8;

Uchida, 1944:13, fig. XII, 1-6; Kinoshita and Uchida, 1950:19, fig. ; Uchida, 1958:19. Type: Japan, unknown.

Cyphoderus orientalis Folsom, 1924:513, pl. 5, figs. 39-41; Handschin, 1928:267; Handschin, 1930:420. Type: Sumatra, in the Museum of

Comparative Zoology, Harvard University, Cambridge,
Massachusetts, U.S.A. (New synonymy).

Serroderus orientalis, Delamare-Deboutteville, 1948:373.

DIAGNOSTIC FEATURES:

Unguis with 1 pair of unequal but well-developed basal inner wing-like teeth, as well as 1 small inner tooth at $1/2$; dens dorsally with an outer row of 6 modified scales; if mucro is tridentate, inner row of scales with only 2 scales, if multidentate, inner row has 6 scales; mucro about $1/2$ as long as dens.

GENERAL DESCRIPTION:

Body length 1-1.2 mm. Color entirely white. Body scaled on head and body segments. Body typically achaetotic, with setae sensuales distributed as 2 + 2, 3 + 3, 2 + 2 on Abd II-IV, each seta sensualis accompanied by simple ciliate microchaetae. Antennae about $1\ 1/4$ as long as head; densely setaceous, with several fine curving, as well as fine erect setae on Ant IV, occurring as far as Ant II; Ant IV without apical end-bulb. Labral margin smooth; labral setae arranged as 5,5,4 from the base, prelabral setae smooth, 2 + 2. Th II not overlapping posterior margin of head; Th II:III = 1.7:1 (1 example). Legs setaceous; trochanteral organ composed of 19 spiny setae (1 example) arranged in a V-pattern; tenent hair slender, weakly clavate apically, about $3/5$ as long as unguis; unguis with a pair of unequal but well-developed basal inner wing-like teeth, a small inner middle tooth, and a pair of basal lateral teeth; unguiculus about $4/5$ as long as unguis, lanceolate with one large outer tooth reaching almost $2/3$ of the former's length. Abd III:IV = 1:5.8 (1 example). Man.:dens:

mucro = 3:2:1; dens usually with an outer row of 6 dorsal scales and an inner row of 2, the inner row with 2 ciliate setae just anterior to subapical inner scale, dorsomedian row of setae absent; mucro about 1/2 as long as dens, tridentate, with a lateral crest terminating just before reaching the anteapical tooth, or multidentate, with 3 smaller teeth situated between the anteapical and dorsal teeth (Pl. XXVIII-E), with 6-7 similar teeth lying anterior to the dorsal teeth; when mucro is multidentate, the inner scales on the dens increase from two to six (2 examples).

MATERIAL EXAMINED:

Type of C. orientalis, Sinabang, Sumatra, from a termite nest, February, 1913; PHILIPPINES: 4 examples, Mudspring Area, Mt. Maquiling, from a termite nest on rotten wood, 13-III-66 (Coll. 36).

DISTRIBUTION:

Japan; Sumatra; Philippines.

DISCUSSION:

The Philippine examples fit the illustrations of C. hozawai by Uchida (1944); the determination was confirmed by Yosii. On the other hand, 2 examples agree in all aspects with the original description, figures, and holotype of C. orientalis Folsom (1924) from Sumatra. Folsom recorded the presence of only 1 inner dental scale, contrary to the 2 dental scales I observed on the holotype. His interpretation of the second scale as a large ciliate seta is

understandable, since such a scale looks much like a seta when viewed in its lateral aspect as it was probably seen by Folsom. I find no significant differences between hozawai and orientalis and therefore place orientalis as a synonym of hozawai on grounds of priority.

Variation in the number of mucronal teeth and inner dental scales was observed in 2 examples from the same ecological niche as the 2 typical specimens. In studying the Philippine specimens of C. hozawai (as orientalis) Handschin (1930) noted the multidentate form of the mucro but failed to mention the dental scales. In 1948, Delamare-Deboutteville erected the genus Serroderus primarily on the basis of the 2 or 3 inner dental scales. Christiansen (1957) commented that this character did not seem to be of generic value and placed Serroderus as a subgenus of Cyphoderus. In C. hozawai, the existing variation in the mucro and dental scales may be a form of sexual dimorphism. It must be noted that in Cyphoderus, as in many other genera, sex determination is extremely difficult due to the absence of external genitalia or representative structures such as a genital field or plate. In C. hozawai, however, if the variation is not a dimorphic one, we have to assume that two distinct species live in close association in the same very specialized niche, an assumption which is hardly tenable. Population studies will be necessary to show whether the existing variation of the mucronal teeth and dental scales is indeed a true form of sexual dimorphism. If it is then Serroderus will have to be redefined and restricted in its scope, or will have to sink as a synonym of Cyphoderus.

Subfamily PARONELLINAE Boerner

1913:320.

The subfamily Paronellinae is similarly in a state of confusion. Most genera are difficult to determine on account of inadequate taxonomic characters used for separation. The group badly needs a basic revision and reevaluation of all the genera.

Two genera of Paronellinae are represented in the Philippines, each containing 1 species.

Key to Philippine Genera

- Mucro 3 to 4 times as long as broad, with 5-7 well-developed teeth; dens without spines; body scales apically pointed.....
.....Aphysa Handschin
- Mucro about as long as broad, with 2 teeth; dens with at least 1 row of well-developed spines throughout its length; body scales apically rounded.....Pseudoparonella Handschin

Genus APHYSA Handschin

Aphysa Handschin, 1925:260.

Microphysa Handschin, 1925:257.

Phorophysa Salmon, 1945:71.

Handschinphysa Paclt, 1947:84.

Body scales generally narrow and apically pointed, with thick but few striations; body normal without humps or swellings; dens without spines, sometimes with spine-like ciliate setae; mucro 3 to 4

times as long as broad, with 5-7 well-developed teeth; eyes 8+8; clavate tenent hair well developed.

The generic status of Aphysa has been greatly advanced by Salmon (1957). Aphysa is a synonym of Microphysa but as the name Microphysa is preoccupied in the Mollusca the name Aphysa is a senior synonym and must take precedence over Phorophysa and Handschinphysa. Yosii's concept of Aphysa greatly differs from that of Salmon. The former considers this genus as a junior synonym of Callyntrura Boerner (1906) for unstated reasons (Yosii, 1968). Salmon (1964) considers Callyntrura as a synonym of Paronella Schoett (1893) on the basis of the type species of Paronella. As a result, many species of Callyntrura described by Yosii seem to fall under Aphysa, and not Paronella, on account of the absence of dental spines, the long mucro, and the number of mucronal teeth. Definitely, generic studies involving these species are greatly needed.

APHYSA LONGICORNIS (Oudemans)

Plates XXIX, XXX

Entomobrya longicornis Oudemans, 1890:74, 87, fig. 14. Cotypes: Java, in the Swedish Museum of Natural History, Stockholm, Sweden (not seen).

Paronella longicornis, Schaeffer, 1898:409; Schoett, 1903:X, pl. I, figs. 21-23, pl. II, fig. 7.

Campylothorax ceylonicus Ritter, 1911:388, figs. 29-31.

Aphysa longicornis, Handschin, 1925:261, figs. 75-78; Handschin, 1926:459; Handschin, 1928:267; Handschin, 1930:421; Denis, 1948:282, fig. 32.

Aphysa dubia Schoett, 1925:121, figs. 4, 25-30.

Paronella (Aphysa) longicornis, Denis, 1936:272, figs. 34-35.

Handschinphysa longicornis, Salmon, 1957:327, pl. XXVIII, figs. 46-52.

DIAGNOSTIC FEATURES:

Antennae 1 1/2 to almost 2 times as long as body; Th II-Abd VI with deep bluish to dark purplish lateral bands; Abd III with a dorsomedian similarly pigmented band not connected to lateral bands; Abd IV with 3 discrete, similarly pigmented irregular patches, a dorsolateral pair and one dorsomedian; posterior margin of Abd IV with a similarly colored narrow dorsal band; body macrochaetae arranged in a fixed pattern (Pl. XXIX-D); mucro with 3 dorsal, 2 apical, 1 outer lateral, and 1 inner lateral teeth, the inner lateral tooth with minute serrations along its length.

GENERAL DESCRIPTION:

Body length 2-3.2 mm. Ground color creamy white with deep bluish to dark purplish pigmentation distributed as follows: antennae entirely pigmented except on proximal areas of Ant I and II; lateral and anterior margins of head with diffused pigmentation, frontal area between antennal bases with a bluish-black spot giving rise on both sides to a dark band terminating at anterior ends of eyepatches; eyes (8+8) on dark eyepatches; lateral bands present on Th II-Abd VI, Abd III dorsally with a median irregular band not joined to lateral bands; Abd IV dorsally and midway with 3 discrete irregular patches, 2 dorsolateral and 1 median; legs light bluish on all segments; ventral tube lightly pigmented. Body densely covered with

light brown, slender, scales. Ant I dorsally with scales; manubrium and dens similarly scaled ventrally. Body oligochaetotic, chaetotaxy shown in Pl. XXIX-D. Antennae about $1\frac{1}{2}$ to almost 2 times as long as body (3 examples); Ant I:II:III:IV \cong 1.1:1.6:1.0:3.3; densely setaceous, with at least 4 outstanding stiff setae on Ant I about 3 times as long as normal ciliate setae; about 4 outstanding stiff setae on Ant II as much as 6 times as long as the rest of the ciliate setae; at least 1 outstanding seta on proximal area of Ant III, twice as long as normal ciliate setae; Ant IV almost $\frac{1}{2}$ as wide as Ant I. Head setaceous dorsally and laterally. Th II:III = 1.5-2:1 (3 examples). Legs densely setaceous; trochanteral organ consisting of 40-56 spiny setae (4 examples) arranged in a quadrangular pattern; tenent hair as long as unguis; unguis stout, with a pair of well developed lateral teeth, a pair of inner teeth at proximal $\frac{1}{3}$, and an inner tooth at distal $\frac{1}{3}$; unguiculus strongly truncate, about $\frac{3}{5}$ as long as unguis. Abd III:IV = 1:6 (5 examples). Ventral tube as long as hind femur, anterior surface distally with 3 + 3 stout, ciliate setae, posterior surface with all setae smooth. Man.:dens: mucro = 6.5:11.2:1.0 (1 example); manubrium and dens dorsally with about 3-4 rows of ciliate setae; mucro stout, 3 times as long as broad, with 7 well-developed teeth, 3 dorsal, 2 apical, 1 outer lateral and 1 inner lateral, the inner lateral tooth with about 6-7 minute serrations; dens dorsally with an apical scale-like membranous swelling present only in the male. Male genital field well-developed, genital orifice surrounded by small lobes and 15 weak setae, the basal pair of setae being the longest (1 example).

MATERIAL EXAMINED:

10 examples, Mudspring Area, Mt. Maquiling, Luzon, decaying leaves near water source, 3-VII-66 (Coll. 90); 3 examples, same locality, decaying leaves on ground of forest, 3-VII-66 (Coll. 96); 1 example, same locality and habitat, 13-III-66 (Coll. 37); 1 example, same locality, decaying leaves and soil, 20-XII-66 (Coll. 163); 3 examples, College, Laguna, banks of Molawin Creek, decaying leaves, 30-II-67 (Coll. 166, D. Llamas and M. Pescador).

DISTRIBUTION:

Java; Bismarck Archipelago; Sumatra; Ceylon; Philippines; North India; Indo-China.

DISCUSSION:

The material at hand fits Aphysa longicornis based on the original description as well as the redescription by Salmon (1957). However, the body chaetotaxy, the trochanteral organ, and the male genital field have not been described until now. The body color pattern of this species seems to be fairly constant as far as Philippine examples are concerned. Also, the body chaetotaxy is specific, as it appears to be in other species. A. longicornis has been adequately studied previously and, with the addition of characters in the present redescription, is now easily distinguished from all other known species of the genus.

Genus PSEUDOPARONELLA Handschin

Pseudoparonella Handschin, 1925:254.

Handschinella Yosii, 1959b:653.

Type species: P. appendiculata (Schoett), Handschin, 1925.

Body scales broad, apically rounded, with extremely minute striations; body without humps or swellings; dens dorsally with at least 1 row of well developed spines throughout its length; mucro small, as long as broad, faintly separate from dens, bidentate; dens usually with 2 long, stout, ciliate apical setae on its inner side; clavate tenent hair well developed.

The genus Handschinella Yosii has been placed as a synonym of Pseudoparonella by Salmon (1964) on the grounds that the femoral organ used by Yosii as diagnostic for his genus appears to be only of specific and not generic value.

Pseudoparonella contains about 10 species, all of which are confined to the Australian and Oriental regions. A single species occurs in the Philippines.

PSEUDOPARONELLA SETIGERA (Boerner)

Plates XXXI, XXXII

Paronella setigera Boerner, 1906:23:178. Type: Java, unknown.

Pseudoparonella setigera, Handschin, 1925:254, figs. 53-58; Handschin, 1926:237; Handschin, 1928:267.

Pseudoparonella orientalis Handschin, 1930:417, pl. 3, figs. 28-34.

Type: Philippines, lost. (New synonymy.)

Handschinella setigera, Yosii, 1959:53, fig. 31.

DIAGNOSTIC FEATURES:

Body achaetotic, usually with narrow lateral purplish bands on Th II and III; proximal areas of precoxae and coxae purplish; femoral organ on the hind leg consisting of small ciliate, spoon-shaped setae; mucro of two forms, 1 with the teeth curved vertically and anteriorly, the other with the teeth not curved and directed posteriorly; dens with a dorsal row of simple spines.

GENERAL DESCRIPTION:

Body length 2.0-2.6 mm. Ground color creamy white to brownish yellow, with purplish coloration distributed as follows: antennae deeply pigmented on distal areas of first three segments, entirely so on fourth; head with an anterior transverse band terminating at posterior side of antennae bases and at anterior ends of eyepatches, the band having a darker median patch; a small patch on each posterolateral part of head; eyes (8 + 8) on deeply pigmented eyepatches; lateral margins of Th II and III banded, proximal areas of precoxae and coxae similarly pigmented; distal area of femora and proximal half of tibiotalarsi lightly tinged only; Abd IV ventrolaterally light purplish. Body achaetotic, except for head and posterior areas of Abd IV-VI; densely covered with apically rounded light brownish, minutely striate scales; antennae scaled up to proximal 1/10 of Ant IV; legs densely scaled on all segments; ventral tube, dorsal and ventral surfaces of manubrium, and venter of dens similarly bearing scales. Antennae remarkably long, at least 4 times as long as head; Ant:head + body = 1:1; Ant I:II:III:IV = 1:1.4:1.4:2.8 (1 example); Ant I twice

as wide as Ant IV; stiff, finely ciliate setae from $1\frac{1}{2}$ to 3 times as long as normal ciliate setae, numbering at least 3 on Ant I, 5-6 on Ant II, and 1 on Ant III (3 examples); fine erect setae occurring at regular intervals on Ant I to Ant IV; fine curving setae absent; Ant II sense organ composed of a slender rod surrounded by normal ciliate setae, situated subapically; Ant III sense organ consisting of 2 similar sensory rods in a shallow groove, a minute blunt spine situated near the inner rod; Ant IV annulate, each annulation lined with a whorl of uniformly short, ciliate setae, apical end-bulb absent. Th II strongly overlapping posterior margin of head; Th II:III = 2.3:1 (3 examples). Legs setaceous; trochanteral organ composed of about 76 minute spiny setae, arranged in a triangular pattern (2 examples); femoral organ on hindleg consisting of 3 rows of specialized spoon-shaped, ciliate setae (2 examples); tenent hair strongly clavate, as long as unguis; unguis with a pair of lateral teeth, as well as 4 inner teeth, a pair at about proximal $\frac{1}{4}$, 1 middle, and 1 at distal $\frac{1}{5}$; unguiculus strongly truncate, about $\frac{3}{4}$ as long as unguis. Abd III:IV = 1:9 (1 example). Lateral flap of ventral tube with 12 + 12 ciliate and 3 + 3 smooth setae (1 example). Setae sensuales on Abd II-IV arranged as 2 + 2, 3 + 3, 2 + 2, respectively, each seta sensualis accompanied by medially expanded accessory microchaetae and several simple pointed microchaetae. Man.:dens:mucro = 30:33:1 (1 example); manubrium dorsally setaceous; dens dorsally with an outer row of strong spiny setae throughout its length, at least 5 rows of ciliate unequal setae, and an inner row of about 50 strong spines paralleled

by a row of minute spiny setae; dens apically with 2 stout, strongly ciliate setae twice as long as other dental setae and extending well beyond mucro; mucro small, indistinctly separate from dens, concealed by large dental apical setae at inner lateral view, bidentate, the teeth either curved upwards and anteriorly or simply straight and directed posteriorly.

MATERIAL EXAMINED:

3 examples, Mt. Maquiling, Luzon (from C. F. Baker collection in the Museum of Natural History at Basel, Switzerland); 1 example, College, Laguna, decaying leaves atop roof of shed, 20-V-65 (Coll. 3); 1 example, same locality, pile of decaying leaves, twigs, and humus soil, 30-I-66 (Coll. 5); 6 examples, Mudspring Area, Mt. Maquiling, decaying leaves from ground of forest, 13-III-66 (Coll. 37); 1 example, same locality and habitat, 3-VII-66 (Coll. 96); 1 example, College, Laguna, banks of Molawin Creek, decaying leaves, 30-II-67 (Coll. 166, D. Llamas and M. Pescador); 4 examples, Tuntungin, College, Laguna, decaying coconut husks, 6-XI-66 (Coll. 154).

DISTRIBUTION:

Java; Sumatra; Philippines; Malaya.

DISCUSSION:

The Philippine material agrees well with P. setigera; the determination was confirmed by Yosii. Boerner's original description mentioned the presence of lateral bands on Th II and III, and purplish coloration at least on the middle and hind precoxae and coxae. In redescribing the same species, Handschin (1925) noted the absence

of coloration on the coxae and precoxae from the Javan examples. The absence of pigmentation was probably caused by decolorization in alcohol; this has been observed in some of my specimens which have been in alcohol for some time. In studying this species it is essential to examine immediately the pigmentation of freshly collected specimens. In this connection, Handschin described Pseudoparonella orientalis as distinct from setigera in the absence of lateral purplish bands on Th II and III, and their presence only on the precoxae and coxae. The separation does not seem valid because some of my specimens do not exhibit the lateral bands and others do. The fact that both types of specimens belong to one collection sample suggests that decolorization could have occurred during preservation. Hence I am considering orientalis as identical to setigera, and hereby place it as a junior synonym.

CONCLUSIONS

The known geographical distribution of Philippine Collembola (Table I) is basically Oriental in origin. However, one species is cosmopolitan and several others extend to the Palaearctic and Australian regions. For Ceratrimeria, such a widespread distribution is attributed to continental displacement. This explanation may not hold true for other Philippine species extending to regions other than Oriental, since most of those known today inhabit the soil or soil surface on lowland areas near human habitation. In such habitats, the possibility of their being transported by man is great. Potted plants, plant cuttings such as sugar cane, and other similar materials

Table I. Geographical distribution of Philippine Collembola in neighboring areas.

Species	Cosmopolitan	Sumatra	Java	Malaya	Singapore	Annam	Indo-China	Ceylon	India	Formosa	Japan	Marcus Is.	Lombok	New Guinea	Marquesas and Society Is.	Hawaii	Australia	New Caledonia	Bismarck Arch.
<u>Ceratrimeria maxima</u>		X	X											X			X		
<u>C. pulchella*</u>																			
<u>Neanura hirtella</u>			X		X		X	X							X		X		
<u>N. bakeri*</u>																			
<u>N. perfusa</u>						X	X												
<u>N. reducta*</u>																			
<u>Xenylla sensilis</u>																	X		
<u>Folsomides exiguus</u>				X												X	X		
<u>Isotomurus balteatus</u>	X																		
<u>Isotomina lombokensis</u>													X						
<u>Parisotoma canituda</u>				X															
<u>Entomobrya proxima</u>	X																		
<u>Acanthurella lepidornata*</u>																			
<u>Lepidocyrtus brunneus*</u>																			
<u>L. parvidentatus</u>														X					X
<u>L. coeruleocinctus*</u>																			
<u>L. indicus</u>								X											
<u>L. vestitus*</u>																			
<u>Alloscopus tenuicornis</u>			X																
<u>A. tetracanthus</u>			X	X															
<u>Seira terrestris</u>											X					X			
<u>S. schaefferi</u>			X					X					X						
<u>Cyphoderus javanus</u>			X	X					X	X									
<u>C. hozawai</u>	X									X									
<u>Aphysa longicornis</u>	X	X				X	X	X											X
<u>Pseudoparonella setigera</u>	X	X	X														X		

* - Restricted to the Philippines.

may serve as conveyances for these soil- and plant-dwelling species. Also, through man's commercial activities involving agricultural and forest products such as lumber exported abroad, certain species can be introduced to other geographical areas. Such means of dispersion have brought about problems in interpreting the distribution of species. Careful investigation of habitats of the species involved may help explain the existing distribution data.

Most Collembola studied inhabit decaying leaves and other decomposing plant materials, grass composts being excellent collecting sites. Several other species had their own peculiar habitats. Soil inhabitants as exemplified by Folsomides exiguus Folsom are easily recognized by the absence or reduced number of eyes and the loss of body pigmentation (Christiansen, 1964). Examples of species inhabiting dark places are Alloscopus tetracanthus Boerner and Cyphoderus hozawai Kinoshita, both termitophiles, and Cyphoderus javanus Boerner, a myrmecophile. Equally interesting is Seira terrestris (Folsom) which is found beneath leaf sheaths of sugar cane as well as in buildings, especially on kitchen sinks and in comfort rooms. This species is obviously a fungal feeder frequenting moist places conducive to the growth of molds. Seira schaefferi (Schoett) was observed on cultivated plots of sweet potato but has not been observed to feed on the plants. The largest species encountered are Aphysa longicornis (Oudemans) and Pseudoparonella setigera (Boerner), both with well-developed antennae, and primarily forest dwellers at high altitudes in the mountains. They roam the forest floor where abundant decaying plant material prevails.

Lastly, Entomobrya proxima Folsom is a curious inhabitant of areas underneath banana leaf sheaths. So far as has been observed it does not seem to cause any damage to the plants. It probably feeds on decaying organic materials which accumulate between the leaf sheaths. Studies on the habits and life histories of the Philippine species should prove useful to many aspects of Collembola research, including systematics.

Since the present study did not cover Visayas and the greater part of Mindanao, future collections must be concentrated in these areas. With so much of the Philippines still unworked, many more species should be discovered, some of which are probably restricted to the country especially in forest and mountainous areas not frequented by man and isolated by geographical barriers.

To a great extent, the taxonomy of many Philippine species of Collembola appears to be more stabilized than it used to be. However, until world generic revisions are undertaken, determinations of certain species such as Folsomides exiguus Folsom, Xenylla sensilis Folsom, and species of Lepidocyrtus cannot be made with great certainty. At present, a very few minute characters separate these species from forms found in other zoogeographical regions.

Many genera and families of Collembola are still in a highly confused state and need to be redefined. More and better diagnostic characters together with the nature and extent of their variations must be discovered and thoroughly studied.

SUMMARY

This study of Philippine Collembola covers the suborders Arthropleona and Neoarthropleona, and includes 26 species, 10 of which are new records for the Philippines. Of the 10 species, Neanura reducta is described as new. The Philippine fauna is basically Oriental in distribution with some species extending to the Australian and Palaearctic regions, one species being cosmopolitan. The present records indicate that 7 species are restricted to the Philippines.

Each species discussed is provided with a complete literature citation, diagnosis, general description, distribution and habitat records, remarks on its affinities and taxonomic characters, and illustrations. Keys, diagnoses, and discussion of taxonomic characters are provided for each category whenever possible. Neotypes have been designated for Ceratrimeria pulchella Handschin, Lepidocyrtus (Acrocyrtus) brunneus (Handschin), L. (Ascocyrtus) coeruleocinctus Handschin, and L. (s. str.) vestitus Handschin. Homoeotypes were designated for Xenylla sensilis Folsom, Folsomides exiguus Folsom, Parisotoma canituda Salmon, Entomobrya proxima, and Seira terrestris (Folsom).

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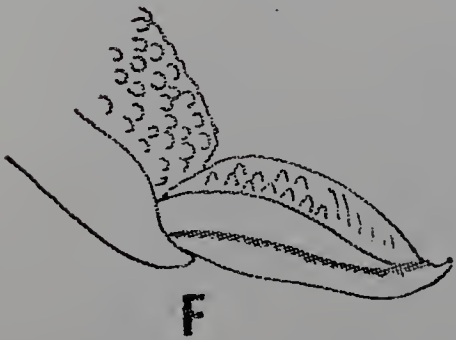
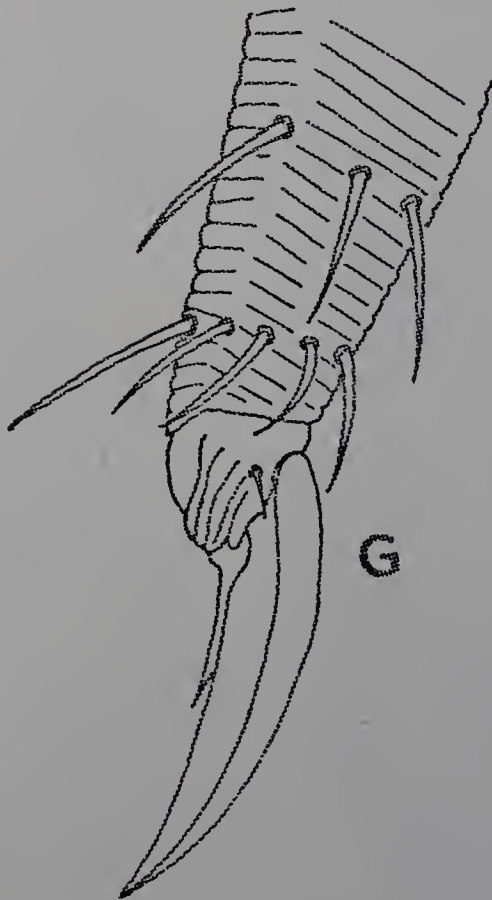
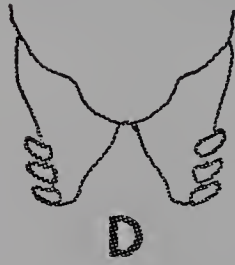
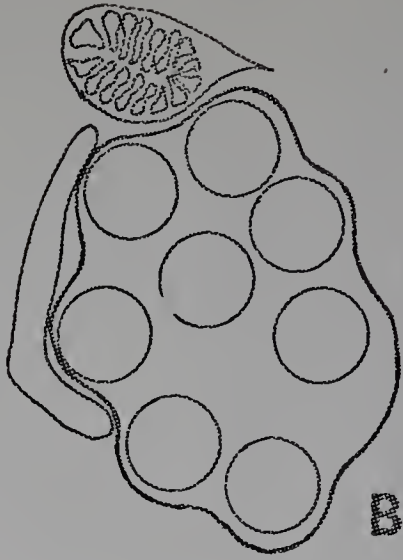
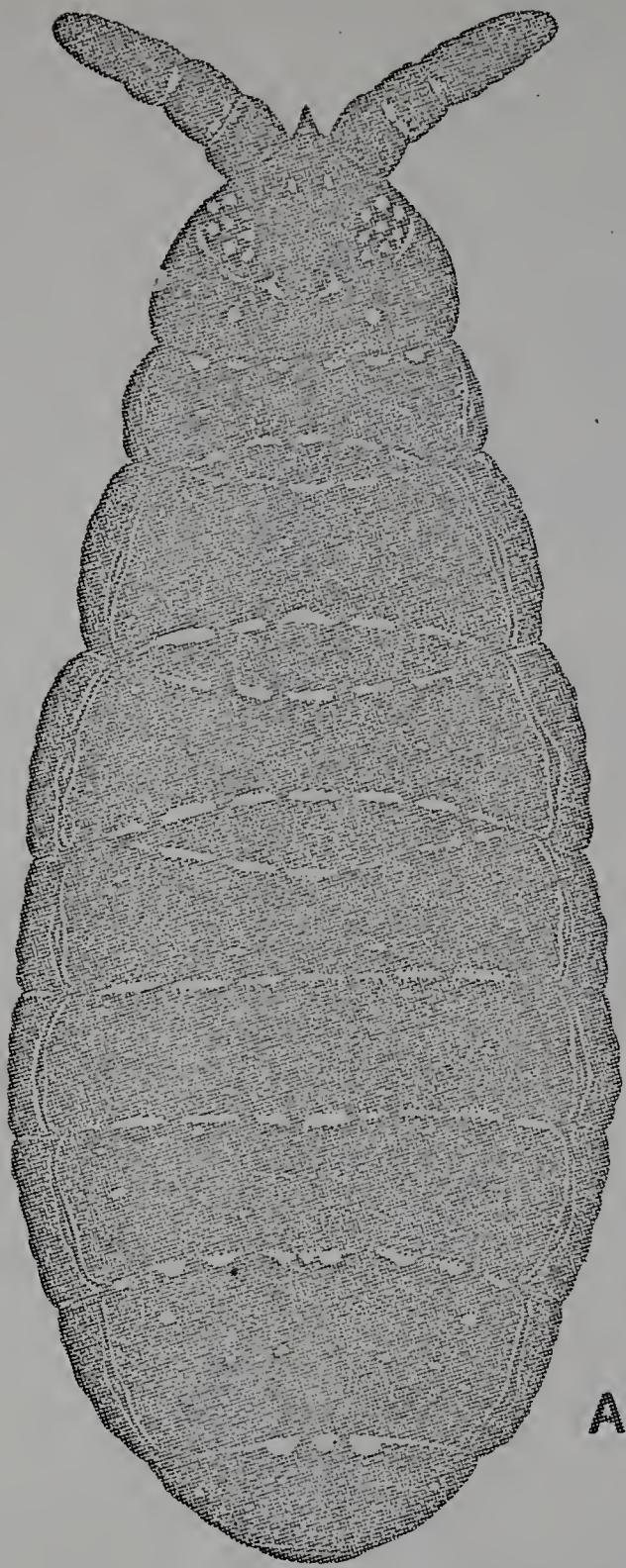
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PLATE I

Ceratrimeria maxima (Schoett)

- A. Habitus, 41 x. B. Postantennal organ and eyepatch showing eyes, left side. C. Left mandible. D. Tenu-
culum, anterior aspect. E. Maxilla. F. Mucro and tip
of dens, dorso lateral aspect. G. Hind unguis and apex
of tibiotarsus, lateral aspect. H. Unguis, posterior
aspect, showing lateral teeth.



I

B

C

D

E

A

G

F

H

PLATE II

Ceratrimeria pulchella Handschin

- A. Antenna III sense organ, lateral aspect. B. Eyepatch and outline of postantennal organ, left aspect.
- C. Unguis and apex of tibiotalrus, lateral aspect.
- D. Unguis, posterior aspect, showing lateral teeth.
- E. Mucro and apex of dens, dorso-lateral aspect.

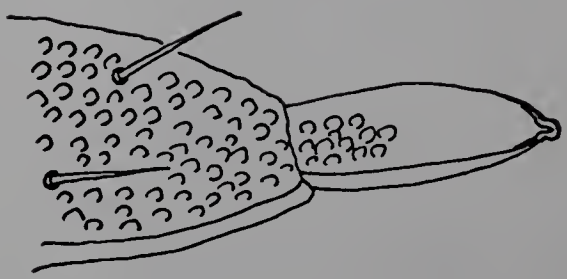
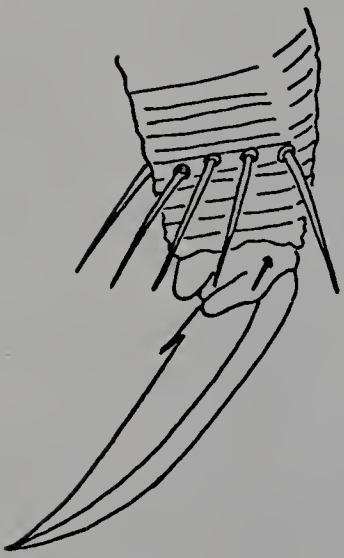
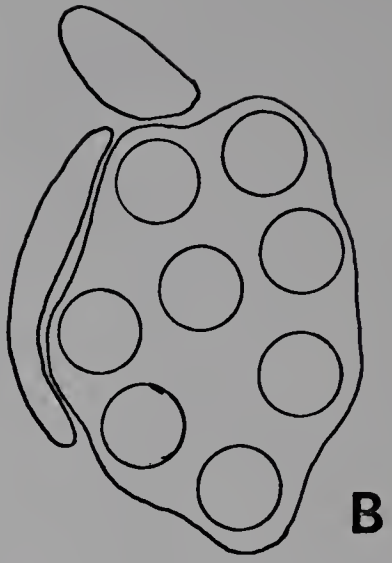


PLATE III

Neanura hirtella (Boemer)

- A. Habitus, female, 56 x. B. Tip of right antenna, dorsal aspect. C. Right ocular tubercle. D. Left mandible. E. Maxilla. F. Ant III sense organ, lateral aspect.

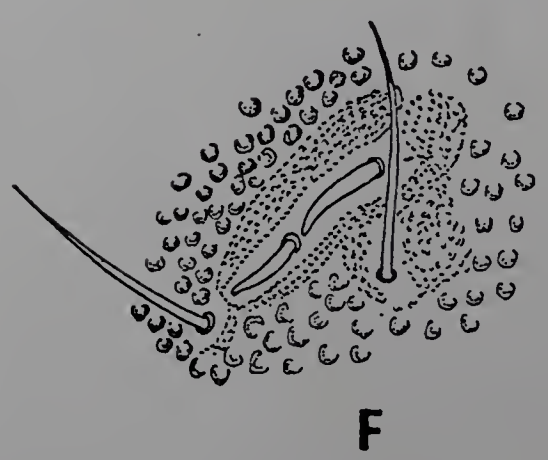
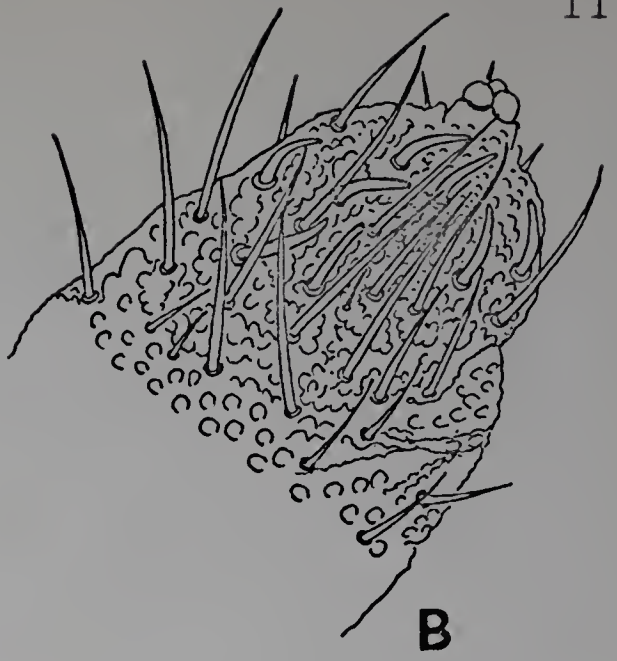
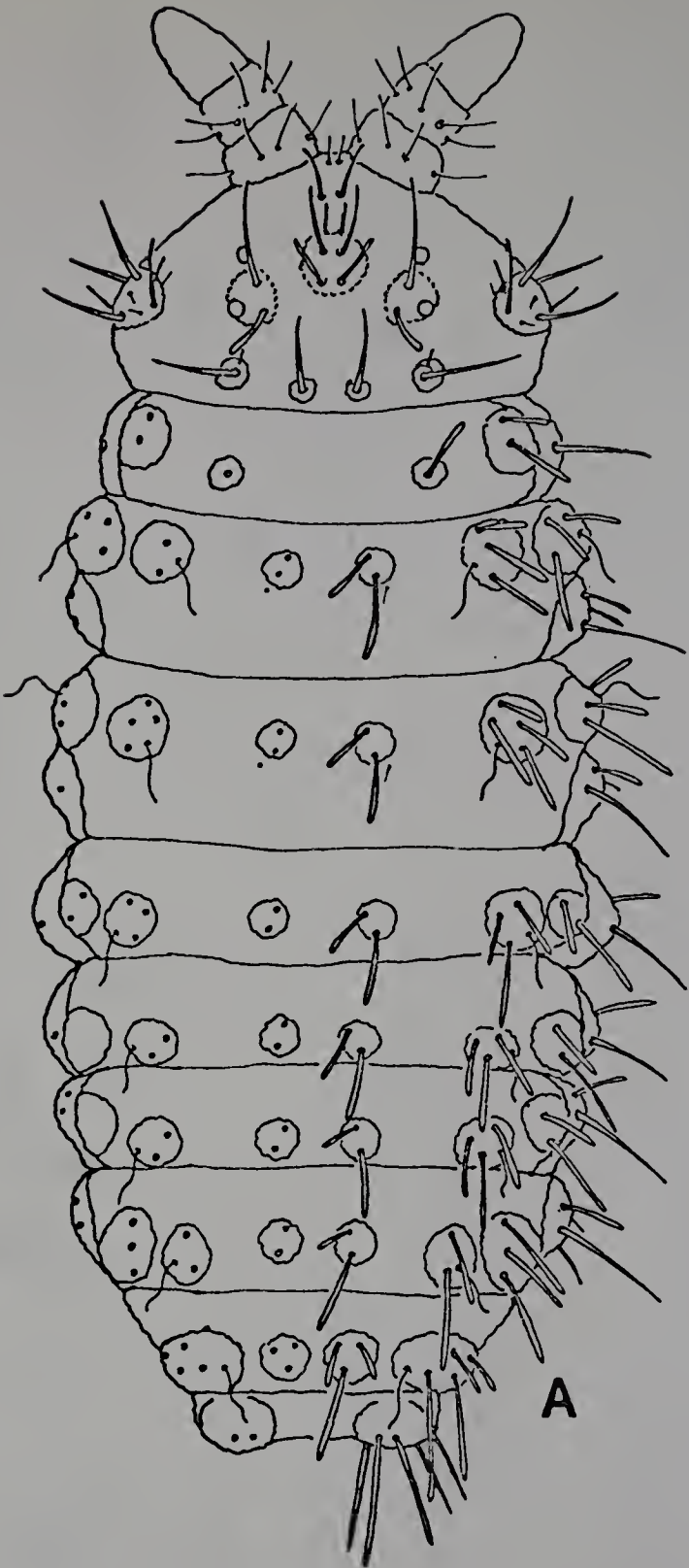


PLATE IV

Mezoura hirtella (Boemer)

- A. Typical body setae showing prominent serrations and blunt tip. B. Right Abd III dorsoexternal tubercle showing characteristic reticulation. C. Unguis and apex of tibiotarsus, lateral aspect. D. Left Abd VI tubercle. E. Male genital plate or field, ventral aspect. F. Female genital field, ventral aspect.

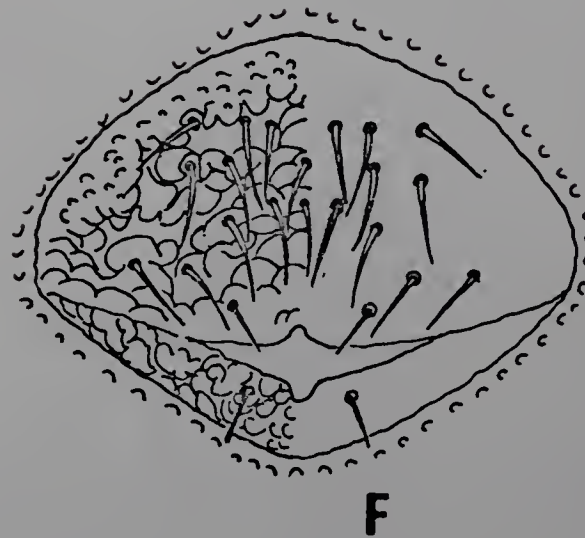
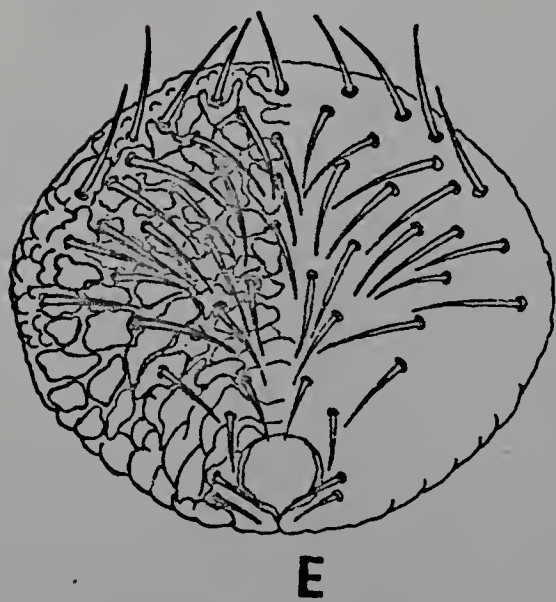
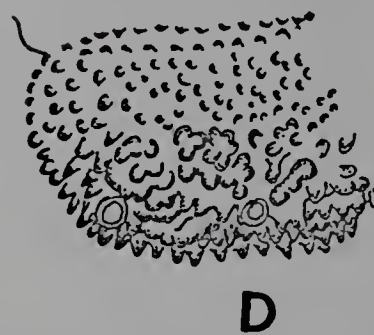
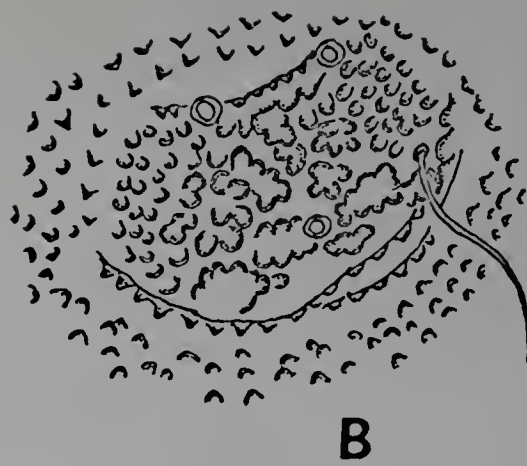
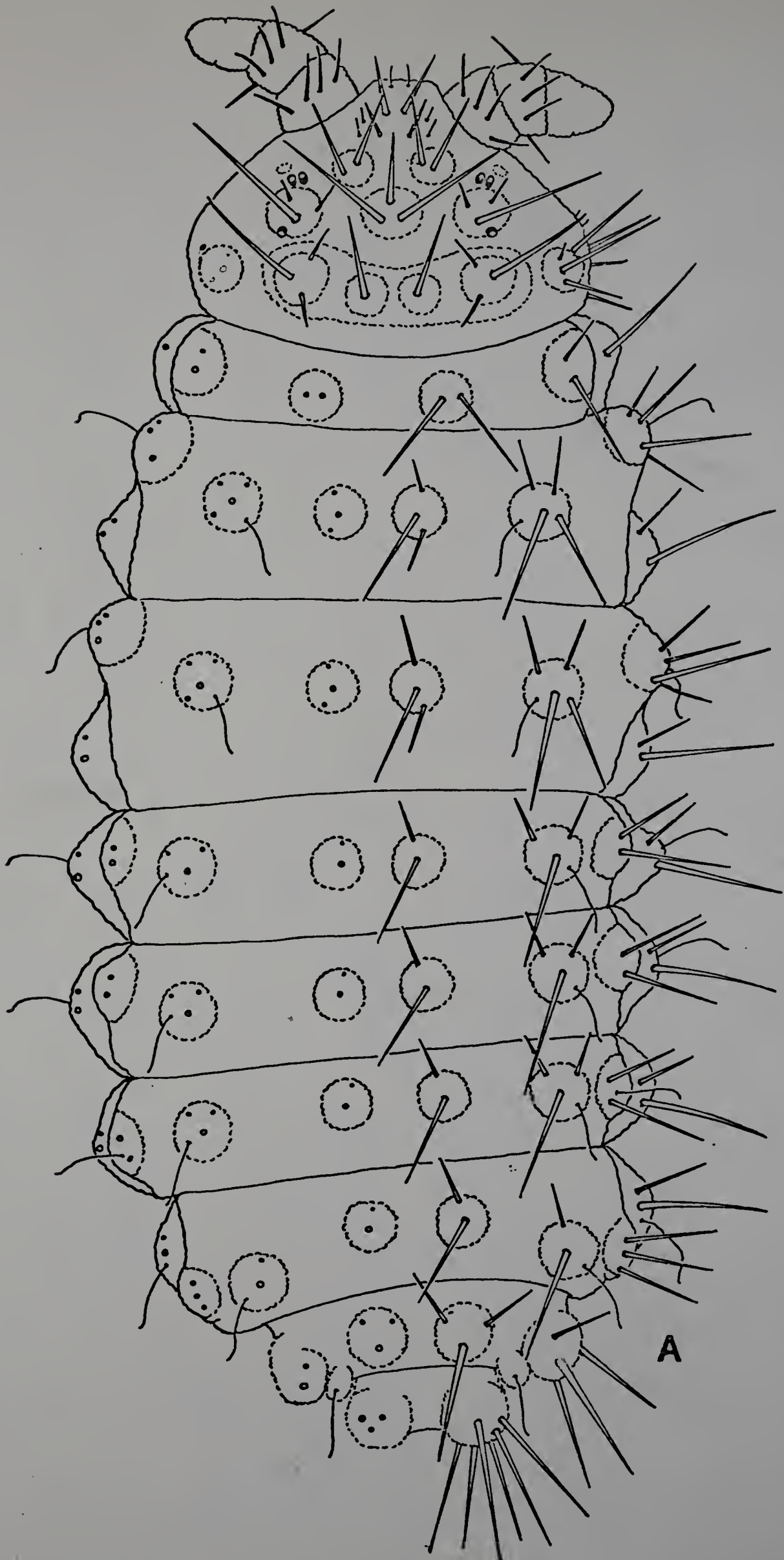


PLATE V

Neanura perfusa (Denis)

A. Habitus, female, 64 x. B. Left mandible. C. Right
maxilla.



B



C

V

A

PLATE VI

Neanura perfusa (Denis)

- A. Tip of left antenna, dorso-lateral aspect, showing Ant III sense organ and Ant IV sensory setae and apical end-bulbs. B. Left ocular tubercle showing granulation and eyes. C. Body setae. D. A body tubercle showing characteristic granulation. E. Unguis and apex of tibiotarsus, lateral aspect. F. Genital field of female, ventral aspect.

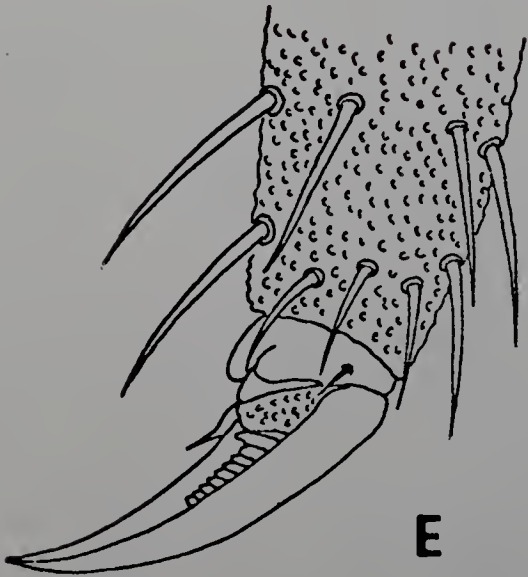
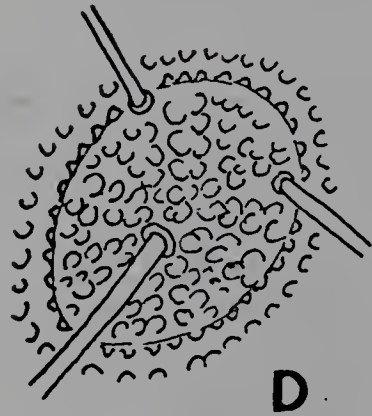
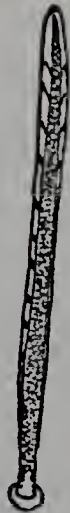
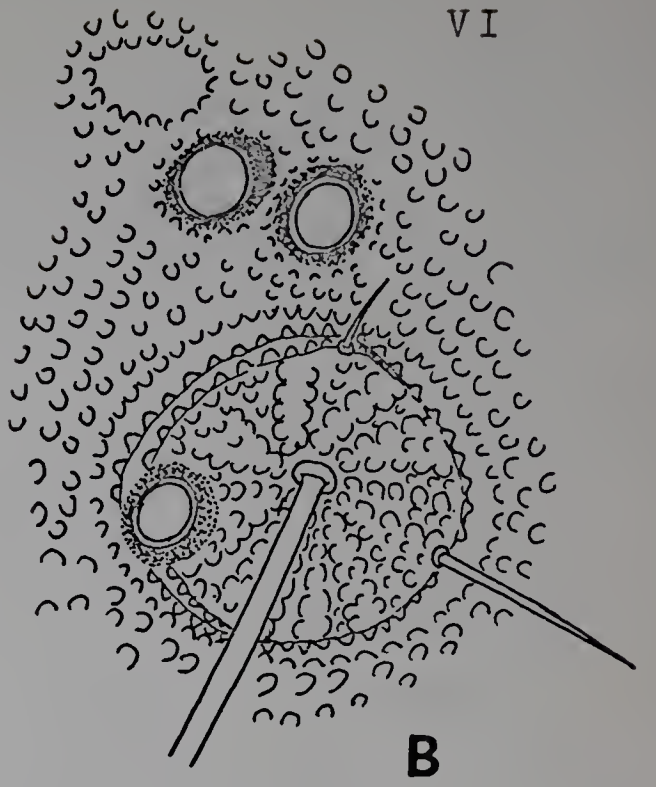
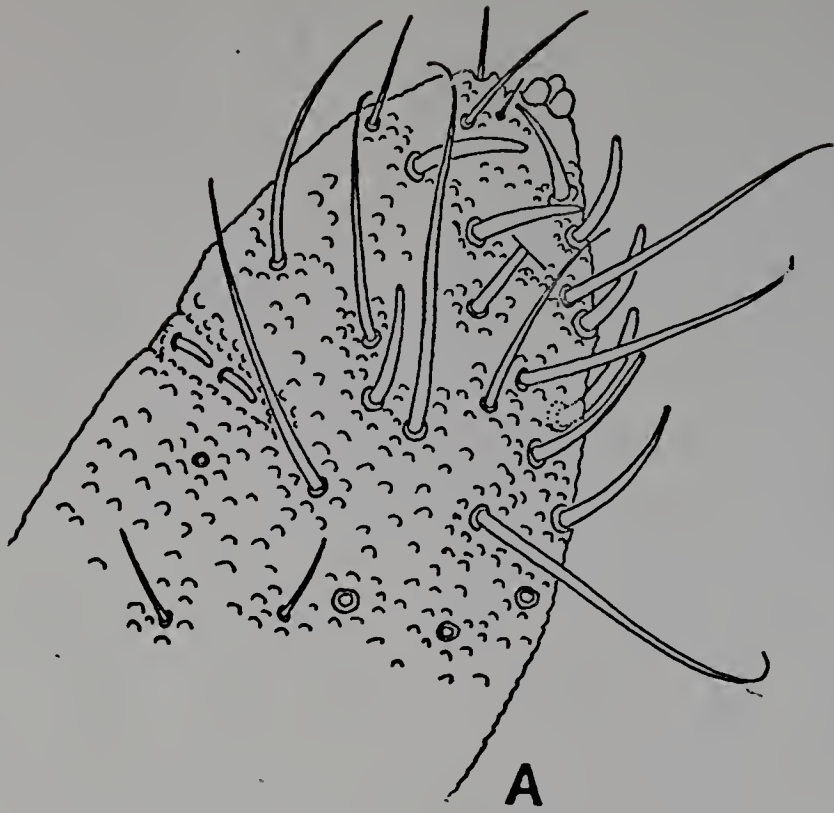
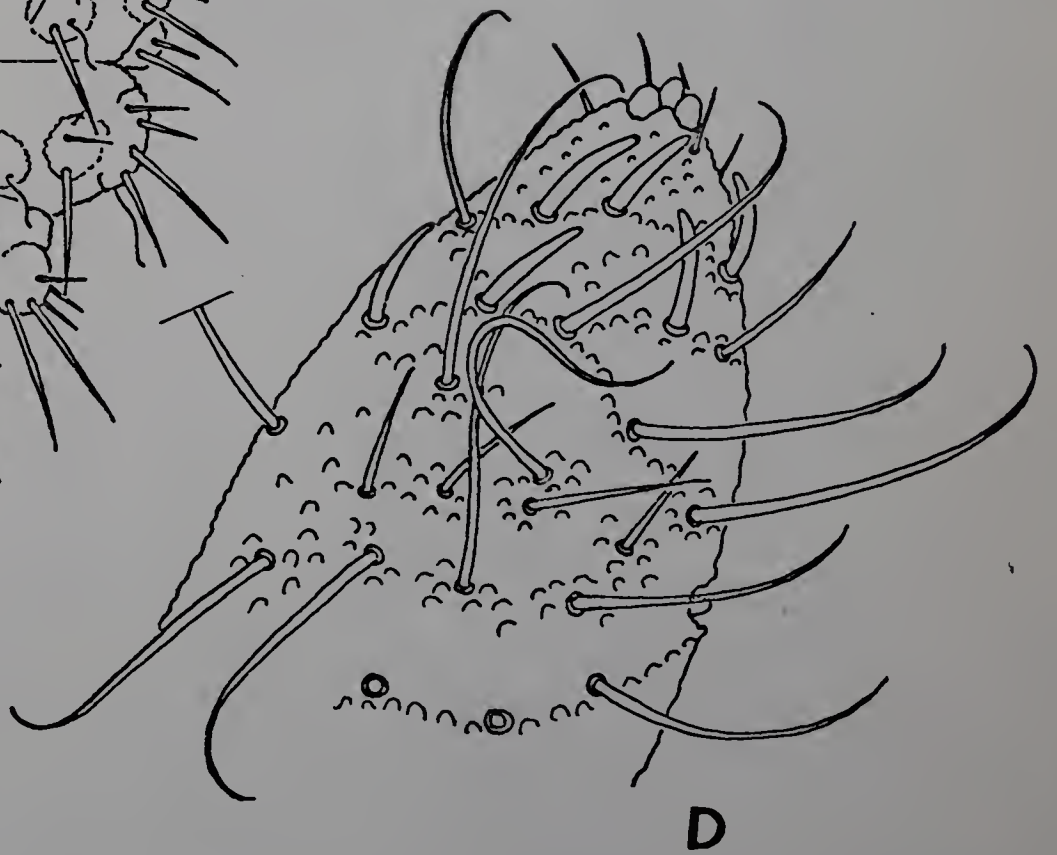
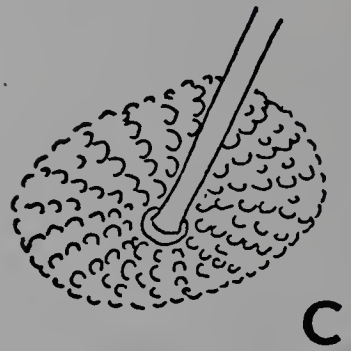
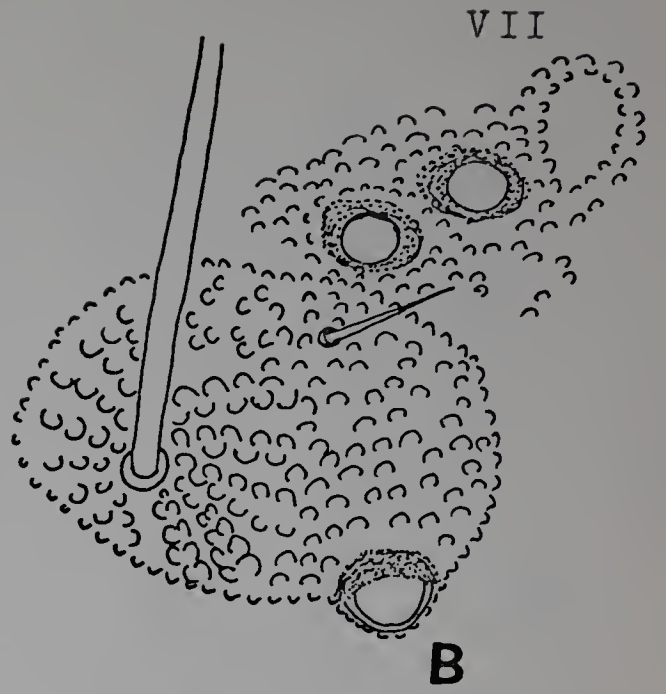
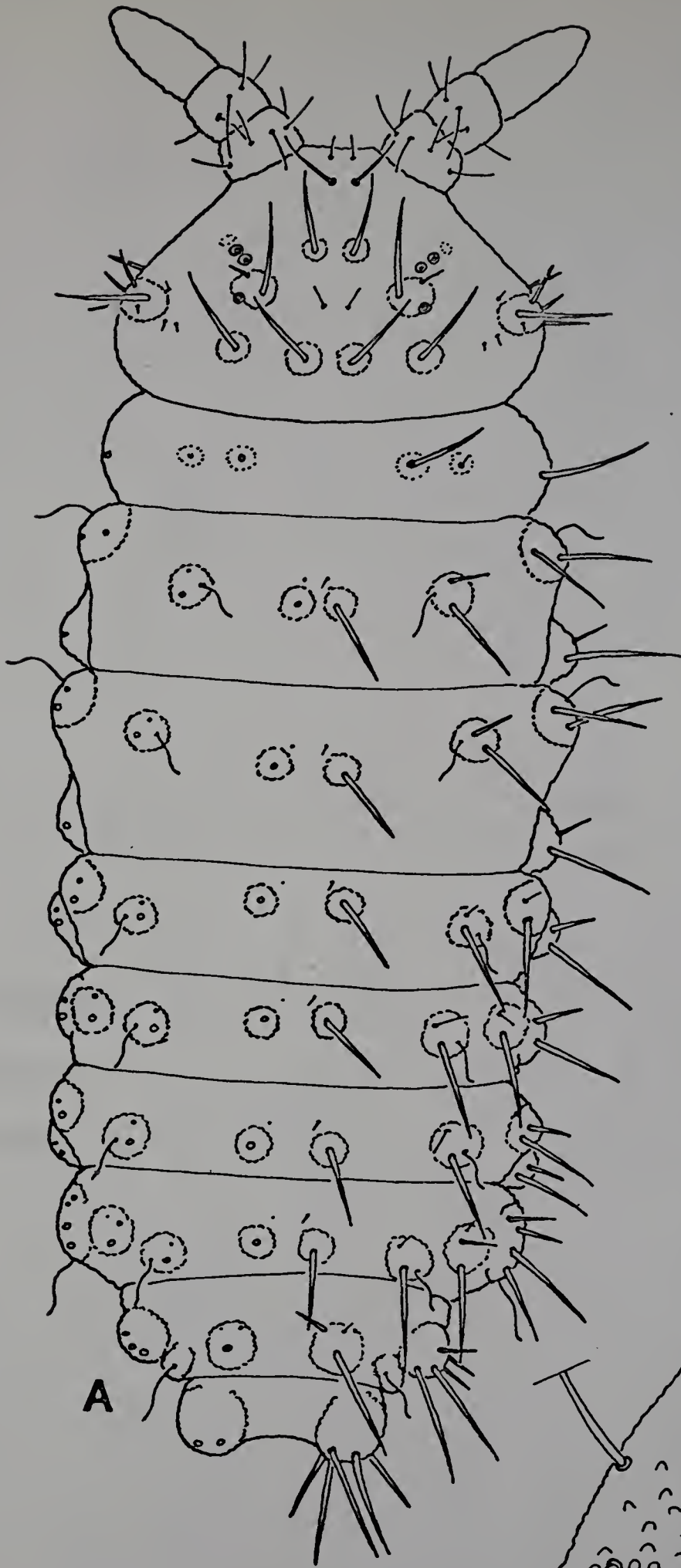


PLATE VII

Neanura reducta new species

- A. Habitus, female, 70 x. B. Right ocular tubercle showing granulation, eyes, and rudimentary postantennal organ. C. A body tubercle showing characteristic granulation. D. Tip of right antenna, dorsal aspect.



A

B

C

D

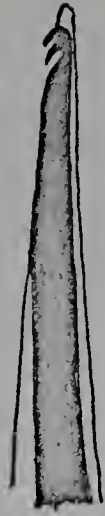
PLATE VIII

Megnura reducta new species

- A. Left mandible. B. Right maxilla. C. Typical body seta showing fine serrations and blunt tip. D. Unguis and apex of tibiotarsus, lateral aspect. E. Male genital field, ventral aspect. F. Female genital field, ventral aspect.



A



B



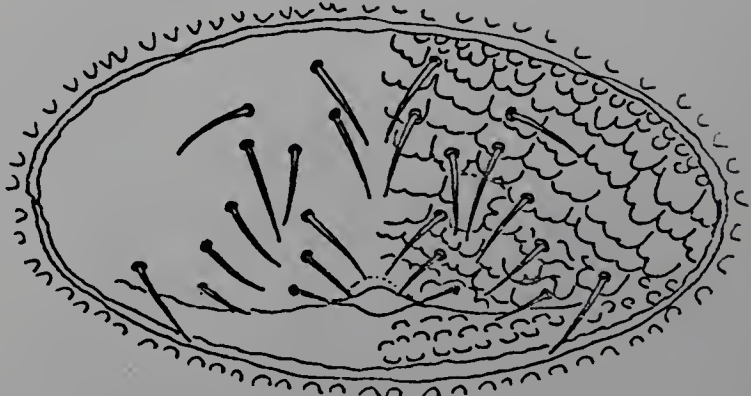
C



D



E



F

PLATE IX

Xenylla sensilis Folsom

- A. Habitus of female, dorsal aspect showing color mottling on head but omitting that on body, 80 x. B. Habitus, female, lateral aspect, color mottling omitted, 73 x. C. Right eyepatch, pigment omitted to show eyes. D. Ant III sense organ, lateral aspect. E. Fore unguis and apex of tibiotarsus, lateral aspect. F. Tip of Ant IV showing blunt sensory setae and apical end-bulb. G. Hind unguis and apex of tibiotarsus, lateral aspect. H. Dens and micro, lateral aspect.

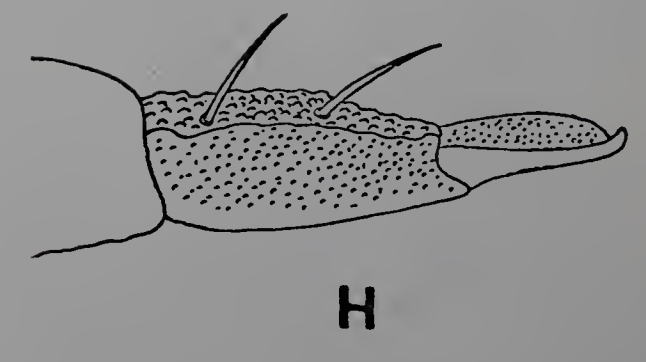
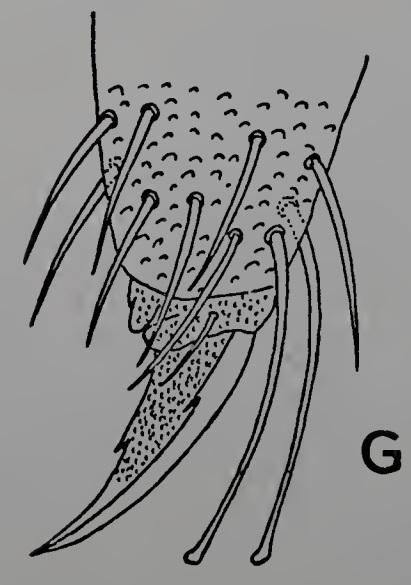
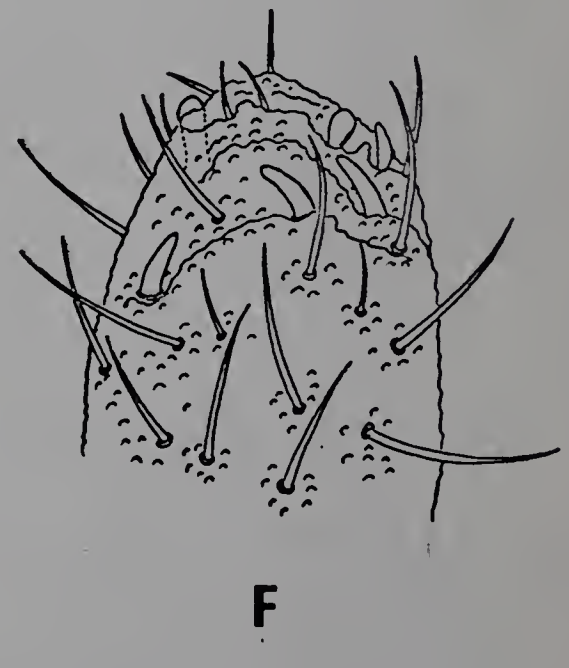
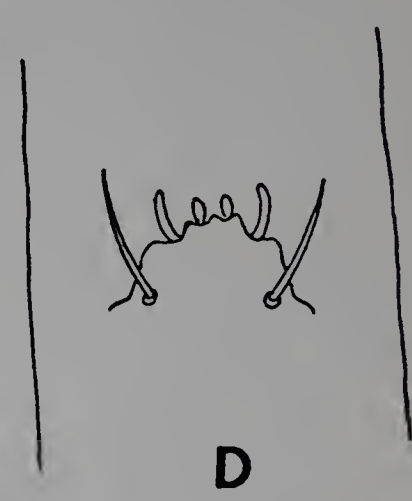
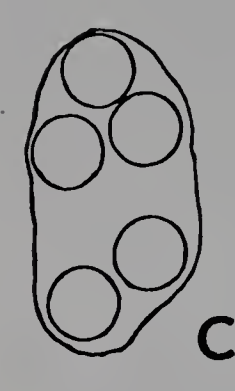
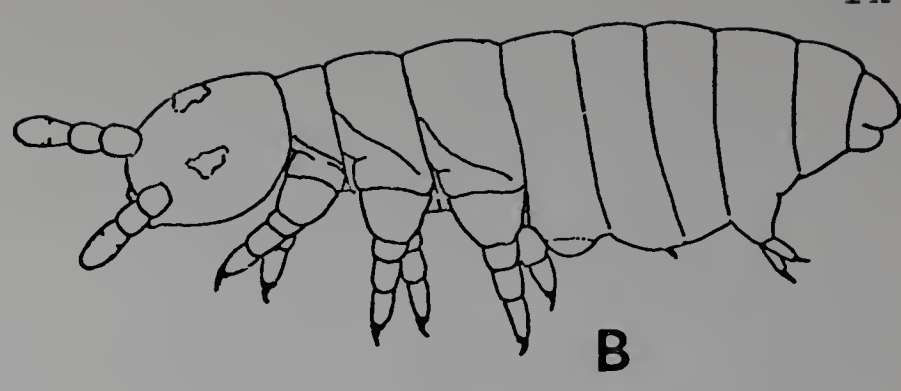
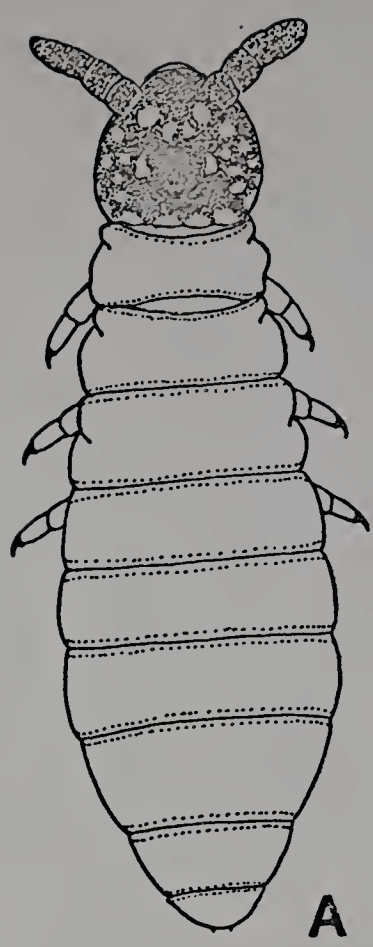


PLATE X

Folsomides exiguus Folsom

- A. Habitus, lateral aspect, color mottling omitted, 132 x.
B. Head showing dorsal chaetotaxy, eyes, and postantennal organs. C. Lateral flap of ventral tube. D. Tena-
culum, anterior aspect. E. Hind unguis and apex of
tibio tarsus, lateral aspect. F. Manubrium and micro-
dens, lateral aspect.

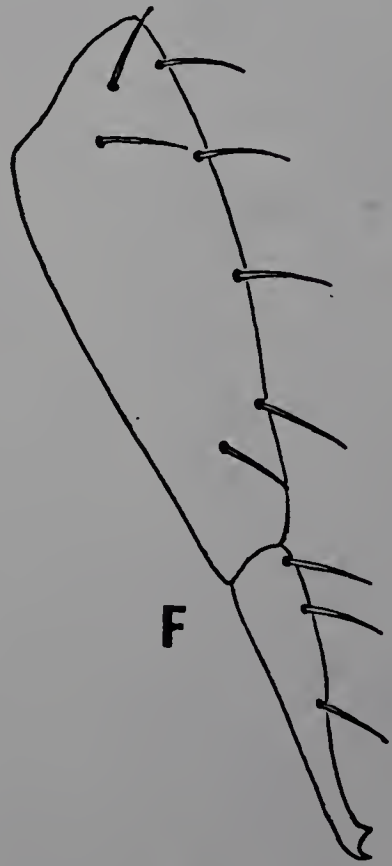
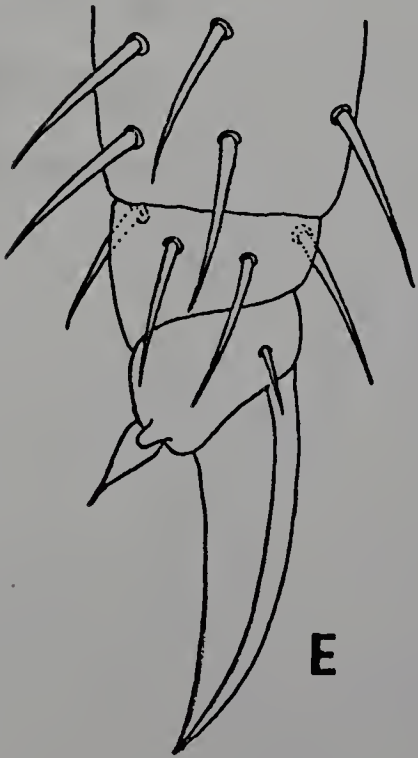
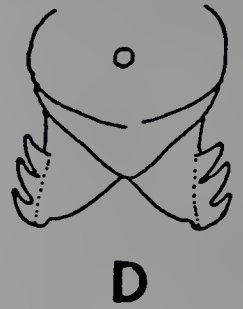
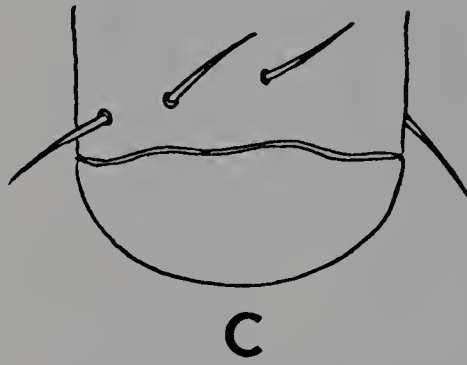
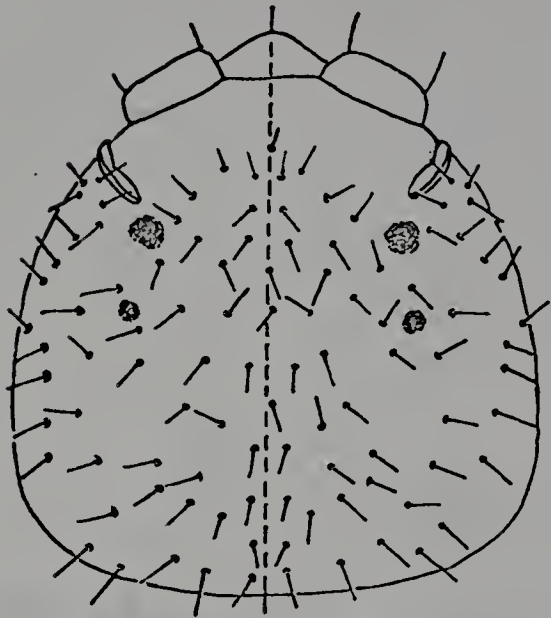
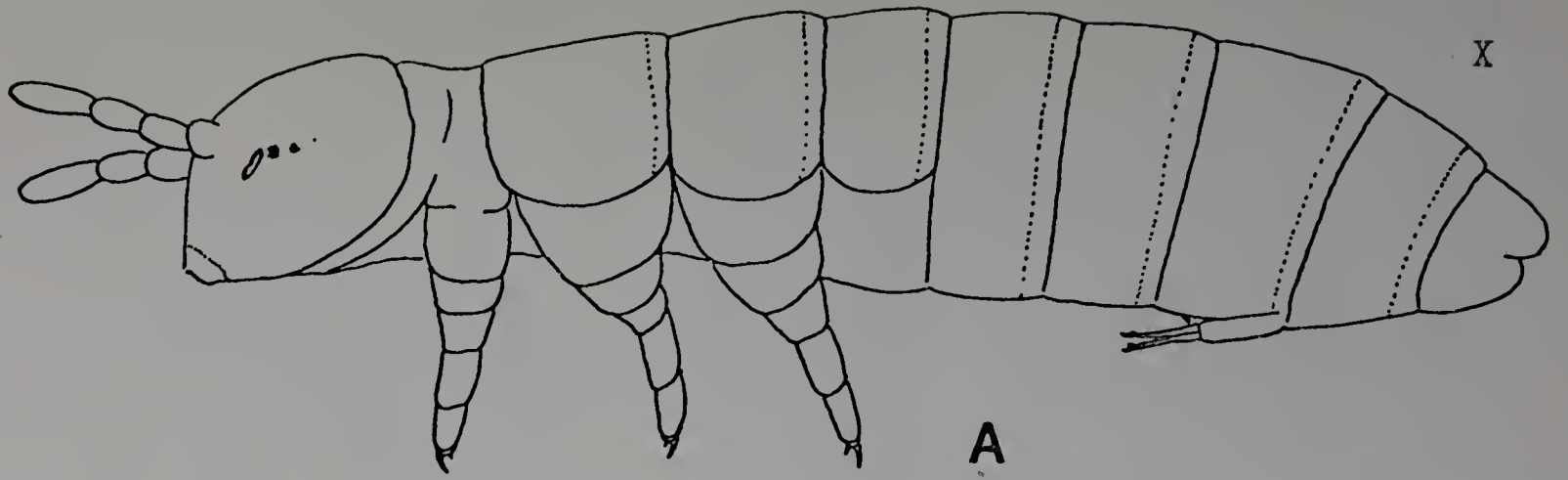


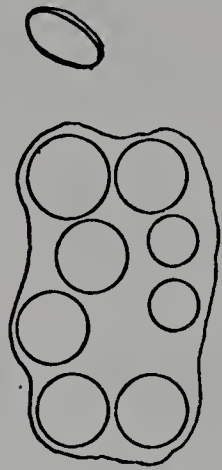
PLATE XI

Iso tomurus balteatus (Reuter)

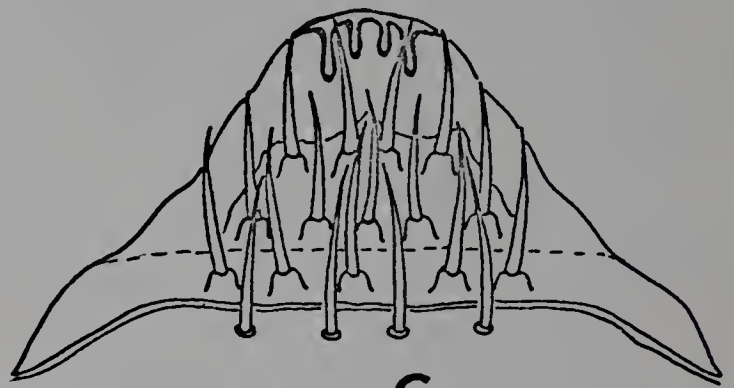
- A. Habitus, lateral aspect with head oriented dorso lateral-ly, 55 x. B. Left eyepatch and postantennal organ.
C. Labrum, dorsal aspect. D. Hind unguis and apex of tibio tarsus, lateral aspect. E. Lateral flap of ventral tube. F. Mucro and apex of dens, lateral aspect.



A



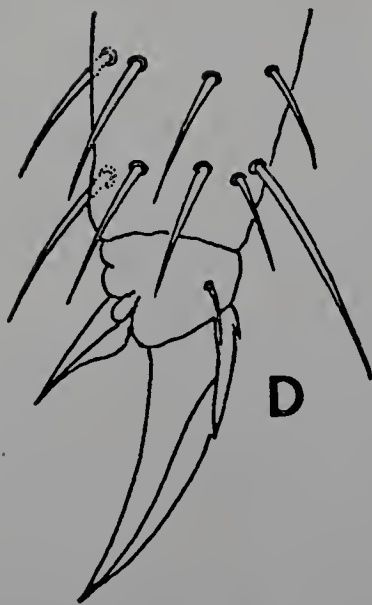
B



C



E



D



F

PLATE XII

Isotomina lombokensis (Schoett)

- A. Habitus, lateral aspect, body color mottling omitted, 79 x. B. Left eyepatch and postantennal organ. C. Hind unguis and apex of tibiotarsus, lateral aspect. D. Dens, ventral aspect. E. Proximal part of left dens, dorsal aspect. F. Mucro and apex of dens, lateral aspect.

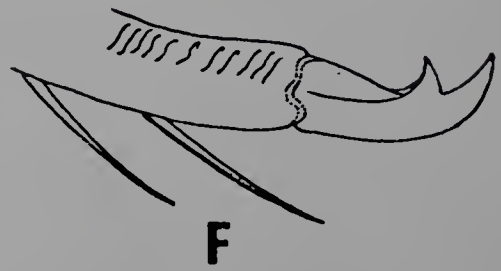
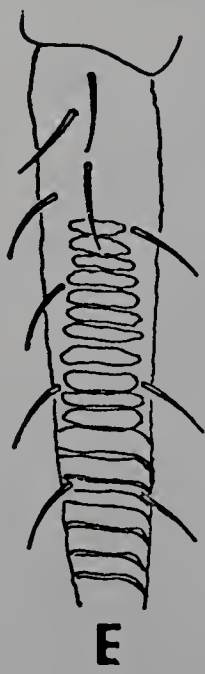
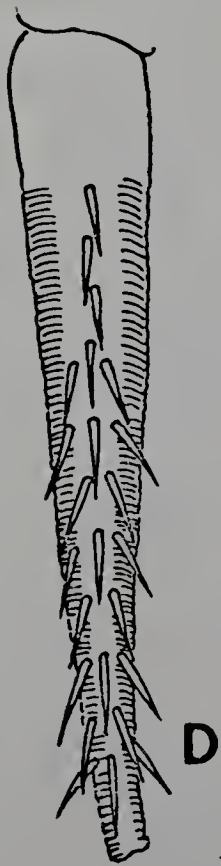
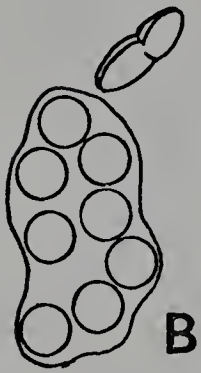
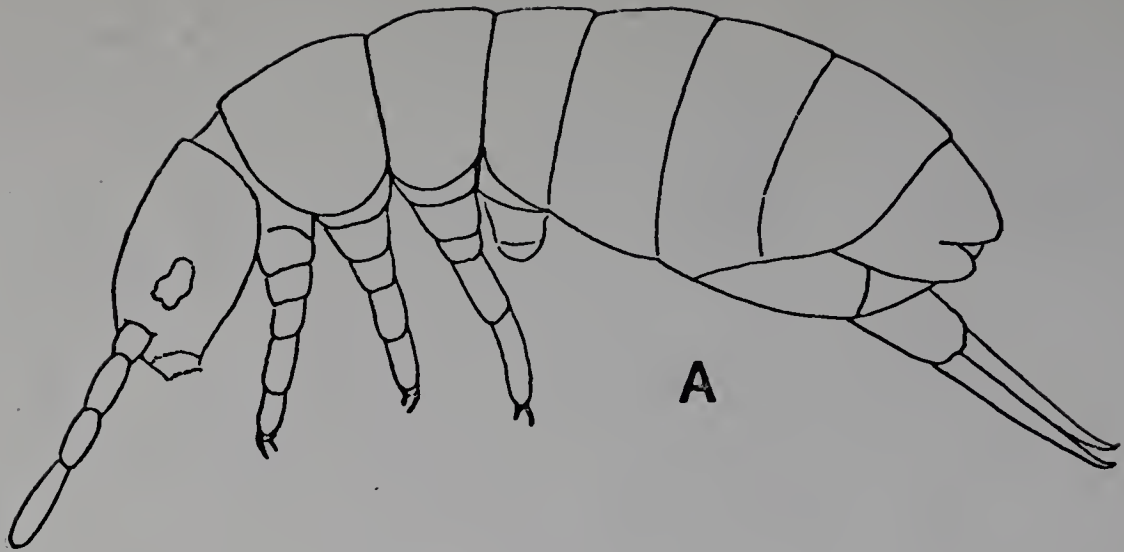


PLATE XIII

Parisotoma cagnituda Salmon

- A. Habitus, dorsal aspect, color mottling not shown, 176 x. B. Head showing dorsal chaetotaxy, eyes, and postantennal organs. C. Abd V, lateral aspect showing chaetotaxy and the club-like pair of sensory setae, drawn from holotype. D. Male genital field and orifice and the pair of anal lobes, ventral aspect. E. Hind unguis and apex of tibiotarsus, lateral aspect. F. Dens and mucro, dorso lateral aspect.

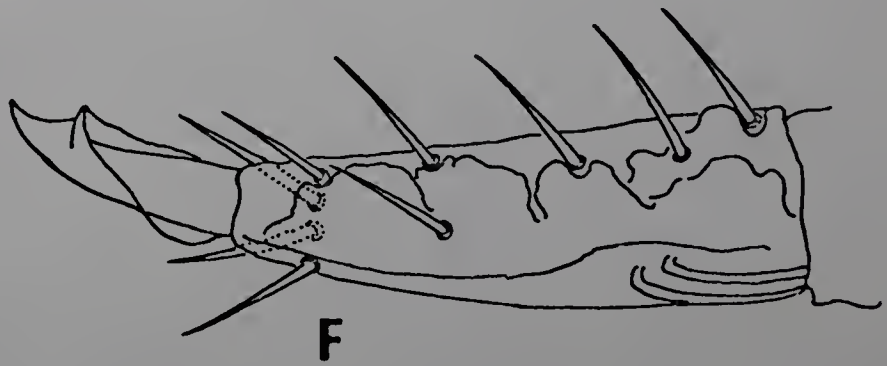
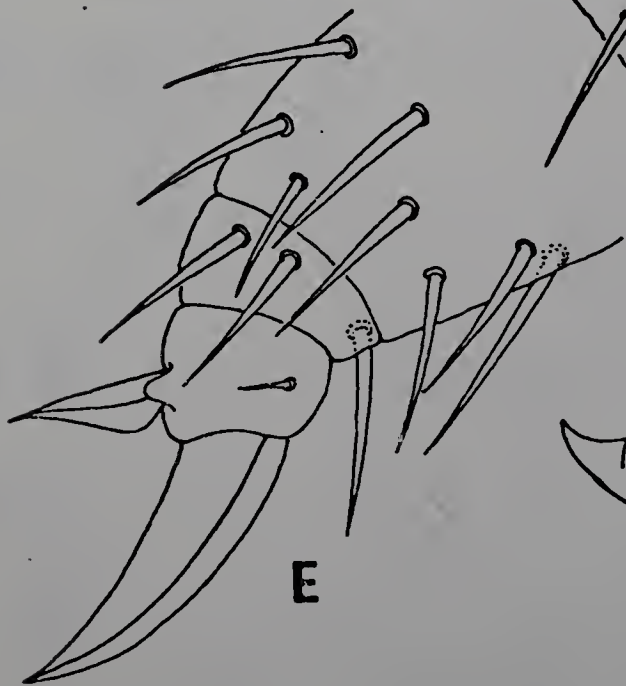
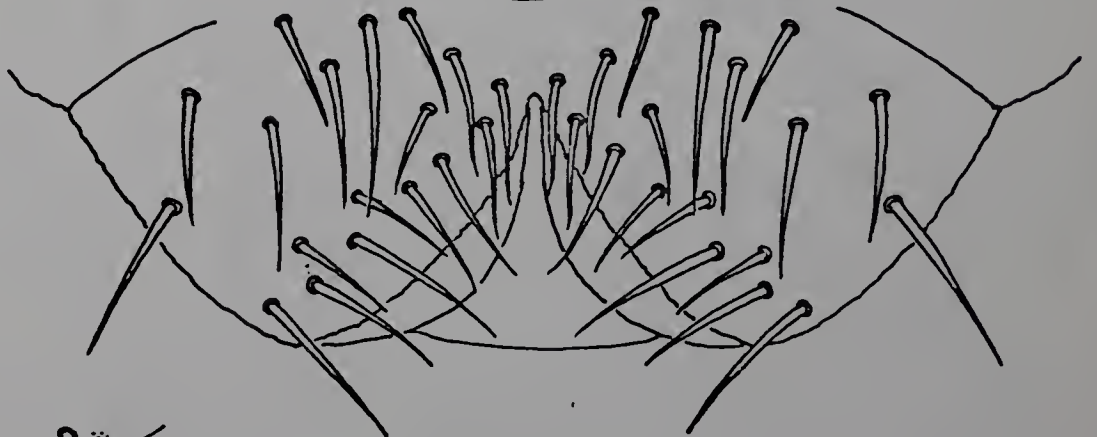
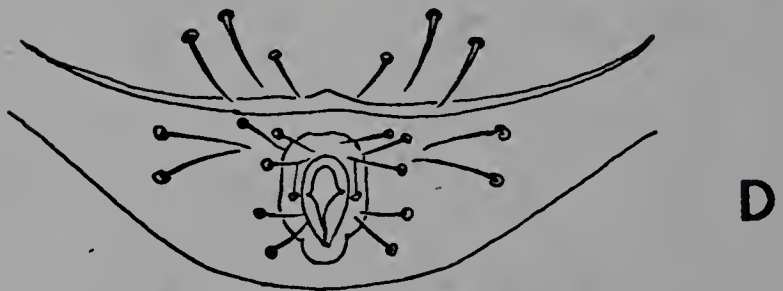
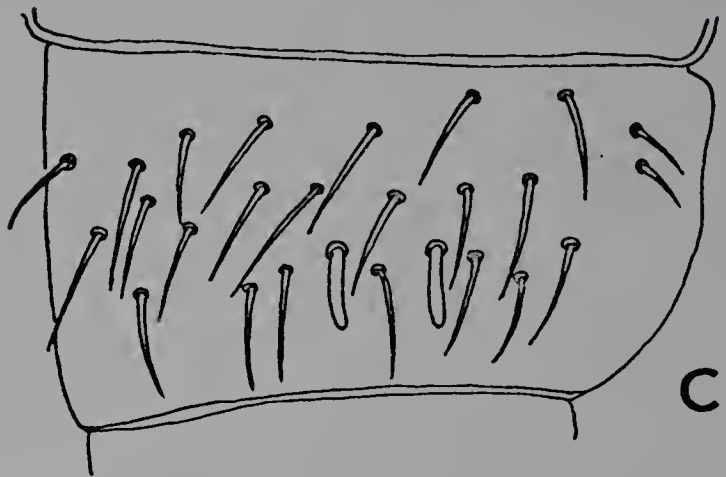
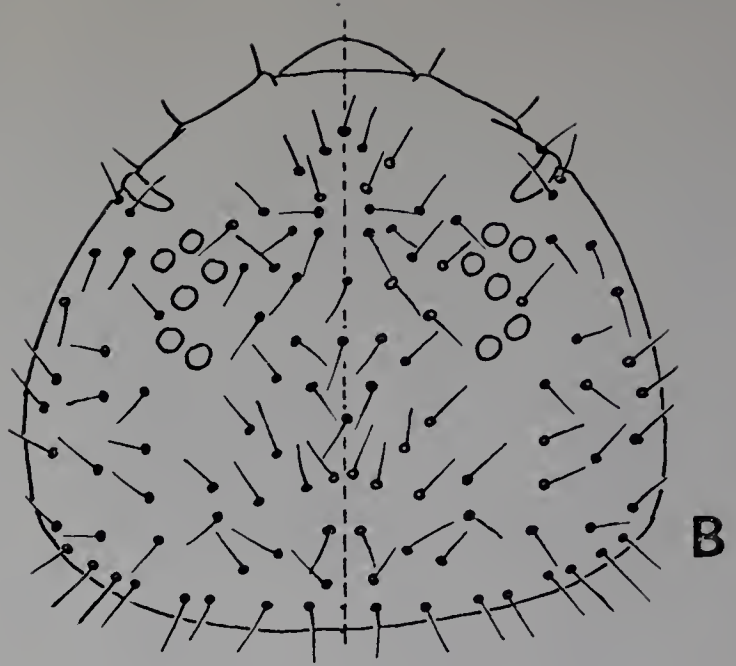
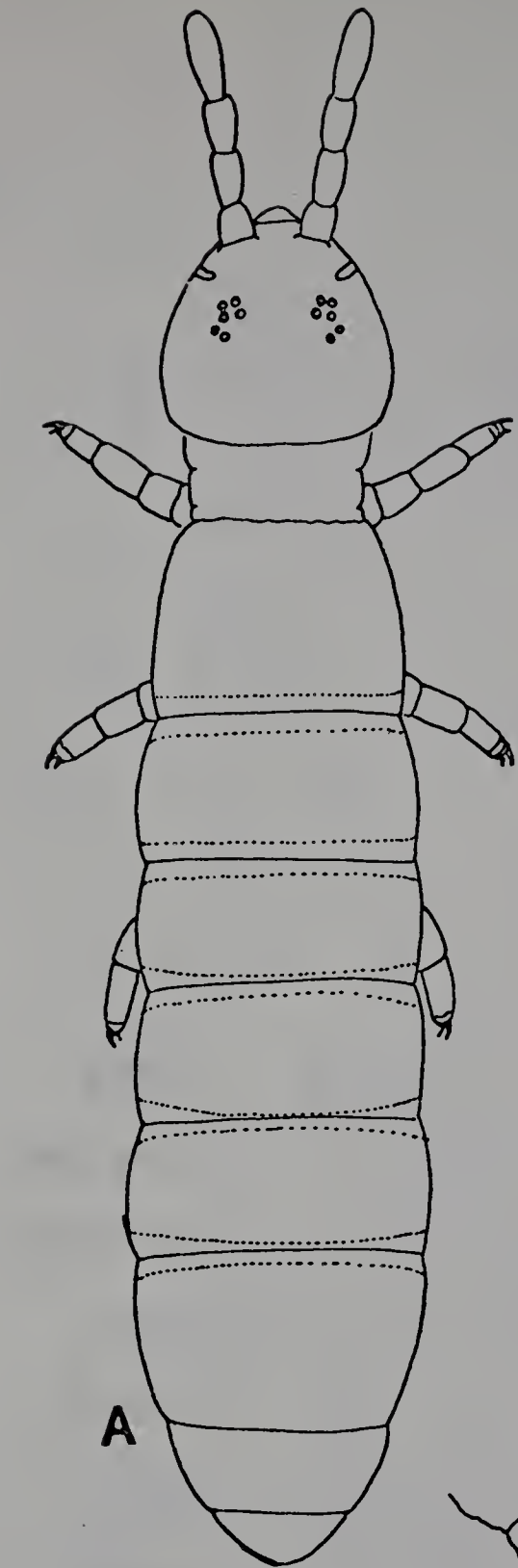


PLATE XIV

Entomobrya proxima Folsom

- A. Habitus, dorsal aspect showing male body color pattern, 90 x. B. Body dorsum showing common female color pattern. C. Same, showing slight color pattern variation from the first, exhibited by both sexes. D. Flexed macrochaetae on head and body dorsum (Type 1). E. A simple, fringed seta of head and body (Type 5). F. Left eyepatch. G. Modified type 5 setae exhibited by the male.

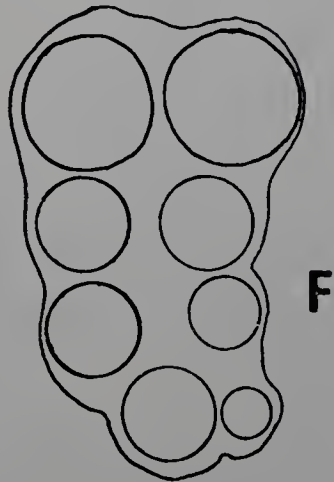
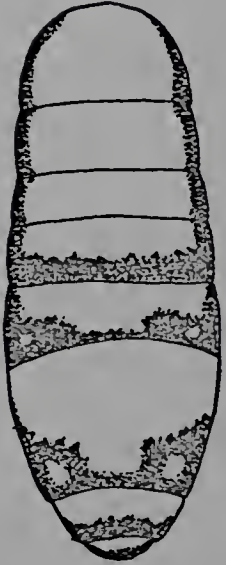
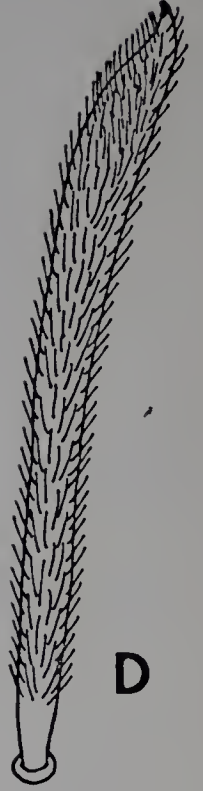
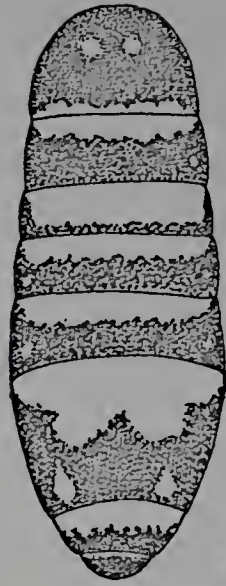
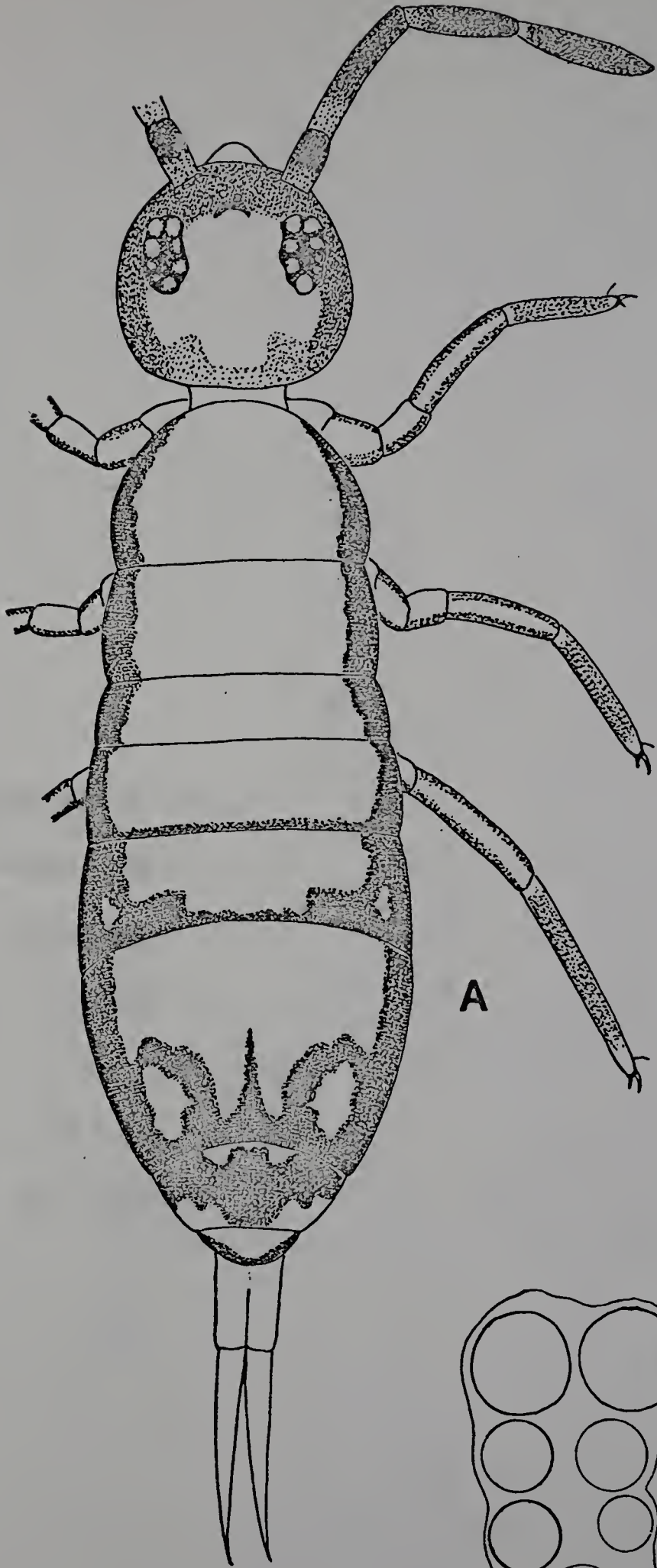
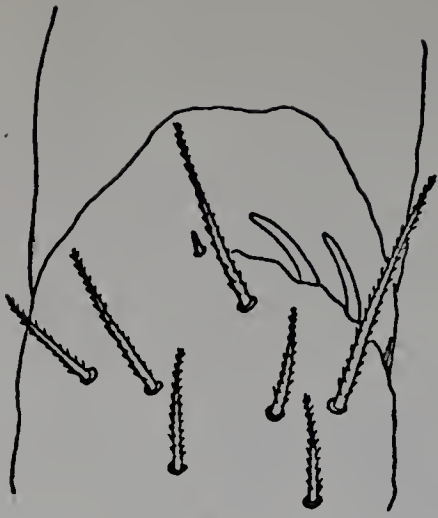


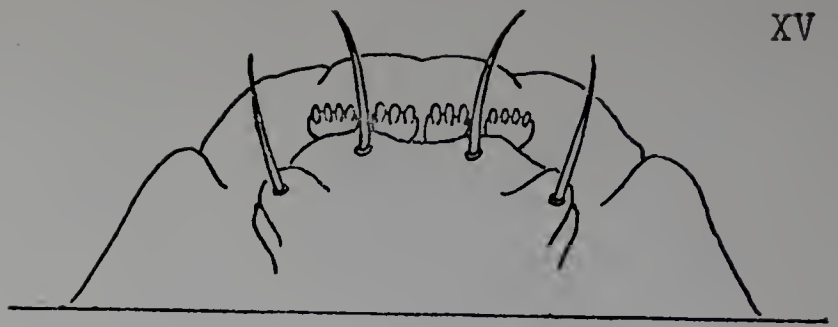
PLATE XV

Entombrya proxima Fo Leon

- A. Ant III sense organ showing 2 minute cone-shaped setae, dorso lateral aspect. B. Apex of labrum, dorsal aspect, showing tubercles bearing apical papillae. C. Trochanteral organ of hind tibiotarsus. D. Hind unguis and apex of tibiotarsus, lateral aspect. E. Left half of Abd V and VI, dorsal aspect, showing chaetotaxy. F. Mucro and apex of dens, lateral aspect. G. Male genital plate, ventral aspect.



A

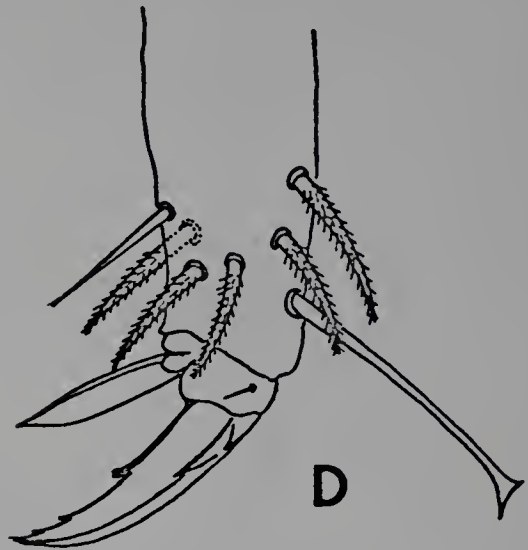


B

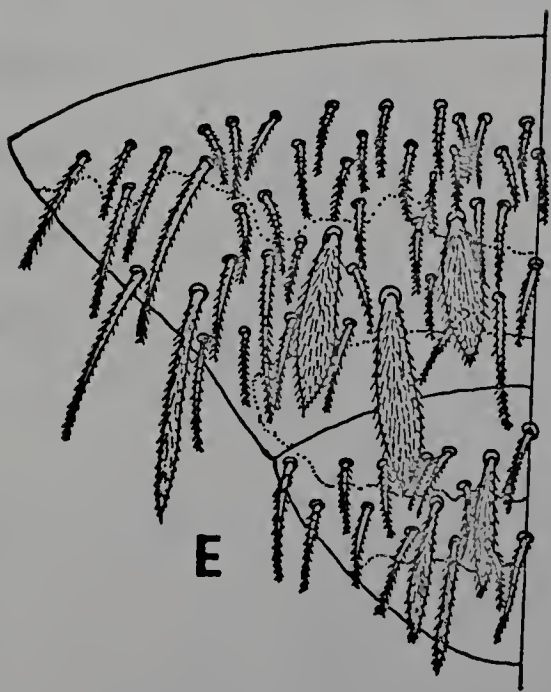
XV



C



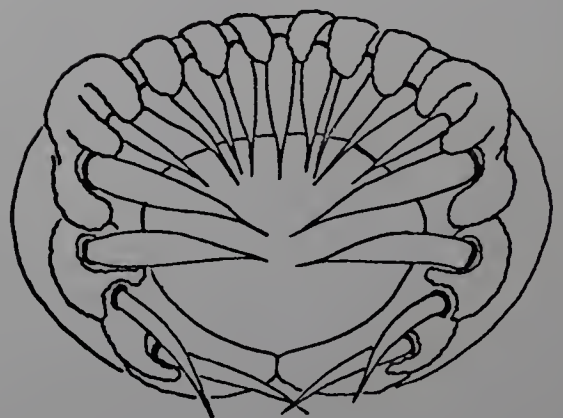
D



E



F

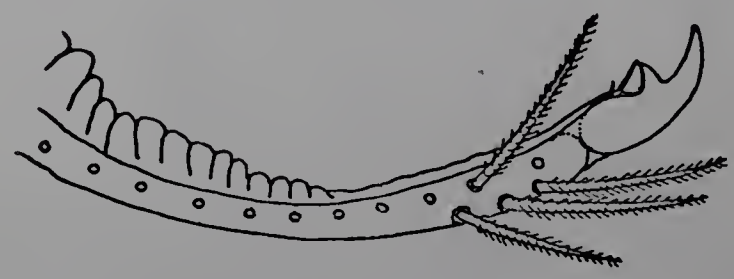
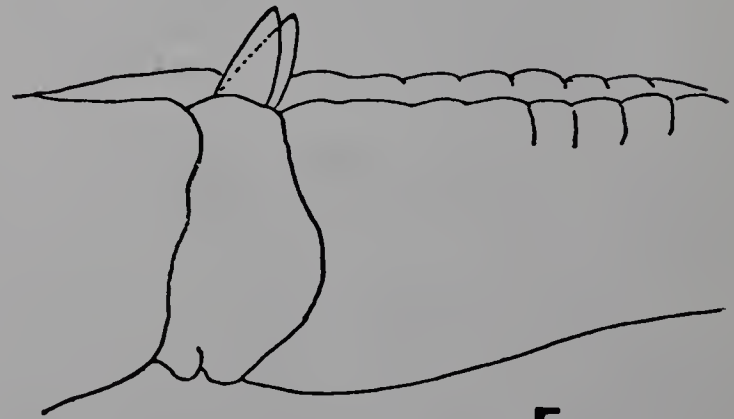
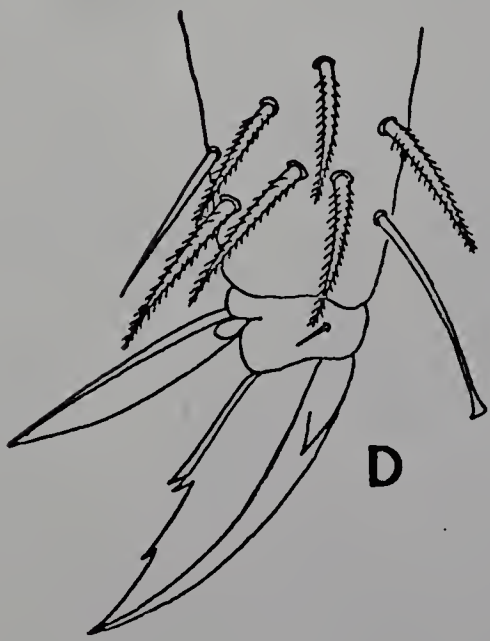
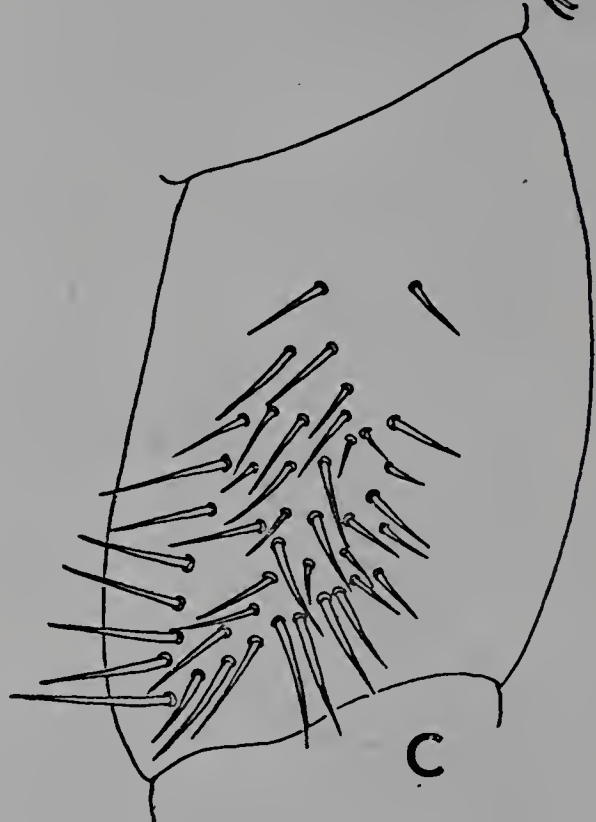
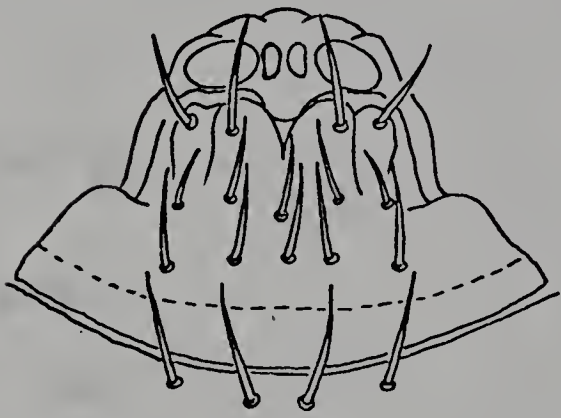
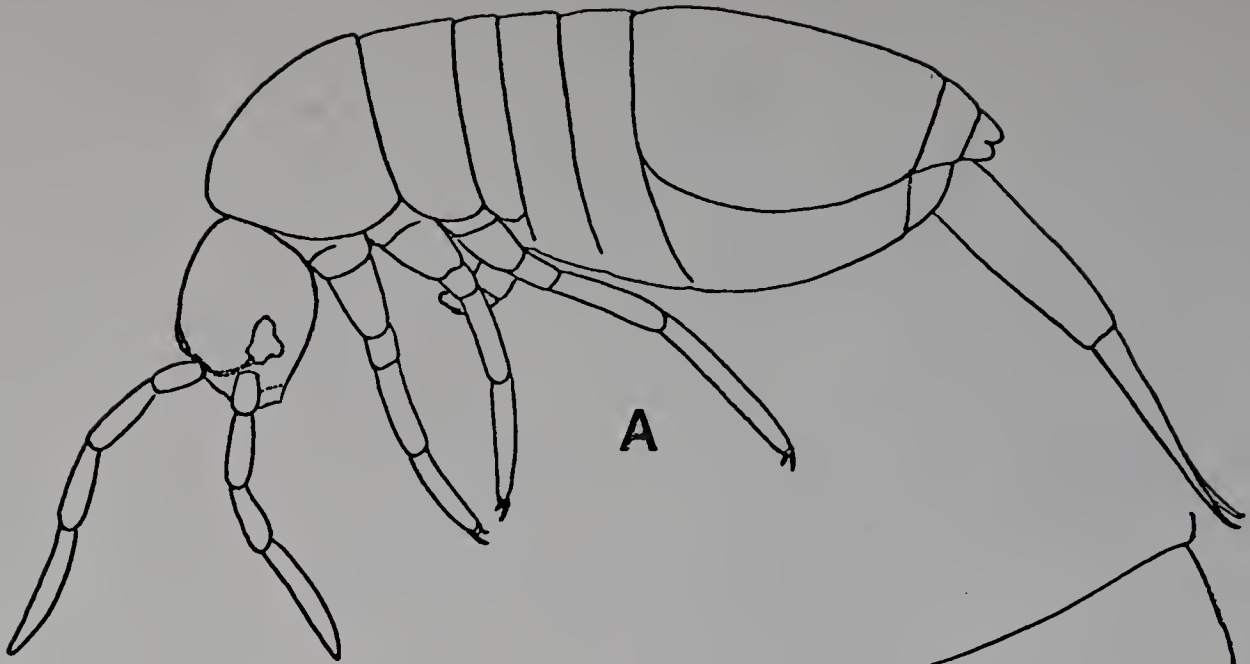


G

PLATE XVI

Lepidocyrtus (Acrocyrtus) parvidentatus Schaeffer

- A. Habitus, lateral aspect, body color pattern omitted, 33 x. B. Labrum, dorsal aspect. C. Trochanteral organ, lateral aspect. D. Hind unguis and apex of tibiotarsus, lateral aspect. E. Apex of manubrium and base of dentes showing pointed accessory apparatus, lateral aspect. F. Mucro and apex of dens, lateral aspect.



B

A

C

D

E

F

PLATE XVII

Lepidocyrtus (Acrocyrtus) brunneus (Handschin) New combination

- A. Apex of labrum showing the unequal tubercles, dorsal aspect. B. Base of dentes showing the sharply pointed accessory apparatus, slightly dorso lateral aspect. C. Fore unguis and apex of tibiotarsus, lateral aspect, showing minute serrations on outer lamella of unguiculus. D. Mucro and apex of dens, lateral aspect.

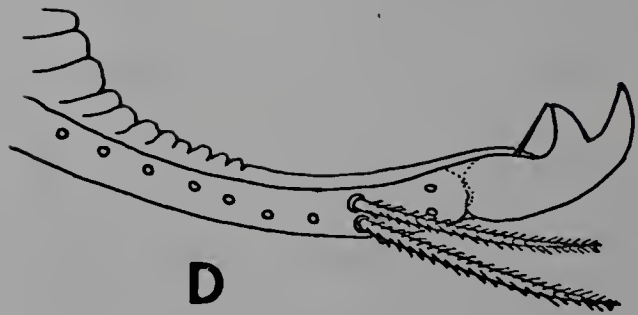
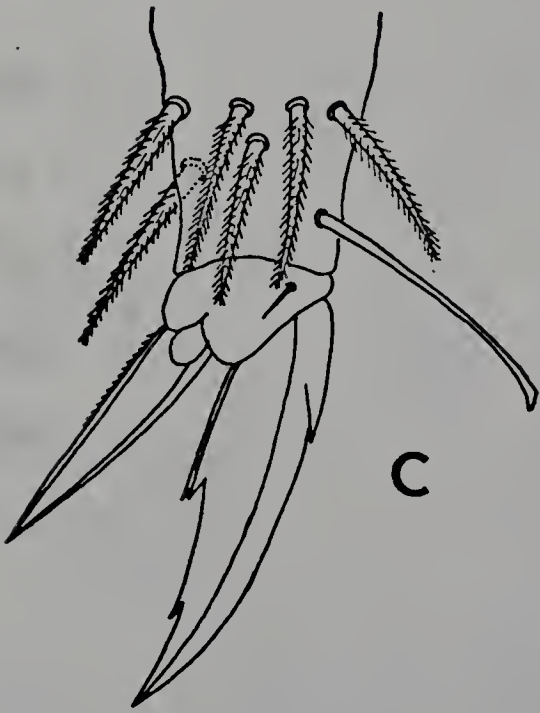
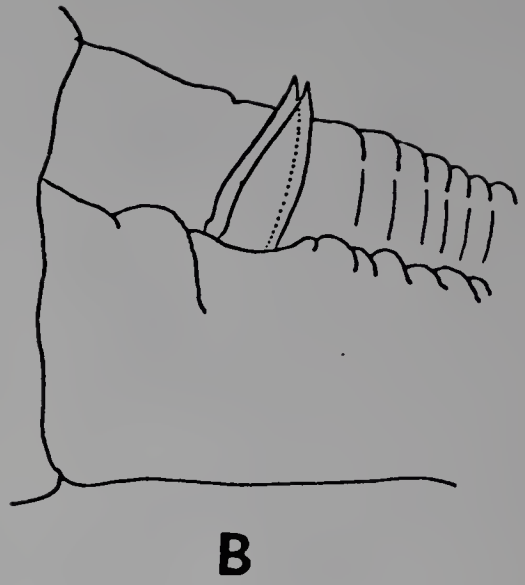
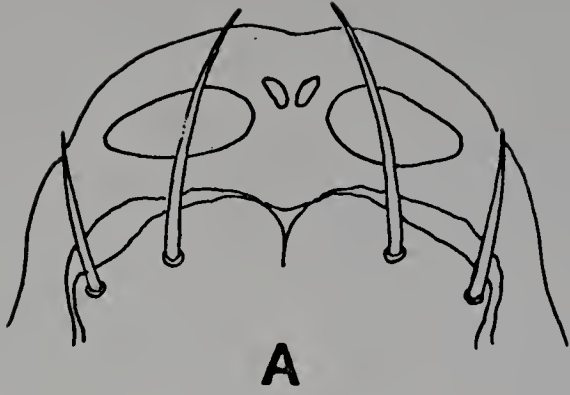
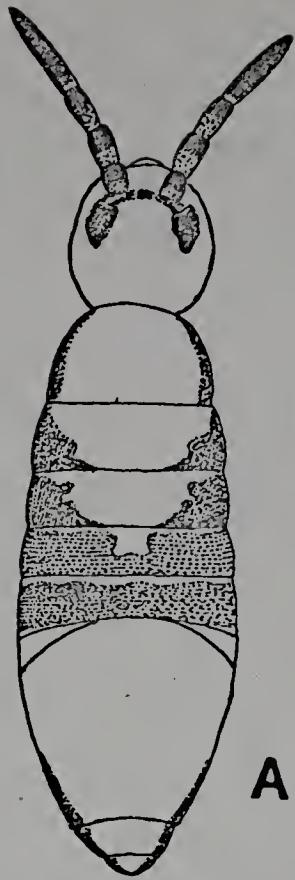


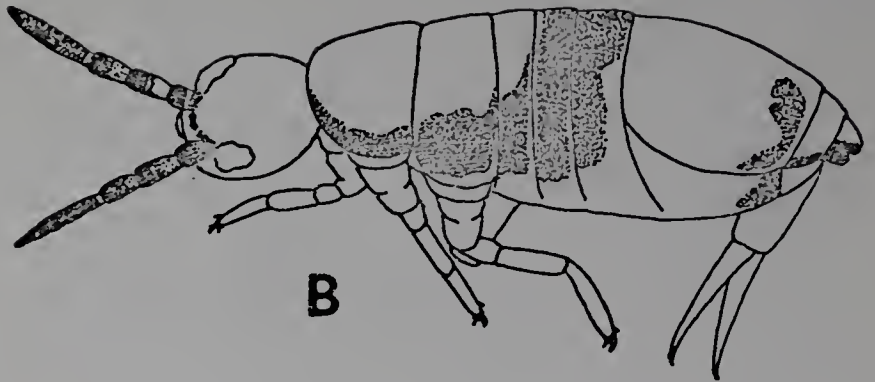
PLATE XVIII

Lepidocyrtus (Ascochyrtus) coeruleocinctus Handschin

- A. Habitus, dorsal aspect, 99 x. B. Same, lateral aspect, 100 x. C. Left eyepatch. D. Apex of labrum showing distal tubercles, dorsal aspect. E. Body dorsum showing color pattern variation in larger specimens, 54 x. F. Hind unguis and unguiculus, apex of tibiotarsus, lateral aspect. G. A body scale showing minute striations. H. Mucro and apex of dens, lateral aspect, showing expanded setae.



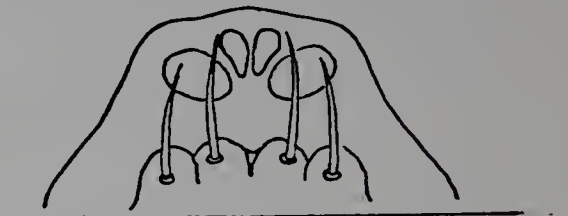
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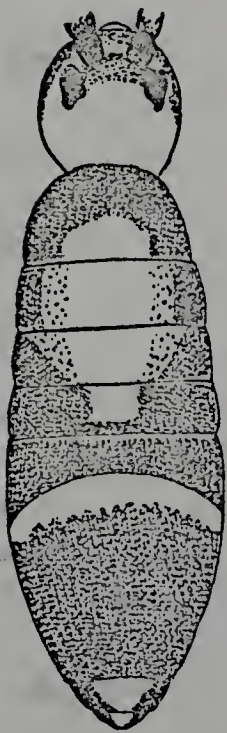
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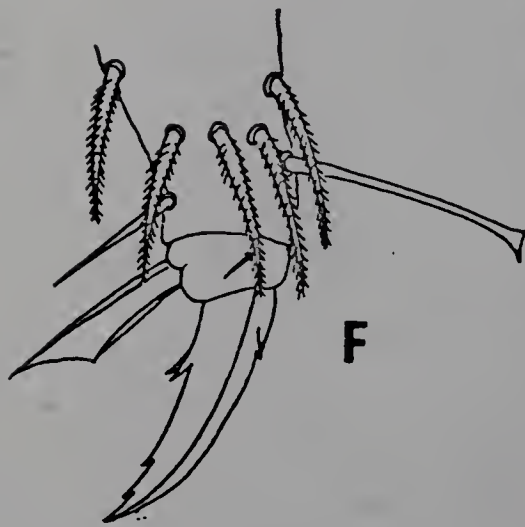
C



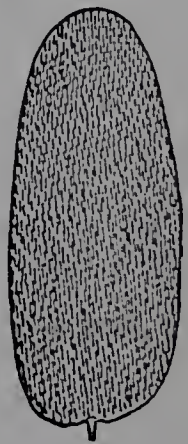
D



E



F



G



H

PLATE XIX

Lepidocyrtus (Ascocyrtus) indicus Handschin

- A. Habitus, lateral aspect, 37.5 x. B. Left eyepatch.
C. Labrum, dorsal aspect. D. Lateral flap of ventral tube. E. Trochanteral organ, lateral aspect. F. Apex of manubrium and base of dentes, slightly dorso lateral aspect, showing the apically rounded accessory apparatus. G. Hind unguis, unguiculus, and apex of tibio-tarsus, lateral aspect. H. Mucro and apex of dens, lateral aspect.

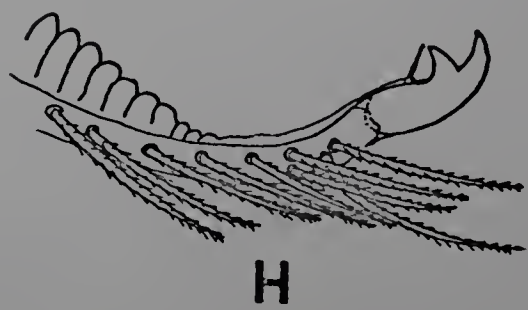
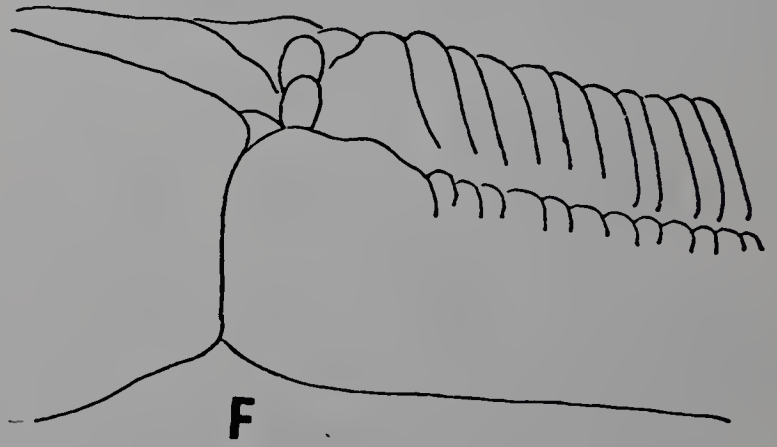
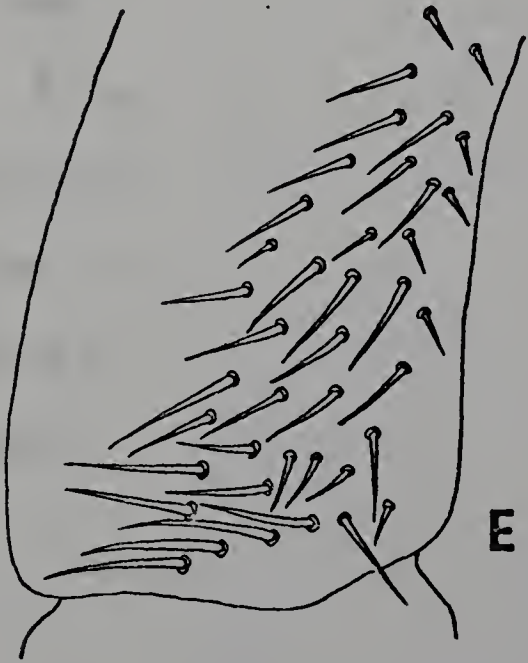
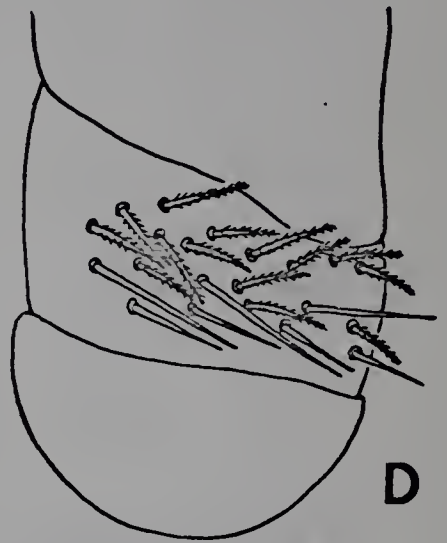
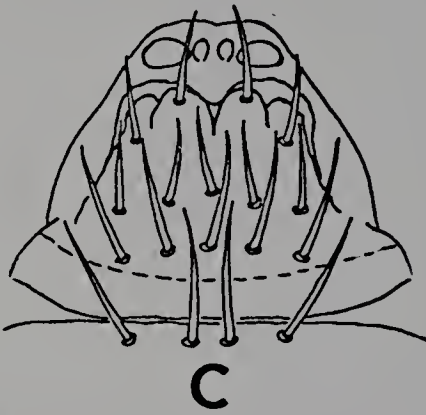
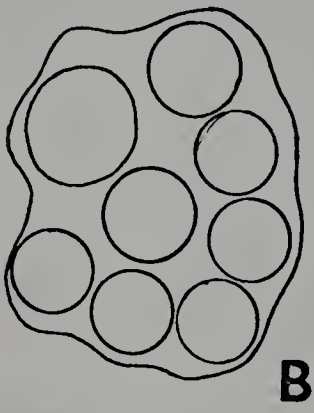
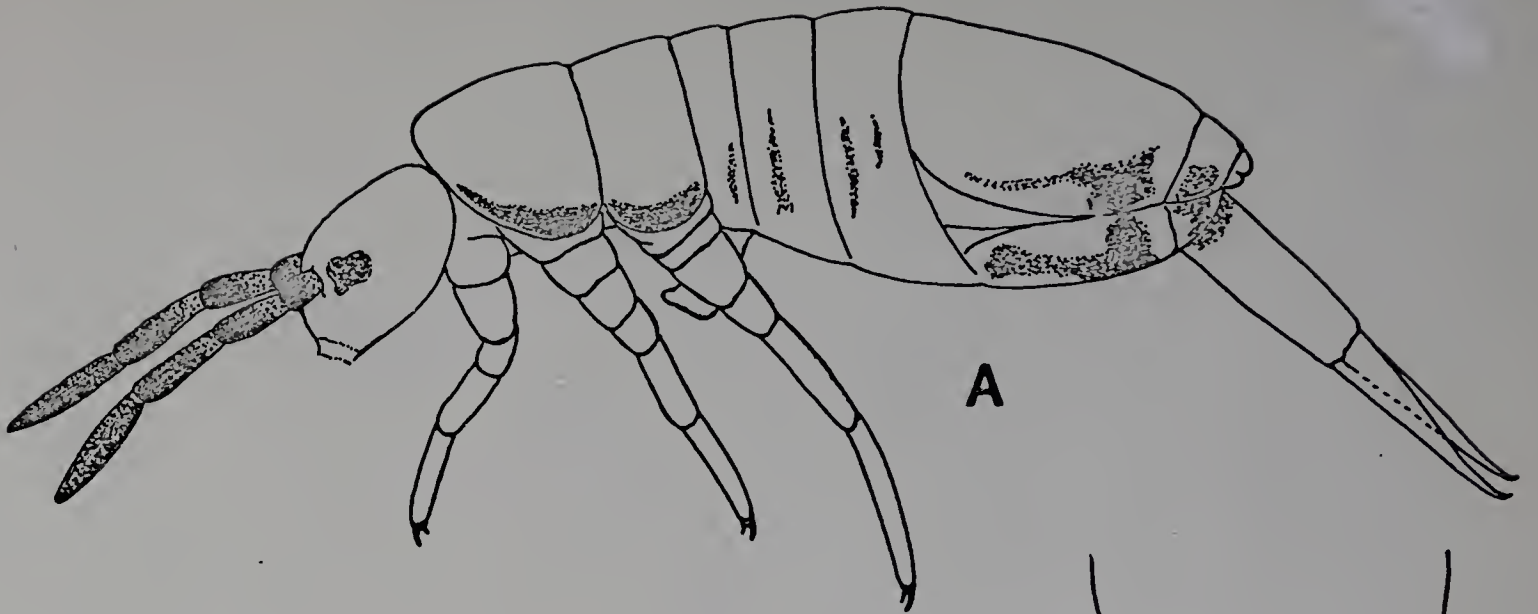


PLATE XX

Lepidocyrtus (Lepidocyrtus) vestitus Handschin

- A. Habitus, lateral aspect, 54 x. B. Left eyepatch.
C. Apex of labrum, dorsal aspect. D. Lateral flap of ventral tube. E. Trochanteral organ, lateral aspect.
F. Hind unguis, unguiculus, and apex of tibiotarsus, lateral aspect. G. Mucro and apex of dens, lateral aspect.

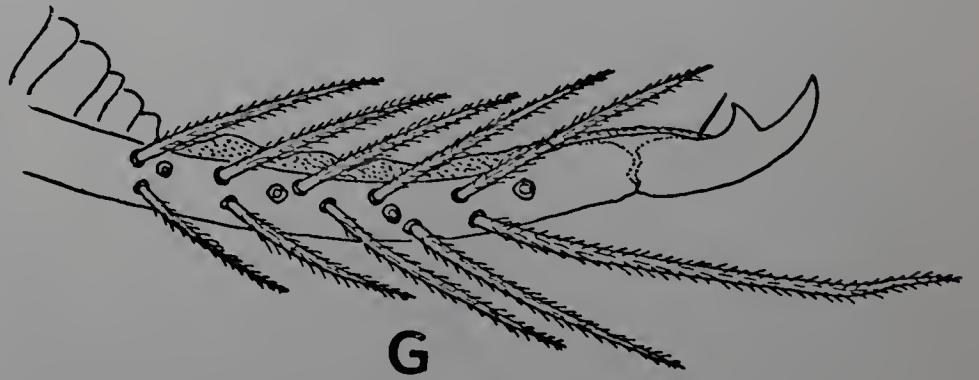
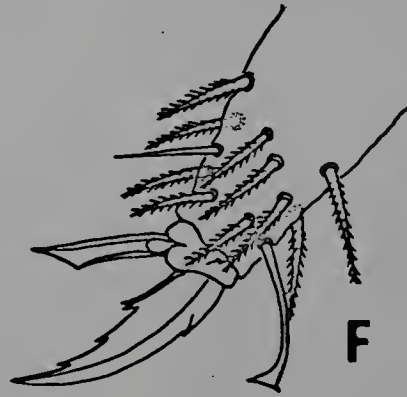
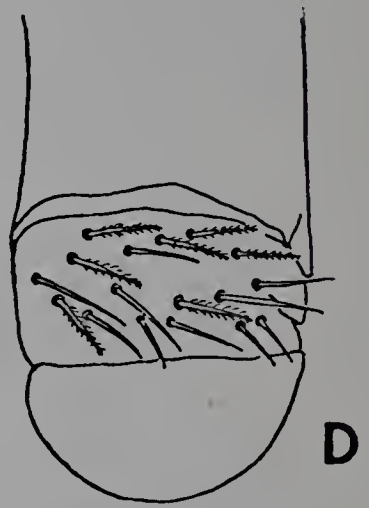
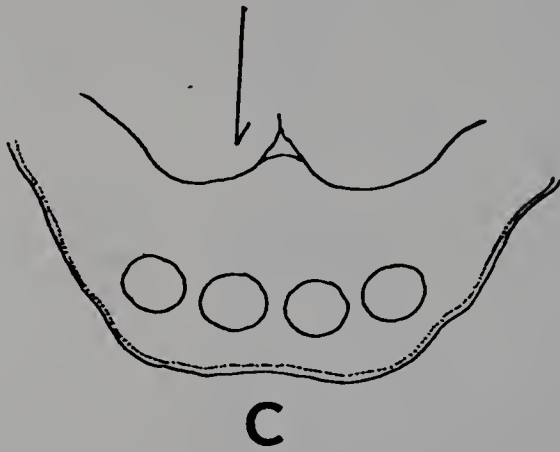
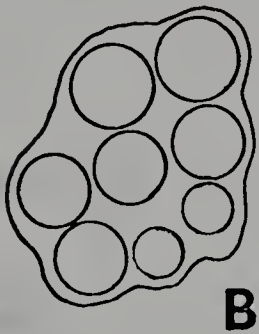
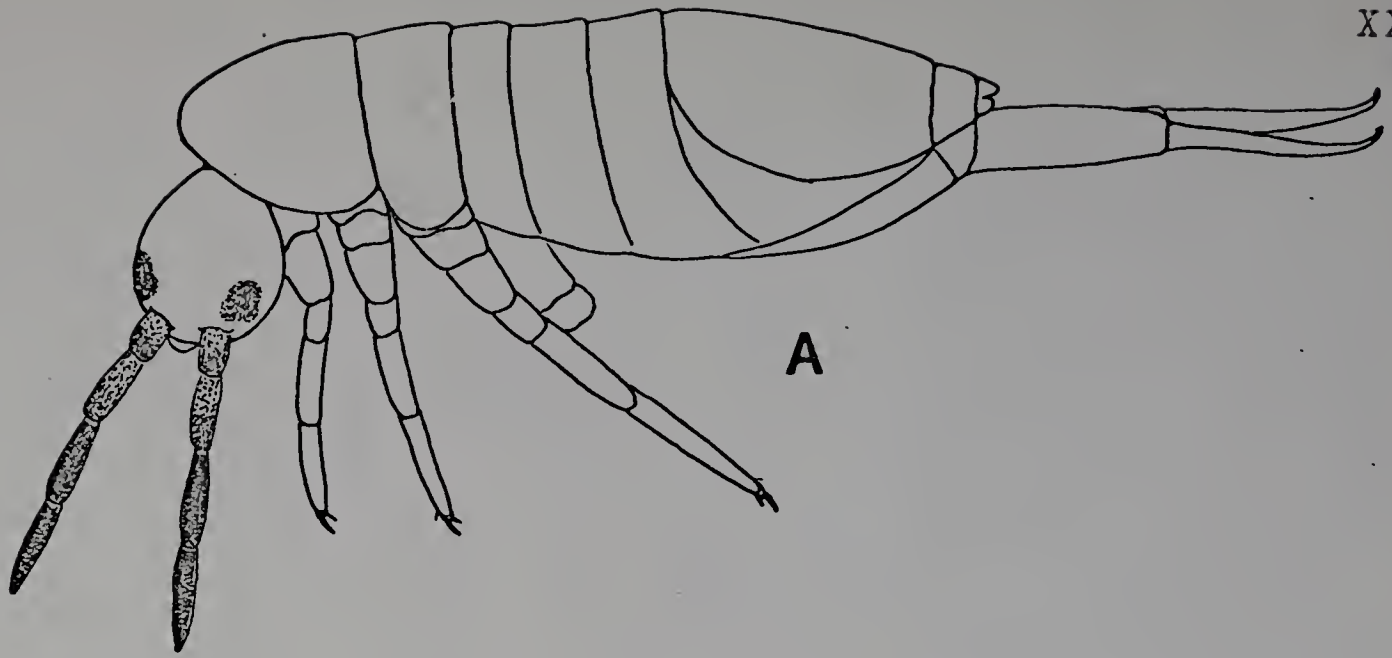


PLATE XXI

Alloscopus tetracanthus Boemer

- A. Habitus, lateral aspect, 55 x. B. Head showing dorsal chaetotaxy and eyes. C. Semi-diagrammatic representation of body chaetotaxy on Th II to Abd III. D. A body scale showing striations. E. Flexed macrochaeta on head and body dorsum. F. Labrum, dorsal aspect. G. Ventral tube, anterior aspect.

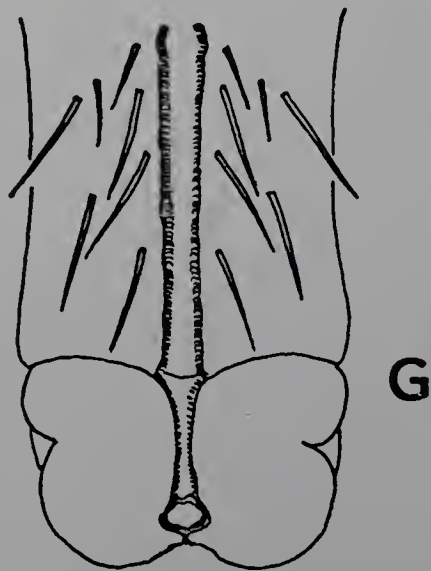
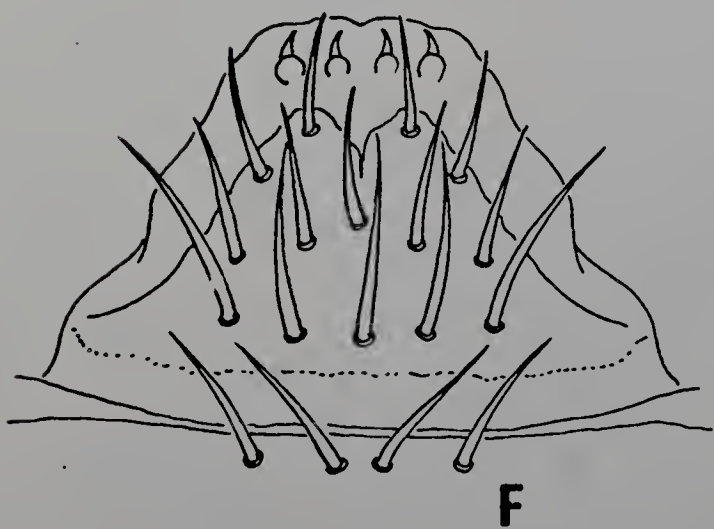
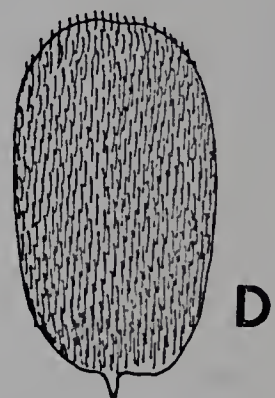
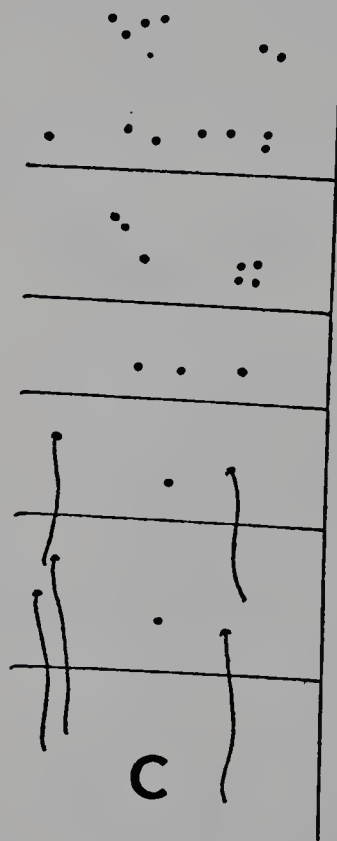
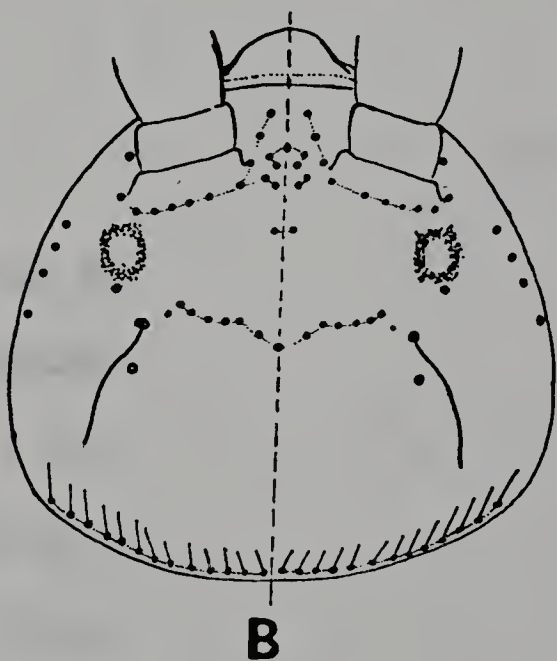
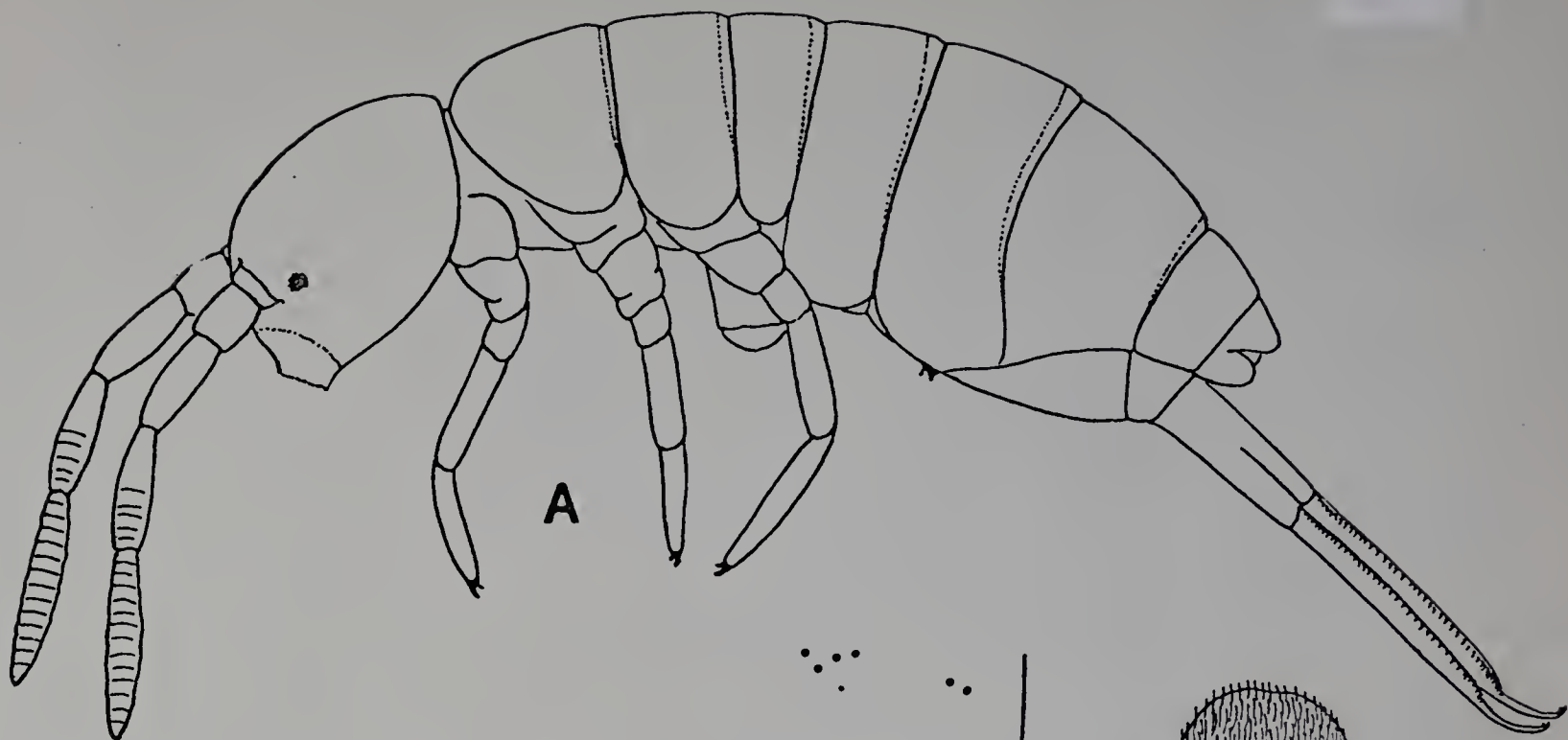


PLATE XXII

Alloscopus tetracanthus Boemer

- A. Ventral tube, posterior aspect. B. Trochanteral organ, lateral aspect. C. Hind unguis, unguiculus, and apex of tibiotarsus, lateral aspect. D. Base of dens, dorso-lateral aspect, showing 5 dental spines. E. Distal part of dens and whole mucro, lateral aspect.

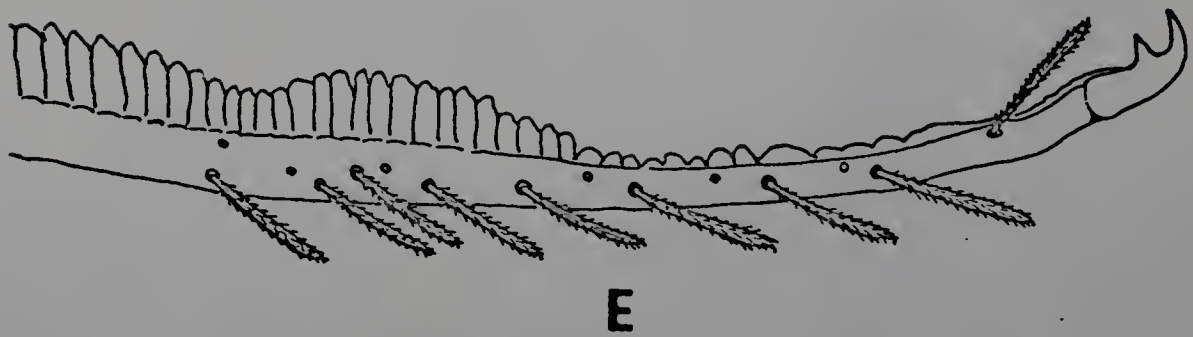
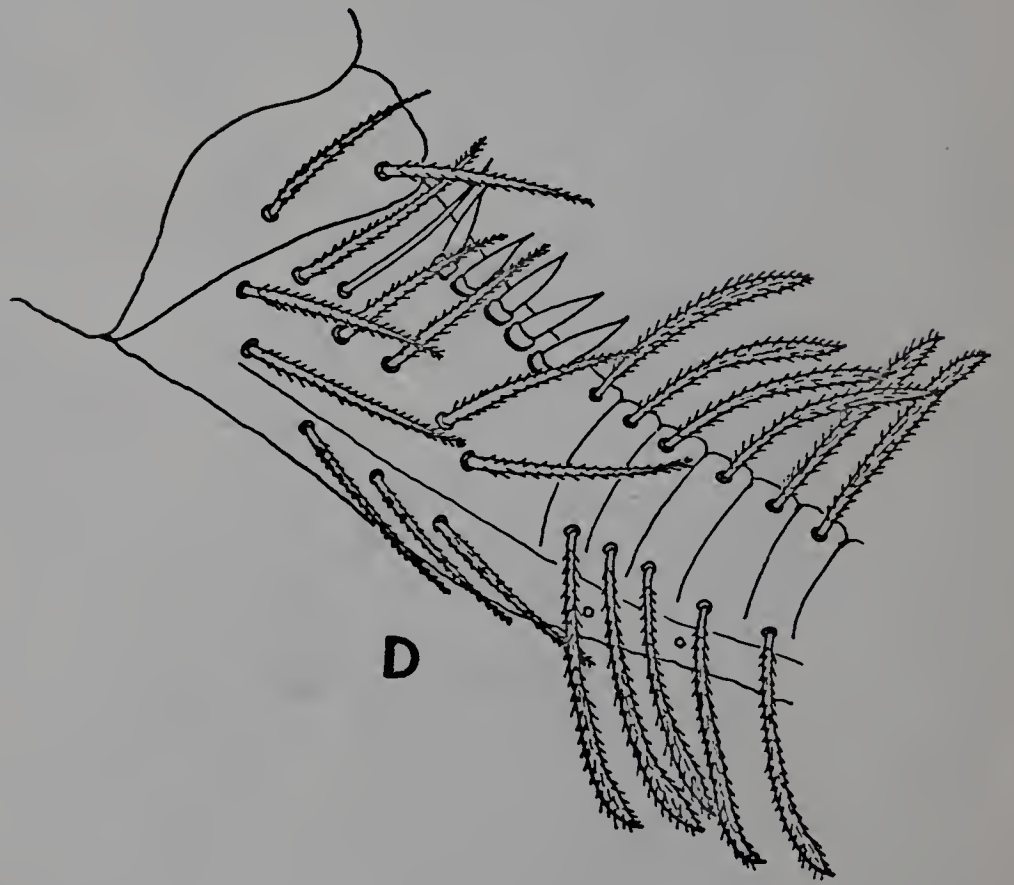
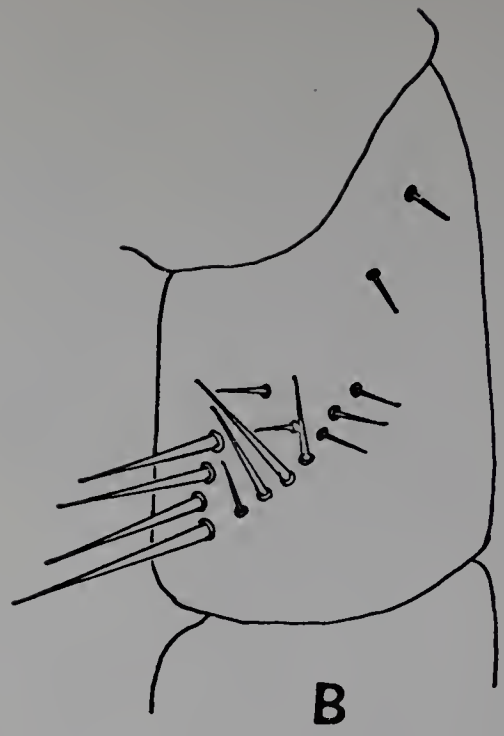
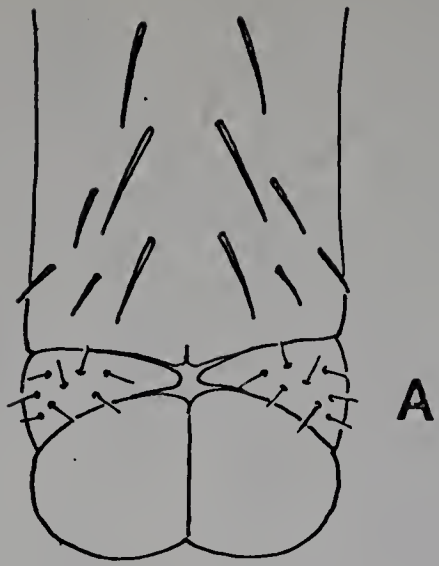
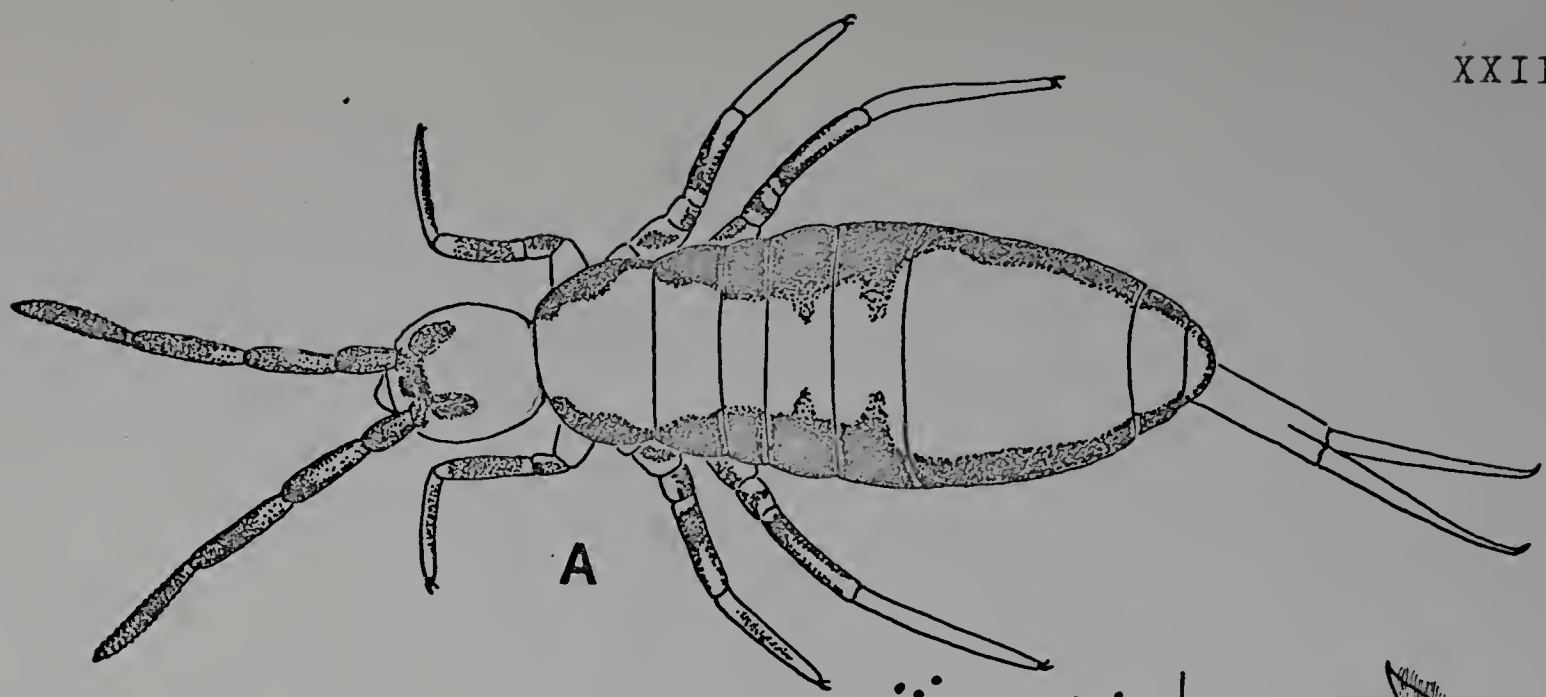


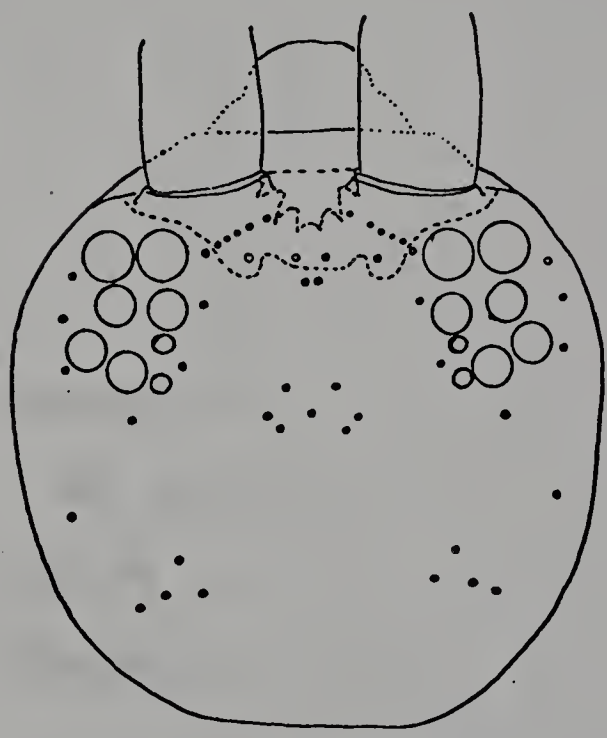
PLATE XXIII .

Seira terrestris (Folsom)

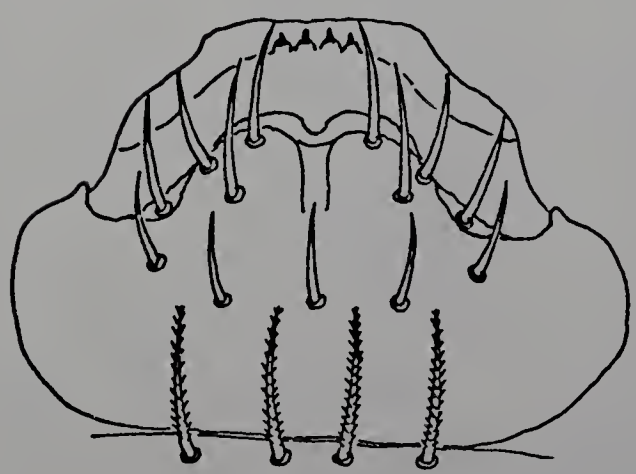
- A. Habitus, dorsal aspect, 34 x. B. Head showing dorsal chaetotaxy and eyes. C. Labrum, dorsal aspect. D. Semi-diagrammatic representation of chaetotaxy on Th II to proximal half of Abd IV. E. Flexed macrochaeta of head and body. F. Body scale.



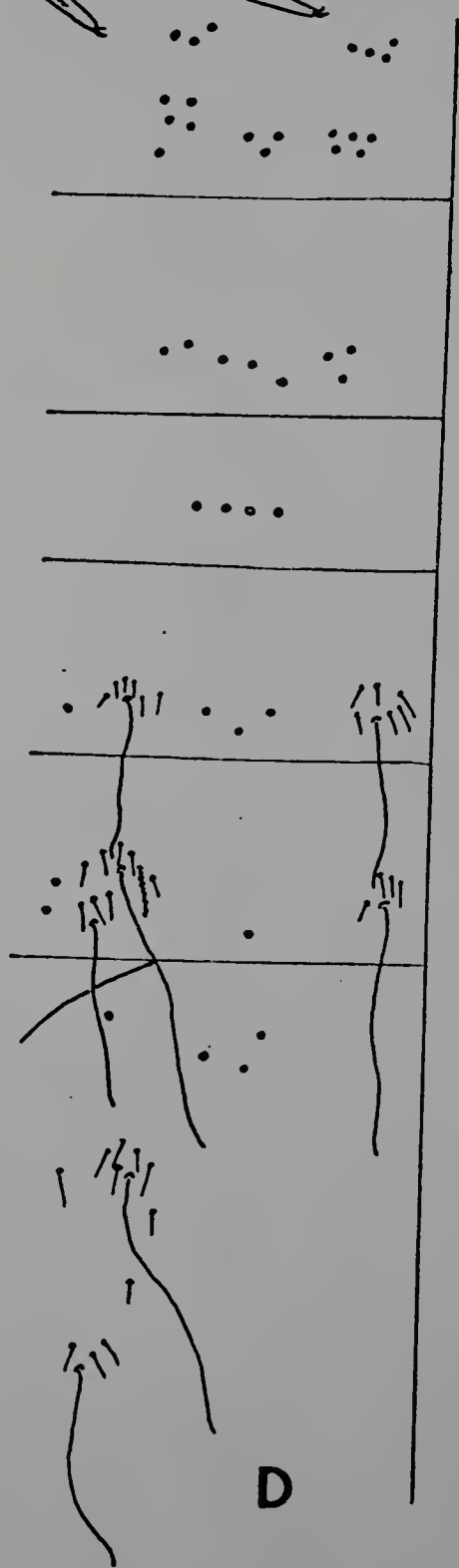
A



B



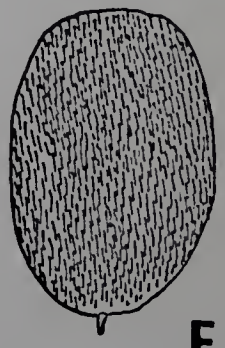
C



D



E



F

PLATE XXIV

Seira terrestris (Folsom)

A. Part of ventral tube, anterior aspect. B. Lateral flap of ventral tube. C. Middle unguis, unguiculus, and apex of tibiotarsus, lateral aspect. D. Mucro and apex of dens, lateral aspect.

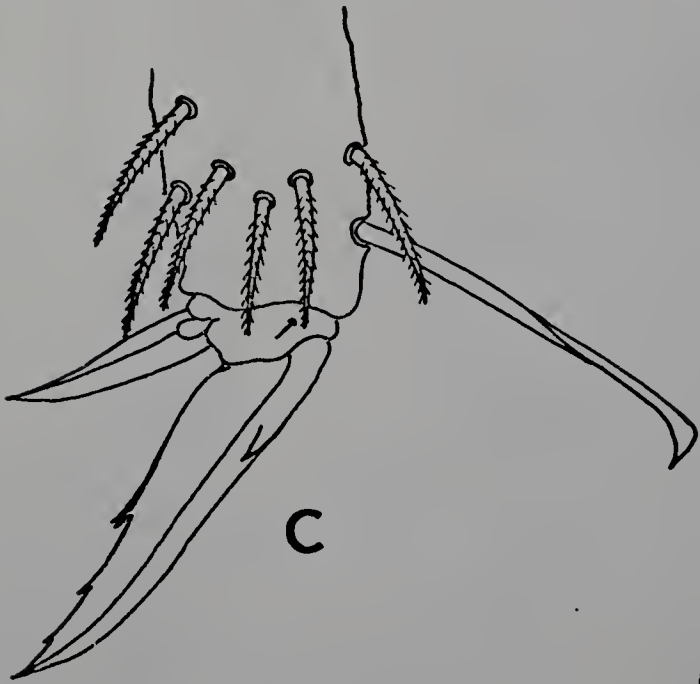
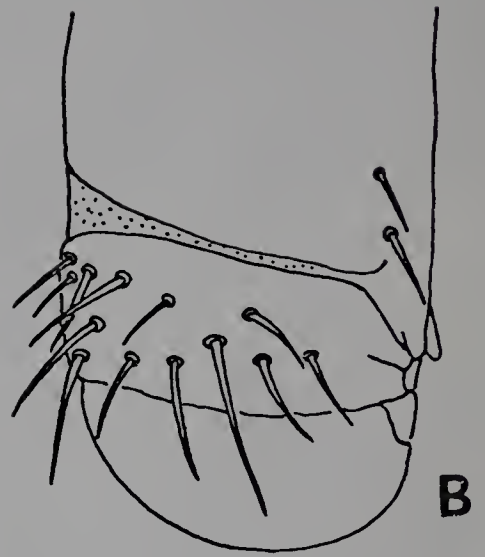
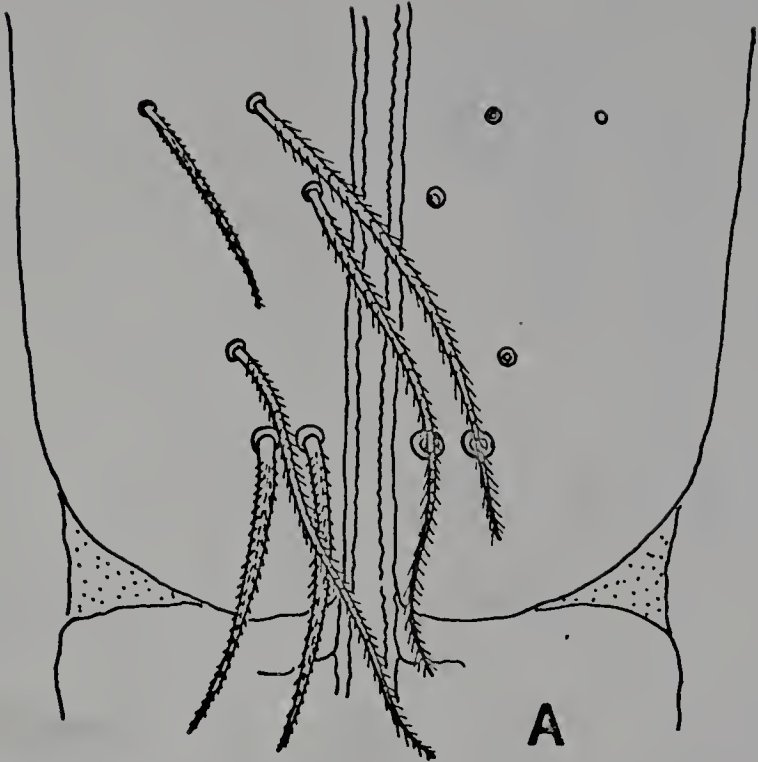
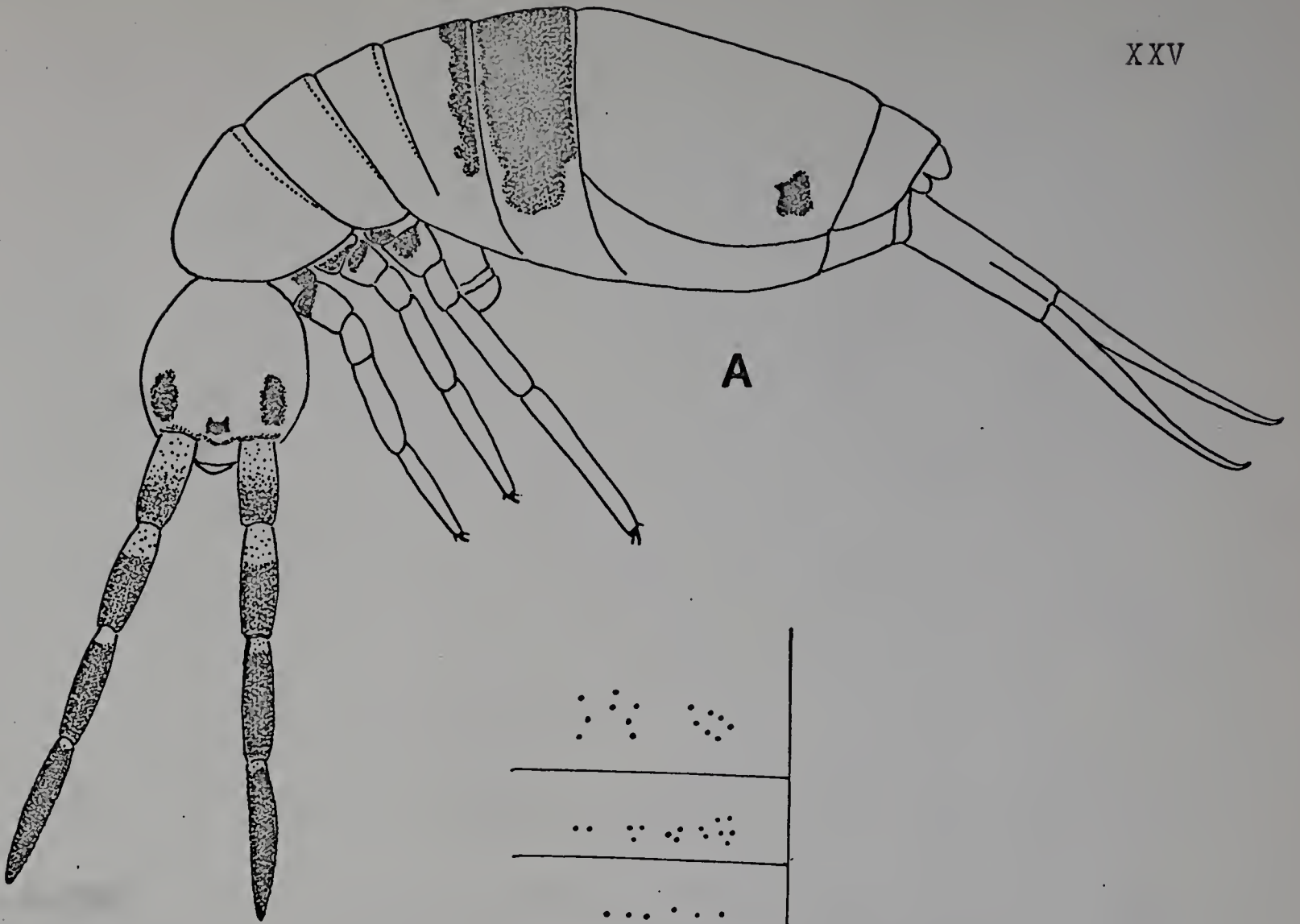


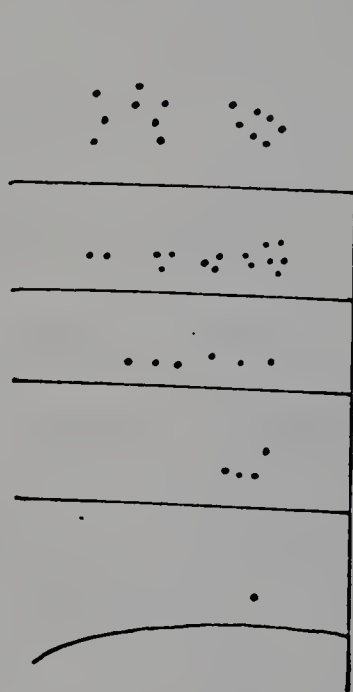
PLATE XXV

Seira schaefferi (Schoett)

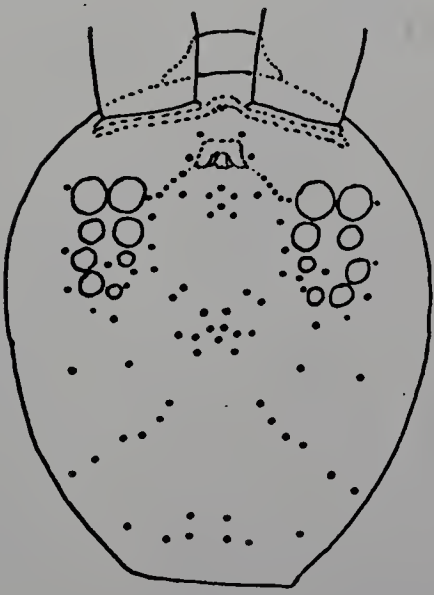
- A. Habitus, lateral aspect with head dorsally oriented, 66 x. B. Head showing eyes and dorsal chaetotaxy. C. Semi-diagrammatic representation of chaetotaxy on Th II to Abd III. D. Stout ciliate setae on apex of manubrium and base of dentes.



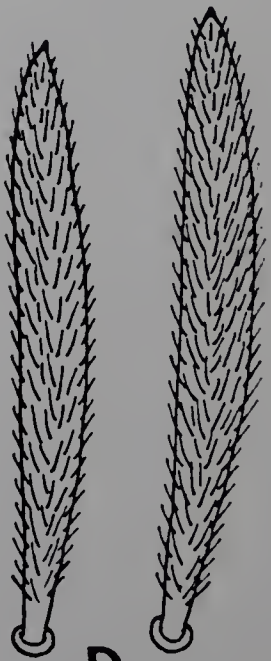
A



C



B

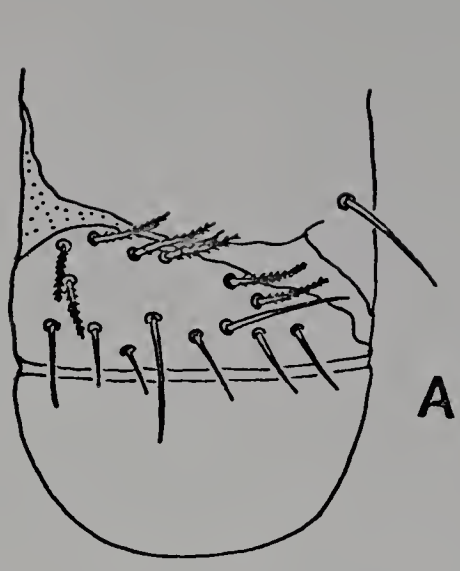


D

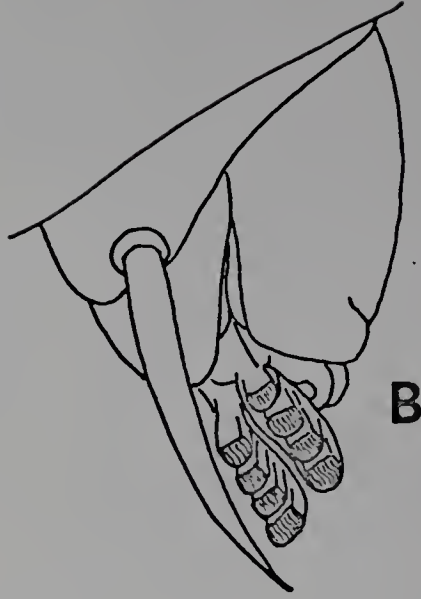
PLATE XXVI

Seira schaefferi (Schoett)

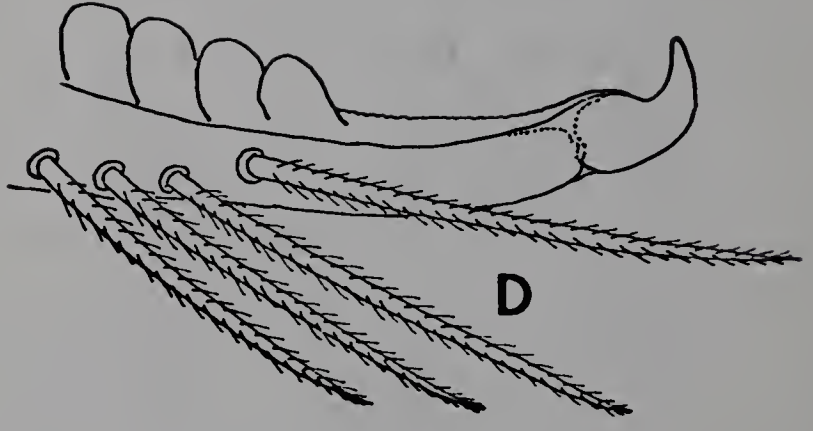
A. Lateral flap of ventral tube. B. Tenaculum, antero-lateral aspect. C. Hind unguis, unguiculus, and apex of tibiotarsus, lateral aspect. D. Mucro and apex of of dens, lateral aspect.



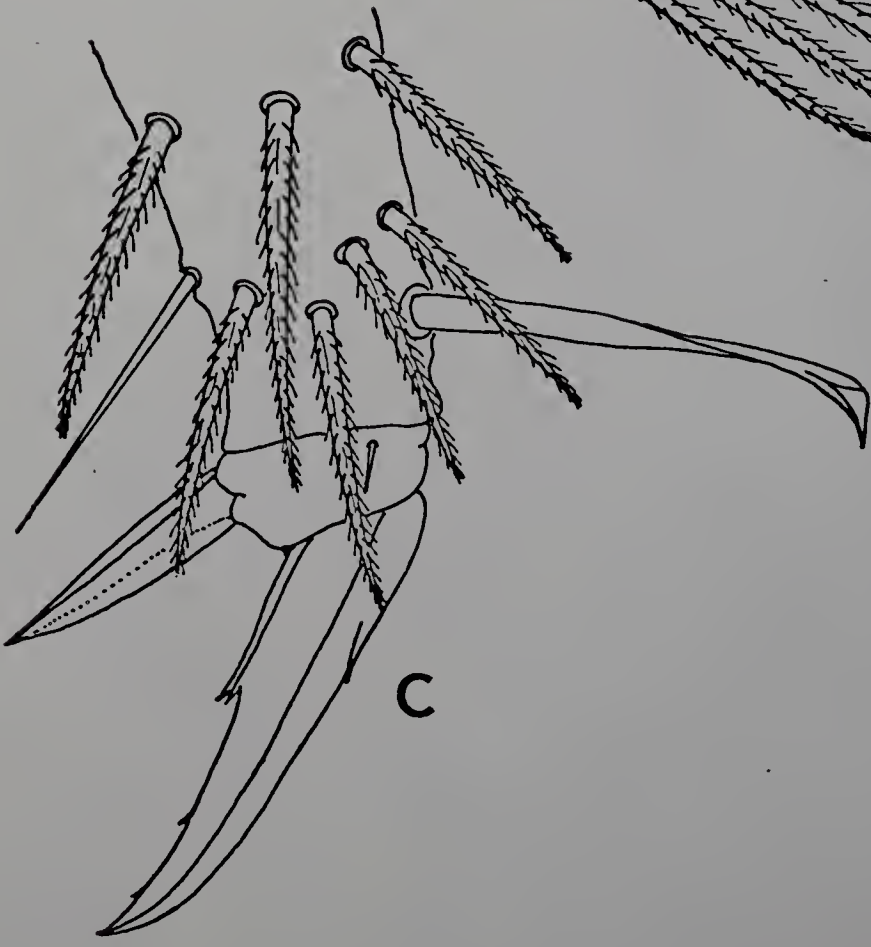
A



B



D



C

PLATE XXVII

Cyphoderus javanus Boerner

- A. Habitus, lateral aspect, 59 x. B. Trochanteral organ, lateral aspect. C. Left setae sensuales of Abd III, showing accessory microchaetae and 1 macrochaeta. D. Middle unguis, unguiculus, and apex of tibiotarsus, lateral aspect. E. Dens, dorsal aspect, showing specialized scales. F. Mucro, lateral aspect.

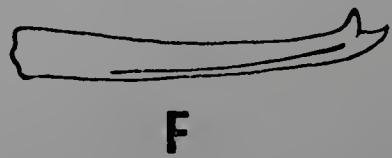
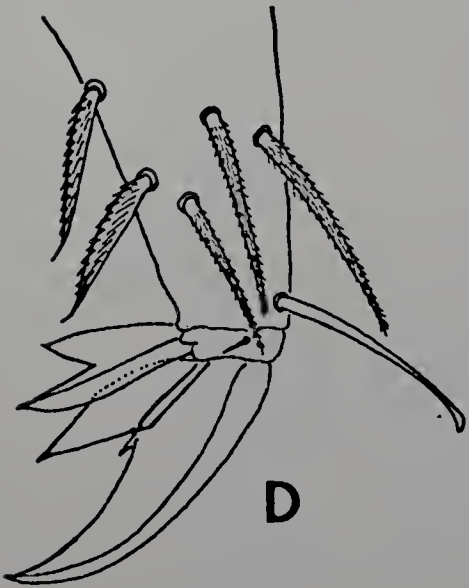
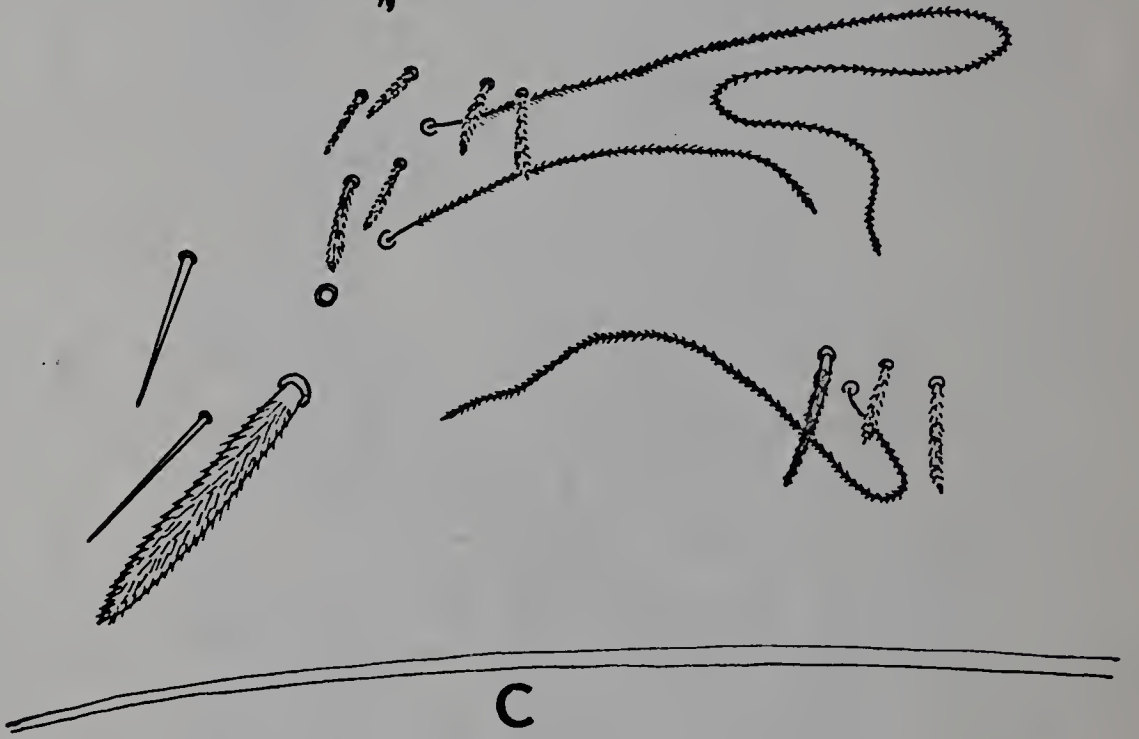
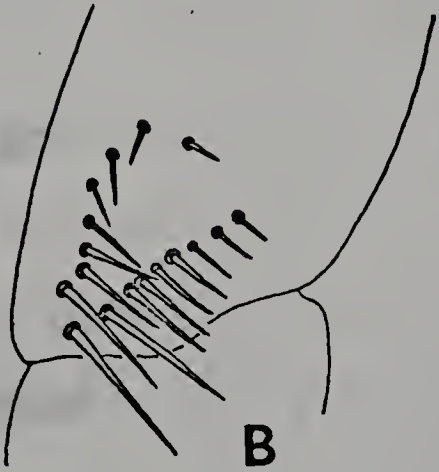
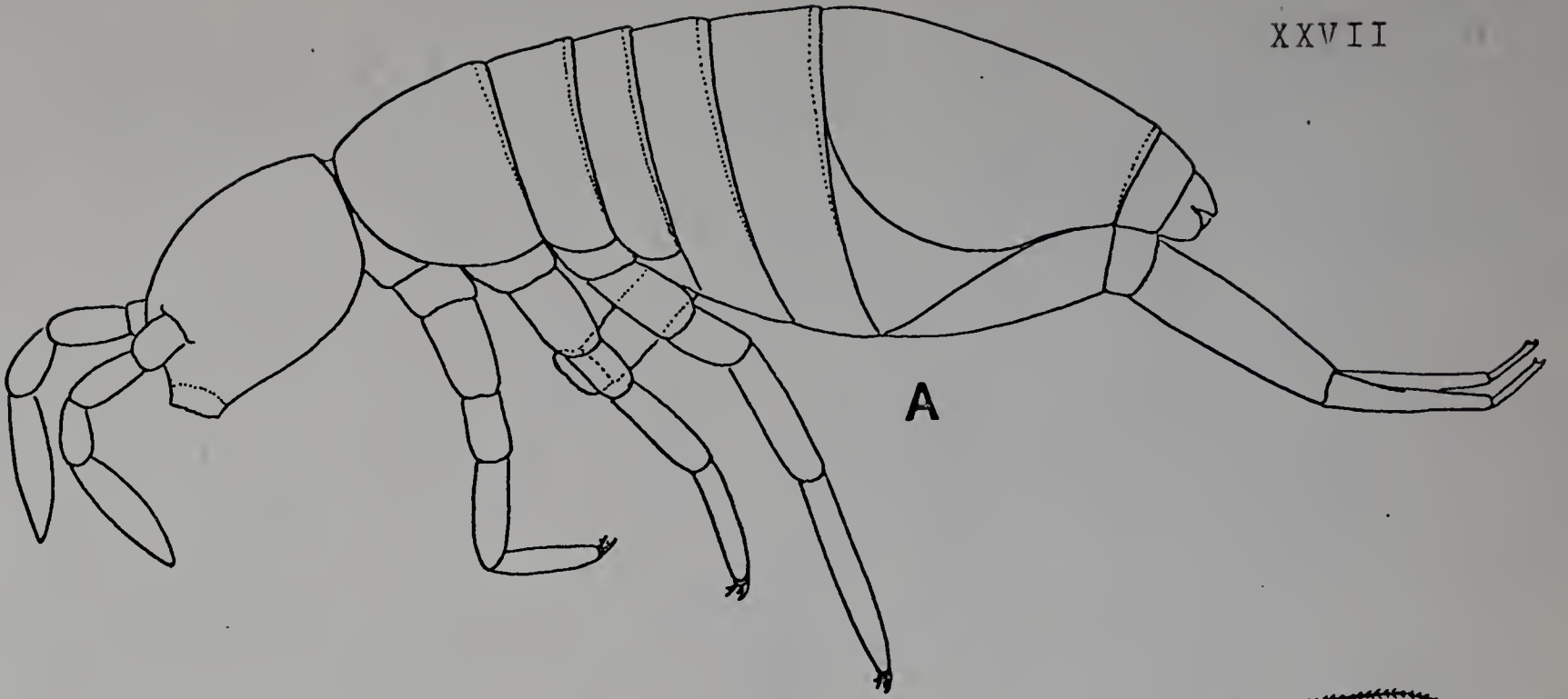
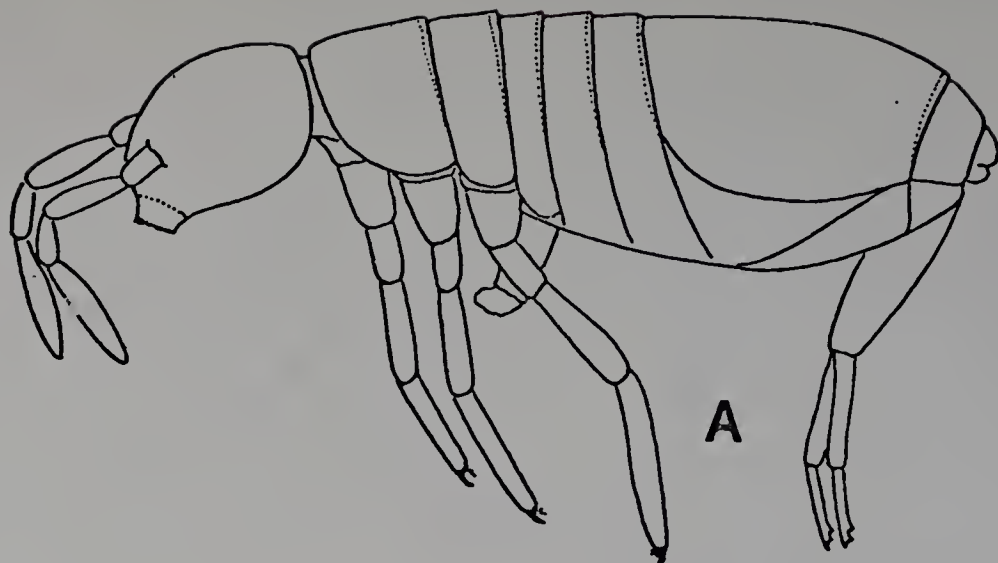


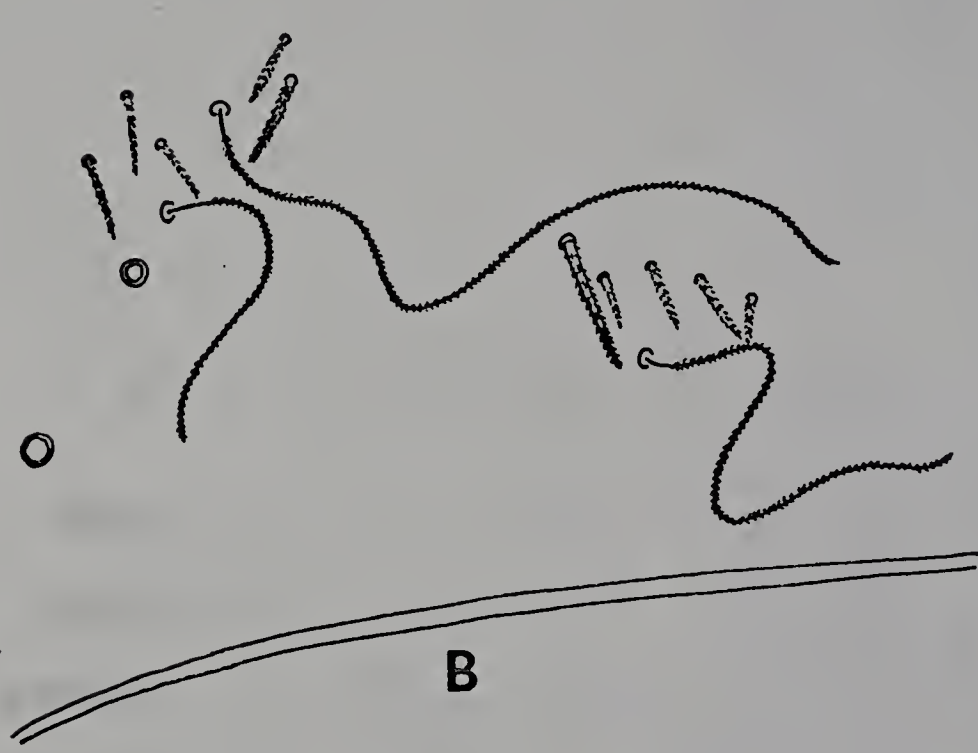
PLATE XXVIII

Cyphoderus hozawai Kinoshita

A. Habitus, lateral aspect, 68 x. B. Left setae sensuales of Abd III, showing accessory microchaetae. C. Hind unguis, unguiculus, and apex of tibiotarsus, lateral aspect. D. Dens, dorsal aspect, showing specialized scales. E. Mucro typical of the species, lateral aspect. F. Mucro of another specimen from same collection, lateral aspect. G. Same, dorsal aspect.



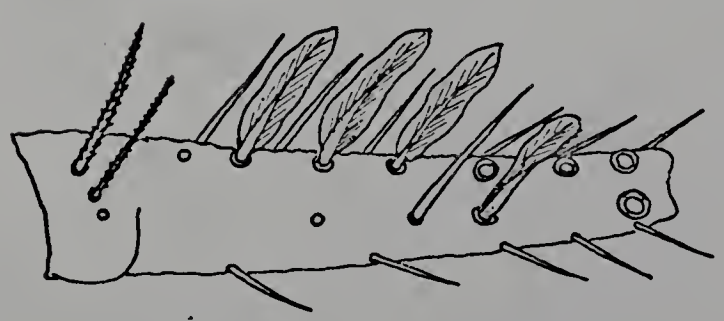
A



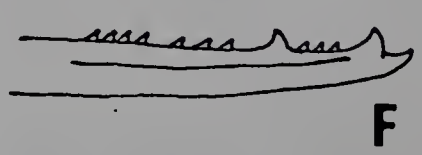
B



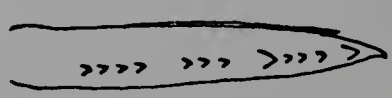
C



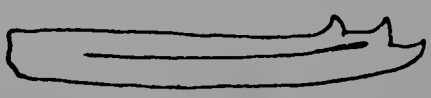
D



F



G



E

PLATE XXIX

Aphysa longicomis (Oudemans)

- A. Habitus, lateral aspect, 32.5 x. B. Left eyepatch.
C. Body dorsum showing color pattern. D. Body
chaetotaxy from Th II to Abd IV. E. Body scale.
F. Body macrochaetae, one not flexed apically.

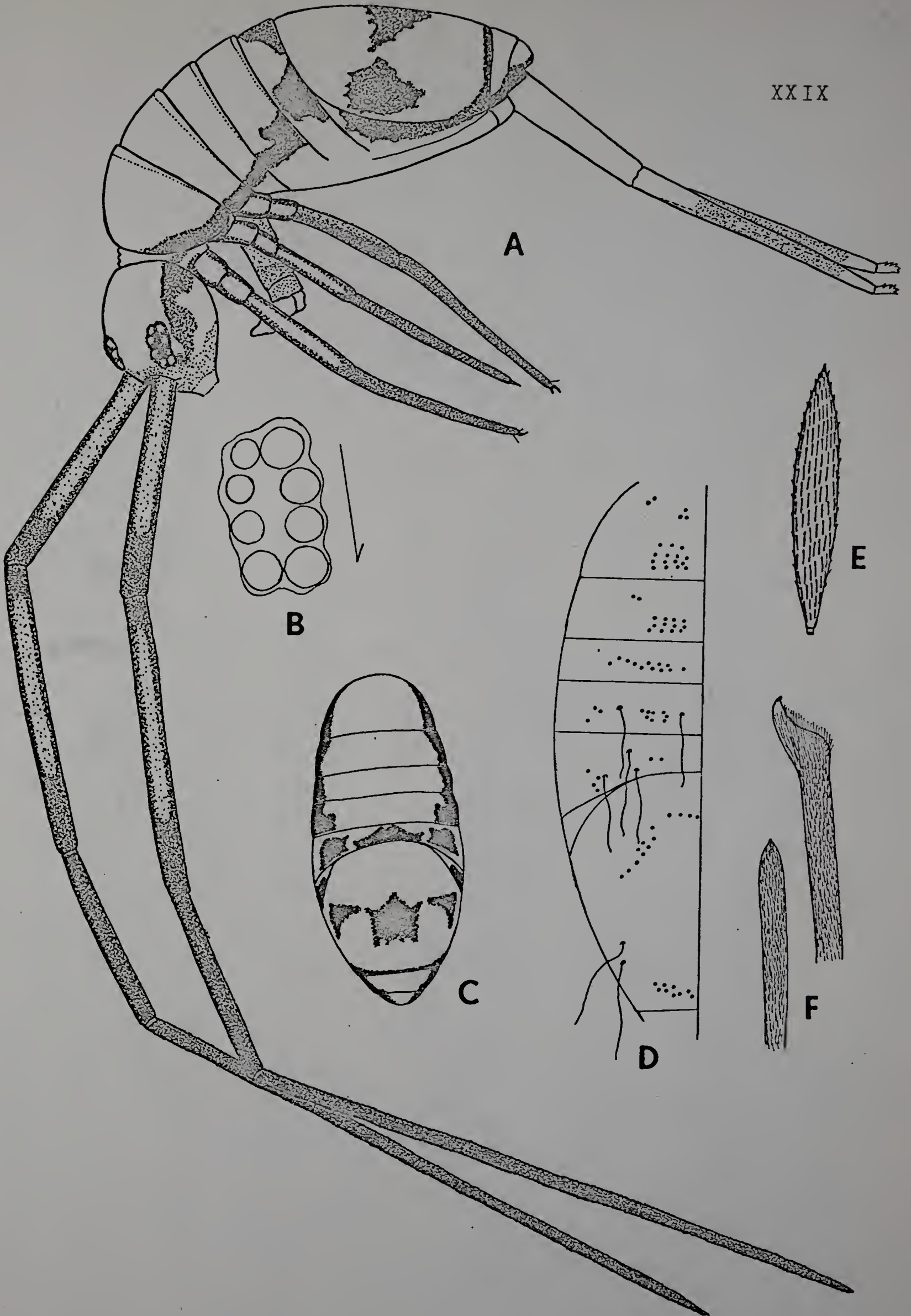


PLATE XXX

Aphysa longicornis (Oudemans)

- A. Trochanteral organ, lateral aspect. B. Male genital plate, ventral aspect. C. Hind unguis, unguiculus, and apex of tibiotarsus, lateral aspect. D. Mucro and apex of dens, lateral aspect. E. Mucro, dorsal aspect.

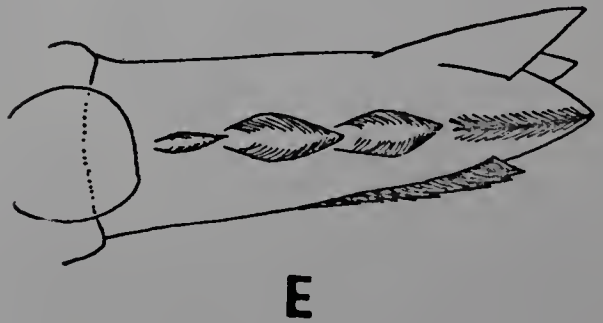
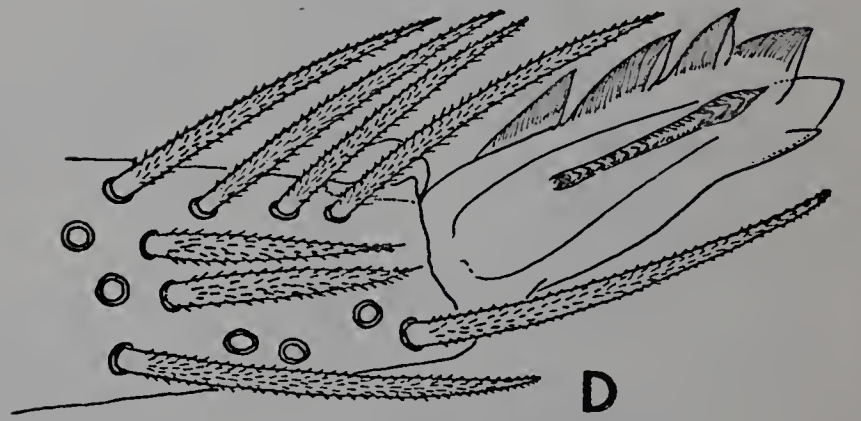
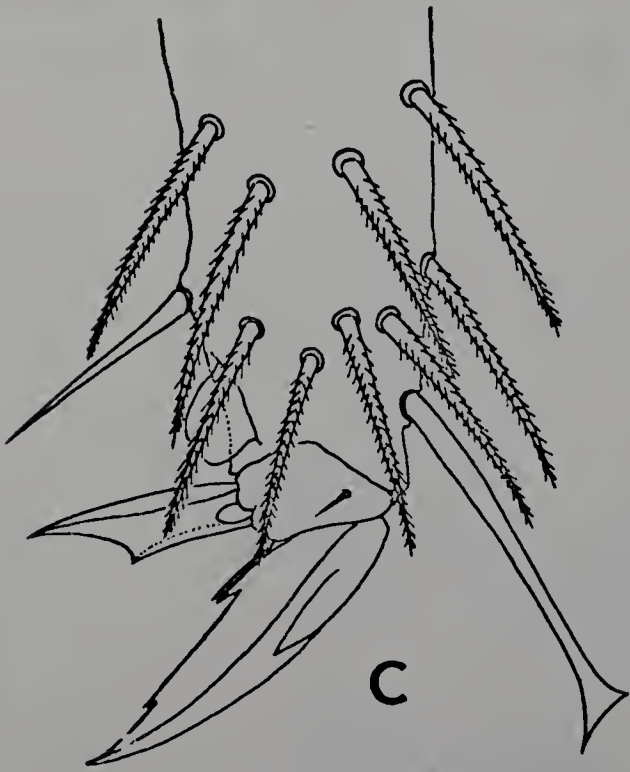
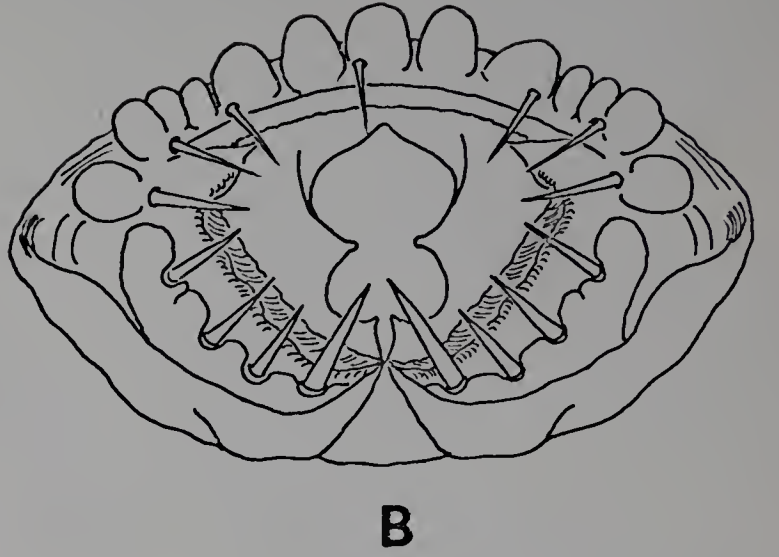
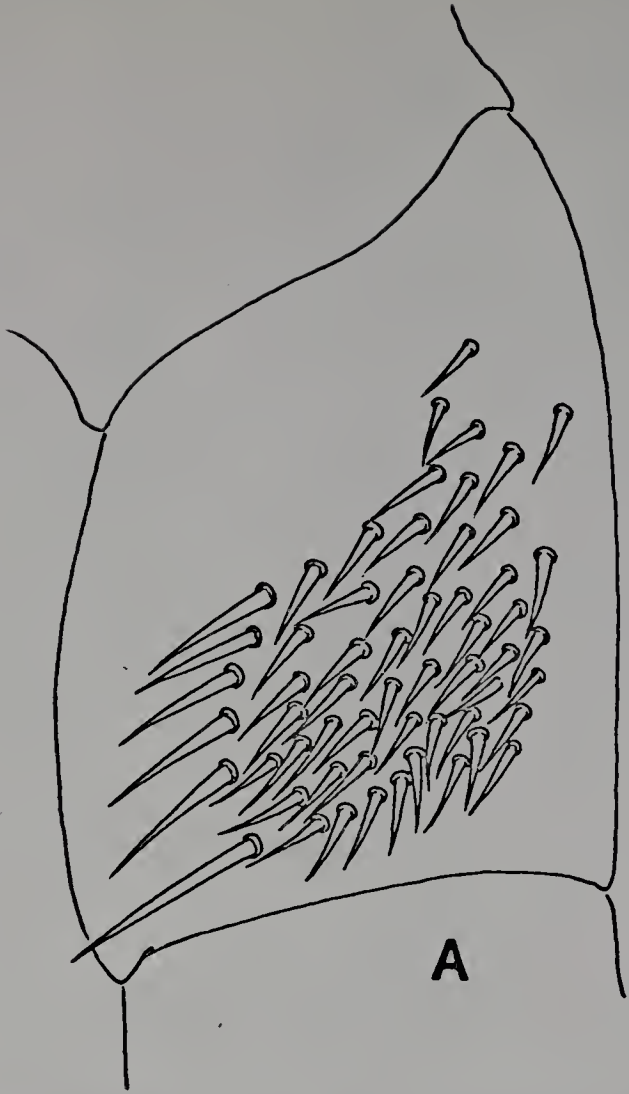


PLATE XXXI

Pseudoparonella setigera (Boemer)

- A. Habitus, lateral aspect, 47 x. B. Right eyepatch.
C. Body scale showing minute striations. D. Trochanteral organ, lateral aspect.

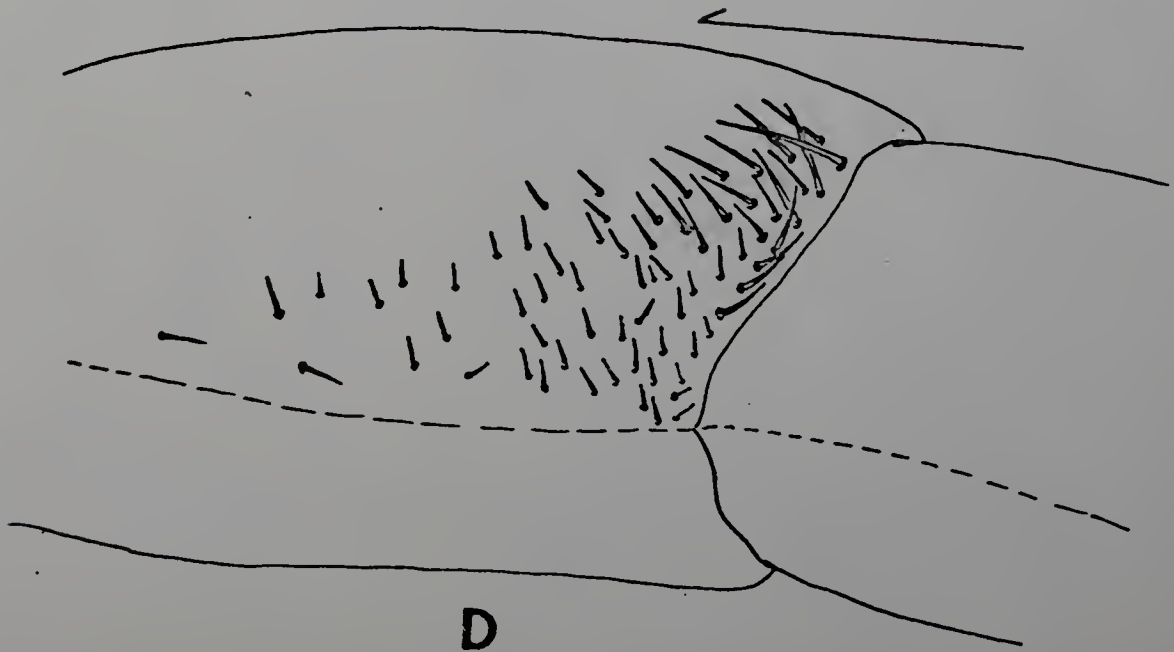
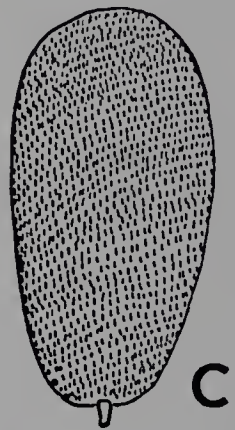
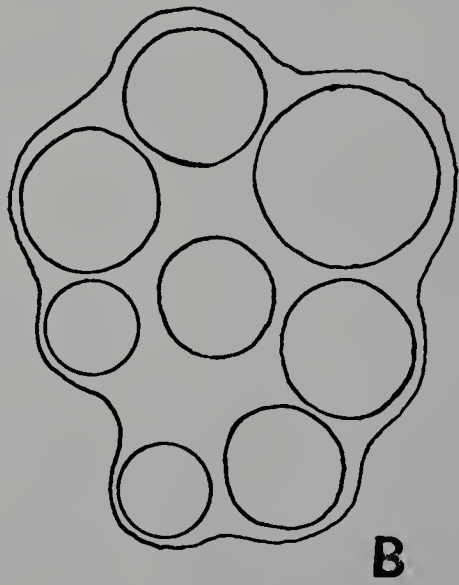
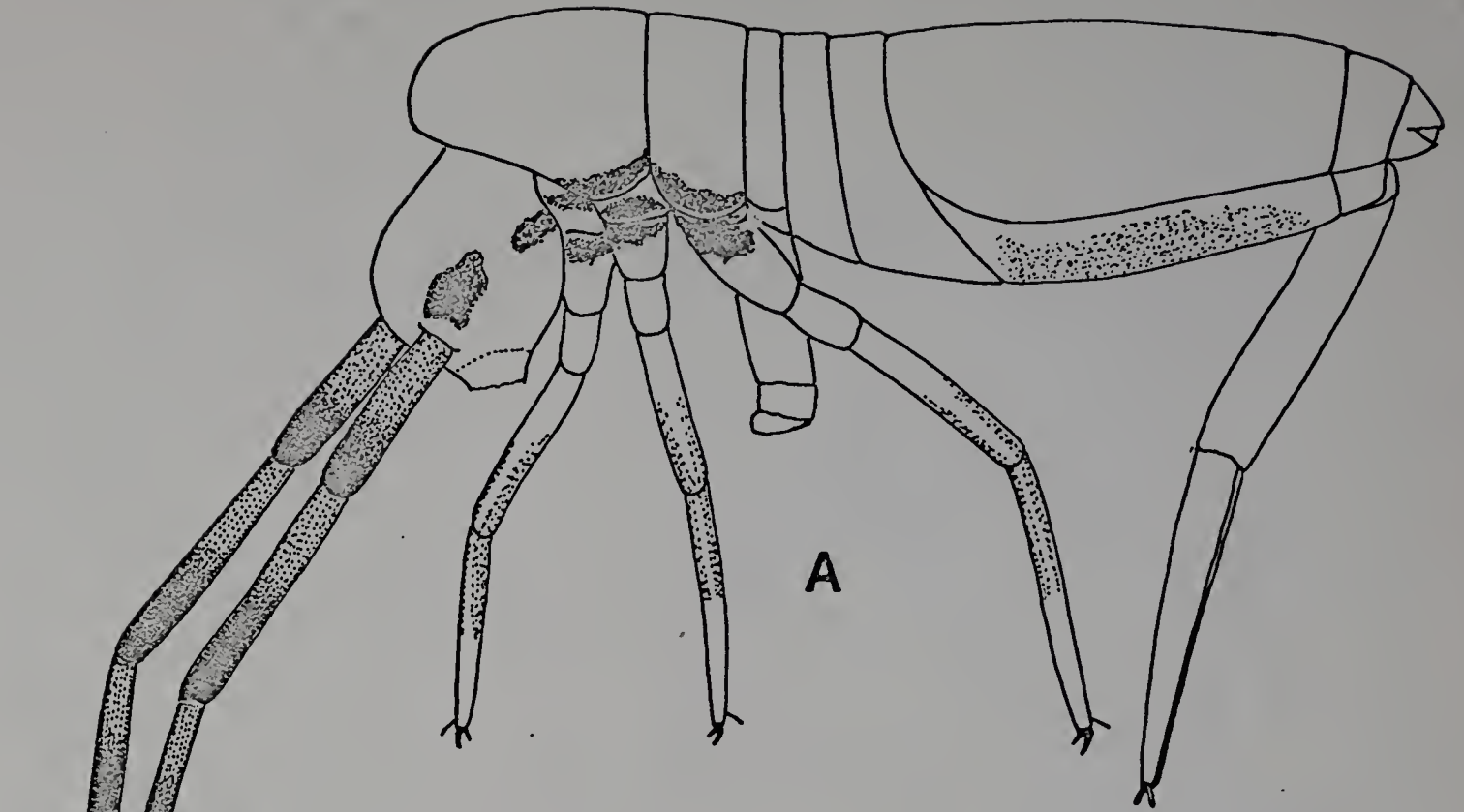


PLATE XXXII

Pseudoparonella setigera (Boemer)

- A. Hind femoral organ showing specialized setae and an enlargement of one such seta. B. A dental spine shown as detached from stalked socket. C. Hind unguis, unguiculus, and apex of tibiotarsus, lateral aspect. D. Mucro and apex of dens, outer lateral aspect. E. Same, inner lateral aspect, showing the 2 stout apical setae of dens. F. Mucro and apex of dens from another specimen, all setae omitted to show mucronal teeth, inner lateral aspect.

