Studies on the Collembolan Fauna of Malay and Singapore

With special reference to the Genera : *Lobella*, *Lepidocyrtus* and *Callyntrura*.

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The present report is based on materials from various sources. First of all, I have had occasion to collect some materials in the beautiful botanical garden of Singapore on my way to Europe in 1940. Some specimens are given to me by Mr. K. YOSHIBA, who has collected them on his trip to Pakistan in 1956. Further materials are obtained by myself on my way to and from the Antarctic in the year 1957–58. A few, but very interesting collection from Batu Cave are forewarded to me by Mr. M. NADCHATRAM of Kuala Lumpur for study. During my stay in Singapore I was much helped by Prof. ALFRED of the RAFFLES MUSEUM in many ways as well as by Dr. SANTIAGO of SELANGOR PLANT BREEDING INSTITUTION. To the above mentioned friends and collegues I should like to express my hearty thanks.

The collembolan fauna of the Malayan Penninsula was not well investigated. First report is that of G. H. CARPENTER in 1932 (Journ. F. M. S. Mus. Kuala Lumpur *17* ; 217-221), who has noted two species from Batu Cave in Selangor. Subsequently, J. T. SALMON has issued in 1951 a report including 9 known species and 12 new forms (Proc. R. Ent. Soc. Lond. B *20* ; 131-141), and lastly, H. E. GOTO has given two notes in 1955, regarding 4 species to be found there. (Ann. mag. nat. hist. Ser. 12, *8* ; 36-42 & Ent. monthl. mag. *91* ; 238-239).

In the present report, 35 species are noted, including two new genera and 16 new species, together with the redescription of those forms, which were poorly known to us. Beside these, the genera *Lobella*, *Lepidocyrtus* and *Callyntrura* are reviewed.

Tropicai Asia is the true "el dorado" for the students of edaphic fauna with its interesting forms and rich population. It is my utmost pleasure, if the present report is helpful for the further study of this interesting field of science.

1 *Ceratophysella exilis* YOSII

Yosii : 1956
2 Examples from penang, Malay 26. VI 1956 K. Yoshiba leg.
In the chaetotaxy of the body, malayan examples coincide well with the Japanese ones. Body colour is grey to olive.

2 *Xenylla similata* DENIS

Fig. 1

Denis 1948
One example from Batu Cave, Selangore, 11. I X 1958 M. Nadchatram leg.
Body length 0, 85 mm. Dorsally mottled with dark pigments. Body setae very short. Their arrangement is not satisfactorily investigated. Th. II, III dorsally with three transverse rows of setae. S. s. seems to be a little longer than others. Ventral tube has 4+4 setae.
The malayan example coincides well with the description DENIS' except for the eye-pigment, which is wholly absent.

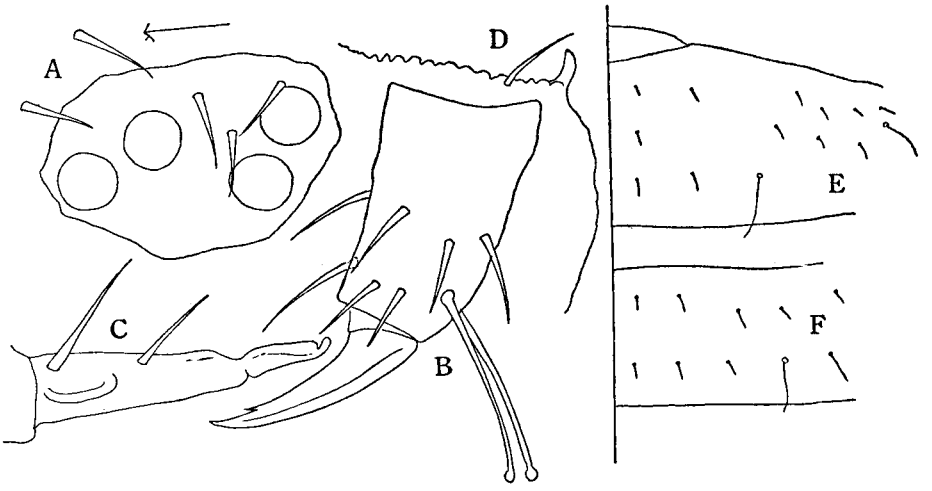


Fig. 1. *Xenylla similata* DENIS
A : Eyes B : Hind claw C : Dens and mucro
D : Anal spine E, F : Setal arrangement on Th. II and Abd. I

3. *Xenylla pseudobrevicaudata* Ritter

Fig. 2

Ritter 1910
1 Example from Singapore 23. VI 1956 K. Yoshiba leg.

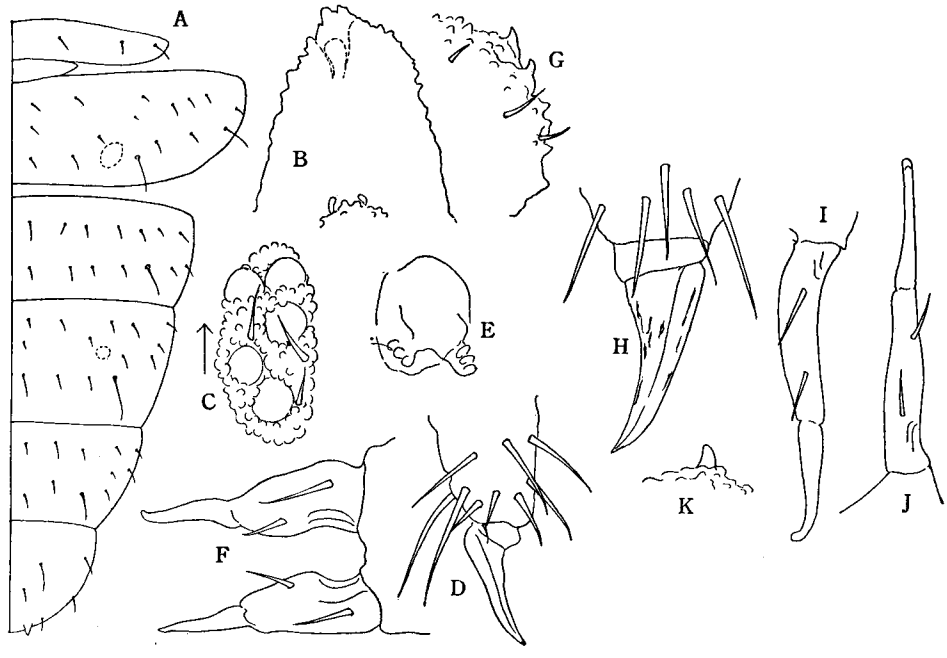


Fig. 2. *Xenylla pseudobrevicaudata* RITTER

A-G Malayan specimens
H-K Type specimen from Ceylon

A : Setal arrangement B : Antennal end C : Eyes
D : Hind claw E : Tenaculum F : Dens and mucro
G : Anal spines H : Middle claw I, J : Dentes and mucro
K : Anal spine

Body length 0.85 mm. Colour uniformly blue. Antennal segments as 7 ; 8 ; 8 ; 9. Ant. IV with an end bulb in a deep pit. Some accessory papillae of sensory nature seems to be present near it. Ant. III organ is a pair of blunt rods. Eyes 5+5, each separately pigmented. Legs with some tenent hairs, presumably 1, 2, 2 in number. They are somewhat longer than others and its apex is either slightly swollen in a spherule or not. Owing to the minute size, these structures are not easily to be observed and seemingly not of constant nature. Ventral tube with 4+4 setae. Tenaculum with 3 toothed rami. Furca poorly developed, being shorter than Abd. III in length. Manub. subequal to dens+mucro. The last two are well separated. Dens dorsally with two setae. Mucro is straight, distally slightly curving and ending in a rounded apex. Anal spines are very insignificant and may be discriminated from other integumentary granules only by

the shape of its corniculated outline. It has no real anal papillae, but the integument near their basis are roundly swollen. Body setae are short, but typically distributed for the genus. Setae sensuales are slightly longer than others and its location is p_3 on Th. II, III, p_5 on Abd. I–III, p_4 on Abd. IV and p_3 on Abd. V. Its position is, therefore, a little different to *X. humicola* from Japan.

An another example of the same species has been collected from Saigon, Vietnam (one male, 18. VI 1956 K. Yoshiba leg.).

In the Natural Historical Museum of Vienna, I have had chance to investigate the RITTER'S type specimen. There was one well preserved example with following data; Body length 0.9 mm. Colour grayish blue and strongly mottled. Eyes 5+5, upon black patch. Unguis slender, not dentated. Tenent hair absent?. Anal spines very small, slightly curved and without basal papillae. Furca well defined. Dentes and mucro separated. The latter is distally slightly curving and about 3/4 the length of the dentes.

SALMON'S *X. malayana* 1951 differs from the present species in having one prominent inner tooth of the unguis.

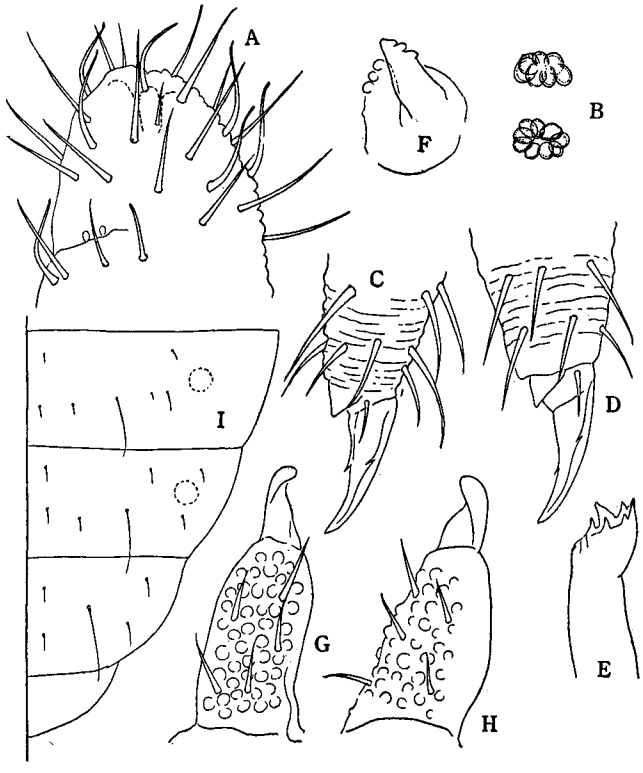


Fig. 3 *Brachystomella contorta* DENIS

A : Antennal end B : Postantennal organ of both sides C : Middle claw D : Hind claw E : Mandible F : Tenaculum G, H : Dentes and Mucro I : Setal arrangement on Abd. III-V

4. *Brachystomella contorta* Denis

Fig. 3

Denis : 1931

Many examples from Batu Cave, Selangore 11. IX 1958 M. Nadchatram leg.

Body length 0.8 mm. Colouration dull gray all over the body. In great magnification, dark pigments are scatterinng irregularly except on legs and furcula, which are almost pale. Antennae short, being

about 3/5 of the head in length. Their segments as 6 ; 7 ; 8 ; 12. Ant. III and IV are almost ankylosed. Ant. IV has distally an apical bulb in a deep groove. Slender, curving sensory setae are 6 in number. Ant. III organ is a pair of small rounded rods in a groove, accompanied by two guard setae, of which the outer one is longer than the other and subequal to the sensory seta of the last segment. Buccal cone is slightly protruded. Maxillar head typically built for the genus. Eyes 8+8, subequal and feebly pigmented to reddish black. Their pigments are isolated to each other. Postantennal organ rounded, as large as an eye in diemeter and composed of some 6-8 "peripheral" elements in a rosette. Upon legs, the claw is dorsally carinate and with one minute inner tooth, which is perceptible only in profile. The presence of a lateral tooth is also very difficult to observe but visible in frontal view. Tenaculum with 3-toothed rami. Furca short. Dentes dorsally granulated and with 5 setae. Mucro about 1/5 of the dentes in length. Its outer lamella is broadly extended and apically rounded in form of a spoon, while the inner margin is not much lamellated. Integument finely granulated all over. Body setae simple and small. They are arranged in two transverse rows in all body segmgnts. S. s. are somewhat larger and represents P_3 on Th. II–Abd–IV, while it is P_2 on Abd. V (parvula-Typus GISIN's 1957).

I have some hesitation to identify the present asiatic form to *B. contorta*, hitherto known from Costa Rica only. But from our present knowledge of the genus, it must be regerded as conspecific, since no decisive differences are to be found between them.

5. *Willemia nadchatrami* sp. n.

Fig. 4, 5

10 Examples from Batu Cave, Selangor, 11. IX 1958 M. Nadchatram leg.

Body length 0.8 mm Colouration entirely white. Ant. ; Head as 10 ; 9. Ant. III and IV dorsally half ankylosed. Ant IV with a spherical apical bulb situated somewhat laterally and one blunt sensory bulb of ellipsoid form, lying a little posterior in a shallow groove of the integument. Other sensory setae are not exactly defined, being not much different from other setae. But some of them are thin, curving and elongated. Ant. III–organ is a pair of rods in a furrow, accompanied by two sensory setae on both sides. Ant. II and I with only a row of curving setae. Surface of these antennal segments are roughly verrucose. Postantennal organ composed of about 7-8 subequal elements arranged radially in form of a rosette in a circle. Eyes absent. Dorsally, the head capsule is

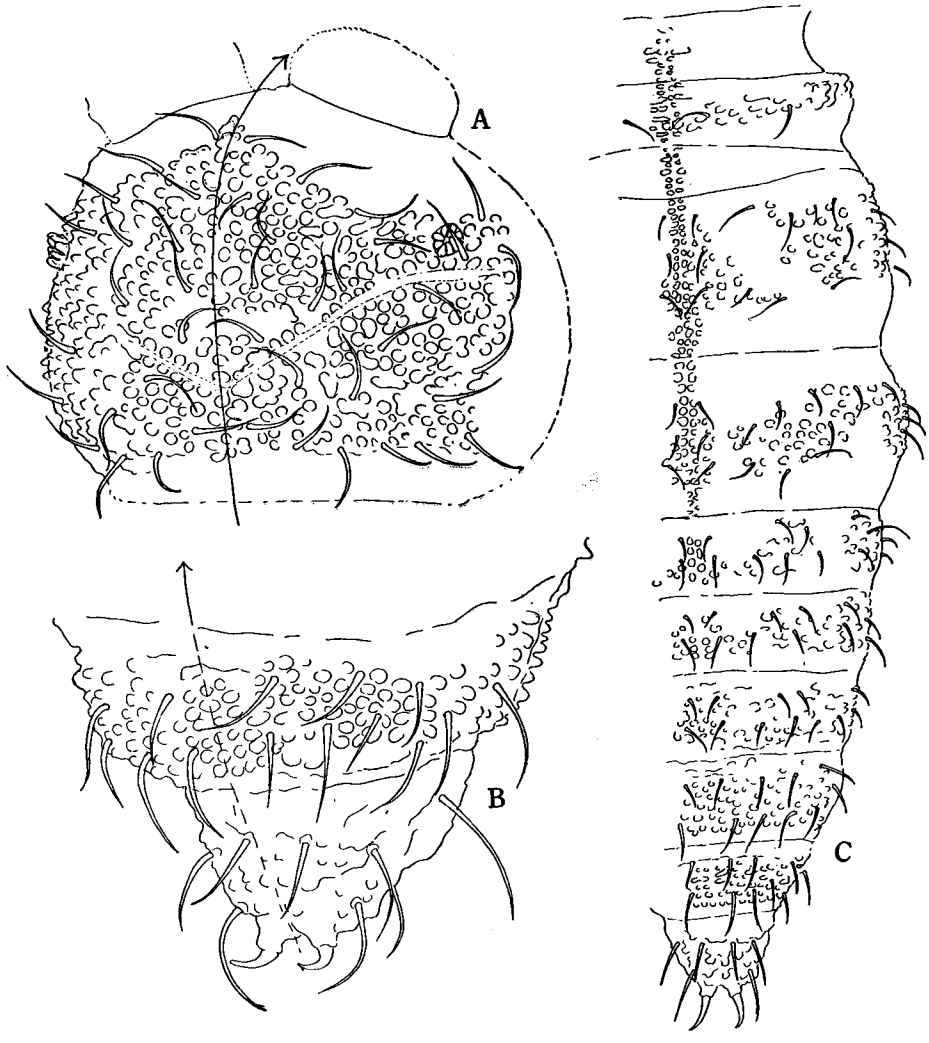


Fig. 4 *Willemia nadchatrami* sp. n.
A : Head B : Abd. V-VI C : Integumentary structure of each body segments

conspicuously granulated and the border of the granulated area is dictinctly defined. Antennal basis and the cervical margin is without such granulation. All setae are distributed within the granulated area. A broadly v-shaped suture of the head capsule is very prominent. Mouth almost not protruded. Mandible is apically 4-5 toothed and with well developed molar plate. Maxillar head is with

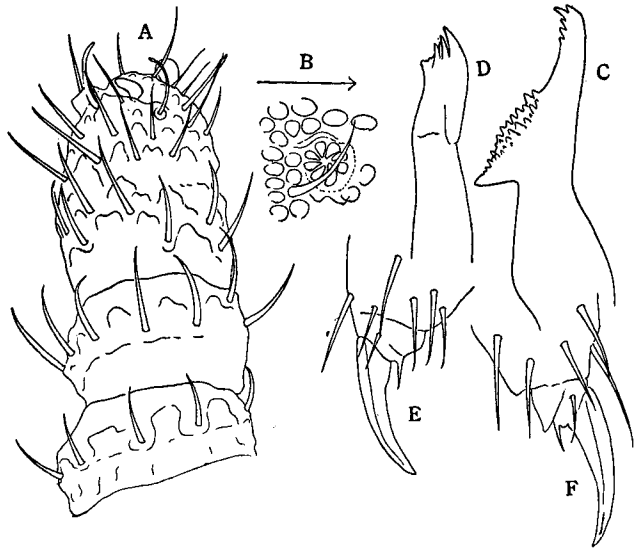


Fig. 5 *Willemia nadchatrami* sp. n.
A : Antenna B : Postantennal organ C : Mandible
D : Maxilla E : Fore claw F : Hind claw

4 teeth and resembles somewhat to that of the genus *Brachystomella*. Area frontalis is confluent with area ocularis and equally beset with setae as in fig. 4A. Their exact identity in comparison to *Hypogastrura* is impossible for the moment. Area verticalis is not separated. Area occipitalis is beset with a row of numerous c-setae and a pair of anteroir row, which is probably the p-setae of *Hypogastrura*. Legs short, with elongated unguis, which is not dentated. Unguiculus setaceous and without lamella. Tenent hair is not to be observed. Ventral tube with 4+4 setae. Furcula and tenaculum is wholly absent. Anal spines arcuate, as long as the unguis and placed on papillae, which are separated to each other at the base. Thoracic segments are characteristcally granulated all along the dorsal median line and on the segmental margin. In all body segments, the places where the body setae are located are roughly granulated to some extent. Th. I with only 2+2 setae. Th. II and III with three rows of them. Abd. I-IV are with two rows of setae. A_2 is situated apart from a_1, while p_1, p_2 and p_3 are equidistant in location. On Abd. V, the integument is more heavily granulated than on the precedent segment. Two rowed setae are subequal in length. Abd. VI is not granulated, but verrucous all over. Some of the body setae, especially those of larger size, are slightly serrated on one side. Setae sensuales are not differentiated.

The species, which is dedicated to my friend, Mr. M. NADCHATRAM of the Institute of Medical Science in Kuala Lumpur, is characterised by the well developed granulation of the integument. In other respects, it is related to *Willemia persimilis* BONET 1945 of Mexico, from which it is to be discriminated by sensory hair of Ant. IV, postantennal organ and by the body setae, which

is not at all vesicular toward the basis but slightly serrated. Integumentary granules are also peculiar.

6. *Lobella kraepelini* (Börner)

Fig. 6

Protanura kraepelini : Börner 1906
Neanura dubiosa : Ritter 1910
? *Neanura pudibunda* : Imms 1912
Protanura spinifera : Carpenter 1917—Salmon 1951—Goto 1955
12 Examples from Singapore 25. IV 1940 R. Yosii leg.

Body length up to 2.3 mm. Colour red in living and milky white in alcohol. Ant./Head as 5 : 6. Ant. III and IV are almost fused dorsally. Distal end bulbs of Ant. IV are not to be observed in all materials I have examined. Sensory hairs of the segment are relatively thin, slightly curving and with rounded apex. Ant. III-organ is normal and with a modified seta on its dorsal side. Ant. I and II have anteriorly a coarsely granulated area and each with a transverse row of setae. Upon head, there may be found only 1+1 ocular tubercle and 3+3 tubercles of the occipital row. Frontal and other tubercles of the head is implicited by the larger setae at the place. Eyes 3+3, either with well developed or feebly developed eye pigments. Two of them are located anterior to the tubercle at some distance from it, while the other one is situated on the postero-lateral side of it. Postantennal organ is represented by a rounded circle of the integument without granulation. The presence of this organ is sometimes difficult to observe, when the specimen is not well preserved. In all species of *Lobella*, this organ must be present in some way or other (Yosii 1956), although it has sometimes missed the notion of previous authors. Imms (1912) and Handschin (1926) have already described the structure precisely. Buccal cone is well developed and its apex is reaching the fore margin of the head. Mandibles are well develpoed, triangular in shape and with 6 teeth accompanied by a short branch of the mandible. Maxillae are elongated, distelly 2 toothed and accompanied by a fringed, hyaline lamella, whose apex is surpassing by far the haed of the maxillar shaft. Arrangement of the segmental tubercle and setae are as indicated in fig. A. Dorsal tubercles of the body are very insignificant except on Abd. V and is represented usually by the setae upon them. In some cases, a slight elevation of the integument is observed on Th. II–Abd. II around the setae. Th. I has remarkably 3+3 tubeucles in addition to a dorsal one, which is represent by one seta. On Th. II to Abd. IV, a fovea is located between dorsal and subdorsal tubercle and a small additional seta anterior to the

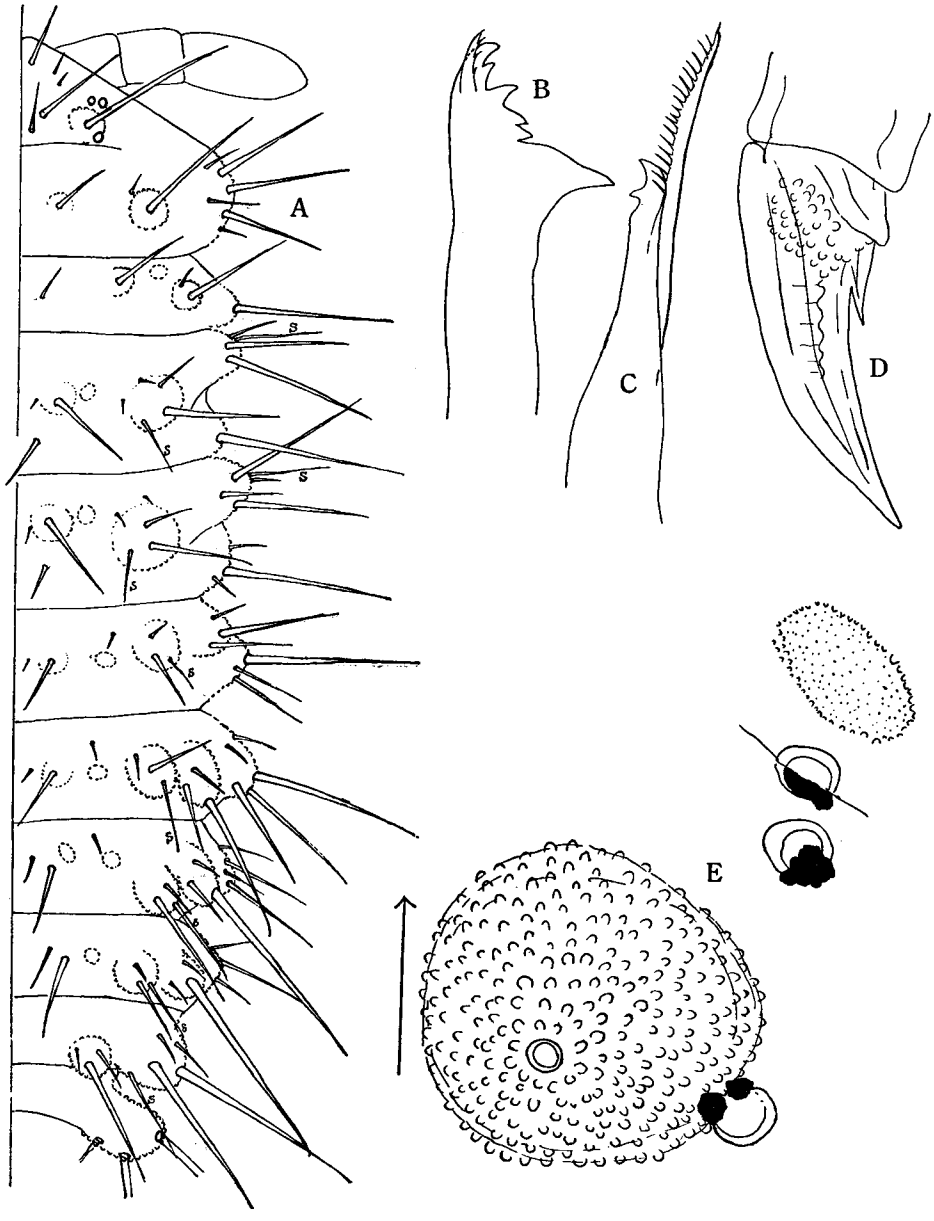


Fig. 6 *Lobella kraepelini* (BÖRNER)

A : Habitus B : Mandible C : Maxilla
D : Middle claw E : Eyes and postantennal field

fovea. Upon Abd. V dorsal tubercle of each side bearing 3 setae on it, is dislocated rather laterally and are, therefore, widely apart to each other. s. s. is lying on the dorsal side of the lateral tubercle in that segment. A paired tubercle of Abd. VI are also situated far apart to each other, thus giving rise to the species a prominent feature to distinguish it from other related species of the genus. All these segmental tubercles are rounded and granulated, but not subdivided to areas. Body setae are all simple, setaceous and slightly brownish in colour. They are never feathered nor serrated. Unguis is dorsally carinate and ventrally with one inner tooth at about the middle. Its inner surface is basally granulated and medially with many transverse striations. Furca is not present and is indicated by a lunate median area, where 1+1 setae are situated.

The species is already described by previous authors with various names. The description of *Protanura kraepelini* Börner 1906 by the example from Java (Buitenzorg) is exactly concordant with the present form. But he has missed the presence of the postantennal organ, which is sometimes not easy to be seen. He has also described the 3+3 eyes as "fast in einer Linie hintereinanderstehend". Possibly, he must have investigated the specimen somewhat in olique situation, when such a view may be observed.

Neanura dubiosa Ritter 1910 is based on the material from Ceylon. His description and figure is so meager that nothing can be decided from it. Fortunately, I have had occasion to investigate the origenal specimens preserved in the "Naturhistorisches Museum" in Vienna in 1941. There has been many examples of well preserved *Lobella*, which are surely equal to the present form.

Neanura pudibunda Imms 1912 from Khayon Cave in Burma is very near to the present species. But he has figured only 1+1 tubercle on Abd. V.

Neanura spinifera Carpenter 1917 from Burma is almost identical with the present specis. But he has not observed the postantennal organ of the head. Later on, Goto (1955) has reported *Protanura* sp. (? *spinifera* Carpenter) from Malay and figured the mouth parts of it. His description coincides well with what I have observed in my specimens.

Anoura fortis Oudemans 1890, from Sumatra, Java and Saleyer is poorly described and not to be correctly interpreted. As it has no inner tooth of the unguis, it can not be identical with the present form. Possibly, *A. fortis* is a collective species including *Lobella* or *Bilobella* spp.

7. *Lobella* (*Propeanura*) *hirtella* (BORNER)

Fig. 7

Achorutes hirtellus : BÖRNER 1906—DENIS 1948

4 Examples from Singapore 7. IV 1958 R. YOSII leg.

Body length ca 1.7 mm. Colour reddish in life and whitish in alcohol. Antennae short. Ant. I and II has each a granulated hump dorsally. Ant. III and IV are confluent dorsally. Ant. III organ, curving sensory setae of Ant. IV and the distal end bulbs are as usual for the genus. Head has 10 tubercles.

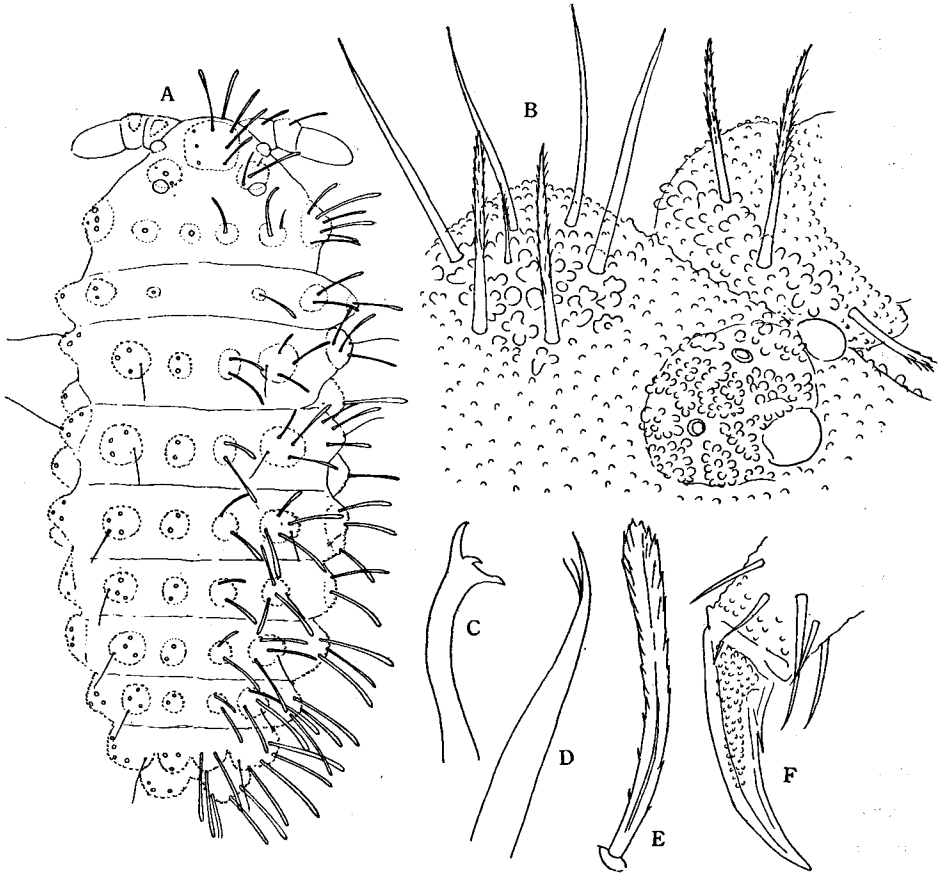


Fig. 7 *Lobella hirtella* (BÖRNER)

A : Habitus B : Anterior part of the head C : Mandible
D : Maxilla E : Body setae F : Middle claw

Antennal trbercle is fused with frontal one. Subocular, lateral and sublateral tubercles are fused to one in the occipital region. Eyes 2+2, very large and totally uncoloured. Ocular tubercle with 2 modified setae and one minute simple seta anterior to them. Frontal (+antennal) tubercle has 3+3 large setae and one mebian seta anterior to them. Clypeal tubercle has 1+1 modified seta upon it. From the occipital region, the dorsal tubercle has one, the subdorsal one large and one simple smaller seta. Buccal cone is dislocated strongly to the ventral side of the head. Mandible is tricuspidate and with some distal teeth. Maxilla is stylett form-and with a feeble branching. Both of them are feebly chitinised. Unguis slender, keeled dorsally and with one inner tooth. It is well granulated all along the side until near to the apex except along the inner ridge, where there is a smooth portion. Unguiculus and tenent hair absent. Ventral tube is beset with 3~4 small setae. Furcal rest is not present. Segmental tubercles well represented especially on distal half of the body. They are hemispherically protruded but not distinctly divided by furrows. Integumentary granules are not differentiated on these tubercles. Body setae are strongly serrated and swollen gradually to the end. But whether they are serrated on all sides or only in one plane is not observed. Their arrangenent is as follows: Th. I: 3+3 tubercles. Setae on it are as 1, 2, 1. Th. II, III: 3+3 tubercles, excluding those upon subcoxa. Dorsal tubercle with 2 subequal setae and one minute seta which lies directly posterior to the tubercle. Subdorsal tubercle with 3 setae and one s. s., lying on the dorsal side of the tubercle. Abd. I–III: Dorsal tubercle with 2+2 unequal setae. The posterior seta being about 2 times longer than the other. Subdorsal tubercle with 3 modified setae and one s. s. on the outer side of the tubercle. Sublateral tubercle with 2 setae. Lateral tubercle is ventro-lateral in position and with 3 modified and one simple setae. Abd. IV: with 2, 3+s, 3, 5 setae. Lateral tubercle is ventro-laterally located and with 2 modified and 3 simple setae. Abd. V: with 2+2 well defined tubercles. Dorsal one is with 3 modified setae, two of which lie anterior to the other greater one. Lateral tubercle has one s. s. on its dorsal side. Ventrally, between the lateral and the paired anal valve, there exists on both sides an another unconspicuous tubercle (ventral t.) with two modified and two simple setae. Abd. VI with a pair of rounded tubercle having some 3 modified dorsal and 2 simple ventral setae. They are situating a little appart to each other.

This is the form reported by DENIS as *A. hirtellus* from Vietnam. It can readily be identified by the peculiar shape of the body setae and by the diminution

of tubercles of the head as well as by the degenerated type of the buccal apparatus. The species is near to *Lobella pterothryx* (BÖRNER) 1909 from Japan (YOSII 1956, p. 619). Both of them have the reduced form of mandible and maxilla, representing a subgenus *Propeanura* YOSII (1956, p. 46). But the cited species has antennal tubercle of the head indepenent of the frontal tubercle (=Zentraltuberkel BÖRNER' s). Its unguis is also not much granulated.

8. *Lobella* (*Yuukianura*) *aphoruroides* (YOSII)

Protanura aphoruroides: YOSII 1953, GOTO 1955
Yuukianura aphoruroides: YOSII 1959
Many examples from Kuala Lumpur 10. IV 1958 M. Nadchatram leg.

The occurence of this species from Malay is already known. The insect is reared in the Laboratory of the Institute for Medical Research in Kuala Lumpur as a food animal for trombiculid mites. These examples coincides in all details with the Japanese form of the species.

Bilobella CAROLI 1912

In the present genus are included all such species, whose segmental tubercles are granulated in a manner as represented by the European *B. aurantiaca*. Body colour is either white, yellow or red in living. Pigments are always in the body fluid and not in the integument and disappears very soon in alcohol. In contrast to *Lobella* and its allies, whose tubercle is granulated regularly with rounded granules, it is warty and crystalloid in appearance. Postantennal organ or its like is not observed.

Known species of the genus is divided by the following manner:

Bilobella aurantiaca (CAROLI) ·····Europe
Head with 8 tubercles. Abd. V with 2+2 tubercles.

Bilobella grassei (DENIS)·····France
Head with 7 tubercles. All tubercles of Abd. V are united to one mass.

Bilobella singaporiensis sp. n. (female) ·····Singapore
Head with 10 tuberces. Body setae hirsute. Abd. V has 2+2 tubercles. Unguis with one inner tooth.

Bilobella singaporiensis sp. n. (male) ·····Singapore
Head with 12 tubercles. Body setae hirsute. Unguis without inner tooth.

Bilobella mandarina (YOSII) ·····Japan
Head with 12 tubercles. Body setae simple or almost so.

To the group are included possibly *A. hirtellus* (nec BÖRNER), HANDSCHIN

1926 from Java.

9. ***Bilobella singaporiensis*** sp. n.

Fig. 8, 9

12 Examples from Singapore 24. IV 1940 R. Yosiileg.

10 Examples from Singapore 6. IV 1958 R. Yosiileg.

The species shows sexual dimorphism. Colouration of both sexes are cinnabar red in living and whitish in alcohol.

Male: Body length 1.7 mm. Breadth 0.8 mm. Ant. /Head as 17 : 20. Ant. I

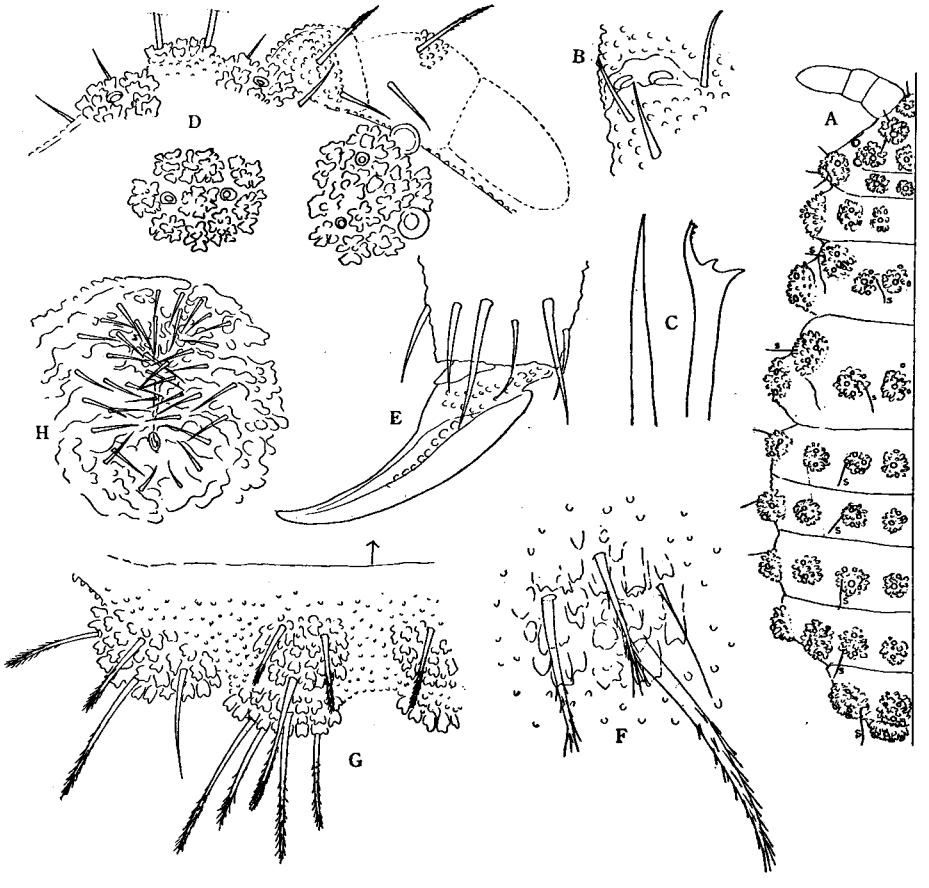


Fig. 8 *Bilobella singaporiensis* sp. n. (male)

A : Habitus B : Third antennal organ C : Mandible and maxilla D : Anterior part of the head E : Midde claw F : Subdorsal tubercle of Abd. III G : Abd. V and VI H : Male genital plate,

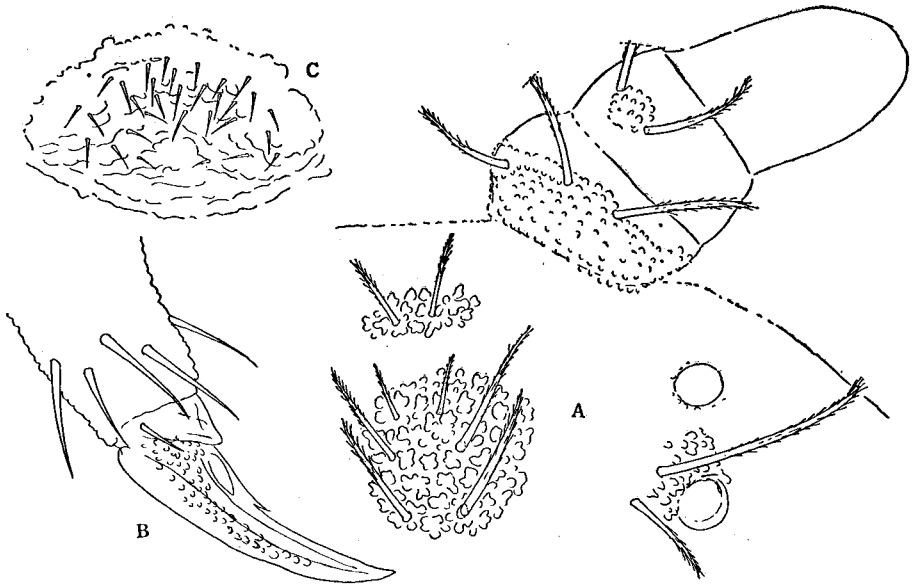


Fig. 9 *Bilobella singaporiensis* sp. n. (female)

A : Anterior part of the head with eyes B : Middle claw
C : Female genital plate

and II with coarsely granulated area. Ant. III and IV are almost fused dorsally. Distal end bulb three, hemispherical. Sensory curving setae 7 in number. Ant. III organ is a paired short rods curved to one side and in a furrow, accompanied by a slightly modified seta on its dorsal side. Eyes 2+2, unpigmented and are located on the anterior and postero-lateral side of the ocular tubercle. Postantennal organ absent. Buccal cone feebly developed, its apex not attaining the fore margin of the head. Mandible elongate with tricuspidate apex. Maxilla styliform. Head capsule bears all together 10 independent tubercles. Antennal tubercle with one large and 2 small setae, independent from the frontal tubercle, which has 1+1 large seta upon it. Dorsal tubercle of the occipital region is near to each other. Subdorsal tubercle has 1 large and 2 small setae. Th. I with 3+3 tubercles having 1, 2, 1 large setae. Th. II with 4+4 tubercles bearing 3, s+3 or 3, s+4, 3 setae. Abd. I-III with 4+4 tubercles having 2, 3+s, 2, 2 setae. Abd. IV with the same number of tubercles having 2, 2+s, 3, 5 setae. Abd. V has 2+2 tubercles with 3, s+4 setae. Paired tubercles of Abd. VI is not much different from others and are located somewat apart to each other. It is not concealed by Abd. V, but often half overlapped by it, when pressed under

the cover glass. Segmental tubercles are of *Bilobella*-type, i. e. they are composed of irregular aggregation of rough, compound granules and its structure is best observed upon posterior segments of abdomen. Body setae are not long, but densely feathered to all sides from the middle of their length. They are practically colourless. Unguis is dorsally carinate and without inner tooth. Inner surface of the unguis is minutely granular until to 2/3 of its length. Ventral tube has 3+3 setae. Furcula absent. A low hump of the integument with 2+2 setae are present at the place. Genital field of the male rounded, with many short setae anterior to the opening, which is surrounded posteriorly with a row of 3+3 setae.

Female: The antennal tubercle of the head is fused with the frontal tubercle to a mass, which has 3+3 feathered setae. Unguis has always one inner tooth at about the middle. Genital field is more depressed in outline than in the male and with many setae anterior to the transverse opening.

This is the first example of sexual dimorphism among the family Neanuridae. At first, I have thought these are two independent species. In invastigating 11 examples, which are divided to 5 examples of type A and 6 examples of type B, all of the type A were males, while all of the type B were females. Male examples are near to *B. mandarina* (Yosii) from Japan. But they may be easily separated by the feathered body setae.

There has been described quite a number of *Neanura* species from various parts of Asia and her vicinity. They are not always adequately known of their taxonomic important characters. Followings are the provisional list of species to be studied further with regard to their taxonomic value.

Morulini

Morulina

Morulina gigantea Tullberg f. alata Yosii ..... Japan

Morulina gilvipunctata (H. Uchida) ..... Japan

Neanurini

Neanura

Neanura fodinarum Yosii ..... Japan

Metanura

Metanura sebastiani Yosii ..... Japan

Lobellini

Crossodonthina

Crossodonthina japonica Yosii ..... Japan

Crossodonthica appendiculata Yosii ..... Japan

Womersleya

Womersleya vicina DENIS ····· Annam

Womersleya dawydoffi DENIS ····· Annam

Uchidanura

Uchidanura esakii (H. UCHIDA) ····· Micronesia

Coecoloba

Coecoloba spp. ····· Japanese caves

Yuukianura

Yuukianura aphoruroides (YOSII) ····· Japan, Malay

Yuukianura nomurai YOSII ····· Japan

Yuukianura halophila YOSII ····· Japan

Yuukianura cavicola YOSII ····· Japan

Lobella

Lobella sauteri BÖRNER 1906 ····· Japan

Lobella perfusa DENIS 1934 ····· Annam

Lobella similis YOSII 1954 ····· Japan

Lobella stachi YOSII 1954 ····· Japan

Lobella uozumii YOSII 1954 ····· Japan

Lobella mizunashiana YOSII 1954 ····· Japan

Lobella roseola YOSII 1954 ····· Japan

Propeanura

Propeanura pterothryx (BÖRNER) 1909 ····· Japan

Propeanura hirtella (BÖRNER) 1906, Denis 1948, ····· Java, Annam, Malay

Bilobellini

Bilobella

Bilobella singaporiensis sp. n. ····· Malay

Bilobella pygmaea (YOSII) 1954 ····· Japan

B. mandarina (Yosii) 1954 ····· "

Neanura Complex

In this group are included various species whose characters are incompletely known to us. They are described as *Achorutes, Neanura, Lobella, Protanura, Gnatholonche, Biocularia* etc.

I Dorsal tubercles reduced

1. Abd. V with 1+1 tubercle

Gnatholonche lipaspis BÖRNER 1906, HANDSCHIN 1926 ····· Java, Sumatra

2. Abd. V with 2+2 tubercles

Neanura corallina IMMS 1912 ····· Ceylon

Neanura intermedia IMMS 1912 ····· Himalaya

Achorutes indicus HANDSCHIN 1929 ····· Nilgiris

Neanura semilunaris SCHÖTT 1917 ····· Borneo

II Dorsal tubercles not reduced

1. Abd. V with 3+3 tubercles

Neanura sexoculata CARPENTER 1916, HANDSCHIN 1929 ..... Seychelles, Ceylon
Protanura carpenteri MUKERJI 1932 ..... Calcutta

2. Abd. V with 2+2 or 1+1 tubercles
A. Body setae smooth or almost so
Neanura zehntneri HANDSCHIN 1920 ..... Java
Neanura bakeri HANDSCHIN 1926 ..... Philippine
Achorutes japonicus BÖRNER 1909 ..... Japan
Protanura capitata FOLSOM 1932 ..... Hawaii
Neanura insularum CARPENTER 1935 ..... Marquesus
Neanura citronella CARPENTER 1904 ..... Hawaii
Neanura rosacea SCHÖTT 1917 ..... Queensland
Neanura borneensis SCHÖTT 1925 ..... Borneo
Neanura hypostoma DENIS 1929 ..... Yunnan
B. Body setae either feathered or serrated
Neanura separata DENIS 1934 ..... Annam
Neanura cirrata SCHÖTT 1917 ..... New Guinea

Following species are not to be identified exactly :
Achorutes takaoensis KINOSHITA 1932, UCHIDA 1954
The species is near to *Lobella sauteri* BÖRNER, but with only 2+2 eyes.
Anoura fortis OUDEMANS 1898 ..... Sumatra, Java etc.
Achorutes roseus (nec GERVAIS) BÖRNER 1909, UCHIDA 1951.
Doubtful species without any reliable description
Achoustes lipaspis (nec BÖRNER) UCHIDA 1944 ..... Micronesia
A species apparently different from BÖRNER's and HANDSCHIN's description.

10. *Folsomides exiguus* FOLSOM

Fig. 10, B—E

FOLSOM 1932

2 examples from Penang, Malay 26. VI 1956 K. Yoshiba leg.

Body length ca 0.7 mm. Postantennal organ about 4 times the length of an eye. The wall is relatively thick and with a notch at about the middle of the anterior side. Eyes 2+2, weakly pigmented, and the anterior omma slightly larger than the other. Unguiculus very small and often vestigial on hind legs. Man: D+Mu as 3:2. Manubrium dorsally with 4+4 setae, accompanied by 2+2 small lateral ones. Dentes with 3+3 subequal setae. Mucro is not sharply defined from the dentes and with two subequal distal teeth. Rami tenaculi with 3 teeth. Body setae polychaetotic. Almost all of them are equal in length and simple. Upon Abd. I-III, setae are arranged almost in 3 transverse rows and with some larger, erect setae, named by FOLSOM (1932) as "sensory hairs".

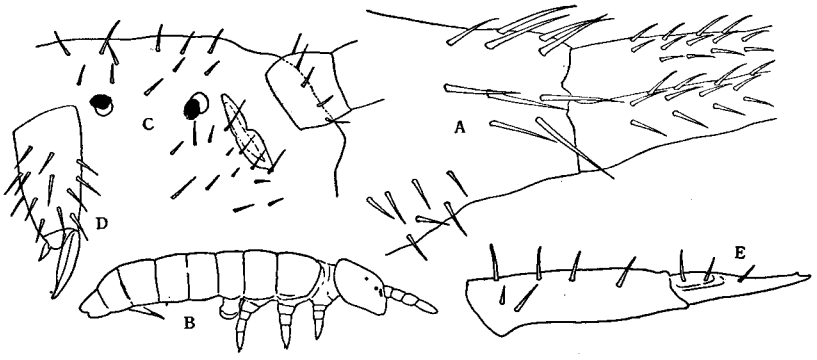


Fig. 10 *Isotomiella minor* (SCHÄFFER)
A : Ventral view of the manubrium and dentes
Folsomides exiguus FOLSOM
B : Habitus C : Postantennal organ and eyes
D : Middle foot E : Side view of the furcula

But they are not s. s. in strict sense and are not different morphologically from others. The species might be a local race of *F. parvulus* STACH (=*F. parvus* FOLSOM).

The species is known to occur from Hawaii and Australia.

11. *Folsomia octoculata* HANDSCHIN

HANDSCHIN. 1925……YOSII 1940, 1956

1 expl. from Penang, Malay 26. VI 1956 K. Yoshiba leg.

1 expl. from Singapore 6. IV 1958 R. Yosii leg.

These exmaples coincide well with japanese ones. The species is already reported from Java, Malay and Japan including Okinawa.

12. *Isotomiella minor* (SCHÄFFER)

Fig. 10, A

YOSII 1939……STACH 1947

2 Expl. from Penang, 26. VI 1956 K. Yoshiba leg.

1 Expl. from Bukit Timah, Singapore 9. IV 1958 R. Yosii leg.

2 Expl. from Singapore, 7. IV 1958 R. Yosii leg.

10 Exples. from Singapore, 25. IV 1940 R. Yosii leg.

All of these examples coincide well with the description STACH's. and GISIN's (1942). Ant. IV has 6 thick sensory hairs. Ventral setae of manubrium is as

1+1, 2+2, 2+2. The species is already reported from Europe, Japan and Hawaii.

13. *Sinella hofti* SCHÄFFER

Yosii ; 1940, 1947

1 expl. from Batu Cave, Selangore, Malay 11. IX 1958 M. Nadchatram leg.

The species is almost cosmopolitan in distribution.

14. *Homidia cingula* BÖRNER

Börner 1906, 1913……Handschin 1925, 1932

7 expls. from Singapore 25. IV 1940 R. Yosii leg.

The species is characterised by the peculiar type of body pattern. Chaetotaxically, it is just the same as Japanese *H. sauteri* Börner described by Yosii 1956. Abd. IV has a transverse row of anterior setae. Male genital opening, incompletely observed in one specimen is of papillated-type, but without setae surrounding it.

Lepidocyrtus BOURLET

The genus *Lepidocyrtus* is completely in chaos. For although there has been described almost 100 species from various parts of the world, we have no good characters to discriminate each of them. Body colour is usually regarded of primary importance, but there is good reason to believe that it is variable in some cases. Shape of the mesothorax, which is sometimes hanging over the head, may be used, but it is not available in all cases. Ratio of various parts of the body is also used (Denis 1948 etc.), but not always with successful results. In studying malayan and other forms of the genus, I have endeavoured to overcome the difficulty and to find any reliable characters to discriminate each species. The result is that, there is no one character all mighty to distinguish each species, comparable to the tergal chaetotaxy of *Seira* or the dental setae of *Arrhopalites*. In the following, general accounts of my results are given.

Antennae : Four segmented antennae are either without scales (*L. cyaneus*), with scales on Ant. I and II (*L. malayanus* sp. n.) or on all segments (*L. curvicollis*). Scales are usually dense on the dorsal side of the segment and the place is deprived of usual setae.

Head : Head capsule has a row of setae between two eyes along the fore margin of the head. They are either well developed (*L. malayanus* sp. n.) or feebly developed (*L. cyaneus*).

In *L. heterolepis* sp. n., some of them are remarkably converted to a kind of modified scales. Hind margin af the head capsule is beset with a row of simple, spiny setae in all species examined, but they furnish no specific difference.

Mouth parts : Clypeus, maxilla and labial papillae are not species specific. Mandible is of normal masticatory type.

Thorax : Prolongation of Th. II over the head is, of course, to be used for the taxonomy. Fore margin of the mesonotum is richly beset with a row of feathered setae. However, they are not with brush formed apex of *Entomobrya*-type.

Coxa : Instead of the absence of tergal chaetotaxy due to the achaetosis of the genus, setae upon coxa and subcoxa of each legs are remarkably emphasized. It is seemingly interesting and fruitful to follow their arrangement in each species. They are arranged in two longitudinal rows on mid legs and in one row on fore and hind legs, although there are more isolated groups of setae upon each of them. In Fig. 11, their arrangement is diagramatically given. Number of setae upon each of these rows is sometimes specific and sometimes not. The case must be further studied. Fore legs have a well represented protrusion near the basis, bearing 3-4 setae. Middle and hindcoxa is basally with a well defined subcoxa with some setae on it.

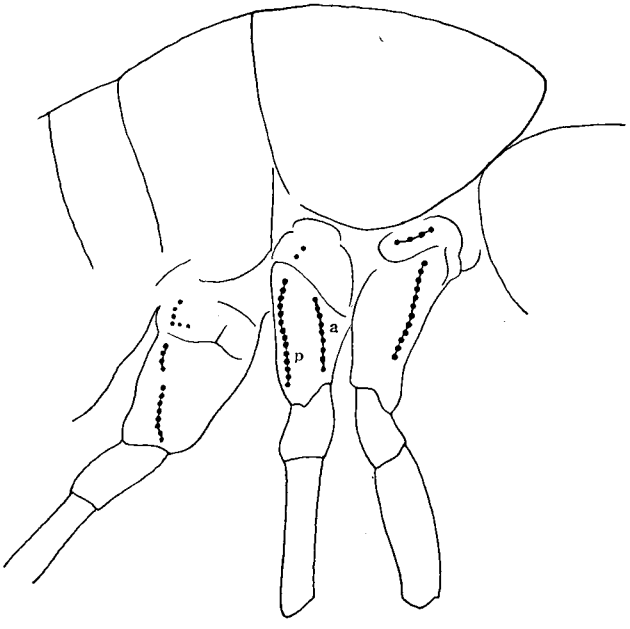


Fig. 11 Setal arrangement of each coxae, diagramatic.

Trochanter : Hind trochanter has, as in all genera of *Entomobryidae*, a trochanteral organ composed of many spiny setae. It is variable from 9 in L-shaped arrangement (*L. cyaneus*) to about 50 in a trianglar area (*L. malayanus* sp. n.). It is, therefore, species specific in some cases.

Tibiotarsus : In some species (*L. cyaneus, medius* etc.) tibiotarsus is without scales, while it is well beset with scales in *L. curvicollis, malayanus* sp. n. etc. Tenent hair is not promising to furnish any specific character.

Unguis and Unguiculus : Position of each denticulation upon unguis is already studied by DENIS 1948 et al. But the result is yet problematic as in the case of *Entomobrya* (cf. CHRISTIAN-

SEN 1958 etc.). Whether the unguiculus is truncte or lanceolate is already used to divide groups of species. It is to be assumed that the truncate form ocurs often in species of relatively remote groups as *L. medius*, *L. suborientalis* and *L. ruber*.

Abdomen : Owing to the progress of *achaetosis*, almost all greater setae of tergites are disappeared and their chaetotaxy is not available for taxonomy. Setae sensuales are, however, unchanged and distributed as 2, 3, 2 upon Abd. II-IV respectively. The place of their incertion is accompanied by some modified scales different from the usual rounded and hyaline ones, thus impliciting their relationship to *Seira*, *Lepidosira* and to *Pseudosinella*.

Ventral tube : Almost all genera of *Entomobryidae* with holochaetotis and oligochaetosis have the ventral tube extremely hirsute. In some achaetotic genera as *Lepidocyrtus* and *Pseudosinella*, the setal arrangement of the ventral sube is promising for further study. The results may be seen in the description of each species. Anterior face has a median groove prolonged from the mouth to the apical lobe of the ventral tube. Each setae are arranged almost symmetrically to the groove and some distal pairs of them are greater than others. On the posterior face, some distal pairs are also greater than others (*L. carosus*, *malayanus* etc.) but not so in others (*L. cyaneus*, *medius* etc.). In some species, the ventral tube is scaled or with spiny setae (*L. carosus*, *curvicollis* etc.)

Tenaculum : Corpus with one median seta and 4-toothed rami. Quite uninteresting from the taxonomic point of view.

Manubrium : The most promising of all the characters examined are of the furcula. Manubrium is well developed. Ventrally, it is densely scaled and without setae. Only 2+2 (*L. cyaneus*, *lanuginosus* etc.) or 3+3 (*L. malayanus* sp. n. etc.) small terminal setae are present medially at the posterior end of the segment. On both sides of these terminal setae, there is a group of scales, which is almost in a few rows (*L. suborientalis*) or in a group (*L. malaynus* sp. n.). Dorsal side of the manubrium is hirsute with many feathered setae (*L. cyaneus* etc.) or with a median glabrous stripe with many scales (*L. curvicollis*). Distal end of it has a isolated group of setae in 7-8 pairs (*L. cyaneus*) or in 15-20 pairs (*L. malayanus*). Laterally, along the border of the dorsal hirsute and ventral scaled area, there may be present a row of stronger hairs or spines finely ciliated (*L. malayanus*, *carosus*. *heterolepis*). If it is confined to *Acrocyrtus* Group of the genus, is not yet certain.

Dentes : Structure of dentes are to be studied with special care. Proximally, dental lobe has either acute (*Acrocyrtus*) or rounded (*Discocyrtus*) protuberance on its dorsal side or not (*Lepidocyrtus* s. str.,). *L. brunneus* HANDSCHIN and *L. lepidornatus* HANDSCHIN 1930 (Philippine) have more pairs of them. Its ventral side has on its distal 3/4, a median glabrous zone faintly annulated. Both sides of the glabrous zone are richly beset with hyaline scales. Setae are arranged in 4 longitudinal rows at about the middle of its length. Two are on its inner side and 2 on the outer side. The upper row of each side is longer than of the lower row in general. Lower inner row is sometimes con-

verted to spiny setae with minute ciliation (*L. malayanus, carosus* etc.) or extremely long (*L. heterolepis*). Whether the former is equivalent to dental spines of *Acanthurella* BÖRNER 1906 is not certain. Dorsal side is crenulated as usual.

Mucro : Bidentate with a basal spine. Its form is generally more elongated than in *Entomobrya* and serves sometimes to distinguish each species. *L. parvidentatus* SCHÄFFER 1898 is different, in this respect, from *L. parv.* HANDSCHIN 1930. Some species with falciform mucro are reported. But their relation to *Seira* is yet to be studied.

For the examination of these characters, the specimen must be dissected. Head and furcula must be cut off. Ventral tube may conveniently beisolated from the body together with hind legs.

Lepidocyrtus (s. lat.) is divided conveniently into some subgenera in the following manner:

1. Dentes without dental spines 2
   Dentes with a row of dental spines ..... *Acanthurella*
2. Dental lobe dorsally with accessory apparatus 3
   Dental lobe without accessory apparatus ..... *Lepidocyrtus*
3. Dorsal accessory apparatus acute ..... *Acrocyrtus m.*
   Dorsal accessory apparatus apically rounded ..... *Discocyrtus m.*

As for the synonymy and allies of the genus, *Paidium* KOCH 1840 is equal to *Lepidocyrtus*. *Lepidocyrtoides* SCHÖTT 1917 is a specialised group of *Seira*. *Bromacanthnus* SCHÖTT 1925 is nearly related to *Pseudoparonella*. *Acanthurella* BÖRNER 1906 must be verified as to whether an accessory apparatus on the dental lobe is present or not. If present, my *Acrocyrtus* might fall in the synonym of it. For *Acanthocyrtus* HANDSCHIN 1925 further studies are needed.

**Lepidocyrtus* (s. str.) *curvicollis* BOURLET

Fig. 12

Some 20 Examples from Liége, Belgium III 1956 F. Carpentier leg.

Body up to 2.0 mm. Ground colour white with slight brownish tinge. Antennae bluish distally from Ant. II. Basal two segments of esch legs slightly pigmented to blue. Eyes black. A black spot is present between eyes. Ant./Head as 2:1. Ant. segm. ratio as 1:2:3. Antennae scaled from the basis until to the basal part of Ant. IV in full grown exsmples (2.0 mm.), while it is scaled on proximal three segment in examples about 1.8 mm. Lesser ones have seales only on Ant. I and II dorsally. These scaled parts are not well haired. Ant. III organ is a paired rods near the distal end. Eyes 8+8. Setae along the fore margin of head about in 10 pairs. They are blunt feathered setae.

* In the present paper, I have incorporated two European forms of the genus to give the full account of the above mentioned thesis

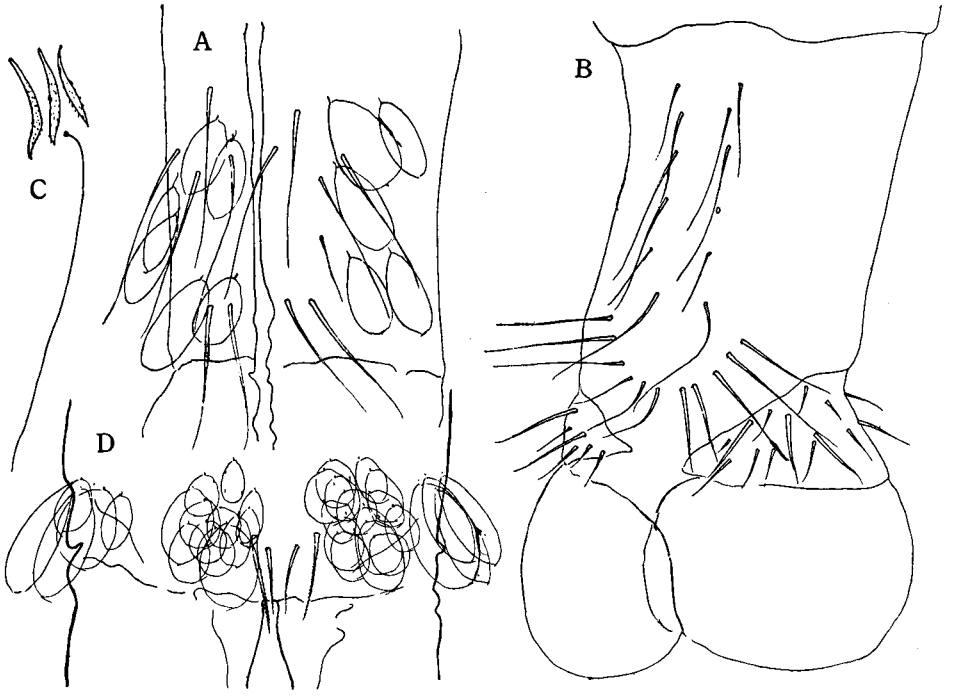


Fig. 12 *Lepidocyrtus curvicollis* Bourlet

A, B : Ventral tube (anterior and posterior face)
C : Seta sensualis with accessory scales
D : Dental end of the manubrium (ventral view)

Mesothorax is moderately hanging over the head. Th. II : III as 2 : 1. Abd. III/IV as 1 : 4. Legs are scaled until to the tibiotarsus. Number of coxal setae about as : I-12, II a-10, p-13, III-15. Trochanteral organ of hind foot composed from 25-30 rather long spiny setae in a triangular area. Unguis with a pair of lateral and inner basal teeth, together with a median inner distal tooth well represented. Unguiculus lanceolate and acuminate to the end. Accessory scales of setae sensuales are very narrow and might be regarded practically as ciliated setae. s. s. are also poorly developed and short. Ventral tube is anteriorly with 2+2 distal and some 5+5 proximal setae in a fixed pattern as Fig. A. Both anterior and lateral face of the tube are richly scaled. Posteriorly, there are a distal group of some 5 central and 3+3 lateral setae together with some 5-6 pairs of proximal satae in two rows. Number of setae are augmenting in larger individuals on its posterior face, but not on anterior face. Furcula with Man. : Dens as 25 : 26. Maubrium is ventrally scaled and with 2+2 terminal setae. Scales of the terminal

group are large and about 20–30 in number, dispersed in a circular area. Dorsally, the manubrium has a broad median stripe scaled and not haired. The manubrial setae are, therefore, restricted to the dorso-lateral stripe of each side in some 2–3 rows, in strong contrast to other forms of *Lepidocyrtus*. Each setae are long and extremely hirsute. Terminal group is about 15–30 pairs, according to the body size. Dentes normal, without dental appendix. Setae are in 4 longitudinal rows and none of them are modified. Scales are relatively large. Mucro bidentate and with a basal spine. Smooth portion of the dentes is about 2.2 times the length of the mucro. Scales of the body are sometimes intensively brown, while it is not much so in some individuals. The difference might be whether the individual is directly after the ecdysis or not or whether they are of different races. Metallic shimmer and the difference of body colour of old authors might due to such condition of body scales.

Lepidocyrtus cyaneus TULLBERG

Fig. 13

5 examples from Liége, Belgium III 1956 F. Carpentier leg.

Body length ca 1.0 mm. Colouration somewhat paler than it is indicated by previous authors. It is pale on occpital region of the head and along each segmental margins. Legs are coloured on the proximal half of each coxae. Ventral tube coloured. Furcula coloured until to the basal part of dentes. Ant. /Head as 8 : 5. Ant. segm. ratio as 10 : 19 : 19 : 32. All of them are not scaled and Ant. I is dorsally well beset with serrated setae. Ant. III-organ normally built. Eyes 8+8. Setae between them are few in number (ca 6+6) and is not differentiated. Mesothorax slightly protruded over the head. Th. II/III as 5 : 3. Abd. III/IV as 4 : 13. Legs are scaled only on the proximal half of each coxae. Trochanteral organ is of ca 10 setae in L-shaped arrangement. Unguis and unguiculus as in *L. curvicollis*. Tenent hair normal. Ventral tube has anteriorly about 10 long feathered subequal setae. Posteriorly, a median distal group of 3–5 setae, 2+2 lateral and 5–7 of proximal group are present. The tube is never scaled. Accessory setae of s. s. are minute, distally broad and with dilatated end. s. s. are short. Furcula with Man : D. as 10 : 9. Manubrium is ventrally scaled and with 2+2 serrated terminal setae. Scales on both sides of them are 10, arranged somewhat in two rows. Dorsal side is not scaled but with many evenly dispersed feathered setae. Terminal group of setae in 5–6 pairs, in a definite arrangement. Dental lobe without appendix. Four rows of setae are not modified. Ventral scales normal. Mucro as in *L. curvicollis*.

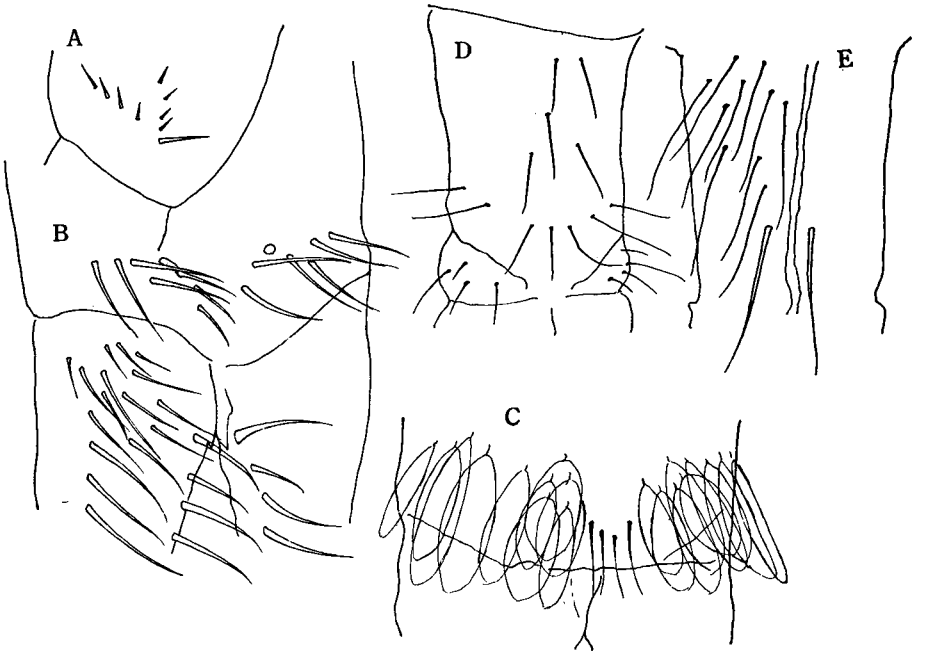


Fig. 13 *Lepidocyrtus cyaneus* Tullberg

A : Trochanteral organ B : Dental end of the manubrium (dorsal view)
C : Ditto (Ventral view) D, E : Ventral tube (posterior and anterior face)

Morphologcally, the species is different from *L. curvicollis* not only by the shape of the mesothoracal tergit, but also in following points: (1) Antennae totallg devoid of scales (2) Legs not scaled distally. (3) Manubrium not scaled dorsally and without median glabrous stripe. (4) Ventral tube not scaled. (5) Trochanteral organ in L-shaped arrangement.

15. *Lepidocyrtus medius* SCHÄFFER

Fig. 14

Schäffer 1898, Börner 1913, Handschin 1926, Uchida 1949

18 expls. from Singapore 25, IV 1940 R. Yosii leg.
1 expls. from singapore 26. VI 1956 K. Yoshiba leg.
4 expls. from Singapore 8. IV 1956 R. Yosii leg.

Body length ca 1.5 mm. Colour brownish white. Antennae pigmented purple distally. A median spot between eyes. Eyes black. Other parts of the body quite pale. Ant./Head as 28 : 15. Ant. segm. as 12 : 28 : 30 : 42. All antennal segments are without scales in all examples examined. But as Ant. I is dorsally denuded of setae, it is possible that the place is scaled. Eyes 8+8.

Fig. 14 *Lepidocyrtus medius* SCHÄFFER

A : Habitus B : Hind claw C : Middle claw D : Accessory scales of seta sensualis of Abd. IV E : Trochanteral organ F : Ventral view of the dental end of manubrium G : Dorsal view of the same H : Mucro I, J : Ventral tube (anterior and posterior view)

Th. II is protruded considerably over the head. Th. II : III as 15 : 7. Abd. III : IV as 1 : 3. Legs without scales at least on distal three segments. Number of coxal setae about as : I-7, II a-5 or 6, p-6 or 8, III-10 or 12. Trochanteral organ of the hind feet of about 15 spiny setae in a triangular area. Unguis and tenent hair usual for the genus. Unguiculus is strongly truncate on its inner side,

especially on fore and mid legs, while it is somewhat obscured on hind legs as was stated by Schäffer (1, c. p. 420). Two ridges of unguiculus are almost parallel to each other in all these feet. Accessory scales of s. s. are small and in form of a foliaceous spindle. Ventral tube is anteriorly with many long setae from which 5+5 are stronger than others. Posteriorly, setae are feebler and all 9 setae of the distal group is subequal. Proximal group is about 5 pairs. Furcula with Man. : Dens as 1 : 1. Manubrium is ventrally scaled and with 3+3 terminal setae, of whch a lateral pair remarkably larger than others. Scales on both sides of them are about 7 pairs in a circular area. Dorsally, it is not scaled but with a narrow median glabrous stripe. Both sides of the stripe is haired and the terminal group of setae are in 8 pairs in a definite arrangement. Dentes are normally with 4 rows of setae. Smooth portion of dentes are 2. 3 times the mucro in length. Mucro with apical tooth elongated. Anteapical tooth is a little smaller than that.

The species is characterised by the truncate unguiculus and by the terminal setae of manubrium. The species is already reported from New Guinea, Java, Malay, and Micronesia.

Subgenus *Acrocyrtus* subgen. nov.

Lepidocyrtus having scales on some antennel segments and legs. Dental lobe with a dorsal appendix apically pointed.

Subgenotypical species : *Lepidocyrtus malayanus* sp. n.

To the subgenus belong further *L. carosus* sp. n. and *L. parvidentatus* (nec SCHÄFFER 1898) HANDSCHIN 1926, 1930 of Java as well as *L. aequidentatus* DENIS 1948 and *L. lobatus* DENIS 1948 from Annam.

16. *Lepidocyrtus* (*Acrocyrtus*) *malayanus* sp. n.

Fig. 15, 16

7 Examples from Bukit Timah, Singapore 9. IV 1958 R. Yosii leg.

Body length up to 2. 5 mm. Ground colour brownish white. Antennae are intensely coloured with bluish pigments distally from Ant. II. Eyes black. Body totally uncoloured except on Abd. V and VI, which are faintly darkened. Legs dark on distal two segments, leaving the tip of each tibiotarsus uncoloured. Ventral side and the furcula are pale. Ant. : Head as 12 : 7. Ant. segm. ratio as 9 : 18 : 11 : 23. Scales are present dorsally upon Ant. I and II, where setae are scarce. Fore margin of the head with a row of about 12+12 robust setae. Eyes 6+6, G and H being very small. Mesonotum strongly hanging over the head. Th. II : III as 7 : 3. Abd. III : IV as 1 : 5. Scales of the hind margin

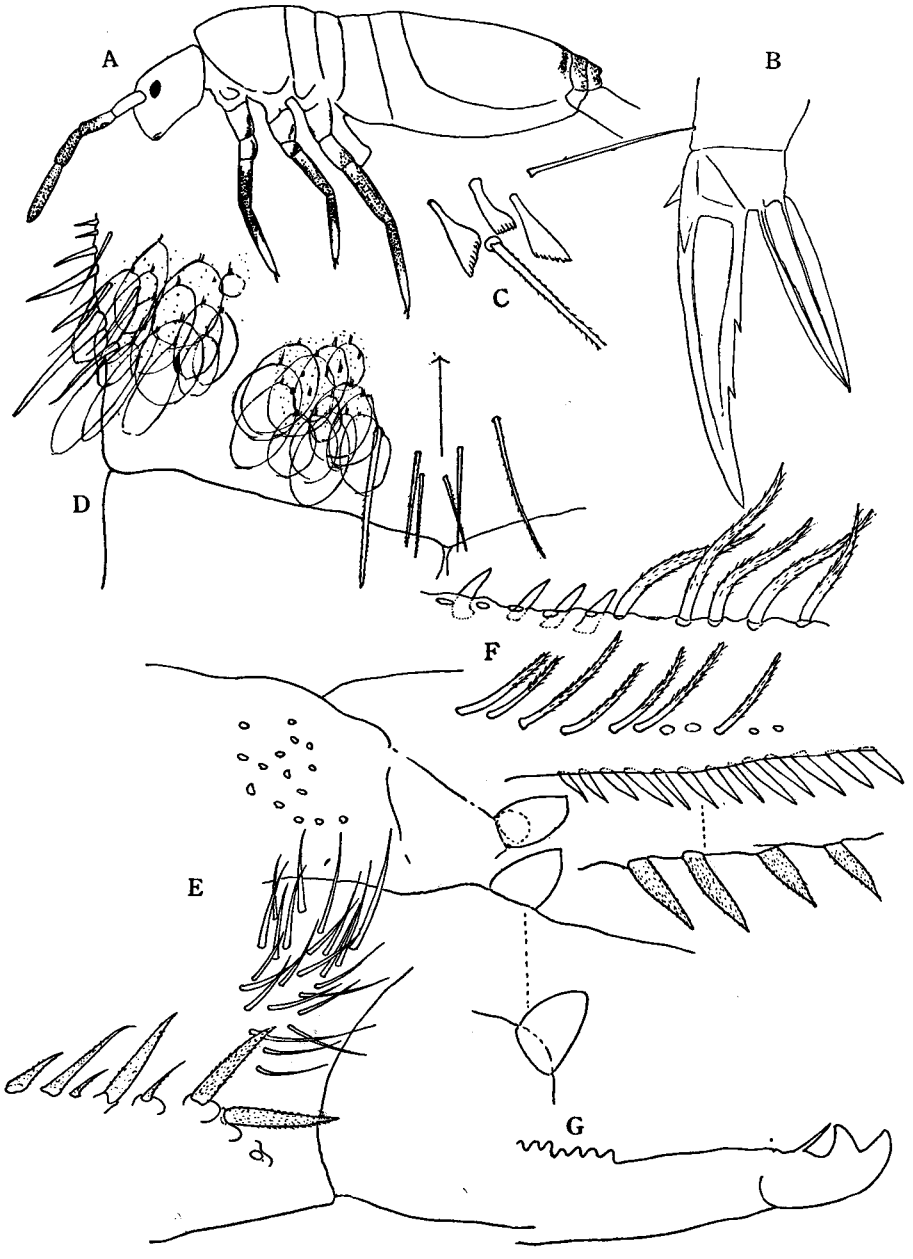


Fig. 15 *Lepidocyrtus* (*Acrocyrtus*) *malayanus* sp. n.

A : Habitus B : Hind claw C : Seta sensualis and its accessory scales
D : Dental end of manubrium (ventral view) E : Dental ent of manubrium (dorso-lateral view) F : Inner lateral view of the middle of the dentes
G : Mucro

Fig. 16 *Lepidocyrtus* (*Acrocyrtus*) *malayanus* sp. n.
A, B : Ventral tube (anterior and posterior view)

of each tergits are considerably large, being about 3 times the length of others. Acessory setae of s. s. are elongated, triangular in shape and their distal margin is slightly dilatated. Legs scaled until to the tibiotarsus. Number of coxal setae about as I-12, II a-14, p-16, III-18. It is, therefore, considerably more numerous than in other species. Unguis long. Dorsal and lateral teeth minute and located near the basis. A paired inner basal and a distal tooth prominent. Unguiculus slender, lanceolate and pointed. Trochanteral organ composed of about 50 large and small spiny setae. Ventral tube anteriorly with very numerous setae and the distal 6 pairs are stronger than others. Posteriorly, it is also multisetaceous and has a pair of strong spiny seta distally. Furcula with Man. : D. as 9 : 8. Ventrally, the manubrium is densely scaled and with 3+3 terminal setae. Scales on both sides of these setae are very many and more than 30+30 in number. Dorsally, it has many feathered setae and the terminal group consists of about 25 pairs of setae. A row of somewhat modified, broad, ciliated setae is present laterally and is 12+12 in number. Dorsal appendix of dental lobe is prominent, acutely pointed in profile. From four rows of dental setae, those of the inner

ventral row are converted to short spines, minutely ciliated on their surface. In the outer ventral row, usual setae and such modified ones are distributed almost alternatively at about the middles of the dentes. Ventral scales located near the median zone are relatively small and considerably large (4-5 times the length of the former) laterally. Mucro bidentate with a basal spine. Apical and anteapical tooth subequal.

The species is near to the form reported by HANDSCHIN 1926, 1930 as *Lepidocyrtus parvidentatus* in morphological details. But the real *L. parvidentatus* SCHÄFFER 1898 from New Britain has another shape of mucronal teeth. From *Acanthurella* spp. the species is different in having a prominent dorsal appendix of the dental lobe. In colour pattern, the species is near to *L. magnificus* CARPENTER 1924 from Assam. The last species is, however, not well known of the dental characters.

17. *Lepidocyrtus* (*Acrocyrtus*) *carosus* sp. n.

Fig. 17

4 Expls from Bukit Timah, Singapore 9. IV 1958 R. Yosii leg.

Body length up to 2.2 mm. Ground colour white, ornamented with beautiful purplish pigments. Antennae are banded on distal half of Ant. III. Deeply pigmented are further from the distal half of Th. III to anterior half of Abd. III. It is more deeply pigmented laterally, including the basal two segments of hind legs. Ant./Head as 14 : 5. Ant. segm. ratioas 7 : 14 : 13 : 19. Antennae scaled dorsally until to the proximal half of Ant. III and the place is not haired. Fore margin of the head with a row of some large setae not differentiated. Eyes 8+8, black. The. II : III as 32 : 10. Th. II is prolonged over the head. Abd. III/IV as 3 : 20. Legs are scaled until to the tibiotarsus. Number of coxal setae are approximately as I-9, II a-12, p-10, III-15. They are, therefore, fewer than in *L. malayanus*. Trochanteral organ of the hind feet composed from about 50 spiny setae in a quadrangular area. Unguis is normal and with lateral teeth rather proximal in position. Tenent hair with broad end. Unguiculus is lanceolate and acuminate to the top. Accessory scales of s. s. are elongated, subtriangular in shape and minutely ciliated. Ventral tube is anteriorly with numerous long setae, including 2+2 large distal ones. Posteriorly, the tube is scaled at the side. A pair of apical setae present. Among some 10 pairs of longer setae, there may be seen a paired row of small spines about 15+15 in number. Furcula with Man. : D. as 9 : 8. Manubrium is ventrally scaled and with 3+3 terminal setae, the lateral pair larger than others. Scales near by are ca 25+25 in a circular area. Dorsally, it is hirsute with feathered setae, and the distal group is in 16 pairs, which are

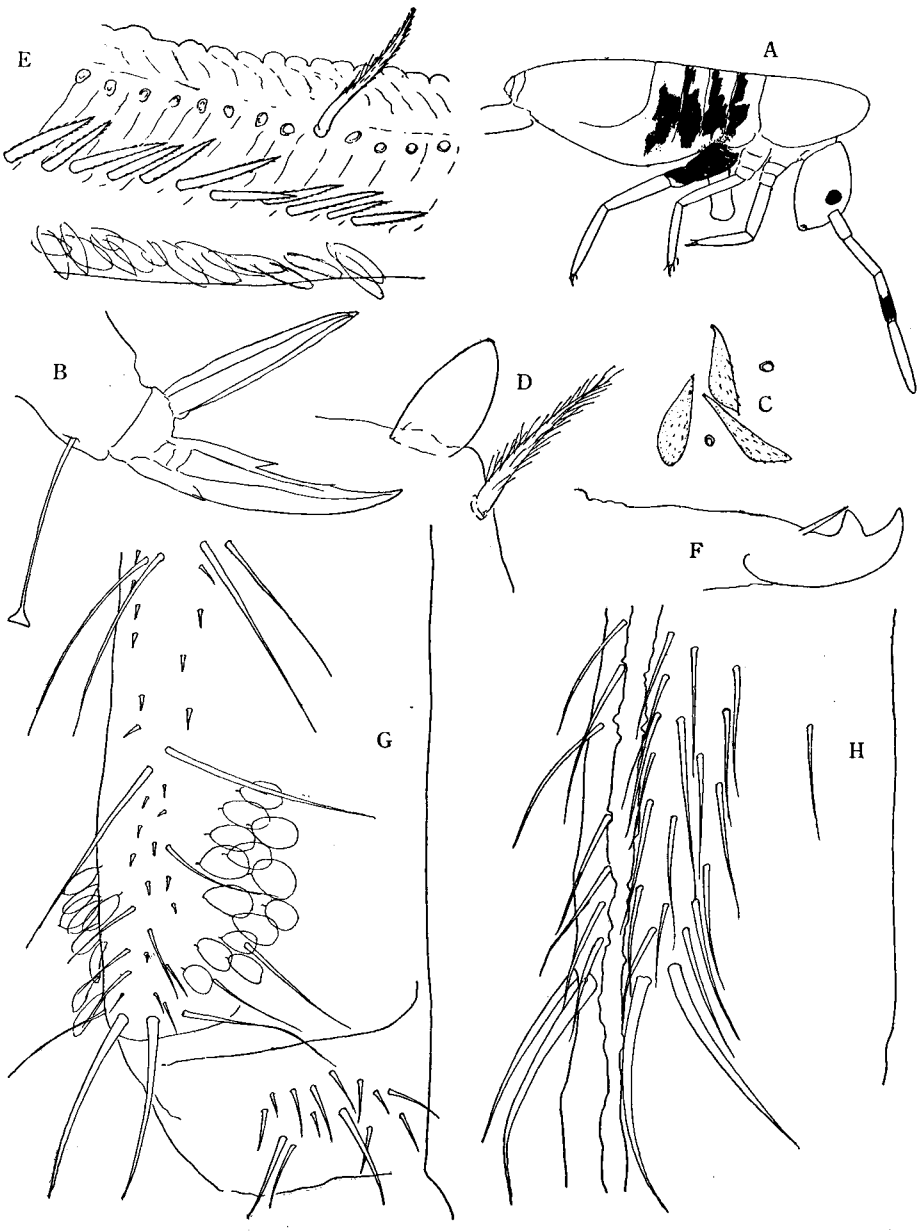


Fig. 17 *Lepidocyrtus* (*Acrocyrtus*) *carosus* sp. n.

A : Habitus B : Hind claw C : Scaly appendix of setae sensuales from Abd. III D : Dental lobe E : Inner lateral view of dentes at about the middle F : Mucro G, H. Ventral tube (anterior and posterior face)

considerably thicker than others. Laterally, a row of some 10+10 spiny, ciliated setae are present. Dentes with a dorsal appendix of dental lobe acutely pointed to the end. From the four rows of dental setae well represented, an inner ventral row is converted to spiny form minutely ciliated. An additional row of smaller feathered setae is observed between dorsal and ventral row of inner side, extending on the proximal half of the dentes. Scales of the ventral side is rounded and rather small. All scales of the body are rather hyaline and not brownish in appearance.

Not only by its peculiar colouration of the body, but also by the spiny setae of furcula and special characters of the ventral tube, the present species is not comparable with other forms of the genus. In the colouration it has some resemblances to *L. lobatus* DENIS 1948 from Vietnam.

18. *Lepidocyrtus* (*Acrocyrtus*) *heterolepis* sp. n.

Fig. 18

8 Examples from Singapore 6. IV 1958 R. Yosii leg.

Lenghth ca 1.6 mm. Antennae uniformly bluish pigmented. Eyes black. A transverse stripe along the fore margin of head. Eyes black. Frontal area and ventral side of the head dark. Body uniformly with bluish tinge. Extremities are pale. Ant./Head as 12:7. Ant. segm. ratio as 15:30:28:48. Ant. I and II are dorsally scaled and the places are without setae. Other segments are not scaled. Ant. III-organ normal. Eyes 8+8. Some of the setae adorning the fore margin of the head are converted to scales with minute ciliation and with especially thick outline. Th. II is slightly protruded over the head. Th. II, III as 75:25. Abd. III:IV as 3:12. Legs are scaled until to the half of the tibiotarsus in middle and hind legs, while the fore legs are scaled until to the femur. Number of coxal setae are as I-7, IIa-6, p-8, III-11. Unguis with usual number of teeth. Unguiculus is acutely lanceolate in all legs. Trochanteral organ of hind legs of about 20 short spiny setae. Scales along the posterior margin of each tergites are not much larger than others, being about 1.5 times on Th. II. Accssory scales of s.s. are somewhat elongated. Ventral tube is anteriorly with 2+2 distal, 2+2 lateral larger setae together with about 7+7 lesser ones. Posteriorly, there is a group of 3+3 short distal setae and some pairs of long, feeble setae. Furcula not well developed. Man.:Dens as 24:18. Manubrium is ventrally scaled and with 3+3 terminal setae, of which the outer pair fairly larger than others. Scales on both sides of these terminal setae are about 10 pairs in a group. Dorsally, manubrium is with many feathered setae. Terminal setae are 7+7 in number. Laterally, a row of especially strong setae (ca 10+10) with fine ciliation is present. Dentes shorter than manubrium.

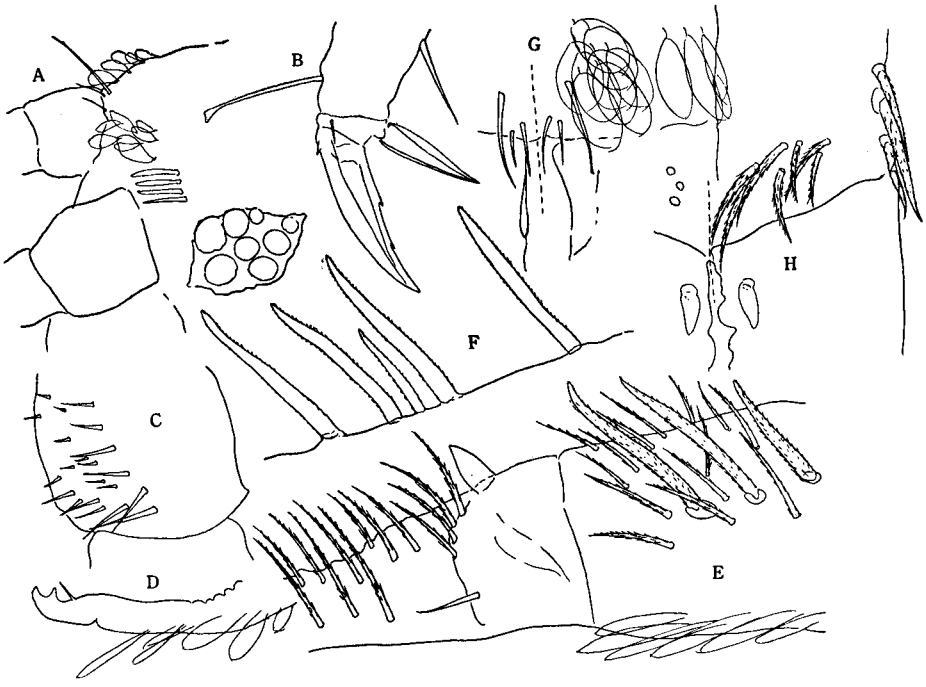


Fig. 18 *Lepidocyrtus* (*Acrocyrtus*) *heterolepis* sp. n.

A : Anterior part of the head, showing specialised scales, eyes and antennal bases
B : Hind claw
C : Trochanteral organ
D : Mucro
E : Outer lateral view of the dentes and manubrium
F : Ciliated setae along the lateral row of the manubrium
G : Ventral view of the dental end of manubrium
H : Dorsal view of the dental end of the manubrium

Dorsal appendix of dental lobe is acutely pointed. Setae in 4 rows at about the middle. Dorsal row of setae is longer than the ventral one and the inner ventral row is not converted to spines. Ventral scales are not enlarged. Mucro bidentate, two teeth subequal and with a basal spine.

This is the unique species of *Lepidocyrtus* having modified scales in front of the head. From *L. malayanus* and *carosus*, it is also distinguised by having no spinous setae on the dentes.

Subgenus *Discocyrtus* subgen. nov.

A kind of *Lepidocyrtus* having the dental lobe with a dorsal appendix apically rounded.

Subgenotypical species: *Lepidocyrtus suborientalis* DENIS

There is, in my collection of Japanese collembola, an another undescribed from of *Discocyrtus*.

19. *Lepidocyrtus* (*Discocyrtus*) *suborientalis* DENIS

Fig. 19, 20

DENIS : 1948

1 Expl. from Singapore 23. VI 1956 K. Yoshiba leg.

12 Expl. from Singapore 6. IV 1958 R. Yosii leg.

Body length ca 1.8 mm. Colour stramineous white. Antennae bluish throughout the length. Distal part of each segments are deeply pigmented. Ant. I is paler than others. Eyes black. A black spot between two antennal basis. Lateral margin of Th. II, III and Abd. I is with slight violet tinge. Ant./Head as 55 : 20.

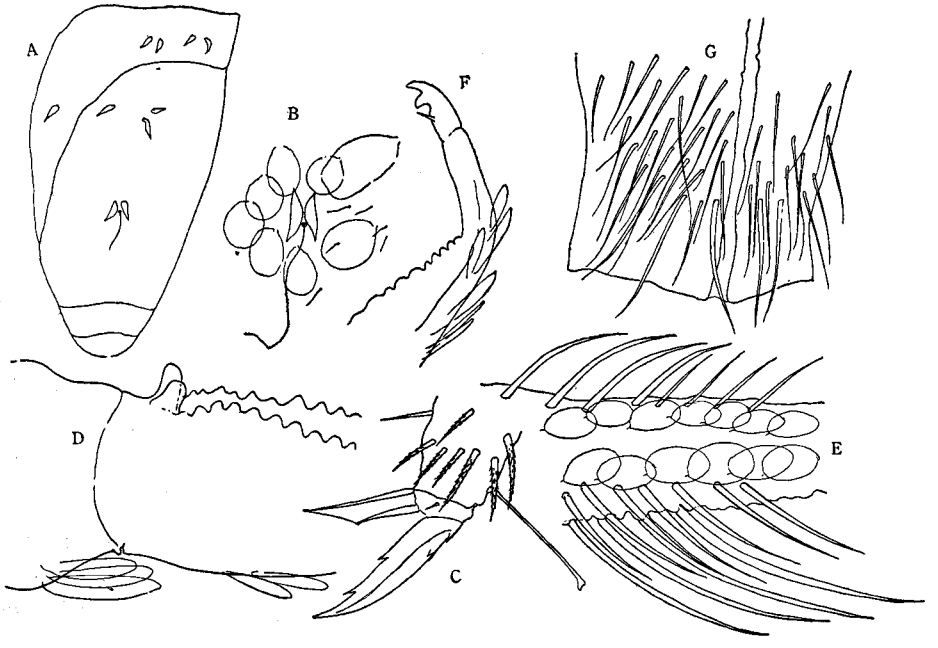


Fig. 19 *Lepidocyrtus* (*Discocyrtus*) *suborientalis* DENIS

A : Chaetotaxy on Abd. III and IV
B : Seta sensualis on Abd. III
C : Fore foot
D : Dental lobe of the dentes (side view)
E : Ventral view of the dentes at about the middle of its length
F : Mucro
G : Anterior face of the ventral tube

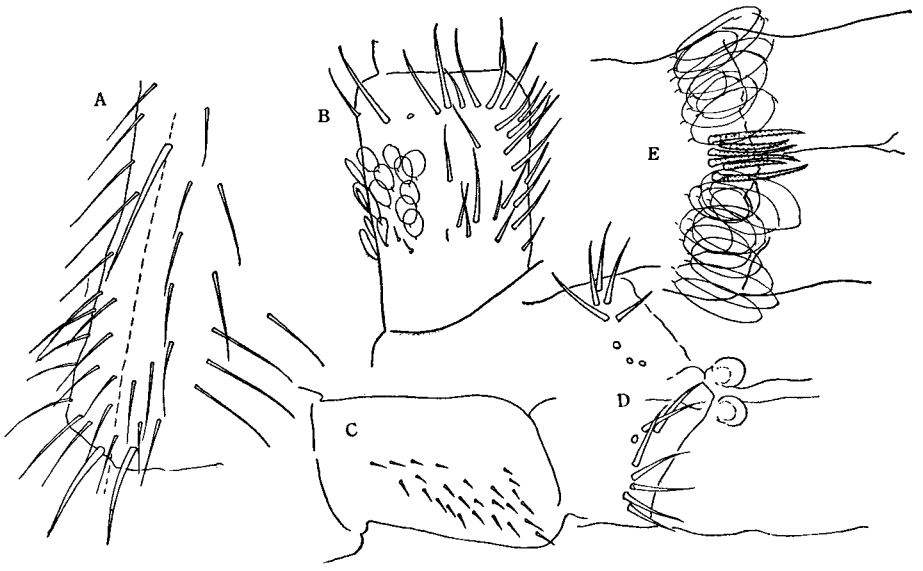


Fig. 20 *Lepidocyrtus* (*Discocyrtus*) *suborientalis* Denis

A : Posterior face of the ventral tube
B : First antennal segment
C : Trochanteral organ
D : Dental end of manubrium (dorsal view)
E : Ditto (ventral view)

Antennal segments as 25 : 45 : 35 : 55. Ant. I is dorsally scaled densely, and the place is without setae. From Ant. II distally, scales are quite absent and the segments are beset with usual feathered setae. Eyes 8+8. Fore margin of the head with a row of about 15+15 well developed setae between two eyes. Mesonotum is strongly protruded over the head. Th. II : III as 2 : 1. Fore legs are scaled only on the coxae, while middle and hind legs are scaled until to the femur of each legs, leaving tibiotarsus unscaled. These scaled portions are poorly haired as in case of Ant. I. Number of coxal setae is roughly as I–7, II a–4, p–8, III–13 or 14. Trochanteral organ is composed from about 25 short spiny setae. Unguis broad with usual number of teeth. Unguiculus is ditsinctly truncate on fore and middle legs, while it is not distinctly so on hind legs. Abd. III : IV as 9 : 40. No dorsal setae on Th. II–Abd. I. Accessory scales of setae sensuales lanceolate with one straight and other curved margin. Ventral tube is not scaled. Anterior face has 4+4 larger distal setae and some 20 pairs of lesser setae apparently symmetrically situated with regard to the median groove. Posterior face is poor in setae, having distally a pair of larger setae, accompanied with a small median seta between them.

An another longer median seta is proximally present. Some 15+15 subequal setae are situated laterally. Man : d as 1 : 1. Ventrally, the manubrium is densely scaled and with 3+3 median terminal setae. Sceles on both sides of these setae are enlarged and arranged in a few irregular rows. Dorsally, it is with many setae and the terminal group of it is about 8+8 in number. No special lateral row of setae present. Dental lobe is well developed and a dorsal appendage is rounded on apex. Ventrally, dental scales are minute. All of the dental setae are elongated and the two inner rows are more filiform than those of outer rows. Inner ventral setae are not specialised. Mucro bidentate, apical and anteapical tooth subequal.

DENIS 1948 has not given any notice about the shape of the dorsal appendix of the dental lobe. But, judging from the general trend of the genus, our examples must be identical with *L. suborientalis* of Annam.

20. *Pseudosinella truncata* sp. n.

Fig. 21

5 Examples from Bukit Timah Hill, Singapore 9. IV 1958 R. Yosii leg.

Body legth 0.8 mm. Colouration whitish. Minute granules of slightly brownish pigments are scattered all over the body, giving some brownish tinge to the body. Antennae : Head as 5 : 3. Antennal segments as 11 : 18 : 18 : 28. Without eyes and eye-pigments. Th. II : III as 2 : 1. Tibiotarsus only with feathered setae and without scales (thrown away?). Tenent hair well represented and knobbed to the end. Smooth opposite seta present on hind legs. Unguis dorsally carinate and with a pair of well developed, winged inner basal tooth. They are unequal in shape and the outer wing is very strongly developed and extended to the side, while the inner one is obscure. One distal inner tooth is not exactly observed. Unguiculus about 3/4 the length of the unugis and its apex is very clearly truncate along the inner side. Abd. II : IV as 5 : 12. Rami tenaculi with 4 teeth. Furca elongated. Man/

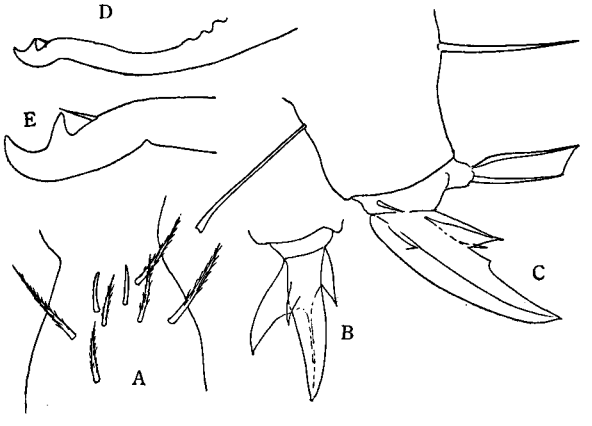


Fig. 21 *Pseudosinella truncata* sp. n.

A : Third antennal organ
B : Dorsal view of the middle claw
C : Hind claw
D : Mucronal end the furcula
E : Mucro

Dens as 11 : 12. Both of them with hyaline scales ventrally. Dentes without spines and with dorsal crenulation leaving a smooth portion some 4.5 times the mucro, which is bidentate equally and with a basal spine.

Pseudosinella with the truncate form of unguiculus is hitherto known only by *Ps. brevicornis* HANDSCHIN 1924 from Brazil, which has the winged tooth of the unguis less developed. *Sinelloides adamsoni* (CARPENTER) 1935 from the Society Island has also truncate unguiculus and well developed winged tooth of the unguis as in the present form, but it has the falciform mucro.

21. *Alloscopus tetracantha* BÖRNER

Fig. 22

BORNER 1906

20 Examples from Singapore, 25. IV 1940 R. Yosii leg.

1 Example from Penang, Malay 26. VI 1956 K. Yoshiba leg.

1 Example from Bukit Timah, Singapore 9. IV 1958 R. Yosii leg.

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 is, therefore, as 1 : 4 : 7 : 10 : 10. Ant. II and III are 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 redish 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* BÖRNER (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 *Lepodocyrtus*. 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 tergites examined in one example from Singapore is symmetrically 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.

My examples coincide well with the short description given by BÖRNER, 1906

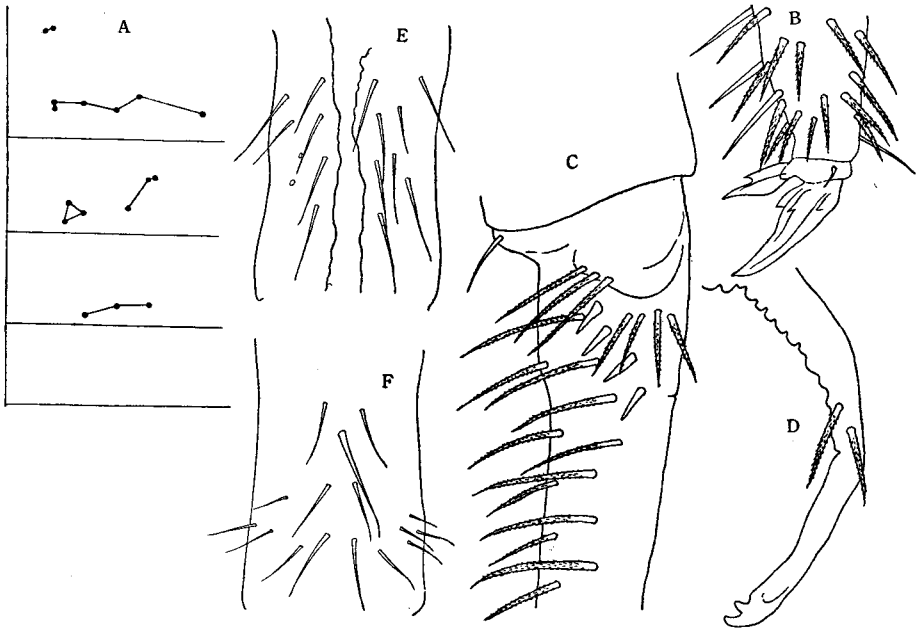


Fig. 22 *Alloscopus tetracantha* BÖRNER

A : Setal arrangement
B : Hind claw
C : Dental spines and the setae of its neighbourhood
D : Mucronal end of the furcula
E ; F : Ventral tube (anterior and posterior view)

from Java.: *Alloscopus* BÖRNER 1906 differs from *Dicranocentrus* SCHÖTT 1893 in the reduction of eyes and in the presence of winged tooth of the unguis and ungniculus. The relation is somewhat as between *Sinella* and *Entomobrya* or between *Pseudosinella* and *Lepidocyrtus*.

22. *Dicranocentrus sundanensis* SCHÖTT

Fig. 23

Dic. sundanensis : SCHÖTT 1925·····DENIS 1948.

3 Examples from Penang, Malay 26. VI 1956 K. Yoshiba leg.

Body length 2.5 mm. Colouration unknown. In lactic acid, the body is whitish and with heavily brownish scales and setae. Antennae long, 6-segmented. Ant. I and III, which are derived from Ant. II and IV are very short. Distal two segments are distinctly annulated as in case of *Tomocerus*. Eyes 8+8(?), strongly

pigmented. Th. II is not protruding over the head. Unguis has a basal pair and a distal inner tooth. Dorsolateral teeth are relatively unconspicuous. Unguiculus is acutely lanceolate and with one obscure outer basal tooth. No inner tooth is present. Tenent hair is needle like and not flattened distally. Coxa of the hind leg is somewhat lobed posteriorly and the lobe is fringed with many long feathered setae. Furcula with long dentes. Dental lobe has numerous elongated, feathered setae but without any special structures. Along the inner side of the dentes, numerous short spines are present, first in three rows and then in a row distally. Mucro is bidentate and with a basal spine. Smooth portion of the dens is long, being 3.7 times the length of the mucro. On Abd. VI, the upper lobe of the anus is elongated posteriorly to some extent. Male genital opening is not observed.

Integument is covered with dense brown scales variable in dimension. They are all rounded in shape and distinctly striated as in *Seira*. Posterior margin of

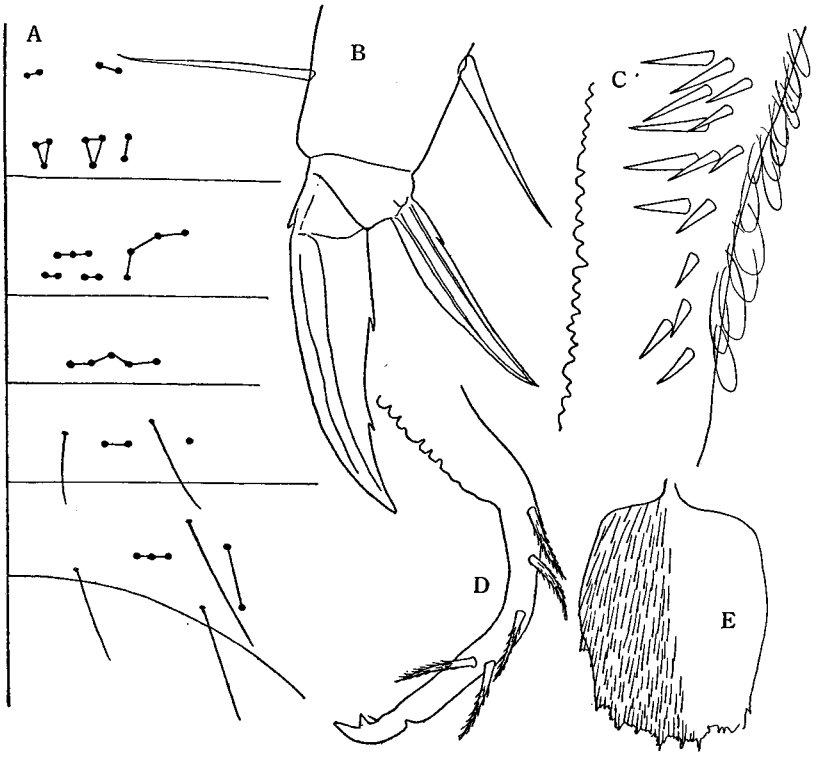


Fig 23 *Dicranoceutrus sundanensis* Schött

A : Setal arrangement B : Hind claw C : Dental spines
D : Mucro E : Body scale

the scale is usually zig-zag in outline and with many incisions. Antennae are scaled from the basis until before the annulated portion. Legs are scaled until to the tibiotarsus heavily. Both manubrium and dentes of the furca are ventrally scaled. Body setae are well differentiated. Large feathered setae are scarce in number and are distally obtuse and not clubbed. Their arrangement on each tergites are as in Fig. A, and these arrangement is constant in all examples examined. Ant. II and IV have also some large setae in definite mode and in symmetrical arrangement. Abd. IV has no proximal row of larger setae.

Compared with other spesies of the genus, *D. sundanensis* is conspicuous in having no inner tooth of the unguiculus. Further researches are in need to assure, how the chaetotaxy is available to discriminate each species of the genus.

23. *Dicranocentrus simplex* sp. n.

Fig. 24

2 Examples from Bukit Timah Hill, Singapore 9. IV 1958 R. Yosii leg.

Body length 1.7 mm. Ground colour whitish. Antennae, legs and ventral side of the body diffusely pigmented to blue. Distal segments of antennae and legs are darker. Eyes-fields almost black. Antennae 6 segmented, the first two segments being subsegmented and their ratio is as 5 : 23 : 9 : 31 : 70 : x. The last segment is lost. Ant. V shows a sign of annulation on its distal half. Ant. VI must probably

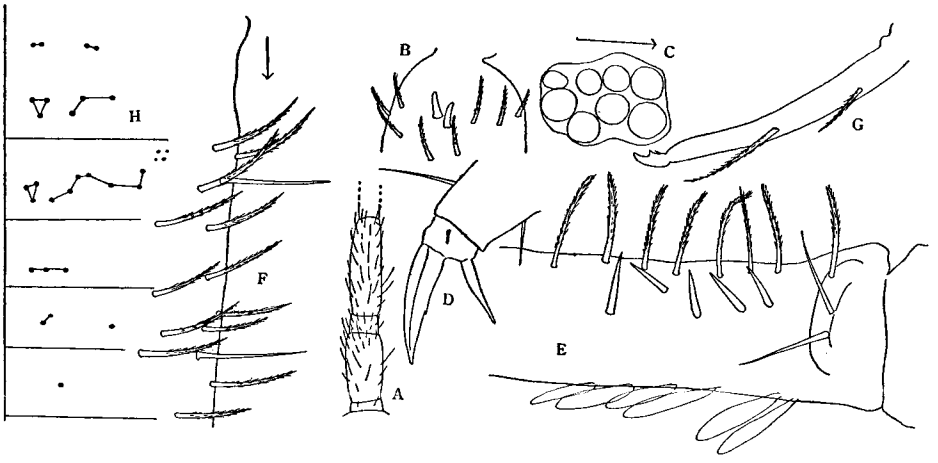


Fig. 24 *Dicranocentrus simplex* sp. n.

A : Antennal segents B : Ant. III-organ C : Eyes
D : Middle claw E : Dental spines
F : Smooth and feathered setae of the manubrium
G : Mucronal end of furcula H : Setal arrangement

be annulated. Ant. III-organ is a pair of blunt small sensilla situated directly near its distal end. All these segments are not scaled. Head with a conspicuous black eye-patch including 8+8 ocelli. Setae along the posterior margin of the head capsule are spiny and rather long. Legs are not scaled. Tenent hair is in all legs spiny. Opposite sete is present on hind legs. Unguis slender, dorsally keeled and with only one obscure inner proximal tooth, which is very minute and often not to be observed. Unguiculus lanceolate and prominently acute. Furcula well developed. Man : D as 11 : 17. They are dorsally with numerous short feathered setae. Ventrally, they are deprived of setae and only densely scaled. Mingled with the feathered setae of the manubrium, there arise 3+3 smooth setae in a pair of longitudinal row, which are but subequal to others in length. Proximal portion of dentes is provided on its inner side with 5 spines of equal size, togather with 2 long smooth setae lying on the hook (dental lobe). Distal end of the dentes has a smooth portion very long, being about 6 times the mucro in length. Mucro is bidentate, the apical tooth is prolonged and the anteapical one short. Basal spine is also present. Body is covered with hyaline oval scales more finely striated than in *Seira*. Body seate are brush shaped. They are arranged as in Fig. 24, H. As there exists a considerable difference of chaetotaxy between the present from and *D. sundanensis* Schött, *D. simplex* is seemingly not a juvenile form of the cited species.

Dicranocentrus with a single row of dental spines is unique. *D. indicus* Bonet 1930 has none of them.

24. *Salina celebensis* (Schäffer)

Fig. 25

Cremastocephalus celebensis : Schäffer 1898

3 examples from Bukit Timah Hill, Singapore 9 IV 1958 R. Yosii leg.

Yellowish species with reduced chaetotaxy of the body. Body 2 mm. Antennae 3.6 mm. Furca 1.2 mm. The species is, therefore, extremely thin and elongated in appearance. Colouration white with yellowish tinge. Antennae slightly darkened upon distal segments to one side. Eyes pigmented black. Head and trunk are coloured diffusely on their ventral side to dark colour. Dorsal side is quite pale. Ant. segm. ratio as 5.0 : 8.5 : 7.0 : 11.0. Ant. I is about 1.8 times as long as the head. Ant. III organ is a pair of blunt sensilla situated side by side. Eyes 8+8, each deeply pigmented and in two rows without forming a compound eye field. Legs are very elongate, the end of the hind leg surpassing Abd. VI. Tibiotarsus with a usual broadly spatulate, slightly ciliated tenent hair, which surpasses the unguis.

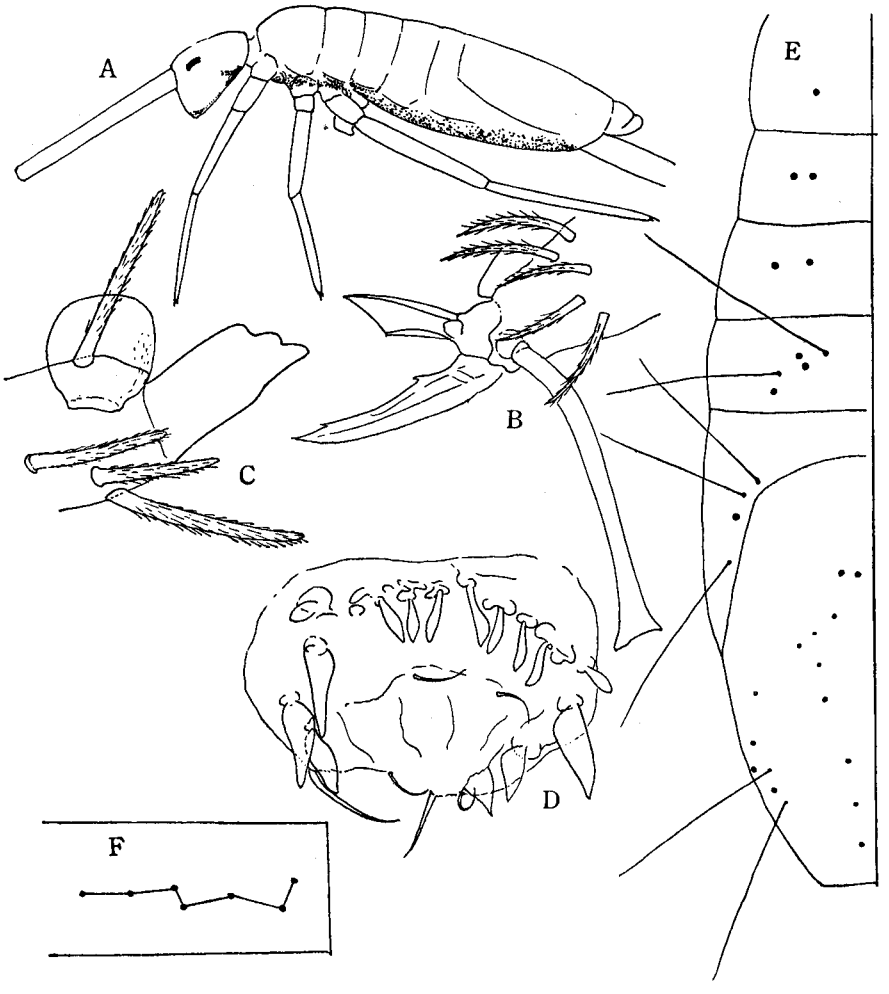


Fig. 25 *Salina celebensis* (SCHÄFFER)

A : Habitus B : Hind claw C : Mucro
D : Male genital opening E : Setal arrangement
F : Setal arrangement of Abd. I in *Salina affinis* (FOLSOM) from Japan

Opposite seta of hind legs present. Unguis slender, with two inner teeth. The proximal one is basally situated and spiniform, while the other is terminal in position and minute. A pair of small lateral tooth is also to be seen. Unguiculus is fairly broad and truncate on its inner side. Trochanteral organ is not well developed, being composed of about 18 setae. Furca with man.: dens as 3:4. Mucro

trilobed and with a terminal bulb of the dentes as usual. The larger body setae present in rather small numbers (Fig. E). Th. II is anteriorly with many such setae, but posteriorly with only 1+1. Th. II and Abd. I has each only 2+2 of them. Abd. II has 3+3 of them, together with 2+2 setae sensuales. Abd. III has seemingly 1+1 of them and 3+3 s. s. Upon Abd. IV there exists an anterior row of 2+2 and many of the posterior group of them, togather with 2+2 s. s. All these setae sensuales are, when compared with that of *Entomobryidae*, more robust, seemingly rigid and easily to be found. No accessory structure is mentioned around them. Porus genitalis of the male is surrounded by the outer discoidal ring, within which a conical elevation is protruded. Dorsal half of the outer ring is provided with 7 small spathulate setae and the ventral half of it has 3+3 larger conical setae, accompanied with 1+1 slender seta. There may be found also a small finger-like process of integument between these two sorts of modified setae. Inner cone has 2+2 very minute setae. There are considerable differences between the genital opening of the present species and of the Sumatran *S. cingulata* described by HANDSCHIN (1925, p. 284 Fig. 48, 49).

Salina celebensis is hitherto reported from various countries of Asia, but all of them must be verified with respect to their chaetotaxy of the body. Japanese examples of *Salina* described as *Crem. affinis* FOLSOM 1899, has the chaetotaxy quite different from the present form. It has namely more than 10+10 great hairs in irregular arrangement on Th. II p and Th. III. Abd. I has 7+7 of them in a definite pattern as in Fig. F . It must, therefore, be separated from *S. celebensis*.

Callyntrura BÖRNER

Börner : 1906
syn. *Aphysa* : HANDSCHIN 1925
Microphysa : HANDSCHIN 1952
Handschinphysa : PACLT 1947, SALMON 1957

There are some confusions about the generic conception of the present genus, which is very widely distributed in tropical countries of the world. It is C. BÖRNER, who has first established *Callyntrura* (Genotypus : *C. anopla* from Java) as a subgenus of *Paronella* with the diagnosis that the antennae and dentes are not scaled. Furthermore, he has described *C. anopla* as having six teeth on the mucro. Wenn HANDSCHIN 1925 rectified the *Paronella* group and established the genus *Aphysa*, taking *Entomobrya longicornis* OUDEMANS* as the genotyus, he has not mentiond whether the species is scaled upon antennae and dentes or not. At the same time he has described a new species *Aphysa villosa* HANDSCHIN with remarkable notes

* Identity of these species are also doubtful.

that "Die Beschuppung erstreckt sich auf den ganzen Rumpf und den Kopf. Antennen und Furka werden jedoch davon ausgenommen", but without naming it as *Callyntrura*. In my opinion, scales of antennae and dentes of the genus may be present or absent according to the species, as described later in each cases. Also, it is very easily to be lost during the conservation in alcohol and seems to be not always rightly observed. *Callyntrura* preoccupies *Aphysa* at any rate.

An another genus *Microphysa* HANDSCHIN 1925 is established at the same time, taking *Entomobrya lineata* PARONA* as the genotype. The diagnostic basis of *Microphysa* is the presence of a scale like swelling near the mucronal end of the dentes. The genus is later renamed as *Handschinphysa* PACLT 1947 on account of the homonymy. In his recent paper about the Indian forms of *Paronellidae*, J. T. SALMON 1957 has come to the conclusion that this dental swelling is the secondary sexual character in nature and *Handschinphysa* (=*Microphysa*) is the male of *Callyntrura* (=*Aphysa*). This is by no means true, since there has been found among my materials of *Callyntrura* (=*Aphysa*) spp., both male and female specimens, viz. those with and without genital ring. At the same time, it was observed that the presence and absence of such swelling of dentes is not a decicive character to separate these two genera. There are some species which have always a prominent swelling, those whose swelling is small and perceptible only with care and lastly those, which have no swelling at all. The character is, therefore, species or group specific and two genera must be united in one genus *Callyntrura*.

HANDSCHIN 1925 has also noted the presence of a row of small spines along the inner side of dentes in his *A. longicornis*. This character is also not to be regarded as generic, because there are some transient forms between such spines and usual setae from which they have derived. How the genus *Callyntrura* may be subdivided to natural groups is the matter of future study.

The difficulty of studying the *Paronellidae* was the lack of any definitive morphological characters. As there has been found among my materials of Malayan examples the body chaetotaxy highly valuable for the purpose, as in the case of *Seira* of South Africa, all species hitherto known to us must be reinvestigated. As the chaetotaxy varies almost parallel to the body pattern, it may be said that we have hitherto regarded each species rather in broad sense.

25. *Callyntrura bukit-timahensis* sp. n.

Fig. 26

3 expls, (2♀, 1♂,) from Bukit Timah Hill, Singapore 9. IV 1958 R. Yosii leg.

4 expls, (2♀, 2♂,) from Batu Cave, Selangore 11. IV 1958 R. Yosii leg.

Body length 2.5 mm. Ground colour white. Slightly purplish pigmented are antennal bases, fore margin of head, lateral margin of body tergites from Th. II to Abd. II. Abd. III and IV are pigmented or not. Antennae lightly coloured proximally and deeper distally. Femur and tibiotarsus of all legs are also sligtly pigmented. Furcula pale. Ant. I is elongated, being 2 times the head in length. Ant. ratio as 70 : 50 : x : x. The last segment is slightly annulated. Antennae not at all scaled. Ant. I : Head as 2 : 1. Eyes 8+8, in two rows and deeply black. Thorax is moderately hanging over the head. Legs not scaled. Trochanteral organ

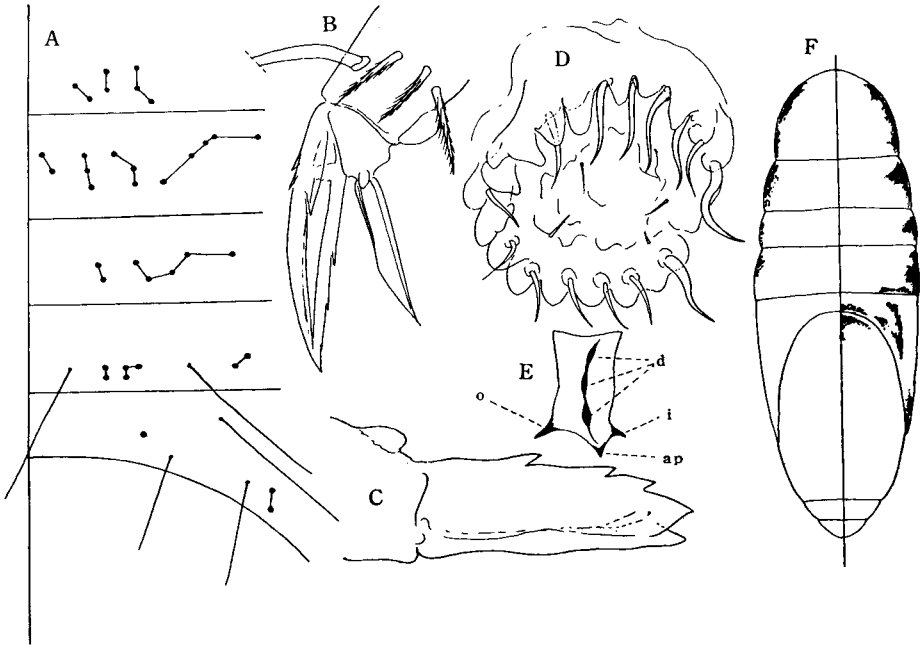


Fig. 26 *Callyntrura bukit-timahensis* sp. n.

A : Setal arrangement
B : Hind claw
C : Mucronal end of the furca
D : Male genital opening
E : Semi diagramatic view of the mucro
d : dorsal teeth
o : outer tooth
i : inner tooth
ap. apical tooth
F : Pattern of the body

well developed and composed of about 50 spiny setae. Unguis rather broad, with a pair of strong lateral teeth, a pair of inner basal and one inner distal tooth. Unguiculus is distinctly truncate on its inner side and often tooth-like at about the middle of the inner margin. Tenent hair distally broad and hyaline. Tenaculum with quadridentate rami and one basal seta. Furcula well developed. Man.: Den. as 30: 45. Both of them are not scaled. Dentes without spines. Distal scale-like swelling is very low but always to be seen, Mucro rather elongated and with typical arrangenent of tooth. Genital opening is of papillate type (cf. K. CHRISTIANSEN 1958). There exist about 15 well developed papillae surrounding the conically protruded genital opening and its inner margin is provided with 7+7 smooth simple setae, which are subequal in shape. These papillae are slightly larger on the anterior half of it and a first pair of seta lying close to the posterior side is slightly larger than others. The species may be determined most effectivelly by the dorsal chaetotaxy. Th. II post. has 7+7 long setae in an arrangement as 2, 2, 3, in a definite order. So is also Th. III, which has 13+ 13 setae as 2, 3, 3, 5. Abd. I bears 7+7 setae also in a definite arragement. Abd. II has 2+2 setae sensuales without any accessory setae and with 7 setae as s, 2, 3, s, 2, Abd. III with 3+3 s.s. and 3+3 setae as 1, s, s, 2. Abd. IV with an anterior transverse row of setae, just 1/3 from the fore margin of the segment. s. s. are 2+2 and situated side by side laterlly near to the hind margin of the segment. As for the structure of the mucro, it is just so constructed as was already reported by many provious authors (cf. HANDSCHIN 1925 etc.). But I am not inclined to adopt the nomenclature proposed by HANDSCHIN, who has named the dorso-ventrality of the furcula according to the natural condition of it in a contracted state. Furcula of collembola is anatomically the extension of the sternal nature and, therfore, to be named, in strict sense, not in dorso-ventral aspect but in antero-posterior sense. The common usage of dorsoventrality of the furcula in its expanded condition is, therefore, more convenient than that proposed by him. The same poinion is already given in DENIS (1948. p. 276).

26. *Callyntrura bimaculata* sp. n.

Fig. 27

10 examples from Singapore 20. IV 1940 R. Yosii leg.
1 example from Singapore 7. IV 1958 R. Yosii leg.

Body length 2.7 mm. Ground colour white. Antennal segments distally pigmented or not. Eyes black. A longitudinal stripe runs along the side of the trunk from the eye patch until to the distal end of Abd. III. A conspicuous paired marking is present at about the middle and on the hind margin of Abd. IV, as well as

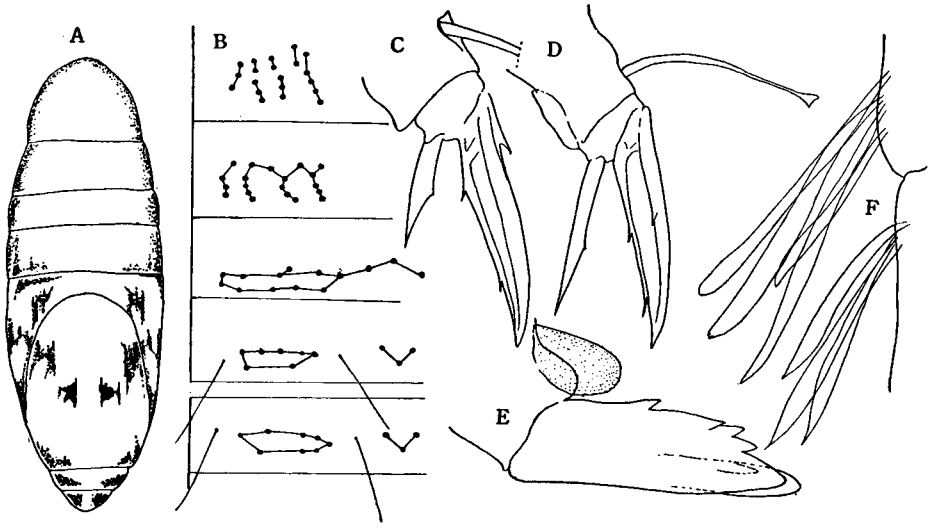


Fig. 27 *Callyntrura bimaculata* sp. n.

A : Patter of the body B : Setal arrangement
C : Fore claw D : Hind claw E : Mucro
F : Scale of the dental end of the manubrium

on Abd. V. Legs with slight markings on coxae, femur (distal) and tibiotarsus (on distal 1/5). Furula and vetral side of the body pale. Antennae elongated. Ant. I: Head as 10:7. Eyes 8+8, in two rows. Unguis slender and typically toothed. Unguiculus are also conspicuously elongated, especially on hind legs. They are with truncate inner margin, where one inner tooth at the angle is somewhat upwright in appearance. Tenent hair normal. Furcula long. Compared with other species here descriped, the form is unique in having many extremely thin and hyaline scales on the ventral side of the furca near the articulation of dentes to the manubrium on both segments, extending to the basal 1/5 of the former. Dorsally, there exists no dental spines along the inner side. Distal scale-like swelling is, in all examples, very well represented. Mucro is 6-toothed as usual. Trochanteral organ with about 30~40 short spinous setae. Genital opening of the male is of papillate-type, but not exactly observed. Chaetotaxy of the body is, as represented in Fig. B. It is near to that of *C. malayana* sp. n. The essential defference lies in the lateral group of Abd. II, where 3+3 setae are situated in different arrangement in the cited species. although the dorsal group is somewhatvariable as figured. The colour pattern is almost constant in all examples in my possession.

The species must fall in the category of *Aphysa longicornis* (Oudemans) of the

old conception. This species, first described from Java, has one unpaired median marking of Abd. IV (1890, Fig. 14). Later on, the species is redescribed by many authors (HANDSCHIN 1925 etc., DENIS 1948) and regarded as highly variable species with respect to the colour pattern of the body. But, so long as I have investigated with Malayan materials, there are species each with relatively few variation of colour and each with special structural difference of unguis, dental apparatus and chaetotaxy of the body. It is reasonable, therefore, to regard each of them as independent.

27. *Callyntrura malayana* sp. n.

Fig. 28

4 expls from Singapore 25. IV 1940 R. Yosii leg.

1 male from Bukit Timah, Singapore 9. IV 1958 R. Yosii leg.

Body length 2.3 mm. Ground colour whitish. Some diffuse markings are laterally on Th. III to Abd. III m. Antennae and legs are distally dark in colour. Antennae elongated. Head : Ant. I as 3 : 5. Ant. I=II. Some filiform scales are

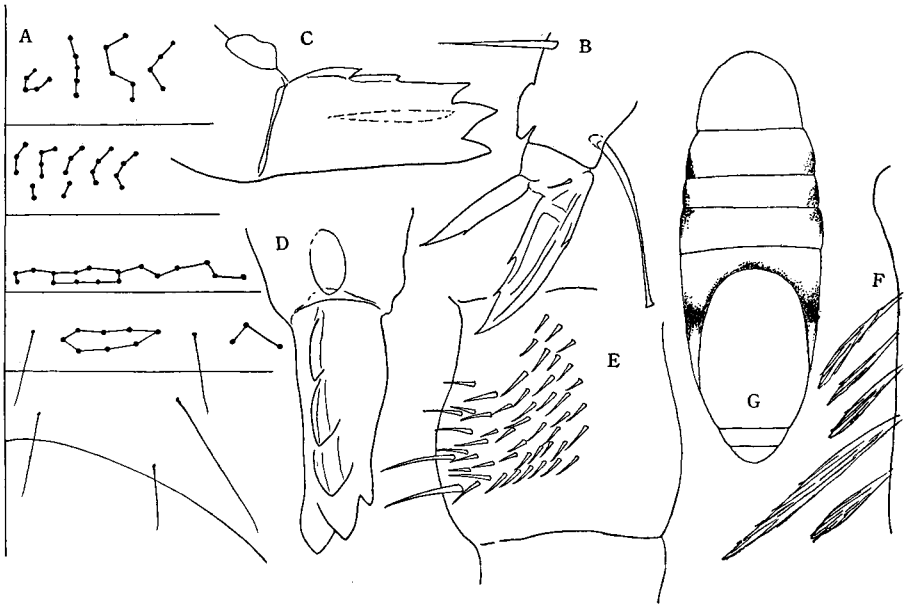


Fig. 28 *Callyntrura malayana* sp. n.

A : Setal arrangement B : Hind claw C : Mucro
D : Mucro (dorsal view) E : Tenaculum
F : Scaly setae on the ventral side of the dental end of manubrium
G : Pattern of the body

present dorsally on Ant. I, but they are confined to its proximal portion. Eyes 8+8, normal in position and intensely black. Tibiotatsus not scaled. Unguis normally shaped for the genus. Unguiculus lanceolate. Although it is slightly truncate on its inner side, it is by no means so conspicuous as in other species of the genus. Tenent hair with hyaline distal part. Furcula well developed. Man : Den. as 2 : 3. Dentes without scales but with double rows of small dental spines about 20 in number. Distal swelling is moderately developed and rounded in profile. Mucro is normally 6-toothed, but some abnormalities with additional teeth are often to be seen. Their general shape is more blunt than in *C. bukit-timahensis*. Trochanteral organ well represented, with about 45 spiny setae. Genital opening of the male same as in *C. bukit-timahensis* sp. n. Body scales spindle shaped and intensely brownish in colour. Greater plumose setae are arranged as Fig. A. The conspicuous feature is that of Abd. I and II, which is constant in all specimens examined. Colour pattern of the body is also constant in all available materials.

The species is easily discriminated by the lanceolate shape of the unguiculus and by its chaetotaxy.

28. *Callyntrura zonata* sp. n.

Fig. 29

1 female from Bukit Timah, Singapore 9. IV 1958 R. Yosii leg.
1 female from Batu Cave, Selangor, 11. IV 1958 R. Yosii leg.

Body length 2.4 mm. Ground colour white. Head capsule, posterior half of each body segments of Th. III, Abd. I and II are deeply pigment purplish black. Abd. III is totally pigmented on its dorsal side. Deeply pigmented are further the basal two segments of hind legs. Other parts as Ant. I, Th. II, Abd IV–VI, fore and mid-legs and furcula are quite pale. Slightly and diffusely pigmented are each tibiotarsus and mucro. Ant. I to head as 10 : 3 in length. Distal segments are mutilated and therefore unknown. Antennae not scaled. Eyes black, 8+8, in two rows. Legs elongated. Tibiotarsrs not scaled. Unguis rather broad and with a pair of prominent lateral teeth, which is covering the unguis. Inner tooth normal. Unguiculus lanceolate. Trochanteral organ of hind legs of about 40 simple setae. Abd. III : IV as 1 : 6. Furcula well developed. Man. : D. as 5 : 8. They are with brown setae. Inner side of dentes without spines but with many extraordinary long setae mingled with usual ones. Scales are quite absent. A tuft of long setae ventrally near the distal end of manubrium are somewhat broad, but not to be regarded as scales. Distal swelling of dentes is not present. Mucro elongated and, in addition to the usual 6 teeth, with an extra small tooth

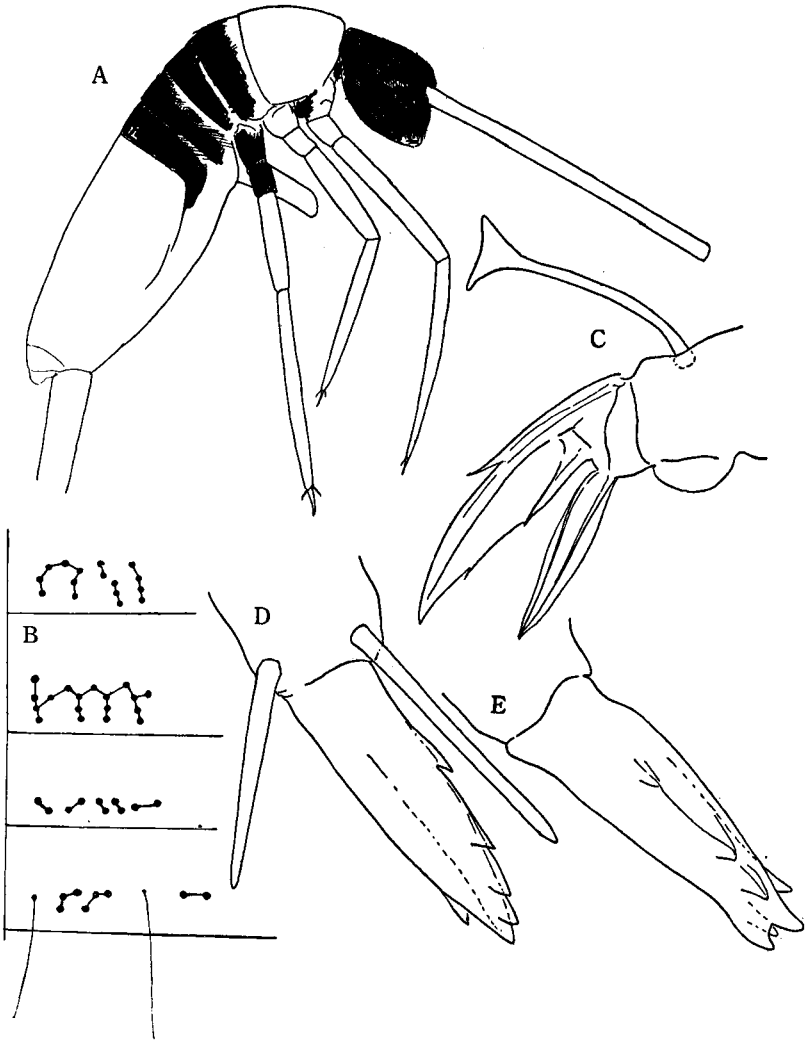


Fig. 29 *Callyntrura zonata* sp. n.

A : Habitus B : Setal arrangement C : Middle claw
D ; E: Mucro

side by side by the ventral tooth. Scales of the body are hyaline and almost white on anterior half of the body, while it is distinctly brownish posteriorly from Th. III. They are fusiform, pointed and roughly sculptured. Long feathered setae are distally pointed and their distibution is as in fig. B. The arrangement on Abd. I and II is very peculiar. The species is near to *M. vestita* HANDSCHIN 1952,

A. carli HANDSCHIN 1929 and *M. escheri* HANDSCHIN 1929 from Java and India, although it is unique in having pale mesothorax and coloured head capsule.

29. *Callyntrura brevicornis* sp. n.

Fig. 30

4 examples from Bukit-timah, Singapore 9. IV 1958 R. Yosii leg.

Body length 1.8 mm. Ground colour yellowish white. Bluish markings are distally on Ant. I, as well as medially and distally on each tibiotarsus. Some diffuse blue markings are scattered on the side of Abd. II, III and IV. Antennae

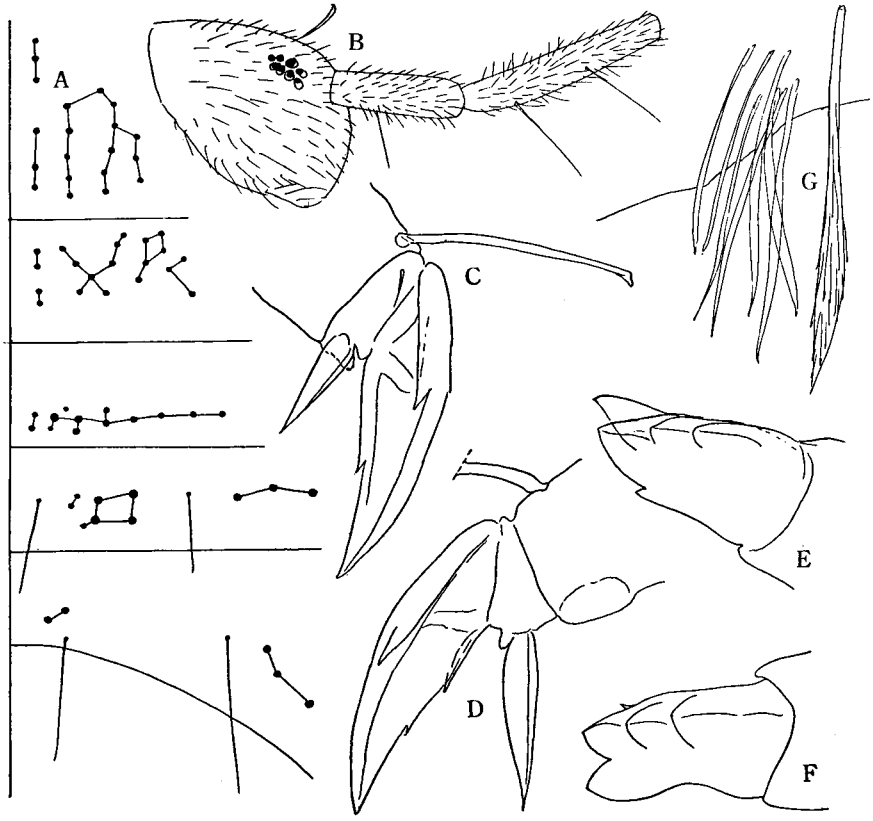


Fig. 30 *Callyntrura brevicornis* sp. n.

A : Setal arrangement B : Head and antennal segments
C : Fore claw D : Hind claw E, F : Mucro
G : Scaly setae from the ventral side of the dental end of the manubrium

rather short for the genus. Ant. I : Head being 5 : 7 in length. Ant. II : I as 7 : 5. Antennal segments I and II are not scaled. Eyes 8+8, black and arranged in two rows. All tibiotarsus are not scaled, but beset with two sorts of setae viz. usual unilaterally plumose curving setae and erected spinous ones, which are not roughly plumose but minutely ciliated. Unguis short and broad. Its dorsal side is laterally expanded to both sides of the unguis and a pair of lateral tooth is, consequently, prominently developed. Inner margin has one paired basal tooth. A distal tooth is absent on fore legs and present upon others. Unguiculus is short on fore legs and elongated upon others. They are lanceolate in profile. Tenent hairs well developed. Trochanteral organ with about 30 rather short setae. Male genital opening not observed. Furca normal. Man. : De. as 4 : 5. Near the articulation of them, there are a tuft of setae half converted to filiform, scale-like strucure, which are striated longitudnally. Inner side of the dentes are provided with numerous (ca. 50) short spines in about 3 irregular rows. Distal scale-like swelling is not at all observed. Inner side of the dentes is also with many extra long setae. Mucro short. An outer tooth is well developed and greater than the apical one. From the usual 3 teeth of the dorsal ridge, the most proximal one is absent or very minute and the mucro is, therefore, practically 5-toothed.

Chaetotaxy of the body is, as represented in fig. A. Th. II with numerous dispersed setae. From Th. III to Abd. III, each segment is haired in a fixed pattern. Most conspicuous feature is that of Abd. II, where greater and lesser setae are situated in a definite order. Abd. IV has an anterior transverse row of setae as usual. An example with body length 3.2 mm. have some additional setae upon Th. III, Abd. I and II. But the arrangement is essentially not different.

The species has some resemblance to the Indian species : *Paronella travancorica* IMMS 1912, with its short antennae and broad unguis, although they are separable by the structure of the mucro.

Handschinella g. n.

Nearly related to *Pseudoparonella* HANDSCHIN 1925. But body scales are rounded and hyaline and minutely striated. Hind legs with special femoral organ.

Genotypical species : *Paronella setigera* BÖRNER 1906

30. ***Handschinella setigera*** (BÖRNER)

Fig. 31

Paronella setigera : BÖRNER 1906, IMMS 1912

Pseudoparonella setigera : HANDSCHIN 1925, 1928

18 examples from Singapore 25. IV 1940 R. Yosii leg.

2 expls. from Singapore 7. IV 1958 R. Yosii leg.

7 expls. from Bukit Timah, Singapore 9. IV 1958 R. Yosii leg.

1 expl. from Penang, Malay 26. VI 1956 K. Yoshiba leg.

This is a common species known to occur from India, Java and Sumatra. Body setae of the species are reduced, there being practically no large setae upon each tergites. s. s. is represented as 2, 3, 2 upon Abd. II-IV in contradiction to the description of HANDSCHIN 1925 p. 254, fig. 53. These setae are accompanied on their basis with some special brownish, plumose scales. Eyes are 8+8 in number, but their arrangement is not in two longitudinal rows, but rather of *Entomobrya* type. Scales are present upon antennae, tibiotarsus and upon dentes. They are small, hyaline and oval in shape. Such characters exhibit the resemblances of *Handschinella* to *Lepidocyrtus*, although dentes are not crenulated dorsally. Queer femoral setae known to occur in *Pseudoparonella orientalis* HANDSCHIN (1930 p. 417) and in *Bromacanthus handschini* SCHÖTT (1925. fig. 37) are present also in this species. Trochanteral organ of very numeous setae rather small in size. Form of the genital opening of the male is intermittent of CHRISTIANSEN'S circinate and multisetaceous type. Ventral tube has proximally 5+5 large setae of which the apical 3+3 are in a row.

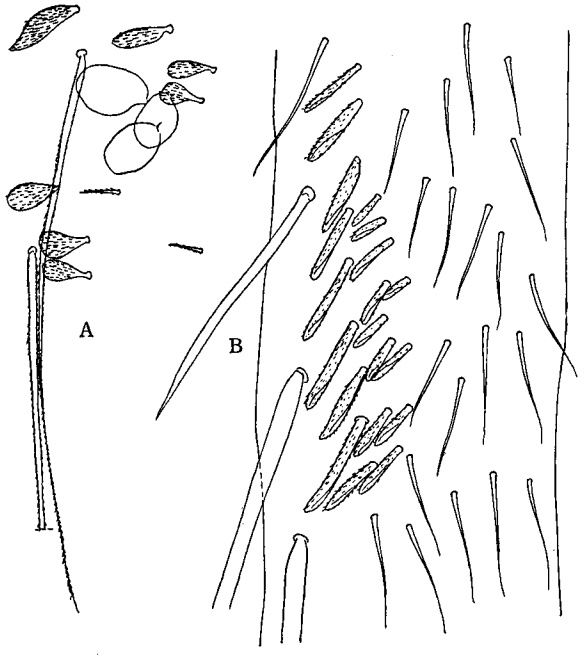


Fig. 31 *Handschinella setigera* (BÖRNER)

A : Setae sensuales on Abd. III
B : Femoral organ of the hind foot.

Setoderus g. n.

Very near to *Cyphoderus* of the *Serroderus* Group, the inner row of the dental scaly setae being 3 in number. But the ventral side of the dentes are provided with

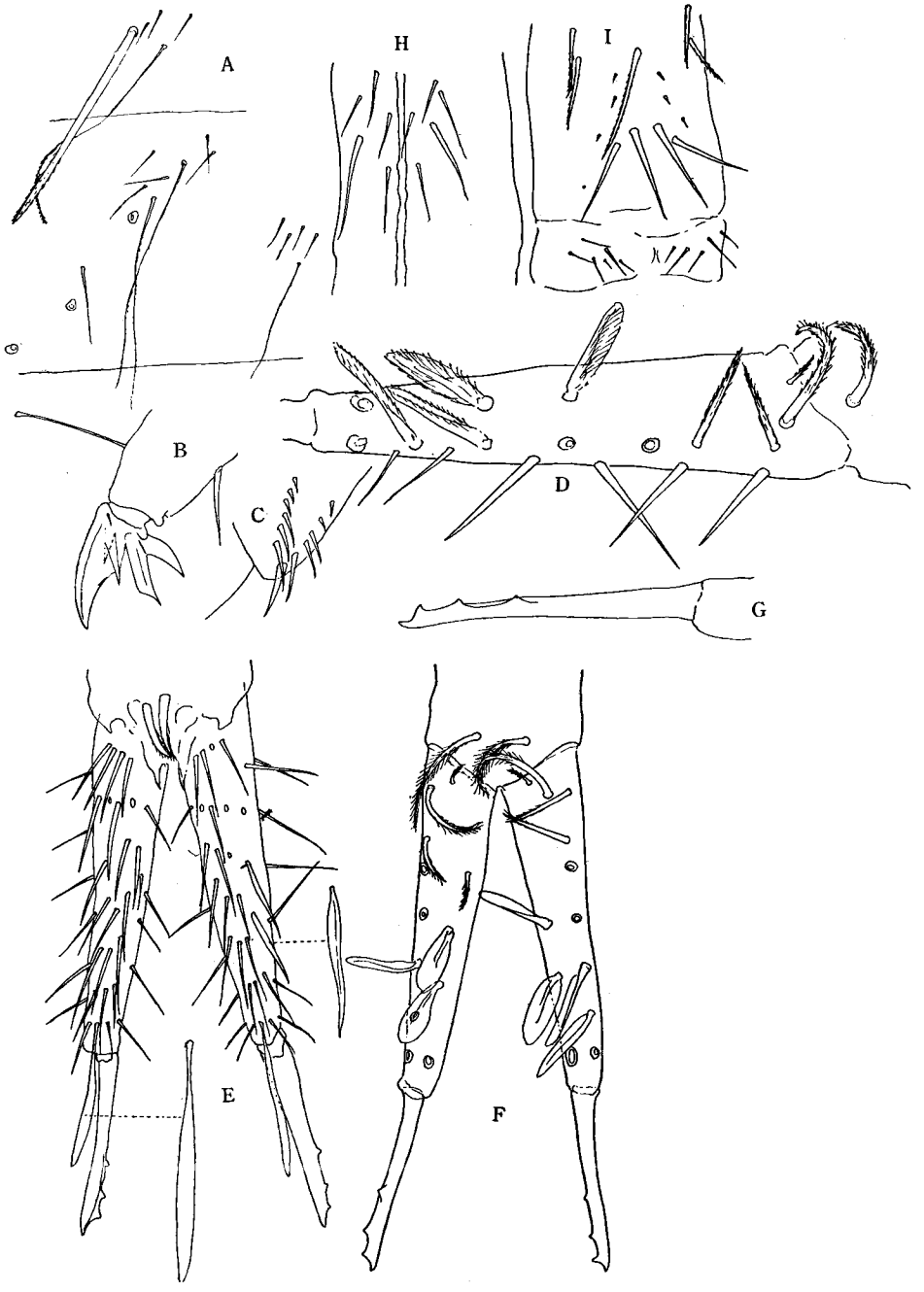


Fig. 32 *Setoderus alfredi* g. n. sp. n.

A : Chaetal arrangement on Abd. II and III B : Middle claw C : Trochanteral organ D : Dorsal view of the dentes E : Ventral view of the dentes and mucro F : Dorsal view of the dentes and mucro G : Mucro H, I : Ventral tube (anterior and posterior face)

numerous setae instead of scales.

Genotypical species: *Setoderus alfredi* sp. n.

31. *Setoderus alfredi* sp. n.

Fig. 32

1 Example from Bukit Timah, Between fallen leaves, Singapore 7. IV 1958 R. Yosii leg.

Body length 0.8 mm. White. Ant.: Head as 5 : 3. Antennal segments as 11 : 20 : 12 : 33. Eyes wanting. Mandibles not reduced. Abd. III : IV as 1 : 6.5. Unguis with a pair of prominently acute lateral tooth. Inner tooth of the unguis is quite absent. Unguiculus is distally slightly truncate and with a broad outer tooth. Tenent hair is feebly developed and seemingly pointed to the end. Trochanteral organ of the hind legs composed of about 12 small smooth setae, arranged in L-shape. One seta at the corner is the largest. Ventral tube is anteriorly with 5+5 feathered setae. Posteriorly, there are distally 2+2 almost smooth setae together with 2+2 lateral and one median feathered setae of the proximal portion. 3+3 minute, peg-like setae are to be observed. Man : D : Mu as 50 : 32 : 18. Manubrium is ventrally scaled and with a pair of hirsute setae directly near the dental end. Dorsolaterally, three longitudinal rows of setae are present. Some of them are spiny and simple, while, others are intensely hirsute. Dentes dorsally with two rows of scaly setae. Those of the outer row is 5 in number, with additional 2 feathered setae. Inner row with 3 of such scales. One hirsute seta is present near the manubrial end. Ventrally, there are about 38 ciliated setae in irregular arrangement. One seta near the distal end is converted to long, flat and hyaline scales, extending to 2/3 of the mucro. The latter is straight and with 4 teeth (a, A, A, A after DEIAMARE-DEBOUTTEVILLE 1948). A mucronal tunica is ventrally to be seen. Body setae poorly developed. s. s. are 2, 3, 3 upon Abd. II–IV. They are accompanied by some ciliated short setae except the last pair of Abd. IV. Larger setae are scarce and are easily lost.

The species is dedicated to the honour of Prof. ALFRED of the Raffles Museum for the memory of our friendship.

32. *Cyphoderus asiaticus* sp. n.

Fig. 33

1 Expl. (female?) from Singapore, From the heap of fallen leaves. 6. IV 1958, R. Yosii leg.

Body length 1.4 mm. White. Ant/Head as 11/8. Segmental ratio as 14 : 32 : 19 : 45. Mouth parts not reduced. Abd. III/IV as 6/25. Unguis with a pair of lateral

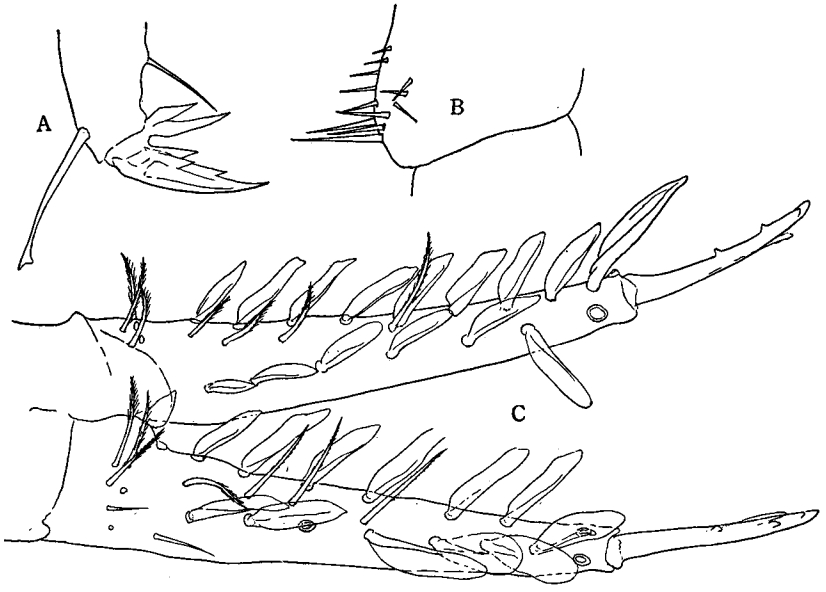


Fig. 33 *Cyphoderus asiaticus* sp. n.
A : Hind claw B : Trochanteral organ C : Dentes and mucro

winged teeth and one inner tooth. Unguiculus lanceolate and with a broad outer tooth. Tenent hair well developed and with flattened apex. Trochanteral organ of the hind leg is composed of about 15 simple setae arranged in L-shape. The corner seta is not much greater than others. Ventral tube is damaged and not well observed. Probably the anterior face is with only 2+2 feathered setae. Manubr.: Dens: Mucro as 7 : 5 : 2. Manubrium is ventrally scaled with a pair of hirsute setae at the dental end. Dorsolaterally, there are many feathered setae in irregular arrangement. Dentes is ventrally only with hyaline scales. Dorsally, scale-like setae are 8–9 on outer row and 7 on inner row. They are not much different in length, except the distal one of the outer row, which is about 2/3 of the length of mucro. Four feathered setae are present dorsally between these two rows. Lastly, there is a group of 4 feathered setae proximally near its end, accompanied by 2 smaller setae laterally. Mucro is straight and quadridentate (a, A, A, A) as in *Setoderus alfredi* sp. n. A terminal scale ventral to the dentes is very hyaline and attains with its apex the third tooth of the mucro.

This is the first record of the quadridentate *Cyphoderus* out of the African continent. Nearest allied species is *Cyphoderus squamidives* SILVESTRI 1918 from Pretoria. The cited one has, however, usually two inner distal teeth of the unguis.

C. tridenticulatus DENIS 1948 from Annam has another form of mucro and another choetotaxy of dentes. Body setae and s. s. do not deffer from those of the precedent species.

33. *Sphyrotheca santiagoi* sp. n.

Fig. 34

1 Female from Bukit Timah, Singapore 9. IV 1958 R. Yosii leg.

Body length ca. 1.2 mm. Ground colour dark white. Head with black markings around the eyes. Posterior margin of it with some dark shadow. Antennae grayish purple distally. Anterior half of the trunk is with a brownish dorsal stripe, leaving the median line uncoloured. Posterior half of the trunk is brownish all over and three pale spots in triangular arrangement are present dorsally at the junction to the anterior stripe. Anogenital segment and the ventral side of the body slightly dark. Legs and furcula pale. Antennae/Head as 20 : 12. Antennal segments as 2 : 3 : 5 : 10 in length. Ant. IV divided to 10 subsegments and apically with a small bulb. Each subsegment with about seven verticillating long setae. Ant. III rather long, with some strong setae. Ant. III-organ is a paired sensory rod incerted in the shallow groove of their own. Eyes 8+8. No postantennal organ. Great abdomen anteriorly with many large upwright and distally blunt spiny setae arranged as 3+3, 4+4, 1+1. Posteriorly, these setae are becoming smaller and some usual curving setae are mingled. Laterally, 3+3 setae sensuales with prominent socket are present. They are slender, needle like and never serrated. Some very short spiny setae are present near the basis of s. s. Trochanter of all legs with a blunt seta on its inner side. Tibiotarsus without tenent hairs, but with a curving seta on the posterior face of the fore leg. Unguis broad, without inner tooth. Dorsally, it has a prominent tunica and paired pseudonychia with serrated margins. Unguiculus triangularly elongated, without tooth and its acute apex is surmounted by a filament, which is longer than the unguis. Ventral tube not well observed. Tenaculum with 3-toothed rami and median corpus, having 4 small apical setae. Anogenital segment has laterally a paired swelling of the integument, on which two long setae and one s. s. are to be seen. Anal setae not differentiated. Appendices anales are very long, curving, smooth and its apex is slightly flattened. Furcula with Man : D : Mu as 7 : 13 : 5. Dentes with setae arranged as:

outer : 1……1, 1……2=5
dorsal : 1, 1, 1, 1=4
inner : 1, 1……1, 1=4
ventral : 2, 1…… 1=4

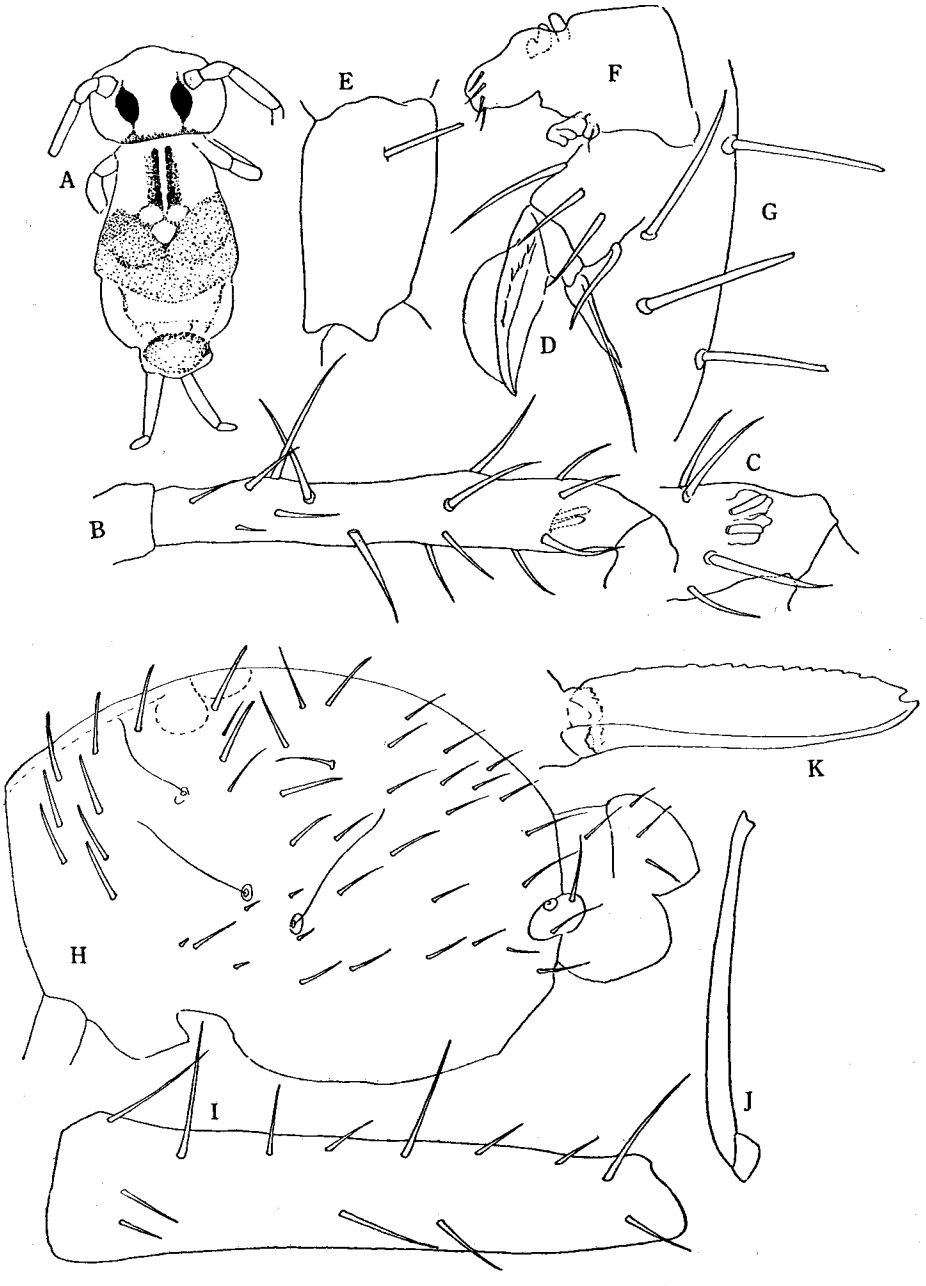


Fig. 34 *Sphyrotheca santiagoi* sp. n.

A : Habitus B : Third antennal segment C : Third antennal organ D : Fore claw E : Trochanter F : Tenaculum G : Dorsal setae of abdomen H : Side view of the abdominal segment showing the arrangement of each setae I : Dentes (dorso-external view) J : Appendix analis K : Mucro

None of them are spiny in appearance. Mucro with smooth outer and serrated (more than 10) inner margin and its apex is with a prominent incision. Mucronal pseudonychium present.

The species is nearly related to *S. boneti* DENIS 1948 from Annam, but may be divided from it readily by appendices anales, dental chaetotaxy etc.

Here is the place to discuss the generic character of *Sphyrotheca*. STACH (1956) has described the presence of mesonotal vesicle in *S. lubbocki* (TULLBERG). The same organ is also to be found in an undescribed species of *Sphyrotheca* from Japan. As this interesting structure is not present in Japanese examples of *S. multifasciata* (REUTER), which is the genotypical species of the genus, *S. lubbocki* must be regarded to belong to an another genus: *Lipothrix*, already proposed by BÖRNER in 1906. An another genus *Papirinus* YOSII 1954, which is at first regarded as *Dicyrtominae*, represents, as was already pointed out by STACH 1956, a highly specialised form of *Sphyrotheca*.

The distinction between *Sphyrotheca* and *Sminthurus* is first based upon the chaetal nature of Ant. III, but it is by no means an absolute character. *S. santiagoi* sp. n. for example, is not at all *Sphyrotheca* in this respect. More weight must be placed on the presence and absence of the postantennal organ of the head which is first described also by STACH (1956). The species is dedicated to the honour of Dr. A. SANTIAGO of the PLANT BREEDING INSTITUTE in SELANGORE.

34. *Sphyrotheca hispida* sp. n.

Fig. 35, 36

2 Females not in perfect condition, from Bukit Timah, Singapore, 9. IV 1958 R. Yosii leg.

Body length ca 1.2 mm. Antennae and legs are intensely black, while furcula is pale. Head purplish on the vertex, but paler downwards. Trunk somewhat dark brown dorsally and a lateral irregular stripe is purplish pigmented. Ventral side pale. Antennae ca 6 : 14 to the head in length. Its segmental ratio as 2 : 4 : 6 : 15. Ant IV is subdivided to 10 subequal segments. All antennal segments are with short simple setae. They are longer on Ant. IV, where each subsegment has a row of setae at about the middle. The last subsegment is twice longer than others and with many long setae on one side. An apical bulb is slightly visible. Ant. III-organ is not observed. Eye field is intensely black. Chaetotaxy of the head is not easily to be interpreted owing to the distorsion of specimens. Area clypealis is with many curving setae in an irregular arrangement. All setae of area clypealis are converted to spines. The great abdomen has many spinous setae alike to those of *Ptenothryx*. On posterior half of it, slender, curving setae are mingled with spinous ones.

Fig. 35 *Sphyrotheca hispida* sp. n.

A : Chaetotaxy of the frontal region of the head B : End of antenna C : Fore claw D : Hind claw E : Tenaculum F : Setae of the great abdominal part. G : Appendix analis H : Mucro

Number of s. s. (more than 2+2) and the position of lateral tubercle is not accertained. Legs have neither special tibiotarsal organ nor tenent hairs. Unguis broad, dorsally keeled and with prominent tunica. Inner margin of the unguis has one small tooth at about the middle. Unguiculus is narrowly triangular, acute on apex and with a terminal filament far surpasing the end and subequal to unguis in length in all legs. A pair of apical lobes of ventral tube are very long, slender and seemingly with smooth surface. Anogenital segment is clearly divided from the precedent segments. A lateral tubercle with a long s. s. is present at the place. The segment has also some spiny and slender setae. Upper flap of the anus has 7 spinous setae accompanied by 3 shorter ones inner to these. Appendices anales are long, curving, setaceous and standing on a prominent socket.

Furcula with Man : D : Mu as 5 : 5 : 2. Manubrium is ventrally smooth and dorsally with some setae distally. Dentes are dorsally with slight crenulation of integument distally (artifact ?) and with three rows of setae as :

outer : 1……3=4

Fig. 36 *Sphyrotheca hispida* sp. n.
A : Anogenital segment (side view) B : Dentes (side view)
C : Dentes and mucro dorsal view D : Ditto (ventral view)

dorsal : 6
inner : 1……3=4

Four distal setae of each row are converted to spines. Ventral setae as : 4, 2, 1……1. Subdistal 2, 1 setae are long. Mucro is distally flattened, ending with rounded apex. Inner margin is distinctly serrated with about 10 teeth, while the outer margin is smooth and with a slight notch at about the middle. Ventrally it is keeled. A prominent mucronal pseudonychium is present. Integument of the great abdoment minutely granulated. No marking of thoracal segment is obsesved on the anterior half of the dorsum.

The species is not well examined with regards to the chaetotaxy of the trunk, owing to the poor state of preservation. Anyhow, it is a form belonging to *Parasphyrotheca* SALMON 1951, with its spiny setae of the dentes. Although I have placed the species provisionally to *Sphyrotheca* following the opinion of JEANNENOT 1957. More studies are needed to settle the problem ultimately. From all *Sphyrotheca* species of the *Parasphyrotheca* group, it is distinguished by having tunica on the unguis.

35. *Dicyrtomina cf calva* (DENIS)

Fig. 37

Dicyrtoma calva : DENIS 1954

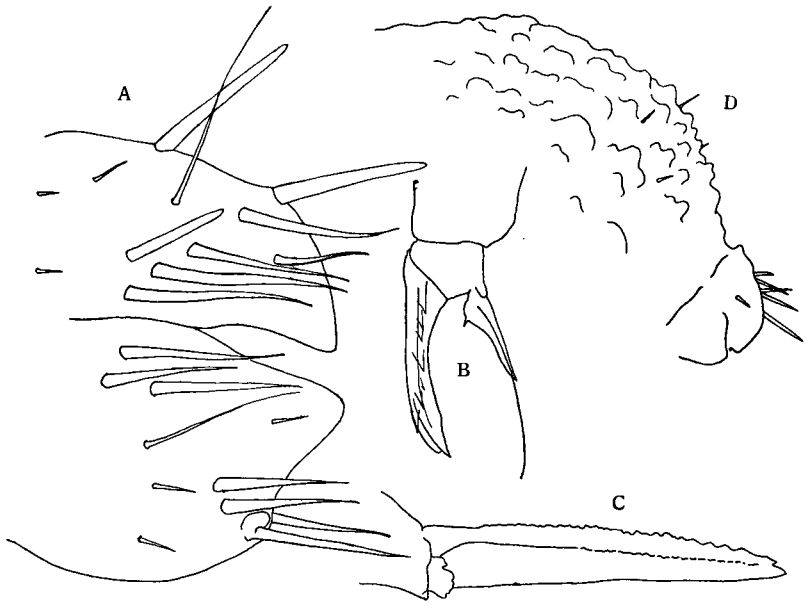
1 female from Singapore 25. IV 1940 R. Yosii leg.

Body length 1.2 mm. Ground colour yellowish white with black to gray markings. Antennae distally brownish dark. Area clypealis of the head pale, area frontalis with a small median patch upon vertex. Eyes black. A paired tubercles near the eyes and the antennal base with scattered pigments. The great abdomen has dorsally 4 transverse bands, one on thorax, two on the posterior part and the other directly before the anogenital segment. Laterally, it has many irregular pigmented bands. All extremities are pale. Ant. segm. ratio as 2 : 8 : 12 : 3. Ant. IV is not subsegmented. Ant. III is distally with lateral protrudings. No prominent seta is observed on area frontalis of the head and the integument is practically smooth. Area frontalis is, however, with usual arrangement of setae, peculiar for the genus. The great abdomen is, on its posterior half, dorsally and laterally with many crenulations. Body setae are very small, pale and pointed to the apex. In the crenulated area, these setae are somewhat spinose and robust. On fore legs, the unguis has no inner tooth. Pseudonychia hyaline and not well developed. An obscure tunica is to be seen. Unguiculus triangular and with one prominent inner tooth. Its terminal filament is very long, being longer than the unguis in length. On middle feet, unguiculus is a little broader and the terminal filament shorter. On hind legs, the unguiculus is the broadest and the terminal filament is only slightly surpassing the end of the unguiculus. Two special setae of the hind tibiotarsus are setaceous and blunt to the apex. Upon furcula, all dental setae are practically smooth and simple, the lateral setae being not modified. They are arranged as:

outer : 3, 1, 1, 1, 1, 1, 1, 2=10
dorsal : 1, 1, 1, ……1=4
inner : 2, 1, 1, 1, 1, 1, =7
ventral : 4, 3, 1, 1, ……1=10

The dorsal setae are the longest. Mucro is straight, basally with a large pseudonychia and distally with a small incision. Its inner margin is minutely serrated, while the outer margin is only minutely undulated and partly smooth. Anal part with some strong macrochaetes and slender setae. Appendices anales are not much different from such strong setae, but with a prominent socket at the base.

The true identity of the species is not possible, because *D. calva* is known to us



Eig. 37 *Dicyrtomina cf calva* (DENIS)

A : Anogenital sement B : Middle claw C : Mucro
D : Posterior half of the abdominal tergite

by one male example from Annam, while I have examined only one female of Malay. But the feature of body setae, claws and furcula indicates the identity of both of them. Whether the crenulation of the posterior part of the body is restricted to the species must be further noted.

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