

POLSKA AKADEMIA NAUK  
INSTYTUT ZOOLOGICZNY, ODDZIAŁ W KRAKOWIE  
**A C T A   Z O O L O G I C A**  
**C R A C O V I E N S I A**

Tom II

Kraków, 10 XII 1957

Nr 14

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**O niektórych *Paronellinae* (*Collembola*) z Indii**

**O некоторых *Paronellinae* (*Collembola*) Индии**

**Some *Paronellinae* (*Collembola*) from India**

[Plates XXI—XXXIII]

ABSTRACT

This paper is a further report on the extensive collections of *Collembola* made in India during 1952 by Miss T. CLAY of the British Museum (Natural History), London. It records the description of two new species belonging to the subfamily *Paronellinae*, and gives further description and notes on 8 other species belonging to this subfamily. The importance of body scales and the „bladderscale“ of the dens in the classification of the genera is discussed.

In a recent paper on „Some *Collembola* from the Belgian Congo“ I referred at some length to the structure of the scales in several genera of *Collembola*, and in this paper I should like to refer in some detail to the scale structure of the *Paronellinae*.

The type species for the genus *Paronella* SCHÖTT is *Paronella fusca* SCHÖTT, 1893, and in the original description SCHÖTT describes the scales as being similar in structure to those of the genus *Lepidocyrtus* BOURLET, and he draws them, in outline, as oval to rounded or tapering towards the base,

with the apices truncate. Late workers have described the typical *Paronellinae* scale as elongated and narrow, usually pointed apically, somewhat club-shaped. This is the structure of a typical *Paronellinae* scale taken from the dentes of any of the scaled species. The scales on the bodies of *Paronellinae* vary considerably in shape between the different genera. Those of *Paronella* SCHÖTT conform to the shapes which SCHÖTT originally described, but are usually somewhat hyaline and heavily striated with longitudinal rows of spikes, the number of rows varying from about 30 to as many as 70 per scale. The smaller scales of the body are usually oval or round; the larger scales become more elongated and truncated apically, tapering towards the base [Fig. 8].

The body scales of the genera *Handschinphysa* PACLT and *Dicranocentroides* IMMS are quite different from those of *Paronella* SCHÖTT, being for the most part elongated and narrow, and pointed apically. Some of the very largest of the scales of these two genera are rounded apically, but they are never oval or round as in *Paronella* SCHÖTT. In *Dicranocentroides* IMMS, for instance, the smaller body scales are elongated and lancet-like with 8 to 16 rows of longitudinal striations, whereas the larger scales are elongated, but rather parallel sided with pointed apices, and vary between 4—6 times longer than they are broad, having up to 24 rows of longitudinal striations. The striations are coarse in appearance, and the individual spikes are large. Occasionally one finds on *Dicranocentroides* IMMS one of these larger body scales tapering noticeably towards the base, but still with more of a rounded than a truncated apex.

In the genus *Handschinphysa* PACLT the smaller and medium sized body scales are all elongate, pointed apically, and rather lancet-like in shape. The small scales have up to 6 rows of longitudinal striations [Fig. 3], the average sized scales 10—15 rows [Fig. 2] and the very large scales up to 20 or 22 rows [Fig. 1]. The individual spikes are large and rather coarse, and on the larger scales they tend to anastomose, giving a kind of spiral-like appearance to the rows of striations. In some species of *Handschinphysa* PACLT, round the posterior margins of the thoracic segments, there are very

large scales three times longer than wide, with up to 30 rows of striations and with their apices rounded instead of pointed [Fig. 4].

If we refer to the dental scales of these genera, those of *Paronella* SCHÖTT are generally somewhat stalked basally, elongated and narrow with rounded apices, with up to 15 rows of striations [Fig. 9]. In *Dicranocentroides* IMMS [Fig. 6] these scales are more lancet-like and do not usually bear such a long basal stalk as those of *Paronella* SCHÖTT. Towards the base of the dens and also on the manubrium these scales become much broader, but still remain elongated and somewhat pointed apically, and are rather club-shaped in general appearance. They normally have 10—20 rows of longitudinal striations.

In *Handschinphysa* PACLT the dental scales are elongate, pointed apically and tapering towards the base with little evidence of the stalk structure typical of *Paronella* SCHÖTT [Fig. 5]. They normally have from 10—15 rows of longitudinal striations.

Towards the apices of both the body and dental scales of both *Dicranocentroides* IMMS and *Handschinphysa* PACLT the longitudinal rows of striations are often seen to extend beyond the margin of the body of the scale, giving it a „feathered“ appearance, especially towards the apex.

From time to time I have noticed morphological differences between specimens of *Collembola* which in the ordinary course of study one would regard as specific, but which I am now coming to regard as differences in morphology between sexes of the same species. A number of genera in the *Paronellinae* are separated on the presence or absence of a scale-like swelling sometimes referred to as a „scale-like appendage“ or „bladder scale“ at the apex of the dens just above the mucro. For instance, *Paronella* SCHÖTT and *Callyntrura* BÖRNER are separated in this way, and so also are *Handschinphysa* PACLT, and *Aphysa* HANDSCHIN, *Paronana* WOMERSLEY and *Pseudoparonella* SALMON, *Salina* MACGILL. and *Plumachaetas* SALMON. From evidence which I will present later in this paper I have come to the conclusion that in the case of *Handschinphysa* PACLT and *Aphysa* HANDSCHIN this structure is merely a sexual

adornment indicative of the male of the species. When more material belonging to these other genera can be assembled it may be that this structure of the dens will prove to have the same significance, and that therefore a number of genera now recognised in the *Paronellinae* will have to be sunk as synonyms. This, however, will probably not occur with *Salina* MACGILL. and *Plumachaetas* SALMON, which have other distinguishing features to separate them.

Genus: *Dicranocentroides* IMMS, 1912

*Dicranocentroides fasciculatus* IMMS, 1912

[Pl. XXII Figs. 10—16]

Some specimens belonging to this species were present in the collection, and I can now enlarge slightly on the very full description given by the original author.

Colour: Very variable, from almost entirely a deep violet with broad yellow transverse bands on Abd. IV to a deep yellow or ochreous overlaid by deep violet pigment between the antennae and along the sides of the head, along the edges of the thoracic terga and those of Abds. I—IV; this pigment is especially heavy on Abd. III and posteriorly on Abd. IV, and there is usually a broad mid-dorsal transverse band across the posterior border of the mesothoracic tergum, across the anterior half of the metathoracic tergum, and narrow central transverse bands occur across Abds. I and II with Abd. III entirely violet dorsally. There is usually a narrow transverse band across Abd. IV about the middle, and this widens into a large lateral blotch on each side. Another medium band occurs round the posterior margin of Abd. IV, and Abd. V laterally is mostly violet, Abd. VI entirely paler violet. The legs and furcula brownish yellow with violet patches on the joints and the apex of the tibiotarsi; the antennae brownish yellow, violet round the joints, base and apex of Ant. IV. The transverse dorsal bands may be entirely absent in some specimens in which only the ventral edges of the thoracic terga are blue or violet pigmented.

**Clothing:** Heavily clothed with scales and short ciliated setae; the scales are parallel sided and coarsely striated as described in the introduction to this paper; these are rather more „fringed“ on one side than ciliated all round, and are more common towards the posterior region; longer ciliated setae occur posteriorly and on the legs and furcula. The antennae with medium length ciliated setae and shorter fringed setae with scales on segments I and II only; towards the apex, Ant. IV with shorter fringed setae only, Ants. I and II and sometimes III with long, plain setae beneath. Furcula, very heavily clothed with scales and setae, a large, dense group of ciliated setae and scale-like paddle-shaped setae round the apex of the manubrium. Posterior face of dens, especially on distal half, with many finely ciliated, straight, spine-like setae, and on the basal half with a row of stout, lancet-like spines which are usually about half as long as the spine-like setae on the distal half. Tibiotarsi with rows of occasional long, plain setae above the unguiculus in each case. Lasiotrichia occur as one pair on Abd. III and two pairs posteriorly on Abd. IV.

**Body:** Length, up to 4 mm., which is considerably longer than the average size given by IMMS. Ocelli, 8 to each side, the antennal segments related as 77 : 80 : 54 : 102; Ant. IV faintly annulated with broad, tapering sense rod at the apex, and numerous slender, tapering sense rods amongst the setae [Fig. 12]. Abd. IV 8—9 times longer than Abd. III. Rami of tenaculum each with four barbs; corpus with a long, stout, curved, simple seta.

**Legs:** The claw with two outer pseudonychia reaching one third down, a pair of inner ridge-like teeth at one quarter to one third down, and a single, large, inner tooth at two thirds down. Unguiculus lanceolate, trilamellate, the outer lamella with prominent basal tooth one fifth down and sometimes with several smaller serrations. A very minute basal spine to each side of claw. On hind feet the unguiculus reaches beyond the tooth of the basal claw, but on front feet it reaches only to the level of the distal tooth. A single stout tenent hair shorter than the claw to each foot [Figs. 10 and 11].

**Furcula:** Manubrium 105 : dens 140 : mucro 7. On most of my specimens the mucro shows an additional small basal

spine-like tooth not described by IMMS [Figs. 12 and 16], while some other specimens have the mucro as in the original type specimen [Fig. 14]. This means that the mucro can have either five or six teeth of which two are apical, two to three occur on the posterior face and one is lateral. The two distal teeth on the posterior face are more plate-like, whereas the basal one is more spine-like.

Localities: Under stones and leaves on the edge of a river, Kangpokpi, Manipur State, 3,500', 23 I 1952. Among rotten bark on the ground in an evergreen forest at 4,500 feet at Kangpokpi, Manipur State, 24 I 1952; Amongst moss on hillside at Singhik, Sikkim, 4,480', 14 II 1952.

Genus: *Handschinphysa* PACLT, 1947

1925. *Microphysa* HANDSCHIN

1925. *Aphysa* HANDSCHIN

1945. *Phorophysa* SALMON

HANDSCHIN (in Treubia, Vol. VI, 1925, p. 253), in proposing the two genera *Aphysa* HANDSCHIN and *Microphysa* HANDSCHIN, separates these two genera by the presence in *Microphysa* HANDSCHIN of a small „bladderscale“ at the apex of the dens which is absent from *Aphysa* HANDSCHIN. In a series of 29 specimens which I can unhesitatingly identify as *Microphysa lineata* (SCHÖTT) from Miss CLAY's collection there are 16 specimens in which the „bladderscale“ is clearly visible, 3 specimens in which it is only rudimentary, and 16 specimens in which there is no trace of it whatever. Those specimens in which it is present also have on the basal two-thirds of each dens, numerous finely ciliated spine-like setae [Fig. 41]. There is no trace of these on the other specimens. In all other respects the specimens are morphologically identical, and I suggest that the presence of the „bladderscale“ used by HANDSCHIN as a generic character, simply denotes a secondary sexual character. At the time of writing I have no definite anatomical proof for this, as all the specimens had been mounted in polyvinyl alcohol before I came to this conclusion. However, in so far as I can ascertain, the presence

of the „bladderscale“ and spinelike setae denote the male form of the insect. Accordingly the genus *Aphysa* HANDSCHIN must be synonymised with the genus *Microphysa* HANDSCHIN, as the latter genus has page priority. The genus *Microphysa* HANDSCHIN has been shown both by myself and by PACLT to be preoccupied, and must therefore now be known as *Handschinphysa* PACLT, 1947, for which the type species is *H. lineata* (PARONA, 1892), as fixed by HANDSCHIN (Treubia VI, 1925, p. 257).

In superficial appearance specimens belonging to the genus *Handschinphysa* PACLT, particularly those with the spine-like setae on the dentes, resemble specimens of *Paronella* SCHÖTT. They can quite easily be separated, however, by the structure of the scales, if any doubt should exist otherwise. I mention this because HANDSCHIN in his figures of *Microphysa lineata* (PARONA) includes a drawing showing distinct spines on the dentes. In large specimens the finely ciliated spine-like setae can quite easily look like distinct spines as they are surrounded by dense masses of ciliated setae which make the fine ciliations on these spine-like setae very difficult to detect. Extra measurements of the relative proportions of various parts of the body and segments of species belonging to this genus must be accepted with caution as the relative proportions of, say, length of antennae in relation to the body, the relative lengths of the antennal segments, the relative lengths of the abdominal segments, and of the dentes and mucro, can vary considerably according to the age of the individual insect, the proportions often being quite different between smaller individuals and larger individuals.

*Handschinphysa börneri* (IMMS, 1912)

[Pl. XXIII, Figs. 17—20]

1912. *Paronella börneri* IMMS

Colour: Basally yellow, paler on the legs and furcula, but overlaid on the body with deep reddish-brown pigment which occurs along the sides of the head, thorax and abdomen with generally a mid-dorsal patch on Abds. II and III and an incomplete broad transverse band posteriorly on Abd. IV; the po-

sterior border of Abd. V with a narrow, reddish-brown or black transverse band broken mid-dorsally. The lateral tergal margins of the thorax and Abds. I, II and III are often very narrowly margined in black, and there is a black spot ventrolaterally on Abd. V. The legs are banded with narrow, blackish-brown or black bands; the ocelli on black fields; Ants. I and II brown with joints black and the sides streaked with dark brown. Ants. III and IV were missing in my specimens.

In addition to the original description given by IMMS, I am including now a figure of the ocelli [Fig. 17] showing the posterior inner ocellus much smaller than the other and the anterior pair larger, which is a slightly unusual arrangement in the *Paronellinae*. The claw has a pair of outer pseudonychia reaching about one third down, a pair of inner teeth at about one third down, a single inner tooth at two thirds and a further small distal inner tooth between this and the claw apex, and situated nearer to the apex than to the first distal tooth. The unguiculus reaches almost to the second distal tooth, is trilamellate, curved on the outer lamella, serrated on the lateral lamella, the inner lamella broadened and thickened on its basal half, but truncated and slightly curved on the distal half, the two halves meeting in a blunt spine. A small lateral spine on each side of the basal part of the claw where it joins the basal section of the foot. A single long, stout, but tapering, strongly clavate tenent hair subequal to the claw in length, to each foot.

IMMS in his original description of the mucrones describes a rod-like setae on each side of the mucro. I think in this he was mistaking the apical plumose setae of the dens which are characteristic of the *Paronellinae* for a mucronal structure. These setae, which usually arise almost on the mucro dens junction, can appear to arise from the mucro. In my specimens these setae had all been rubbed off, but the sockets from which they arose were clearly visible on the apex of the dens. The mucrones are provided with six teeth, being two distal, one more or less spine-like and two plate-like teeth on the posterior face, and one lateral tooth. These teeth appear under the microscope to be very finely serrated [Figs. 18 and 20]. The apex of the dens in all my specimens carried a small „bladderlike“ organ.

Remarks: The scales of this species are of the typical *Handschinphysa* PACLT pattern, not *Paronellinae*, and were, in fact, drawn by IMMS [Fig. 73, c] as elongate lanceolate, in his original description. The species must, therefore, be transferred from *Paronella* SCHÖTT to *Handschinphysa* PACLT.

Locality: Amongst dry and rotten leaves, Gangkok, Sikkim, 6000', 11 II 1952.

***Handschinphysa crassicornis* (CARPENTER, 1917)**

[Pl. XXIV, Figs. 21—25]

1917. *Paronella crassicornis* CARPENTER

Several specimens of this species of CARPENTER'S were present in Miss CLAY'S collection, and I have taken this opportunity to give more detailed description and further figures for this species. The scales are typically of the *Handschinphysa* PACLT type, not *Paronellinae*, and therefore I have no hesitation in transferring this species to the genus *Handschinphysa* PACLT.

Colour: A general ground colour of yellow shaded laterally on Abds. III, IV and V with dark brown which extends as irregular transverse bands across Abds. III and IV, both posteriorly. Head darker brown on sides, ocellar fields black. There are two oblique red-brown streaks across the sides of the prothorax. Ants. I and II dark red-brown, black at the joints, Ants. III and IV yellow, Ant. IV becoming brown towards apex. Legs, yellow shaded with broad bands of dark red-brown. Manubrium yellow, furcula yellow basally, greyish brown distally.

Clothing: Densely clothed with scales on the body and furcula. Antennae and legs with scales round the basal regions only. The body ventrally and posteriorly with long simple setae and numerous short and long ciliated setae round the posterior. Ants. I and II with short ciliated setae and occasional very long simple setae. Ant. III similarly clothed, but the simple setae not so long. Ant. IV with short ciliated setae only. Legs with short ciliated setae and many moderately long simple setae. The dens and manubrium scaled and with both short and long ciliated setae.

Body: Length, to 4.5 mm, the antennal segments related as 8/9 : 8/9 : 6/7 : 9/10. A distinct antennal base is present. Ocelli, 8 to each side with the anterior two the largest and the posterior pair very small [Fig. 21]. Abd. IV 8—8.5 times as long as Abd. III. Rami of tenaculum each with 4 barbs; corpus with one short simple seta.

Legs: Foot claw with long pseudonychia reaching one third down, a pair of large inner teeth at one third and a large distal inner tooth just beyond half way. Unguiculus lanceolate, reaching to distal tooth, and with a very prominent tooth about one quarter down its outer edge. A single slender strongly clavate tenent hair shorter than the claw to each foot.

Furcula: The manubrium to dens to mucro as 120/140 : 170/182 : 9/10. The mucro with six teeth, two apical, three on the posterior face and one laterally. CARPENTER in his original description described the mucro with only 4 teeth, apparently failing to see the lateral tooth and the small basal tooth on the posterior face. I have examined paratypes of this species which are in the British Museum and I have no hesitation in referring the present specimens to CARPENTER's species, as this discrepancy in the mucro is apparent on close examination of the paratypes in the British Museum. Three different views of the mucro are included [Figs. 22, 24 and 25] which show the appearance of this organ from different angles from different specimens. The differences in appearance and structure of the teeth on the posterior face should be noted.

Localities: In dry and rotten leaves, Gangkok, Sikkim, 6,000', 11 II 1952.

***Handschinphysa lineata* (PARONA, 1892)**

[Pl. XXV, XXVI Figs. 26—41]

1892. *Entomobrya lineata* PARONA

1903. *Paronella lineata* SCHÖTT

1906. *Paronella tarsata* BÖRNER

1912. *Paronella tarsata* IMMS

1925. *Microphysa lineata* HANDSCHIN

Colour: Normally pale to deep yellow with deep blue-black ocellar fields and deep blue pigment shading the sides of the head, bases of the antennae and the latero-ventral areas

of the thoracic and abdominal segments; on Abd. IV this pigmentation expands to almost completely cover the entire segment although dorsally it is much paler than it is ventrolaterally. Legs, yellow, marked by narrow transverse bands of deep blue. Antennae yellow with blue shading at the joints and the apex. Furcula pale yellow. In some specimens the blue body pigment is reduced and occurs only along the ventrolateral margins of the terga and on the legs.

Clothing: Of typical scales on the body and furcula. A pair of lasiotrichia posteriorly on Abd. IV. Dens scaled. Ants. I and II with scales and short ciliated setae; Ants. III and IV with short ciliated setae only. Legs with basal segments only bearing scales and setae, otherwise clothed with short and long ciliated setae. Ciliated setae occur on the sides of the head posteriorly and latero-ventrally on the body with a tuft of long, finely ciliated setae at the apex of the mesotergum (these setae are not flexed). Many stout, flexed, ciliated setae do occur dorsally and laterally on the thorax and Abds. I and II. The furcula, as well as being scaled, is typically heavily clothed with short and long ciliated setae. The dens with or without the small apical „bladderscale“, but always with long, stout, plumose apical setae; these latter setae are often rubbed off, but the sockets from which they arise are always visible.

Body: Length, to 3,75 mm; antennae a little longer than the body, with the four segments related as 75/80 : 55/125. Apex of Ant. IV [Fig. 33] with four stout conical sense rods and 4—5 slender, straight sense rods; the apex with short, curved setae, ciliated on one side only, interspersed amongst the slightly longer ciliated setae. Occasional slender, tapering sense rods which are slightly hooked also occur amongst the setae on both Ant. IV and Ant. III. Ocelli, 8 to each side, subequal [Fig. 27]. Abd. IV 6—9 times longer than Abd. III. The rami of the tenaculum each with 4 barbs, the corpus with a long, stout, curved seta [Fig. 40].

Legs: Each tibiotarsus above the unguiculus with a bladder-like swelling [Fig. 30—32]; claw with a pair of large lateral outer pseudonychia reaching to between one third and one half down; a pair of strong inner teeth at about half way down on the hind feet, at about one quarter or one third down on

the other feet; a large single distal inner tooth at about three quarters down, and a smaller subapical inner tooth nearer to the apex of the claw than to the distal tooth. Unguiculus reaching to the first distal inner tooth on the hind feet, but shorter on the other feet, trilamellate, broadened and thickened on the basal half of the inner lamella, broadly truncate on the distal half of the inner lamella with a short spine at the junction of the two halves [Fig. 32]. In some specimens the thickened basal portion of the inner lamella extends beyond half way, especially on the hind feet [Fig. 26]. In some specimens the hind feet have the outer lamella of the unguiculus strongly serrated [Fig. 26], in others it is plain [Fig. 31], and in some specimens the outer lamella of the unguiculus of the fore and middle feet carries a strong basal tooth [Fig. 30] or else a number of serrations [Fig. 32]. There is a single, very stout, but tapering, strongly curved tenent hair longer than the claw to each foot, the clavate portion usually subdivided into several „fingers“; the hind tibiotarsus with a strong, simple seta above the bladderlike swelling above the unguiculus [Fig. 26].

Furcula: Manubrium to dens to mucro as 105: 130: 7/8; the clothing as described previously; the bladderlike swelling either present or absent; the mucro with 6—7 teeth, varying between different specimens [Figs. 30—39]. The shape and structure of the teeth of the mucro varies between specimens, but normally there are two apical teeth, two plate-like teeth and a spine-like tooth on the posterior face and one or two lateral teeth. These teeth are nearly always striated. The dens apically on the anterior face usually carries a long plumose seta on each side.

Localities: Under stones on a hillside, Singhik, Sikkim, 4480', 14 II 1952; under stones, and amongst leaves and moss on the edge of a wood, and under stones in a pasture, Chungtang, Sikkim, 5120', 16 II 1952; amongst earth, dead leaves and rotten wood in an evergreen forest at 5000' at Bishenpur, Manipur State, 19 I 1952.

Remarks: If we consider the detailed morphology of the mucro dens and the feet of these specimens we find that there is a very close similarity and an intergrading between

the specimens which have no bladderlike scale on the dens and those which have this scale. For instance, Fig. 26 is the hind foot of a specimen with no bladderlike scale on its dentes, Fig. 30 is the front foot of a specimen with a bladderlike scale, Fig. 31 is the hind foot from a specimen in which the bladderlike scale is rudimentary, and Fig. 32 is the front foot of a specimen with no bladderlike scale. Fig. 34, of the apex of the dens and mucro, and Fig. 30, of the front foot, are from the same specimen, that is a specimen in which the bladderlike scale is present. Figs. 26, 32, 35 and 36 are from the same specimen, one in which the bladderlike scale was absent. The only morphological difference of any significance between the feet of these species is the number of teeth or serrations on the outer lamella of the unguiculus, a feature which I consider is not of sufficient importance to be of either generic or specific difference. A complete intergrade exists amongst the specimens which I have from a non serrated unguiculus to a heavily serrated unguiculus, and this feature also varies independently with the presence, absence or rudimentary appearance of the bladderlike scale on the dens, so that the specimens cannot be separated completely into two groups on either of these features. It was for this reason that I first came to the conclusion that *Aphysa* HANDSCHIN and *Handschinphysa* PACLT were synonymous, and on further examination of the specimens I was convinced that those insects with the „bladderlike scale“ represent the male of the species, and those without the female.

***Handschinphysa vestita* (HANDSCHIN, 1925)**

[Pl. XXVII Figs. 42—45]

1925. *Microphysa vestita* HANDSCHIN

A full description of this species is as follows:

Colour: Deep yellow overlaid by deep blue pigment from the head to the posterior border of Abd. III and paler blue shading on the sides of Abd. IV posteriorly and on the sides of Abds. V and VI. Ventral tube dark blue, legs pale yellow banded with blue particularly on the tibiotarsi. Antennae pale yellow, becoming bluish towards apex of Ant. IV. Furcula pale

yellow with a little pale blue shading on the posterior face of the manubrium. The deep blue pigment may also cover the head entirely or be broken dorsally so that the blue persists only on the sides. The forms in which the blue pigment does not cover the dorsal surface resemble more closely *Handschinphysa lineata* (PARONA), but can be distinguished from this species through the basal inner pair of teeth on the claw being much closer to the claw base.

**Clothing:** Of typical scales and setae. The setae are ciliated and occur principally ventrally and posteriorly on the body antennae, legs and furcula. Two pairs of lasiotrichia on Abd. IV posteriorly. Clothing of the furcula is as in *H. lineata* (PARONA) with scales, ciliated setae and spine-like setae. The antennae having only Ant. I with scales; Ants. II and III with short ciliated setae and occasional long single setae which are longer on Ant. II than on Ant. III. Ant. IV with whorls of short ciliated setae.

**Body:** Length, up to 2,5 mm. in my specimens (HANDSCHIN gives a length of 3,5 mm. in his original description). Antennae, slightly longer than the body, the four segments related as 41 : 45 : 30 : 75. Ant. IV annulated, the annulations corresponding with the whorls of setae. Apex of Ant. IV with one large sense cone and several tapering sense rods, and occasional plain tapering sense rods amongst the ciliated setae. Ocelli, 8 to each side as in *H. lineata* (PARONA). Rami of tenaculum each with four barbs; corpus with one long stout curved seta [Fig. 43]. Abd. IV 8—9 times longer than Abd. III.

**Legs:** Claw with a pair of short outer lateral teeth and a pair of small inner teeth situated about one fifth down on the front of the middle feet and one quarter down on the hind feet; these teeth are very small on the front feet and difficult to detect as a pair. All feet with a single inner tooth at two-thirds down and a very small basal seta to each side of claw. Hind tibiotarsi with a long, simple seta above the unguiculus. All tibiotarsi immediately above the claw base with a bladder-like swelling as in *H. lineata* (PARONA) [Figs. 42, 44]. Unguiculus shorter on the front feet than on the hind feet, trilamellate with the outer lamella narrow, the inner lamella broad, thickened on its basal half and truncate from a little beyond midway

to the apex. A very faint suggestion only of a blunt spine at the angle between the basal section of the lamella and the truncate section.

**Furcula:** Manubrium to dens to mucro as 76 : 96 : 5. The dens with the apical setae heavily ciliated and arranged in transverse rows across the dens. Mucro with 6—7 teeth; the small spine-like basal tooth on the posterior face of the mucro shown by HANDSCHIN is almost rudimentary and only barely visible on my specimens. The mucro has three apical teeth, of which two are truly apical and one slightly subapical, with two plate-like teeth and a small spine-like tooth on the posterior face and a large lateral tooth.

**Localities:** From amongst moss on stones and logs in an evergreen forest, 5,000', Kohima, Naga Hills, Assam, 28 I 1952. From moss on a hillside at Singkik, Sikkim, 4,480', 14 II 1952.

***Handschinphysa longicornis* (OUDEMANS, 1890)**

[Pl. XXVIII Figs. 46—52]

1890. *Entomobrya longicornis* OUDEMANS

1903. *Paronella longicornis* SCHÖTT

1910. *Campylothorax ceylonicus* RITTER

1925. *Aphysa dubia* Schött

This species was redescribed and figured by HANDSCHIN in 1925, and in his Fig. 75 he shows a specimen in which the antennae are peculiarly twisted and contorted. The way in which the appendages, especially the antennae but also the dentes, and to a lesser extent the legs, become twisted and contorted by preservatives is a striking feature of this species. The following is a more full description of the species.

**Colour:** Yellowish to brown with blue-black ocellar fields joined round the antennal bases by a band of blue-black pigment; a narrow blue-black edging to the thoracic and abdominal terga, Abds. III. and IV with lateral blue-black shading and Abds. V and VI each with ventrolateral blue-black pigment blotches. Legs and furcula yellow, the legs with narrow transverse blue-black bands. Antennae pale blue with Ant. I conspicuously shaded with dark blue, the other segments with the joints deeply pigmented.

Clothing: Similar to that of the other species of *Handschinphysa* PACLT. The antennae are scaled on the first three segments. The scales of the body are typically pointed except across the dorsal surface of the thorax and anterior part of the abdomen where they become larger and much more rounded apically.

Body: Length, to 3,5 mm. Antennae longer than the body, the average ratio of my specimens being 310 : 275, the four segments of the antennae related as 66 : 75 : 52 : 110. Ant. IV annulated and with sense rods and apical setae similar to *H. lineata* (PARONA). Ocelli [Fig. 52] with the anterior pair very much larger than the others which are approximately subequal. Abd. IV 6—7 times longer than Abd. III (SCHÖTT gives Abd. IV approximately 5 times longer than Abd. III). The tenaculum could not be seen on any of the specimens I examined.

Legs: Claw with two long outer pseudonychia reaching to the level of the inner teeth [Fig. 50]. A pair of prominent inner basal teeth at about one quarter down on the fore and middle feet and one third down on the hind feet. A single inner distal tooth at two thirds down on all feet. There is no second or apical distal tooth as in *H. lineata* (PARONA). The unguiculus reaching the distal inner tooth on the hind feet but just short of this on the other feet; trilamellate, with the outer lamella bearing one prominent basal tooth or a row of up to 4 finer teeth on the basal half; inner lamella thickened on the basal half, passing into a distinct spine after which it is truncated or tapers rapidly to the apex. A single very stout, strongly clavate tenent hair equal to, or slightly longer than, the claw to each foot. Each tibiotarsus with a bladderlike swelling above the unguiculus; the hind tibiotarsi only with a strong, simple seta above this.

Furcula: Manubrium to dens to mucro as 110: 135: 7/8. The dens on its distal half has many spine-like ciliated setae which are ciliated on their apical two-thirds along one face only, so that they may be described as fringed [Fig. 46]. In other respects the clothing of the dens is similar to the other species of *Handschinphysa* PACLT. The mucro with 7—9 teeth [Figs. 47—49]; one of these teeth is always a lateral ridged

tooth two are usually apical and subequal, two are subapical and there are two or three plate-like teeth on the posterior face. Sometimes the basal of these plate-like teeth is distinctly spine-like [Figs. 47 and 48]. Occasionally the anterior face bears two minute teeth on the apical half [Fig. 48]. The bladder-like scale on the dens can be present or absent.

Localities: From foliage of the undergrowth in an ever-green forest, Oating, Sibsager district, Assam, 350', 4 II 1952; from amongst dry and rotting leaves at Gangtok, Sikkim, 6000', 11 II 1952.

Remarks: SCHÖTT (1925) in his paper on *Collembola* from Mt. Murud, describes the species *Aphysa dubia* SCHÖTT as a form of *Collembola* falling into HANDSCHIN'S new genus *Aphysa* HANDSCHIN, but SCHÖTT states, however, that he had great difficulty in correctly placing the specimen, mentioning in particular that in some individuals the dentes are armed with spines and in others they are unarmed. From his description and figures I would say that the species is a synonym of *H. longicornis* HANDSCHIN. In his remarks, SCHÖTT states that the species is close to *H. longicornis* HANDSCHIN, but can be separated by the occurrence of the dental spines and the shorter length of the antennae. At mentioned previously, I have found the antennae as well as other parts of these *Collembola* to be variable in their relative lengths.

***Handschinphysa serrata* n. sp.**

[Pl. XXIX Figs. 53—58]

Colour: Deep ochreous with blue-black shading that extends as a broad lateral band along the sides of the head, thorax, and Abds. I—III. A broad lateral irregularly rectangular area of blue-black on each side of Abd. IV which gives off an anterior and a posterior narrow, somewhat broken transverse band. There is a large oval area of blue-black on each side of Abd. V. Ocelli on black fields, antennae and legs shaded with deep blue, the legs particularly so on the femora and tibiotarsi. Furcula yellow.

Clothing: Typical, of scales and ciliated setae as in *H. lineata* (PARONA); a pair of lasiotrichia on each of Abds. III and IV; dens with a row of very stout and long, finely plumose setae along the posterior and inner face. These setae on all my specimens are always directed away from the dens and lie at an angle with the surface, whereas all other setae are directed towards the apex, lying more or less along the surface of the dens. Apex of dens with many medium length, straight and curved ciliated setae surrounding the base of the mucro and arranged in longitudinal rows along the dens. Their sockets are readily visible when they have been rubbed off. The ciliated spine-like setae characteristic of other species of *Handschinphysa* PACLT are not present on any of my specimens of *H. serrata* sp. n.

Body: Length, up to 1.4 mm. The antennae have been broken in all of my specimens, and Ant. IV is not present on any of them. One specimens has 3 segments present which are related as 55 : 68 : 44. Ocelli, 8 to each side, the anterior two being very large, the posterior inner two very small, the rest subequal [Fig. 61]. Abd. IV four times longer than Abd. III. Tenaculum similar to that of *H. lineata* (PARONA).

Legs: Claw with a pair of small outer lateral teeth at about one quarter to one third down, a pair of strong inner teeth at about one quarter down, a single distal inner tooth at two thirds and a small subapical inner tooth nearer to the apex than to the distal tooth. Unguiculus on the hind feet almost reaching the subapical inner tooth but only reaching to the distal inner tooth on the middle feet and only just beyond the paired inner tooth on the front feet; with a narrow outer lamella and truncate inner lamella bearing a distinct blunt spine about the centre. A single, slender, strongly clavate tenent hair slightly longer than the claw to each foot; hind feet only with a simple seta above the unguiculus.

Furcula: Manubrium to dens to murco as 54 : 85 : 4. Mucro normally with two prominent apical teeth, one prominent subapical tooth on the posterior face, a large lateral tooth and a row of up to 7 tooth-like serrations along the posterior edge [Figs. 54 and 55]. The mucronal serrations are often very irregular and may be reduced to 4 or 5 [Fig. 57].

Sometimes the mucro has an additional subapical lateral tooth on the anterior face [Fig. 58]. The dens apically with prominent plumose setae often rubbed off, but without any trace of a bladderlike swelling.

Localities: Type locality, from moss on stones and logs in evergreen forest, 5000', Kohima, Naga Hills, Assam, 29 I 1952. From amongst leaves and roots on the edge of a stream in evergreen forest, 6000', Mt. Japvo, Naga Hills, near Kohima, Assam, 30 I 1952.

Genus: *Salina* MAC GILLIVRAY, 1894

*Salina indica* (IMMS, 1912)

[Pl. XXX, XXXI Figs. 59—69]

1912. *Cremastocephalus indicus* IMMS

1912. *Cremastocephalus montanus* IMMS

1928. *Cremastocephalus striatus* HANDSCHIN

1929. *Salina striata* HANDSCHIN

Amongst Miss CLAY'S material were a number of specimens which can undoubtedly be referred to as this species (see *montanus* of IMMS and *indicus* of IMMS). The series gives a complete intergrade between these two species and I have no hesitation in synonymising *montanus* IMMS with *indicus* IMMS. The species must now be known as *Salina indica* (IMMS), as the name *indicus* IMMS has page priority over the name *montanus* IMMS. The following is a more complete description of this species:

Colour: Very variable, a yellowish ground colour overlaid irregularly by violet pigment which usually follows the lateral edges of the terga and may form broken dorsal lateral longitudinal bands along the trunk, particularly on the abdomen. Sometimes this pigment completely covers the thorax and Abds. I, II and III, and in these forms it is more blue than violet. Antennae pale violet basally, darkening towards the apex; legs banded with blue pigment; furcula yellow or white; ocelli on black fields. Specimens do occur almost devoid of any violet body pigment.

**Clothing:** General clothing of short to medium length ciliated setae with some long, stout, lightly flexed ciliated setae at the apex of the mesotergum and along the dorsal surface of the thorax. The posterior borders of the trunk segments usually each with a transverse band of short, simple setae having pronged tips [Fig. 59]. A group of these setae also occurs on the top of the head. This type of setae forms the general clothing in the anterior region down as far as Abd. IV in some specimens, but posterior to this the setae are the normal ciliated type. On the anterior face on the dens some of the setae are rather spine-like with their distal halves finely ciliated, and some finely ciliated setae occur round the posterior and ventral edges of the abdomen. Setae of the furcula ciliated. Hind tibiotarsi only each with a long, slender, spine-like seta above the unguiculus. The setae of the legs are both ciliated and simple, the shorter ones usually being simple and on the basal segment of the legs, the longer setae being finely ciliated and on the distal segment of the legs. Setae of the antennae finely ciliated.

**Body:** Length, to 2.6 mm. Antennae 4 segmented, shorter than the head, each with a distinct triangular base, the four segments related as 40 : 55 : 47 : 69. These figures are an average over a number of specimens; the actual figures for individuals vary considerably; for instance, the measurements of two individuals, (a) 86 : 116 : 94 : 156; (b) 80 : 110 : 94 : 138. Ant. IV apically with an eversible knob and 4—5 straight, tapering sense rods. Ants. III and IV with occasional long tapering sense rods amongst the setae, and Ant. IV faintly annulated in some specimens, clearly annulated in others. Ant. II with numerous short, slender, curved sense rods interspersed amongst the setae. Apex of Ant. I with a single, exposed, slender sense rod about as long as a seta. Ocelli, 8 to each side, the anterior pair very large, the others smaller, with the posterior inner pair the smallest [Figs. 60 and 67]. Abd. IV 3—4 times longer than Abd. III. Tenaculum not seen.

**Legs:** Claw with a pair of outer lateral pseudonychia, a pair of strong, plate-like inner teeth reaching to about one third down, a single distal inner tooth at about two thirds down and about midway between this and the apex a small

subapical tooth. The unguiculus varying from one third to two thirds the length of the claw, being shorter on the front feet and longest on the hind feet; with a central strong rib, narrow outer lamella and broad inner lamella, the inner lamella abruptly truncate from two thirds down with the basal two thirds strongly thickened. A single, very stout, heavily clavate and very finely ciliated tenent hair considerably longer than the claw to each foot. A distinct bladder-like swelling above the unguiculus on each tibiotarsus, and above this on the hind tibiotarsi a long strong simple seta.

Furcula: Manubrium to dens to mucro as 76 : 83 : 4. The apex of the dens with a scale-like lobe which is very variable in shape, sometimes long, being almost as long as the mucro [Fig. 65], and sometimes short [Fig. 63]; sometimes this structure is simply in the form of a lobe-like swelling [Fig. 62] and at other times it is more in the form of a scale-like appendage [Figs. 63, 65, 66 and 69]. The mucro normally surrounded by moderately long ciliated setae which are often rubbed off. Mucro itself more or less parallel sided or concave with a truncate apex bearing three plain teeth. These teeth are extremely variable in shape [Figs. 63, 66, 69] and sometimes the one adjacent to the scale-like appendage is vestigial [Fig. 65].

Localities: Amongst earth, dead leaves and rotten wood in an evergreen forest at 5000', Bishenpur, Manipus State, 19 I 1952; by beating foliage and undergrowth in secondary wood, Gangtok, Sikkim, 6000', 11 II 1952.

Remarks: In the British Museum (Natural History) London are some paratypes of IMMS' species of *Cremastcephalus indicus* IMMS which I have examined and from which Figs. 67—69 were taken. From a study of the published descriptions of *Salina striata* HANDSCHIN, I consider that this species is also synonymous with *S. indica* (IMMS). The figure given by HANDSCHIN in *Revue Suisse de Zoologie* 36, p. 246, Fig. 26, conforms almost exactly with some of the colour forms of this species that I have examined. His Figs. 27 and 28 of mucro and foot show, in my opinion, no difference to separate this species from *Salina indica* (IMMS). I am satisfied that the synonymising of these species is justifiable and correct.

*Salina celebensis* (SCHAEFFER, 1898)

[Pl. XXXII Figs. 70—73]

1898. *Oremastocephalus celebensis* SCHAEFFER

This species is very closely related to *Salina indica* (IMMS), but is most easily separated from that species by the structure of the claw. In *Salina celebensis* (SCHAEFFER) the basal pair of inner teeth are fairly large, plate-like, in fact almost wing-like, reaching not more than one fifth down, often finishing even closer than this to the claw base. In *Salina indica* (IMMS) the pair of inner teeth are much smaller and reach to between one third and one half down the inner margin. The pseudonychia are longer in *Salina indica* (IMMS) and the unguiculus is very much more strongly curved and thickened on the inner margin in *Salina celebensis* (SCHAEFFER) than it is in *Salina indica* (IMMS). Additional notes on the description of this species are:

Colour: Yellow to ochreous, with or without pigment which is variably distributed over the body.

Clothing: Normally with long ciliated setae posteriorly and blunt, apical, projecting setae around the segmental margins and on the head as in *Salina indica* (IMMS).

Body: Length, to 2,7 mm. Antenna 4 segmented, very variable in the relations of the segments, as for instance: specimen (a), 103 : 35 : 55 : 105; specimen (b), 60 : 90 : 82 : 111; specimen (c), 37 : 66 : 60 : 75. It becomes almost impossible to even give an average, although an average taken from several specimens worked out at 60 : 33 : 82 : 111. Ant. IV distinctly annulated with a prominent eversible knob at the apex; clothed with ciliated setae amongst which are short, simple, tapering sense rods with their apices slightly hooked. Ant. III with a suggestion of annulation towards the apex. Ocelli, 8 to each side as in *Salina indica* (IMMS). Abd. IV 4—6.5 times as long as Abd. III. The tenaculum was not seen.

Legs: Claw with paired inner teeth as described above, and in addition there is a single distal tooth about two thirds down and a very small subapical inner tooth nearer to the apex of the claw than to the distal tooth. A pair of short, outer lateral pseudonychia reaching to about one sixth down each

claw; the unguiculus with two lamellae, the outer lamella of medium to broad width and curved, the inner lamella very broad, greatly thickened on its basal half and curved towards a prominent spine half way along its length, thereafter truncately curved to the apex [Fig. 73]; unguiculus not quite reaching the single distal inner tooth on the front feet [Fig. 72] but reaching just beyond this on the hind feet [Fig. 73]. No external basal setae to the claw, but a stout, strongly clavate ciliated hair about equal to or a little longer than the claw to each foot. A bladderlike swelling on each tibiotarsus just above the unguiculus and on the hind tibiotarsi only a long simple seta above this.

Furcula: Manubrium to dens to mucro as 90 : 95 : 5. The posterior face of the dens with a row of stout, rather blunt ciliated setae, the other setae of the dens arranged in rows longitudinally and towards the apex as transverse bands as well; they are mostly medium to long, and ciliated. The mucronal structure very similar to that of *S. indica* (IMMS), but the mucro is generally relatively shorter and broader, in some specimens almost stumpy with three tooth-like lobes or three simple lobes. Usually the most apical lobe of the mucro is more tooth-like than the others, the medial one usually rather truncate and the third one more lobelike [Figs. 70 and 71].

Localities: By beating the foliage of undergrowth of an evergreen forest, Oating, Sibsager district, Assam, 350', 5 II 1952.

Genus: ***Pseudoparonellides*** SALMON, 1941

The occurrence in India of a species of this genus, previously known only from New Zealand, is extremely interesting and serves further to establish the zoogeographical links between the New Zealand — Australian and Indian — Malayan regions.

***Pseudoparonellides bulbosa*** n. sp.

[P. XXXIII, Figs. 74—77]

Colour: Yellow ground colour with dark bluish shading extending along the sides of the head, the thorax and the abdomen, to the posterior: a broad band of irregular and

coarsely broken blue shading midventrally from the metathorax to Abd. V. Ocellar fields and bases of the antennae joined by a narrow dark blue band; ocellar fields black; antennae medium violet or blue, deepening towards the apex, deep blue or deep violet at the joints; legs and furcula yellow, legs with pale blue shading around the joints.

**Clothing:** On the body and appendages of short, ciliated setae with a pair of lasiotrichia on Abd. IV posteriorly.

**Body:** Length, to 1.7 mm. Antennae shorter than the body, with the first three segments related 26 : 38 : 32 (Ant. IV missing). Ant III with two short, straight, exposed subapical sense rods. Ocelli, 8 to each side, the anterior two the largest, the posterior inner two the smallest, the others large and subequal. Abd. IV 9 times longer than Abd. III. Rami of tenaculum each with four barbs; the corpus naked.

**Legs:** Claw with a pair of short, outer lateral teeth about one fifth down; a pair of inner teeth at one third down and a single inner tooth at two thirds down. Unguiculus with narrow curved outer lamella and broad curved inner lamella which is sharply truncate on its apical third, but without any spine or protuberance at the point of truncation; the unguiculus reaching to just below the paired inner teeth on the front foot, but just beyond the distal inner tooth on the hind feet. All tibiotarsi with a large bladder-like swelling above the unguiculus, but the hind tibiotarsi only with a long, simple seta above this. A single, stout, clavate tenent hair, nearly twice as long as the claw, to each foot.

**Furcula:** Manubrium to dens to mucro as 42 : 47 : 2.5. The dens swollen or distended apically, giving it a bulbous appearance and with a moderately large, bladder-like or scale-like subapical appendage. The mucro small, parallel sided, obliquely truncate apically with two more-or-less shallow notches giving the impression of three small, plate-like teeth across the apex [Figs. 74 and 76]; the mucro surrounded and overreached by strong ciliated setae arising from the apex of the dens.

**Locality:** Type locality, by beating the leaves of sedges at the edge of a lake, Imphal, Manipur state, 14 I 1952.

Remarks: This species, known only from the type specimen, which is slightly rubbed, would in all probability have a heavier and more extensive clothing of setae than I have indicated. There should normally be more, longer, and probably flexed ciliated setae along the dorsal surface of the thorax and the anterior part of the abdomen.

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#### РЕЗЮМЕ

Настоящая работа является результатом дальнейших исследований коллекции *Collembola* из Индии, собранных в 1952 году Т. Клеем из Британского Музея (British Museum, Nat. Hist.) в Лондоне. Настоящая работа содержит описания двух новых видов из подсемейства *Paronellinae* и описания и заметки, касающиеся восьми других видов, принадлежащих к тому же семейству. В работе оговаривается так же значение чешуек на теле и пузырчатых чешуек на зубах, играющих важную роль при изучении систематики родов.

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#### STRESZCZENIE

Praca niniejsza jest dalszymi wynikami badań nad zbiorami *Collembola* z Indii zebranymi w roku 1952 przez T. CLAY z British Museum (Nat. Hist.) w Londynie. Praca ta zawiera opisy dwóch nowych gatunków z podrodziny *Paronellinae* oraz opisy i uwagi nad ośmioma innymi gatunkami należącymi do tej rodziny. Zostało również omówione znaczenie łusek na ciele oraz łusek pęcherzykowatych na zębach dla systematyki rodzajów.

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## Plate XXI

Figs. 1—5. Typical scales of *Handschinphysa lineata* (PARONA)

Fig. 1, large body scale; Fig. 2, medium body scale; Fig. 3, small body scales;  
Fig. 4, larger rounded body scale from thorax; Fig. 5, scale from dens.

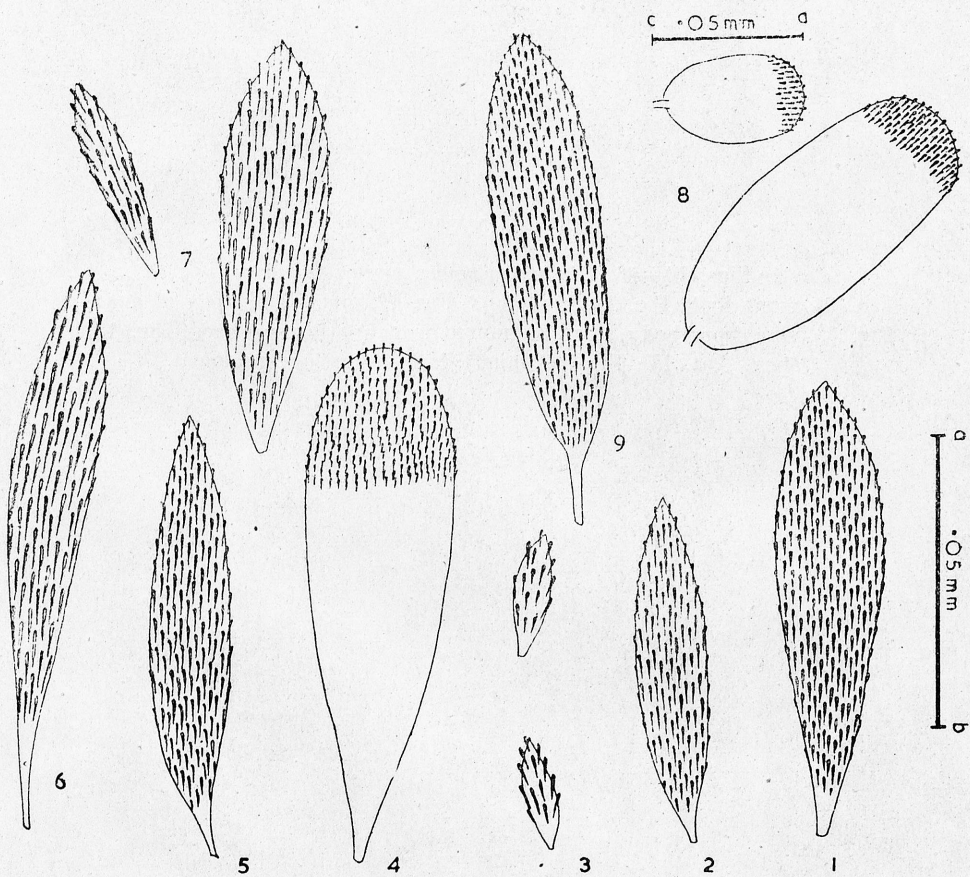
Figs. 6—7. Scales of *Dicranocentroides fasciculatus* IMMS

Fig. 6, scale from dens; Fig. 7, small and medium sized body scales.

Figs. 8—9. Scales from *Paronella nigromaculata* SCHÖTT

Fig. 8, scales from body, small and medium sized; Fig. 9, scale from dens.

(Figs. 1—7, 9, scale a—b; Fig. 8, scale c—d).

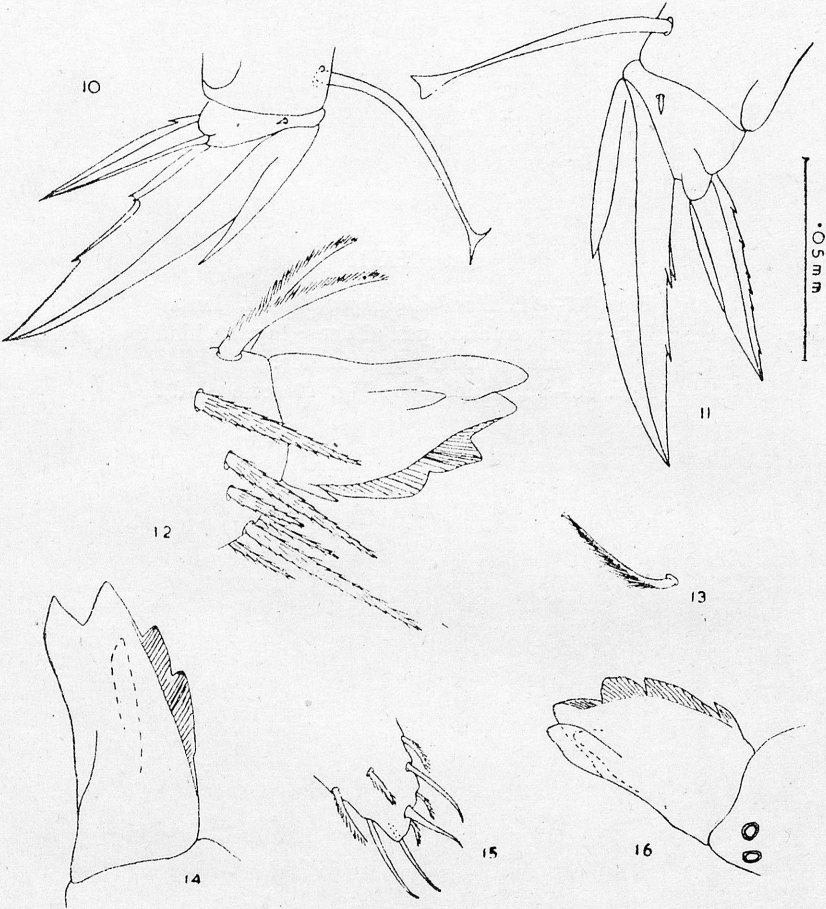


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## Plate XXII

Figs. 10—16. *Dicranocentroides fasciculatus* IMMS

Fig. 10, front foot; Fig. 11, hind foot; Fig. 12, mucro and apex of dens;  
Fig. 13, seta from body; Fig. 14, mucro from another specimen; Fig. 15,  
apex, Ant. IV; Fig. 16, mucro from a further specimen

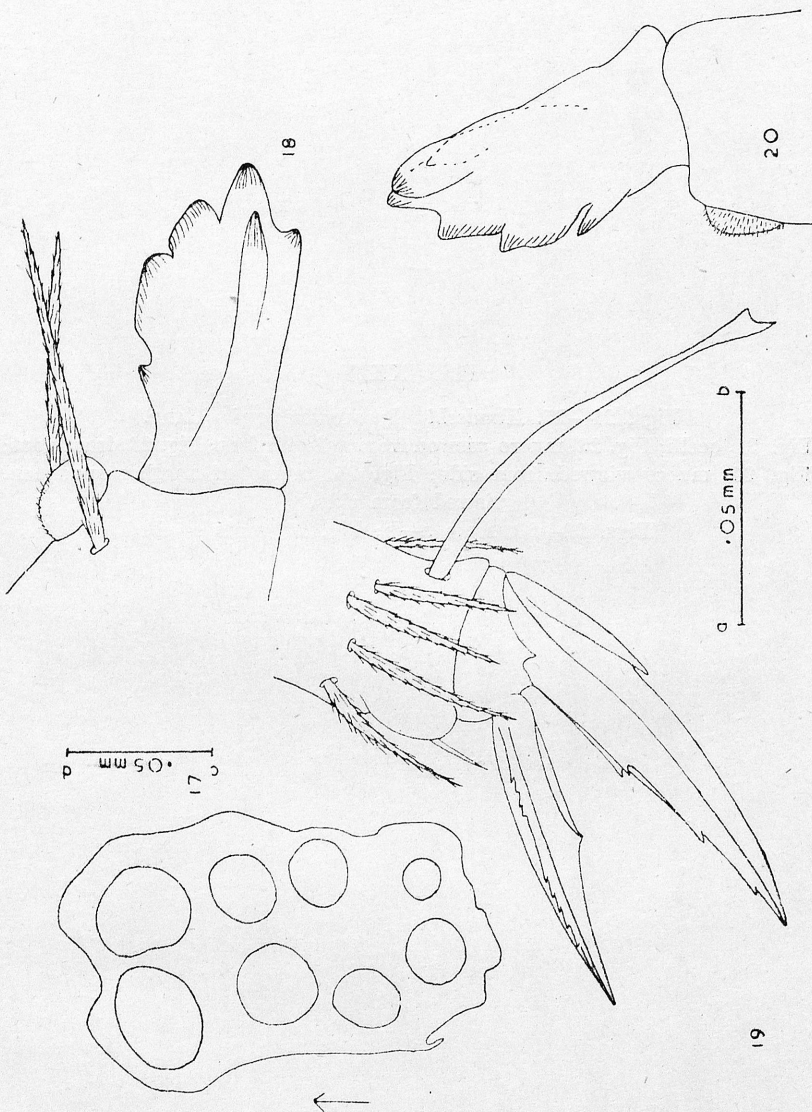


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## Plate XXIII

Figs. 17—20. *Handschinphysa börneri* (IMMS)Fig. 17, ocelli; Fig. 18, mucro and apex of dens; Fig. 19, hind foot; Fig. 20,  
mucro from opposite side.

(Figs. 18—20, scale a—b; Fig. 17 scale c—d).



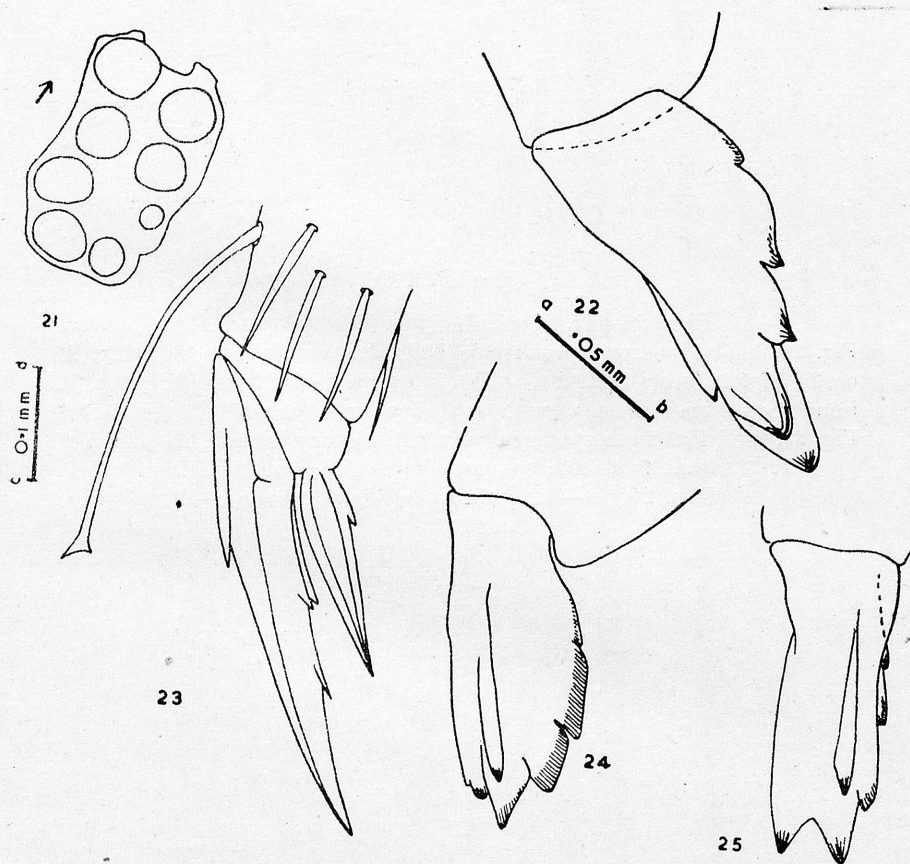
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## Plate XXIV

Figs. 21—25. *Handschinphysa crassicornis* (CARP.)

Fig. 21, ocelli; Fig. 22, mucro viewed from anterior face; Fig. 23, front foot;  
Fig. 24, mucro viewed from side; Fig. 25, mucro of another specimen,  
viewed from side.

(Figs. 22—25, scale a—b; Fig. 21, scale c—d).



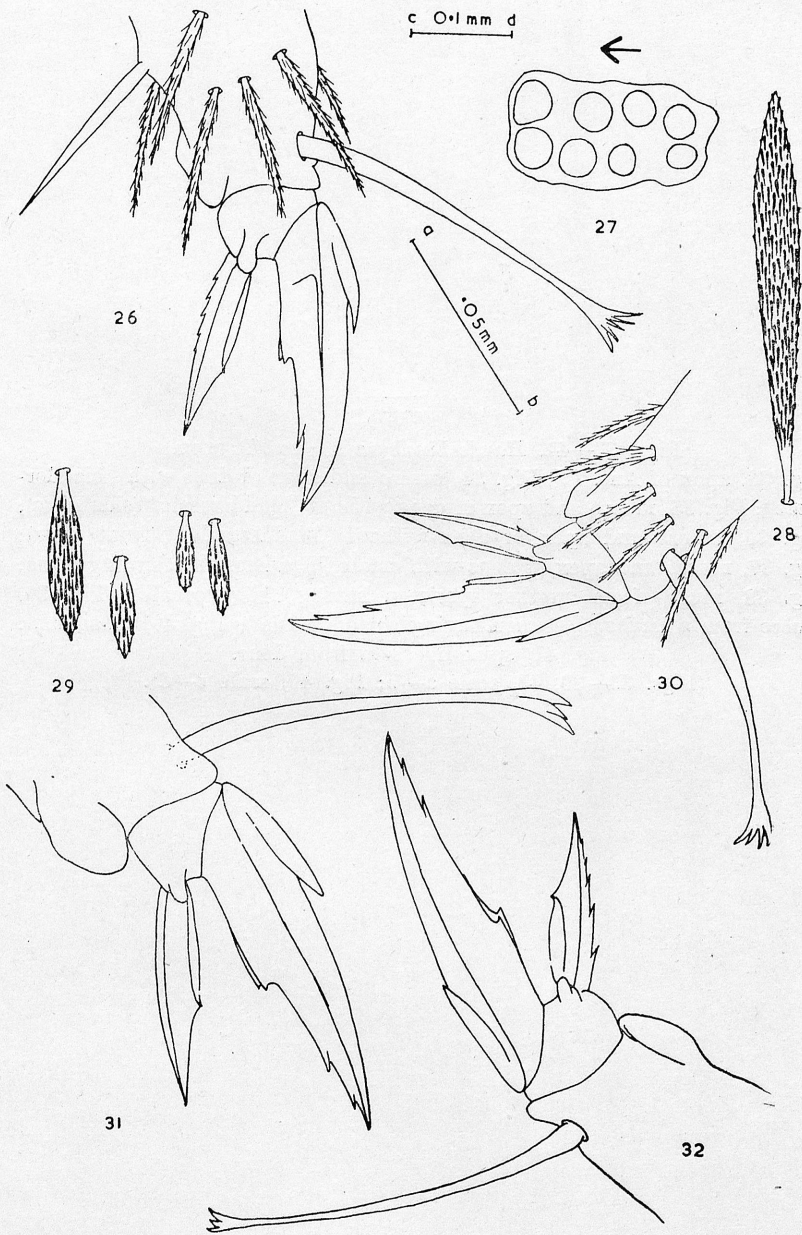
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## Plate XXV

Figs. 26—32. *Handschinphysa lineata* (PARONA)

Fig. 26, hind foot from specimen without dental „bladderscale“ Fig. 27, ocelli; Fig. 28, scale from dens; Fig. 29, small scales from body; Fig. 30, front foot from specimen with well developed dental „bladderscale“; Fig. 31, hind foot from specimen with rudimentary dental „bladderscale“, Fig. 32, front foot from specimen without dental „bladderscale“.

(Figs. 26, 28—32, scale a—b; Fig. 27, scale c—d).



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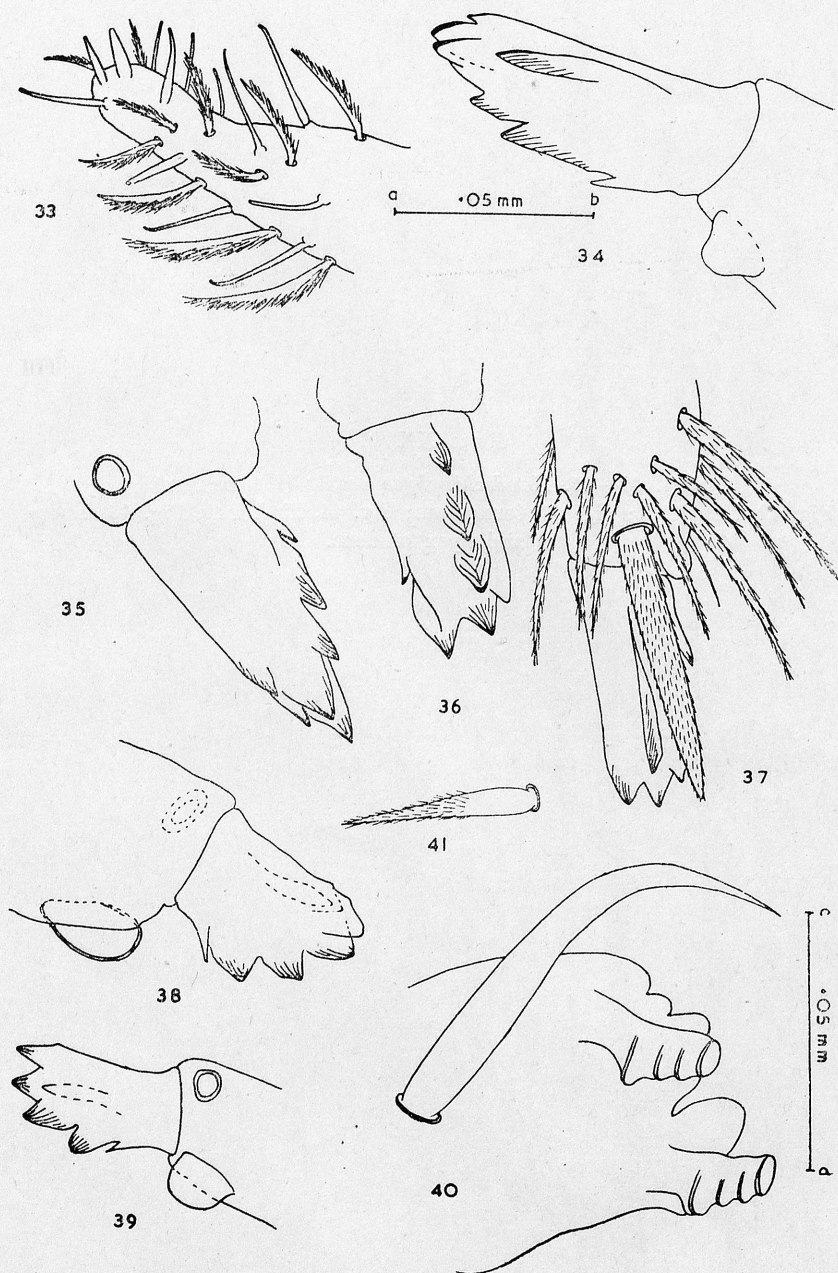
## Plate XXVI

Figs. 33—41. *Handschinphysa lineata* (PARONA)

Fig. 33, apex of Ant. IV; Fig. 34, mucro and apex of dens with „bladderscale“; Fig. 35, mucro and apex of dens without „bladderscale“ (side view); Fig. 36, mucro and apex of dens without „bladderscale“ (front view); Fig. 37, mucro and apex of dens with small „bladderscale“ showing setae; Fig. 38, mucro from another specimen having „bladderscale“; Fig. 39, mucro from a further specimen having „bladderscale“; Fig. 40, tenaculum.

Fig. 41, spine-like seta from dens.

(Figs. 33—39, 41, scale a—b; Fig. 40, scale c—d).

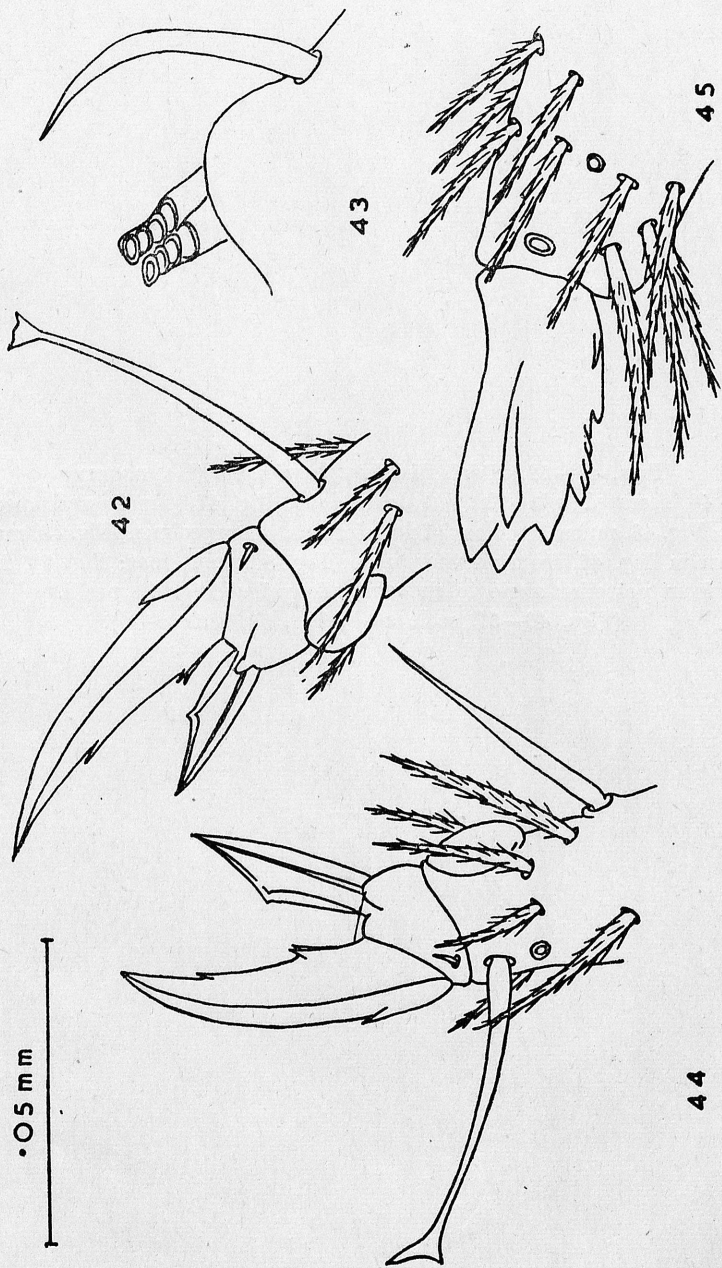


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## Plate XXVII

Figs. 42—45. *Handschinphysa vestita* (HANDSCHIN)

Fig. 42, front foot; Fig. 43, tenaculum; Fig. 44, hind foot; Fig. 45. mucro  
and apex of dens.



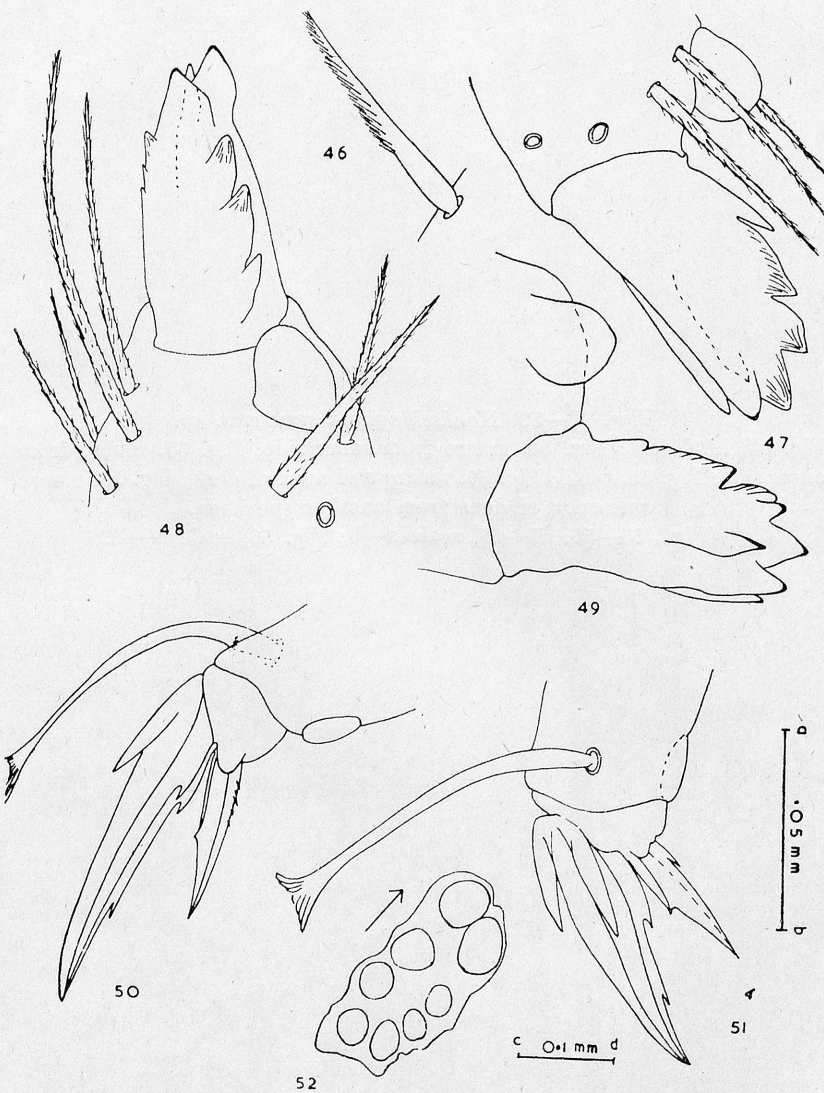
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## Plate XXVIII

Figs. 46—52. *Handschinphysa longicornis* (HANDSCHIN)

Fig. 46, serrated spine-like seta from dens; Fig. 47, mucro and apex of dens; Fig. 48, mucro and apex of dens from another specimen; Fig. 49, mucro shown in Fig. 47, from another angle; Fig. 50, front foot; Fig. 51, front foot from posterior angle to show pseudonychia; Fig. 52, ocelli.

(Figs. 46—51, scale a—b; Fig. 52, scale c—d).



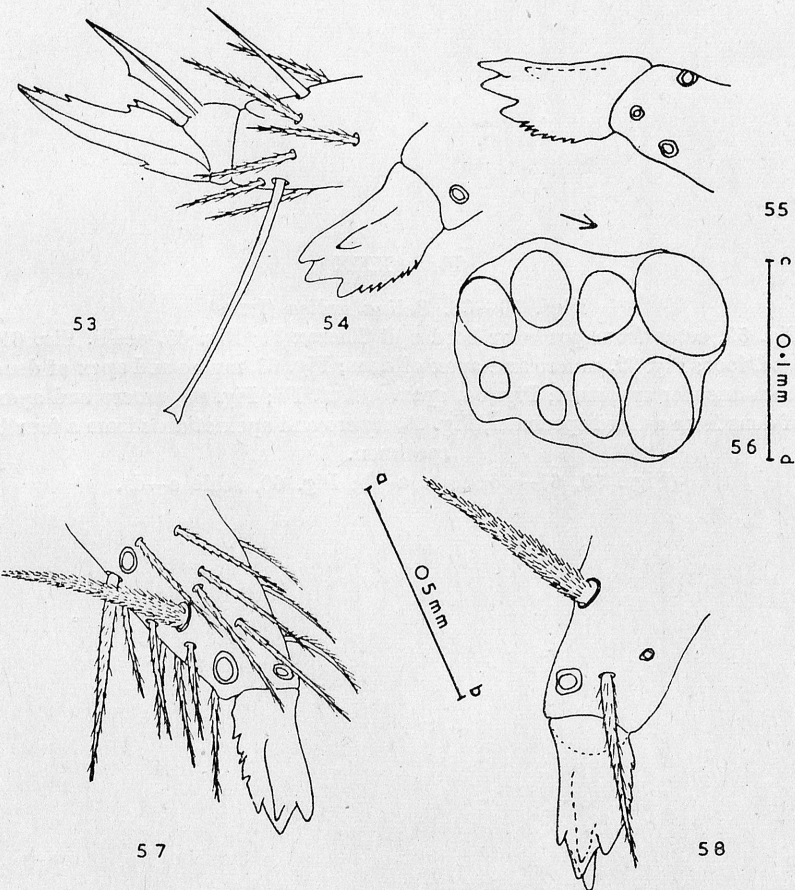
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## Plate XXIX

Figs. 53—58. *Handschinphysa serrata* n. sp.

Fig. 53, hind foot; Fig. 54, mucro from inner side; Fig. 55, mucro from outer side; Fig. 56, ocelli; Fig. 57, mucro and apex of dens; Fig. 58, mucro and apex of dens from another specimen.

(Figs. 53—55, 57—58, scale a—b; Fig. 56, scale c—d).



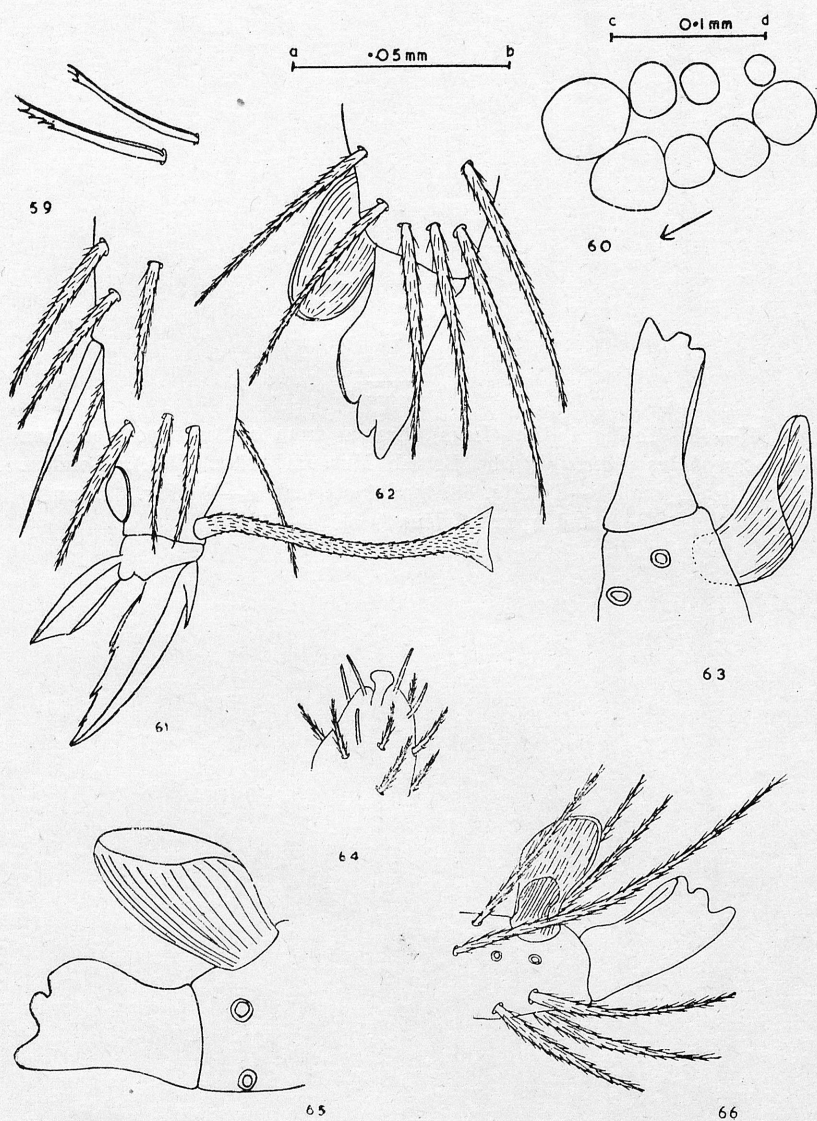
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## Plate XXX

Figs. 59—66. *Salina indica* (IMMS)

Fig. 59, setae from posterior border of Thorax II; Fig. 60, ocelli. Fig. 61, hind foot; Fig. 62, mucro and apex of dens; Fig. 63, mucro and apex of dens from another specimen; Fig. 64, apex of Ant. IV; Fig. 65, mucro and apex of dens from a third specimen; Fig. 66, mucro and apex of dens from a fourth specimen.

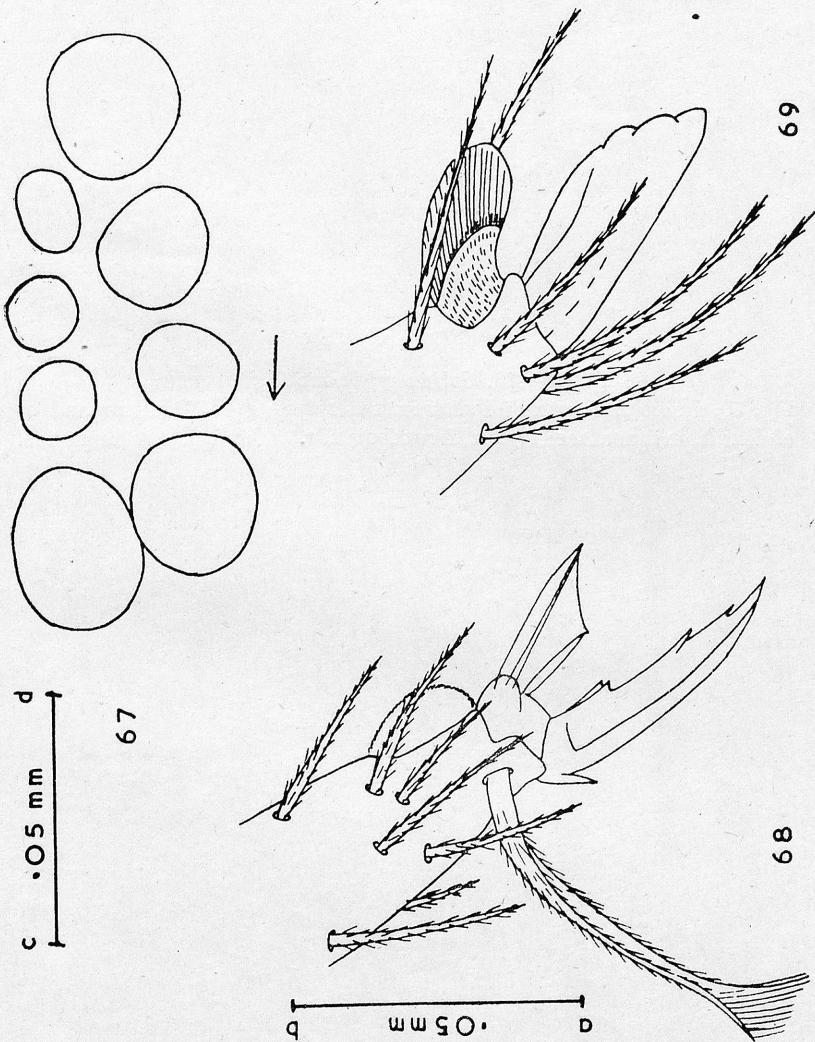
(Figs. 59, 61—66, scale a—b; Fig. 60, scale c—d).



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## Plate XXXI

Figs. 67—69. *Salina indica* (IMMS), drawn from a Paratype specimen *Cremastocephalus indicus* in the British Museum (Nat. Hist.), London. Fig. 67. ocelli (scale c—d); Fig. 68. hind foot (scale a—b); Fig. 69, mucro and apex of dens (scale a—b).

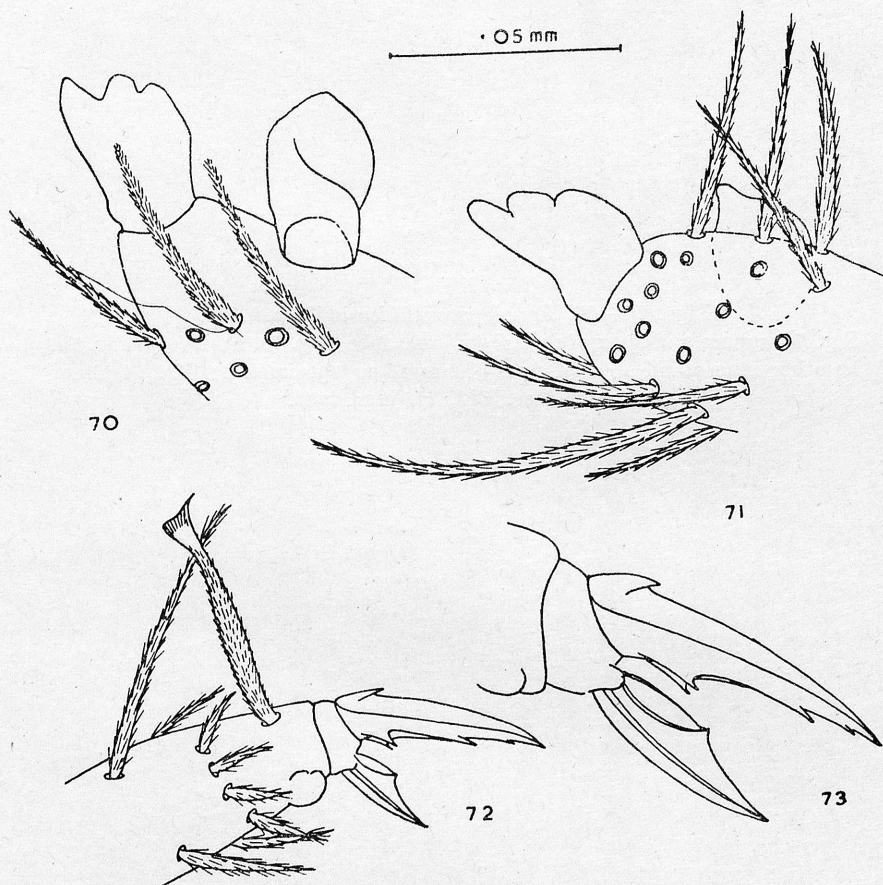


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## Plate XXXII

Figs. 70—73. *Salina celebensis* (SCHAEFFER)

Fig. 70, mucro and apex of dens from outer face; Fig. 71, mucro and apex of dens from inner face; Fig. 72, front foot; Fig. 73, hind claw and unguiculus.

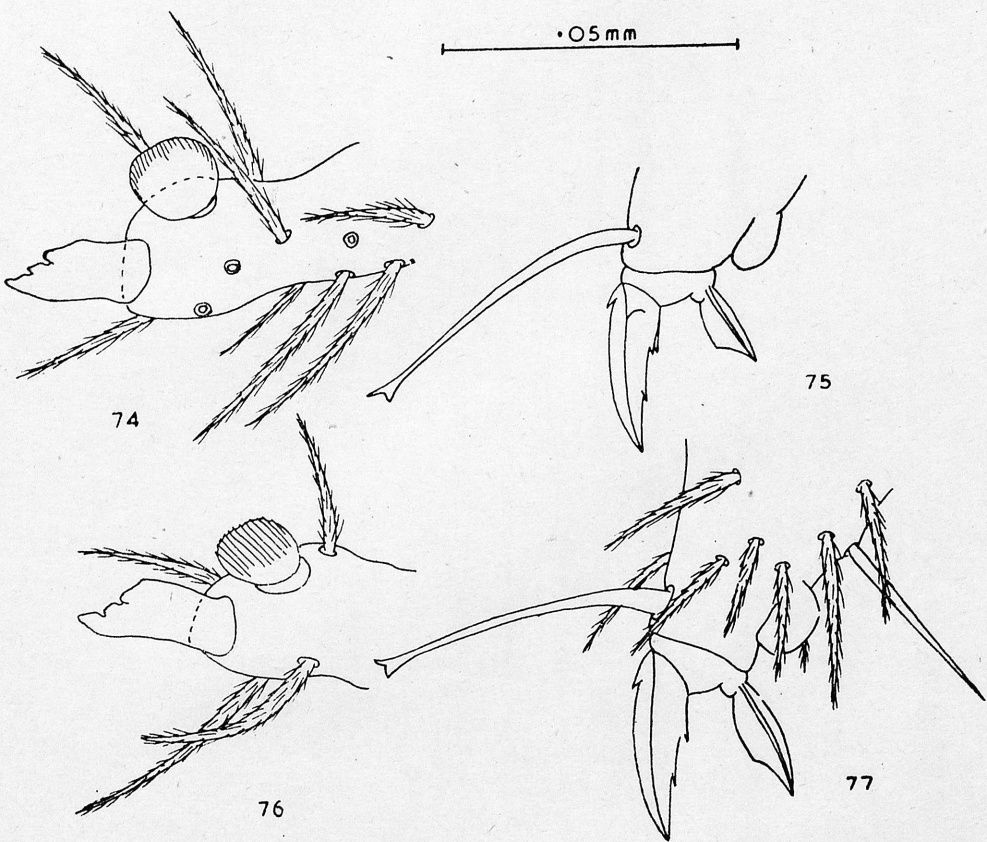


Auctor del.  
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## Plate XXXIII

Figs. 74—77. *Pseudoparonellides bulbosa* n. sp.

Fig. 74, mucro and apex of dens from inner face; Fig. 75, front foot; Fig. 76, the other mucro and apex of dens of the same specimen as Fig. 74, from outer face. Fig. 77, hind foot.



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Zam. 402/57 Cena zł 12,—

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