

NANORCHESTES ANTARCTICUS STRANDTMANN<sup>1</sup>;  
A TAXONOMIC DESCRIPTION OF THE INSTARS<sup>2</sup>

BY

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INTRODUCTION.

*Nanorchestes antarcticus* Strandtmann is a minute antarctic mite, the southernmost occurring arthropod in the world (85°32'S), and has the greatest altitudinal (3 — 2245 metres) as well as latitudinal distribution of any antarctic arthropod (GRESSITT and SHOUP, 1967 p. 317). It has a broad distribution, ranging north to Campbell Island and occurs abundantly at low elevations in the middle of its range.

The original description of *N. antarcticus* by WOMERSLEY and STRANDTMANN (1963) is based on the adult. STRANDTMANN (1967 pp. 75-79) gives a corrected setal count for the pedipalp, describes slight morphological differences in this species from other localities, and introduces a new antarctic species, *N. bifurcatus*, bringing the number of species of the genus to nine<sup>4</sup> (*N. amphibius* Topsent and Trouessart, 1890; *N. arboriger* Berlese, 1905; *N. siculus* Berlese, 1910; *N. collinus* Hirst, 1918; *N. pulvinar* Grandjean, 1942; *N. pseudocollinus* Schuster, 1958; *N. kirsteueri* Schuster, 1965, (THOR and WILLMANN, 1941 pp. 129-133, 145-148; SCHUSTER, 1965)). Subsequently, SHIBA (1969 pp. 94-95) has recorded a *Nanorchestes*, identified as *N. antarcticus* from Japan.

Prior studies of *N. antarcticus* and its congeners have been cursory and *Nanorchestes* is poorly known compared with other Endeostigmata. The present paper is an attempt to provide a more complete description of the adult and to describe the immature instars.

The 2,704 specimens on which this paper is based were collected throughout Wright and Taylor Valleys, Antarctica, during the 1969-70 austral summer. Mounted specimens are deposited with the Acarology Laboratory, The Ohio State University, Columbus (U.S.A.).

OBSERVATIONS.

*N. antarcticus* has four active immature instars; larva (L), protonymph (N1) deutonymph (N2), and tritonymph (N3), as does *N. pulvinar* (Grandjean, 1942). They resemble the adult.

1. Acari, Nanorchestidae.

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4. Theron and Ryke (1969) have since described seven new species from South Africa (*N. usualis*, *N. globosus*, *N. capensis*, *N. exsertus*, *N. coatesi*, *N. pollicaris*, *N. africanus*) making a total of sixteen.

*Key to the instars of N. antarcticus.*

Note : Throughout the text, divided femur refers to a partial or a complete division.

1. Contained within egg ; lacking legs ; with one pair of 3-segmented palps..... Prelarva  
Free-living or contained within egg ; with legs and 4-segmented palps..... 2
2. Hexapod ; femur I undivided ; tarsus I with 15 setae ; coxa III with 1 seta ; pedipalpal segment I with 1 seta..... L  
Octopod ; femur I divided ; tarsus I with 17 setae ; coxa III with 2 setae ; pedipalpal segment I with 2 setae..... 3
3. With one pair of genital papillae ; femur IV undivided and lacking setae ; genu IV with 1 seta ; tarsus I with 7 setae ; femur I with 4 setae ; coxa IV with 2 setae ; pedipalpal segment II with 1 seta..... N1  
With two pairs of genital papillae ; femur IV divided and with 3 setae ; genu IV with 3 setae ; tarsus IV with 11 setae ; femur I with more than 4 setae ; coxa IV with 3 setae ; pedipalpal segment II with 2 setae..... 4
4. Lacking prodorsal ecdysial line ; with eugenital setae and eight pairs of genital setae. Adult (6)  
With prodorsal ecdysial line ; eugenital setae lacking and with less than 7 pairs of genital setae..... 5
5. With 3 pairs of genital setae ; intercoxal setae between coxae II and III numbering 6 (2 lateral pairs and 1 medial pair (Figure 10)) ; tarsus I with 17 setae ; femur I with 5 setae. N2  
With 6 pairs of genital setae ; intercoxal setae between coxae II and III numbering 8 (1 medial pair and 2 lateral triads (Figure 11)) ; tarsus I with 18 setae ; femur I with 6 setae... N3
6. With 7 pairs of eugenital setae..... Adult male  
With 3 pairs of eugenital setae ; a cuticularized vagina ; may contain eggs, prelarvae or larvae  
Adult female

ADULT. Average length of mounted specimens (including gnathosoma) ♀ 269.0  $\mu$  (range 189  $\mu$  to 369  $\mu$  (41 individuals)) ♂ 279.6  $\mu$  (198  $\mu$  to 364.5  $\mu$  (28)). In vivo, bluish body contents, sometimes resembling a string of beads, against the red body colouring can be seen. Saltatorial.

Gnathosoma : Each lateral lip bearing a two tined rutellum (poil maxillaire), a large incurved nude adoral seta and 2 small plumose adoral setae. Labrum almost tubular extending beyond the chelicerae, its distal end terminating dorsally in a point (GRANDJEAN, 1939 p. 28). Chelicerae massive, chelate, bearing a large dorsal plumose seta with two main branches of equal length or with a shorter paraxial branch, and a nude, apically inflated, seta on its anti-axial surface. Subcapitulum distinguishable from ventral podosoma by direction of striations. There is no circumcapitular furrow. Two pairs of dendritic (irregularly branched) subcapitular setae. Pedipalp composed of 4 segments, 2—2—3—7. STRANDTMANN (1967) does not show the raised cones bearing 2 of the nude setae of the terminal article, nor the palmate form of the paraxial ventral seta of the subterminal article (Figure 1 B).

Legs : Femur I is only partially divided. Chaetotaxy summarized in Figures 2 to 5. Setal counts differ from those of STRANDTMANN (1967) (Table 1). No distinction is made here between normal setae and eupathidia. A distinction is made in the figures between *plumose* and *branched* leg setae. The majority of leg setae have a single axis and are plumose. Some setae have two axes (branches) arising from a single axis near its base. The two branches may be equal in size or one may be more prominent. Each branch is ciliated. Tarsi I and II each bear a short, thick, peg-like famulus. Solenidia (serpentine lines of WOMERSLEY and STRANDTMANN (1963)) are located on the tarsus (3), tibia (3), and genu (2) of leg I, the tarsus (1) and tibia (1) of leg II and the tibia (1) of leg III. Each solenidium is unstriated and uniform in thickness except  $\omega$  II which is clavate and appears to be transversely striated at its inflated distal end.  $\omega$ I $\pi$  and  $\phi$ I $\alpha$

curl antiaxiad and are quite conspicuous by their diameter which allows their profile to be raised above the surface of the leg. The remaining solenidia are smaller in diameter and more difficult to see when the leg is disadvantageously oriented.

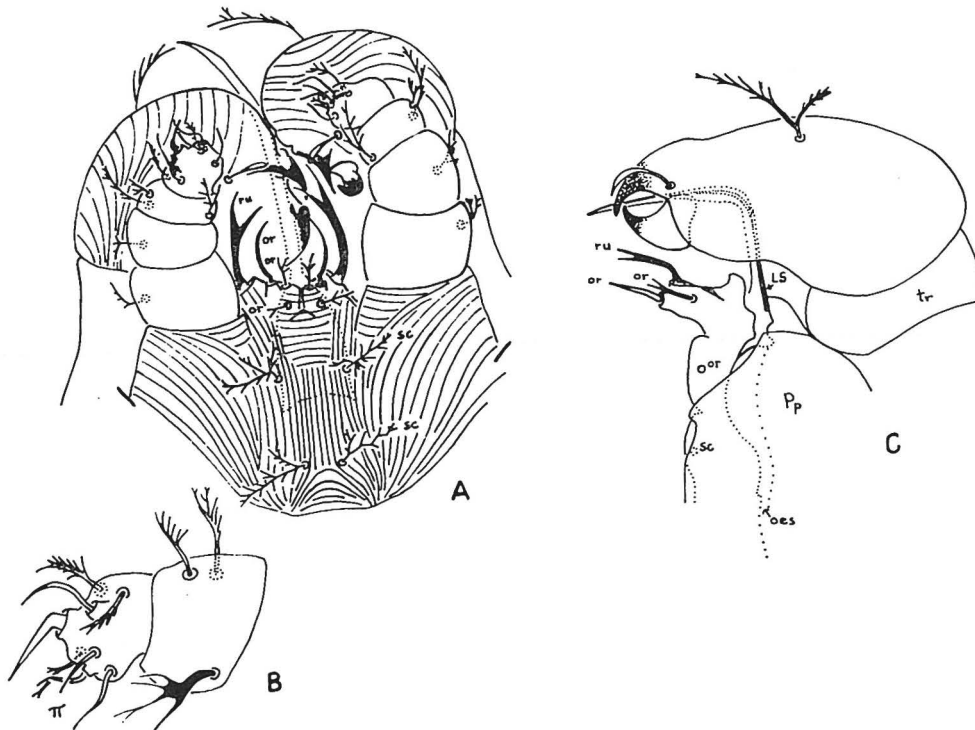


FIG. 1 : Gnathosoma. A, Larva, ventral view. Labrum and pharynx shown by dotted lines. Lateral lips bear rutella and three pairs of adoral setae ; B, pedipalp of adult, ventrolateral view showing chaetotaxy of terminal and subterminal segments ; C, protonymph, lateral view of antiaxial surface. Coxa of pedipalp only is shown.

Although setae remain equal in size on paraxial and antiaxial surfaces, there is a noticeable concentration of setae on the antiaxial surfaces. This is particularly apparent on leg IV where, except for the tarsus, no paraxial setae are present. Leg III carries no paraxial lateral setae, and genu of leg II carries the sole ventral seta antiaxiad and the tarsus of leg I carries an antiaxial dorsal seta in addition to the more centrally placed pair of setae. The femur of leg I carries the two ventral setae antiaxiad.

Branched setae occur dorsally on femur I (2, sometimes only the anterior is branched), femur II (1), femur III (1) genu III (1), and ventrally on femur I (1), femur II (1), femur III (1), genu III (1, partially), tibia III (1) and genu IV (1). Coxal setae are branched except the anterior lateral of leg III and the posteromedial of leg IV may be unbranched.

The setal bases of each leg increase in size (Figures 2 to 5) distad. The proral, unguinal, iteral and antelateral setae are shorter than the others. The ambulacra bear a single claw which carries 5 pairs of rays.

The trochanter of leg IV bears an apophysis on the basal paraxial edge (Figure 5). This articulates ventrally with a large apodeme (ap. sa. GRANDJEAN 1939, p. 28) from the line of fusion of the venter with coxa IV.

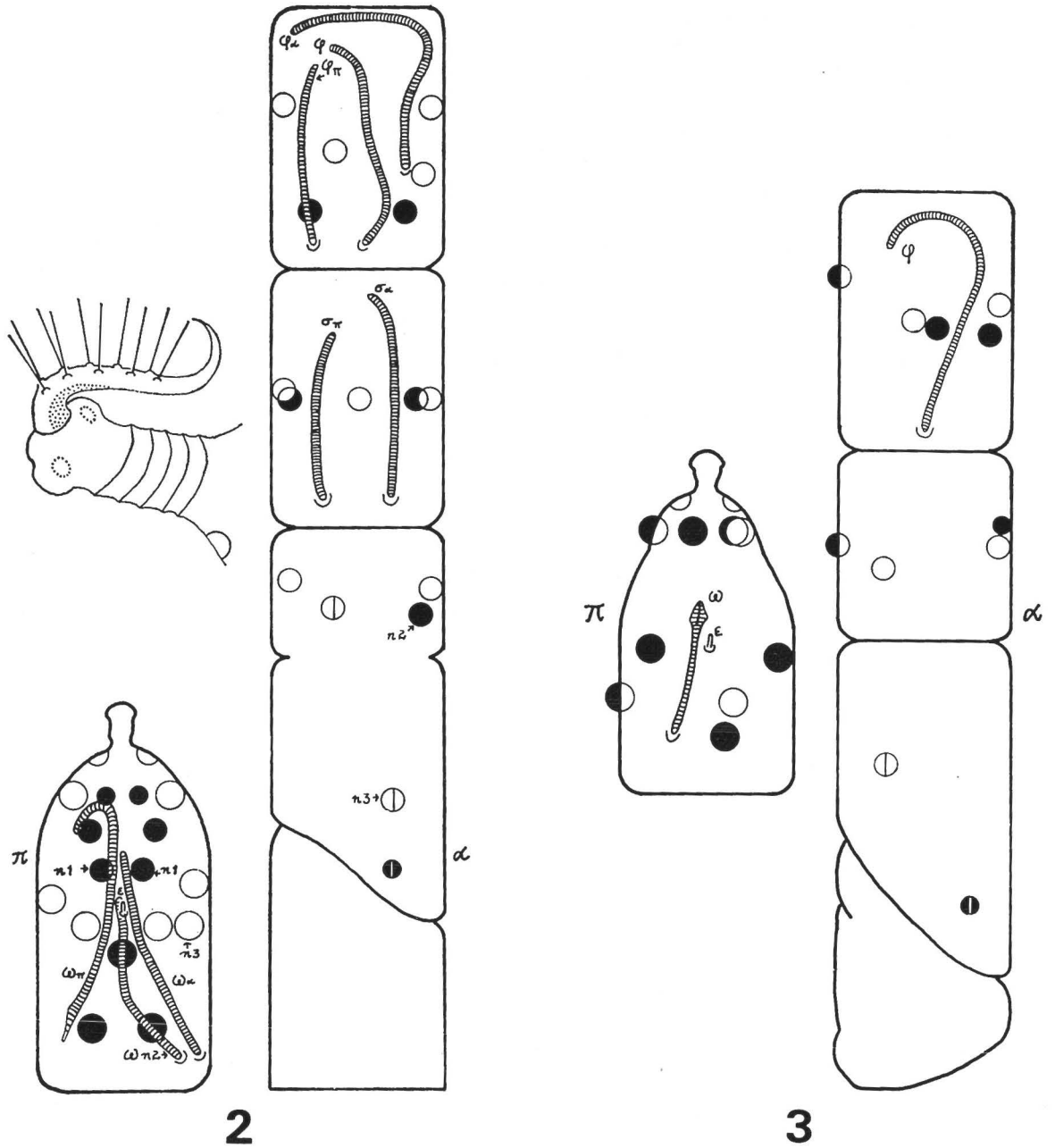


FIG. 2 : Leg I adult, semi-diagrammatic. Dorsal view. A projected view of ventral setal bases are shown in black. Divided circles indicate branched setae. Solenidia are striated for clarity only. Insert, dorso-lateral view of ambulacrum with base of proral seta shown.

FIG. 3 : Leg II adult, semi-diagrammatic. Dorsal view.

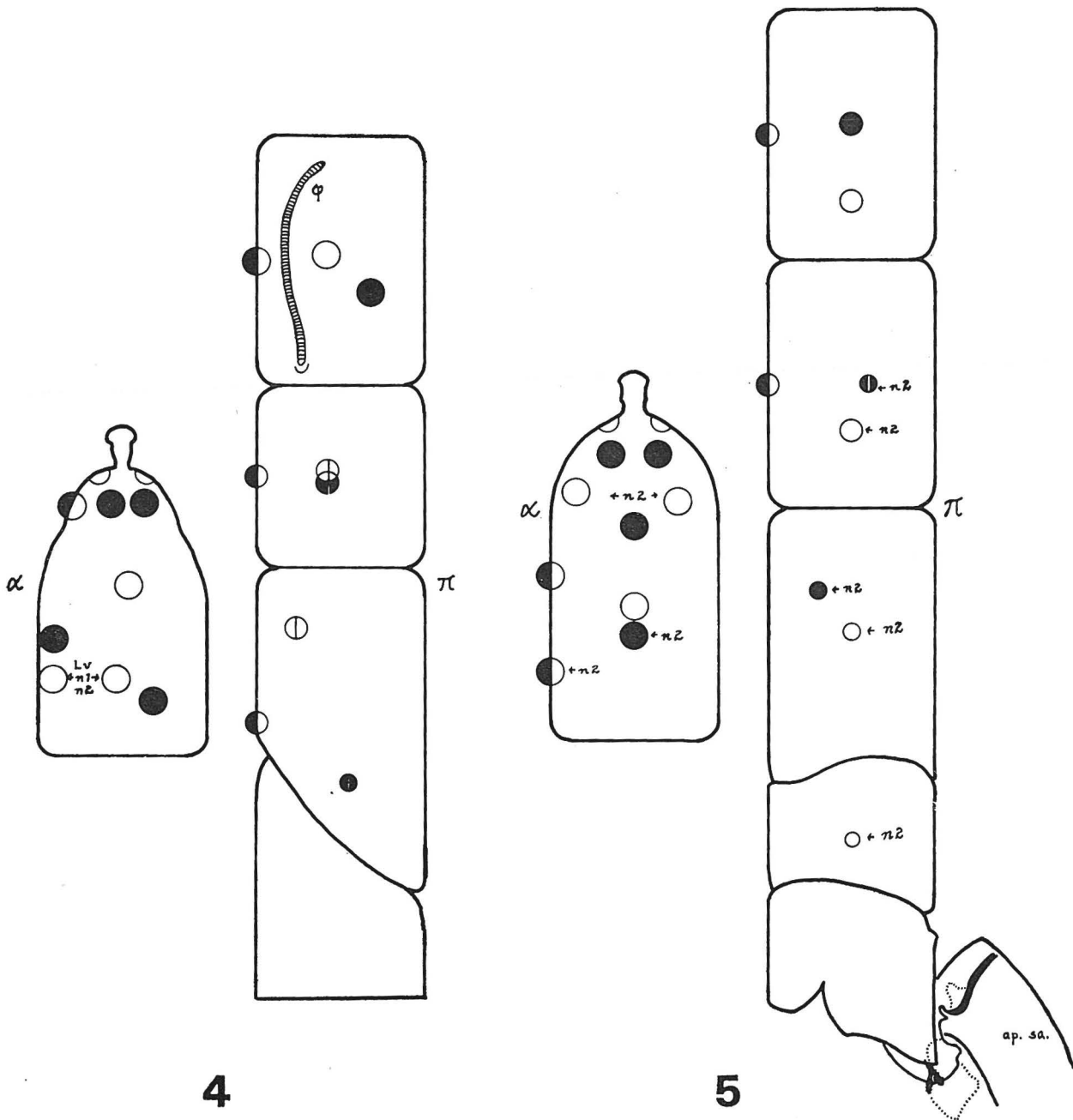


FIG. 4 : Leg III adult, semi-diagrammatic. Dorsal view.

FIG. 5 : Leg IV adult, semi-diagrammatic. Dorsal view. Femur is divided. Trochanter bears an apophysis which articulates with a large apodeme (ap. sa.). The points of articulation are shown in black and indicate heavily cuticularized regions.

TABLE I. *Chaetotaxy of appendages of Nanorchestes antarcticus Strandmann.*

Instar	Appendage	ta	ti	ge	fe	tr	c	I	II	III	IV (Distad)
L	I	15	6	5	4	0	2				
	II	11	5	4	2	0	1				
	III	8 or 10	3	3	3	0	1				
	P <sub>p</sub>							1	1	3	7
N <sub>1</sub>	I	17	6	5	4	0	3				
	II	11	5	4	2	0	1				
	III	8 or 10	3	3	3	0	2				
	IV	7	3	1	0	0	2				
	P <sub>p</sub>							2	1	3	7
N <sub>2</sub>	I	17	6	5	5	0	3				
	II	11	5	4	2	0	1				
	III	10	3	3	3	0	2				
	IV	11	3	3	3	0	3				
	P <sub>p</sub>							2	2	3	7
N <sub>3</sub>	I	18	6	5	6	0	3				
	II	11	5	4	2	0	1				
	III	10	3	3	3	0	2				
	IV	11	3	3	3	0	3				
	P <sub>p</sub>							2	2	3	7
Adult	I	18	6	5	6	0	3				
	II	11	5	4	2	0	1				
	III	10	3	3	3	0	2				
	IV	11	3	3	3	0	3				
	P <sub>p</sub>							2	2	3	7

Venter : Coxae in 2 groups, distinguishable by their simple striations as compared to the punctulate striations on the rest of the body. Coxal setae 3—1—2—3, heavier than body setae. Ventral body setae dendritic. Intercoxal setae between coxae II and III numbering 8 (rarely 9) consisting of 2 lateral triads and 1 medial pair. Intercoxal setae surrounding coxae III-IV usually numbering 5 pairs.

Genital valves with simple striations and each valve bearing 8 dendritic setae. Genital papillae in 2 pairs each 4-partite. Anal valves indistinct and bear 2 pairs of anal setae and simple striae. The remainder of the ventral setae number about 90 and do not form a symmetrical or consistent pattern.

Dorsum : Prodorsum as described by WOMERSLEY and STRANDTMANN (1963) except that they do not mention the existence of a small flap of cuticle which lies between and anterior of setae nf. The posterolateral borders of this flap lie anterior of setal bases nf and continue anterior and partially cover setal bases na. The flap is longitudinally and simply striated and convex in outline. In mounted specimens it often ruptures down its middorsal line and separates, appearing as two wing-like structures. The sensory region is simply striated. The region anterior to both the sensory area and the flap of cuticle has punctulate striations posteriorly, and an area with simple striations at the anterior end. The opisthosoma has punctulate striations and bears dendritic setae, variable in number and position. No supracoxal setae were observed.

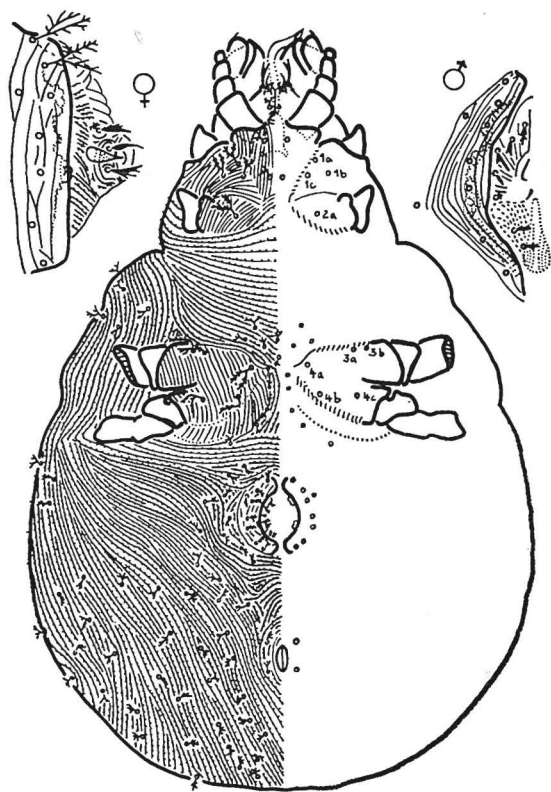


FIG. 6 : Adult male, ventral view. Insert ♀, everted ovipositor showing eugenital setae surrounding papilla from which a droplet is apparently issuing. Insert ♂, genital region (one side only) showing eugenital setae, one of a pair of cuticularized ridges, and the medial and one lateral lobe of a trilobed saccular structure. Genital papillae are shown by dotted lines.

(i) Female. Eugenital setae plumose, in 2 groups of 3, each group clustered around a small papilla. What the papilla represents is unknown. It seems logical that it should represent the termination of a lateral lobe. However, in 2 mounted specimens a droplet was seen apparently issuing from the papilla when it was fixed which indicates that it may represent the opening of a genital gland (Figure 6 ♀). The cuticularized vagina is eversible to form a very short ovipositor. *N. antarcticus* is ovoviviparous. Of 656 females studied, 50 contained 1 egg, 2 contained 2 eggs, 1 contained 3 eggs, 1 contained 1 egg and 1 larva, 1 contained 2 larvae and 1 developing larva, 1 contained 2 larvae and 2 developing eggs, and 1 contained 3 larvae.

(ii) Male. The 7 pairs of plumose eugenital setae are arranged as shown (Figure 6 ♂) and surround a small opening, bordered by a pair of cuticularized ridges, which leads into a trilobed saccular structure, the middle lobe of which extends furthest dorsad. Since there is no aedeagus, mating is probably indirect by means of a spermatophore. The trilobed structure presumably aids in spermatophore production.

IMMATURE INSTARS. The immature instars may be easily separated from adults by the absence of eugenital setae and the presence of a prodorsal ecdysial line ( $\delta$ ) which runs just anterior of the anterior trichobothria ventrad of the small flap of cuticle, and anterolaterad of the eyes at the posterior margin of which, for a short distance, the line widens slightly and becomes more cuticularized. The line continues posteroventrad and terminates on each side posterodorsad to coxa III.

Eggs average  $105.2 \mu$  in long axis (range  $90-126 \mu$  (21 eggs)) and are red in colour.

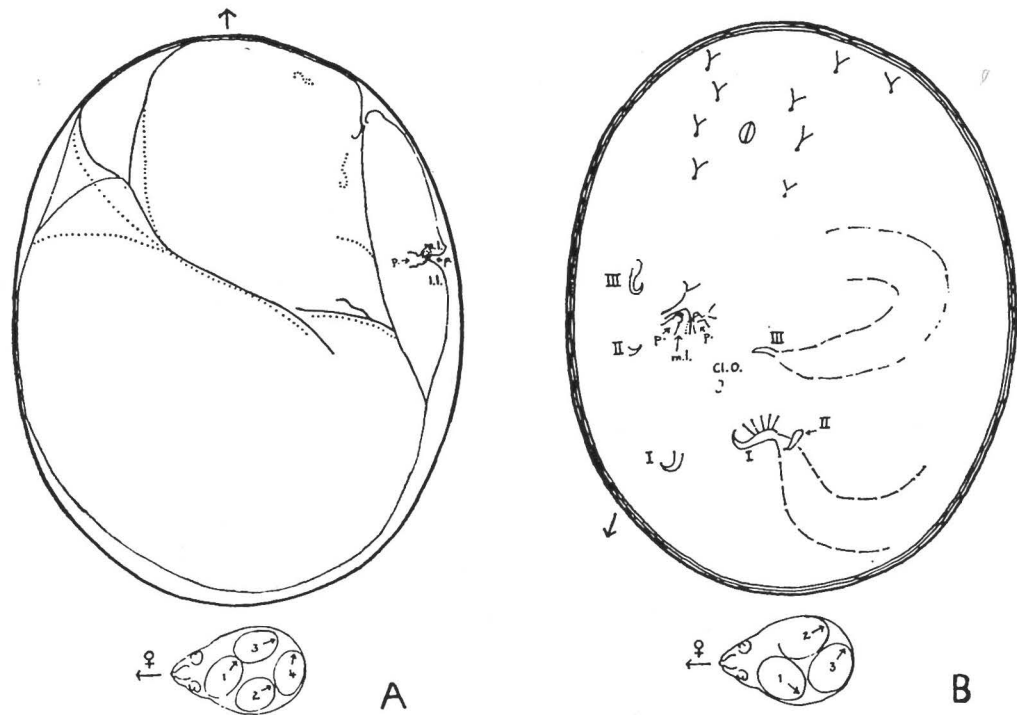


FIG. 7 : Prelarva. A, Lateral view of prelarva within egg shell. Dotted lines indicate a deeper focus ; B, ventral view of larval cuticle appearing within prelarval cuticle. Only the distal narrow neck of Claparede's Organ (one side only), and the ambulacra of the legs are visible. Broken lines indicate approximate leg positions. The palp of the prelarval cuticle is positioned along the midventral axis of the larva between claws II and III. Lower diagrams show positions of developing eggs within female. Arrows indicate the anterior end. Enlarged views of eggs 1 were drawn.

(i) Prelarva. In several females, intervals in egg development could be observed. A prelarval stage is passed through within the body of the female. This instar (Fig. 7) is characterized by the possession of a pair of 3-segmented palps which lie just anterior to three lobes (medial, and two lateral). The palps are directed posteriad. It would seem that the lobes border the primitive oral opening and the 3-segmented palps represent the pedipalps.

Within the cuticle of the prelarva, the developing larva could be seen. All larvae observed within the female were positioned with their anterior end toward the posterior of the female and their venter towards the dorsum of the female. The more developed larvae were at the posterior end of the female. The larva of *N. antarcticus* is born enveloped in two coverings — the cuticle of the prelarva and the egg shell.



(ii) Larva. Hexapod and bears no trace of a genital field. Free-living larvae average  $147.4 \mu$  long (total larval range including embryos  $108 \mu$  to  $184.5 \mu$  (56)). CLAPAREDE's Organ is well developed, its distal end being prolonged to a short narrow neck (Figure 8). It is covered with an anterior scale (écaille protectrice, GRANDJEAN, 1939) and lies between coxae I and II. One pair of large, branched intercoxal setae between coxae III. The larva is orthotrichous. It carries the mediodorsal setal pairs  $c_1$ ,  $c_2$ , and  $c_3$  (D3 of GRANDJEAN, 1939), the opisthosomal setal pairs  $d_1$  and  $d_2$ ,  $e_1$  and  $e_2$ ,  $f_1$  and  $f_2$ ,  $h_1$ ,  $h_2$ ,  $h_3$  and the rare setal pair  $h_4$ , and  $ps_1$  and  $ps_2$ .

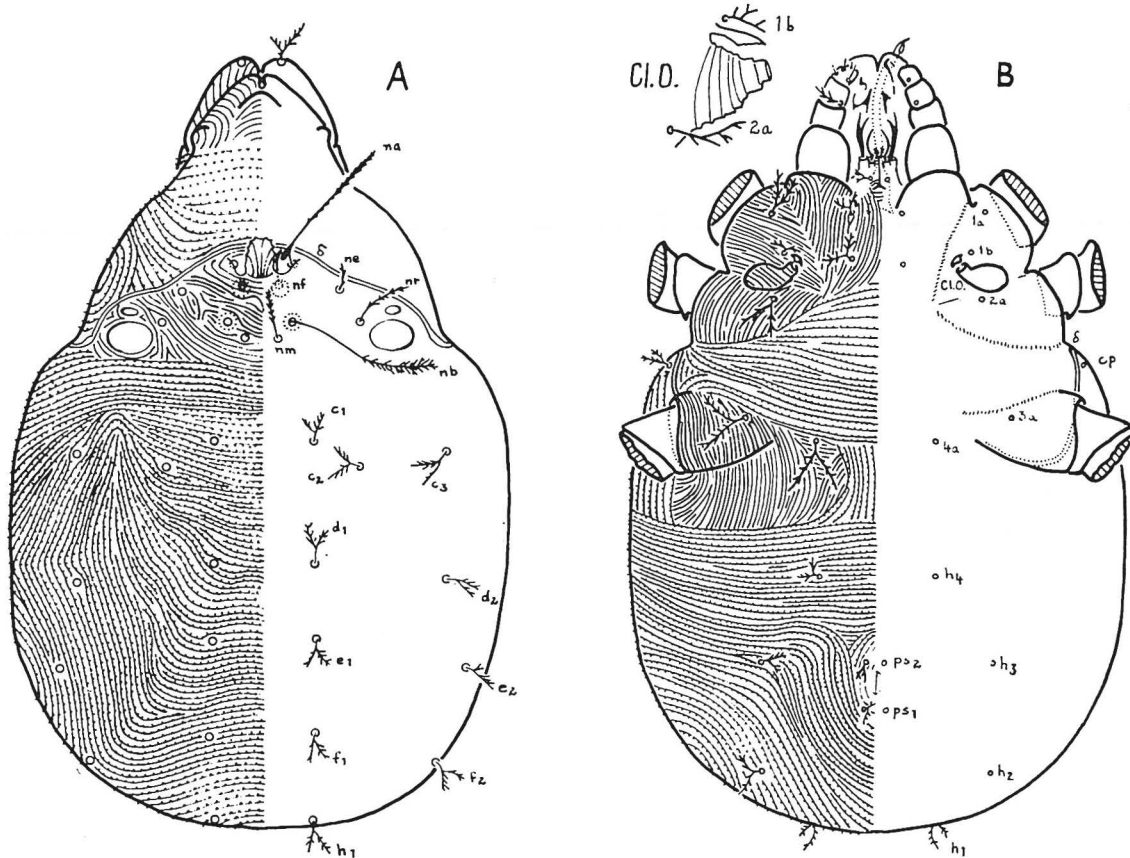


FIG. 8 : Larva. A, Dorsal view. Bothridia of sensory setae are represented by dotted lines : B, ventral view ; Insert, lateral view of CLAPAREDE's Organ with its protective scale.

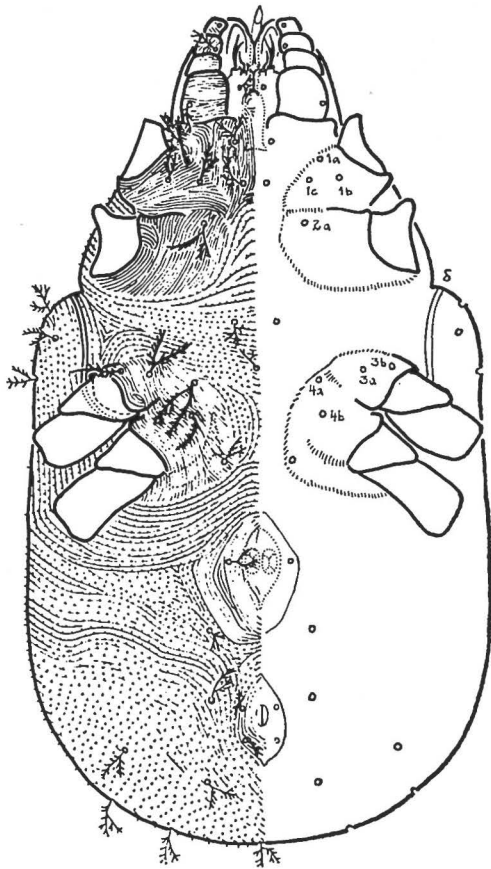
Appendages : Femur I is undivided. Both tarsi I and II bear a famulus. Tarsus I bears 2 solenidia only. Remaining solenidia as in adult. Branched setae are found dorsally on femur I, femur II and ventrally on tibia III. All coxal setae branched.

There is a variation in setal count for tarsus III. Some individuals possess 10 setae, others possess 8. What proportion of the sample possessed 10 setae was not determined.

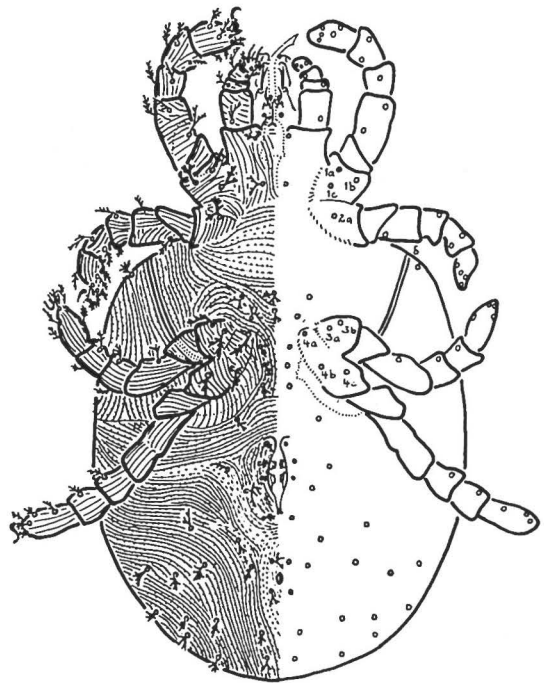
The palp bears only 1 (the dorsal seta) seta on the proximal segment and on the next more distal segment (Fig. 1 A).

(iii) Protonymph (Fig. 9). Octopod, averaging  $172.0 \mu$  long (range  $153 \mu$  to  $211.5 \mu$  (23)). Genital field consisting of one pair of genital setae and one pair of genital papillae. Femur I is divided, femur IV is undivided. Intercoxal setae between coxae II and III numbering 3

(1 medial and 2 lateral). One pair of intercoxal setae between coxae IV. Intercoxal setae dendritic, similar to opisthosomal setae. Ventral opisthosomal setae number about 5 pairs. Dorsal opisthosomal setae variable in number and arrangement.



9



10

FIG. 9 : Protonymph, ventral view. Four-partite genital papillae are shown in deep focus.

FIG. 10 : Deutonymph, ventral view.

(iv) Deutonymph (Fig. 10). Average length 191.8  $\mu$  (range 162  $\mu$  to 243  $\mu$  (21)). Two pairs of genital papillae and 3 pairs of genital setae. Intercoxal setae between coxae II and III numbering 6 (2 lateral pairs and 1 medial pair). Four pairs of intercoxal setae surrounding coxae IV. Femur IV divided. Deutonymph has the adult complement of solenidia. Opisthosomal venter with about 17 pairs of setae. Opisthosoma dorsal setae numerous and variable in arrangement.

(v) Tritonymph (Fig. 11). Average length 222.1  $\mu$  (range 193.5  $\mu$  to 261  $\mu$  (22)). Six pairs of genital setae. The anterior third seta on each valve is most laterad. Intercoxal setae between coxae II and III numbering 8, arranged as in adult. Intercoxal setae surrounding coxae IV 5 pairs as in adult. Remaining ventral setae numbering about 74. Dorsal opisthosomal setae numerous, variable in position.

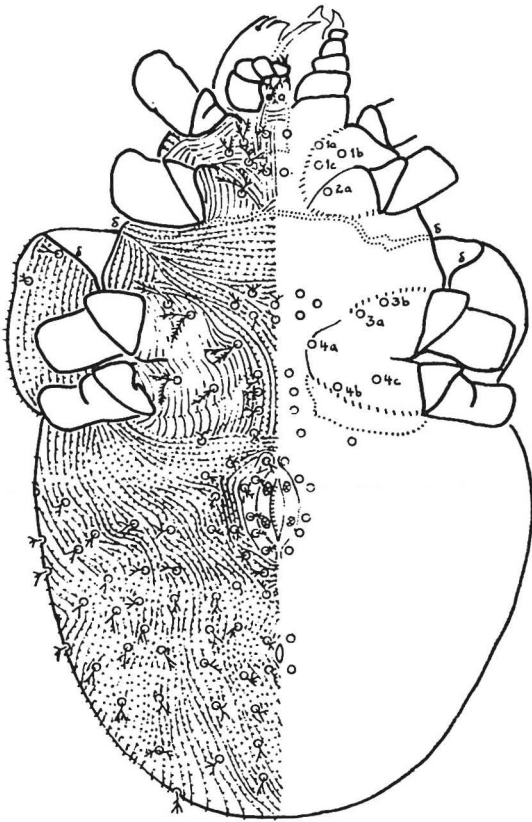


FIG. 11 : Tritonymph exuvia, ventral view. Separation along the ecdysial line is shown dorsally by dotted lines.

#### DISCUSSION.

The small flap of cuticle on the prodorsum of *N. antarcticus* demands special consideration. A similar structure is figured by SCHUSTER (1958, p. 105) for *Nanorchestes amphibius*. In *N. antarcticus* the margin of the protuberance lies antieriad of setal base nf, but the protuberance does cover setal base nf as is figured for *N. amphibius*. On 1 specimen (a larva) no trace of this prodorsal protuberance could be seen, although the setal base nf was covered. Presumably the bothridium of nf is very deep and directed posteriorly. Why an occasional individual should not possess the prodorsal protuberance is unknown. This flap of cuticle is interesting in its relationship to the ecdysial line. GRANDJEAN (1939, p. 50) says that in *Pachygnathus* and *Terpnacarus* the ecdysial line cuts the frontal protuberance horizontally leaving the unpaired eye below it. I have looked for an eye beneath this flap of cuticle in *N. antarcticus* and do not distinguish one. However the positioning of the ecdysial line in relation to this flap of cuticle agrees so closely with GRANDJEAN's description of the frontal protuberance that the flap of cuticle of *Nanorchestes antarcticus* must be the frontal protuberance (or nose) of other Endeostigmata. The striations differ between the sensory area and the region which surrounds it. The trochanters of the chelicerae are covered by the region with simple striations anterior to this prodorsum. The nose of the Endeostigmata therefore does not always project freely.

The larva of *N. antarcticus* is orthotrichous, the nymphs and adult are neotrichous. This was also reported by GRANDJEAN (1942) for *N. pulvinar*. GRANDJEAN (1939) says that in the

Nanorchestidae neotrichy begins to appear at the posterior region of the opisthosoma, lessening towards the front, but in *Nanorchestes* it eventually covers the mediodorsum.

The number of setae on the genital valves of the adult of *N. antarcticus* was reported to be 7 pairs by other authors. Adjacent to the third anterior pair of setae are a pair of genital setae, out of line with the others. This seta apparently was regarded as belonging to the paragenital series by other authors. It lies within the striae of the genital valves, does not align with a paragenital series and occupies the same position in the tritonymph where it is more recognisable as a genital seta. The genital setae therefore number 8 pairs in *N. antarcticus*.

Ovoviviparity is previously unreported for *Nanorchestes*. GRANDJEAN (1942) says that females of *N. pulvinar* contained almost always a single developing egg. This suggests that *N. pulvinar* is also ovoviviparous. He says that it lacks an ovipositor. In *N. antarcticus* this is very short. Ovoviviparity and the simultaneous incubation of several eggs by a female may account largely for the success of *N. antarcticus* in its Antarctic environment.

The leg setae are summarized in Figure 2 to 5. The possession of famuli on both tarsi I and II in *Nanorchestes antarcticus* is shared by *Terpnacarus*, *Alycomesis* (GRANDJEAN 1939) and *Anystis* (GRANDJEAN, 1943). I was unable to distinguish supracoxal setae, although GRANDJEAN (1939) says they are always present in the Endeostigmata. Size of setae : Four sizes of setal bases are figured. These represent the adult sizes. The largest setae are found on the tarsi of each leg and the setae decrease in size proximad. On legs I, II, and III certain ventral setae are smaller than the dorsal setae on that segment. Seta FeIv distal increases in size ontogenetically, being smaller when it first appears.

Branching of setae : Some branched setae occur in the larva. The remaining setae branch in the instars which follow it, namely —

N1 — FeIv proximal and FeIIv,

N2 — GeIIIv, GeIIIId and GeIVv, (first appearance),

N3 — FeId proximal when first appearing may be also unbranched.

Addition of setae : Setae of the appendages are added in the following manner —

N1 : Tarsus I — 1 pair of ventral setae. The Oribatid homologues of these setae are uncertain. They occupy the position of the antelaterals, but would agree more with the iterals in their late appearance. If they are the iterals they occupy a more ventral position and lie behind, instead of in front of, the antelaterals.

Coxa I — 1 seta. This seta probably replaces the protective scale of CLAPAREDE's Organ, which is a modified seta of coxa I (GRANDJEAN, 1942).

Coxa III — 1 seta. This seta is often unbranched.

Coxa IV — 2 setae. This coxa appears with its setae, one of which is similar in size and branching appearance to the intercoxal seta between coxae III of the larva. Apparently this intercoxal seta represents a precocious appearance of the coxal seta of leg IV. It also lies within the area of simple striations. The other coxal seta is often unbranched.

Proximal segment (1) of pedipalp — 1 ventral seta.

N2 : Tarsus I — 1 solenidion.

Femur I — 1 ventral seta.

Tarsus III — 1 pair of dorsal setae. This setal pair is often precocious in its appearance in the larva of some individuals.

Tarsus IV — 1 pair of dorsal setae (these may be homologized with the tectals although they are in front of the subunguinal), 1 ventral seta, and 1 lateral seta.

Genu IV — 1 dorsal seta and 1 ventral seta.

Femur IV — 2 dorsal setae (one on each femoral segment), and 1 ventral seta.

Coxa IV — 1 seta.

Segment II of pedipalp — 1 ventral seta.

N<sub>3</sub> : Tarsus I — 1 dorsal seta. This appears to be in the same verticil as a pair of setae which may be homologized with the Oribatid fastigials.

Femur I — 1 dorsal seta on the basifemur.

Precocity : Leg III demands special attention because of the precocious appearance of certain setae. GRANDJEAN (1942) mentions a precocious formation of certain leg setae in *N. pulvinar* and *Speleorchestes*. Tarsus III has either 8 setae or the adult number of 10 setae in the larvae and protonymph. All deutonymphs have 10 setae. Whether protonymphs add setae on tarsus III is unknown.

The intercoxal seta between coxae III of the larva may be a precocious coxa IV seta.

The possession of seta h<sub>4</sub> in the larva is shared by *Terphnacus Bouvieri* (GRANDJEAN, 1939) and some of the primitive oribatids.

#### SUMMARY.

*N. antarcticus* has 6 instars. They are ; 1) prelarva which is passed through within the egg within the female. It is characterized by a pair of 3-segmented palps ; 2) larva which is orthotrichous and exhibits several unusual characters, namely, 2 famuli, seta h<sub>4</sub>, no circumcapitular furrow and a precocity in the addition of leg setae ; 3) protonymph with 1 pair of genital setae ; 4) deutonymph with 3 pairs of genital setae ; 5) tritonymph with 6 pairs of genital setae and ; 6) adult with 8 pairs of genital setae. The male has 7 pairs of eugenital setae and probably produces a spermatophore. The female is ovoviparous, produces 1 or more eggs (maximum of 4 observed) at a time, and has a very short ovipositor with 3 pairs of eugenital setae. Setae show a concentration on the antiaxial surfaces of the legs, and throughout ontogeny certain leg setae branch. One solenidion is added during development. The femurs of legs I and IV are undivided when they first appear.

#### ABBREVIATIONS.

I — IV ; legs from anterior to posterior, or pedipalpal segments from basal to distal.

Pp ; pedipalp.

$\alpha$ ,  $\pi$  ; antiaxiad, paraxiad.

Lv, n<sub>1</sub>, n<sub>2</sub>, n<sub>3</sub> ; leg setae added at L, N<sub>1</sub>, N<sub>2</sub>, N<sub>3</sub> instars.

d, v ; dorsal, ventral, setae.

1 — 4, a — c ; coxal setae of leg I — IV, order of appearance ontogenetically.

c d, e, f, h, ps ; setae of opisthosomal segments C — PS.

na, nb, ne, nf, nm, nr ; prodorsal setae.

sc, or, ru ; subcapitular and adoral setae, rutellum.

ta, ti, ge, fe, tr, c ; tarsal, tibial, genual, femoral, trochantal, and coxal segments.

$\omega$ ,  $\phi$ ,  $\sigma$  ; solenidia of tarsus, tibia and genu.

$\epsilon$  ; famulus.

$\delta$  ; ecdysial line.

ap. sa. ; apodeme articulating with apophysis of leg IV.

oes ; oesophagus.

l.l. ; lateral lobe of prelarva.  
m.l. ; medial lobe of prelarva.  
p. ; 3-segmented palp of prelarva.  
LS ; labrum.  
Cl. O. ; Claparede's Organ.

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