
New Species of Trichodectidae from South African Mammals.

By G. A. H. BEDFORD, F.E.S., Research Officer, Onderstepoort.

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GENUS TRICHOECTES Nitzsch.

TRICHOECTES OVALIS nov. sp.

(Plate I, figs. 1, 3; and plate VI, fig. 13.)

FEMALE. *Head* wider than long; the anterior margin slightly rounded, with a median notch. Antennal bands dark and broad, separated in front by a clear space, and connected behind with the ocular blotch. Trabecula-like processes prominent. Antennal sinuses shallow. Ocular projections prominent. Temples rounded with a narrow marginal band. Occipital bands very dark at the base, extending forwards to the ocular blotch, and connected at their bases by a broad band. Margins of pre-antennal area and temples with several short hairs, and on the venter there are two hairs on each side of the head in the clear space in front. Antennae short, the third segment slightly longer than the first; the second the shortest.

Prothorax very short and broad, with a large spiracle on each side; on the lateral margin there is a short hair and a longer one on each side of the meson on the posterior margin.

Metathorax shorter and broader than the prothorax; on the posterior margin there is a row of six hairs in the middle and three on each side.

Abdomen elliptical, almost as wide on the fourth segment as long, without bands except for a narrow transverse band on the dorsum of each of the eighth and ninth segments. On the dorsum there is a median row of six hairs on the first segment; second to sixth segments each with a transverse row of hairs divided into three groups, the median group consisting of 11 to 15 hairs, and each lateral group of 4 to 6 hairs; seventh segment with a row of about nineteen hairs; eighth with a row of eight hairs divided into four groups; ninth with a transverse row of four minute hairs in the middle, and a longer hair on each margin. Pleurites present on the second and third segments. Stigmata on the third to seventh segments. On the venter there is a hair on each side of the meson on the first segment; second segment with a median row of eight hairs; third with a row of twelve hairs in the middle, and two on each side; fourth to sixth with a median row of 14 to 16 hairs, and two to three on the lateral margins; seventh with eight or nine hairs in the middle, and two on each side; eighth and ninth as shown in figure 13.

MALE. *Head* as in the female. First segment of the antenna only very slightly longer than that of the female, almost as broad as long; third segment very slightly longer than the second, with two minute spines at the distal, post-axial angle.

Pro. and *meta-thorax* as in the female.

Abdomen very slightly wider at the third and fourth segments than long. On the dorsum there is a hair on each side of the meson on the first segment, second to seventh segments each with a narrow transverse median band, and from one to four hairs on each side beneath the postero-lateral margins of each band; there being three to four fairly strong admedian hairs on the second and third segments, two to three weaker ones on the third to sixth, and one on the seventh. In addition to these there is a row of three to five hairs on each side. On the eighth segment there is a small hair on each side of the meson, and two long hairs on the latero-posterior margin; ninth segment with two small hairs, one above the other, on each side of the middle near the posterior margin. On the venter there is a transverse row of hairs on the second to seventh segments, each row divided into three groups, the median group consisting of about six to twelve hairs, and each lateral group of three hairs, except that on the second and third segments there is only one lateral hair.

Measurements.

	Female.		Male.	
	Length.	Width.	Length.	Width.
	mm.	mm.	mm.	mm.
Head.....	0.38	0.48	0.35	0.43
Prothorax.....	0.1	0.36	0.08	0.31
Metathorax.....	0.05	0.5	0.05	0.43
Abdomen.....	0.86	0.81	0.6	0.63
TOTAL.....	1.39		1.08	

Holotype: the female.

Described from females and males collected by the writer off *Poecilogale albinucha* (family Mustelidae) at Onderstepoort on the 1st March, 1920.

This new species appears to be closest related to *T. melis* Fabr. found on *Males taxus* (European badger) and *T. interruptofasciatus* Kellogg and Ferris found on *Taxidea taxus* (American badger).

TRICHODECTES CALOGALEUS NOV. SP.

(Plate II, fig. 4; plate III, fig. 7.)

MALE. *Head* subequal in length and breadth; pre-antennal area conical, slightly emarginated in front. Antennal bands broad and dark, separated in front by a clear space. On each side of the forehead there are three hairs, one above the antennal sinus, one a short distance in front of this one, and one near the apex. Hairs on the dorsum as in the female. On the venter there are two short hairs above and at the side of each mandible. Trabecula-like processes prominent. Antennal sinuses deep. Ocular projections small with an ocular blotch in front. Temples with a very narrow marginal band, and four hairs, one below the eye and three at the angle. Occipital margin almost straight. Occipital bands short on dorsum, long on venter, connected at their bases by a broad band.

Antennae with the first joint long and broad, the second and third subequal in length and breadth, the latter with two minute spines at the distal, post-axial angle.

Prothorax broader than long, with a spiracle on each side; posterior margin slightly convex with a short hair on each side of the meson on the posterior margin, and one on each side.

Metathorax wider than prothorax with four hairs on each side on the posterior margin.

Abdomen egg-shaped, widest at the fourth segment; last segment rounded posteriorly. Second and third segments each with a dark transverse band, fourth to sixth segments each with two bands, and seventh and eighth with one band each. On the dorsum there is a transverse row of about five minute pustulated hairs near the lateral margins of the third to seventh segments; eighth segment with a transverse row of similar hairs, and on the apical segment there are about six minute pustulated hairs on each side of the meson near the middle, and several on the posterior margin. On the venter there is a transverse row of minute pustulated hairs on the third to eighth segments; last segment with four or five hairs in the front of the posterior margin. Pleurites present on the second to fourth segments; each with a row of five hairs on their posterior margins. Stigmata present on the third to fifth segments. Genitalia as in figure 7 on plate III.

FEMALE. *Head* as in the male, except that the antero-lateral margin is slightly more convex, and the antennal sinuses are not so deep. Antennae with the joints subequal in length, the first slightly broader than the second and third.

Prothorax and *Metathorax* as in the male.

Abdomen with a dark transverse band on the second to eighth segments, those on the third to eighth tapering to a point on each side. Chaetotaxy on dorsum as shown in figure 4 on plate II. On the venter there is a minute pustulated hair on each side of the meson on the second and third segments, fourth to seventh segments each with a transverse row of minute pustulated hairs; eighth with a row of four or five similar hairs on each side; last segment bilobed at the apex, with three hairs on each lobe, and with a semi-circular row of minute hairs in the middle.

Measurements.

	From <i>C. cauii</i> .				From <i>C. pulverulentus</i> .			
	Male.		Female.		Male.		Female.	
	Length.	Width.	Length.	Width.	Length.	Width.	Length.	Width.
Head.....	0.38	0.36	0.38	0.36	0.4	0.41	0.43	0.45
Prothorax.....	0.08	0.28	0.08	0.28	0.1	0.29	0.1	0.33
Metathorax.....	0.06	0.35	0.06	0.35	0.08	0.38	0.08	0.45
Abdomen.....	0.83	0.58	0.78	0.61	0.85	0.65	0.95	0.78
TOTAL.....	1.35		1.3		1.43		1.56	

Described from females and males taken off *Calogale cauri* (slender mongoose) in the Rustenburg district, Transvaal, on the 28th September, 1917 (W. Powell), and from *Calogale pulverulentus*, at Kenkelbosch, C.P., on the 8th September, 1919 (Lawrence Hill).

Holotype: the male from *Calogale cauri*.

This species is closely allied to the species described next, and a discussion on its relationship to other species will be found under that species.

TRICHOECTES CYNICTIS NOV. SP.

(Plate III, fig. 8.)

Abdomen elongated-oval, widest at the fourth segment, last segment pointed posteriorly. On the dorsum of the second segment there is a very small chitinized spot in the middle on the posterior margin, and a fairly strong, short pustulated hair on each side of it; third to sixth segments each with a narrow transverse band in the middle and three to four minute pustulated hairs on the latero-posterior margins of the bands of the third to fifth segments; last segment with a small chitinized spot on each side of the meson, three minute hairs below each spot, and four smaller hairs on their outer margins. On the venter of the third to seventh segments there is a transverse median band, and a row of minute pustulated hairs on the posterior margins. Last segment with a minute hair on each side of the meson. Stigmata present on the third to fifth segments. Indistinct pleurites on the second to fourth segments.

FEMALE. The female resembles that of *T. calogaleus* and can only be distinguished by its smaller size, and having the lateral margins of the forehead almost straight instead of slightly convex.

Measurements.

	Male.		Female.	
	Length.	Width.	Length.	Width.
	mm.	mm.	mm.	mm.
Head.....	0.31	0.27	0.35	0.33
Prothorax.....	0.06	0.18-0.2	0.07	0.25
Metathorax.....	0.05	0.21-0.22	0.05	0.31
Abdomen.....	0.53-0.58	0.4-0.43	0.68-0.78	0.51-0.55
TOTAL.....	0.95-1.0	—	1.15-1.25	—

Described from males and females taken off *Cynictis penicillata* (yellow mongoose) at Onderstepoort (G.A.H.B.) and at Bothaville, O.F.S., on the 29th May, 1920 (W. Powell).

Holotype: the male.

Both *T. calogaleus* and *T. cynictis* are closely allied to the other species that have been described from mongooses, namely *T. mungos* Stobbe, *T. rammei* Stobbe, *T. acutirostris* Stobbe and *T. inaequalis* Piaget; also to *T. subrostratus* Nitzsch, found on the domestic cat.

The females of all these species are very similar and probably almost impossible to separate, except that the female of *T. mungos* may possibly be distinguished from the others by the shape of its head. Unfortunately Stobbe did not figure or describe the shape of the abdominal bands of the species he named. The males of *T. calogaleus*, *T. rammei* and *T. inaequalis* have the last abdominal segment rounded posteriorly, and in the males of *T. cynictis*, *T. acutirostris* and *T. subrostratus* the last abdominal segment is pointed posteriorly. The males of *T. calogaleus* appear to be very closely allied to *T. rammei*, but can be distinguished from that species by the abdominal bands and male genitalia. The males of both *T. cynictis* and *T. subrostratus* possess a pair of fairly strong short hairs on the dorsum of the second abdominal segment; these being absent in *T. calogaleus*. *T. cynictis* can be distinguished from *T. subrostratus* by the male genitalia, and both of these from *T. acutirostris* by the general shape of the abdomen.

TRICHODECTES STERNATUS NOV. SP.

(Plate IV, fig. 9, and plate V, fig. 12.)

Females and males of this new species were collected, along with specimens of *T. lindfieldi* Hill and *T. serraticus* Hill (including the types), from a *Procapra capensis natalensis* Roberts at Mtabamhlopi, Estcourt district, Natal, by P. Barnes. It is closely allied to *T. lindfieldi*, which is probably a synonym of *T. univirgatus* Neumann, described from specimens taken off a *Hyrax* sp. in the Congo. From *T. lindfieldi* it can be distinguished by:—

1. The shape of the clear space on either side of the ventral surface of the forehead, this being the same in both sexes. Compare figs. 11 and 12 on plate V.

2. The absence in the male and female of a small clear space on each side of the ventral surface of the forehead in front of the large clear space.

3. The absence of a chitinized protuberance on the posterior margin of the temples of the male.

4. The male genitalia.

In my paper "A check-list and host-list of the external parasites found on South African Mammalia, Aves and Reptilia," I erroneously included *T. serraticus* as a synonym of *T. univirgatus*. The two are very distinct.

Holotype: the male.

TRICHODECTES EMARGINATUS NOV. SP.

(Plate II, fig. 5.)

MALE. *Head* about as wide as long. Forehead elongated, deeply emarginated in front, with the sides slightly convex. Antennal bands broad and dark, terminating approximately mid-way between the anterior margin and apex of trabecula-like processes. Antennal sinuses deep. Ocular projections prominent. Temples rounded, with a narrow marginal band, and about four hairs on the margin. Occipital bands extending forwards to the antennal bands, and connected at their base by a narrow band. On the margin of the forehead there are about five hairs on each side and on the dorsum there are three on each side of the meson a short distance behind

the anterior notch; one on each side of the occipital bands between the antennae, and one near each eye. On the venter there are two in each of the clear lateral spaces in front.

Prothorax broader than long, posterior margin slightly convex, with a minute hair on each side of the meson.

Metathorax wider than prothorax; posterior margin slightly emarginated in the middle, and with three short pustulated hairs on each side.

Abdomen elongated-oval; third to sixth tergites each with two median dark transverse bands, and a row of very minute pustulated hairs between them. Seventh and eighth tergites each with one transverse band and a row of minute pustulated hairs on the posterior margin, and another row of short pustulated hairs in front of the posterior margin. On the venter there is a row of very minute hairs on the posterior margins of the third to eighth segments. Transverse bands appear to be present, but they are very indistinct.

Measurements.

	Length.	Width.
	mm.	mm.
Head.....	0.36	0.36
Prothorax.....	0.11	0.16
Metathorax.....	0.07	0.31
Abdomen.....	0.78	0.51
TOTAL.....	1.32	

Described from a single male taken off *Heterohyrax ruddi* Wr. (Rudd's dassie) in the Zoutpansberg district, Northern Transvaal, on the 29th July, 1924 (G.A.H.B.)

This new specimen possesses a transverse band beneath the hind pair of legs which turns abruptly upwards at each end for a short distance. The only other species known to me which possess a similar band are *T. lindfieldi* Hill, *T. serraticus* Hill and *T. sternatus*. In *T. serraticus* the band is semi-circular and only present in the female.

TRICHODECTES ROBERTSI nov. sp.

(Plate I, fig. 2.)

MALE. *Head* sub-equal in length and breadth. Forehead rounded, with six short hairs on each lateral margin, and three minute pustulated hairs on the dorsum on each side. Antennal bands dark, narrow at the sides, broad and serrated in front. Trabecula-like processes well developed. Antennal sinuses deep. Ocular projections prominent. Temples widest behind the eyes, then narrowing abruptly, with a narrow marginal band, a minute hair beneath the eye, and two minute pustulated hairs near the latero-posterior angle. Occiput with a narrow basal band, which is concave in the middle. Occipital bands absent on the dorsum; on the venter there is a narrow band on each side extending back from the antennal

bands, but not reaching the occiput. Antennae extending beyond posterior margin of head; first joint broad, second and third equal in length; the latter with two minute spines at the distal post-axial angle.

Prothorax wider than long, with a narrow band on the lateral margins; posterior margin straight; hairs apparently absent.

Metathorax wider than the prothorax, and about the same length, with two minute hairs on each lateral margin, and a minute pustulated hair on each side.

Abdomen elongated-oval, with the lateral margins crenulated, widest at the fourth segment; second to eighth segments each with a dark, median transverse band on the dorsal and ventral surfaces, those on the dorsum being slightly narrower and longer than those on the venter, and a row of very minute pustulated hairs on the posterior margins, each row consisting of about eight hairs on the dorsum and four on the venter, except on the second segment there are only two admedian hairs on the dorsum. Ninth segment with a transverse band on the dorsum. Basal plate of male genitalia long.

Measurements.

	Length.	Width.
	mm.	mm.
Head.....	0·3	0·28
Prothorax.....	0·08	0·2
Metathorax.....	0·08	0·26
Abdomen.....	0·61	0·38
TOTAL.....	1·07	—

Described from a male taken off *Heterohyrax ruddi* Wr. (Rudd's dassie) in the Zoutpansberg district, Northern Transvaal, on the 29th July, 1924. I have much pleasure in naming this species after Mr. Austin Roberts of the Transvaal Museum, Pretoria, to whom I am indebted for his kind help in determining a number of hosts for me.

TRICHODECTES OCLATUS nov. sp.

(Plate IV, fig. 10, and plate VI, fig. 14.)

MALE. *Head* very slightly wider than long. Pre-antennal area with the lateral margins very slightly concave, emarginated in front. Antennal bands very narrow, surrounding the head in front, and projecting slightly inwards a short distance midway between the anterior margin and trabecula-like process. Trabecula-like processes large and pointed. Antennal sinuses deep. Ocular projections very large. Temples rounded, with a few very minute pustulated hairs on the dorsum, and three hairs on the lateral margin. Occipital bands on dorsum absent. Occiput straight, with a narrow band on the margin. Antennae long, projecting beyond base of head, first joint broad and long; third very slightly longer than second, with two minute spines at the distal post-axial angle.

Prothorax wider than long, very slightly wider in front than behind; lateral margins almost straight; posterior margin very slightly convex.

Metathorax wider than prothorax; lateral margins winged, with two minute hairs a short distance from the lateral borders.

Legs long and narrow. Ungues of mid and hind legs serrated as in *Eutrichophilus diacanthus* Ehrenberg (see Plate II, fig. 6 (b)).

Abdomen elongated-oval, widest at the fourth segment; second to sixth segments slightly crenulated laterally. A single median transverse band appears to be present on the dorsal and ventral surfaces of the second to eighth segments, but these are not very distinct. These segments also have a row of very minute pustulated hairs on their posterior margins. Pleurites present on the second to fourth segments.

Measurements.

	Length.	Width.
	mm.	mm.
Head.....	0·23	0·26
Prothorax.....	0·08	0·18
Metathorax.....	0·08	0·24
Abdomen.....	0·66	0·41
TOTAL.....	1·05	

Described from a male taken off a *Heterohyrax ruddi* Wt. (Rudd's dassie) in the Zoutpansberg district, Northern Transvaal, on the 29th July, 1924 (G.A.H.B.). This new species can be easily distinguished by the shape of the head, large eyes, male genitalia, and the ungues of the mid and hind legs being serrated on their inner margins.

GENUS EUTRICHOPHILUS Mjöberg.

EUTRICHOPHILUS DIACANTHUS (Ehrenberg).

Ehrenberg, Symbolae, Physicae Hyrax (1828).

Taschenberg, Die Mallophagen, p. 224 (1882).

Stobbe, Sitz, Ges. nat. Freunde, VIII, p. 382, f. 9 (1913).

In the collection there is a single female taken, along with a male of *T. serraticus* Hill, off a *Procavia capensis coombi* Roberts (Transvaal dassie) at Rooikrans, Transvaal, on the 5th September, 1916 (W. Powell).

This specimen, which at present I am unable to separate from Ehrenberg's species, has the ungues of the mid and hind legs serrated on their inner margins as in *T. ocellatus*, and the antennae are five-jointed. It is figured on Plate II, fig. 6.

E. diacanthus was described from specimens taken off a *Hyrax syriacus*, and was transferred by Stobbe from the genus *Trichodectes* to the genus *Eutrichophilus*, which mainly includes species found on porcupines. I feel convinced that it cannot remain in this genus.

GENUS DAMALINIA Mjöberg.

Mjöberg, Arkiv. för Zoologi, vi, p. 69, f. 41-43 (1910).

Up to the present this genus contained but a single species, *D. crenelata* Piaget (Pédiculines, 1880, p. 402, Pl. 32, f. 8) found on *Antilope albifrons*—*Damaliscus albifrons* (blesbok). I am now

adding a second, taken off a *Gorgon taurinus* Burch. (blue wildebeest) in the Zoutpansberg district, Northern Transvaal, on the 26th July, 1924. This new species, of which, unfortunately, we only possess a female, can be readily distinguished from *D. crenelata* by its large size and markings on the ventral surface of the last abdominal segments. It is the largest species of Trichodectidae known.

DAMALINIA THEILERI nov. sp.

(Plate VI, fig. 15, and plate VII, fig. 16.)

FEMALE. *Head* very slightly longer than broad. Forehead elongated, sides convex, very deeply notched and chitinized in front. Antennal bands narrow. Hairs numerous on the dorsum in front, and on the antennal bands; also two hairs on each side near the base of the antennae. On the venter there is a broad longitudinal chitinized band on each side of the notch, and extending backwards to the mandibles; between this band and the lateral margin there are several short hairs. Trabecula-like processes prominent, rounded. Antennal sinuses broad. Eyes and ocular blotch prominent. Temples rounded, with a narrow marginal band and numerous hairs on the dorsum. Occipital bands short, connected at their bases by a broad band. Between the occipital bands there is a transverse row of eight short hairs. Antennae three-jointed, long and narrow, the second segment being the longest.

Prothorax short and broad, with five minute pustulated hairs on each side on the posterior margin; spiracles apparently absent.

Metathorax wider than prothorax, with a row of pustulated hairs on the posterior margin, the hairs being minute, except for two longish ones on each side.

Legs long and narrow.

Abdomen elongated-oval, widest at the fourth segment. First tergite small, with a minute hair on each side of the meson. Second to eighth tergites each with a dark median transverse band, and a row of minute pustulated hairs beneath; on the second segment the row of hairs extends to the lateral margins, and on the eighth the last hair on each side is long. Ninth tergite with two dark blotches on each side of the meson. Pleurites present on the second to eighth segments. Stigmata on the third to eighth segments. Second to sixth sternites each with a dark median transverse band and a row of minute pustulated hairs beneath. Seventh to ninth sternites as shown in figure 15.

Measurements.

	Length.	Width.
	mm.	mm.
<i>Female—</i>		
Head.....	0·83	0·79
Prothorax.....	0·18	0·53
Metathorax.....	0·23	0·61
Abdomen.....	0·16	1·15
	—	—
TOTAL.....	2·84	—
	—	—

LIST OF REFERENCES.

- (1) Piaget (1880). "Les Pédiculines."
- (2) Mjöberg (1910). "Studien über Mallophagen und Anopluren." *Arkiv. f. Zool.*, vi, pp. 1-296.
- (3) Stobbe (1913). "Mallophagen." 3. Beitrag. Die Trichodectiden des Berliner Museum für Naturkunde. *Sitz.-Ber. Ges. nat. Freunde*, pp. 365-383.
- (4) Neumann (1913). "Notes sur les Mallophages, III." *Arch. d. Parasitologie*, xv, pp. 608-634.
- (5) Ferris (1915). "The Anoplura and Mallophaga of North American Mammals." *Leland Stanford Jun. Univers. Pub.*, pp. 1-74.
- (6) Hill (1922). "Three New Species of Trichodectes from *Cephalophus monticola* and *Procapra capensis* from South Africa." *Parasit.*, xiv, i, pp. 63-68, Pl. 1 and 2 (1922).
- (7) Bedford (1926). "A Check-list and Host-list of the External Parasites found on South African Mammalia, Aves and Reptilia." 11th and 12th Rept., *Dir. Vet. Educ. and Res., Un. S. Afr.*, pp. 705-817.

EXPLANATION OF PLATES.

PLATE I.

- Fig. 1. *Trichodectes ovalis* nov. sp., ♀
 Fig. 2. *Trichodectes robertsi* nov. sp., ♂.
 Fig. 3. *Trichodectes ovalis* nov. sp.
 (a) Sternal plate of ♂.
 (b) Dorsum of abdomen of ♂.

PLATE II.

- Fig. 4. *Trichodectes calogaleus* nov. sp., ♀
 Fig. 5. *Trichodectes emarginatus* nov. sp., ♂.
 Fig. 6. *Eutrichophilus diacanthus* Ehrenberg, ♀.
 (b) Claw of mid and hind legs.

PLATE III.

- Fig. 7. *Trichodectes calogaleus* nov. sp., ♂ genitalia.
 Fig. 8. *Trichodectes cynictis* nov. sp., ♂ genitalia.

PLATE IV.

- Fig. 9. *Trichodectes sternatus* nov. sp., ♂ genitalia.
 Fig. 10. *Trichodectes oculatus* nov. sp., ♂ genitalia.

PLATE V.

- Fig. 11. *Trichodectes lindfieldi* Hill, ventral surface of head of ♂.
 Fig. 12. *Trichodectes sternatus* nov. sp., ventral surface of head of ♂.

PLATE VI.

- Fig. 13. *Trichodectes ovalis* nov. sp., ventral surface of terminal abdominal segments of female.
 Fig. 14. *Trichodectes oculatus* nov. sp., ventral surface of head of ♂.
 Fig. 15. *Damalinia theileri* nov. sp., ventral surface of terminal abdominal segments of ♀.

PLATE VII.

- Fig. 16. *Damalinia theileri* nov. sp., ♀.

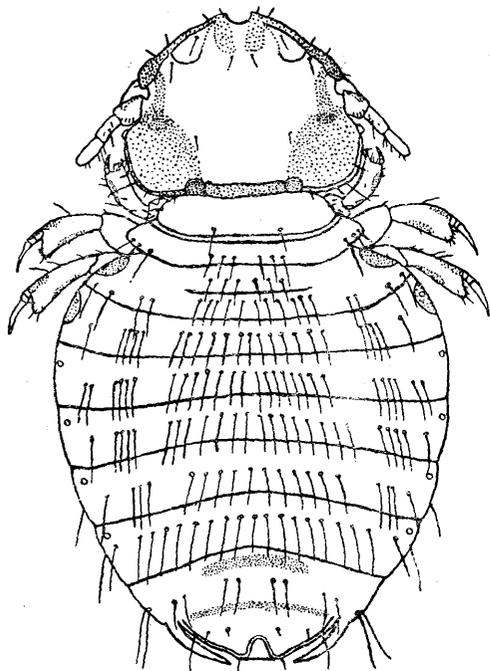


FIG. 1.

G. A. H. B. del.]
Trichodectidae.]

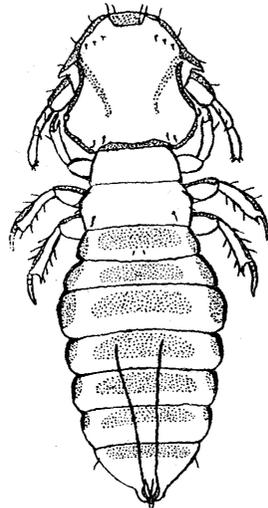


FIG. 2.

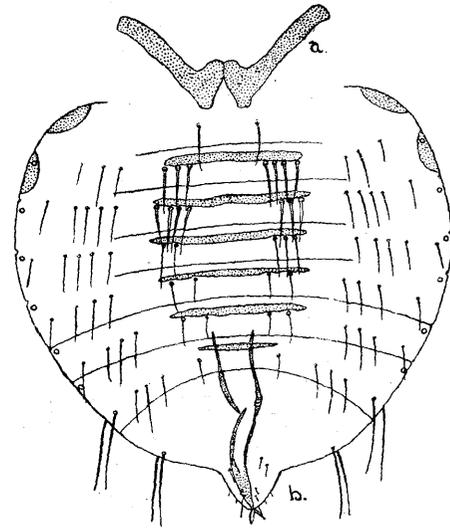


FIG. 3.

PLATE I.

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[Bedford.]

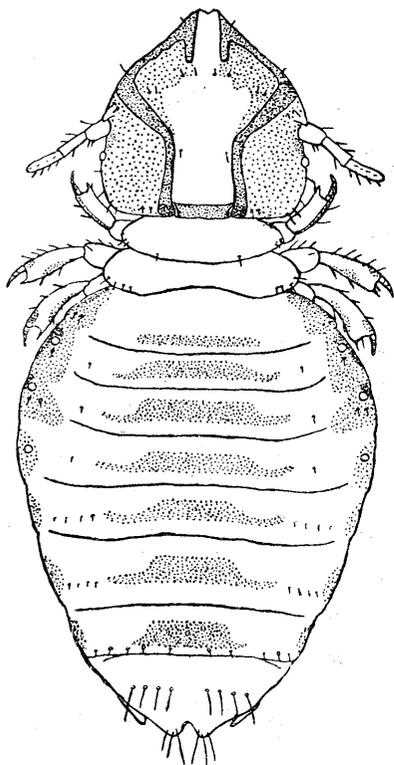


FIG. 4.

G. A. H. B. del.]

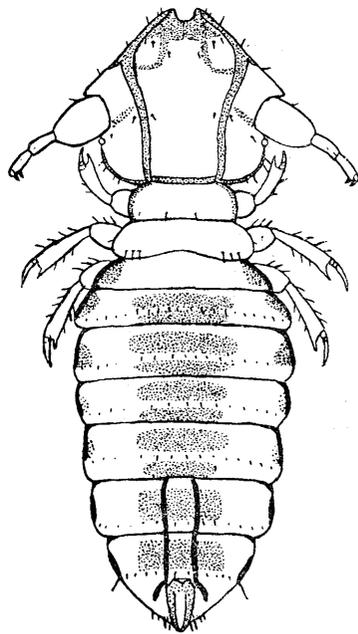


FIG. 5.

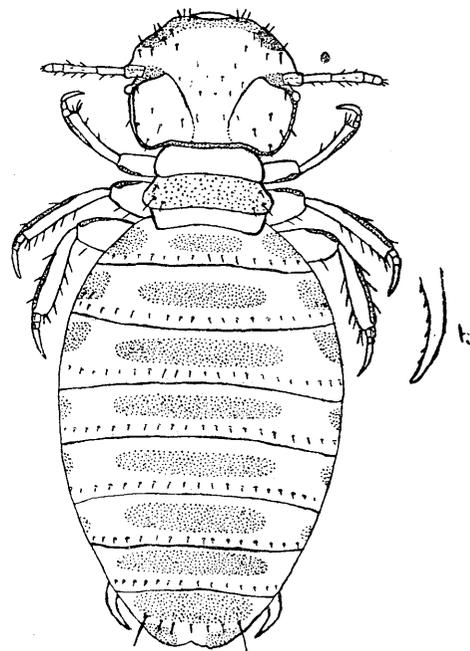


FIG. 6.

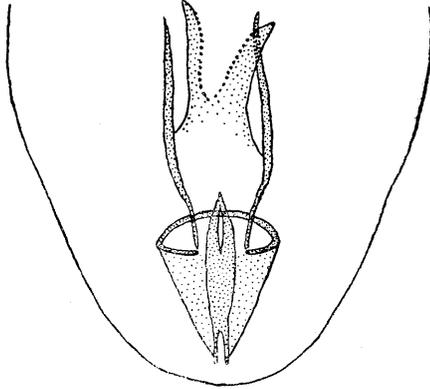


FIG. 7.

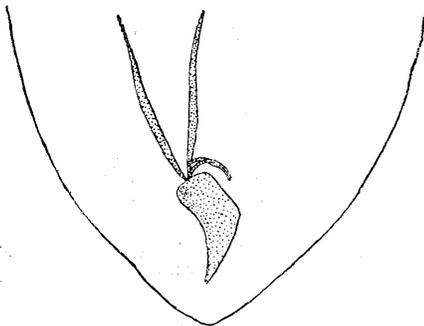


FIG. 8.

PLATE IV.

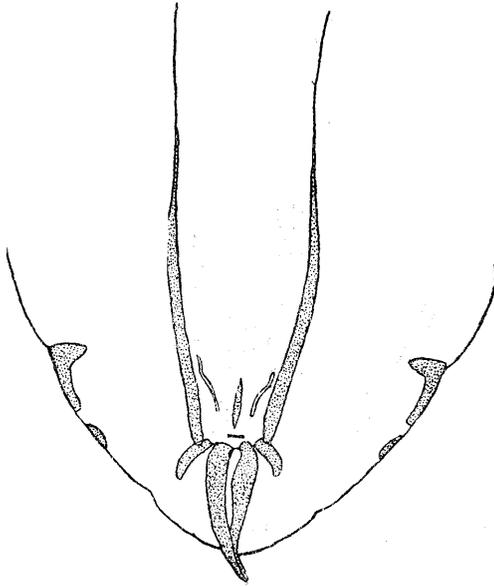


FIG. 9.

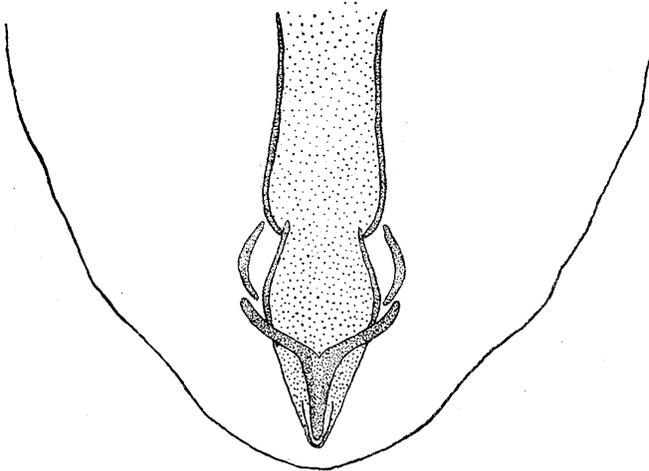


FIG. 10.

G. A. H. B. del.]

PLATE V.

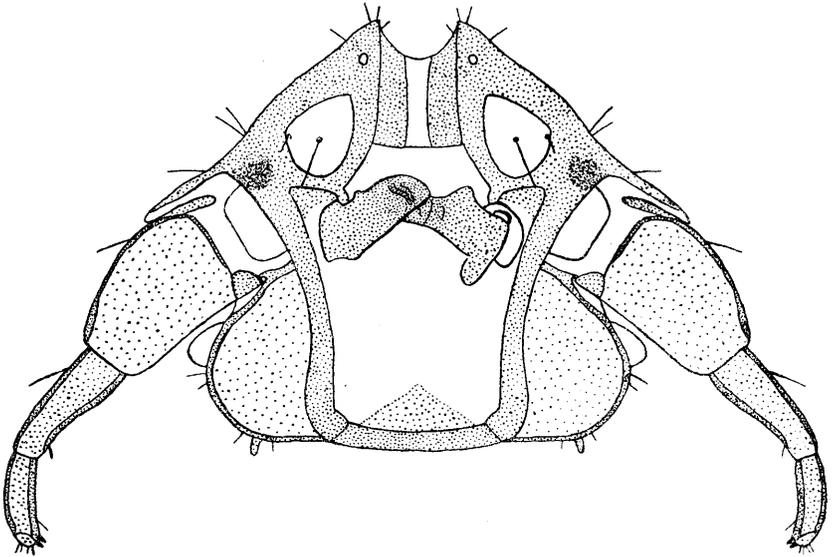


FIG. 11.

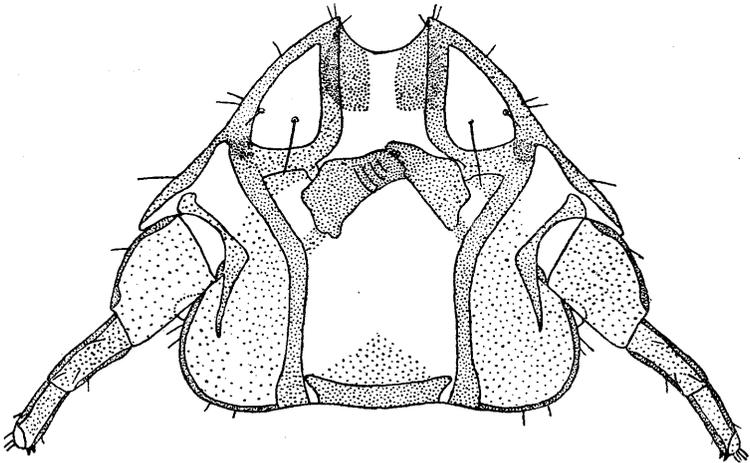


FIG. 12.

PLATE VI.

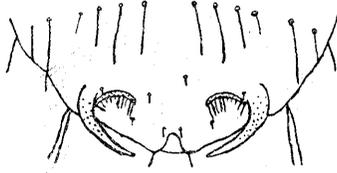


FIG. 13.

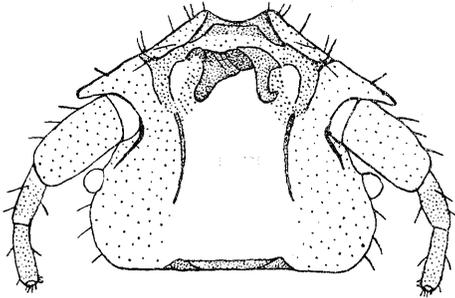


FIG. 14.

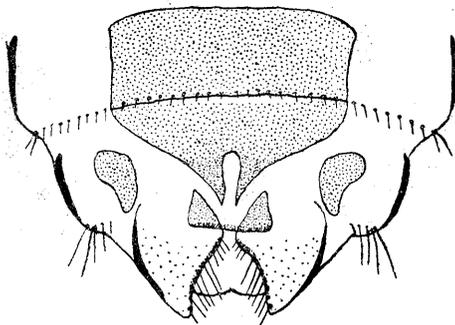


FIG. 15.

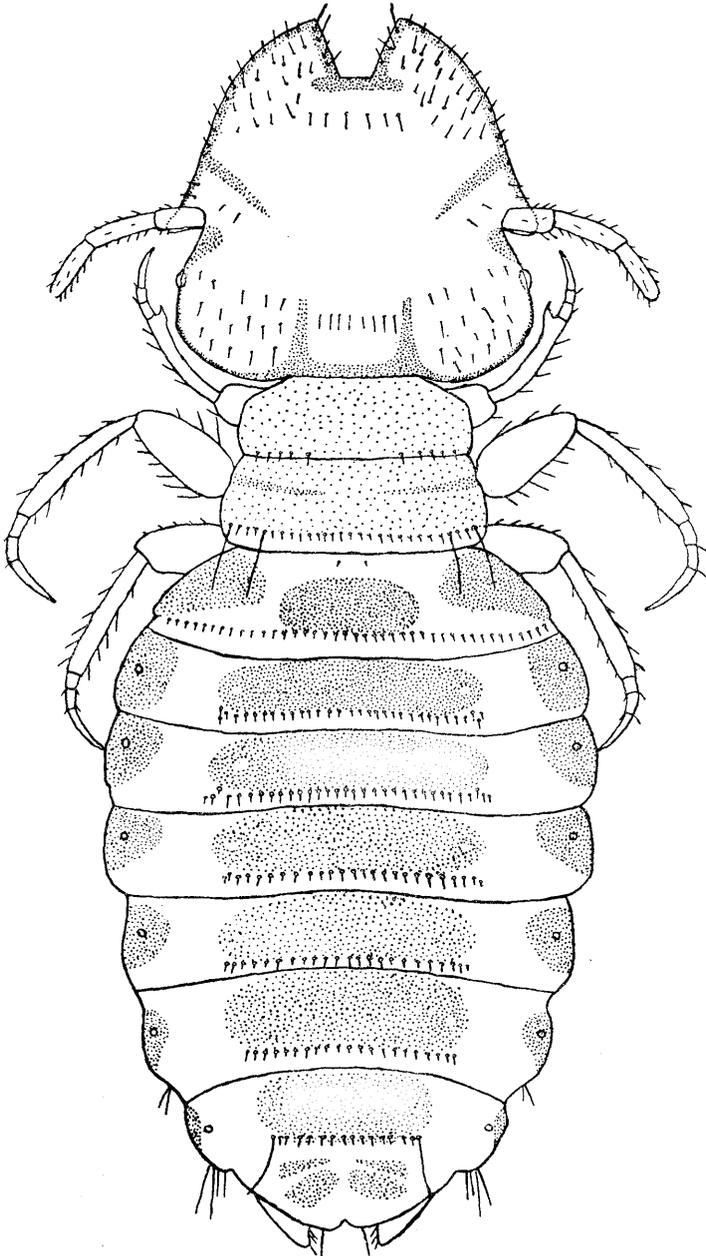


FIG. 16.

G. A. H. B. del.]