

TRICHODECTIDAE (MALLOPHAGA) FOUND ON AFRICAN CARNIVORA

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(With 9 Figures in the Text.)

MOST of the new species herein described were collected by me from skins in the Transvaal Museum, Pretoria, for the loan of which I am deeply indebted to Mr Austin Roberts.

In most species of Mallophaga, as Harrison (1915) pointed out, there are six pairs of abdominal spiracles, situated either on segments 3-8 or 2-7. In a number of species of Trichodectidae parasitic on carnivora, however, there are only three pairs of abdominal spiracles present, and in at least three species, including *Trichodectes nasuatis* Osborn, found on *Nasua narica*, an American carnivore, they are absent. Harrison (1915) stated that he could only detect five pairs in *Trichodectes divaricatus* Neumann, and according to Stobbe (1913) there are only four pairs in *Felicola viverriculæ*. The only other exceptions known are to be found in the species belonging to the sub-family Glicicolinae and the family Trimenoponidae. In both these groups, the species of which are also parasitic on mammals, there are only five pairs of abdominal spiracles, these being present on segments 3-7.

In addition to the abdominal spiracles the Trichodectidae also possess a pair of prothoracic spiracles. The only other species known to possess these belong to the family Gyropidae and also to the genus *Tetrophthalmus*, which includes a few species parasitic on pelicans.

Harrison (1915) states that it is reasonable to conclude that the difference in stigmatal arrangement is due to the suppression of the first abdominal segment or its incorporation with the thorax, and that this condition is strongly suggested in *Trichodectes*. He found that the segments in front of those which bear the stigmata usually show small scars in the position which the spiracles would have had, the scars indicating that the Mallophaga, or their ancestors, originally had two additional pairs of abdominal stigmata. His argument does not, however, explain either the entire absence of abdominal spiracles or even the presence of only three or four pairs. He states that he examined about twenty species of Trichodectidae, but it is very evident that these did not include either *Felicola subrostrata* (Nitzsch) or any of the species parasitic on mongooses.

Harrison, in the same paper, compared the diameter of abdominal spiracles of species belonging to different genera, and found that the stigmatic apertures

of the Ischnocera were considerably smaller than those of the Amblycera. However, in the Trichodectidae, which is included in the Ischnocera, the abdominal spiracles frequently vary in size, even in closely allied species of about the same size. Furthermore, in at least one species, namely *Felicola acutirostris*, the first pair of spiracles is larger than the two remaining pairs. Also, those of the females are usually larger than those of the males, but as the females are larger than the males, this is only to be expected.

Harrison (1915) stated: "The general constancy of the respiratory system in Mallophaga seems to be a good argument for allowing a fair amount of importance to such differences as occur." He considered that the number of abdominal spiracles present is at least of generic, if not of family importance. We have seen that the number of abdominal spiracles present varies in the Trichodectidae parasitic on Carnivora, and the question arises, can they be considered of generic importance in this family?

It will first of all be necessary to explain that the parasites of carnivora can be divided into two very distinct groups, namely, one group parasitic on Canidae, Mustelidae and the American Procyonidae, and the other on Felidae and Viverridae. There are, however, two species found on Viverridae, viz. *Trichodectes madagascarensis* Mjöberg and *Suricatoecus cooleyi* (Bedf.) which belong to the first group. *Protelicola intermedia* n.gen. et sp., the parasite of the aardwolf, *Proteles cristatus*, is intermediate between these two groups, and it is interesting to note that this host is the only animal included in the family Protelidae, which mammalogists place between the Canidae, Mustelidae, etc., on the one hand, and the Felidae and Viverridae on the other.

In both these groups the number of abdominal spiracles present is variable. As no mention is made of these in most descriptions, and they are shown only in one or two figures, I can, for the most part, only refer to those of species I have examined. In the first group there are six pairs present in all the species recorded from African hosts, excepting *Suricatoecus cooleyi* (Bedf.), which possesses only three pairs. In *Trichodectes octomaculatus* Paine, parasitic on Procyonidae, there are, according to Neumann's figure, only three pairs present. In *Trichodectes nasuatis*, also parasitic on Procyonidae, they are absent.

In the second group, most species of *Felicola* known to be parasitic on cats and mongooses possess three pairs of abdominal spiracles. *F. caffra* (Bedf.), a typical cat parasite, however, possesses six pairs of abdominal spiracles, and has a longitudinal sclerite on each side of the male genitalia. These sclerites have probably no generic importance as similar sclerites may be present or absent in closely related *Trichodectes* spp. In both *F. genetta* (Bedf.) and *F. helogale* n.sp. the abdominal spiracles appear to be absent. The latter species also differs from other *Felicola* spp. in the shape of the head and gonopophyses of the female, but they are hardly sufficiently distinct to be considered of generic significance.

As *F. caffra* is far more closely related to *Felicola* spp. than it is to other

species possessing six pairs of abdominal spiracles, and as neither *F. genetta* nor *F. helogale* is closely related to *T. nasuatis*, the only other species known in which the abdominal spiracles are absent, I can only conclude that the structure of the respiratory system in the Trichodectidae is not, in the absence of other important characters, of generic significance.

It is of interest that the parasites of mongooses, excepting *S. cooleyi*, are more closely related to the parasite of the domestic cat than to those of genets, which mammalogists include along with the mongooses, in the family Viverridae. It is difficult to understand why *S. cooleyi*, the parasite of the suricate, should be so very distinct. Genets also harbour two very distinct types of parasites.

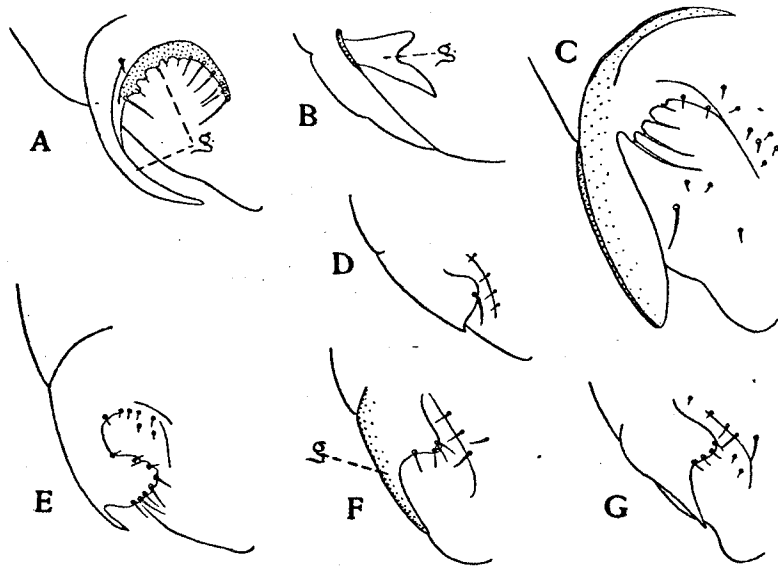


Fig. 1. Gonopophyses of females of: A, *Trichodectes ovalis* Bedford; B, *Suricatoecus cooleyi* (Bedford); C, *Protelicola intermedia* n.sp.; D, *Felicola helogale* n.sp.; E, *Felicola caffra* (Bedford); F, *Felicola setosa* n.sp.; G, *Felicola subrostrata* (Nitzsch).

The most important generic characters in the Trichodectidae appear to be:

- (i) The shape of the head and its sclerites.
- (ii) The presence or absence of sclerites on the tergites and sternites.
- (iii) The gonopophyses of the females.

In several of the other families of Mallophaga the male genitalia are of generic significance, but in the family Trichodectidae they frequently vary considerably, even in closely allied species.

The antennae are three-segmented in both sexes in all the known species parasitic on Carnivora.

KEY TO THE GENERA.

1. Forehead short and broad, with anterior margin rounded, but a median notch may be present. 2.
Forehead triangular or sub-triangular. 3.
2. Gonopophyses of female as in Fig. 1 A; abdominal spiracles present on segments 2-7 in African species. Trichodectes Nitzsch.
Gonopophyses of female as in Fig. 1 D; abdominal spiracles present on segments 2-4. Suricatoecus n.gen.
3. Tergal plates absent in both sexes; gonopophyses of female as in Fig. 1 C. Protelicola n.gen.
Tergal plates well developed in both sexes; gonopophyses of female with a well-developed lobe on inner margins. Felicola Ewing.

Genus TRICHODECTES Nitzsch.

1818. *Trichodectes* Nitzsch, p. 294.

Until recently most species belonging to the family Trichodectidae were placed in this genus. It should probably only include species parasitic on carnivores belonging to the Canidae, Procyonidae, and possibly Mustelidae.

Ewing (1929) erected the genus *Neotrichodectes* for *Trichodectes mephitidis* Packard, parasitic on an American skunk, but it is impossible to state at present whether it should be retained, and if so, what other species the genus should include.

Genotype: *Ricinus canis* De Geer (1778).

1. *Trichodectes canis* (De Geer).

1778. *Ricinus canis* De Geer, p. 81, pl. 4, fig. 16.

1838. *Trichodectes latus* Nitzsch, in Burmeister, p. 436.

1852. *Trichodectes octopunctatus* Leach, in Denny, p. 29.

1880. *Trichodectes latus* (Nitzsch) Piaget, p. 384, pl. 31, fig. 6.

This species has been recorded taken off domestic dogs in Europe, America and Australia, but so far has not been reported from these animals in Africa. Mr F. V. Collins, of Port Adelaide, informs me that he has found it on the Australian dingo.

2. *Trichodectes matschiei* Stobbe.

1913. *Trichodectes matschiei* Stobbe, p. 372.

Described from two females taken off *Lutra matschiei* in the Cameroons. It is closely related to *T. exilis* Nitzsch, a parasite of the European otter, *Lutra vulgaris*.

3. *Trichodectes ovalis* Bedford.

(Fig. 1 A.)

1928. *Trichodectes ovalis* Bedford, p. 841, pl. 1, figs. 1, 3; pl. 6, figs. 1, 3.

Described from females and males taken off *Poecillogale albinucha* at Onderstepoort. Bedford (1929) also recorded it taken off *Ictonyx striatus* in South-West Africa and Natal.

4. *Trichodectes vosseleri* Stobbe.

1913. *Trichodectes vosseleri* Stobbe, p. 371, fig. 2.

Described from male and female taken off *Potamochoerus demunisi*, Tanganyika Territory. I have taken a male and female off *Mellivora capensis* (Sehr.), Knysna, C.P. (Transvaal Mus. No. 1362), and have also received specimens from Mr J. Hewitt taken off the same host at Kleinpoort, Albany District, C.P. As this large species is a typical parasite of Mustelidae there can be no doubt that either an error was made in recording the host of the types, or the specimens were stragglers. I here designate the male as the holotype, no previous designation having been given.

5. *Trichodectes zorillae* Stobbe.

1913. *Trichodectes zorillae* Stobbe, p. 374, fig. 3.

Described from females and males taken off *Zorilla lybica* and *Z. vaillanti* in Tunis. I here designate the female as the holotype, no previous designation having been given.

6. *Trichodectes madagascariensis* Mjöberg.

1910. *Trichodectes madagascariensis* Mjöberg, p. 64, figs. 38, 39.

Described from a male taken off a civet cat, *Eupleres goudoti* in Madagascar. It is a very distinct species and will probably have to be placed in a new genus.

Genus **SURICATOECUS** n.gen.

Head wider than long, the anterior margin rounded, without a median notch. The lateral sclerites on forehead turn inwards for a short distance in front of the trabecula-like processes and project backwards in front for a short distance on each side of the meson. Temporal bands absent. Abdomen without tergal sclerites, except for a narrow transverse plate on the eighth segment in the female, and in the male there is a narrow transverse sclerite at the latero-anterior angles of the first tergite. Gonopophyses of female very characteristic, as shown in Fig. 1 D. Abdominal spiracles present on segments 2-4. Only the following species is included in this genus.

1. *Suricatoecus cooleyi* (Bedford).

(Fig. 1 B.)

1929. *Trichodectes cooleyi* Bedford, p. 513, fig. 13.

Described from males and females taken off the mongoose, *Suricata suricatta hamiltoni* in the Pretoria District, Transvaal.

Genus **PROTELICOLA** n.gen.

Head wider than long; forehead triangular, slightly notched in front; the lateral sclerites on each side turn inwards for a short distance in front of the trabecula-like processes. Temporal bands present, but not well developed.

Abdomen without tergal sclerites, except for a transverse plate on the eighth segment in the female. Gonopophyses of female characteristic, as shown in Fig. 1 C. Abdominal spiracles present on segments 2-7.

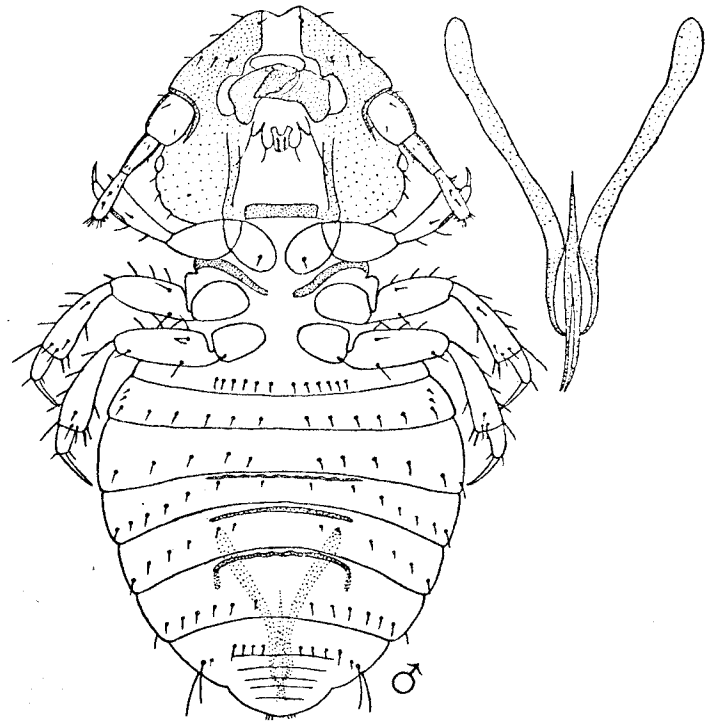


Fig. 2. *Protelicola intermedia* n.sp., ventral aspect and genitalia of ♂.

Only the following species is included in this genus.

1. *Protelicola intermedia* n.sp.

(Figs. 1 C, 2.)

Males and females taken off aardwolf, *Proteles cristatus* (Sparrm.), Umkomaas Valley, Natal, 19. vi. 1931 (coll. L. Hill). Holotype a male.

The head of this species resembles those of the majority of species parasitic on Felidae and Viverridae and the abdomen is similar to those of species found on Canidae and Mustelidae.

Male. Total length 1.22 mm. Head 0.36×0.42 mm. Forehead slightly asymmetrical in front. On the dorsum there is a transverse row of nine setae on the forehead, two on each side between the antennae and a median transverse row of four behind. Sternites 4-6 each with a median, narrow transverse sclerite. Genitalia as in Fig. 3.

Female. Total length 1.82 mm. Head 0.47×0.56 mm. Differs from the male in having a broadish transverse sclerite at the base of the eighth tergite, and a narrow, transverse sclerite is only present on the sixth sternite.

Genus **FELICOLA** Ewing.1929. *Felicola* Ewing, pp. 122, 192.1929. *Felicinia* Bedford, p. 519.

Forehead triangular or sub-triangular. Transverse tergal sclerites of female usually terminate in long, narrow, curved points at either end. They are slightly narrower in some species than in others, but it is doubtful whether these small differences are of systematic value. Gonopophyses of female with a well-developed lobe on the inner margins. Male genitalia frequently vary considerably, even in closely allied species. Abdominal spiracles usually present on segments 2-4 but may be entirely absent, or present on segments 2-5 or segments 2-7.

Species parasitic on Felidae and Viverridae. The females of the different species are for the most part very similar and often difficult, if not impossible, to identify. The males, on the other hand, are very dissimilar and easy to determine. Fortunately they are about as numerous as the females, and not extremely rare as in some species of Trichodectidae, such as *Bovicola bovis* (L.) and *B. equi* (L.).

Genotype: *Trichodectes subrostrata* Nitzsch.

KEY TO THE SPECIES.

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| 1. Abdominal spiracles present. | 2. |
| Abdominal spiracles absent. | 10. |
| 2. More than three pairs of abdominal spiracles present. | 3. |
| Three pairs of abdominal spiracles present. | 4. |
| 3. Six pairs of abdominal spiracles present on segments 2-7. | F. caffra (Bedf.). |
| Four pairs of abdominal spiracles present on segments 2-5. | F. viverriculae (Stobbe). |
| 4. ♂: sclerite on tergite 1, if present, without well-developed setae; genitalia with well-developed spines on preputial sac; transverse sclerite on tergite 8 of ♀ entire. | 5. |
| ♂: sclerite on tergite 1 with either two or six well-developed setae; genitalia without spines on preputial sac; transverse sclerite on tergite 8 of ♀ either interrupted in the middle or absent. | 6. |
| 5. ♂ without a sclerite on tergite 1; sclerites duplicated on tergites 4 and 5; ♀ large, 1.76 mm. in length. | F. rammei (Stobbe). |
| ♂: sclerite on tergite 1 with two minute setae; sclerites duplicated on tergites 4-6; ♀ smaller, 1.2-1.48 mm. in length. | F. calogalea (Bedf.). |
| 6. ♂: sclerite on tergite 1 with two well-developed setae; ♀: sclerite on tergite 8 usually present (absent in <i>F. cynictis</i>). | 7. |
| ♂: sclerite on tergite 1 with six well-developed setae; ♀: sclerite on tergite 8 absent. | F. setosa n.sp. |
| 7. Spiracles on tergite 2 larger than those on tergites 3-4 in both sexes; basal plate with sides parallel, except at the apex where it abruptly becomes narrower. | F. acutirostris (Stobbe). |
| Spiracles on tergites 2-4 equal in size in both sexes. | 8. |
| 8. ♂: sclerite absent on tergite 6; basal plate V-shaped; ♀: sclerite on tergite 8 absent. | F. cynictis (Bedf.). |
| ♂: sclerite present on tergite 6; basal plate narrower in front than behind; ♀: sclerite on tergite 8 present. | 9. |

9. ♂: tergite 8 with two separate median longitudinal sclerites; ♀: gonopophyses as in Fig. 1 G.
F. subrostrata (Nitzsch).
♂: sclerites on tergite 8 united in front; ♀: gonopophyses similar to Fig. 1 F.
F. rostrata n.sp.
10. Gonopophyses of ♀ as in Fig. 1 B.
Gonopophyses of ♀ similar to Fig. 1 F.
F. helogale n.sp.
F. genetta (Bedf.).

F. mungos (Stobbe) and *F. acuticeps* (Neumann) are not included in the above table as it is not known how many abdominal spiracles they possess. The latter is probably closely related to *F. genetta* (Bedf.).

1. **Felicola caffra** (Bedford).

1919. *Trichodectes caffra* Bedford, p. 724, pl. 3, figs. 10, 11.

Described from a female and a male taken off a Cape wild cat (*Felis ocreata caffra* Desm.), at Blockspruit, Rustenburg District, Transvaal. I here designate the male as the holotype. The head is very similar to that of *F. subrostrata* and other closely related species parasitic on mongooses. On each side of the male genitalia there is a narrow longitudinal sclerite.

2. **Felicola viverriculae** (Stobbe).

1913. *Trichodectes viverriculae* Stobbe, p. 375, fig. 4.

Described from specimens taken off a civet cat, *Viverricula rasse*, in Madagascar. I here designate the male the holotype, no previous designation having been given.

Length of male 1.4 mm.; of female 1.5 mm. The lateral margins of the forehead are convex, and the abdomen of the male resembles that of *F. rammei* in shape.

3. **Felicola rammei** (Stobbe).

(Fig. 3.)

1913. *Trichodectes rammei* Stobbe, p. 377, fig. 6.

Described from specimens (both sexes) taken off water mongoose, *Atilax paludinosus* G. Cuv. (= *Herpestes galera*), Tanganyika Territory. Ferris (1930) records numerous specimens, which he considers to be this species, from *Galerella brunneo-ochracea* Matschix, Belgian Congo, and specimens which I regard as probably this species have been taken off Cape Ichneumon (*Herpestes caffer* Gmelin) at Pietermaritzburg, Natal (coll. L. Hill). The type specimens may have been stragglers, or the host misidentified, as Stobbe records a second species from *A. paludinosus*, and this is the only one I have found on this animal.

I here designate the male the holotype, as no previous designation has been given.

Female: the gonopophyses are shown in Fig. 6; the transverse sclerite on tergite 8 is entire.

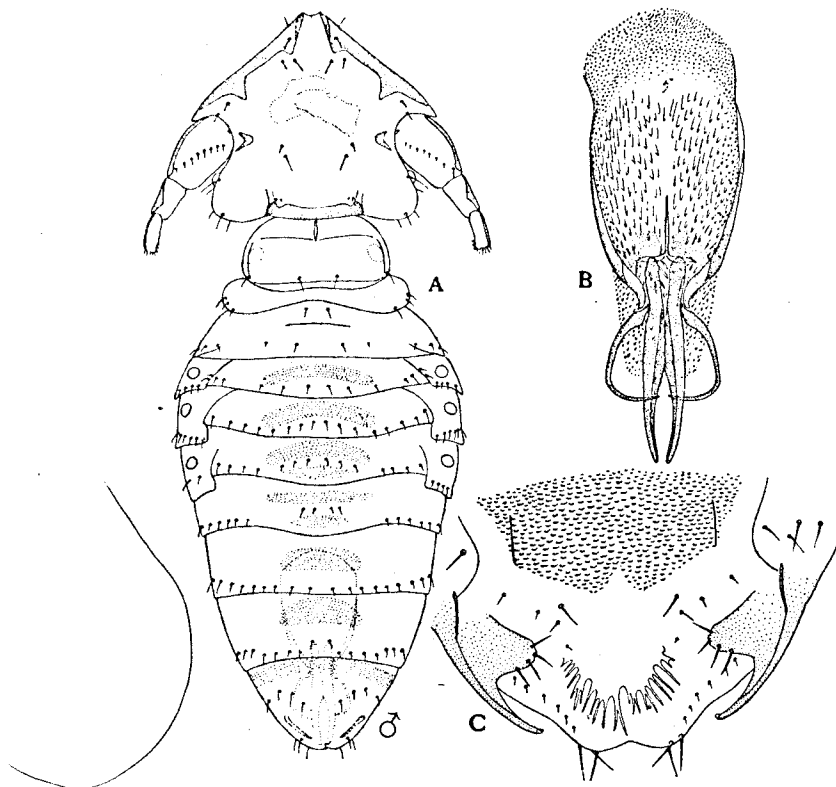


Fig. 3. *Felicola rammei* (Stobbe). A, dorsal aspect of ♂; B, genitalia of ♂; C, gonopophyses of ♂.

4. *Felicola calogalea* (Bedford).

(Fig. 4.)

1928. *Trichodectes calogalea* Bedford, p. 843, pl. 2, fig. 4; pl. 3, fig. 7.

Described from females and males taken off slender mongoose, *Myonax cauxi* (= *Calogale cauxi*) in the Rustenburg District, Transvaal, and from *M. pulverulentus* (= *C. pulverulentus*), Kenkelbosch, C.P. Specimens have also been taken off *Myonax nigratus* (Thomas), Otjitundua, Kaokoveld, South-West Africa.

Female: the gonopophyses are similar to those of *F. rammei* (Fig. 3C); the transverse sclerite on tergite 8 is not interrupted in the middle.

5. *Felicola acutirostris* (Stobbe).

(Fig. 5.)

1913. *Trichodectes acutirostris* Stobbe, p. 378, fig. 7.

Described from specimens taken off water mongoose, *Atilax paludinosus* G. Cuv. (= *Herpestes galera*), Pemba. Numerous specimens have also been taken off the same host, Vredendal, Olifants River (Transvaal Mus. No. 6191).

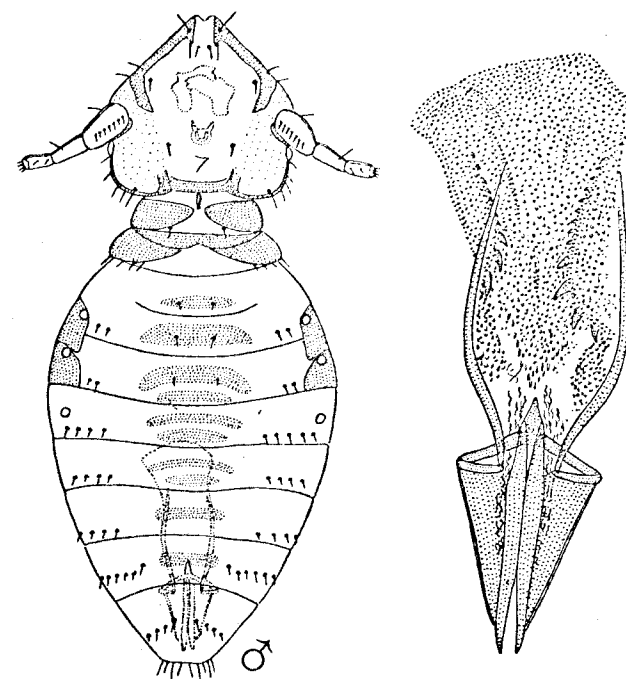


Fig. 4. *Felicola calogalea* (Bedford), dorsal aspect and genitalia of ♂.

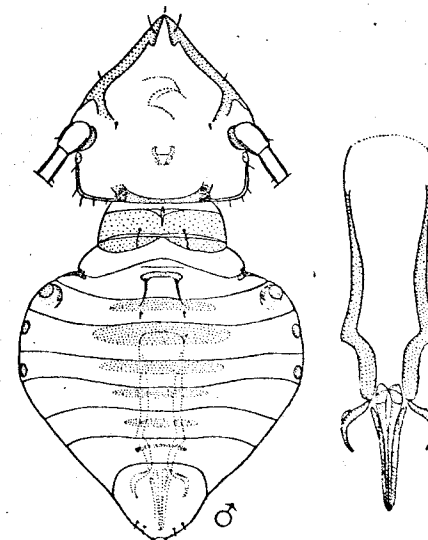


Fig. 5. *Felicola acutirostris* (Stobbe), dorsal aspect and genitalia of ♂.

I here designate the male the holotype, no previous designation having been given.

The gonopophyses of the female are similar to those of *F. setosa* (Fig. 1 F).

6. *Felicola subrostrata* (Nitzsch).

(Figs. 1 G; 6 B, b.)

1838. *Trichodectes subrostratus* Nitzsch, in Burmeister, p. 436.

1880. *Trichodectes subrostratus* (Nitzsch) Piaget, p. 389, pl. 31, fig. 9.

This species has been recorded taken off domestic cats in Europe and America; also from a domestic cat at Pietermaritzburg, Natal, but it is not common.

7. *Felicola rostrata* n.sp.

(Figs. 6 A; 6 B, a; 6 C.)

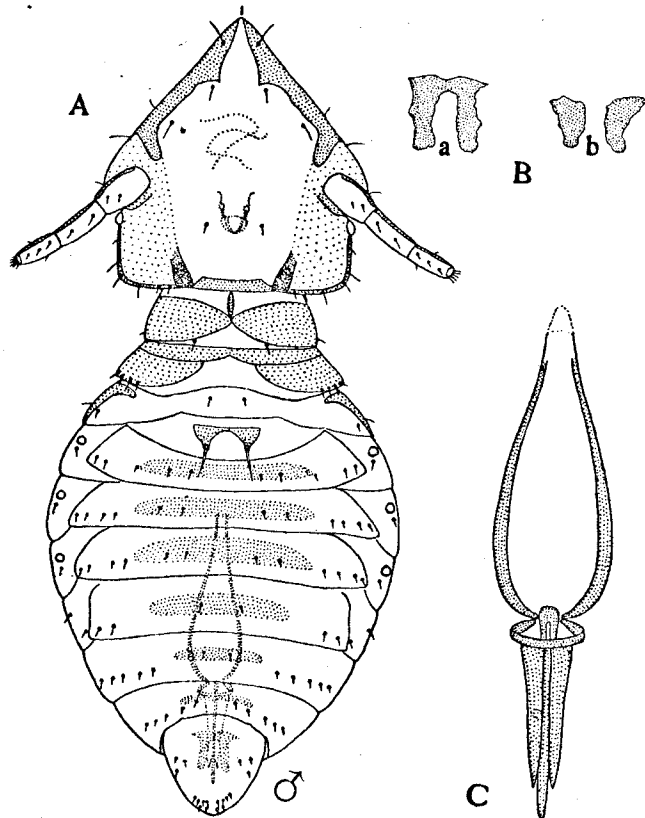


Fig. 6. *Felicola rostrata* n.sp. ♂: A, dorsal aspect; B a, sclerite of eighth tergite; C, *Felicola subrostrata* (Nitzsch) ♂, genitalia. B b, sclerites of eighth tergite.

Numerous specimens taken off white-tailed mongoose (*Ichneumia albicauda* G. Cuvier), Umfolosi River, Zululand, 1. vii. 1922 (Transvaal Mus. No. 3003). Holotype a male.

Male. Length 1.03 mm. Head 0.35 × 0.31 mm. Only differs from the

male of *F. subrostrata* in having the median, longitudinal sclerites on tergite 8 united in front.

Female. Length 1.31 mm. Head 0.42 × 0.41 mm. Indistinguishable from the female of *F. subrostrata*, except that the gonopophyses resemble those of *F. setosa* (Fig. 1 F). The length of the latter is 1.17–1.29 mm. and the head measures 0.33 × 0.33 mm. to 0.40 × 0.31 mm.

8. *Felicola cynictis* (Bedford).

(Fig. 7.)

1928. *Trichodectes cynictis* Bedford, p. 844, pl. 3, fig. 8.

Described from males and females taken off yellow mongoose (*Cynictis penicillata* G. Cuvier) at Onderstepoort, Transvaal, and at Bothaville, Orange Free State.

9. *Felicola setosa* n.sp.

(Figs. 1 F, 8.)

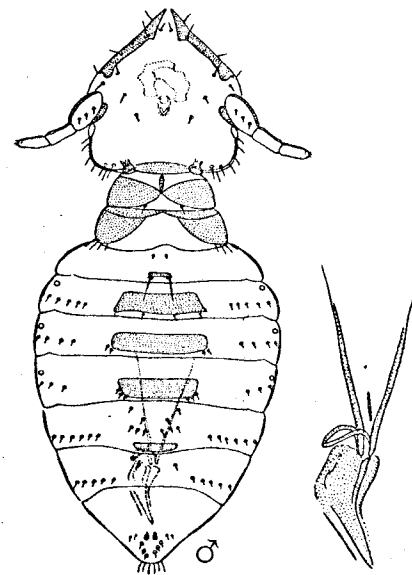


Fig. 7. *Felicola cynictis* (Bedford), dorsal aspect and genitalia of ♂.

Several males and females taken off Selous' mongoose (*Paracynictis selousi* de Winton, Mokeetsi, Transvaal (Transvaal Mus., No. 6201).

Holotype a male.

Male. Length 0.94 mm. Head 0.33 × 0.29 mm. The sclerite on tergite 1 has six well-developed setae; on tergite 5 the sclerite is duplicated; on tergite 6 it is triplicated, and on tergite 7 it is interrupted in the middle. The genitalia are distinct, but resemble those of *F. cynictis* in having the basal plate V-shaped.

Female. Length 1.13 mm. Head 0.35 × 0.36 mm. The gonopophyses are shown in Fig. 1 F. Sclerite on tergite 8 absent. It is indistinguishable from *F. cynictis*.

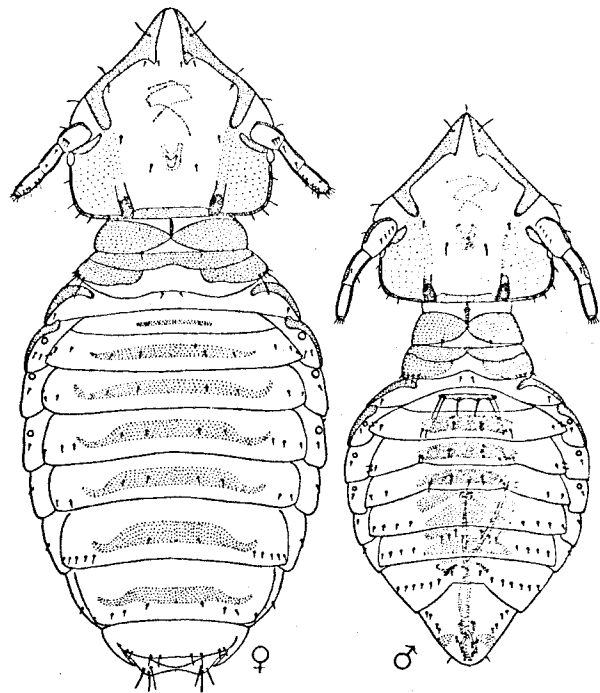


Fig. 8. *Felicola setosa* n.sp., dorsal aspect of ♂ and ♀.

10. *Felicola mungos* (Stobbe).

1913. *Felicola mungos* Stobbe, p. 375, fig. 5.

Described from specimens taken off *Herpestes affinis gracilis*, Tanganyika Territory, and from ruddy mongoose, *Myonax ratlamuchi* A. Smith (= *Herpestes badius*), Zanzibar. The former is probably its true host, and the latter record may have been due to the specimens being stragglers or, as is more likely, the host was incorrectly identified. *F. calogalea* is probably the only species parasitic on species of *Myonax*. I here designated the male the holotype, no previous designation having been given.

This is a small species resembling *F. helogale* in the shape of the head, except that the lateral margins of the forehead are not convex on each side of the middle.

Male. Length 0.92 mm. Head 0.29 × 0.38 mm.

Female. Length 1.15 mm. Head 0.3 × 0.42 mm.

11. *Felicola helogale* n.sp. (Figs. 1 D, 9.)

Two females and one immature male taken off pigmy mongoose, *Helogale parvula brunnula*. Thomas and Schwann, N'jelele River, Northern Transvaal. 6. viii. 1929 (Transvaal Mus., No. 5869). Holotype a female.

This species is probably closely related to *F. mungos*. The female can be distinguished from that of *F. setosa* (Fig. 8) and other related species in the shape of the head (Fig. 9) and gonopophyses (Fig. 1 D), and the absence of abdominal spiracles. The sclerite on the anterior margin of tergite 8 is entire. Length 0.87 mm. Head 0.26 × 0.31 mm. The head of the immature male is similar to that of the female, and the abdomen resembles that of *F. acutirostris* in shape.

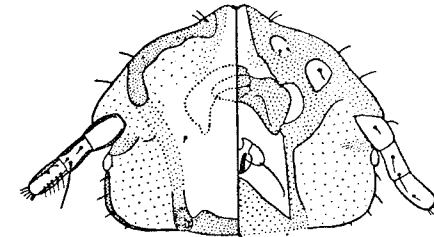


Fig. 9. *Felicola helogale* n.sp., head of ♀.

12. *Felicola acuticeps* (Neumann).

1902. *Trichodectes acuticeps* Neumann, p. 601.

Described from specimens taken off a genet in Abyssinia. I here designate the male as the holotype, no previous designation having been given. Neumann did not figure the species or describe the male genitalia, but it appears to be closely related to *F. genetta*. The first antennal segment of the male is as long as the two succeeding segments together, whereas in *F. genetta* it is shorter than the two last segments.

13. *Felicola genetta* (Bedford).

1919. *Trichodectes genetta* Bedford, p. 725, pl. 4, figs. 12-13.

Described from two slightly immature females and one male taken off small-spotted genet, *Genetta felina ludia* Thomas and Schwann, Jericho, Transvaal. I here designate the male the holotype. Females, which I take to be the same, have been collected from a large-spotted genet, *Genetta tigrina* Schreber, Pietermaritzburg, Natal (coll. L. Hill).

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