

NOTES ON TRICHODECTIDAE (MALLOPHAGA) ¹

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(With 3 figures)

The drawings in this paper have been made by Dr. F. L. WERNECK. The types of the species described below will be sent to the British Museum as soon as possible.

A new East African *Procavicola*

Procavicola (Procavicola) thornntoni n. sp.

Male. Genitalia (fig. 1) nearest to those of *P. mokeetsi* Bedford, differing as follows: basal plate narrower and almost parallel-sided in the posterior two-thirds, sides not diverging regularly towards the anterior end as in *mokeetsi*; parameres shorter and stouter; endomeres slenderer, their outer sides slightly concave (convex in *mokeetsi*), their bases much less swollen, and their apices not truncate; preputial sac clothed with minute denticles anteriorly and larger ones posteriorly (in the retracted position), but the larger denticles very much smaller than in *mokeetsi*. The basal plate is unusually well sclerotised and the bifurcation of the anterior end is easily visible even in unstained specimens.

Female. Not distinguishable from those of the other members of the subgenus.

Type-material — Holotype male, allotype female and six male and twenty-three female paratypes obtained from a skin of *Procavia johnstoni matschiei* Neumann, which Mr. D. THORNTON most kindly collected for me at Mwanza, Tanganyika Territory, in March 1942. The host-individual is a topotype of *matschiei*.

I am not at all sure that this form would not be better regarded as a subspecies of *mokeetsi*, but prefer to give it provisional specific status on account of the very marked differences in the armature of the preputial sac and in the shape of the tips of the endomeres.

The Genera of the Trichodectidae of Carnivora

BEDFORD (1939, p. 103) laid down a principle with regard to Mallophagan genera which is worthy of the widest acceptance: that the genera ought to be such that they give an indication of the group of

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hosts on which their members occur. If we accept, as all modern students of the Mallophagan do, the belief that the Mallophaga have

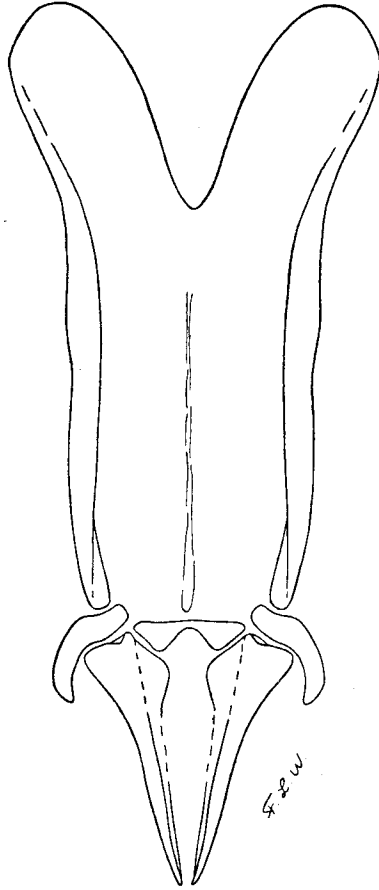


Fig. 1 — *Procavicola (Procavicola) thornntoni* n. sp., male genitalia.

evolved with (but usually more slowly than) their hosts, then the principle laid down by BEDFORD is incontrovertible. There are occasional exceptions to the general rule, due to transfer from one host to another and subsequent establishment of the parasite on its new host, but such instances are extremely rare. If, therefore, we find that by a given generic arrangement we are left with numerous instances of anomalous host-parasite relationships, we should suspect that we are using wrong criteria in our definitions of genera, and we should re-examine these criteria with this suspicion in mind.

Applying this test to the latest classification of the *Trichodectidae* (KÉLER, 1938) it at once becomes apparent that there are striking divergencies from the ideal represented by BEDFORD's principle. Taking only KÉLER's subfamily *Trichodectinae*, the genus *Trichodectes* is held to occur on *Canidae*, *Procyonidae* and *Mustelidae*, *Stachiella*, *Galictobius* and *Lutridia* on *Mustelidae* (the last-named only on the sub-

family *Lutrinae*), *Ursodectes* on *Ursidae* and *Mustelidae*, and *Neotrichodectes* on *Mustelidae* and *Procyonidae*. There is obviously something wrong, since there is hardly any correspondence between the families of the hosts and the genera of the parasites, the *Trichodectidae* of the *Mustelidae*, for instance, being allocated to every one of the six genera recognised by KÉLER, and those of the *Procyonidae* to two of the genera. I believe the explanation to be that the *Trichodectidae* are in process of dividing up into genera; in some cases the divergence has proceeded far enough for us to recognise the segregates as generically distinct, but in a much greater number of cases extreme members of a group may have become strikingly distinct while others remain as connecting-links which entirely undo our attempts to find characters peculiar to the group. KÉLER, with a profound knowledge of the very limited Trichodectid-fauna of Europe, but with very little first-hand knowledge of non-European forms, accepted the characters of the extreme forms as generic and overlooked the connecting-links, several of the most striking of which had not been described when he wrote. The most convenient way to test my belief will be to take each of the Carnivora-infesting genera of *Trichodectidae* in turn and examine the value of the characters which are supposed to separate it from *Trichodectes s. str.*

The characters of *Stachiella* are the complete absence of tergo-central setae in the female; very few (1-2) spines on the axillary pleurite; very slight antennal dimorphism; strong and thick copulatory lobes and presence of small hyaline cones on the base of the median lobe; very delicate penis with unusually long band-shaped hyaline basal plate and long, very narrow and sharp parameres.

Three African species which must unquestionably be referred to *Stachiella* if the genus is to be maintained completely dispose of the supposed generic value of these characters. In all of these species tergo-central setae are present in the female (as they are in the males of the European species also); in *Trichodectes ovalis* Bedford and *T. ugandensis* Bedford there are three or four spines on the axillary pleurite, which is hardly less than in at least one species referred by KÉLER to *Trichodectes*; antennal dimorphism, though still not great in the African species, is better-marked than in the European species known to KÉLER, and I have already shown in the case of *Felicola* that this character, taken by itself, is not of generic value (HOPKINS, 1941, p. 35); in both *ovalis* and *ugandensis* the small hyaline cones on the base of the median lobe of the female genital lobes are absent, and I am unable to understand KÉLER's supposed difference in the strength and thickness of the genital lobes, for these are (proportionately to the size of the insects themselves) of precisely the same type and size in the two groups. The African species are particularly illuminating with regard to the male genitalia, for in *T. ovalis* they conform to KÉLER's definition, in *T. ugandensis* they are of much the same type as in

the genotype of *Trichodectes*, while in *T. zorillae* Stobbe they are of yet a third type. Yet these three species are very obviously congeneric and *ovalis* and *ugandensis* are so closely related as to be not very easy to distinguish in the female sex.

The genotype of *Lutridia*, *L. exilis* (Nitzsch), certainly has a somewhat distinct facies, and if it stood alone one would be disposed to accept this genus, which KÉLER characterised by the very broad thumb-spurs of the mid and hind tibiae, the slender copulatory lobes with outwardly-curved apices, and the simple nature of the setae guarding their emarginations.

Yet in *Trichodectes lutrae* Werneck, of which KÉLER had apparently not seen the description, and which is clearly of the same group as *exilis*, we find a more normal facies, copulatory lobes quite different from those of *exilis* and much more like those of *Trichodectes* and *Stachiella* and with some of the setae guarding their emargination set on pedestals (*i. e.* not simple). This species is only known to me from WERNECK'S excellent description and figures, so I am unable to check the breadth of the thumb-spurs, but their being broader than usual seems an unsound basis on which to found a genus.

The characters of *Ursodectes* are the trapezoidal, anteriorly broadly truncate head; the proportionately small, elliptical abdomen; the strong emargination of the genital lobes, which is fringed with simple setae; and the presence of four thumb-spurs on the mid and hind tibiae. KÉLER regards the genus as intermediate between *Trichodectes* and *Lutridia*.

Examination of KÉLER'S excellent figures of the genotype shows that in the first two characters the difference from *Trichodectes* or *Stachiella* is practically nil. The emargination of the genital lobes is certainly unusually deep, but I cannot regard this as a generic character; the fact that the setae on the margin of this emargination are not set on pedestals is obviously unimportant, because in *Trichodectes lutrae* Werneck three of the setae are on pedestals and the rest arise direct from the margin. The only remaining character is the number of thumb-spurs on the mid and hind tibiae, and this loses all significance when we note that in KÉLER'S definition of *Trichodectes s. str.* he states that from two to four thumb-spurs may be present. I have already stated that I do not consider the type of male genitalia of generic import, but for those who disagree with me it may be worth noting that the male genitalia of *Ursodectes pinguis* (Burmeister) are described by CUMMINGS (1916, pp. 273, 283) as being the same type as in the genotype of *Trichodectes*.

EWING'S description of *Neotrichodectes* (1929, p. 194) is long and careful, but gives hardly any characters of real value. It runs as follows:

"Forehead irregularly rounded except for the frontal notch at the junction with the hair groove. Heavy internal skeleton joins lateral,

chitinized margin of forehead a short distance in front of antennae. Hair groove almost closed below in front of mandibles by lateral flaps. Antennae very different in the two sexes, second segment in female without lateral process and first in male without the same. Genital armature of type found in *Geomydoecus*, having the armature proper surrounded by an U-shaped structure; basal plate with lateral margin thickened into rodlike structures; parameres united, forming a stout pseudopenis; endomeres poorly developed".

In a later paper (1936, p. 242) EWING clearly attaches most importance to the absence of abdominal spiracles and the form of the male genitalia (of the parts of which he now recognises the homologies) and he includes in the genus certain species which I unhesitatingly refer to *Felicola*.

None of the characters given, except the apparent absence of abdominal spiracles² and pleural plates, and the structure of the male genitalia would serve to distinguish this genus from *Trichodectes* s. str. I have mentioned elsewhere (HOPKINS, 1941, p. 36) the fact that spiracles may be present and apparently absent in forms which are so closely related that they might well be regarded as of no higher rank than subspecies. As regards differences in the male genitalia, one has only to examine such obviously closely related species as *Procavicola angolensis* Bedford and *P. lopesi* Bedf., or *Felicola acutirostris* (Stobbe), *F. rammei* (Stobbe) and *F. calogaleus* (Bedf.), to be convinced that to regard differences in the structure of the male genitalia, taken by themselves, as of generic value is to obscure the true relationships of the species. Not only do the genitalia of closely-related species very frequently differ greatly, but the same type of genitalia crops up again and again in groups which are very distinct.³

The genus *Galictobius* was separated from *Trichodectes* by the curved preantennal region, with flatly triangular osculum, and by certain characters of the male genitalia (parameres broadly triangular, sharply pointed; basal plate with transverse band on posterior margin; preputial sac with four strong teeth). I consider all these characters to be of no more than specific value.

According to KÉLER the genus *Felicola*, with *Bedfordia*, *Protelicola* and *Suricatoecus*, would constitute the subfamily *Felicolinae*. I have already dealt with these supposed genera (HOPKINS, 1941, p. 35) and have expressed the opinion that *Bedfordia* and *Suricatoecus* certainly, and *Protelicola* probably, cannot be separated from *Felicola*. Even *Fe-*

² WERNECK (1937, p. 20, footnote) doubts this absence being genuine.

³ Compare *Cervicola lipeuroides* (Megnin), *Damalinea crenelata* (Piaget), *Dasyonyx validus* Bedf., *Felicola viverriculae* (Stobbe), *Geomydoecus geomydis* (Osborn), and *Procavicola jordani* Bedf., all showing quite small deviations from one rather peculiar type of genitalia, and including representatives of all three of the families into which KÉLER divides this group of Mallophaga. The importance of the differences in the male genitalia is very easy to exaggerate; throughout the group the same parts (basal plate, parameres, endomeres, preputial sac and intercalary pieces between the bases of the parameres) are found, the differences being only in the reduction or fusion of these same parts.

licola itself, though the more typical species are very different in appearance from *Trichodectes* s. str., is separable with great difficulty, if at all, since such species as *F. mungos* (Stobbe) seem to me to bridge the gap between KÉLER'S *Trichodectinae* and *Felicolinae* almost, if not quite, completely. My own opinion is that the genus is good, in spite of the difficulty of defining it, though the group certainly does not merit subfamily rank. Pending the discovery of better characters it can be separated from *Trichodectes* by the fact that the whole of the dorsal abdominal chaetotaxy (except for the setae on the specialised tergal plate of the first abdominal segment in the males of a few species) is composed of microchaetae; in the remaining groups of species found on Carnivora at least several of the anterior abdominal segments possess macrochaetae, even in *Trichodectes exilis* Nitzsch, which shows the nearest approach to *Felicola* in this respect.

From the above evidence I am forced to conclude that, excluding *Felicola* and perhaps *Protelicola*, there is only one genus of *Trichodectidae* on Carnivora. The members of certain groups, such as *Lutridia*, tend to resemble each other more closely than they resemble the members of other groups, but it is not possible to recognise them as being worthy of even subgeneric rank. In my opinion *Stachiella*, *Lutridia*, *Ursodectes*, *Neotrichodectes* and *Galictobius* should all be regarded as synonyms of *Trichodectes* Nitzsch, 1818.

A new East African *Felicola*

Felicola bedfordi n. sp.

Female (fig. 2) — At once separable from all other known species of the genus by the possession of one (only) pair of abdominal spiracles. Length 1.39 mm.

Head as broad as long (index 1.00), preantennal region strongly triangular, its sides somewhat convex at each end but very distinctly concave in the median portion; eye unusually prominent; vertex smoothly convex, its median portion projecting posteriorly, not (as is usual in the genus) placed more anteriorly than the hind margin of the temples. Prothoracic spiracle unusually large. Abdomen oval, very stout, with a very large spiracle on the second (apparent) segment, but none on any other segment; tergal sclerites very broad and shallow, anterior ones almost linear, more posterior ones broader, all shaped very much as in *F. acutirostris* (Stobbe); gonapophyses (fig. 3) also very like those of *acutirostris*, but both lobes (especially the outer one) distinctly broader.

Type-material — Female holotype and five female paratypes collected by myself, together with several nymphs, from a skin of *Bdeogale crassicauda omnivora* Heller (a mongoose), obtained at Sokoke Forest, near Malindi, Coastal Province, Kenya, on 23.vi.1932.

I would not normally have described a new species of *Felicola* without knowing the male, but *F. bedfordi* is so distinct and of such unusual interest and importance with regard to the classification of the genus, that this course seems fully justified. The number of

specimens obtained is sufficient to constitute a very strong indication that *Bdeogale* is the true host.

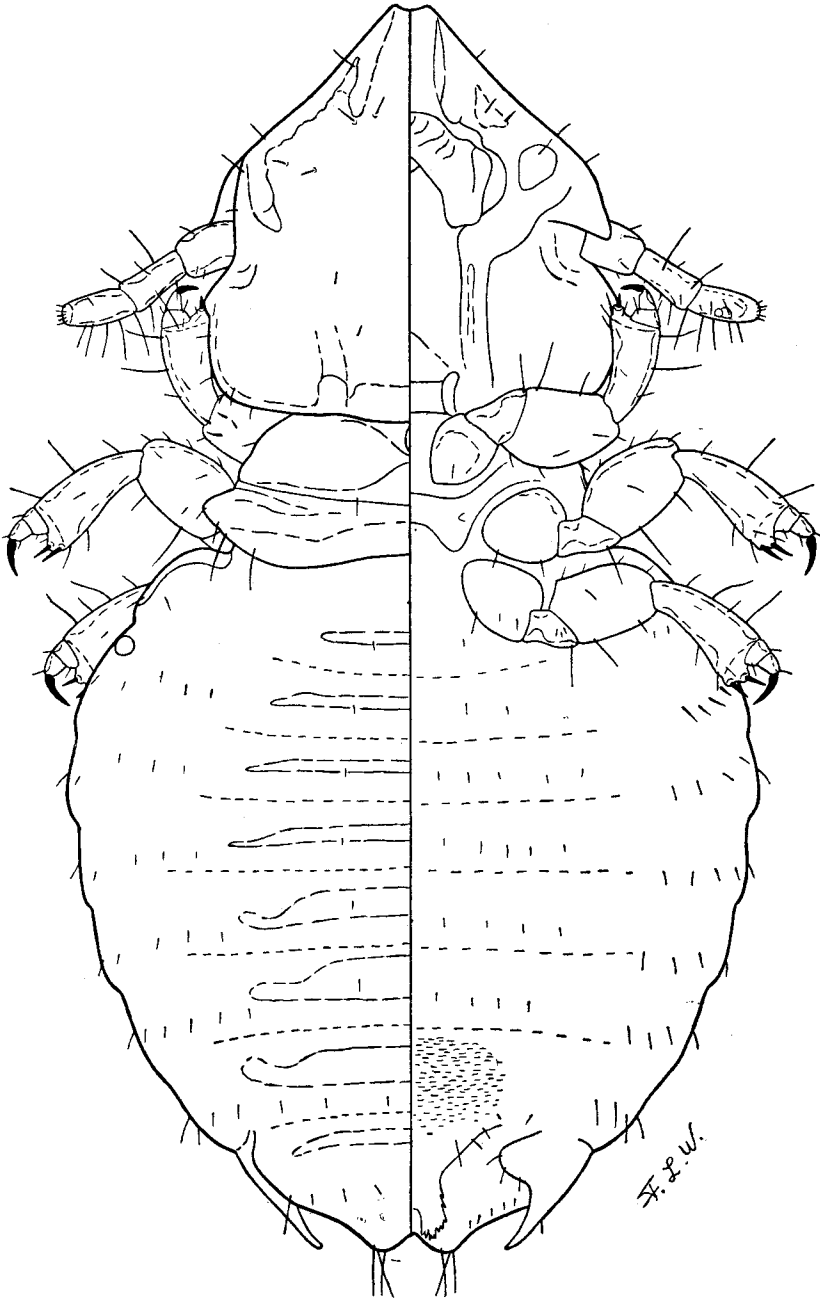


Fig. 2 — *Felicola bedfordi* n. sp., female.

The point of special interest about the new species is its possession of only one pair of abdominal spiracles, because in all hitherto-known species of the genus there are either six, four or three pairs, or none

at all. The condition found in *bedfordi* is faintly foreshadowed in *Felicola acutirostris* (Stobbe); in this latter species there are three pairs of abdominal spiracles, but the spiracles of the two posterior pairs are very distinctly smaller than those of the anterior pair.

It is a great pleasure to name such an unusually interesting species in honour of my friend the late Mr. G. A. H. BEDFORD, who did so much to increase our knowledge of the African *Trichodectidae*.

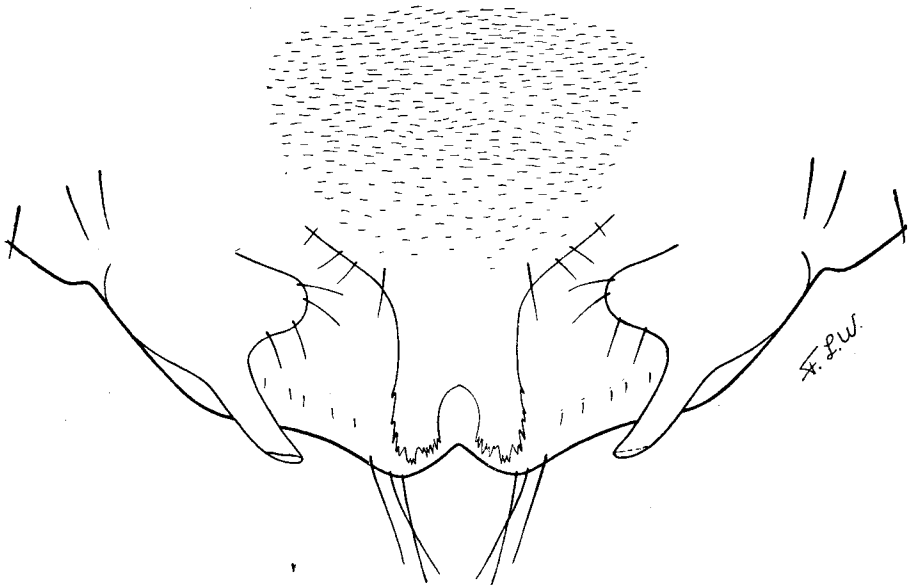


Fig. 3 — *Felicola bedfordi* n. sp., female genitalia.

In a recent paper I found it necessary (HOPKINS, 1941, p. 36) to place the genus *Bedfordia* Kéler, 1938 as a synonym of *Felicola* Ewing, 1929. My further studies on the genus have given me no reason to alter this opinion, but I find that my action was almost unnecessary because the name *Bedfordia* is preoccupied, having been used by FAHRENHOLZ in 1935 for a genus of sucking lice.

The *Trichodectidae* of domestic Goats

Unlike the vast majority of Artiodactyla, domestic goats are infested with no less than three species of *Trichodectidae* — a fact possibly attributable to the polyphyletic origin of the host. The fact that this host is a domestic animal resulted in the parasites becoming known at a fairly early date, and the fact that there are three of them, coupled with the carelessness and irregularities of authors of the nineteenth century, has produced a situation in which the correct name of every one of the parasites is in dispute. No less than seventeen names (omitting misspellings and emendations) have been employed for the three species, and the name *limbatus* Gervais has been used

by different authors for all three of them. The types of several of the names being lost, it is open to each author to interpret the descriptions according to his own beliefs, and the only way to avoid an indefinite continuance of this state of chaos is to fix the names by erecting neotypes where necessary. This I propose to do in the following notes.

An essential preliminary is to establish provisional names under which the species can be discussed without any doubt arising as to which is meant. I propose to refer to *Trichodectes hermsi* Kellog & Nakayama (1915, p. 34) as "the *Holakartikos*", to the species redescribed by WERNECK (1936, p. 540, figs. 175-178) as *T. caprae* Gurlt as "*Bovicola A*", and to the species redescribed by the same author as *T. limbatus* Gervais (*l. c.*, p. 545, figs. 179-182) as "*Bovicola B*" until I have established what are their correct names. "The *Holakartikos*" is only known from the Angora goat, "*Bovicola A*" and "*Bovicola B*" both occur on both Angora and common goats, but the former is more characteristic of the common goat and the latter of the Angora goat, and there is evidence which suggests that common goats are only infested with "*Bovicola B*" if the goats have been in contact with Angoras and that the same is true as regards Angora goats and "*Bovicola A*".

NITZSCH (1818, p. 296) created the original source of the confusion by mentioning a *Trichodectes climax* of "Caprae Aegagri dom." without "an indication, or a definition, or a description" (Article 25, International Rules of Zoological Nomenclature). From the subsequent descriptions of GIEBEL (1861, p. 81, pl. 1 figs. 1, 2) and others, including KÉLER (1938, p. 446, fig. 32), it is clear that NITZSCH's material was of "*Bovicola A*", but the name *climax* had no validity until provided with a description or other indication. Before such an indication had been provided GURLT had given "*Bovicola A*" another name.

GURLT (1843, p. 3, pl. 1 fig. 2) described and figured a *Trichodectes caprae* from "Ziege"; this is unquestionably the first valid name for any Trichodectid from a goat. His figure is fairly good and his series of cotypes is, according to TASCHEBERG (1882, p. 214) in the Berliner Thierarzenschule, with the name *caprae* struck out and *climax* substituted, apparently by GURLT himself. The name undoubtedly applies to "*Bovicola A*", which must be known as *Bovicola caprae* (Gurlt). Lectotypes should be selected from GURLT's series in Berlin.

In 1844 GERVAIS described two species from "Chèvre d'Angora" as "*Trichodectes climax?*" (p. 313, pl. 48 fig. 3) and *Trichodectes limbatus* (p. 313, pl. 48 fig. 4). These two names have been the bugbear of systematists ever since, both being really indeterminable. *T. climax* Gervais has usually been assumed either to be the same as *T. climax* Nitzsch, 1818 or to be preoccupied by the latter, but both these assumptions are wrong; a *nomen nudum* has no standing in nomenclature and cannot invalidate the later use of the same name, and GERVAIS' *climax* is not that of NITZSCH. The most important fact about

T. climax Gervais, however, is the presence of the question-mark, which (although the fact has been ignored by all later authors) renders it a *nomen nudum*. Since GIEBEL described *T. climax* Nitzsch in 1861 and all references to *climax* Gervais without the question-mark are later, GERVAIS' name is preoccupied by *climax* Nitzsch 1861, though not by *climax* Nitzsch 1818. In these circumstances I need only mention that BEDFORD (1936, p. 41) was the first to suggest that GERVAIS' species was not any known goat-parasite, that KÉLER (1937, p. 316 and 1938, p. 446) confidently identified it as a straggler from some Carnivorous host, and that WERNECK (1938, p. 396) pointed out the improbability of this suggestion and thought it might possibly be the *Holakartikos*. In these circumstances it is indeed fortunate that the presence of the question-mark saves us the unprofitable and probably vain task of attempting to identify the species.

T. limbatus Gervais is unquestionably validly described and the fact that it is a true goat-parasite has never been questioned, but the name has been applied by different authors to every one of the three known parasites of goats. GIEBEL (1874, p. 57) merely quoted the description; PIAGET (1880, p. 395) contented himself with remarking that GERVAIS described it as having eight abdominal segments and figured it with nine; TASCHENBERG (1882, p. 214) considered it to be probably the same as "*Bovicola A*". The first real attempt to identify *limbatus* was made by OSBORN (1896, p. 206, fig. 129), who described and figured "*Bovicola B*" as *Trichodectes limbatus* Gervais; in my opinion this identification by the first reviser should be accepted unless there is conclusive evidence that it is wrong. OSBORN'S identification of *limbatus* apparently passed unchallenged for forty years, when BEDFORD (1936, p. 41) rejected *limbatus* as indeterminable. KÉLER (1937, p. 316) stated that *limbatus* was "*Bovicola A*", which he insists on calling *climax* Nitzsch. WERNECK (1938, pp. 398-400) restored the name *limbatus* for the species which OSBORN called by this name.

I can find nothing whatever in the original description and figure published by GERVAIS which conflicts with OSBORN'S identification of the species. KÉLER (1938, p. 316) claims that the proportions of head and body indicate that the species is "*Bovicola A*", but these proportions must have been taken from the very indifferent figure, for no measurements are given in the description, and in any case they would give us no certain indication of what the species was.

To put an end to the controversy, I hereby designate as neotype male and neallotype female of *Trichodectes limbatus* Gervais a pair of specimens, in the BEDFORD collection of Mallophaga, which were taken from Angora goats at Onderstepoort, Transvaal, and which agree excellently with the description and figures published by WERNECK (1936, p. 545, figs. 179-182); I designate as neoparatypes a second pair in the BEDFORD collection and a pair in my own collection from the same

host and locality. This definitely fixes "*Bovicola B*" as *Bovicola limbatus* (Gervais).

Trichodectes climacium Giebel (1861, p. 292) is a mere unnecessary *nomen novum* for *climax* Nitzsch and is based on the same types; it can, therefore, be dismissed at once. The next names to be considered are those put forward by RUDOW.

In 1866 RUDOW published a paper in which he gave descriptions and figures of three supposedly new goat-Mallophaga: *Trichodectes mambricus* (p. 111, pl. 6 fig. 2) from "*Hircus mambricus* aus Westafrika", *T. crassipes* (p. 111, pl. 7 fig. 1) from "die Angora ziege", and *T. solidus* (p. 112, pl. 7 fig. 2) from "Ziege von Guinea". The figures are almost incredibly bad, giving no assistance whatever towards the recognition of the species⁴, and the descriptions are little better. PIAGET (1880, p. 394) listed the names with caustic and fully-justified criticism of the figures. Fortunately TASCHENBERG was able to examine part of RUDOW's type-material of *crassipes* and *solidus* and to establish what they are. He states that *solidus* "ist identisch mit *Tr. climax*", i. e. is *Bovicola caprae* (Gurlt), and his statement can certainly be accepted, because RUDOW's material included males and the male of *limbatus* is strikingly different from that of *caprae* although the females could easily be confused. Unfortunately he was unable to see specimens of *mambricus*, but he considered that this, also, was probably a synonym of *B. caprae* (Gurlt). In this suggestion I have not the smallest doubt that he was right: there is no such animal as *Hircus mambricus* (still further distorted, by GIEBEL or the printer's devil, to *Hircus manubricus* with *Trichodectes manubricus* as its parasite), but *Capra mambrina* is an African variety of the domestic goat. I have examined a very long series of Mallophaga from African domestic goats in Uganda and have failed to find any Trichodectid except *Bovicola caprae* (Gurlt).

Trichodectes crassipes is undoubtedly a good species, but we have to establish its identity by a rather circuitous method: TASCHENBERG stated (p. 214) that it is identical with *T. penicillatus* Piaget; this latter species is the *Holakartikos*, which is only known from the Angora goat and is the most unmistakable of all the three goat-Mallophaga. The only author who has seriously disputed this identification is KÉLER (1937, p. 318), who does so on the ground that the size mentioned by RUDOW is less than half that of the *Holakartikos*, but I have shown (HOPKINS, 1940, p. 418) that RUDOW's measurements are usually fantastically incorrect. There can, therefore, be no doubt that the *Holakartikos* must be called *H. crassipes* (Rudow). I cannot erect neotypes for any of RUDOW's species because of the probability that the

⁴ Compare RUDOW's figures of *Trichodectes mexicanus* and *T. breviceps* with those of the same species published by TASCHENBERG.

types may still be in the Hamburg Museum, where those of *solidus* and *crassipes* certainly were in TASCHENBERG's time.

PACKARD (1871, p. 96, fig. 28) described and figured a *Trichodectes caprae*, evidently in ignorance of the fact that this name had already been employed by GURLT. There has been some discussion (see OSBORN, 1896, p. 205) as to whether PACKARD's species is *B. limbatus* (Gervais) or *B. caprae* (Gurlt), but the point is not of much importance, since GURLT's name has many years priority. The late Mr. G. A. H. BEDFORD agreed with me (*in litt.*) that the very bad figure probably represents the species described by GURLT under the same name.

PIAGET (1880) added quite considerably to the confusion by describing two lots of stragglers or mis-labelled specimens. His "*Trichodectes pilosus* G." (p. 395, pl. 32 fig. 4) has nothing to do with GIEBEL's species, nor with its own supposed host (the ass), but is *Holakartikos crassipes* (Rudow), as also is PIAGET's *T. penicillatus* (p. 406, pl. 32 fig. 10), supposedly from a species of kangaroo. PIAGET's material of both these species is in the British Museum, where BEDFORD examined the specimens (BEDFORD, 1936, p. 42). The types of PIAGET's var. *truncatus* (PIAGET, 1880, p. 393) are also in the British Museum and were examined by BEDFORD, who found (BEDFORD, 1936, p. 40) that this form is *B. caprae* (Gurlt).

TASCHENBERG, in addition to giving us the absolutely invaluable information about RUDOW's species which I have already mentioned, did not fail to add slightly to the prevailing chaos. He described (p. 218, pl. 7 fig. 10) a *Trichodectes peregrinus*, supposedly from a marabout stork, the type of which has been examined by KÉLER (1938, p. 219) and found to be a perfectly ordinary female of *B. caprae* (Gurlt).

The next contribution to the muddle was PIAGET's description (1885, p. 86, pl. 9 fig. 5) of *Trichodectes climax* var. *major* from "*Hircus angorensis*". Unfortunately PIAGET did not attach much importance to the forms he described as varieties (many of which are excellent species) and frequently did not label them with the varietal name. The fact that his specimens from Angora goat, which are in the British Museum, are not labelled var. *major* has given rise to doubt as to whether they are the types of the variety, but I think this doubt needless, since they agree with the description and are from the correct host. If these specimens are not the types, then the types are lost, and to avoid any further uncertainty I formally designate the series as neotypes of *climax* var. *major* Piaget. BEDFORD (1936, p. 40) examined the specimens and found them to be the species which I have fixed, above, as *Bovicola limbatus* (Gervais). Lectotypes should be selected from this series.

MJÖBERG (1910, p. 64, figs. 38, 39) found a single male Trichodectid on an alcoholic specimen of *Eupleres goudoti* (a member of the *Herpestinae*, or mongooses) received a short time previously from Madagascar. His figures are rather sketchy but not inaccurate, and show

the species to be an undoubted *Bovicola*. Since there are no indigenous Ungulata in Madagascar, the true host must be *Bos*, *Equus* or *Capra*, and the figures show no resemblance to the parasites of the two former hosts. It has not been possible to examine the type, but Dr. F. L. WERNECK and I have been in correspondence about the species and are agreed that the figures unquestionably represent *Bovicola limbatus* (Gervais).

I am unable to add anything to our knowledge of *Trichodectes baculus* Schömmer (1913, p. 26), described from specimens obtained from "oberbayrischen Ziegen", because I have been unable to consult a copy of SCHÖMMER's very rare paper. MÜLLER (1932, p. 20) seems to think that it may be *Trichodectes hermsi* Kellogg and Nakayama, which is *Holakartikos crassipes* (Rudow); KÉLER (1938, p. 447, footnote) states that it is not *B. caprae* (Gurlt) but makes no suggestion as to its real identity.

Trichodectes painei Kellogg and Nakayama (1914, p. 90, fig. 1) was described from a male and a female supposed to have been collected on two different species of birds on islands off Baja California. The description and figures are fairly good and it is generally recognised that the species is *Bovicola limbatus* (Gervais).

In April of the following year the same authors published (1915, p. 34) the description of *Trichodectes hermsi* from "merino goat", corrected the following month (KELLOGG & FERRIS, 1915, p. 58) to Angora goat. Very shortly afterwards HALL (1915, p. 186) suggested the strong probability that *hermsi* was the same as *crassipes* Rudow and *penicillatus* Piaget. This suggestion is certainly correct, and KÉLER (1937, p. 317) uses *hermsi* for the species which should be called *Holakartikos crassipes* (Rudow).

The last two names we need to consider are *Bovicola sachtlebeni* Kéler (1937, p. 314, figs. 1, 2) and *B. wernecki* Kéler (*l. c.*, p. 317). WERNECK (1938, p. 399) has dealt thoroughly with these supposed species and has shown conclusively that both are synonyms of *B. limbatus*, the differences being due solely to accidents of preparation and mounting.

To summarise: there are three species of *Trichodectidae* which are normal parasites of domestic goats; they should be called *Bovicola caprae* (Gurlt), *B. limbatus* (Gervais) and *Holakartikos crassipes* (Rudow). Of these, *caprae* is normal to the common goat, *limbatus* to the Angora goat, and *crassipes* has only been found (apart from obvious accidental contaminations) on the latter host. Where the two kinds of goat are in close association, as in South Africa, there is some interchange of the two species of *Bovicola* between the two hosts, but the extent to which this occurs is not known. In order to terminate the unending controversy as to the identity of *Trichodectes limbatus* Gervais, I have adopted the views of the first reviser to express a de-

finite opinion (OSBORN, 1896) and have erected neotypes for the species. The synonymies of the three species are given below.

Bovicola caprae (Gurlt, 1843)

- (*Trichodectes climax* Nitzsch, 1818, p. 296. *Nomen nudum*).
Trichodectes caprae Gurlt, 1843, p. 3, pl. 1, fig. 2.
Trichodectes climactum Giebel, 1861, p. 292.
 ?*Trichodectes mambricus* Rudow, 1866, p. 111, pl. 6, fig. 2.
Trichodectes solidus Rudow, 1866, p. 112, pl. 7, fig. 2.
Trichodectes caprae Packard, 1871, p. 96, fig. 28.
Trichodectes climax var. *truncata* Piaget, 1880, p. 393.
Trichodectes peregrinus Taschenberg, 1882, p. 218, pl. 7, fig. 10.

Bovicola limbatus (Gervais, 1844)

- Trichodectes limbatus* Gervais, 1844, p. 313, pl. 48, fig. 4.
Trichodectes climax var. *major* Piaget, 1885, p. 86, pl. 9, fig. 5.
Trichodectes limbatus Osborn, 1896, p. 206, fig. 129.
Trichodectes madagascariensis Mjöberg, 1910, p. 64, figs. 38, 39.
Trichodectes painei Kellogg and Nakayama, 1914, p. 90, fig. 1.
Bovicola sachlebeni Kéler, 1937, p. 314, figs. 1, 2.
Bovicola wernecki Kéler, 1937, p. 317.

Holakartikos crassipes (Rudow, 1866)

- Trichodectes crassipes* Rudow, 1866, p. 111, pl. 7 fig. 1.
Trichodectes "pilosus G." Piaget, 1880, p. 395, pl. 32, fig. 4, *nec* Giebel, 1874.
Trichodectes penicillatus Piaget, 1880, p. 406, pl. 32, fig. 10.
Trichodectes hermsi Kellogg & Nakayama, 1915, p. 34.

The status of the genus *Bovicola* will be discussed in a future paper.

REFERENCES

- BEDFORD, G. A. H., 1936, Notes on species of Trichodectidae with Descriptions of New Genera and Species, *Onderst. J. Vet. Sci. Anim. Ind.*, 7: 33-58.
 BEDFORD, G. A. H., 1939, Further Notes on species of Trichodectidae, with Descriptions of New Species, *Onderst. J. Vet. Sci. Anim. Ind.*, 12: 103-119.
 CUMMINGS, B. F., 1916, Studies on the Anoplura and Mallophaga, part I., *Proc. Zool. Soc. Lond.*, 1916, pp. 253-295.
 EWING, H. E., 1929, *A Manual of External Parasites*. London.
 EWING, H. E., 1936, The taxonomy of the Mallophagan family Trichodectidae, with special reference to the New World fauna, *J. Parasit.*, 22: 233-246.
 GERVAIS, P., 1844, *Aptères* (in Walckenaer's *Histoire Naturelle des Insectes*, 3: 307-361 and Atlas, p. 23, pls. 48, 49).
 GIEBEL, C. G., 1861a, Die Haarling der Gattungen *Trichodectes* und *Gyropus*. *Z. ges. Nat.*, 18: 81-93.
 GIEBEL, C. G., 1861b, Verzeichniss der von Chr. L. Nitzsch untersuchten Epizoen nach den Wohnthiere geordnet, *Z. ges. Nat.*, 18: 289-319.
 GIEBEL, C. G., 1874, *Insecta Epizoa*. Leipzig.
 GURLT, E. F., 1843, Ueber die auf den Haus-Säugethieren und Haus-Vogeln lebenden Schmarotzer-Insekten und Arachniden, pt. II. *Mag. ges. Thierheilk.*, 9: 1-10.
 HALL, M. C., 1915, A note in regard to *Trichodectes hermsi*, *Proc. Ent. Soc. Wash.*, 17: 186-187.
 HOPKINS, G. H. E., 1940, Stray Notes on Mallophaga, nos 5-8, *Ann. Mag. Nat. Hist.*, 11 (5): 417-429.
 HOPKINS, G. H. E., 1941, New African Mallophaga, *J. Ent. Soc. S. Africa*, 4: 32-47.
 KÉLER, S., 1937, Ueber einige neue und interessante Mallophagen des Deutschen Entomologischen Instituts in Berlin-Dahlem, *Arb. morph. tax. Entom.*, Berlin-Dahlem, 4: 312-324.
 KÉLER, S., 1938, Baustoffe zu einer Monographie der Mallophagen, 1. Teil, Überfamilie der Trichodectoidea, *Nova Acta Leopoldina*, N. F., 5: 395-467.
 KELLOGG, V. L. & FERRIS, G. F., 1915, The Anoplura and Mallophaga of North American Mammals, *Stanford Univ. Public.*, *Univ. Ser.*, pp. 1-74.
 KELLOGG, V. L. & NAKAYAMA, S., 1914, A new *Trichodectes* from Baja California, *Psyche*, 21: 90-92.

- KELLOGG, V. L. & NAKAYAMA, S., 1915, A new Trichodectid from the goat, *Psyche*, 22: 33-35.
- MJØBERG, E., 1910, Studien über Mallophagen und Anopluren. *Arkiv. Zool.*, 6: 1-296.
- MULLER, T., 1932, Ergänzungen zu den Beobachtungen über die Mallophagen der Frischen Nehrung... *Ber. Westpreuss. Bot.-Zool. Ver.*, 54: 17-37.
- NITZSCH, H., 1818, Die Familien und Gattungen der Thierinsekten, *Germer's Mag. Ent.*, 3: 261-316.
- OSBORN, H., 1896, Insects affecting domestic animals, *Bull. 5 (n. s.) U. S. Dept. Agric. Div. Entom.*, pp. 189-249.
- PACKARD, A. S., 1871, Certain parasitic insects. *Amer. Nat.*, 4: 83-99.
- PIAGET, E., 1880, *Les Pédiculines*, Leyden.
- PIAGET, E., 1885, *Les Pédiculines*, Supplément, Leyden.
- RUDOW, F., 1866, Sechs neue Haarlinge, *Z. ges. Nat.*, 27: 109-115.
- SCHÖMMER, F., 1913, Über die Mallophagen, insbesondere die unserer Haustiere. *Dissert.*, Giessen.
- TASCHENBERG, O., 1882, Die Mallophagen, *Nova Acta Halle*, 44: 1-244.
- WERNECK, F. L., 1936, Contribuição ao conhecimento dos mallophagos encontrados nos mamíferos sul-americanos, *Mem. Inst. Oswaldo Cruz*, 31: 391-589.
- WERNECK, F. L., 1937, Notas para o estudo da ordem Mallophaga, *Mem. Inst. Oswaldo Cruz*, 32: 13-27.
- WERNECK, F. L., 1938, Sobre os mallophagos da cabra, do cavallo e do jumento, *Mem. Inst. Oswaldo Cruz*, 33: 395-401.