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NOTES ON TRICHODECTIDAE (MALLOPHAGA) [1]

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(With 21 figures)

Figures 1-9 in this paper are the work of my friend Mrs. G. J. EDNEY, to whom I wish to express my gratitude. For the remaining figures I am deeply indebted to my friend Dr. F. L. WERNECK, who spontaneously offered to make the drawings and also undertook the wearisome task of reading the proofs for me.

The types of all the species described below will be presented to the British Museum as soon as conditions allow.

THE GENERIC POSITION OF THE MALLOPHAGA OF THE ANTELOPES

All hollow-horned ruminants which have been sufficiently examined have been found to possess one species of *Trichodectidae,* and the domestic goat is the sole known instance in this group of mammals of a host which possesses more than one species of *Trichodectidae.* The genera into which the forms found on antelopes have been divided include *Damalinia* Mjöberg, 1910; *Bovicola* Ewing, 1929; *Tricholipeurus* Bedford, 1929; and *Holakartikos* Kéler, 1938. The genotypes of *Damalinia* and *Tricholipeurus* are from antelopes, those of *Bovicola,* and *Holakartikos* from the domestic goat.

Using BEDFORD'S principle (mentioned in my last paper published in this journal) to examine the *Trichodectidae* of the antelopes, it soon becomes obvious that there is something seriously wrong with our present generic concepts. I give below a list of the antelopes from which *Trichodectidae* are known, with the genus in which each parasite would be included if we use the current classification. The hosts are arranged according to their subfamilies, and I have added (for a reason which will become apparent below) the approximate height of the host at the shoulder. The subspecies of the hosts are omitted.

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HOST	*SUBFAMILY*	*HEIGHT*	*PARASITE*
Alcelaphus lelwel	*Alcelaphinae*	52"	*Bovicola*
Damaliscus albifrons	"	40-42"	*Damalinia*
Connochaetes gnou	"	46"	*Bovicola*
Gorgon taurinus	"	51-52"	*Damalinia*
Cephalophus caerulus	*Cephalophinae*	13"	*Tricholipeurus*
Cephalophus nigrifrons	"	18-19"	*Tricholipeurus*
Sylviacapra grimmi	"	23-25"	*Tricholipeurus*
Oreotragus oreotragus	*Oreotraginae*	20-22"	?
Neotragus pygmaeus	*Neotraginae*	10"	*Tricholipeurus*
Ourebia ourebi	"	24-26"	*Tricholipeurus*
Raphicerus campestris	"	22"	*Tricholipeurus*
Rhynchotragus guentheri	*Madoquinae*	14"	*Tricholipeurus*
Adenota kob	*Reduncinae*	32-35"	*Bovicola*
Kobus ellipsiprymnus	"	48-53"	*Bovicola*
Onotragus leche	"	40-41"	*Bovicola*
Pelea capreolus	"	30-31"	*Bovicola*
Redunca arundinum	"	36-37"	*Tricholipeurus*
Redunca fulvorufula	"	28-31"	*Tricholipeurus*
Aepyceros melampus	*Aepycerotinae*	37-38"	*Tricholipeurus*
Aepyceros petersi	"	38"	*Tricholipeurus*
Antidorcas marsupialis	*Antilopinae*	30-32"	*Tricholipeurus*
Antilope cervicapra	"	32"	*Tricholipeurus*
Gazella dorcas	"	21-24"	*Tricholipeurus*
Gazella granti	"	32-34"	*Tricholipeurus*
Gazella thomsonii	"	25-27"	*Tricholipeurus*
Taurotragus oryx	*Tragelaphinae*	67-70"	*Damalinia*
Tragelaphus scriptus	"	28-30"	*Tricholipeurus*

It is quite clear from the above list that there is no good correlation between subfamily of host and genus of parasite. At first sight there does appear to be a very imperfect correlation of this nature (the *Antilopinae,* for instance, possessing only *Tricholipeurus*), but further examination immediately shows that a subfamily of hosts is infested with only one genus of parasites when the subfamily shows no great range in size and not otherwise. There is a most striking (though not quite perfect) correlation between size of host and genus of parasites : with the sole exception of *Bovicola pelea Bedford*, from *Pelea capreolus*, the species referred to *Damalinia* and *Bovicola* are all from hosts of large size and the parasites referred to *Tricholipeurus* are all from much smaller animals. [2]

The single discrepancy is probably due to the true correlation being with texture of coat rather than with size — a coarse coat usually, though not invariably, going with large size; unfortunately I do not

[2] An exactly parallel phenomenon occurs in the *Trichodectidae* of deer, where the species referred to *Rhabdopedilon* are found on the larger hosts and those referred to *Cervicola* on the smaller hosts. I am convinced that the former genus must be sunk as a synonym of *Cervicola*, which was described four years earlier.

know the type of coat possessed by *Pelea,* and the only available book on African antelopes merely describes it as "somewhat woolly". Omitting the case of *Pelea,* this correlation is particularly striking in *Reduncinae* and *Tragelaphinae*; it may be apparent to some degree even within a host-genus, for the parasite of *Gazella granti,* for instance, is much stouter than the species found on smaller species of *Gazella,* approaching *Bovicola* to some degree in this character. The parasite of *Oreotragus* (which is small but has an exceptionally coarse coat) combines the head-form of *Bovicola* with a general facies intermediate between *Bovicola* and *Tricholipeurus.*

Let us now consider the characters on which the antelope-infesting species of *Trichodectidae* were divided into genera. KÉLER (1938, p. 459) defines his family *Bovicolidae* as : Elongate, oval or barrel-shaped species, usually with head densely beset with setae, an oblique transverse row of setae on each side on the protergum, and a dense transverse row of very short setae on the abdominal segments. Thumbs with hyaline apical spurs. The following is a rearrangement of his key to the genera of *Bovicolidae,* omitting those genera to which no antelope-infesting species have been referred :

1. Preantennal region long trapezoidal with deep V shaped osculum ..... *Damalinia.*
— Preantennal region otherwise shaped, if trapezoidal then with flat osculum ..... 2.

2. Preantennal region distinctly trapezoidal with flat, roundish, or triangular osculum. Head weakly transverse or elongate, with a postepistomalis seta and a transverse row of vertical setae ..... *Tricholipeurus.*
— Preantennal region crescentic or semicircular, sometimes truncate anteriorly or flatly emarginate ..... 3.

3. Chaetotaxy of body short and thin, middle part of head and postvertex naked. Abdominal segments dorsally with 1-2 rows of short setae. Legs and antennae with thin setae or with only sparse thick spines among them. Penis without endomeres ..... *Bovicola.*
— Chaetotaxy of body spiny and very dense. Head only naked at postvertex. Abdominal segments beset with a row of longer, and anterior to these a row of shorter setae. Penis with endomeres ..... *Holakartikos.*

Holakartikos can soon be dismissed, because KÉLER referred only one of the Mallophaga of antelopes to this genus, and I am quite unable to understand why he did so. The species in question is *Trichodectes harrisoni* Cummings; its chaetotaxy is utterly unlike that of the genotype of *Holakartikos* and agrees with KELER's own definition of that of *Bovicola.* The genitalia admittedly include endomeres, but the degree of reliance to be placed on this character may be judged from the fact that KÉLER only included three species in the genus, of which one is not known in the male sex, so that he was generalising from only

two species. Furthermore, the statement that endomeres are absent in *Bovicola* is not correct; they are present in the genotype and in many other species, though they have often been mistaken for the parameres. which are frequently much reduced or modified in this group. *Trichodectes harrisoni,* though a rather unusual species, is not generically separable from other species, found on antelopes, which have been referred to *Bovicola.*

This leaves *Bovicola, Damalinia* and *Tricholipeurus* to be discussed. In KÉLER's key *Damalinia* is separated from all the other genera found on ruminants by the shape of the frons, and he gives no other differentiating character. He separates *Tricholipeurus* from all the remaining genera by the shape and chaetotaxy of the head. Actually the chaetotaxy of the head is precisely the same in many members of all three groups : on the central field of the dorsum of the head there is an anterior row of postepistomal setae and a posterior row of vertical setae; normally both these rows ar single, but in *T. harrisoni* the setae are more numerous and the anterior row is irregular and tends to be multiple; in *ovis,* for example, the setae are still more numerous and the groups of setae tend to merge with one another.

Frontolateral setae may be numerous, few, or absent in species which must be referred to *Tricholipeurus* if the genus is to be maintained. Certainly the chaetotaxy of the head will not assist us in dividing into genera the species contained in these three groups. The chaetotaxy of the thorax and abdomen is even more uniform : on the dorsal surface of the thorax there are a prothoracic row (often reduced to one seta on each side), a mesothoracic row, and a metathoracic row, both the latter single and consisting of numerous setae; on the dorsum of each unmodified abdominal segment there is a very regular single row of small tergocentral setae and very occasionally indications of a second somewhat irregular row anterior to it, a group of tergolateral setae and a group of pleural setae, the tergolateral group often appearing as a continuation of the tergocentral row and easiest distinguished by its irregularity. A character to which KÉLER attaches great importance is the structure of the apical portion of the tibia : I can find no difference in this respect between typical species of *Damalinia, Tricholipeurus* and *Bovicola.*

The presence or absence of more than one tergal plate on one of the abdominal segments in the male is also certainly of no generic importance; the extra plates are present in *Tricholipeurus reduncae, T. trabeculae* and *T. clayi* and absent in all other species of this group, yet in other respects these are typical members of *Tricholipeurus;* in *Damalinia* they are always present, and in *Bovicola* they are present in most species but decidedly variable in number. The male genitalia are

very variable in the *Trichodectidae* of *Bovidae,* and some authors attach generic importance to the structure of these organs, but in view of the very great differences in the male genitalia of obviously very closely-related species (*Tricholipeurus aepyceros, T. elongatus* and *T. lineatus,* for instance) I cannot regard them as having more than specific value.

We are left with only the general facies of the insect, and in particular the shape of the head, to distinguish *Damalinia, Tricholipeurus* and *Bovicola* from each other, and here also we find that no sharp distinction can be drawn. The most extreme members of each group are very distinct in facies and in head-shape, but there are numerous intermediates. I have already (1941, p. 41) expressed misgivings as to whether *Bovicola chorleyi* and its allies should be separated from *Damalinia,* and further study of the group has not only convinced me that it should not, but also that *Tricholipeurus* and *Bovicola* cannot be kept separate from *Damalinia.* The differences between extreme members of *Damalinia* and *Bovicola* (*D. crenelata* and *B. hilli,* for example) are very striking, yet if we consider the group as a whole these differences completely disappear. In *crenelata* the frontal concavity is very deep and narrow, in *theileri* it is much shallower and broader, in *hopkinsi* narrow but very shallow, in *chorleyi* and its relatives broad but extremely shallow, in *conectens* (described below) the frons is convex. In general facies the members of this series pass imperceptibly from rather elongate insects with sub-parallel abdominal margins to stouter forms with markedly convex margins. When we come to *Tricholipeurus* the case is even stronger : it is completely impossible to draw a line which would separate species with a narrow and deep frontal concavity, such as *T. lerouxi,* from those with a shallow and broad concavity, such as *T. antidorcus,* nor can we find any division between comparatively stout species with convex sides (*T. reduncae*) and very elongate forms with sub-parallel sides (*T. lineatus*); in both characters there is a complete transition between the two extremes. The final fact which convinced me that *Tricholipeurus* cannot be kept separate was the discovery of *Damalinia annectens,* described below. In size and general appearance this species is a typical *Tricholipeurus,* in head-shape and the form of the male genitalia (for those who consider the latter of more than specific value) it is a *Damalinia.*

Damalinia conectens is an even more perfectly transitional form between *Tricholipeurus* and *Bovicola.* Its head, both in shape and chaetotaxy, resembles that of such a species of *Bovicola* as B. ovis, its abdomen is also intermediate in shape between the type found in *ovis* and that found in extreme forms of *Tricholipeurus,* while its genitalia are of the type found in such extreme forms of *Tricholipeurus* as *victoriae.* The only alternative to uniting *Tricholipeurus* and *Bovicola*

would be to erect a new genus for *conectens* and I am convinced that this course would be thoroughly unjustified.

I consider, therefore, that *Tricholipeurus* and *Bovicola* cannot be separated from *Damalinia,* and I refer to the latter genus all the species hitherto referred to *Tricholipeurus,* together with *Bovicola adenota* Bedford, *B. bovis* (Linn.), *B. caprae* (Gurlt), *B. chorleyi* Hopkins, *B. dimorpha* Bedford, *Trichodectes harrisoni* Cummings, *Bovicola hilli* Bedford, *B. limbatus* (Gervais), *B. martinaglia* Bedf., *B. ovis* (Schrank) and *B. pelea* Bedf., as well as the three species at present included in *Damalinia.* As I have not yet examined minutely the characters of the other genera included in the *Bovicolinae,* I cannot express any opinion as to their validity.

With regard to the family *Trichodectidae* in general, I am convinced that evolution has again and again taken parallel lines in different groups, so that extreme care is necessary if we are not to be misled into mistaking instances of convergence for cases of true relationship. This is certainly very often true of the loss of spiracles and of the possession by two insects of male genitalia of a similar type. A remark (ELLERMANN, 1940, p. 22) which was written of the Rodents should be remembered whenever the genera of the *Trichodectidae* are under consideration : "The most important point to be emphasized is that 'Parallelism, parallelism, more parallelism and still more parallelism' is the evolutionary motto of the Rodents in general". This might equally well have been written of the *Trichodectidae.*

FIVE NEW SPECIES OF TRICHODECTIDAE FROM ANTELOPES

In the descriptions which follow I have introduced a few new or little used terms which should give greater precision to the descriptions. Cervical index and abdominal index have both been used before but deserve a more general application. Cervical index has been defined by CLAY (1940, p. 2) as "breadth : length, taken from centre of clypeal margin to centre of occipital margin", but the peculiar head-shape of such species as *Damalinia crenelata* in the group under discussion, or of the genera *Acidoproctus* and *Ornithobius* among bird-infesting Mallophaga, makes this definition unworkable in such instances; I define it as the maximum length of the head divided by its maximum breadth at the temples. Abdominal index is the length of the abdomen divided by its maximum breadth, and total index is the total length of the insect divided by the maximum breadth of the abdomen. In both cases the structures projecting from the apex of the abdomen in the males of such species as *Damalinia chorleyi* (Hopkins) and *D. crenelata* (Piaget) are included in the length, but not the male genitalia, which often

project somewhat beyond the apex of the abdomen even when they are retracted.

The frontal angle is the angle formed by the emargination (present in most species of *Damalinia*) of the frons with the long axis of the head. This angle varies very little within a species and it is one of the most useful specific criteria, but its measurement presents some difficulty when the angle approaches 90° (*i. e.* in species with an almost flat frons), when the sides of the frontal concavity are convex, and when the concavity has a square or rounded apex (as in *D. crenelata*). In the case of species (*elongatus*, for example) in which the concavity has clearly-marked ends but concave sides, the angle is measured from an imaginary straight line joining the ends, and in those whose frontal concavities have square or rounded apices (*e. g. annectens*) the sides are considered as being produced until they meet.

Although I do not regard the general facies of the insect as being of even subgeneric value within *Damalinia*, yet it is an extremely convenient character in describing and recognising the species. I propose to write of Damalinioid, Tricholipeuroid and Bovicoloid forms, though regarding the groups which are defined by these terms as having an adaptive and not a phylogenetic significance.

In the cases of all the species described below I have recorded the numbers of each sex which were found, but counting the nymphs was found to take up too much time and had to be abandoned. The proportion of nymphs probably varies considerably from time to time within a species, but seems to be normally of the order of two nymphs per adult (*annectens* 316:112, *conectens* 124:103, *spinifer* 751:348, *victoriae* 911:590). In all these species females are slightly more numerous in the collections than males.

Damalinia victoriae n. sp.
(Figs. 1-4)

A small, moderately sclerotised, very elongate Tricholipeuroid species, so like *Damalinia lineata* (Bedford) that only the differences need be noted.

Male (fig. 1) — Lenght 2.08 mm. Frontal angle about 75°. Total index 6.05.

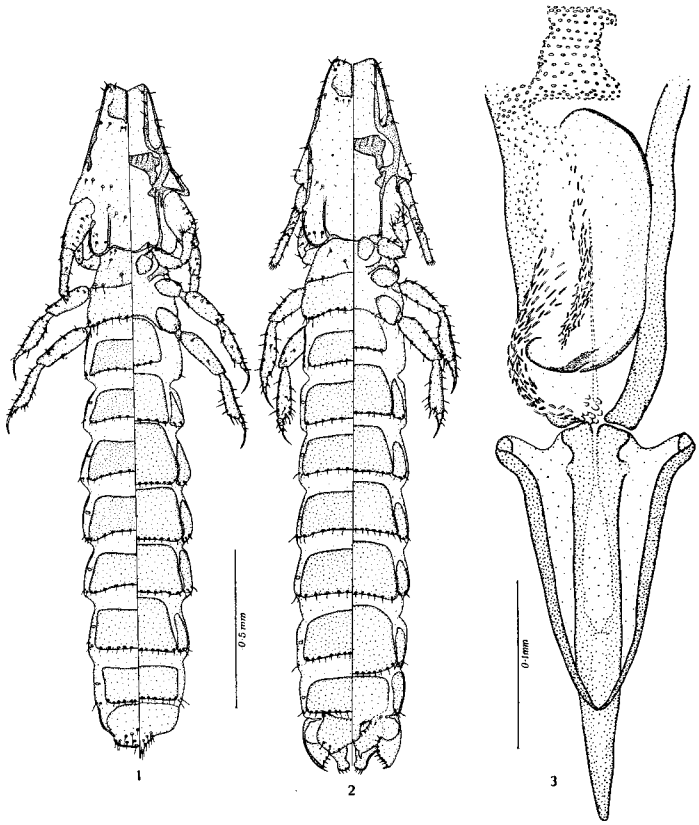
Head much longer and narrower than that of *lineata* (index 2.03); frontal notch distinctly deeper and with straighter sides; temples projecting beyond vertex to a slightly greater degree; antenna longer and slenderer. Chaetotaxy of head indistinguishable from that of *lineata*.

Prothoracic tergocentral seta very much larger than the others, or than in *lineata*.

Abdominal index 3.85. Apex of last abdominal tergite even straighter than in *lineata*, bearing rather fewer setae, and these setae distinctly shorter. Apex of last abdominal sternite stouter and ending more squarely.

Genitalia (fig. 3) very like those of *lineata*, the parameres fused to form a very perfect V (whence the specific name), but longer and slenderer than in

lineata and distinctly curved instead of practically straight, Endomeral rod tapering regularly to its apex (without the swelling found in *lineata*) and showing distinct traces of its derivation from a pair of fused endomeres. Basal plate with much smaller median linear sclerite. Copulatory sac armed with coarser



Damalinia victoriae n. sp. — Fig. 1: Male; fig. 2: female; fig. 3: male genitalia.

denticles, and its apex strongly sclerotised (not, or very weakly, sclerotised in *lineata*).

Female (fig. 2) — Length 2.24 mm. Total index 6.10.

Head appearing even slenderer than in male but not actually so (index 1.90). Abdominal index 3.80. Tergal plate of eighth segment with a very large triangular emargination of the posterior border (fig. 2). Anterior end of inner margin of swollen apical portion of gonapophyses somewhat more produced than in *lineata,* and the fringing setae of the gonapophyses shorter (fig. 4).

Type-material — Holotype male, allotype female and 175 male and 299 female paratypes from *Rhynchotragus guentheri smithi* (Thomas) (Western Guenther's dik-dik), Nyanga, Jie County, Karamoja, Uganda, 9.ix.1941, T. W. CHORLEY.

The entire type-series, together with 788 nymphs, was obtained by dissolving the hair of three individuals, all of which were infested, so the species would seem to be very common. I also have a series of 37 males, 79 females and 123 nymphs obtained by dissolving the hair of two specimens of *Rhynchotragus kirkii cavendishi* (Thomas), obtained near Naivasha, Kenya Colony. These are

absolutely inseparable from the type-series, but I have refrained from making them paratypes on account of the supposed specific difference between the hosts.

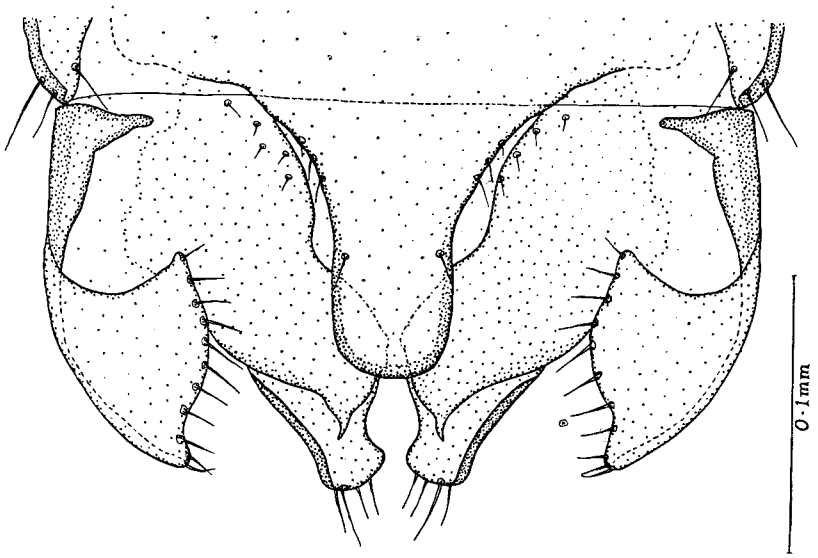


Fig. 4 — *Damalinia victoriae* n. sp., genital region of female

Damalinia ourebiae n. sp.
(Figs. 5-9)

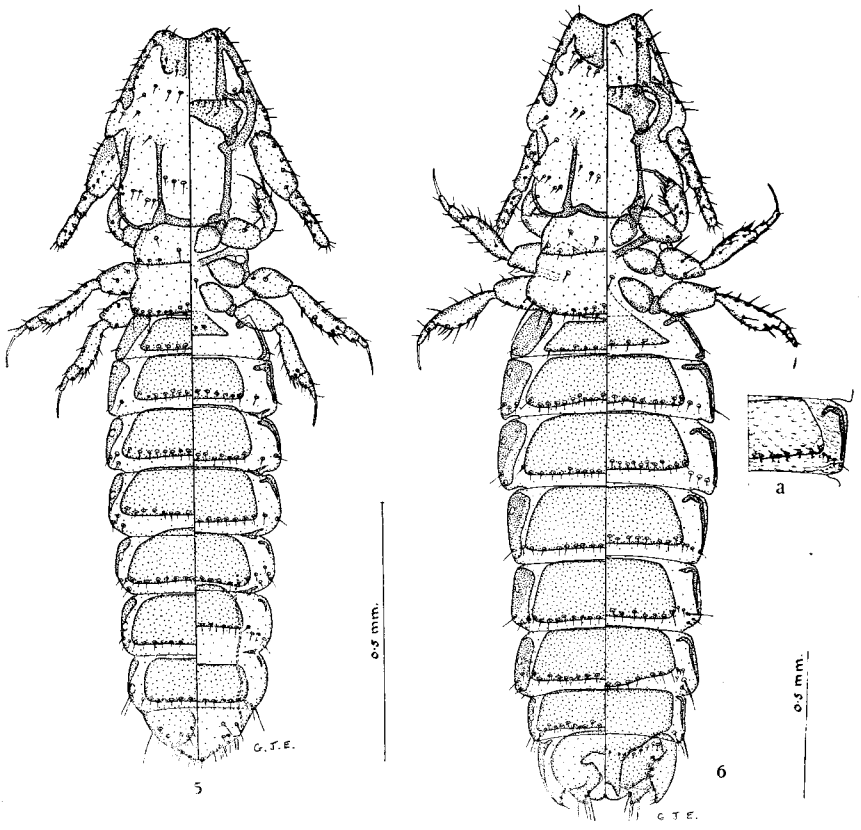
A small, rather stout Tricholipeuroid species, which is not very closely related to any hitherto described; possibly nearest to *D. antidorcus* (Bedford), but easily distinguishable from this and all other known species by the shape of the head and the characters of the male and female terminalia. Colour dark, the tergal and sternal plates being extensive and dark brown.

Male (fig. 5) — Length 1.43 mm. Frontal angle about 63°. Total index 4.17.

Head rather large in proportion and fairly broad (index 1.35); frontal notch shallow and very like that of *D. parkeri* (Hopkins); preantennal region with practically straight, slightly convergent sides; temples projecting only slightly posteriorly beyond the vertex; trabeculoid processes very weakly sclerotised, broad and with rounded apex. First segment of antenna very much enlarged, but not so much as in many species of the genus, comprising only just over half the length of the antenna and about twice the diameter of the second segment, second and third segments subequal in diameter but the third about 1 ½ times the length of the second. Chaetotaxy of head almost exactly as in *parkeri*.

Prothorax much broader than long, with convex outer margin and a very large spiracle, its chaetotaxy as in *parkeri* except that I can find no trace of a seta in the anterolateral angle, the tergocentral seta is hardly larger than the others and the row of setae near the hind margin usually contains only three setae on each side. Pterothorax very little broader and a little longer than prothorax, the meso-metathoracic junction clearly indicated; of the setae on the posterior margin a few (in the holotype the outermost and third on one side and the two outermost on the other) are more than twice as long as the rest.

Legs without any characters of particular interest, proportionately distinctly larger than in *parkeri*, second and third pairs almost alike.



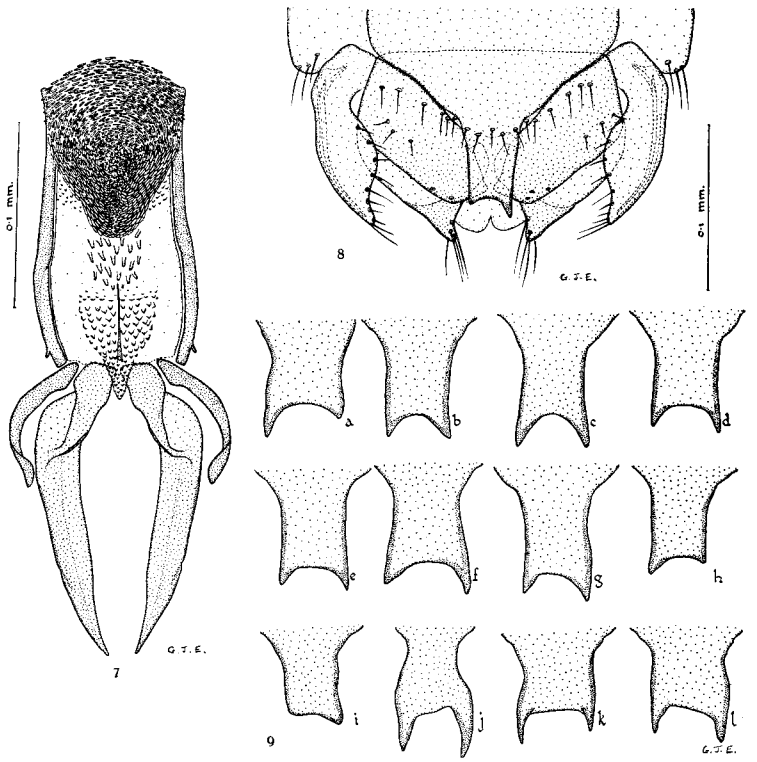
Damalinia ourebiae n. sp. — Fig. 5: Male; fig. 6: female (*a* — abdominal scale-like structure).

Abdomen with index 2.55, with moderately crenulated, almost parallel sides, second, third and fourth segments of almost equal width. Tergal and sternal plates large, rather well sclerotised, single. The usual small Y-shaped sclerites strengthening the ends of the intersegmental grooves (hereafter called the intersegmental sclerites) are present but are poorly sclerotised and very inconspicuous. The usual longitudinal sclerotic bars on each side of the genitalia are present and without special features; these bars are apparently the anchorage for the muscles which move the genitalia, and I propose for them the name "genital apodemes". Their presence or apparent absence seems to be of only minor taxonomic importance. Spiracles rather large in proportion to the size of the insect, present on apparent abdominal segments 2 to 7.

The whole surface of the head and body is covered with scale-like structures as shown in fig. 6a. These structures are frequent in the Trichodectidae and seem to be almost universal in *Damalinia*, but their shape and arrangement vary somewhat in different species.

Genitalia (fig. 7) with basal plate moderately long and slender, its sides concave anteriorly and convex posteriorly. Parameres short and strongly curved but with widely separated tips. Endomeres long and only very slightly curved, shaped like the blade of a sharp-pointed knife, poorly-sclerotised except basal-

ly; near the base there is apparently a broad flange on the outer side of the dorsal aspect and the endomere is much broader dorsally than ventrally. There is a very distinct, almost linear, median longitudinal sclerite on the apical portion of the basal plate. The copulatory sac is armed with small spines and plaques as in *parkeri* and has a somewhat similar sclerotised apex with "finger-print" striae, but the dagger-shaped sclerite is replaced by a pair of oval plates.



Damalinia ourebiae n. sp. — Fig. 7: Male genitalia; fig. 8: genital region of female; fig. 9: subgenital plates.

Female (fig. 6) — Length 1.46 mm. Total index 3.78 (the specimen drawn has the anterior abdominal segments slightly crushed and broader than is normal).

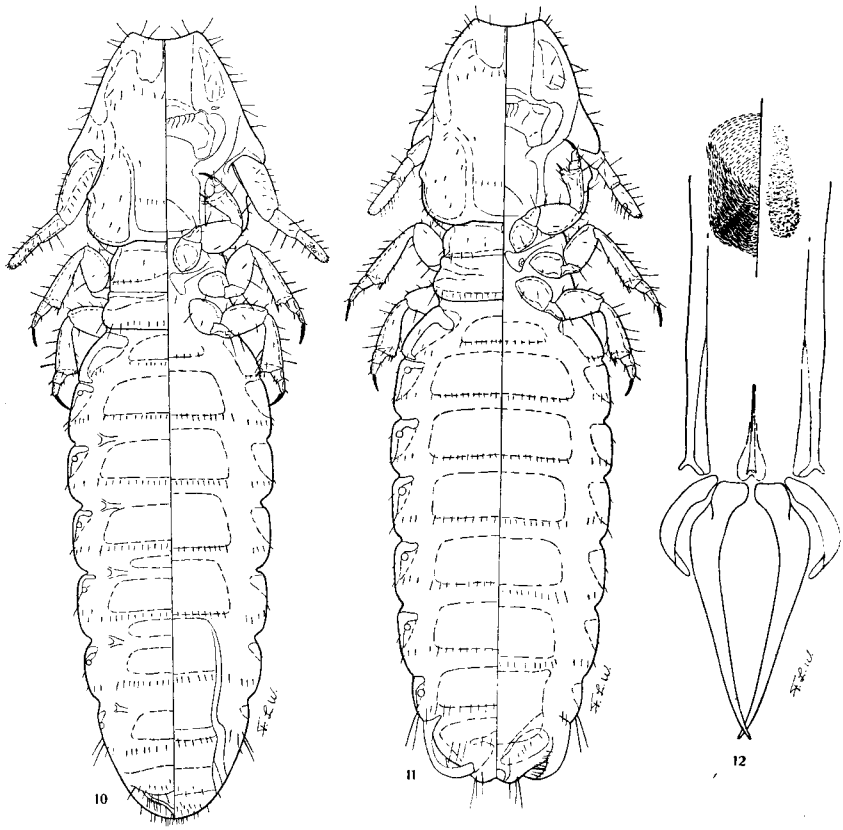
Cervical index 1.35, shape of head hardly differing from that of the male except for the unmodified antenna and consequent difference in the shape of the antennal fossa. Antenna with first segment slightly shorter and stouter than the second, the third segment the longest.

Thorax and legs as in male.

Abdomen distinctly stouter than that of the male (index 2.36) but otherwise similar except in the apical region and in the absence (as always) of the small Y-shaped sclerites and genital apodemes. Tergal plate of terminal segment (fig. 6) with a slot not unlike that of *parkeri* but differently shaped. Terminal portion of subgenital plate without apical setae, very variable, normally with almost straight and subparallel sides and the apex deeply concave and forming two spinose lateral projections, but very often strongly asymme-

trical. The terminal part of the subgenital plate of the allotype is shown in fig. 8, and those of all the first twelve other females in the type-series to be collected in fig. 9, where *a* is the plate of a specimen from the same host-individual as the types, *b-g* those from another host-individual from the type-locality, *h* and *i* from the Gulu host, and *j-l* from the host-individual obtained in Mongalla.

Gonapophyses (fig. 8) not like those of any adequately-figured species of the genus, their inner margin only rather gently convex, rather as in *parkeri*, but without the large and deep emargination which separates triangular projections in that species.



Damalinia spinifer n. sp. — Fig. 10: Male; fig. 11: female; fig. 12: male genitalia.

Type-material — Holotype male, allotype female, one male and one female paratypes from *Ourebia ourebi ugandae* De Beaux (Uganda common oribi), Nakitoma, Buruli, Buganda Province, Uganda, 12.v.1941, G. H. E. HOPKINS. Other paratypes from the same host-form as follows : — 4 males and 6 females, Nakitoma, May 1941, T. W. CHORLEY; 3 females, Gulu District, Uganda, May 1941, T. W. CHORLEY; 1 male and 3 females (the male and two females badly damaged) Mongalla Province, Sudan, November 1940, T. W. CHORLEY; 118 males and 143 females, 6 males and 9 females, 14 males and 12 females, 8 males and 17 females, and 13 males and 24 females respectively from five different host-individuals, Lango District, Uganda, March 1942, T. R. F. COX.

The species appears to be normally rather uncommon, but occasionally very abundant. Of twelve skins examined (by dissolving the hair), three were not infested.

Damalinia spinifer n. sp.
(Figs. 10-13)

A Tricholipeuroid form, closely related to *D. parkeri* (Hopkins), from which it is easily distinguished by its much stouter build. From other species with a similar facies it is readily separated by the male genitalia and the structure of the terminal segments of the abdomen. In several characters it has a close resemblance to *D. ourebiae*, but I believe these resemblances to be instances of convergence. Colour pale, the tergal and pleural plates being neither very extensive nor strongly sclerotised.

Male (fig. 10) — Length 1.84 mm. Frontal angle about 65°. Total index 3.80.

Head rather less than 1 ½ times as long as broad (index 1.41); frontal concavity wide and shallow; preantennal region with markedly convex sides; temples with strongly convex sides, but only projecting slightly posterior to vertex; trabeculoid processes very feebly sclerotised. First segment of antenna considerably enlarged, constituting about half the total length, second segment distinctly shorter than the third. Postepistomal row composed of about 12 small setae, row on vertex of about 12 still smaller setae, temporal setae few and small (4 on each side).

Thorax almost as in *parkeri*. Legs short and stout.

Abdomen broadest at second segment, thence tapering regularly, index 2.39, sides very slightly convex, fairly strongly crenulated. Tergal plates single, fairly large but weakly sclerotised. Intersegmental sclerites Y-shaped. Genital apodemes well developed. Spiracles very small and poorly sclerotised, almost colourless. Terminal tergite of abdomen ending in a distinct median point, on each side of which the outline of the tergite is concave and clothed with conspicuous setae.

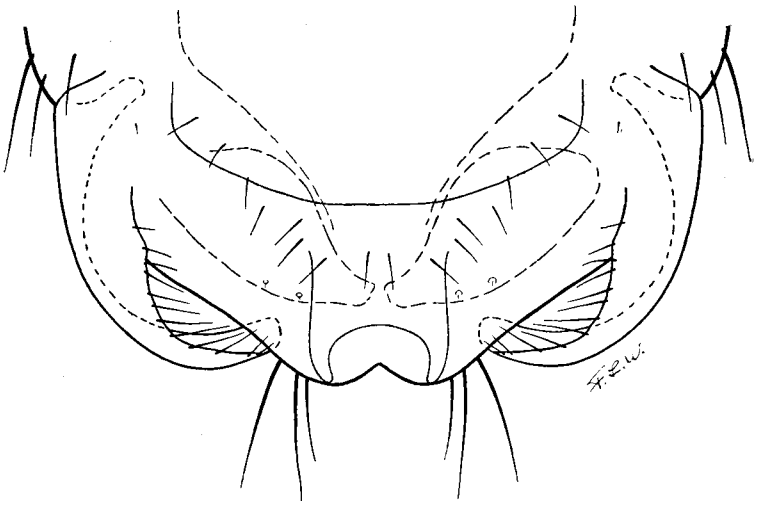


Fig. 13 — *Damalinia spinifer* n. sp., genital region of female.

Genitalia (fig. 12) very like those of *parkeri*, the endomeres longer, not so straight, and much sharper-pointed; copulatory sac clothed with spicules and

plaques very much as in *parkeri* but the dagger-shaped sclerite replaced by two ovoid sclerites.

Female (fig. 11) — Length 1.75 mm. Total index 3.61.

Cervical index 1.30, temples lesse convex than in male. Antenna with third segment considerably the longest.

Abdomen with almost parallel sides, index 2.22. Subgenital plate not unlike that of *parkeri,* but the two projections bordering the concavity at its apex without setae and almost spine-like, the concavity itself very much deeper than in *parkeri* (fig. 13). Gonapophyses hardly distinguishable from those of *parkeri.*

Type-material — Holotype male, allotype female and fourteen male and eighteen female paratypes from a specimen of Bright's gazelle, *Gazella (Nanger) granti brighti* Thomas, shot near Moroto, Karamoja District, Uganda, on 16.x.1941, by myself. Other paratypes include 119 males and 195 females obtained from other specimens of the same host, shot at the same and other localities in Karamoja during September and October 1941 by Mr. T. W. CHORLEY and myself.

The species is apparently common. The dissolved hair from five skins yielded 20 males 32 females 192 nymphs, 42 males 78 females 254 nymphs, 33 males 48 females 169 nymphs, 15 males 19 females 52 nymphs, and 24 males 37 females 84 nymphs, respectively. None of the skins were uninfested.

Damalinia annectens n. sp.
(Figs. 14-17)

A moderately stout Tricholipeuroid species, easily distinguished from all other known Tricholipeuroid forms by the shape of the frontal concavity, and by the genitalia. It exhibits a most interesting combination of the features supposed to be characteristic of *Tricholipeurus* and of *Damalinia,* the frontal concavity being very like that of *Damalinia crenelata* (Piaget), the general facies strongly Tricholipeuroid, and the male genitalia of the Damalinioid type. Colour not very dark, the tergal plates being rather well sclerotised but not very extensive, especially in the female.

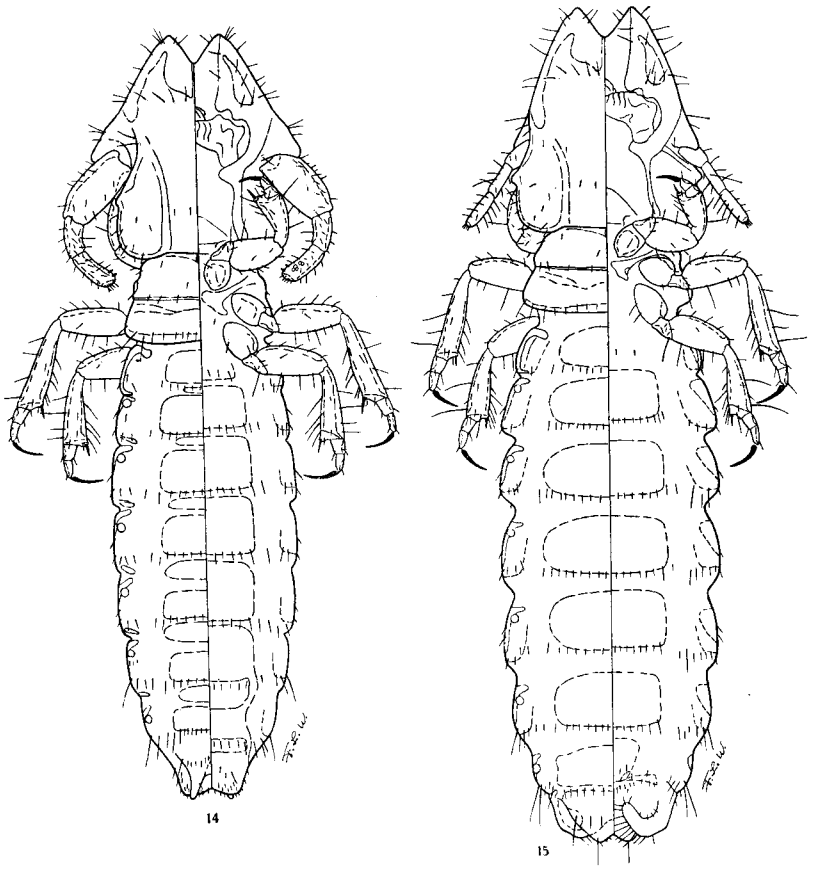
Male (fig. 14) — Length 1.81 mm. Frontal angle about 30°. Total index 4.46.

Head rather long (index 1.43); frontal notch deep and almost straight-sided, its apex rounded off; preantennal region with nearly straight, markedly convergent sides; temples only slightly convex and projecting only a very little beyond the hind margin of the vertex; trabeculoid processes rather well sclerotised towards their wedge-shaped apices. First segment of antenna much enlarged, constituting over half the total length of the antenna, second segment very short but markedly stouter than the third, third segment with the usual pair of peg-like spines and also with its inner margin very distinctly toothed. Post-epistomal row composed of eight or nine rather large setae, row on vertex comprising only four much smaller setae, temporal setae small and very few (three on each side, excluding marginal and submarginal setae).

Thorax with sides almost straight and only diverging slightly posteriorly; prothorax with a large spiracle, a small anterolateral seta and an oblique row of three hind-marginal setae on each side, tergocentral seta no larger than the others. Pterothorax with a row of about 18 hind-marginal setae, of which the two outermost on each side are very much larger than the rest. Legs rather large, but without characters of special interest.

Abdomen with index 2.65, sides almost parallel but very strongly crenulated. Tergal plates narrow but deep and well sclerotised, accessory plates present on segments 1 to 6, the anterior ones very shallow but the posterior ones almost

as large as the main plates. Intersegmental sclerites very strongly sclerotised (almost black), not Y-shaped but single and wedge-shaped. Genital apodemes present but not conspicuous. Spiracles large and conspicuous. Terminal tergite of abdomen ending in two very conspicuous points.



Damalinia annectens n. sp. — Fig. 14: Male; fig. 15: female.

Genitalia very unusual; parameres very much curved; endomeres as shown in fig. 16; copulatory sac densely clothed with small spines and apparently without any larger sclerotic areas. Unfortunately I have failed to find a specimen with the genitalia extruded.

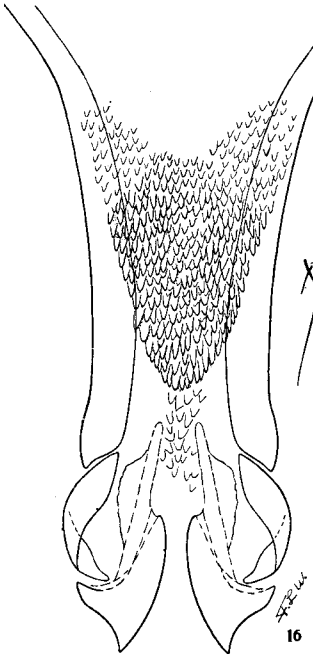
Female (fig. 15) — Length 2.09 mm. Total index 3.96.

Cervical index 1.25, sides of preantennal region and of temples slightly more convex than in male. Antenna with first segment slightly stouter and shorter than second, second and third subequal.

Abdomen slightly stouter than that of male (index 2.42), tergal plates single and intersegmental sclerites absent. Subgenital plate not projecting posteriorly. Gonapophyses with foot-shaped ends, rather like those of *D. martinaglia* (Bedford) (fig. 17).

Type-material — Holotype male, allotype female and 53 male and 54 female paratypes collected from skins of Uganda bushbuck, *Tragelaphus scriptus bor* Heuglin, obtained in Lango District, Uganda, in March 1942 by Mr. T. R. F. Cox,

and in Buruli District, Uganda, by Mr. T. W. CHORLEY; the types are from the former locality.



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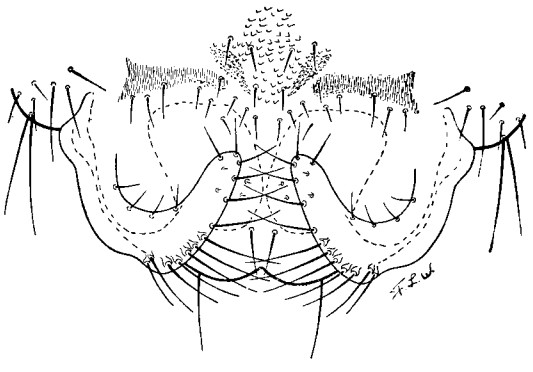

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Damalinia annectens n. sp. — Fig. 16: Male genitalia; fig. 17: genital region of female.

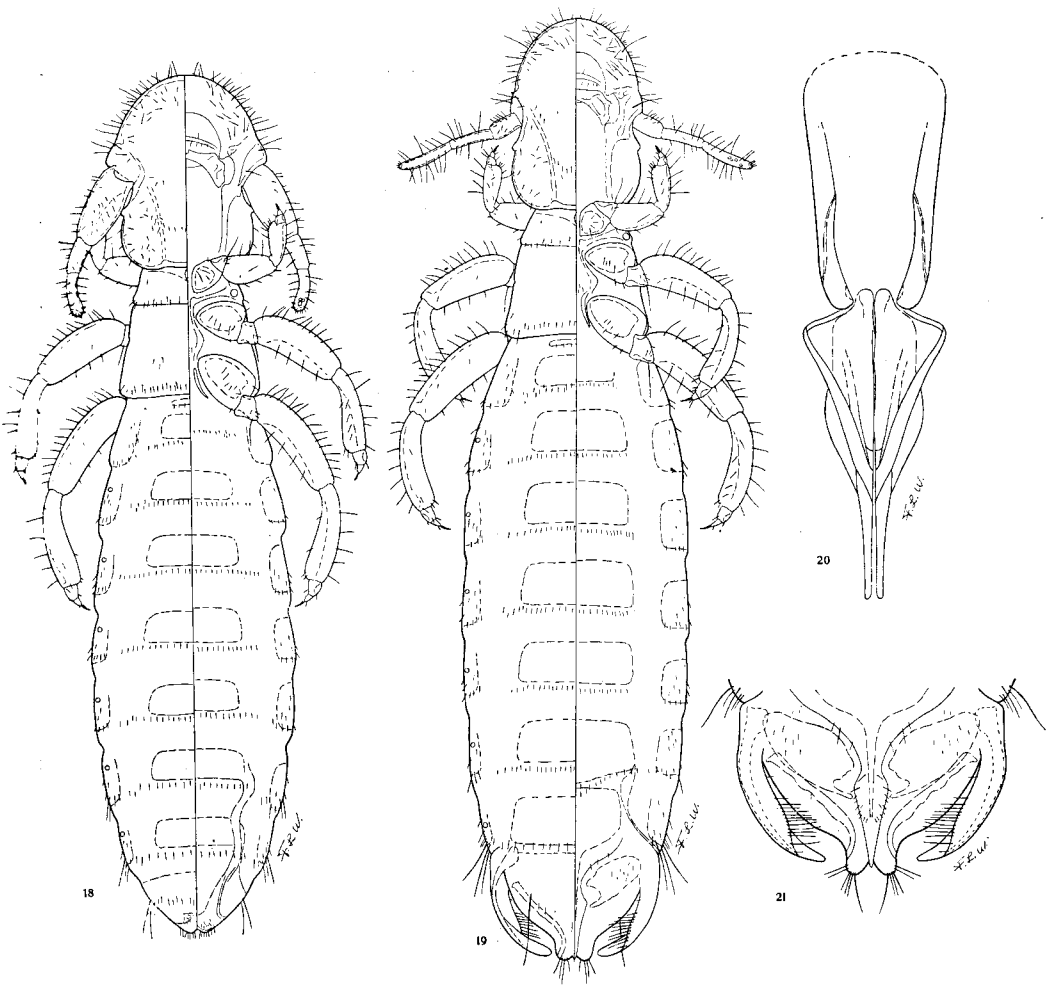
Normally a very uncommon species, but found in large numbers on occasional specimens of the host. Sixteen skins were examined by dissolving the hair, of which eight produced no specimens of *Damalinia*. The remainder produced 3 nymphs, 2 males 2 nymphs, 1 female 3 nymphs, 4 males 5 females 26 nymphs, 2 males 1 female 2 nymphs, 45 males 49 females 273 nymphs, 1 male 1 female 3 nymphs, and 1 female 4 nymphs, respectively. An attempt was made to ascertain whether young or adult specimens of the host were more heavily infested. Of 8 skins of young animals, 4 were not infested and the remainder had an average of 3 adults and 9 nymphs; of 8 adult skins 4 were not infested and the remainder bore an average of 25 adults and 70 nymphs. But almost the whole of this high average on adult hosts is accounted for by the single heavily infested skin, the average excluding this specimen being 2 adults and 3 nymphs. The apparent difference between the infestations of young and adult hosts is, therefore, almost certainly not significant. Of the total specimens obtained 54 were males, 58 females, and 316 nymphs.

Damalinia conectens n. sp.
(Figs. 18-21)

A most remarkable species, with the shape and head-chaetotaxy of certain species hitherto referred to *Bovicola,* while the general facies is Tricholipeuroid and the genitalia are of the type found in such extreme Tricholipeuroid forms as *D. victoriae* except that the endomeral plate still shows very clearly its origin from two fused endomeres. By picking out individual characters of this insect

it would be easy to refer it to either *Bovicola* or *Tricholipeurus* or to erect a new genus for it, and I regard its characters as complete proof that these two supposed genera cannot be maintained. In some points, especially the fact that the sclerotic anterior margin of the head is unbroken in the median line, the species resembles *D. ovis* (Schrank), and I do not exclude the possibility that there may be a fairly close relationship with the latter species. In head-structure and in the great length of the thorax the species appears to be very primitive, but the male genitalia are of a very specialised type. The colour is very pale, the tergal and pleural plates being small and weakly sclerotised.

Male (fig. 18) — Length 2.45 mm. Frontal angle not measurable, the frons being smoothly convex. Total index 4.29.



Damalinia conectens n. sp. — Fig. 18: Male; fig. 19: female; fig. 20: male genitalia; fig. 21: genital region of female.

Head nearly 1 ½ times as long as broad (index 1.45); preantennal region strongly and smoothly convex, semicircular; trabeculoid processes extremely short and broad, with rounded apices; temples moderately convex, not projecting behind level of vertex. Antenna with first segment much enlarged, com-

prising nearly half the total length, second and third segments subequal, third distinctly expanded apically and bearing the usual pair of short spines. Eye small but very prominent. Setae of preantennal region small, arranged in a continuous, rather irregular row of about 30, not distinctly divided into groups, a group of three setae on each side internal to the antennal fossa, setae of vertex about 18 in number, forming a single row in the median area but irregularly arranged at the sides and merging with the temporal setae, of which there are about 12 on each temple.

Thorax most exceptionally long, about as long as its greatest width, the divisions between the three segments clearly indicated at the sides, the sides almost straight and diverging gently and gradually in a posterior direction. Prothoracic spiracle small; chaetotaxy of prothorax normal, with a small anterolateral seta, a small tergocentral seta and a hind-marginal row on each side, the row consisting of about 8 small setae on each side, much less oblique than usual, and distinctly irregular. Hind marginal row of setae on pterothorax composed of about 30 setae, in front of which there are a few other irregularly-disposed setae. Fore legs short and stout, second and third pairs of legs long and slender.

Abdomen widest at the fourth segment, index 2.73, sides very slightly undulant but not at all crenulated. Tergal plates single, small, poorly sclerotised, pleural plates very poorly sclerotised. All normal segments with a rather irregular single row of about 30 very small hind-marginal setae. Intersegmental sclerites absent. Genital apodemes well developed but rather weakly sclerotised. Spiracles very small and inconspicuous but present, as usual, on segments 2 - 7. Terminal tergite of abdomen with two small setifercus lobes which project dorsally, medially and in a slightly anterior direction.

Genitalia (fig. 20) of the same general type as in *victoriae;* parameres fused at their apices to form a V; endomeres fused basally but terminally appearing as a pair of closely-approximated but perfectly distinct straight rods; copulatory sac clothed with small spicules and plaques, without any large sclerotic pieces.

Female (fig. 19) — Length 2.70 mm. Total index 4.32.

Head much as in male, but preantennal region even more convex and temples less convex, cervical index 1.53; trabeculoid processes hardly developed; antenna long and slender, first segment much the shortest and stoutest, third slightly longer than second and slightly expanded towards the apex.

Abdomen broadest at the fourth segment, but very little narrower near the apex, index 2.85. Bilobed apex of abdomen strengthened by a pair of very conspicuous sclerotic rods running in an antero-exterior direction. A conspicuous small round spermatheca is present. Gonapophyses not remarkable, their apices not much expanded, fringed on the inner side with rather long setae (fig. 21).

Type-material — Holotype male, allotype female and 45 male and 56 female paratypes collected, together with 124 nymphs, from a klipspringer, *Oreotragus oreotragus aureus* Heller, shot by T. W. CHORLEY on Loriu Hill, Jie County, Karamoja District, Uganda on 28-II-1942. A second specimen of this host, also obtained by Mr. CHORLEY, was not infested.

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