A new species of *Linognathus* (Anoplura: Linognathidae) from the Damara dikdik

by
J. A. Ledger
Department of Entomology,
South African Institute for Medical Research,
Johannesburg

INTRODUCTION

Within the Anopluran genus *Linognathus* Enderlein, 1905 there is a group of four closely-related species which are characterized by having most of the abdominal setae lanceolate in form. Other characters common to the group are a short, wide head and thorax, absence of a thoracic sternal plate, short and broad abdomen and typical female genitalia, with broad, leaf-like gonapophyses bearing microtrichia on their distal surfaces. This assemblage is probably of monophyletic origin, and may be called the *pithodes* species-group, the earliest species described being *L. pithodes* Cummings, 1916 from *Antilope cervicapra*. The other species included in the group are *L. bedfordi* Ferris, 1932 from *Antidorcas marsupialis*, *L. lewisi* Bedford, 1934 from *Gazella thompsoni* and *L. spicatus* Ferris, 1932 from *Connochaetes taurinus*.

Certain characters found in some species of the *pithodes* group are rather anomalous for *Linognathus*. *L. spicatus*, for example, has the claws of the first pair of legs strong and stout, and only slightly smaller than those of the second and third legs; in *Linognathus* it is usual for the first pair of legs to bear claws which are much smaller and more slender than those of the other legs. *L. pithodes* and *L. lewisi* have distinct sclerotized abdominal tergal plates on some segments in the male, a character not found in any other *Linognathus* species. The available evidence suggests that the *pithodes* group was an early offshoot from the main line of *Linognathus* evolution, and probably had a wider host distribution than at present. The geographical distribution tells us little about the possible origin of the group; the four species are all parasitic on Bovidae, one is found in the Oriental region and the other three in the Ethiopian region.

The genus *Stobbella* Eichler, 1949 was erected for the *pithodes* species-group, with *L. pithodes* as type-species. Ferris (1951) rejected *Stobbella*, but it is my opinion that the name might be useful as a subgenus of *Linognathus*, should further research confirm the homogeneity of the *pithodes* group, and if the use of subgenera should prove of value in subdividing *Linognathus*, which at the time of writing comprises 48 described species.

The purpose of this paper is to describe a new species belonging to the *pithodes* group, to give diagnostic characters which distinguish the new species from others in the group, and to provide a key to the five species now contained in the group.

In the following account I use the symbols *m* (marginal) and *a* (anterior) to distinguish the double rows of setae present on some tergites and sternites.

All measurements are in millimetres; a value in parenthesis following a statement of range represents the mean.

Linognathus damarensis n. sp., figs. 1—8

TYPE-HOST: *Madoqua kirki damarensis* (Günther, 1880)

HOST DISTRIBUTION: northern limit near Benguela in south western Angola; eastern limit near Grootfontein, southern limit Mount Brukkaros (25° 50' S.), both in South West Africa. In the west it occurs into Namib subdesert, confined here to riverine woodland and thicket of larger seasonal rivers and reaching to within about 45 km of the coast (Tinley, 1969).

FEMALE. General appearance and chaetotaxy as in fig. 1.

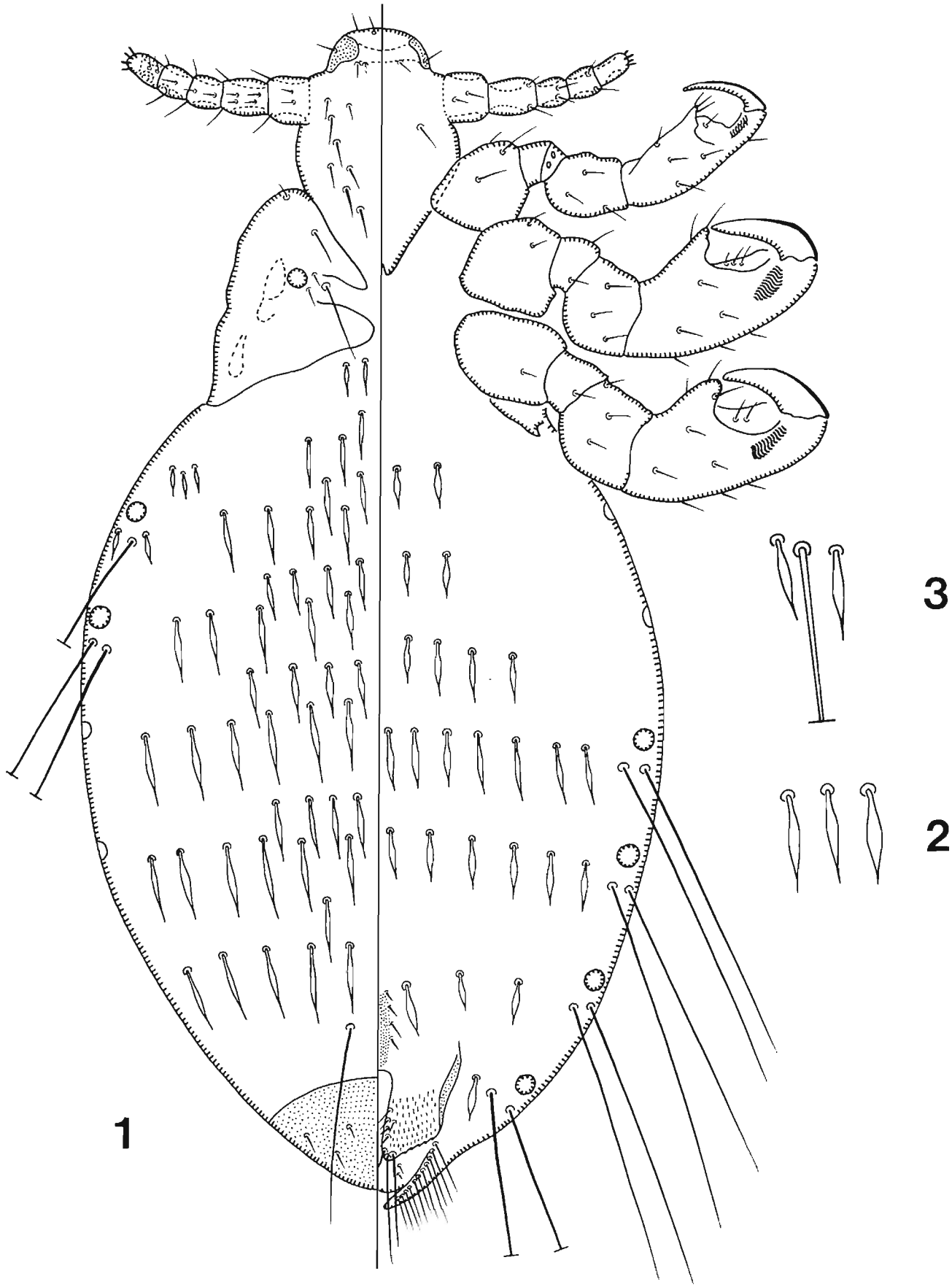
Thorax. 1 + 1 stout pronotal setae; 1 long, 2 short setae associated with each spiracle. Claws of 1st pair of legs markedly more slender than those on 2nd and 3rd pairs. Sternal plate lacking.

Abdomen. With lanceolate setae as in fig. 2.

Dorsal chaetotaxy. A single, short row of lanceolate setae on I, two rows of lanceolate setae on II-VII and 1 + 1 long, stout setae on VIII. Tergal setal counts for holotype: I, 4; II, 3 *m*, 3 *a*; III, 7 *m*, 4 *a*; IV, 9 *m*, 8 *a*; V, 11 *m*, 7 *a*; VI, 12 *m*, 8 *a*; VII, 7 *m*, 2 *a*; VIII, 1 + 1. Terminal tergite with a sclerotized band and 3 + 3 short setae.

Spiracles. Small and rounded. On anterior segments the spiracular openings are dorsal, posteriorly they are located on the ventral surface of the abdomen. Two long setae posterior to each spiracle on IV-VIII; on III the postspiracular complex consists of 1 long, 2 lanceolate setae (fig. 3); on II, although there is no spiracle, a group of 3 lanceolate setae in the postspiracular position.

Ventral chaetotaxy. In the holotype specimen the ventral setae are arranged in single rows with the following counts: II, 4; III, 4; IV, 8;



Figures 1-3. *Linognathus damarensis* n. sp. 1. Female in dorsal/ventral view. 2. Lanceolate abdominal setae. 3. Postspiracular complex of segment III.

V, 15; VI, 12; VII, 6; VIII, 1 + 1. In some of the paratype specimens there is a tendency towards vestigial double setal rows on IV-VII, the additional setae usually apearing towards the lateral margins.

All ventral setae lanceolate.

Genitalia. As in fig. 4. Median sclerotization present, linear and slightly expanded towards the middle. Gonapophyses with lateral strips of sclerotization slightly convergent, apices convergent with finely serrated margins; 3—4 long, stout apical setae; mesal margins clearly separated, slightly clerotic, with 6—8 short setae. Terminal third of gonapophyses with closely-set microtrichia.

MALE. Characters of head, thorax, spiracles and postspiracular setae as for female.

Abdomen. As in fig. 5. There are two major types of abdominal setae. Those of the ventral surface are lanceolate, as in female. A second type predominates on tergites V—VII; these are stout, with characteristic blunt tips (see fig. 6).

Dorsal chaetotaxy. Single rows of setae on I and VIII; double rows on II—VII. Blunt-tipped setae principally on V—VII, the most lateral setae on these segments tending towards the lanceolate type; short, slender setae only on VIII. Range (6 specimens;: I, 4; II, 2 *m*, 2—4 *a*; III, 6—7 *m*, 0—2 *a*; IV, 9—12 *m*, 5—7 *a*; V, 9—15 *m*, 6—7 *a*; VI, 13—16 *m*, 6—8 *a*; VII, 12—15 *m*, 1—7 *a*; VIII, 6—8. Terminal segment trilobed, with short setae as in fig. 5.

Ventral chaetotaxy. Lanceolate setae throughout, usually in single rows, with the following range (6 specimens): II, 3—4; III, 4; IV, 4—8; V, 9—14; VI, 8—11; VII, 4—7; VIII, 1 + 1. In some specimens there may be one or two additional setae between rows.

Genitalia. As in fig. 7. Basal apodeme fairly short and broad; parameres long and slender, totally enclosing the pseudopenis. Endomeral piece (fig. 8) with anterior prolongation reaching into the notch formed by the bifid basal apodeme.

DIMENSIONS (6 ♂♂, 9 ♀♀)

	Females	Males
Head width	0.20—0.21 (0.20)	0.19—0.20 (0.19)
Head length	0.31—0.32 (0.32)	0.29—0.31 (0.30)
Total length	1.3 —1.4 (1.4)	1.1 —1.2 (1.2)

HOLOTYPE. ♀ ex *Madoqua kirki damarensis*, Namutoni, Etosha National Park, South West Africa (F. Zumpt, 15. iii. 1970)

PARATYPES. 6 ♂♂, 8 ♀♀, same data as holotype.

The holotype and 2 ♂♂, 2 ♀♀ paratypes have been deposited at the South African Institute for Medical Research, Johannesburg. The ramaining paratypes have been distributed as follows: State Museum, Windhoek, South West Africa (1 ♂, 1 ♀); British Museum (Natural History), London (1 ♂, 1 ♀); United States National Museum, Washington (1 ♂,

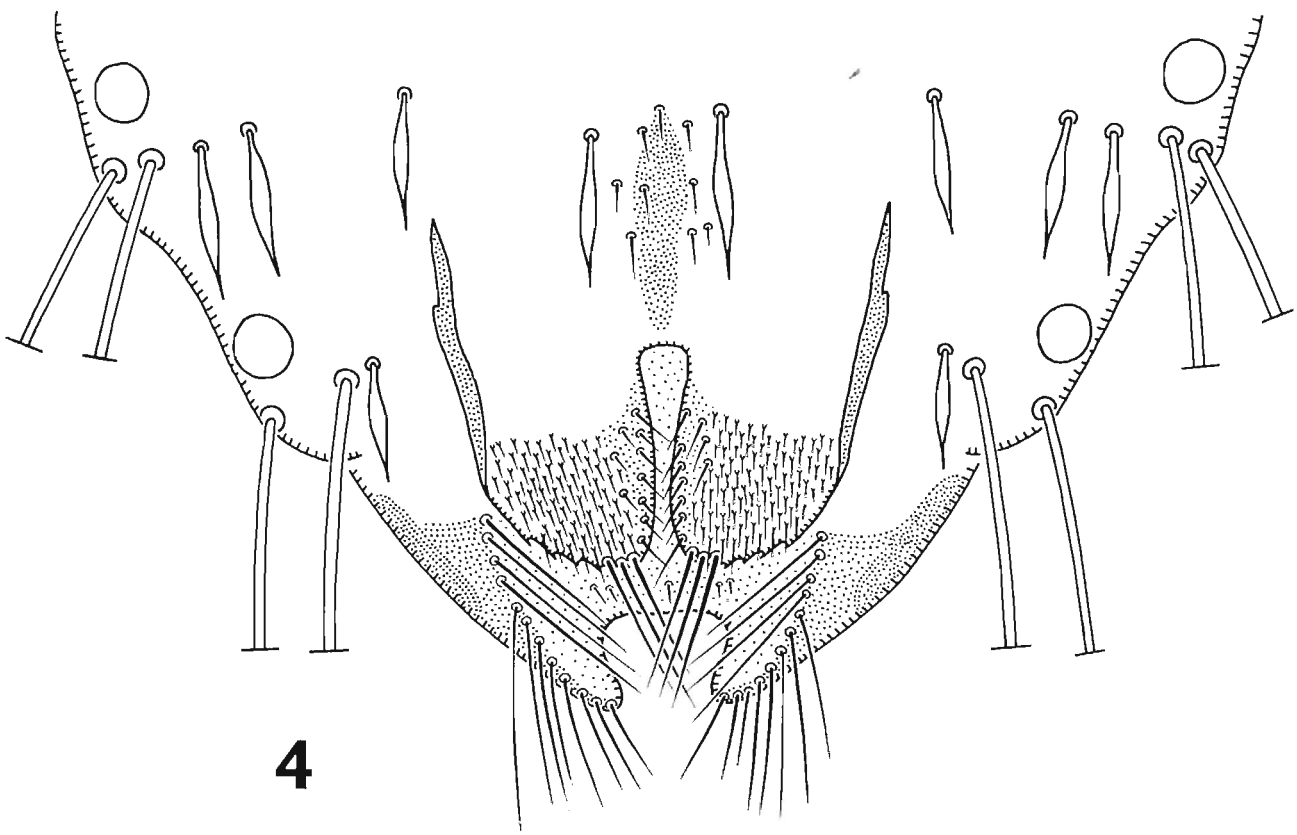
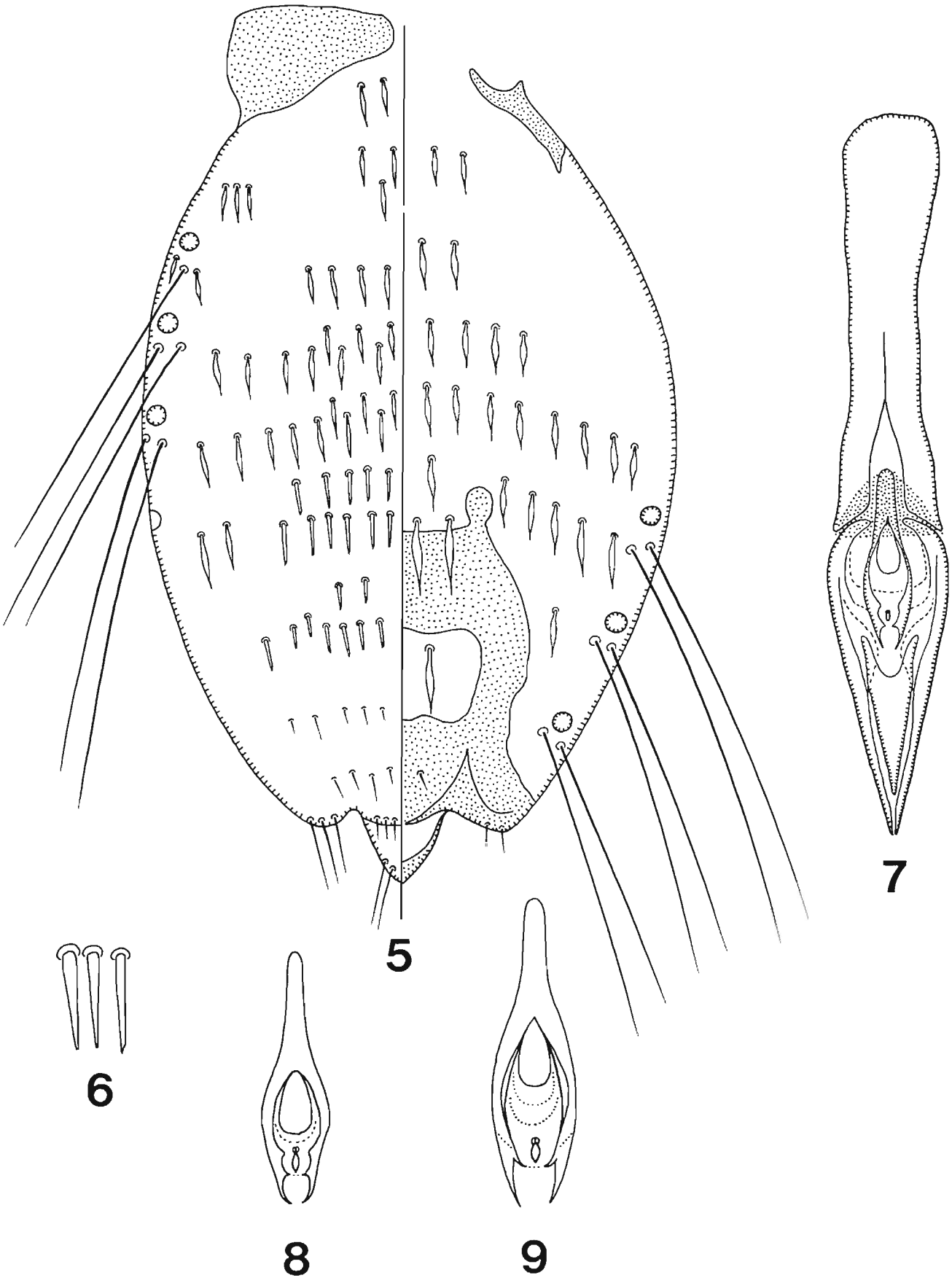


Figure 4. *Linognathus damarensis* n. sp. Female genitalia.



Figures 5-9. 5. *Linognathus damarensis* n. sp. Male abdomen in dorsal/ventral view. 6. Blunt-tipped tergal setae. 7. Male genitalia. 8. Endomeral piece. 9. Endomeral piece of *L. bedfordi*, drawn to same scale as fig. 8.

1 ♀); Veterinary Research Institute, Onderstepoort (1 ♂, 1 ♀); Dr K. C. Emerson, Arlington, Virginia, U.S.A. (2 ♀♀).

DIAGNOSIS

Linognathus damarensis n. sp. is closely related to *L. bedfordi* (see key). The characters most useful for separating the two species are the chaetotaxy of the abdomen in both sexes, and the characters of the genitalia. *L. bedfordi* has considerably more abdominal setae, dorsal and ventral, than *L. damarensis*, and the sternal setae on IV—VII are invariably arranged in distinct double rows. In *L. damarensis* there are normally single rows of sternal setae on IV—VII, any additional setae being scattered towards the lateral margins of the sternites, and not arranged in definite rows. The differences in abdominal chaetotaxy are illustrated by comparing the ranges of setal counts for *L. damarensis*, as given in the description above, with those of a sample of 5 ♂♂, 5 ♀♀ of *L. bedfordi*:

FEMALE. *Dorsal*: I, 4; II, 4 *m*, 4 *a*; III, 12—20 *m*, 8—11 *a*; IV, 15—20 *m*, 13—19 *a*; V, 17—22 *m*, 16—18 *a*; VI, 16—19 *m*, 15—20 *a*; VII, 12—14 *m*, 11—14 *a*; VIII, 4—5. *Ventral*: II, 4; III, 3—4; IV, 16—17 *m*, 8—16 *a*; V, 17—20 *m*, 14—22 *a*; VI, 15—16 *m*, 13—19 *a*; VII, 9—13 *m*, 14—17 *a*; VIII, 1—3 each side.

MALE. *Dorsal:* I, 4; II, 4—5 *m*, 3—4 *a*; III, 11—16 *m*, 0—4 *a*; IV, 16—20 *m*, 6—10 *a*; V, 18—24 *m*, 10—13 *a*; VI, 20—24 *m*, 7—14 *a*; VII, 17—21 *m*, 7—10 *a*; VIII, 10—17. *Ventral*: II, 3—4; III, 3—4; IV, 12—16 *m*, 4—6 *a*; V, 17—19 *m*, 10—12 *a*; VI, 14—18 *m*, 10—13 *a*; VII, 11—13 *m*, 7—12 *a*; VIII, 4—5.

The female genitalia of *L. damarensis* and *L. bedfordi* are illustrated in figs. 5 & 13 respectively, the main difference being that in the latter the mesal margins of the gonapophyses touch in the midline, whereas they are clearly separated in *L. damarensis*. The male genitalia of the two species are exceedingly similar, but there are differences in the proportions of the endomeral pieces, as illustrated in figs. 8 & 9.

It may be noted that the blunt-tipped tergal setae described for the male of *L. damarensis* also occur in males of the other members of the *pithodes* group, with the exception of *L. spicatus*.

DISCUSSION

The Damara dikdik, *Madoqua kirki damarensis*, is confined to the Southwest Arid Zone of the Ethiopian region. In the Northeast Arid Zone, separated by some 2 100 km from the Southwest population (Tinley, 1969) are found six further subspecies of *Madoqua kirki* (Ansell, 1968). This discontinuous distribution is but one example of the biotic similarity between the Southwest and Northeast Arid Zones, presently isolated but probably in contact at different times during the Pleistocene (Tinley, 1969). Further examples are quoted by Benson & White (1962), and the map of the discontinuous distribution of the weaver bird *Ploceus rubiginosus* given by Moreau (1966, fig. 41) is remarkably similar to the distribution map for *Madoqua kirki* (Tinley, 1969, map 1). A detailed comparison of the Phthiraptera of *M. k. damarensis* and those of the Northeastern populations should be instructive, and might provide some useful information on the rate of speciation of lice on populations of the same host species which have probably been isolated from one another for some 11 000 years (Moreau, 1966, p. 186).

Unfortunately the Phthiraptera of *Madoqua kirki* are poorly known at present. The Ischnoceran *Damalinia victoriae* Hopkins, 1949 was described from *Rhynchotragus guentheri smithi* Thomas, 1901. Hopkins & Clay (1952) later cited the host as a form of *Rhynchotragus kirki*, but according to Ansell (1968), *smithi* Thomas is a subspecies of *Madoqua guentheri*, and the original combination given by Hopkins was correct. Turning to Anoplura, only one species of *Linognathus* is known from a form of the Northeastern *Madoqua kirki*. *L. geigyi* Büttiker, 1949 was based on specimens taken off a dikdik in the Zoological Gardens at Basel, Switzerland.

Büttiker (1949) has described how the dikdik (which he called *Madoqua saltiana*) was originally captured as a juvenile near Arusha, Tanzania. The ranges of *Madoqua* species as listed by Ansell (1968) makes it clear that the host was not *M. saltiania* but *M. kirki*, the probable subspecies being *M. k. cavendishi* Thomas, 1898. Mr. W. F. H. Ansell (*in litt.*, May, 1970) is in agreement: "... you are pretty safe I think in referring the Arusha dikdiks to *M. k. cavendishi*."

L. geigyi and *L. damarensis* are not in any way comparable; the former has an elongated forehead, and certainly occupies a different niche on the body of the host. The requirements for a valid comparison would be at least a species similar to *L. geigyi* from the Southwest *M. kirki*, or a member of the *pithodes* group from the Northeast populations. I have before me a single female *Linognathus*, belonging to an undescribed species, taken from the same animal as the series now described as *L. damarensis*. This specimen is again not strictly comparable with *L. geigyi*, having a somewhat short and bulbous forehead, which probably indicates a different feeding site on the host. Previous experience indicates that we can expect anything from one to five different species of Anoplura on the same host species (five *Linognathus* species have been recorded from *Antidorcas marsupialis*, see Kleynhans, 1968). Clearly, further collecting must be done to provide more knowledge of the Phthirapteran fauna on *Madoqua kirki* in both the Southwest and Northeast regions before we can take advantage of the opportunities provided by the discontinuous distribution of the host to shed some light on the possible rate of speciation in the lice.

KEY TO SPECIES OF THE *pithodes* GROUP

1. 1st claw similar in form and size to 2nd and 3rd claws. Abdomen in both sexes thickly beset with lanceolate setae dorsal and ventral, the normal pattern of two rows per segment being obscured, particularly towards lateral margins. Female genitalia as in fig. 10; male lacking blunt-tipped tergal setae *L. spicatus*

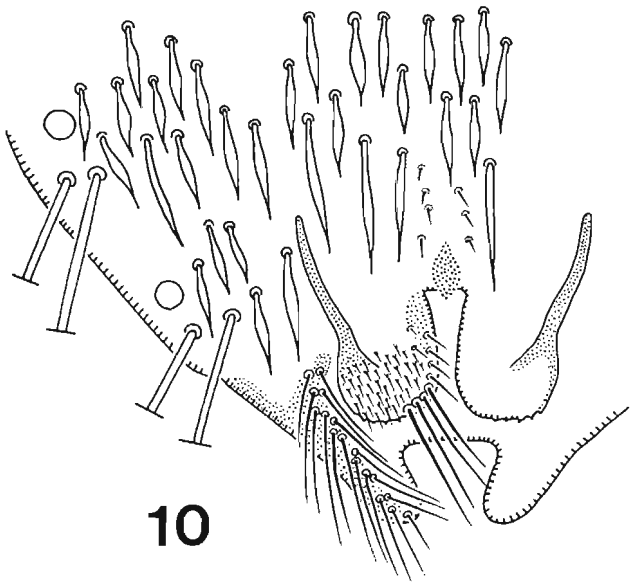
— 1st claw small and slender, abdominal chaetotaxy in both sexes less dense; males with blunt-tipped setae on some tergites 2.

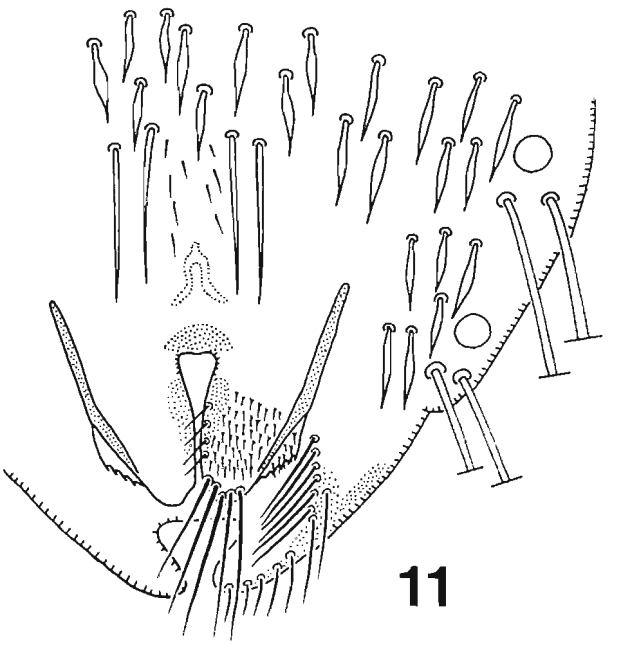
2. Median sclerotization of female genitalia as in fig. 11 or fig. 12, not linear. Males with distinct tergal plates on III—VII 3

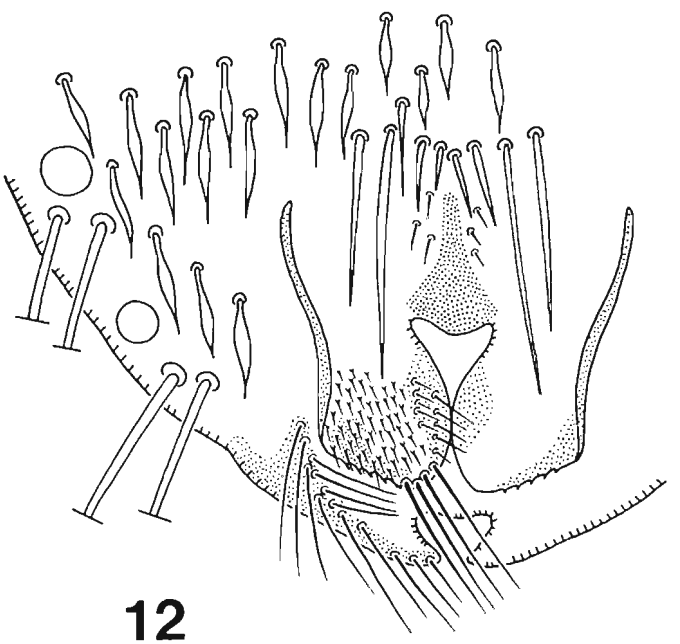
— Median sclerotization of female genitalia linear; males without tergal plates 4

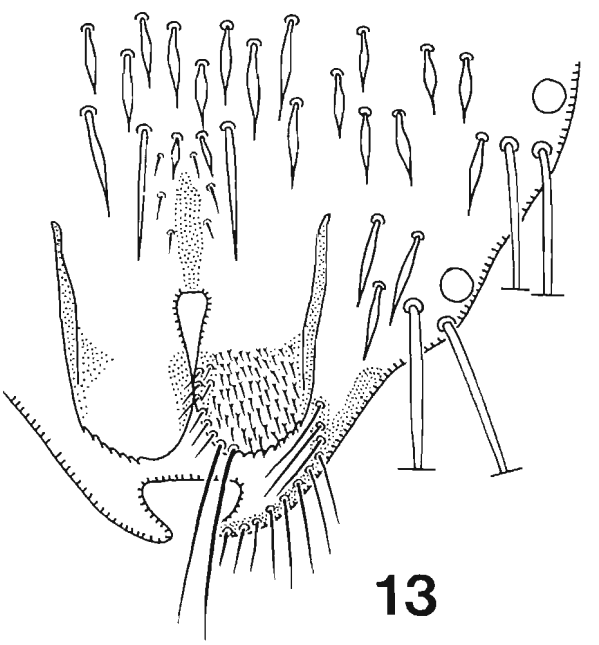
3. Female genitalia as in fig. 11; median sclerotization elliptical, gonapophyses tapering and convergent towards apices, mesal margins not touching *L. pithodes*

— Female genitalia as in fig. 12; median sclerotization widened at vulval margin, gonapophyses broad, lateral sclerotizations divergent apically, mesal margins touching *L. lewisi*









Figures 10-13. Female genitalia of *Linognathus* species, drawn to same scale. 10. *L. spicatus*. 11. *L. pithodes*. 12. *L. lewisi*. 13. *L. bedfordi*.

4. Female genitalia as in fig. 13; mesal margins of gonapophyses touching. Sternal setae on IV–VII in both sexes always in two full rows. Endomeral piece of male genitalia as in fig. 9.

– Female genitalia as in fig. 4; mesal margins of gonapophyses not touching. Sternal setae in both sexes usually in single rows; if additional setae are present, they are not arranged in definite rows. Both sexes with distinctly fewer setae, dorsal and ventral, than *bedfordi*. Endomeral piece of male genitalia as in fig. 8 *L. damarensis*

MATERIAL EXAMINED

The follwing specimens from the collections of the Veterinary Research Institute, Onderstepoort (OP) and the South African Institute for Medical Research, Johannesburg (SAIMR) were examined during the preparation of this paper: *L. bedfordi*: 1 ♂, 1 ♀ ex *Antidorcas marupialis*, Onderstepoort, from Northern Transvaal (25.vii.1930. OP); 8 ♂♂, 13 ♀♀ ex *Antidorcas marsupialis*, Bloemhof, Transvaal (J.A. Ledger, 18.iii.1968. SAIMR).

L. lewisi: 2 ♀♀ ex *Gazella thompsoni*, Naivasha, Kenya (E. A. Lewis, 11.ii.1931. OP); 1 ♂, 1 ♀ ex *Gazella thompsoni*, Narrosura, Masai Reserve, Kenya (E. A. Lewis, 29.xi.1932. OP); 1 ♂ ex *Gazella thompsoni*, Barkitabuk, Masai Reserve, Kenya (E. A. Lewis, 1.xii.1932. OP); 1 ♀ ex *Gazella thompsoni*, Banagi Hill, Tanzania (A. C. Brooks, 3.ix.1952. OP); 1 ♀ ex Thompson's Gazelle, Loliondo, Kenya (A. C. Brooks, 23.ii.1954. SAIMR)

L. pithodes: 1 ♂, 1 ♀ ex *Antilope cervicapra*, London Zoo (1938. OP).

L. spicatus: 2 ♂♂, 2 ♀♀ ex *Gorgon taurinus*, Maasstroom, Northern Transvaal (15.viii.1930. OP).

SUMMARY

A new species named *Linognathus damarensis* is described from the Damara dikdik. The new species belongs to the *pithodes* species-group, and a key to the latter is provided. Because of the discontinuous distribution of the host, a detailed examination of the lice on the isolated populations might provide useful information on the rate of speciation of the parasites.

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This paper is based in part upon the experience which I gained during a study trip to the British Museum (Natural History), London, during 1969; the financial support of the South African Concil for Scientific and Industrial Research for this purpose is gratefully acknowledged.

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