

A NEW SPECIES OF LIPOPTENA (DIPTERA: HIPPOBOSCIDAE) FROM SOUTHERN AFRICA

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ABSTRACT

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A new species of *Lipoptena* Nitzsch, 1818 was found on springbok *Antidorcas marsupialis* Zimmerman, 1780 in the Cape Province and the Orange Free State, South Africa. The flies, for which the name *Lipoptena annalizeae* is proposed, can be differentiated from the closely related *Lipoptena sepiacea* Speiser, 1905 on size, palps, chaetotaxy, pulvilli, and the shape of the posterior genital plates of the males. The morphology of the puparium of the new species is also described and compared with that of the puparia of *Lipoptena paradoxa* Newstead, 1907 and *Lipoptena binocula* (Speiser, 1908). A revised key to the southern African species and a summary of host records and distributional information is also presented.

INTRODUCTION

The subfamily Lipopteninae Speiser, 1908 was revised by Maa (1963) who synonymised the genus *Echestypus* with *Lipoptena* Nitzsch, 1818 and thereafter treats *Echestypus* as a species group of *Lipoptena*. Maa (1965) also provided a key to the genera and species, as well as a summary of the hosts. Maa (1969) placed *Lipoptena paradoxa* Newstead, 1907 and *Lipoptena binocula* (Speiser, 1908) in the *capreoli*-group (*sepiacea*-subgroup) of *Lipoptena* and supplied a revised checklist and a host index of the Hippoboscidae.

Lipoptena is a genus commonly recorded on antelopes (Bovidae) throughout the Afrotropical region. To date only 2 species, namely *L. paradoxa* and *L. binocula*, have been recorded for southern Africa. Their host-preferences have been listed by Haeselbarth, Segerman & Zumpt (1966). Although there are several incomplete descriptions of the exteriors of the puparia of various hippoboscid species (Ferris & Cole, 1922; Ferris, 1923; Schuurmans-Stekhoven, 1926; Bequaert, 1953; Maa, 1969). Baker (1990) and Visagie, Horak & Boomker (1992) provide the only detailed descriptions of the external characteristics of puparia of the genus *Lipoptena*, namely that of *Lipoptena mazamae* Rondani 1878 and *L. paradoxa* respectively. This paper records the discovery and provides the description of a 3rd species, *Lipoptena annalizeae*, occurring in South Africa. The diagnostic features of both the adult and puparium of this species were elucidated by means of scanning electron microscopy.

MATERIALS AND METHODS

Terminology

The various types of setae encountered on the flies are classified into 5 categories: *setae*, for ordinary cuticular extensions arising from alveoli; *bristles* or *macrosetae*, for long, stout, erect or sub-erect setae; *setulae*, for extra-fine, very short setae (costa of wing); *spurs*, robust setae at apex of tibia; *spines*, for short, very stout, dark coloured, modified setae on sternum and tarsomeres; the only true spines occur on wings (microtrichia). The descrip-

tive terms used for the wing venation have been modified from Bequaert (1940, 1942, 1957) and Maa (1962, 1963). The terminology used for the puparium follows Maa (1969) and Baker (1990). All measurements were made under the same magnification. The combined length of head and thorax was taken from the tips of the apical arms of the frons to the hind margin of the scutellum; and the length of the wing was taken from the base of the tegula to the tip of the membrane. Head width is the distance between the extreme outer margins in dorsal view, usually the outermost bulges of the eyes. Eye width is the greatest width of eye in dorsal view and the inner orbit is measured at the midline of the medio-vertex. The length and width of structures are expressed by the symbol "x" between the actual measurements.

Key to the genera of Lipopteninae of southern Africa [Adapted from Maa (1965)]

1. Wing represented only by a tiny, veinless, opaque, subcylindrical knob; halteres absent; eye narrower than antennal pit; ocelli absent; sternite 1 posteriorly emarginate *Melophagus* (Latreille)
Wing well developed in newly emerged adult, later breaking off and leaving a short, veined, partially transparent, flat stump; halteres present; eye considerably wider than antennal pit.....*Lipoptena* Nitzsch.....2

Key to the species of *Lipoptena* of southern Africa

2. (1) Palp distinctly protruding beyond anterior margin of frons; 1, 2 or 3 pairs of scutellars; metathoracic legs pulvilli knob-like; spiracular pores of pupa consistently arranged in 2 groups of 3 curved rows3
Palp hardly protruding beyond anterior margin of frons; 2 pairs of scutellars; the last tarsomere of all 3 pairs of legs with 1 apical, round, elongate pulvillus. Surface sculpture of pupa polygonal; spiracular pores of pupa scattered in 2 groups of 3 fields
..... *L. paradoxa* Newstead
3. (2) One pair of scutellars; inner orbit as broad as, or nearly as broad as the eye;

postvertex considerably shorter than mediovertex; the last tarsal segment of pro- and mesothoracic legs each with 1 apical, round, elongate pulvillus. Surface sculpture of pupa squamose; less than approximately 10 pupal spiracular pores in each curved row (Visagie, 1992, unpublished data)..... *L. binocula* (Speiser)

Two or 3 pairs of scutellars; inner orbit narrower than the eye; postvertex not or hardly shorter than mediovertex; the last tarsal segment of pro- and meso thoracic legs with knob-like pulvilli. Surface sculpture of pupa dentate polygonal; more than approximately 10 pupal spiracular pores in each curved row.....
..... *Lipoptena annalizeae* sp. nov.

LIPOPTENA ANNALIZEAE SP. NOV.

Description of adult

Female

Head and thorax: length holotype 2,87 mm (paratype range 2,40–2,87 mm); dark brown, with yellow-brown patches. Head: extended and broad behind eyes. Head width 1,43 mm (1,27–1,47 mm). Eye width 0,35 mm (0,27–0,35 mm). Inner orbit 0,23 mm (0,20–0,24 mm), (slightly narrower than eye), with 1 long vertical and 2–3 orbital bristles and 6 fine, short, orbital setae in curved row. Postvertex 0,27 × 0,58 mm (0,27–0,32 × 0,51–0,63 mm), width greater than length, posterior slightly raised, nearly as long as mediovertex. Mediovertex 0,34 × 0,27 mm (0,29–0,34 × 0,27–0,31 mm), usually slightly longer than wide, and slightly longer than postvertex and frontoclypeus. Palpus 1,5 × as long as antennal pit and in lateral view twice as long as wide (0,31 × 0,14 mm). Ventrally, and lateral to palpi, a group of 3–4 short setae and 2 bristles (1 of which is very long). Ventrolaterally below eye, 1 long bristle and ventrocentrally, 1 long bristle and 4 short setae (Fig. 1). Outer margin of eye with a series of fine spines and a few scattered short fine setae on the postgena. The gula bears a few setae at concave margin of prosternal lobes. Antenna short, subglobular, and recessed in antennal pit, which is surrounded by a continuous rim. Arista and setae illustrated in Fig. 2.

Thorax: Pronotum: narrow and transverse, posterior margin subangulate in centre, anterior margin gently concave; median notal and transverse mesonotal sutures not clearly defined and both terminate just above scutellum; longitudinal intrascutal groove absent; posthumeral suture well marked. Mesonotal chaetotaxy: 3 humerals, 7 left and 6 right acrostichals (paratype range from 4–7, asymmetrical), 2 dorsolatero-centrals (1 large, 1 small), 4 (range 3–4) postalar (1 usually long), 1 long prescutellar, 5–6 mesopleurals (in 2 rows, those of posterior row very long), 4 (range 4–6) scutellars in 2(3) pairs. Prosternal lobes (Fig. 3) nearly as long as wide, anteriorly acute, inner margin with 4–5 setae (penultimate very long) arranged in single, occasionally double series. Mesosternal spines irregular in distribution and in length and robustness. Spines of anterior-most row and of pos-

terior and posterolateral margins distinctly stouter than the rest of the intermediate spines, 1 long posterolateral bristle; submedian area bare; lateral area of mesosternum with long, fine setae. Metabasisternal spines in 3–4 irregular rows and a posterior row of distinctly longer spines than on mesosternum (Fig. 3).

Wing: Holotype wingless. Description based on paratype. Length 3,90 mm. Wing venation (Fig. 22): 3 well-developed longitudinal veins, viz. the 1st (R1), 3rd (R4+5) and 5th (M3+C1); the 6th longitudinal vein (2nd An) sclerotised and incomplete; other veins are depressed concave lines; 1 cross-vein (rm + M3), between 3rd and 4th longitudinals. Basal cell (1 + 2 basal cells fused), which lies between 3rd longitudinal vein (R4 + 5), the 5th (M3 + C1) and cross-vein (rm + M3) or (im), as well as 2nd marginal cell which lies between the longitudinal veins R1 and R4+5 and apical costal vein (CO2) are free of microtrichia. Wing blade cells 3R (radial), 1m and 2m (medial) and axillary cell bear uniformly scattered microtrichia on dorsal and ventral surfaces. Thickened basal costa (CO1), has 1 long and a few short setae. Apical costa (CO2), has 4 setulae.

Legs: 1 and 2—stout and setose, 3—more slender and setose. Coxa 1 bearing a dorsal row of 5 setae which gradually lengthen towards thorax, 5–6 long setae ventroposteriorly. Trochanter: 1 long ventral seta. Femur 1 with 4 major bristles along dorsomedian line, as well as 3 long bristles near base (1 anterior, 1 ventral, 1 posterior). Tibia 1 with 1 apical spur (Fig. 4). Foretarsus: 1st tarsomere, with 1 minor proximal ventrolateral spine, and 1 minor proximal mid-ventrolateral spine; 2nd and 3rd tarsomeres each with 1 minor proximal ventrolateral spine; 4th tarsomere with 1 major and 1 minor proximal ventrolateral spine and another minor spine just posterior to the major spine, 1 minor spine distally. Fifth tarsomere, 4 major ventroproximal spines in a row, of these 2nd and 3rd are the longest. Claw: asymmetrical, anterior claw longer. Pulvilli both knob-like (Fig. 4). Coxa 2: Small, few setae on anterior margin. Femur 2: 4 major bristles along dorsomedian line and 1 long ventral bristle. Tibia 2: 2 apical spurs (Fig. 5), 1 major on inner aspect and 1 minor proximal. Midtarsus: 1st tarsomere, with 1 major and 1 minor lateroproximal spine; 2nd tarsomere with 1 minor lateroproximal spine; 3rd tarsomere with 1 minor lateroproximal spine; 4th tarsomere, 1 major and 1 minor spine ventrolaterally, proximal and just posterior to the major spine there is another minor spine, 1 minor spine distally; 5th tarsomere with 4 major spines with 2nd and 3rd the longest (Fig. 5). Claw: asymmetrical with anterior claw longer, pulvilli knob-like. Femur 3: 10 major dorsal bristles in 2 rows, ventrally 1 proximal bristle and laterally 3 distal bristles. Tibia 3: 6 apical spurs (Fig. 6a), 3 major dorsal bristles, 3 major and 1 minor anterolateral bristles, 3 major ventral bristles and 1 major posterolateral bristle near apex. Hindtarsus: 1st tarsomere 2 minor spines on each side ventrolaterally; 2nd and 3rd tarsomeres 1 minor spine on each side ventrolaterally; 4th tarsomere with 1 major and 1 minor spine on each side ventro-

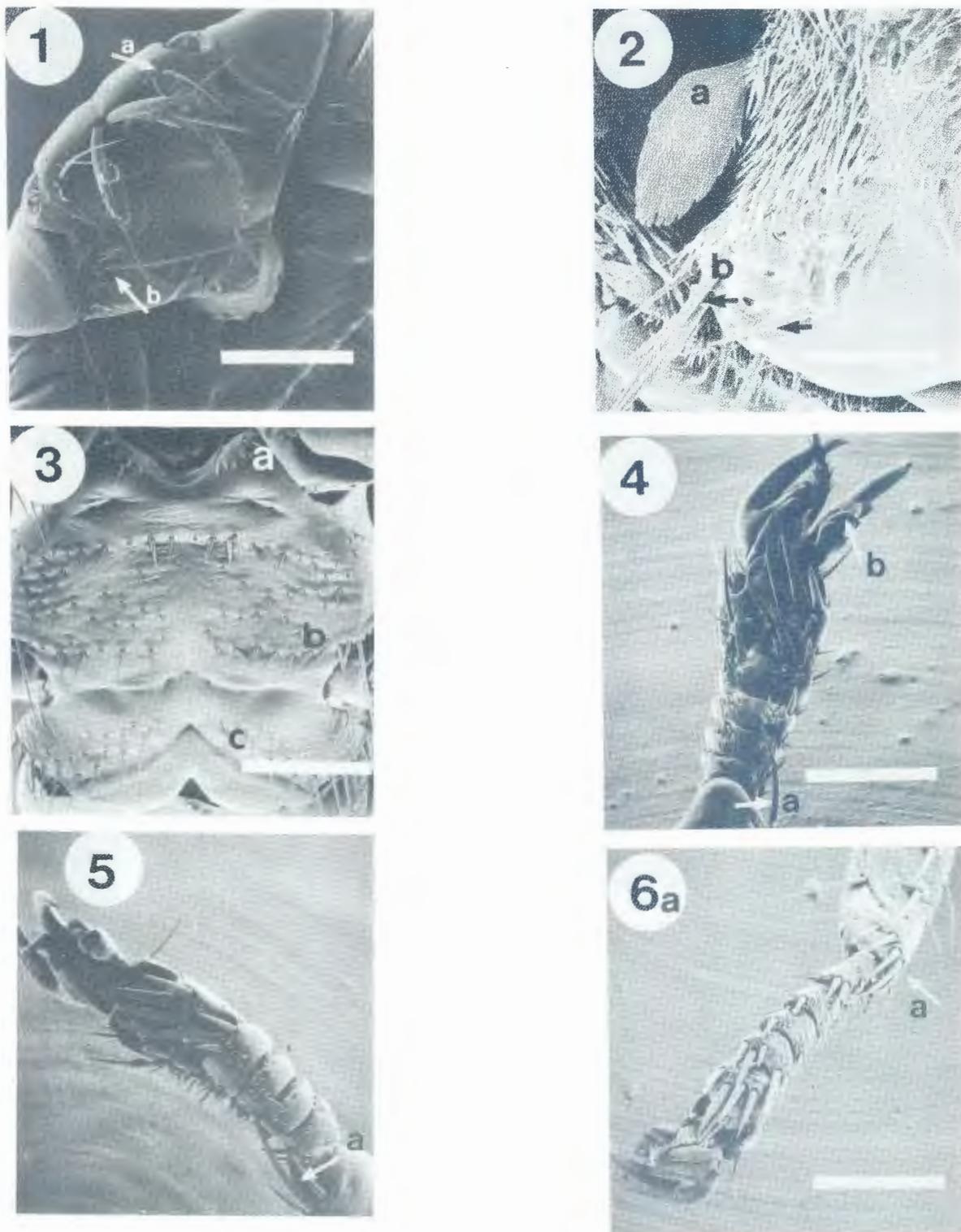


FIG. 1–6a *Lipoptena annalizeae* (sb = scalebar)

FIG. 1 Ventral view of head, 3–4 short setae and 1 long bristle ventrally next to palpi (a); 1 long bristle and 4 short setae below the eyes (b) (sb = 0,38 mm)

FIG. 2 Antenna, arista (a); setae (b) (sb = 43 μ m)

FIG. 3 Thorax ventrally, prosternal lobe (a); mesosternal spines (b); metabasisternal spines (c) (sb = 0,50 mm)

FIG. 4 Left tibia 1 with 1 apical spur (a). Tarsus with major and minor spines. Claw and knob-like pulvilli (b) (sb = 250 μ m)

FIG. 5 Left tibia 2 with 2 apical spurs (a). Tarsus with major and minor spines (sb = 250 μ m)

FIG. 6a Right hind tibia with apical spurs (a) and major and minor spines on the tarsus (sb = 0,38 mm)



- FIG. 6b–11 *Lipoptena annalizeae* (sb = scalebar)
 FIG. 6b Last tarsal segment of hindleg with simple bidentate claw (a) and knob-like pulvilli (b) (sb = 50 μ m)
 FIG. 7 Female pregenital plate (sb = 136 μ m)
 FIG. 8 Female genitalia, postgenital plate (a); and supra-anal plate (b); infra-anal plate (c) (sb = 150 μ m)
 FIG. 9 Male postgenital plate (sb = 200 μ m)
 FIG. 10 Male parameres (ventral view) (sb = 0,38 mm)
 FIG. 11 Male aedeagus (dorsal view) (sb = 0,38 mm)

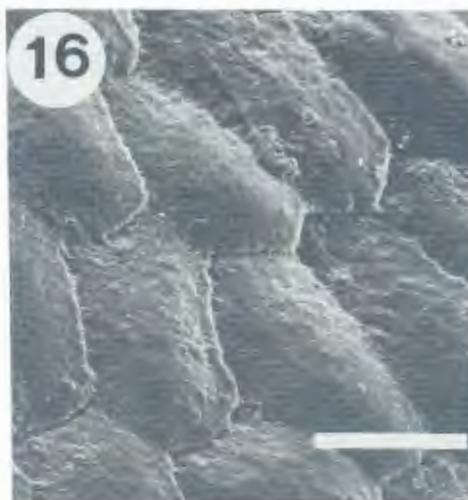


FIG. 12–17 *Lipoptena annalizeae* (sb = scalebar)

FIG. 12 Male parameres (a) and aedeagus (b) in dorsal view (sb = 0,38 mm)

FIG. 13 Surface of puparium with dentate polygonal pattern (sb = 31 μ m)

FIG. 14 Buccal opening on puparium (sb = 30 μ m)

FIG. 15 Posterior end of puparium with anal opening (a) and spiracular system (b) (sb = 0,38 mm)

FIG. 16 Pentagonal pattern on puparium between the spiracles (sb = 12 μ m)

FIG. 17 Spiracular pores radiate in 3 curved rows on either side of puparium (sb = 231 μ m)

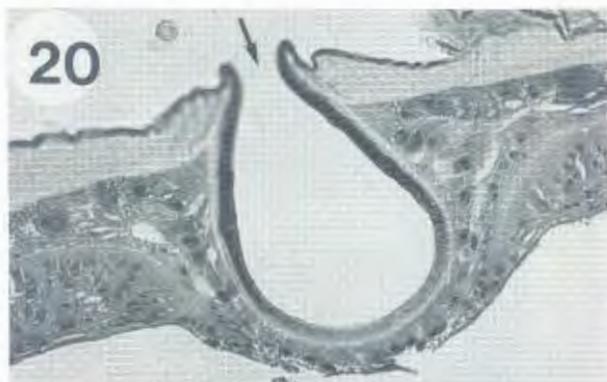


FIG. 18–21 *Liptoptena annalizeae* (sb = scalebar)

FIG. 18 Spiracular pore on puparium (sb = 6 μ m)

FIG. 19 Three tracheal branches on inner surface of puparium (a); large internal tracheal branch with smaller side branch (b) (sb = 100 μ m)

FIG. 20 Section through sclerotised anal opening on puparium.

FIG. 21 Lumen of tube lined by alimentary tissue leading from anal opening near posterior end of puparium

laterally, 1 minor spine just posterior to major distal spine. Fifth tarsomere 3 major mid-ventral spines and 1 long major ventrolateral, proximal spine and 1 minor ventrolateral, distal spine (Fig. 6a). Claws symmetrical and pulvilli knob-like (Fig. 6b).

Abdomen: Pleurite 1: large, transverse, outer margin slightly curved and longer than inner margin, posterior margin straight and fringed with 7 bristles, surface with few scattered setae, posterolateral angle narrowly rounded. Pleurite 2: narrowly rounded at apex, straight along inner margin, with long and robust setae. Tergites 3 + 4 subcampanulate, with 6 + 5 (range 4–7) setae; tergites 5 + 6 larger, transverse with 5 + 6 setae (range 3–6); tergite 7 clearly divided into 2 circular sections each bearing 4 setae (range 3–5). Sternite 1: posterior emargination semicircular, outer margin of posterior lobe straight and apex of this lobe oblique with 3–5 long, stout, apical bristles and some spines. Median length of sternite 1 exceeding that of its lateroposterior lobe. Setae on ventral abdominal membrane fairly uniform in length and robustness. Supra-anal plate fairly large and margin covered

with setae like those on infra-anal plate.

Genital area bordered anteriorly by 9 setae of same length as those on ventral membrane, arranged in single arcuate row; pregenital plate triangular, small, with 2, occasionally 4, robust setae at base (Fig. 7). Infra-anal plate covered with robust setae like those on supra-anal plate; post-genital plate with very short setulae centrally (Fig. 8).

Male

Similar to female, differing only in following characters.

Head and thorax: length 2,72–2,76 mm (n = 60).

Abdomen: tergites 3, 4, 5, and 6 + 7 with a range of 5–7, 4–6, 4–6 and 4–8 setae respectively. Sternite 1 with posterior emargination more triangular than in female, outer and inner margins straight and apex of posterior lobe evenly rounded, with 3–4 long, stout bristles and a few shorter spines on margin.

Genitalia: Post-genital plate is shaped as illus-

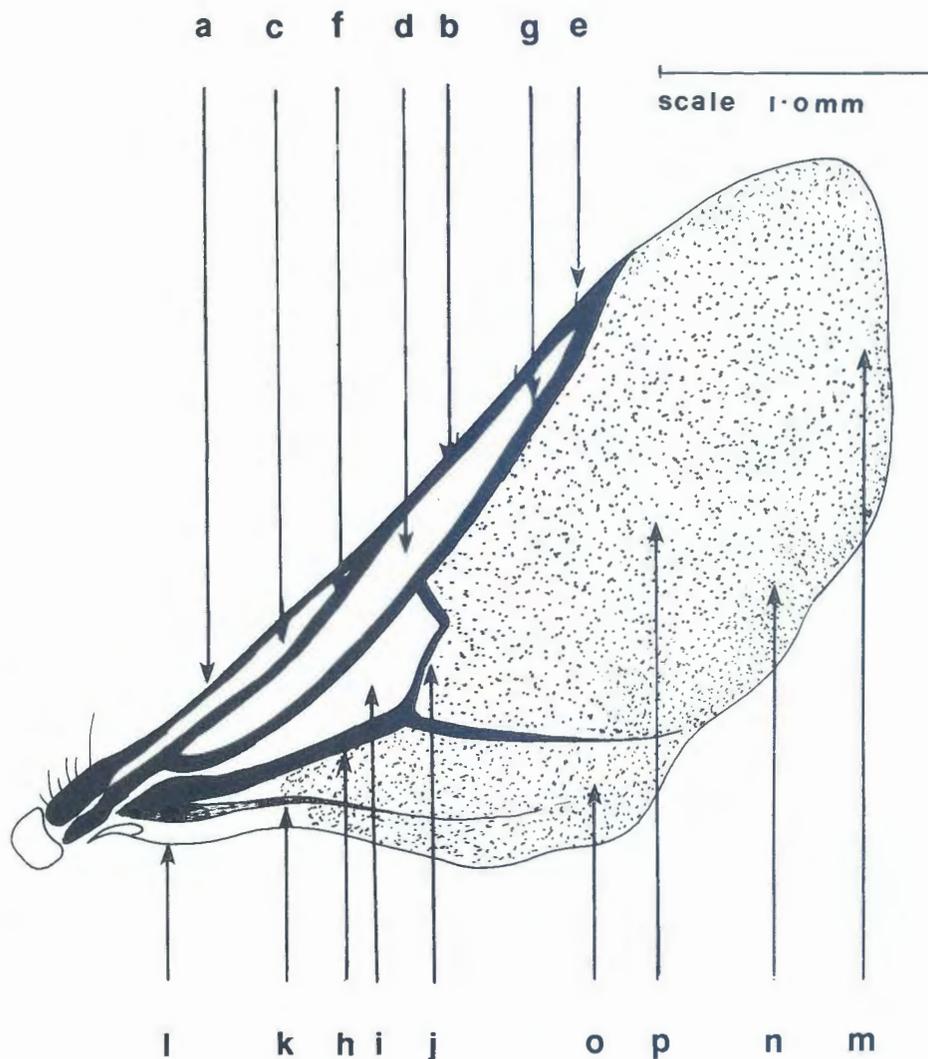


FIG. 22 Wing of *Lipoptena annalizeae* (a) basicosta-CO1; (b) apical costa-CO2; (c) 1st marginal cell; (d) 2nd marginal cell; (e) setulae; (f) R1; (g) R4+5; (h) M3+C1; (i) 1 + 2nd basal cell; (j) M3 + r-m cross-vein; (k) 2nd An; (l) alula (rudimentary); (m) 3r cell; (n) 1m cell; (o) 2m cell; (p) microtrichia

trated in Fig. 9 and parameres and aedeagus as in Fig. 10 to 12.

Puparium

Black, oval, mean size 3,2 × 2,3 mm (n=38). Surface smooth and shiny with a dentate, polygonal pattern (Fig. 13). Anteriorly an oval, folded, buccal opening (Fig. 14). Semicircular seams of anterior cap (via which adult escapes) run across surface and around to sides of puparium. Ventroapical pit, with circular opening bearing a cuticular, raised rim, lies just anterior to posterior plate (Fig. 15). Protruding posterior end of puparium encompasses anal area and spiracular complex (Fig. 15). Areas bearing a distinct pentagonal pattern between spiracles (Fig. 16). Externally spiracular pores radiate laterally in 2 groups of 3 curved rows. Number of pores in each row variable [in the specimen illustrated the number of pores on the 1 side is 10, 15, 9 and 12, 11, 14 on the other (Fig. 17)]. Each spiracular pore

consists of a circular plate with a central opening (Fig. 18). Internally on either side 3 tracheal branches attached to pupal wall. A larger tracheal branch with a smaller branch extends into body of the larvae inside puparium (Fig. 19). Internal surface of trachea with cuticular thickenings.

Material examined

Abbreviations of institutions as in Arnett & Samuelson (1986) with additionally: VRIO-Veterinary Research Institute, Onderstepoort, South Africa.

Information on the type material is given verbatim from the labels. Lines on the labels are separated by a slash (/), and different labels, from the top of the pin to the bottom, by a double slash (//).

Type material: **Holotype**—Female. S. Africa, CP / Wonderboom / Richmond / 31° 03' S, 24° 43' E // 8 Jan. 1991 / E. Visagie (BMSA) // *Antidorcas marsupialis*. (In alcohol).

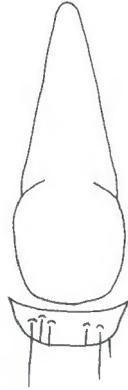


FIG. 23 Male postgenital plate of *Lipoptena sepiaceae* (illustration after Maa, 1969: 219, Fig. 39) (no scale given)

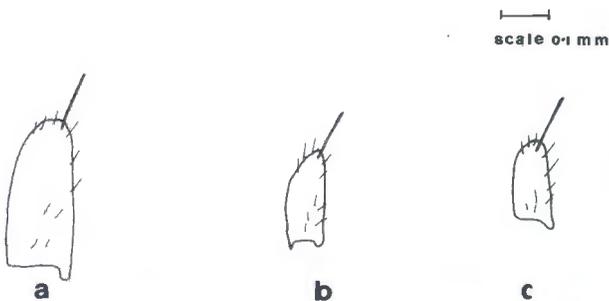


FIG. 24 *Lipoptena* species, right palpi of female — lateral view (a) *L. annalizeae*; (b) *L. sepiacea* illustrated after Maa (1969: 225, Fig. 66); (c) *L. binocula* illustrated after Maa (1969: 225, Fig. 68)

Paratype—120 specimens. 50 males, 50 females: S. Africa, CP / Wonderboom / Richmond / 31° 03' S, 24° 43' E // 8 Jan. 1991 / E. Visagie (BMSA) // *Antidorcas marsupialis*. (In alcohol).

Two male and 2 female paratypes, same data as above, have been deposited in each of the following institutions: BMNH, BPBM, MCZC, NMSA and ZMHB.

All other material examined was collected from springbok, *Antidorcas marsupialis*, within the Republic of South Africa. Other material: 1 ♂, 1 ♀, Pearston (32° 05' S, 25° 07' E), Cape Province (CP), 1965 (NMSA); 3 ♂, 9 ♀, Willem Pretorius Nature Reserve (ca 28° 17' S, 27° 15' E), Winburg, Orange Free State (OFS), Jul. 1977 (VRIO); 10 ♂, 12 ♀, 2 pupae, Dombietersfontein (31° 06' S, 23° 22' E), Victoria West, CP, 1 May 1978 (VRIO); 2 ♂, 2 ♀, 3 pupae, Hopewell (32° 21' S, 23° 07' E), Beaufort West CP, Jul. 1978 (VRIO); 10 ♂, 38 ♀, Hendrik Verwoerd Dam (ca 30° 35' S, 25° 33' E), OFS, 9 Apr. 1989, S. Vrahimis (BMSA); 4 ♂, 10 ♀, Willem Pretorius Nature Reserve, 7 Jun. 1989, H. Terblanche (BMSA); 1 ♂, Willem Pretorius Nature Reserve, 9 Apr. 1991, S. Vrahimis (BMSA); 1 ♂, 1 ♀, Willem Pretorius Nature Reserve, 19 Feb. 1992, S. Vrahimis (BMSA); 6 ♂, 4 ♀, 1 pupa, Sandveld Nature Reserve (ca 27° 45' S, 25° 47' E), Hoopstad, OFS, 23 May 1989, E. Visagie (BMSA); 1 ♂, 4 ♀, Iona (30° 29' S, 25°

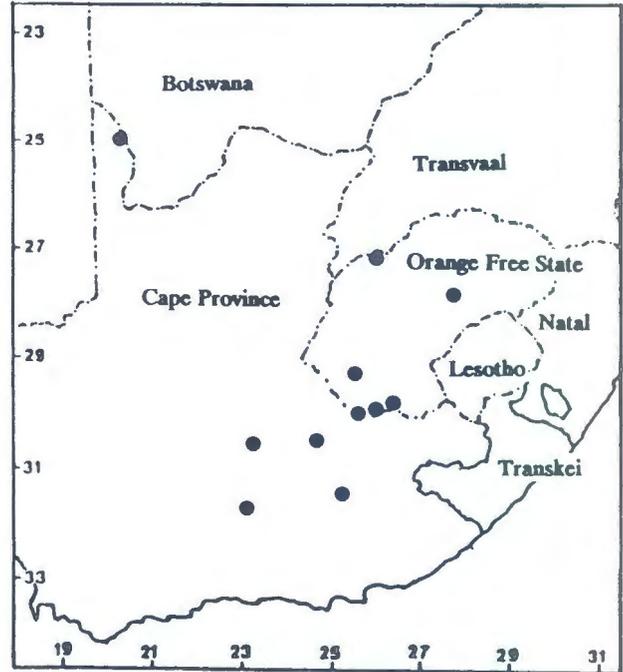


FIG. 25 Distribution of *Lipoptena annalizeae* in South Africa

49' E), Bethulie, OFS, 2 Jul. 1989, R. Adam (BMSA); 2 ♂, 4 ♀, Rusfontein (29° 56' S, 25° 26' E), Fauresmith, OFS, 2 Jul. 1990, P. van Rensburg (BMSA); 15 ♂, 18 ♀, 2 pupae, Rusfontein, Fauresmith, 1 Sept. 1990, E. Visagie (BMSA); 1 ♂, 1 ♀, Nossob (25° 25' S, 20° 36' E), Kalahari Gemsbok National Park, CP, 5 Oct. 1984, I. Horak (BMSA); 19 ♂, 15 ♀, Nossob, Kalahari Gemsbok National Park, Oct. 1990, K. Herholdt (BMSA); 30 ♂, 43 ♀, 1 pupa, Wonderboom (31° 03' S, 24° 43' E), Richmond, CP, 16 Jun. 1990, E. Visagie (BMSA); 17 ♂, 42 ♀, 33 pupae, Wonderboom, Richmond, 8 Jan. 1991, E. Visagie (BMSA); 34 ♂, 54 ♀, Wonderboom, Richmond, 20 Apr. 1991, J. Theron (BMSA); 34 ♂, 48 ♀, 4 pupae, Wonderboom, Richmond, 10 May 1991, P. van Rensburg (BMSA); 4 ♀, Tussen die Riviere Nature Reserve (ca 30° 29' S, 26° 11' E), Bethulie, OFS, 29 May 1991, A. Bothma (BMSA).

Distribution

From the collection localities of recently collected specimens and reliable older records, *L. annalizeae* is at present known from the central, and north- and south-western Orange Free State, the Kalahari Gemsbok National Park and the central parts of the Karoo, Cape Province (Fig. 25).

DISCUSSION

Adult

In general appearance *L. annalizeae* resembles *L. sepiacea* Speiser, 1905. However, *L. sepiacea* occurs in Ghana, Nigeria, Sudan, Eritrea, Kenya, Uganda, Tanzania and Malawi (Maa, 1969). According to Bequaert (1942) the only record of *L. sepiacea* for South Africa is based on a specimen from

“Caffraria” which Speiser included among the types. Bequaert restricted the name *sepiacea* to the form represented by the type from Witu, Lamu and Wangi, on the coast of Kenya. His description was based on 2 females in the ZMHB, 1 dry and labelled “Caffraria, Drege”, the other in alcohol, labelled Witu, Lamu u. Wangi 23 / 8, 95 Denhardt (Bequaert, 1942). He had not seen the types. The male holotype specimen of *L. sepiacea* which I received from ZMHB, was labelled “Caffraria / Witu, Lamu u / Wangi / Denhardt s.” and was preserved in alcohol. Only 2 other *L. sepiacea* specimens, 2 females, from Zumpt’s collection in NMSA were seen. They were labelled by Zumpt in 1960 as originating from Garua, Cameroons ex *Gazella rufifrons* Gray 1846. He labelled 2 other specimens, 1 male and 1 female, also as *L. sepiacea* — 1965 from Pearston, Cape Prov. ex *A. marsupialis*. After comparison with the type specimen of *L. sepiacea* from Kenya, and my type specimens of *L. annalizeae* I identified both the latter specimens as *L. annalizeae*.

The host list for *L. sepiacea* supplied by Maa (1969) is — Bovidae: Bovinae *Tragelaphus scriptus* (Pallas, 1766), *Tragelaphus strepsiceros* (Pallas, 1766); Cephalophinae: *Philantomba monticola* (Thunberg, 1789), *Cephalophus rufilatus* Gray, 1846, *Sylvicapra grimmia* L., 1758; Hippotraginae: *Damaliscus lunatus* (Burchell, 1823); Antilopinae: *Ourebia ourebi* (Zimmermann, 1783), *Gazella rufifrons* Gray, 1846, *Gazella thomsonii* Günther, 1884 and *Gazella granti* Brooke, 1872. The only host known for *L. annalizeae* is *A. marsupialis* Zimmerman, 1780.

L. annalizeae and *L. sepiacea* are so similar in appearance that at first glance, they were thought to be identical. The chief morphological differences are summarized in Table 1.

TABLE 1 Morphological differences between *Lipoptena annalizeae* and *Lipoptena sepiacea*

<i>L. annalizeae</i>	<i>L. sepiacea</i>
1. Size: female length (head and thorax) 2,88 mm palp 0,32 × 0,15 mm	Size: female 2,20 mm palp 0,20 × 0,08 mm
2. Shape of palpus (Fig. 24) much the same as <i>L. binocula</i> . See illustration by Maa (1969: 225, Fig. 68)	Illustration by Maa (1969: 225, Fig. 66)
3. 2 or 3 pairs of scutellars	2 pairs of scutellars
4. Tibia 3 with 6 apical spurs	Tibia 3 with 4 apical spurs
5. Tarsomere 4 + 5 of leg 3 with 5 + 5 plantar spines	Tarsomere 4 + 5 of leg 3 with 3 + 4 plantar spines
6. Pulvilli of legs 1 and 2 knob-like and vestigial	Pulvilli of legs 1 and 2 1 is knob-like and 1 is elongate.
7. Shape of male postgenital plate as in Fig. 9	Shape of male postgenital plate as in Fig. 23 after illustration by Maa (1969: 219, Fig. 39)

In both species the inner orbit is distinctly narrower than the eye. The arrangement of the mesosternal spines is similar in that they are irregularly distributed and not uniform in length and robustness. In the case of *L. annalizeae* the spines of the

anterior and posterior rows are a bit stouter and longer and the submedian area is bare. The shapes of the male and female sternite 1 of *L. annalizeae* differ slightly. These differences are not apparent for *L. sepiacea*. After examination of the 2 type specimens I received from ZMHB, I do not agree with Maa’s (1969) description or comparison of the mesosternal spines of *L. sepiacea* and *L. binocula*.

All known specimens of *L. annalizeae* have been collected from *A. marsupialis*. *L. binocula*, which also occurs in South Africa, has been recorded from *A. marsupialis* in the Cape Province (Middelburg) and the Orange Free State (Hoopstad) (Bequaert, 1942). In the Kalahari, South Africa (Bequaert, 1942) and Ovamboland, Namibia (Maa, 1965), it has been collected from *Rhaphicerus campestris* (Thunberg, 1811) without definite localities being supplied.

Zumpt’s collection, at NMSA, contains 2 male specimens of *L. binocula* from Ovamboland, Namibia and 1 female specimen from Bokbaai, Cape Province ex *Oryx gazella* (L., 1758) and 1 female specimen from Cape Town ex *Rhaphicerus melanotis* (Thunberg, 1811). Other specimens collected are 3 males and 3 females at Nossob, Kalahari Gemsbok Park on *R. campestris* (8 Oct. 1984) and 1 male at Langebaan, on *A. marsupialis* (12 Feb. 1990). According to Maa (1969) its distribution also includes Botswana and Mozambique.

It would be interesting to know where the distributions of *L. binocula* and *L. annalizeae* overlap, and whether the flies occur on the same hosts. It would appear as if the preferred host of *L. binocula* is *R. campestris* and that it mainly occurs in the western areas of southern Africa. *L. annalizeae* has been recovered only from *A. marsupialis* and then only in the more central regions of the country.

Puparium

The only detailed studies of the external characteristics of puparia are those of *L. mazamae* Rondani, 1878, by Baker, (1990) and *L. paradoxa* by Visagie *et al.* (1992). Maa (1963, 1969) and Baker (1990), referred to the opening, anterior to the stigmatic plate, on the ventral surface of the puparium, as the ventroapical pit, of which the function is unknown. In the present study, puparia, with larvae inside, were sectioned in order to examine this pit. These sections show a sclerotized opening leading to a posteriorly directed tube with typical alimentary tissue (Fig. 20 and 21). It would therefore appear as if the ventroapical pit is actually the anal opening, an opinion which is in agreement with Keilin (1944) and Hagan (1951). Although the shape of the puparium of *L. annalizeae* is similar to that of *L. mazamae* and *L. paradoxa* it is considerably larger.

The buccal cavity of the puparium of *L. annalizeae* is an oval, folded opening, while that of *L. paradoxa* is a circular opening with a ventral, slit-like extension (Visagie *et al.*, 1992). Bequaert (1953) mentioned that surface patterns occur on the puparia of several genera and Baker (1990) gives a detailed description of the pattern of *L. mazamae*. In the case of southern African *Lipoptena* the surface visually appears smooth and shiny, but microscopi-

cally each species has a particular surface pattern. Between the spiracular fields there are areas bearing distinct patterns which also differ between species. More research is needed to determine whether the differences in surface patterning are taxonomically important or not.

Externally the number and arrangement of the spiracular openings differ in the 3 South African species. *L. annalizeae* and *L. binocula* have 3 curved rows of spiracles that radiate laterally from the anal opening on each side. In the case of *L. paradoxa* the pores are scattered in 3 fields on either side. Internally the 3 tracheal branches have smaller secondary branches in *L. paradoxa*, a feature not noticed in the other species. The posterior ends of the puparia of the 3 species also differ in appearance.

Etymology

Named for my daughter, in appreciation of her support during my study.

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REFERENCES

- ARNETT, R. H. Jr & SAMUELSON, G. A., 1986. The insect and spider collections of the world. Brill, E. J., Gainesville, USA.
 BAKER, G. T., 1990. Morphology of the puparium of *Lipoptena*

- mazamae* Rondani (Diptera: Hippoboscidae). *Proceedings of the Entomological Society of Washington*, 92, 224–229.
 BEQUAERT, J. C., 1940. Notes on Hippoboscidae. 14. The genus *Echestypus* Speiser. *Psyche, Cambridge*, 47, 85–104.
 BEQUAERT, J. C., 1942. A monograph of the Melophaginae. *Entomologica Americana*, 22, 138–160.
 BEQUAERT, J. C., 1953. The Hippoboscidae or louse-flies (Diptera) of mammals and birds. Part I. Structure, physiology and natural history. *Entomologica Americana*, 32, 1–209 and 211–242.
 BEQUAERT, J. C., 1957. The Hippoboscidae or louse-flies (Diptera) of mammals and birds. Part II. Taxonomy, evolution and revision of American genera and species. *Entomologica Americana*, 36, 417–611.
 FERRIS, G. F., 1923. Observations on the larvae of some Diptera Pupipara, with description of a new species of Hippoboscidae. *Parasitology*, 15, 54–58.
 FERRIS, G. F. & COLE, F. R., 1922. A contribution to the knowledge of the Hippoboscidae (Diptera Pupipara). *Parasitology*, 14, 178–205.
 HAESSELBARTH, E., SEGERMAN, J. & ZUMPT, F., 1966. The arthropod parasites of vertebrates in Africa south of the Sahara (Ethiopian Region), Vol. III. (Insecta excl. Phthiraptera). Publication No 52 of the South African Institute for Medical Research, Johannesburg.
 HAGAN, H. R., 1951. Embryology of the viviparous insects. The Ronald Press Company, New York.
 KEILIN, D., 1944. Respiratory systems and respiratory adaptations in larvae and pupae of Diptera. *Parasitology*, 4, 53–57.
 MAA, T. C., 1962. Notes on the Hippoboscidae (Diptera). *Pacific Insects*, 4, 583–614.
 MAA, T. C., 1963. Genera and species of Hippoboscidae (Diptera). Types, synonymy, habitats and natural groupings. *Pacific Insects Monograph*, 6, 1–186.
 MAA, T. C., 1965. A synopsis of the Lipopteninae (Diptera: Hippoboscidae). *Journal of Medical Entomology*, 2, 233–248.
 MAA, T. C., 1969. Studies in Hippoboscidae (Diptera). Part 2. *Pacific Insects Monograph*, 20, 205–236 and 261–299.
 NEWSTEAD, R., DUTTON, J. E. & TODD, J. L., 1907. Insects and other Arthropoda collected in the Congo Free State. Being the Seventh Interim Report of the Expedition of the Liverpool School of Tropical Medicine to the Congo, 1903–5. *Annals of Tropical Medicine and Parasitology*, 1, 1–112 + 6 plates.
 SCHUURMANS-STEKHOVEN, J. H., 1926. Studies on *Hippobosca maculata* Leach and *H. equina* Leach in the Dutch East Indian Archipelago. *Parasitology*, 18, 35–50.
 SPEISER, P., 1905. Beiträge zur Kenntnis der Hippobosciden (Diptera). *Zeitschrift für Systematische Hymenopterologie und Dipterologie*, 5, 347–360.
 SPEISER, P., 1908. 5. Diptera pupipara (Hippoboscidae). *Denkschriften der Medizinische Naturwissenschaftliche Gesellschaft zu Jena*, 13, 175–178.
 VISAGIE, ELIZE J., HORAK, I. G. & BOOMKER, J., 1992. The louse fly *Lipoptena paradoxa* Newstead, 1907 (Diptera: Hippoboscidae): description of its adult and puparium and biology in South Africa. *Onderstepoort Journal of Veterinary Research*, 59, 303–314.