

A redescription of *Lipoptena binocula* (Speiser 1908) (Hippoboscidae: Diptera), with notes on its biology and comparisons with the other two flies of this genus in South Africa

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ABSTRACT

VISAGIE, ELIZE J. 1993. A redescription of *Lipoptena binocula* (Speiser 1908) (Hippoboscidae: Diptera), with notes on its biology and comparisons with the other two flies of this genus in South Africa. *Onderstepoort Journal of Veterinary Research*, 60:51–58 (1993)

The external morphology of the adult and puparium of *Lipoptena binocula* are described by means of scanning electron microscopy and the morphological characteristics are compared with those of *Lipoptena paradoxa* and *Lipoptena annalizeae*. The geographic distributions and hosts of the 3 flies are also discussed.

INTRODUCTION

According to the latest revision of Maa (1969) the subfamily Lipopteninae includes the genera *Lipoptena* (with 28 species and subspecies allocated to 4 groups), *Neolipoptena* (with 1 Nearctic species) and *Melophagus* (with 4 species and subspecies allocated to 2 groups). The 4 groups of *Lipoptena* are the *pteropti* group, *cervi* group, *capreoli* group and the *depressa* group. The *cervi* group is divided into 2 subgroups, namely *cervi* and *pauciseta* and the *capreoli* group is divided into the *capreoli* and *sepiacea* subgroups. The *capreoli* subgroup occurs in the Palaearctic Region, while the *sepiacea* subgroup is found in the Ethiopian and Oriental (India) Regions where it is present on Bovinae, Cephalophinae, Hippotraginae and Antilopinae. The main characters from which the *sepiacea* subgroup can be recognised are ocelli generally absent, palpi occasionally vestigial, reduced chaetotaxy and female pregenital plate always present. The 3 southern African species belonging to the

sepiacea subgroup are *Lipoptena paradoxa* Newstead, 1907, *Lipoptena binocula* (Speiser, 1908) and *Lipoptena annalizeae* Visagie, 1992.

GENUS: LIPOPTENA NITZSCH, 1818

SEPIACEA-GROUP (*Echestypus*)

Lipoptena binocula (Speiser, 1908)
Lipoptena sepiacea Speiser, 1905 (pt paratype) (Caf-
fraria) new synonymy
Echestypus binoculus Speiser, 1908 (Bechuana-
land)
Echestypus binoculatus "Speiser" Aldrich, 1923

Description of adults

Female

COLOUR. Light to dark brown.

HEAD AND THORAX. Length range from 2,03–2,23 mm.

HEAD. Moderately extended behind the eyes. Head width range from 1,20–1,30 mm. Mediovertex:

0,24–0,32 mm × 0,12–0,24 mm, longer than wide, slightly longer than frontoclypeus and postvertex. Inner orbit (0,26–0,30 mm) nearly as broad as the eye (0,29–0,32 mm) with 1 long vertical bristle and 5 orbital setae set away from the inner margin. [I do not agree with Maa (1969) and Bequaert (1942), that the inner orbit is broader than the eye. The original description of Speiser (1908) also mentions that it is only nearly as broad as the eye]. Postvertex: 0,19–0,24 mm, about half the length of mediovertex, short and wide, flattened, semi-elliptical. Palpus: 0,26 × 0,10 mm, twice as long as wide and longer than the antennal pit. Lower margin of palpus minutely dentate (Fig. 1). Shape (illustrated in Maa 1969, p. 225, Fig. 68), similar to *L. annalizeae* (Visagie 1992). Apicad 1 long seta and a few small setae. Ventrally and lateral to palpi a few short setae and 2 bristles (of which 1 very long) (Fig. 2). One long bristle midlaterally below the eye. Outer margin of eye with a series of fine spines and on the postgena there are a few scattered short, fine setae, fewer than in the case of *L. annalizeae*. The gula bears a few setae at the concave margin of the prosternal lobes.

ANTENNA. Short, subglobular and recessed in antennal pit, which is surrounded by a continuous rim. Arista and setae illustrated in Fig. 3.

THORAX. Pronotum: narrow and transverse, anterior margin gently concave and posterior margin subangulate in centre. Median notal and transverse mesonotal suture faint and both terminate just above scutellum; longitudinal intrascutal groove absent; posthumeral suture distinct. Mesonotal chaetotaxy: 3 humerals, 3–5 acrostichals (asymmetrical) in a curved row; 2 dorsolatero-centrals (1 very long); 2 postalars (1 very long); 3–4 mesopleurals (posterior row longest); 1 prescutellar and 1 pair of scutellars. Prosternal lobes shorter than wide, anteriorly acute, inner margin with 3 setae of which the 3rd is the longest. Mesosternal spines: irregularly distributed and spines of anterior-most row and posterior row stouter than on intermediate area and on ventral disc of coxa 3 and larger than spines of posterolateral margin. Posterolateral margin of mesosternum, 1 long bristle. [These spines do not correspond with Maa's (1969) description.] Spines on metabasisternum in 3 rows, those of hindmost row distinctly longer than on mesosternum.

WING. Unknown.

LEGS. Fore- and midleg, stout and setose, hindleg more slender and setose. Coxa 1 bearing a dorsal row of 3–4 setae which gradually lengthen towards the thorax, 4 long ventroposterior setae. Trochanter, 1 long ventral seta. Femur 1 with 3 major bristles along dorsomedian line, as well as 3 long anterior bristles near base (1 anterior, 1 ventral, 1 posterior). Tibia 1 with 1 apical spur (Fig. 4). Fore-

tarsus: 1st, 2nd and 3rd tarsomeres each with 1 minor proximal ventrolateral spine; 4th tarsomere 1 minor and 1 major proximal, ventrolateral spine and 1 minor ventrodorsal spine. Just posterior to major spine, 1 minor ventral spine. Fifth tarsomere, 2 major ventroproximal spines (Fig. 5). Claw: asymmetrical, anterior claw longer, anterior pulvillus short and posterior pulvillus elongate and fully developed (Fig. 5). Coxa 2: small with few fine setae on anterior margin. Femur 2: 3 major bristles along dorsomedian line and 1 long ventroposterior bristle. Tibia 2: 2 apical spurs with 1 minor proximal spine and 1 major spine on inner aspect. Midtarsus (Fig. 6): 1st, 2nd and 3rd tarsomere, 1 minor proximal ventrolateral spine; 4th tarsomere same as foreleg. Fifth tarsomere with 2 major ventrolateral spines with proximal spine the longest. Claw: asymmetrical, anterior claw longer, anterior pulvillus short, posterior pulvillus elongate, fully developed. Femur 3: 8 major dorsal bristles in 2 rows, ventrally 1 long bristle at the base and 1 proximal lateral bristle near the apex. Tibia 3: with 4 apical spurs (Fig. 7), 3–4 long bristles dorsomedially, 1 long bristle lateroproximally near apex and 2 bristles laterodistally near apex, and 3 ventral bristles. Hindtarsus (Fig. 7): 1st tarsomere, 2 minor ventrolateral spines on either side; 2nd and 3rd tarsomere, 1 minor ventrolateral spine on each side; 4th tarsomere, 1 major and 1 minor ventrolateral spine on each side; 1 minor spine just posterior to the major distal spine. Fifth tarsomere, 1 major and 1 minor midventral spine, distally 1 major spine; 1 minor spine laterodistally and 1 major spine lateroproximally. Claws: symmetrical and pulvilli both knob-like (Fig. 7).

ABDOMEN. Pleurite 1: large, square with outer margin nearly straight, posterior inner margin straight and fringed with 3–5 bristles, surface without any setae. Pleurite 2: dorsal view truncate at apex, posterior inner margin slightly curved, concave surface with uniformly spaced setae. Tergites 3–5, large subcampanulate, each with 1 seta in hind corner. Tergite 6, large, transversely elliptical with 2 (occasionally 3) setae in each hind corner. Tergite 7 divided into a pair of circular sections each bearing 2 (occasionally 3) setae. Sternite 1: posterior emargination almost semicircular; outer margin of its posterior lobe slightly curved and the lobes long and narrow with the apex rounded, with 3–4 long stout bristles and stout spines along the hind margins. Median length of sternite 1 exceeding that of its lateroposterior lobe. Setae on ventral membrane fairly uniform in length and robustness and arising from thickened bases. Supra-anal plate: margin covered with robust setae like those on infra-anal plate. Genital area bordered anteriorly by 7–10 setae of same length as setae on ventral membrane, arranged in single arcuate row; pregenital plate small, roundish with 2 robust setae (Fig. 8), 1

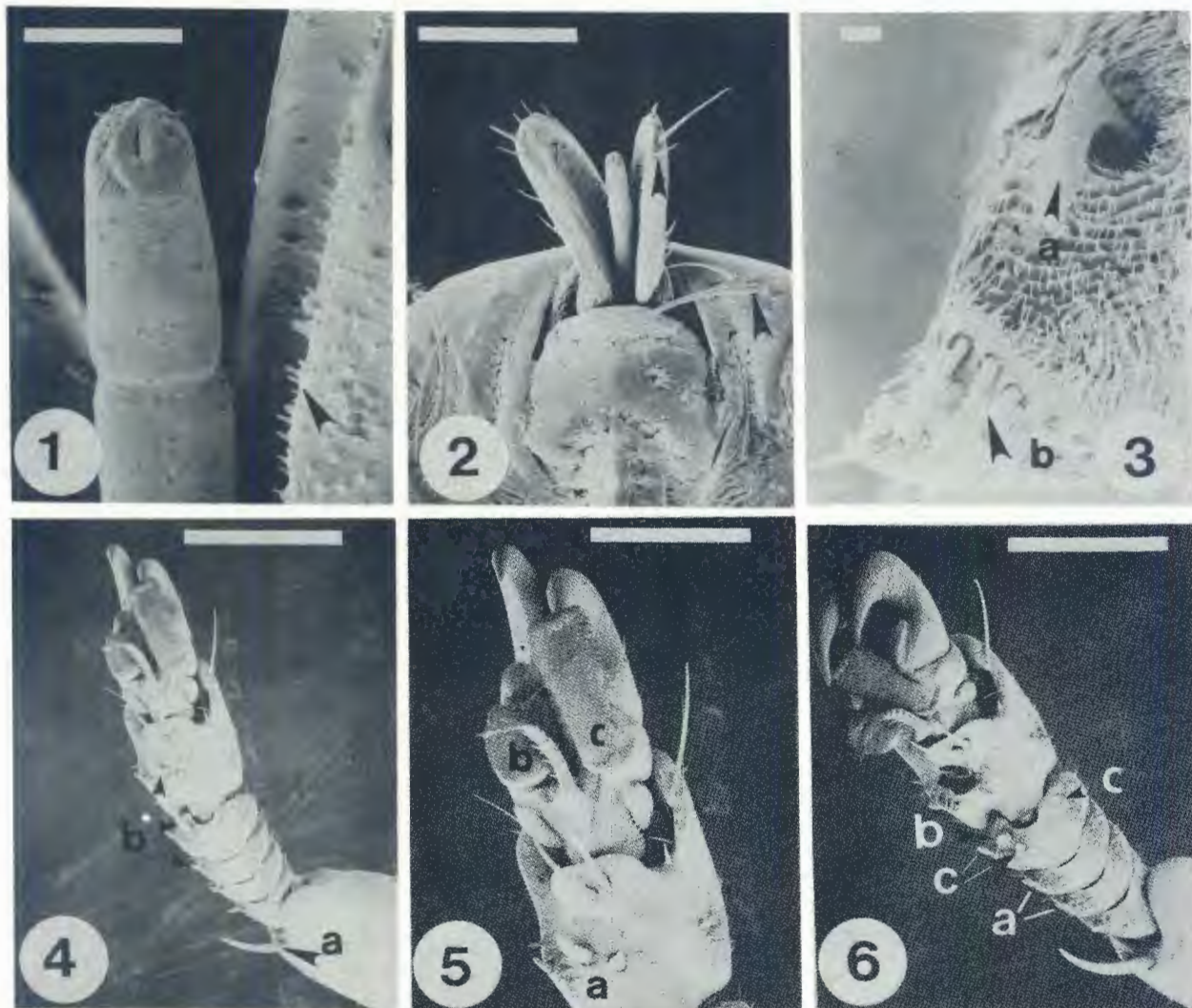
at each corner and plate not larger than basal papilla of neighbouring setae. Infra-anal plate covered with robust setae like those on supra-anal plate; post-genital plate (Fig. 9) with short setulae centrally.

Male

HEAD AND THORAX. Length 1,95–2,23 mm. Head, thorax and legs similar to female. Mesosternal spines slightly fewer and less robust.

ABDOMEN. Tergites 3, 4, 5, 6 and 7 (fused) with 1, 1, 1 and 2 setae respectively in each corner. Sternite 1: outer margin of posterior lobe is more straight than curved and the apex of the lobes is narrowly rounded.

GENITALIA. Post-genital plate with about 14 setae at the broader posterior edge (Fig. 10). The parameres are covered by microsetae at the apices and the aedeagus with microsetae in the central part extending to the apex (Fig. 11).



Lipoptena binocula (sb = scale bar)

FIG. 1 Palpus with lower dentate margin (sb = 27 μ m)

FIG. 2 Palpi with setae and 1 long bristle lateral to each palpus (sb = 176 μ m)

FIG. 3 Arista (a) and setae (b) of antenna (sb = 10 μ m)

FIG. 4 Fore tibia with spur (a) and spines (b) (sb = 0,27 mm)

FIG. 5 Fifth tarsomere with 2 major spines (a), anterior pulvillus (b) and posterior pulvillus (c) (sb = 150 μ m)

FIG. 6 Midtarsus: 1st–3rd tarsomeres each with 1 minor spine (a) and 4th tarsomere with 1 major spine (b) and 3 minor spines (c) (sb = 200 μ m)

Material examined

The 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 (//). The abbreviations for the institutions from which material was examined for this study are given below:

ZMHB—Museum für Naturkunde der Humboldt Universität zu Berlin

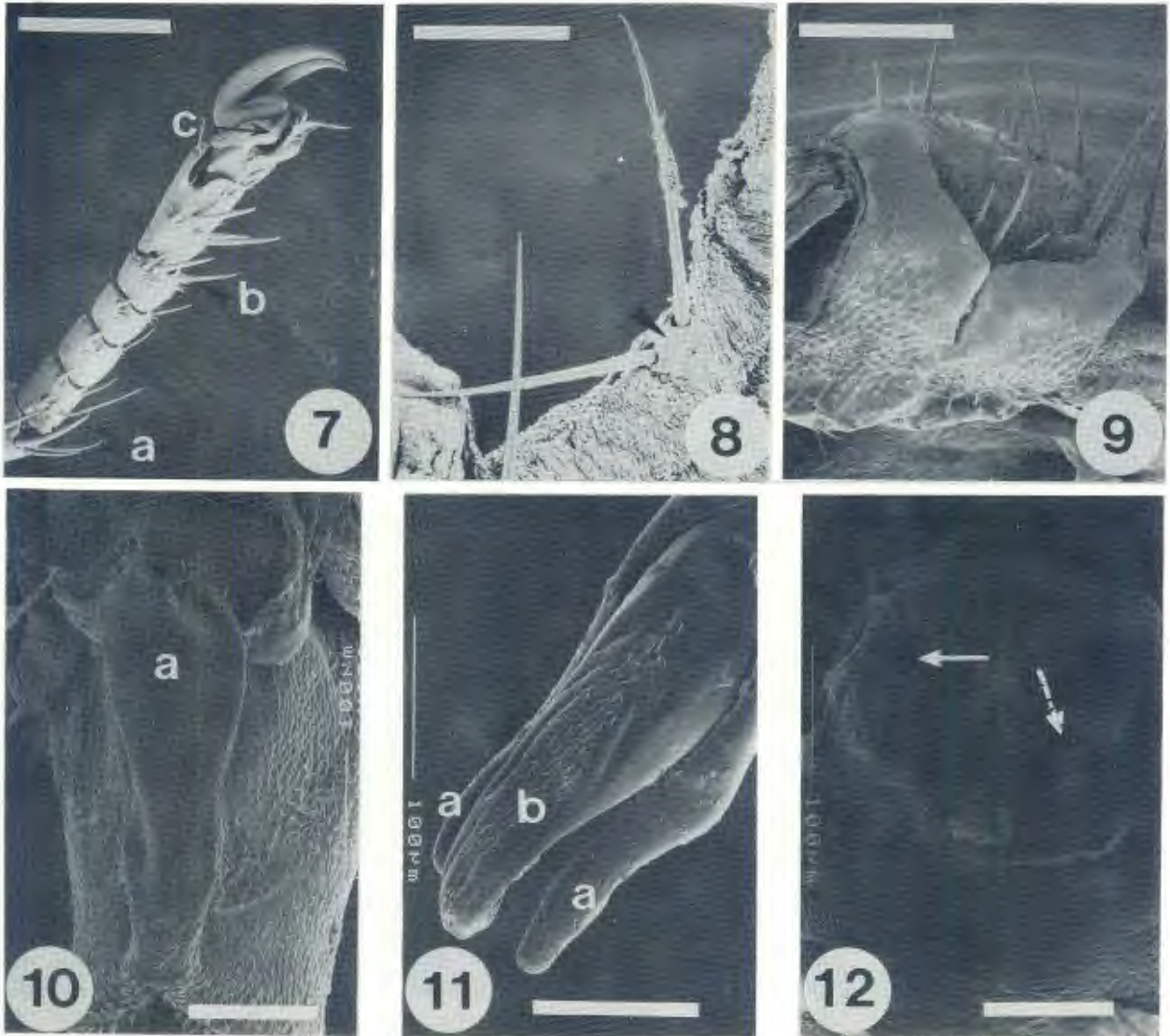
BMSA—Bloemfontein National Museum, South Africa

NMSA—Natal Museum, Pietermaritzburg, South Africa

KNP—Kruger National Park

Lectotype

Female; *Echestypus/binoculus* female/ Speis./ Lecto-holotype/(sic!)T.C. Maa det. 1962//ZMHB.



Liptoptena binocula (sb = scale bar)

FIG. 7 Hind tibia with apical spurs (a) and tarsus with spines (b) and knoblike pulvillus (c) (sb = 0,30 mm)

FIG. 8 Pregenital plate of female (sb = 100 μ m)

FIG. 9 Postgenital plate of female (sb = 100 μ m)

FIG. 10 Male postgenital plate (a) (sb = 100 μ m)

FIG. 11 Male parameres (a) and aedeagus (b) (sb = 100 μ m)

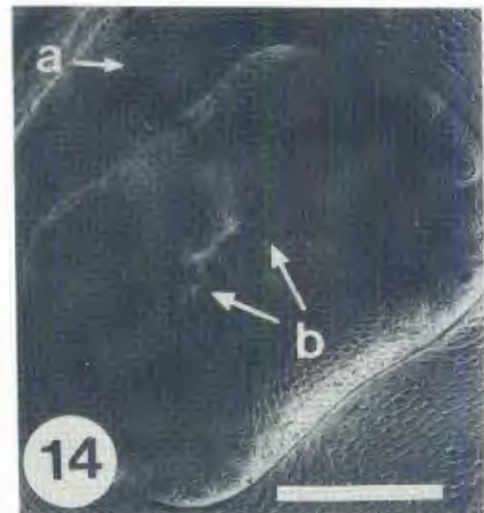
FIG. 12 Buccal cavity with slit-like extension at anterior end of puparium (sb = 100 μ m)

Although not recorded on the label, this fly was collected from a steenbok, *Rhaphicerus campestris*, in the Kalahari, South Africa (Speiser 1908). Material received from: NMSA: 2♂♂, Ovamboland, SWA, no host record, Apr. 1971; 1♀, Bokbaai (33°34'S, 18°20'E), Cape Province, ex *Oryx gazella*, 16 June 1973; 1♀, Cape Town, ex *Rhaphicerus melanotis*, Aug. 1976; KNP: 2♂♂ and 2♀♀, Nossob (25°30'S, 20°37'E), Kalahari Gemsbok Park, Cape Province, ex *Rhaphicerus campestris*, 8 Oct. 1984; BMSA: 1♂, Langebaan, (33°58'S, 17°58'E) Cape Province, ex *Antidorcas marsupialis*, 12 Feb. 1990; 6♂♂ and 4♀♀, Ester (25°24'S, 22°56'E), Vryburg, Cape Province, ex *Rhaphicerus campestris*, Dec. 1991, H. Eksteen.

Puparium

The general morphology of the puparium of *L. binocula* is similar to that of *L. paradoxa* (Visagie, Horak & Boomker 1992) and *L. annalizeae* (Visagie

1992). The size is unknown because no pupae could be obtained from living flies. The pupa which was used for SEM study was dissected from a female uterus. The buccal cavity of the puparium of *L. binocula* (Fig. 12) is a circular opening with a slit-like extension, like that of *L. paradoxa*. The surface pattern of the puparium as illustrated in Fig. 13, is squamose. It differs from those of *L. paradoxa*, in which it is polygonal (Visagie *et al.* 1992) and *L. annalizeae*, in which it is dentate polygonal (Visagie 1992). In Fig. 14 the posterior end of the puparium with the 2 tracheal openings and spiracular pores, which radiate in 2 groups of 3 curved rows as well as the anal opening is illustrated. The number of pores in the 3 rows on the 1 side of the specimen illustrated in Fig. 15 is 7, 5 and 10 respectively. The spiracular pores on the pupal wall are attached to small tracheal branches leading into the 3 main tracheal branches on either side of the spiracular plate (Fig. 16.)



Lipoptena binocula (sb = scale bar)

FIG. 13 Surface pattern of puparium (sb = 10 µm)

FIG. 14 Posterior end of puparium with postventral anal opening (a) and 2 tracheal openings (b) (sb = 231 µm)

FIG. 15 Spiracular pores on posterior end of puparium radiate in 3 curved rows with 7, 5 and 10 openings (sb = 136 µm)

FIG. 16 Spiracular pores open via small tracheal branches into main tracheal branch on inner surface of puparium (sb = 10 µm)

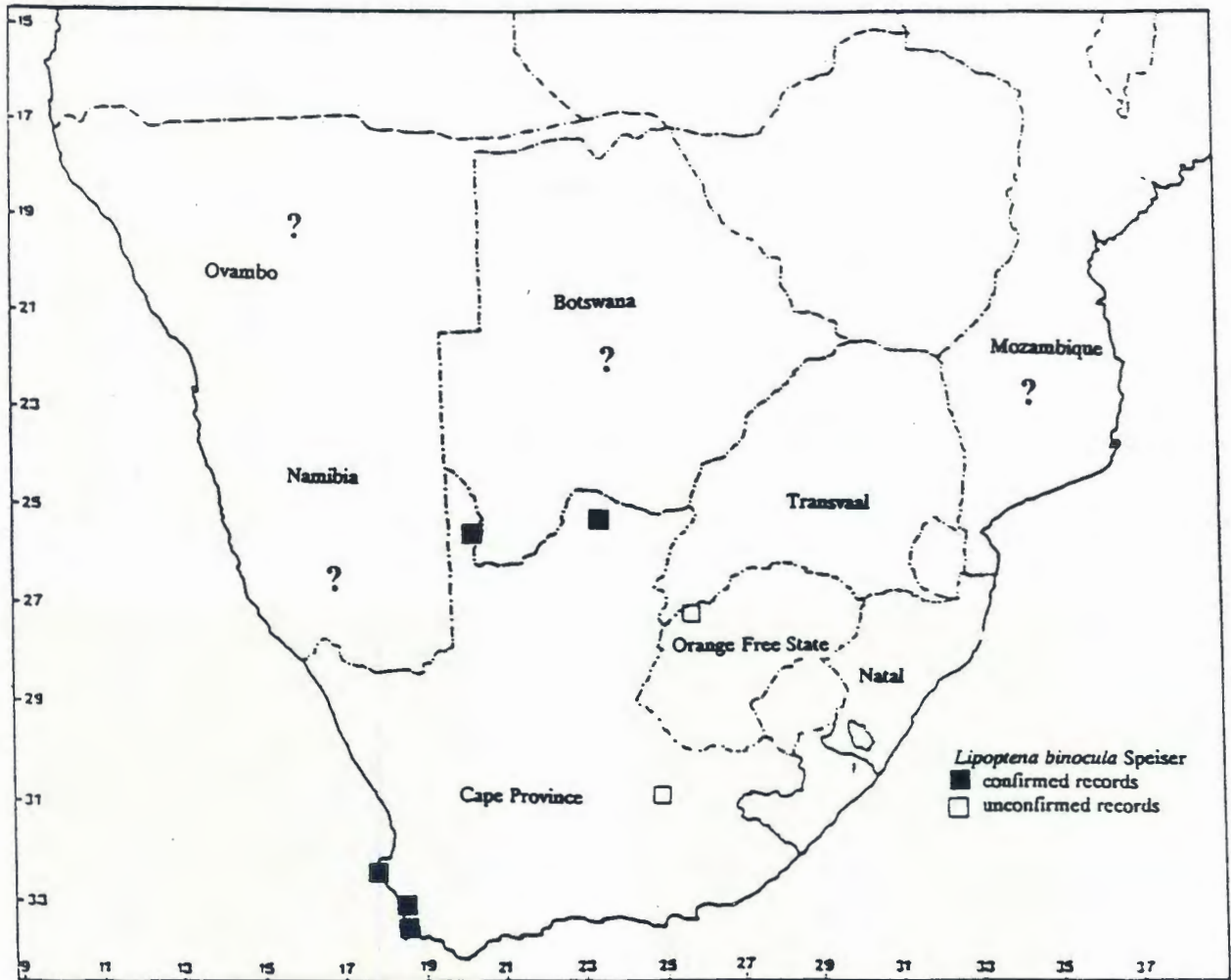


FIG. 17 Distribution of *Liptoptena binocula* Speiser in southern Africa [? = distribution according to Maa (1969) and Hutson & Oldroyd (1980)]. Unconfirmed records □ according to Bedford (1932) and Bequaert (1942)

Geographic distribution

Sensu (Bedford 1932; Bequaert 1940, 1942; Haeselbarth, Segerman & Zumpt 1966; Maa 1969; Hutson & Oldroyd 1980). Illustrated in Fig. 17.

Hosts

Sensu (Bequaert 1940, 1942; Haeselbarth *et al.* 1966; Maa 1963, 1965, 1969). Bovidae: Antilopinae: steenbok (*Rhaphicerus campestris*) Thunberg, 1811; Cape grysbok (*Rhaphicerus melanotis* Thunberg, 1811); springbok (*Antidorcas marsupialis* Zimmerman, 1780); gemsbok (*Oryx gazella* Linnaeus, 1758).







DISCUSSION

The main morphological differences between the 3 South African species of *Liptoptena* are sum-

marized in Table I. The 3 species can be differentiated from each other on size, palp shape and size, shape of the male post genital plate, apical spurs on the tibia, pulvilli and number of plantar spines, as well as on the surface sculpture of the puparium and the arrangement of the spiracular pores.

The flies also differ in their geographic distributions. *L. paradoxa* prefers the more moist, eastern half of the country in which the rain falls mainly in summer, and it is found particularly in those regions where woodland and thickets predominate (Visagie *et al.* 1992). *L. annalizeae* is found in the central regions of the country which are generally considerably drier and where rain also falls mainly in summer (Visagie 1992). Although there are few confirmed records of *L. binocula*, this fly appears to occur mainly in the western regions of the country which are either very dry, or where rain falls mainly in winter, with consequent hot dry summers. However,

TABLE 1 Morphological differences between *Lipoptena paradoxa*, *Lipoptena annalizeae* and *Lipoptena binocula*

Description	<i>L. paradoxa</i>	<i>L. annalizeae</i>	<i>L. binocula</i>
1. Size: Type	1,80–2,10 mm (Bequaert)	2,87 mm (Visagie)	2,10 mm (Bequaert)
2. Female (head and thorax)	1,87–2,10 mm	2,40–2,87 mm	2,03–2,23 mm
3. Male (head and thorax)	1,60–1,80 mm	2,72–2,76 mm	1,95–2,23 mm
4. Palp shape as illustrated			
5. Palp size	0,06 mm, hardly protruding	0,32 x 0,15 mm, protruding	0,26 x 0,18 mm, protruding
6. Inner orbit	narrower than eye	narrower than eye	nearly as broad or as broad as eye
7. Mediovertex	slightly longer than postvertex	slightly longer than postvertex	1,5 x longer than postvertex
8. Scutellars	2 pairs	2 or 3 pairs	1 pair
9. Mesosternal spines	regularly arranged, 1st row more robust	irregular in distribution, anterior, posterior and posterolateral spines stouter; submedian area bare	irregularly distributed, anterior and posterior row stouter
10. Metabasis sternal spines	2 regular rows, similar in length and robustness to posterior rows of mesosternum	3–4 irregular rows, posterior row distinctly longer than on mesosternum	3 rows, posterior row longer than on mesosternum
11. Tergites	short, transverse and broad	large, subcampanulate, transverse	large, subcampanulate
12. Female pregenital plate	3 x as large as basal papilla of neighbouring setae	2 x larger than basal papilla	not larger or hardly larger than basal papilla
13. Male post genital plate as illustrated			
14. Tibia 3	3 apical spurs	6 apical spurs	4 apical spurs
15. Tarsomere 4 + 5 of leg 3	2 robust spines	5 + 5 robust spines	4 + 5 robust spines
16. Pulvilli	anterior pulvilli vestigial on all legs, posterior pulvilli elongate on all legs	anterior pulvilli knoblike on all legs, posterior pulvilli knoblike on all legs	anterior pulvilli vestigial on all legs, posterior pulvilli on legs 1 + 2 elongate, vestigial on leg 3
17. Puparium—surface sculpture	polygonal scattered	dentate polygonal	squamous
18. Spiracular pores		3 curved rows—more than 10 openings per row	3 curved rows—less than 10 openings per row

the distributions of the latter 2 flies do overlap in the Kalahari Gemsbok Park (Visagie 1992). Perhaps other areas of overlap will be found once more flies of both species have been collected.

Visagie *et al.* (1992) surmised that the pupae of *L. paradoxa* survived because the prepupae dropped from the host animals in the latters' preferred habitat, namely woodland and thickets, the dense vegetation in these localities affording protection for the pupae. The dry climate of the regions preferred by *L. binocula* and *L. annalizeae* suggests that the prepupae and pupae of these flies are adapted to harsher conditions.

The hosts of the 3 flies also differ. *L. paradoxa* prefers bushbuck (*Tragelaphus scriptus*), nyalas (*Tragelaphus angasii*) and kudu (*Tragelaphus strepsiceros*) and can also be found on common duikers (*Sylvicapra grimmia*) (Visagie *et al.* 1992). *L. annalizeae* has only been recovered from springbok (Visagie 1992). *L. binocula* utilizes both steenbok and springbok, but has also been recovered from Cape grysbok and gemsbok (*Oryx gazella*). At the same time as the collections recorded in this paper were made from springbok at Langebaan, bontebok (*Damaliscus dorcas dorcas*), gemsbok and eland (*Taurotragus oryx*) were also examined. None of the latter animals was infested (Horak & Boomker, unpublished data 1990).

ACKNOWLEDGEMENTS

I wish to thank the personnel of the Museum für Naturkunde der Humboldt Universität in Berlin; the personnel of the Natal Museum in Pietermaritzburg and Dr L. E. O. Braack, Kruger National Park for the loan of specimens. I am grateful to Mrs Annamé Wels for her assistance and Mr H. Eksteen of Vryburg for collecting material. I am indebted to Prof. I. G. Horak of the University of Pretoria and Dr J. G. H. Londt of the Natal Museum for their guidance dur-

ing this study. This research was funded by the National Museum, Bloemfontein.

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