

https://dspace.org/

A morphological study of phlebotomine sandflies and their role in the transmission of human leishmaniasis, with special reference to Namibia

Davidson, Ian Hugh

2015-02-20
http://hdl.handle.net/10539/17033

Downloaded from a DSpace repository. https://dspace.org/

		Page
Figs 16-19	♀ mouthparts	60
Figs 20-22	♀ labral tips	63
Figs 23-25	Apical margins of ♀ hypopharynges	63
Fig. 26	Miscellaneous diagrams	65
Fig. 27-29	Female pharynges of **bedfordi**, **fallax** and **schwetzi** groups	68
Fig. 30-32	Male parameres of **bedfordi**, **fallax** and **schwetzi** groups	68
Figs 33-108	Figures to keys to "**bedfordi** group"	
33-35	**Sergentomyia ashfordi**	85
36-38	**Sergentomyia bereiri**	86
39-41	**Sergentomyia bedfordi**	86
42-44	**Sergentomyia caliginosa**	87
45-47	**Sergentomyia distincta**	87
48-54	**Sergentomyia congolensis**	88
55-58	**Sergentomyia firmata**	89
59-61	**Sergentomyia formica**	89
62-64	**Sergentomyia impudica**	90
65-67	**Sergentomyia magnidentata**.....	90
68-71	**Sergentomyia pastoriana**	91

		Page
72-74	**Sergentomyia renauxi**	91
75-79	**Sergentomyia richardi**	92
80-83	**Sergentomyia rima**	92
84-86	**Sergentomyia ruttledgei**	93
87-89	**Sergentomyia schoutedeni**	93
90-95	**Sergentomyia salisburiensis**	94
96-98	**Sergentomyia serridentata**	95
99-101	**Sergentomyia ?silva**	95
102-108	**Sergentomyia yusafi**	96
Figs 109-136	Figures to keys to "**fallax** group"	
109-112	**Sergentomyia buxtoni**	97
113-116	**Sergentomyia bimangoui**	97
117-120	**Sergentomyia antennata**	98
121-124	**Sergentomyia cincta**	98
125-128	**Sergentomyia dubia**	98
129-132	**Sergentomyia fallax**	99
133-136	**Sergentomyia montana**	99
Fig. 137	Map showing distribution of **Sergentomyia sensu stricto** species	100
Fig. 138	Distribution of human cases of CL Shaded section shows range of suitable rock hyrax habitat to	

Page

indicate probable range of the vector **P. rossi** sp. B 104

Fig. 139 Study area showing mesa's about Hardap Dam, Mariental 109

Fig. 140 Number of **P. rossi** species B (♀♀ and ♂♂) caught and prevailing weather conditions at the time ... 111

Fig. 141 Age composition of the **P. rossi** sp. B population caught at light during the 1981 study period 116

Fig. 142-143 Diagrams showing structures measured 128

CHAPTER ONE

GENERAL INTRODUCTION

1.1 SUBSAHARAN LEISHMANIASES.

In Subsaharan Africa, as in the rest of the Old World, leishmaniases manifests themselves in two main forms - cutaneous and visceral. These leishmaniases, unlike the New World form, are absent from equatorial forests and appear to be confined to arid and semi-arid biotopes. It is thought that leishmaniasis may have originally arisen in the Middle East and beyond (Lysenko, 1971). From there, Garnham (1977) suggests that it spread to the Mediterranean and tropical bush and savannah areas of Africa where new vectors and new animal reservoirs became involved in the life-cycle.

The parasites causing the visceralising or the cutaneous forms are classified as such depending on whether they disseminate throughout the body, invading in particular the spleen, liver and the bone marrow or remain confined to the skin producing a chronic ulcer

known as Oriental Sore. Parasites of some strains which are normally strictly dermal may move to the lymph nodes and even visceralise, causing visceral leishmaniasis (Molyneux & Ashford, 1983).

Leishmaniasis is caused by the protozoon **Leishmania**, which occurs as a flagellated **promastigote** in its vector and in culture and as an ovoid intracelluler **amastigote** in its animal reservoir. **Leishmania** species are transmitted by a limited range of vectors which belong to the subfamily Phlebotominae (Diptera; Psychodidae), known colloquially as sandflies (Table 1). Rodents are often the reservoir for the cutaneous form, and wild or domestic canids the hosts for the visceral form.

1.2 RéSUMé OF LEISHMANIASIS IN SOUTHERN AND EAST AFRICA.

1.2.1 Southern Africa.

The first cases of cutaneous leishmaniasis (CL) from southern Africa (here understood to include South Africa, Namibia, Zambia, Zimbabwe, MalaWi, Angola and Mozambique) were documented by Grové in 1970. All patients came from northern SWA/Namibia. Since this report there have been 23 other cases (Grové & Van Dyk, 1973; Grové, 1978; Rutherford & Uys, 1978) as

TABLE 1 Subsaharan *Leishmania* (*L.*) parasites causing disease in man

SPECIES	VECTORS	COUNTRIES	DISEASE FORM
L. aethiopica	*P.* (*Larroussius*) *longipes pedifer/elgonensis*	Ethiopia, Sudan, Kenya	Cutaneous (DCL)
L. donovani	*P.* (*Synphlebotomus*) ?*martini*, ?*celiae*, ?*vansomerenae* ?*S. garnhami*	Kenya, Uganda & Sudan	Visceral
	P. (*Larroussius*) *orientalis*	Sudan	Visceral
?*L. major*	?*P.* (*Synphlebotomus*) *complex and/or* ?*S. garnhami*	Kenya	?Cutaneous
L. major	*P.* (*Phlebotomus*) *duboscqi*	Senegal, Cameroon, Upper Volta	Cutaneous
L. sp. nov.	*P.* (*Synphlebotomus*) *rossi* sp. B	SWA/Namibia, South Africa	Cutaneous

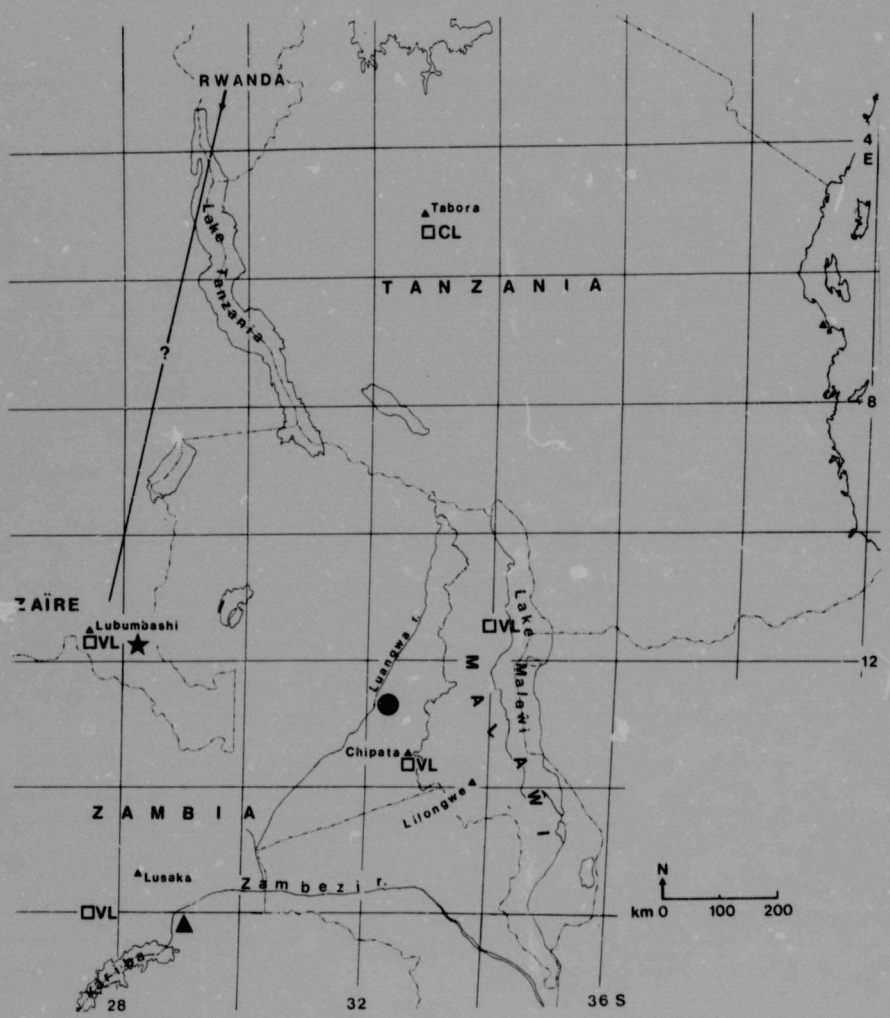
(*P.* = *Phlebotomus* and *S.* = *Sergentomyia*.
DCL = Diffuse Cutaneous Leishmaniasis.)

well as a number of undocumented cases from this territory. There is also a single report of a case from the northern Cape in the Republic of South Africa (Campbell **et al**., 1979). Cutaneous leishmaniasis (visceral leishmaniasis [VL] has not been recorded) has a scattered distribution in SWA/Namibia and at no time has it reached epidemic proportions [Fig. 2]. Transmission is sporadic with more cases occurring during and immediately following wet years than in drought years. Outside the borders of the Republic of South Africa and SWA/Namibia there have been occasional reports of cases of VL and CL, some of which are difficult to substantiate, from Angola (Sabido et al., 1963 referred to by Cahill, 1968), Malawi (Paul & Knowles, 1981; Knowles **et al**., 1981), Mozambique (Prates, 1928 cited by Fendall, 1952a; Sati, 1959 [mention]) and Zambia (Hira **et al**., 1973, Naik **et al**., 1976) and Zimbabwe (Miller-Cranko, 1975) [Fig. 1].

1.2.2 East Africa.

While VL was recognised as occurring sporadically in Kenya it is only since the 2nd World War that it has, at times, reached epidemic proportions and has thus become a major health problem. Fendall (1952a-c) has reviewed in detail VL in East Africa, including Kenya.

Fig. 1. Map showing the distribution of sporadic cases of VL and CL to the south of Kenya and to the north of the Zambezi river. It also shows the limited distribution (as far as is known) of three potential vector species.



LEGEND

★ P. (Synphlebotomus) katangensis (type locality)

● P. -do- ?grovei ♀

▲ P. -do- grovei & rossi sp. A

Fig.1

Since 1941 cases of VL have been reported from five districts in Kenya, namely West Pokot, Baringo, Kitui (the locations of Tseikuru, Voo, Usueni), Machakos including the recent Masinga focus and Meru (location of Tharaka) [Fig. 3]. Although the disease in Kenya has been intermittent, serious outbreaks have been known to occur. In the areas to the north of Kenya, VL occurs in the Sudan, Ethiopia and the drier parts of NE Uganda. The cutaneous form of the disease is rare. The only confirmed CL foci, outside Ethiopia, are the Mt Elgon area in NW Kenya (Kung'u **et al.**, 1972) and the recently noted (Mutinga & Odhiambo, 1986) eastern slopes of the Aberdares (to the north of Nairobi). It has been suggested (Kung'u **et al.**, 1972) that reports of CL originating from areas of endemic VL may perhaps be aberrant forms of VL or perhaps post kala-azar dermal leishmaniasis (PKDL), a recognised post VL incomplete recovery syndrome. The recent discovery of **L. major** and **P. duboscqi** [which are responsible for CL in Senegal (Dedet **et al.**, 1982; Desjeux & Dedet, 1982)] in Kenya (Beach **et al.**, 1982; Mutinga & Ngoka, 1983) may, however, prove to negate this hypothesis. A single case of CL has been reported from Tanzania (Clyde, 1964) [Fig. 1].

1.3 BACKGROUND TO PHLEBOTOMINE CLASSIFICATION.

1.3.1 Introduction.

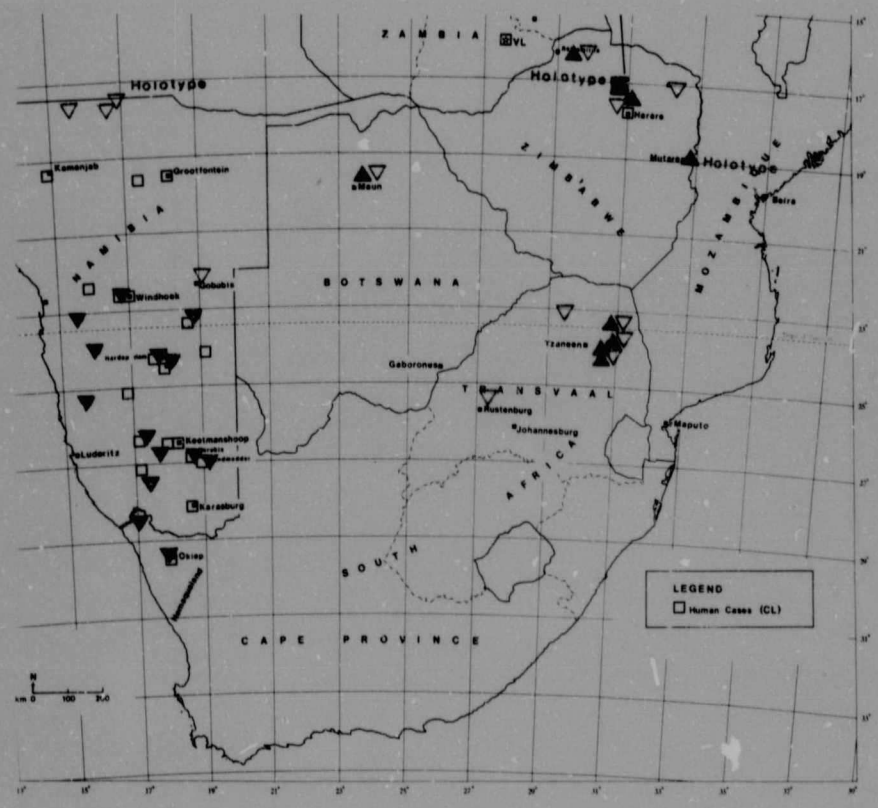
Although classification of the Phlebotominae began in 1911, some aspects of the taxonomy of the group have still to be resolved. Within the Old World, following the system of Theodor (1948; 1958), it is generally accepted that there are two genera ie. **Phlebotomus** and **Sergentomyia** and it has recently been suggested (Davidson, 1982b) that the subgenus **Parvidens** be raised to generic level. Both **Phlebotomus** and **Sergentomyia** are subdivided into a number of subgenera. The subgenera considered in this dissertation are the subgenus **Synphlebotomus** of the genus **Phlebotomus** and the subgenus **Sergentomyia** of the genus **Sergentomyia** including the species complex "**bedfordi**".

1.3.2 Southern Africa.

Prior to the discovery of CL in SWA/Namibia virtually no sampling of the sandfly fauna had been undertaken in southern Africa. Sandfly surveys were initiated shortly after cases of CL were documented in SWA/Namibia. Initially, surveys were carried out in the northern part of the territory as the first CL

cases appeared to originate from there. Grové **et al**., 1971, reported that until 1970 only 3 species of sandfly had been reported from SWA/Namibia. They had collected 8 additional species of **Sergentomyia** (including 2 new species) and two species of **Phlebotomus** one of which was a new species belonging to the subgenus **Synphlebotomus**, a subgenus to which suspected vectors of VL in Kenya belong. At the time it was thought that this new species might be the vector in SWA/Namibia. This species, **Phlebotomus (Synphlebotomus) grovei**, was described by Downes, 1971. Incidentally, of the 6 additional **Sergentomyia** species collected, three were incorrectly identified and one, namely **Sergentomyia bedfordi**, is now considered to be a species complex (Davidson, in prep). The first CL cases appeared to originate from the northern and north eastern parts of the territory. All subsequent cases have been diagnosed from the area to the south of Windhoek with the exception of two recent cases which appear to have been contracted in Kamanjab, in the arid north west [Fig. 2]. In 1974 field work was switched to the arid southern part of the territory in response to the diagnosis of 5 cases of CL. At the time, because of above average rains, there was an abundance of Rock Hyrax (**Procavia capensis**) [so much so that the Department of Nature Conservation was compelled to declare it a

Fig. 2. Map showing the distribution of human cases of CL in SWA/Namibia and the northern Cape. The overlay maps the known distribution of the potential vector species listed.



LEGEND

▲ P. rossi sp. A

▼ P. rossi sp. B

▽ P. grovei

■ P. taylori

Fig. 2

proclaimed problem animal as they were competing with stock animals for grazing]. The ecological similarities between this area and Ethiopia where Ashford **et al**. (1973) found Rock Hyraxes (**Procavia habessinica** and **Heterohyrax brucei**) infected with **Leishmania** are striking. It was decided to examine Rock Hyraxes (**Procavia capensis**) for **Leishmania** and at the same time examine the habitat for sandflies. A species of **Phlebotomus** considered to be new (Grové & Ledger, 1975; Grové, 1976) was collected. After much deliberation Lewis & Ledger (1976) decided that this species was **P. rossi** (De Meillon & Lavoipierre, 1944), previously only known from Zimbabwe. Since the discovery of **P. rossi** in SWA/Namibia it has been collected by myself and others from the northern Transvaal and additional material has been collected by others in Zimbabwe. Evidence obtained during this study, based on this additional material suggests that **P. rossi** in SWA/Namibia may indeed be a new species. **P. grovei** has now also been found in the northern Transvaal, Zimbabwe and possibly Zambia (Davidson, pers. obs.) and an additional new species **P. taylori** Davidson (1982a) of the same subgenus has been described [Fig. 2]. The similarity in appearance of females of **P. grovei** and **P. rossi sensu lato** (those of **P. taylori** are unknown) pose potential identification problems in areas where their

distributions overlap. A similar difficulty arises in the case of the three species of **Synphlebotomus** which occur sympatrically in some VL foci in Kenya (Minter, 1962).

1.3.3 East Africa (Kenya).

The earliest documented records of sandflies in Kenya are those of Sinton (1930, 1932). Thereafter, until the outbreak of a serious epidemic of VL in the Kitui district of south east Kenya toward the end of 1952 collecting of sandflies was sporadic. Until this time no species of the genus **Phlebotomus** had been found. Later Minter (1964) reported that the number of sandfly species recorded in Kenya now totalled thirty-four. Three of these belonged to the subgenus **Synphlebotomus**. These were **Phlebotomus martini** (Parrot, 1936), **P. vansomerenae** (Heish, Guggisberg & Teesdale, 1956) and **P. celiae** (Minter, 1962). **Phlebotomus martini** was described from Ethiopia as early as 1936 and was also known to occur in the Sudan (Kirk & Lewis, 1947) prior to it being recorded in Kenya. Of the three species it is the most widespread. It is distributed through south east and north west Kenya, eastern Uganda, Sudan and Ethiopia. **Phlebotomus celiae** and **P. vansomerenae** have only

Author Davidson I H
Name of thesis A Morphological study of Phlebotomine Sandflies and their role in the transmission of Human Leishmaniasis with special reference to Namfbia 1987

PUBLISHER:
University of the Witwatersrand, Johannesburg
©2013

LEGAL NOTICES:

Copyright Notice: All materials on the University of the Witwatersrand, Johannesburg Library website are protected by South African copyright law and may not be distributed, transmitted, displayed, or otherwise published in any format, without the prior written permission of the copyright owner.

Disclaimer and Terms of Use: Provided that you maintain all copyright and other notices contained therein, you may download material (one machine readable copy and one print copy per page) for your personal and/or educational non-commercial use only.

The University of the Witwatersrand, Johannesburg, is not responsible for any errors or omissions and excludes any and all liability for any errors in or omissions from the information on the Library website.