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First collection records of phlebotomine sandflies (Diptera: Psychodidae) in Botswana

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ABSTRACT

No phlebotomine sandflies have ever been recorded in Botswana, southern Africa, although there are several reports from the surrounding countries, namely South Africa, Namibia, Zambia and Zimbabwe. During a pilot survey in 2014–2015 in Maun, northern Botswana, 41 specimens, belonging to two species and species groups, respectively, were detected: *Sergentomyia* (*Grassomyia*) *inermis* (Theodor) and *Se*. (*Sergentomyia*) "*bedfordi* (Newstead) group". The latter comprised of specimens resembling *Se*. (*Ser*.) *congolensis* (Bequaert et Walravens), *Se*. (*Ser*.) *caliginosa* (Davidson) and *Se*. (*Ser*.) *salisburiensis* (Abonnenc). None of these species are known to be vectors of human leishmaniasis parasites.

KEY WORDS: Afrotropical Region, *Sergentomyia*, Phlebotominae, Botswana, faunistics.

INTRODUCTION

Botswana is a well-known safari destination due to its vast savannah and desert areas (e.g. the Kalahari Desert) as well as the Okavango Delta World Heritage Site, all of which harbour abundant wildlife populations and unique landscapes. These prerequisites and the necessity to conserve the biological diversity have generated numerous research programmes. However, it is surprising that relatively little is known about the insect fauna of Botswana. In fact, the country appears as a white spot on many insect taxa distribution maps. This also applies to some insects of medical importance, such as phlebotomine sandflies.

Sandflies (Psychodidae: Phlebotominae) are haematophagous nematoceran insects, which easily go unnoticed due to their small size and their nocturnal activity. However, in many regions of the world they act as vectors of human and animal leishmaniasis, caused by protozoans of the genus *Leishmania*. Major disease foci are found across Africa, with the exception of southern Africa, where there are only small and scattered foci known in Namibia (Noden & van der Colf 2013) and Zambia (Alvar *et al*. 2012). The low incidence here may partially be attributable to the fact that the sandfly species composition of southern Africa differs from the remaining continent in that the main vectors, species of the genus *Phlebotomus*, are scarce or even absent in the south. Nevertheless, the sandfly fauna of southern Africa accounts for about 49 species, many of which are endemic to this African sub-region (WRBU 2015). It is only from Botswana that not a single record has ever been reported.

In this paper the first collection records of sandflies from Botswana are presented, based on morphological identifications.

MATERIAL AND METHODS

The study area is located in the vicinity of Maun, northern Botswana, the centre of the Ngamiland district, and the safari hub for visiting the Okavango Delta. The entire

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region is very flat at an elevation of 900 m above sea level, and is characterised by the unique combination of an inland river delta surrounded by savannah and semi-desert.

The sandfly collection device was a Standard CDC light-trap, deployed 50 cm beside a termite hill at a fan height of 50 cm, about 10–200 m off Thamalakane river, one of the major outlets of the Okavango Delta during high water levels. Collections were carried out during the wet season from November 2014 to January 2015. One collection site was in Sexaxa ward, on the premises of the Okavango Research Institute, and the second site in a private property in Disaning ward. The trap was run from 5pm to 8.30am, resulting in seven trap nights.

The collection jar was immediately put into a freezer to kill the insects. For the morphological examination the sandfly specimens were prepared according to Krüger *et al*. (2011). Each specimen was documented photographically and identified using the morphological keys provided by Kirk and Lewis (1951), Abonnenc (1972) and Davidson (1990). For comparative characterisation, some basic morphometric measurements were carried out, i.e. the number of the cibarial teeth, the lengths of the antennal segments A3, A4 and A5, as well as the length of the labrum. All specimens are deposited in the sandfly collection of the Department of Tropical Medicine of the Military Hospital Hamburg.

RESULTS AND DISCUSSION

Overall, 41 sandflies were collected, of which 28 were morphologically identified to species or species group level.

The specimens belonged to two species and species groups, respectively: *Sergentomyia* (*Grassomyia*) *inermis* (11 females, three males) and *Se*. (*Sergentomyia*) "*bedfordi* group" (11 females, three males). The latter comprised of specimens resembling *Se*. (*Ser*.) *congolensis* and *Se*. (*Ser*.) *caliginosa*. One female showed the characteristics of the species *Se*. (*Ser*.) *salisburiensis*. Figure 1 depicts representative photomicrographs of the female cibarial armatures with the following characteristics: *Sergentomyia inermis* with 20–24 large, monomorphic cibarial teeth, *Se*. *salisburiensis* with a deep median notch in the posterior margin of the hard palate and very small median cibarial teeth, *Se*. *congolensis* with 30–38 cibarial teeth and a rather horizontal posterior margin of the pigment plate, which obstructs most of the cibarial teeth, and *Se. caliginosa* with 35 very small, monomorphic cibarial teeth and the pigment plate with a posterior median projection. The detailed morphometric measurements of 20 females are summarised in Table 1. An additional diagnostic character for the classification of subgenus *Grassomyia* and its species is the presence of pleural scales, and in particular the presence or absence of mesanepimeral scales. Figure 2 presents an overview of the lateral thorax, indicating the diagnostic presence of scales (i.e. insertion sockets) on the mesanepisternum, mesocatepisternum and metepisternum, as well as the mesanepimeron of two specimens with 14 and eight scale insertion sockets, respectively. According to Abonnenc (1972), *Se. inermis* should have four to nine mesanepimeral setae, whereas the other continental Afrotropical species of the subgenus either lack these scales (i.e. *Se. ghesquierei*) or possess more than 17 scales (*Se. squamipleuris*).

According to Abonnenc (1972) and Davidson (1990), all the abovementioned species are known from one of the countries neighbouring Botswana, i.e. Angola,

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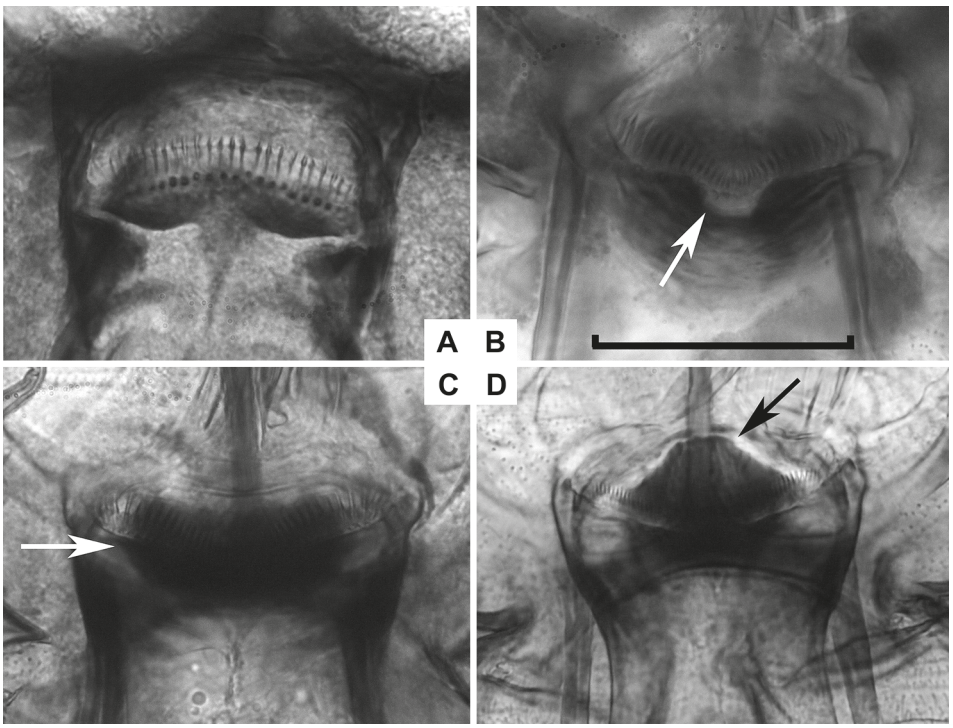


Fig. 1. Cibarial armatures of female *Sergentomyia* spp. from Botswana. (A) *Se.* (*Gra.*) *inermis*; (B) *Se.* (*Ser.*) *salisburiensis* (arrow: deep median notch in posterior margin of hard palate); (C) *Se.* (*Ser.*) *congolensis* (arrow: horizontal pigment plate); (D) *Se.* (*Ser.*) *caliginosa* (arrow: pigment plate with posterior projection). Scale bar = 50 µm.

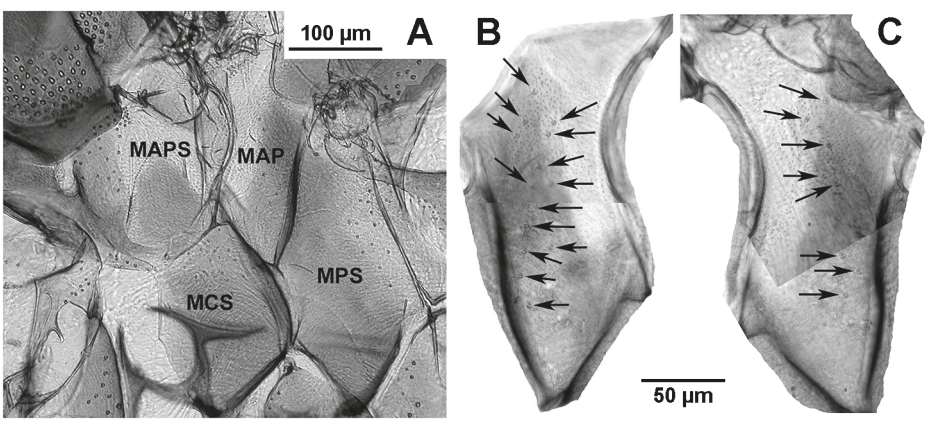


Fig. 2. Photomicrographs of the thoracic pleurites of *Se.* (*Gra.*) *inermis*. (A) overview indicating the presence of scales, e.g. sockets on the mesanepisternum (MAPS), mesocatepisternum (MCS) and metepisternum (MPS), as well as on the mesanepimeron (MAP). (B, C) mesanepimeron of two specimens, showing the number and position of the scale insertion sockets.

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TABLE 1

Morphometric measurements of sandfly specimens from Botswana, with counting of the cibarial teeth, lengths of antennal segments A3, A4 and A5, length of labrum and ratios of A3/Labrum. SE: standard error; nd: not determined. All lengths measures are given in micrometres.

Character:		Species:				
		inermis n=9	***congolensis*** n=5	***caliginosa*** n=1	***salisburiensis*** n=1	***bedfordi* group** n=4
Cibarial teeth	Range	20–24	30–38	35	29	40–51
	Mean (SE)	22 (0.6)	35 (1.72)	nd	nd	46.75 (2.5)
A3	Range	144–167	120–136	121	127	105–121
	Mean (SE)	152.1 (2.49)	128.2 (3.35)	nd	nd	111 (3.84)
A4	Range	78–84	70–77	70	79	65–73
	Mean (SE)	80.8 (0.84)	73.2 (1.12)	nd	nd	68 (1.92)
A5	Range	80–90	70–80	70	90	65–70
	Mean (SE)	84.1 (0.99)	75.2 (1.59)	nd	nd	68.25 (1.18)
Labrum	Range	153–181	138–161	151	192	133–145
	Mean (SE)	165.3 (3.57)	148.8 (4.63)	nd	nd	140.5 (2.64)
A3/Labrum	Range	0.82–0.97	0.84–0.87	0.8	0.66	0.73–0.86

Namibia, South Africa, Zambia and Zimbabwe, with *Se. inermis* and *Se. congolensis* rather widespread throughout Africa. However, all new collections represent the first phlebotomine sandflies ever recorded in Botswana (Seccombe *et al*. 1993; WRBU n.d.).

None of these species are known to be anthropophagic (except for old reports about "man-biting" *Se. congolensis*, Kirk & Lewis 1951) or to be vectors of human leishmaniasis parasites. The subgenus *Grassomyia*, with *Se.* (*Gra.*) *inermis*, only contains species feeding on amphibians and reptiles. The host preferences of species of the *Se*. "*bedfordi* group" are unknown.

These results certainly reflect only a small portion of the potential sandfly fauna of Botswana, as this country offers a wide range of suitable habitats, resembling those found in the neighbouring countries, where, according to the Walter Reed Biosystematics Unit (WRBU), 49 species have been recorded, including species of the subgenus *Capensomyia*, which is endemic to southern Africa (Davidson 1983). However, species of this subgenus are refined to rock formations and hyrax (*Procavia capensis* (Pallas)) habitats, both of which are not present in most parts of Botswana.

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