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The role of *Anopheles merus* in malaria transmission in an area of southern Mozambique

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Anopheles merus (Diptera: Culicidae) is a member of the *Anopheles gambiae* Giles complex known to occur widely in Mozambique[1–5]. It has been implicated in malaria transmission in Kenya, Tanzania and Madagascar[6–9] but its role in malaria transmission in Mozambique has not previously been reported.

During February 2000, some parts of the southern Mozambique received exceptionally high rainfall, the highest observed over a period of 50 years. This resulted in flooding in most of the river basins and low-land areas. During a four day period, the study village Boane received more than half the normal rainfall for a year. Before the flooding, both *An. merus* and *An. arabiensis* were collected in Boane, resting indoors and in human bait collections, between December 1995 and March 1996, with relative proportions of 85:44[3] and in indoor-resting collections between January and February 1998 with relative proportions of 75:20[2]. Mnzava *et al*[4] observed a higher frequency of human blood index in *An. merus* in the Maputo area. The exceptional abundance of *An. merus*, together with the observations by the previous author[4] lead to suggestions that this species may be an important malaria vector in the area. Therefore, mosquito collections were performed during 2000 in order to determine the role of *An. merus* in malaria transmission in Boane, southern Mozambique.

Mosquito collections took place in the environs of Boane town (25° 2′S 32° 19′E; altitude <100 m), a semi-rural area, in southern Mozambique. Boane is a town with 26,124 inhabitants and lies in the basin of the Umbeluzi River, approximately 26 km from the capital city of Mozambique (Maputo). The centre of the town is predominantly occupied with bricks houses, whereas in the environs, where most of inhabitants live, the houses are typically made of wood and mud or grass-thatched walls and covered with thatched roofs. A few houses have corrugated iron roofs. The climate is dry tropical with monthly rainfall fluctuating up to 326 mm and an annual average of 650 mm; the wet season lasts from November to April. *An. funestus* is the most common malaria vector, at least close to the Umbeluzi River[10]. *Plasmodium falciparum* accounts for >90% of malaria infections in this region.

In 2000, between April and June after the floods, 13 resting collections were conducted in 10 houses. Mosquitoes from seven of these houses were used for relative density assessment while mosquitoes from the remaining three houses were retained for infectivity studies. Engorged females, from the three houses, were provided with 10% glucose solution, kept in insectary cages at 25–27°C temperature, for a period of eight days to assure the detection of both stages of infections by standard dissection method (oocysts and sporozoites). After dissection, specimens of the *An. gambiae* complex were individually preserved in Eppendorf tubes with 75% alcohol for subsequent species identification by PCR[11].

Within the *An. gambiae* complex, the relative species proportions were 125:140 of *An. merus*: *An.*

arabiensis, respectively. The results of mosquito dissections are shown in Table 1. There were no significant differences in oocyst rate among *An. merus*, *An. arabiensis* and *An. funestus* ($\chi^2 = 5.48$, $p > 0.05$) and also sporozoite rate among the three species ($\chi^2 = 4.67$, $p > 0.05$). In a previous study in the Boane area *An. funestus* was found with an oocyst rate of 4.1% (n = 988), after holding engorged mosquitoes for two days in an insectary[10]. No other comparable data are available from Mozambique. Nevertheless, the sporozoite rate of *An. merus* of our study (4.2%) is approximate to that of 3.3% observed in Kenya[6].

The presence of both oocysts and sporozoites stages confirms that *An. merus* plays significant role in malaria transmission in Boane, the first time that this species has been incriminated as malaria vector in Mozambique. This is a widespread species that has been found, in more recent collections, as far as 350 km inland (Massingir) as well as along the coast

Table 1. The oocyst and sporozoite rates (95% CI) of members of *An. gambiae* complex and *An. funestus* in Boane from April to June 2000

Species	No. dissected	Oocysts		Sporozoites		Oocysts and sporozoites	
		n	%	n	%	n	%
An. merus	72	10	13.9 (6.9–24.5)	3	4.2 (0.9–11.7)	3	4.2 (0.9–11.7)
An. arabiensis	83	9	10.8 (5.1–19.5)	8	9.6 (4.2–18.1)	7	8.4 (3.5–16.6)
An. funestus	761	53	7 (5.3– 9)	33	4.3 (3–6)	25	3.5 (2.1–4.8)
Total	916	72	7.9 (6.2–9.8)	44	4.8 (3.5– 6.4)	35	3.8 (2.7–5.3)

n = Number of positives.

Table 2. Distribution of *An. merus* in selected localities in Mozambique during the years 2000–02

Locality	Map reference	Date of collection	Collection method	*An. merus*	*An. arabiensis*	*An. gambiae*	*An. quadriannulatus*
Salamanga	26° 28′ 21″S; 32° 36′ 59″E	01/05/00	HBI	59	22	–	–
Salamanga	26° 28′ 21″S; 32° 36′ 59″E	12/05/00	HBO	98	17	–	–
Hokwe	24° 41′ 25″S; 33° 10′ 11″E	11/06/00	HBO	23	48	–	–
Massingir	23° 53′ 21″S; 32° 09′ 02″E	14/02/02	PSC	5	24	–	2
Combomune	23° 27′ 59″S; 32° 27′ 55″E	17/07/01	LAR	1	35	–	20
Macome	24° 43′ 45″S; 34° 48′ 07″E	16/03/01	PSC	21		38	–
Chindjiguire	23° 56′ 32″S; 35° 1′ 44″E	02/02/02	HBI	1	20	40	–
Mazoe	16° 16′ 22″S; 33° 32′ 44″E	13/07/01	ASP	3	15	–	–
Macuse	17° 43′ 24″S; 37° 11′ 26″E	26/07/00	PSC	2	3	21	–
Mossuril	14° 57′ 42″S; 40° 39′ 32″E	01/08/00	PSC	10	–	12	–

ASP—Collection by aspiration; HBI—Human bait indoor; HBO—Human bait outdoor; LAR— Larvae collection; PSC—Pyrethrum spray collection.

(Macome, Macuse and Mossuril) as shown in Table 2. Further studies are required to determine the relative importance of *An. merus* in malaria epidemiology elsewhere in Mozambique.

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