A Preliminary Report on a Morphological Character Distinguishing Important Malaria Vectors in the *Anopheles gambiae* Giles Complex in Southern Africa

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ABSTRACT. The efficient malaria vectors *Anopheles gambiae* Giles and *Anopheles arabiensis* Patton are separated from the less efficient vectors *Anopheles merus* Dönitz and *Anopheles quadriannulatus* Theobald by means of the banding patterns on the hind legs of the adults. The specimens used are either wild adults, adults bred out from wild-caught larvae, or the progeny of wild females. All specimens are electrophoretically typed.

INTRODUCTION

Since Paterson (1962) first proposed that *Anopheles gambiae* Giles was a complex of species, many attempts have been made to find morphological characters to distinguish the sibling species. This exercise was of great importance as it was already known that the efficiency of the species, previously called varieties, as malaria vectors differed considerably (Muirhead-Thompson 1951). Unfortunately, many of these studies were conducted using colony material (Coluzzi 1964, Reid 1973, 1975a, 1975b, White and Muniss 1972) and one cannot have confidence that observations on laboratory strains, under artificial selection for survival in such unique circumstances, will have relevance to the field situation. Work on the morphology of specimens taken only from the wild (Bryan 1980) involved two species from a single locality and the results show considerable overlap.

None of the above work was done in southern Africa and here we are only able to morphologically distinguish the salt-water form *An. merus* from the fresh water breeders on egg characters (Coluzzi 1964) and salinity tests (Muirhead-Thompson 1951). *An. melas* has not been recorded further south than Lobito, Angola (Gillies and de Meillon 1968) and so does not concern us.

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The present work demonstrates the feasibility of using certain hind leg banding patterns to separate the important malaria vectors *An. gambiae s.s.* and *An. arabiensis* from the apparently less important species *An. merus* and *An. quadriannulatus* in southern Africa.

MATERIALS AND METHODS

The legs of wild-caught females and of individual adults emerging from wild-caught larvae were mounted and the suitably coded bodies were stored in liquid nitrogen for electrophoretic identification. Some wild-caught females were induced to lay eggs and the progeny reared in the laboratory. Each batch of eggs was treated as a separate family and each family was electrophoretically typed (Miles 1979). Not more than five individuals per family were used for scoring the leg bandings. The leg banding patterns were examined under an ordinary dissecting microscope (magnification X 40). Collection details are given in Table 1.

RESULTS AND DISCUSSION

Figure 1 shows the difference in pale markings at the joints of tarsomeres 2, 3, 4 and 5. *An. gambiae* and *An. arabiensis* have very narrow apical pale bands while in *An. quadriannulatus* and *An. merus* these bands are more prominent, usually overlapping the joint, especially between tarsomeres 3 and 4. This character has been constant in the females examined but three males of *An. quadriannulatus* bred out in the laboratory showed a certain amount of overlap. The speckling on tarsomere 2 seems to be more abundant in *An. meris* and *An. quadriannulatus* but this is variable.

The syntype of *An. quadriannulatus* was examined and though the specimen is in very poor condition, the one leg rubbed and the distal segments of the other leg missing, it did look as though the apical pale marking of tarsomere 2 extended over the joint onto tarsomere 3. Tarsomeres 3 and 4 seemed to have narrow apical bands only.

Two paratypes of *An. merus* were examined. The one specimen (type no. 13807) from Dar-es-Salaam could not be used as both hind legs were missing. The other specimen was also not used as there appears to be some confusion with the labels. While it is labelled *An. merus*, the locality given is Sorris Sorris, South West Africa (Namibia). The known distribution of *An. merus* is confined to east Africa and the type locality is Dar-es-Salaam, Tanzania. There is also a morphological difference between the two paratypes with the one from Dar-es-Salaam having four banded palps and the other from Sorris Sorris three banded palps. It appears that the specimen labelled as coming from Sorris Sorris should be excluded from the type series, but comparison with the holotype must be made to resolve the issue.

Ten specimens from two colonies housed in the entomology department of the South African Institute for Medical Research were examined for interest

sake. One is a colony of *An. arabiensis* from Kanyemba, Zimbabwe and the other a colony of *An. gambiae s. s.* from Gambia. All individuals conformed to the above characters for these species.

Though the major malaria vectors *An. gambiae* and *An. arabiensis* so far remain morphologically inseparable, it is of undoubted benefit for the field worker in malaria control to be able to distinguish these species from the less important members of the complex. From these preliminary results, the leg banding character appears to be most promising but more data are being assembled and processed to consolidate these findings.

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Table 1. Collection details of members of the *Anopheles gambiae* complex.

Species	Locality	Collection Technique	No. Families	No. Individuals
gambiae	Namibia	Resting indoors	8	40
arabiensis	Swaziland	Biting man	4	20
	Namibia	Resting indoors	1	5
	Transvaal, R.S.A.	Resting outdoors	2	10
	Transvaal, R.S.A.	Biting man	3	15
				50
quadriannulatus	Transvaal, R.S.A.	Cattle kraal	1	5
	Transvaal, R.S.A.	Man-baited net	5	25
	Transvaal, R.S.A.	Resting outdoors	10	50
	Transvaal, R.S.A.	Larval coll.		12
	Natal, R.S.A.	Resting outdoors	6	29
	Natal, R.S.A.	Cattle kraal		3
	Natal, R.S.A.	Man-baited net		1
	Natal, R.S.A.	Larval coll.		17
				142
merus	Transvaal, R.S.A.	Biting man	1	5
	Transvaal, R.S.A.	Larval coll.		5
	Natal, R.S.A.	Cattle kraal	3	24
	Natal, R.S.A.	Resting outdoors	2	16
	Natal, R.S.A.	Man-baited net		7
				57
		Total		289

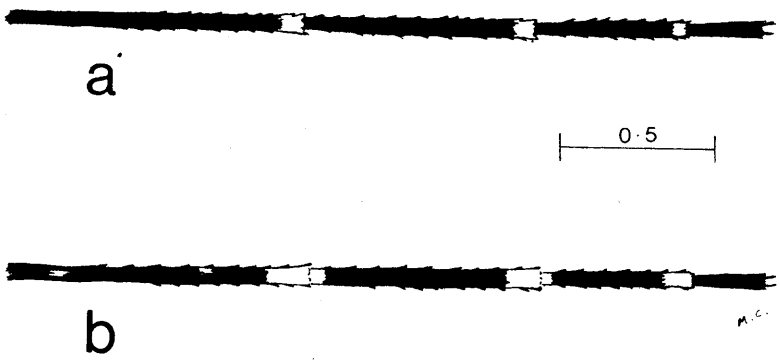

Fig. 1. The last four segments of the hind leg of a mosquito showing the pale banding differences between

a) *Anopheles gambiae* and *Anopheles arabiensis* and

b) *Anopheles merus* and *Anopheles quadriannulatus*.