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COMPARATIVE STUDIES ON THE INFECTIBILITY WITH PLASMODUM FALCIPARUM OF SPECIES A AND B OF THE ANOPHELES GAMBIAE COMPLEX IN MADAGASCAR[1]

by

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Introduction

Anopheles gambiae, the main vector of malaria in the Ethiopian region, is a complex made up of six related species. In Madagascar we have observed the fresh-water species A and B and a salt-water species, A. merus (Chauvet, 1969a).

We have implemented studies with the objective of finding potential differences in ethological and physiological characteristics which should be specific for either species A or B. The observations were conducted in a station of the eastern slope where these two species coexisted as well as their two major hosts: man and bovines (Chauvet, 1969b).

At least in this area it turned out that very pronounced endophilic and anthropophilic behaviour make species A ethologically a more efficient vector than species B which seems to be essentially exophilic. The latter is physiologically though a more potent vector than species A as its longevity and capacity of reproduction are higher.

It remained to be checked as to whether these species also exhibit a different intrinsic receptivity to Plasmodum falciparum which in Madagascar accounts for 99% of all slides positive for human plasmodia.

Methods

In an open-air insectarium within the hospital compound of Moramanga we have succeeded in breeding species A and species B from individual egg batches. Several larvae of every batch were identified either by a chetotaxic method (Chauvet et al., 1969) or by a cytotaxonomic method (Coluzzi & Sabatini, 1967).

The batches were subsequently put together according to their proper species. At three to four days' intervals new breeding was initiated with the aim of obtaining young females of identical age, awaiting the detection of gametocyte carriers.

In this hypo- to mesoendemic zone the search for gametocyte carriers was rather arduous. It was systematically conducted in the villages of Perinet forest after a first selection of

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fever patients among children and adolescents. More than 500 slides, thick and thin films, had to be examined in order to find three carriers.

The carriers were then admitted to the hospital nearby. Every day one slide was prepared for confirming the presence of gametocytes, and a measured amount of blood taken in order to determine leucocyte count and gametocyte count per mm^3. At dusk, each patient's forearms were introduced into two cages containing unfed females, one cage with species A, the other with species B of the same age. Half an hour later the fed mosquitos were transported to the insectarium at Tananarive and kept there at practically stable temperature and relative humidity, of 25°C and 70-80% respectively.

Dissections of the female mosquitos extended from the tenth to the sixteenth day after the potentially infective blood meal. We have determined oocyst counts according to the method of Shute & Maryon (1966).

Results

The oocyst count offers certainly more precision than the sporozoite count whose value could be argued. The results are summarized in the following table:

Carrier No.	Sex	Age (years)	No. of leucocytes per mm^3	No. of gametocytes per mm^3	Oocyst count (arithmetic mean)[1]	
					Species A	Species B
1	F	17	4 200	180	3.3 (10)	3.0 (12)
2	M	20	5 200	200	1.5 (12)	1.3 (12)
3	F	15	6 850	1 500	67.0 (23)	77.0 (25)

[1] Number of oocyst-positives in parentheses.

In view of sample size and high oocyst counts, our conclusions are based exclusively on Anophelines fed on carrier No. 3.

As the quantity of blood ingested may be subject to considerable variation in nulliparous females, one could expect that the mosquitos of either species would show quite different degrees of infection although they are of the same age. On the guts with oocysts (88% in species A and 90% in species B), we have counted between two and 295 oocysts.

Both species had identical breeding conditions in the same environment. The females of both species had apparently the same size and mean weight in the unfed condition (in average 1.22 mg) and could therefore be expected to take blood meals of virtually the same volume. A t-test was applied on the logarithmic means (Neperian logarithms) which failed to establish a significant difference ("t" = 0.46 - 46 degrees of freedom). From the data it appears that both species get infected to a similar extent.

The epidemiological conclusions following from these studies and the previous observations on the comparative ethology and physiology indicate that the vectorial capacity of the two species in a zone where they are sympatric is essentially based on relative density, behaviour, longevity and reproductive capacity, since their receptivity for P. falciparum is quite similar.

RESUME

Une étude expérimentale sur la réceptivité comparée des espèces A et B du complexe Anopheles gambiae vis-à-vis de Plasmodium falciparum à Madagascar permet de conclure que ces deux espèces s'infestent d'une façon semblable dans un même écoclimat.

SUMMARY

An experimental study was carried out in Madagascar to investigate the comparative receptivity of species A and B of the A. gambiae complex to P. falciparum. The results led the writers to conclude that the two species can be infected to a similar extent with no significant difference between one and the other.

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