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MALARIA VECTORS AT HIGH ALTITUDE (ADDIS ABABA AREA)

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1. INTRODUCTION

This is a report of the research work carried out at Pasteur Institute of Ethiopia between 1953 - 1954.

The subject is of general interest for malaria workers, and is more so in Ethiopia - a tropical country with a great expanse of plateaux situated at high altitude. Its capital Addis Ababa (population 300,000) lies at an altitude of 2,470 to 2,580 metres high.

2. PREVIOUS WORK UP TO 1950

Numerous malariologists have studied this problem:

In 1937, Lega-Raffaele and Canalis fixed 2,000 metres as the absolute altitude limit for endemic malaria.

In 1938, the works of Coradetti give the same conclusions. More recently, in 1942, Martin, referring to the traditional view that malaria prevails at Dichoftou, Doukham, Akaki, reported the occurrence of autochtonous cases of malaria at Addis Ababa itself (in the slums of the town - the thermal springs of Filoha), mostly due to Plasmodium vivax and a few cases due to Plasmodium falciparum.

From the entomological point of view, the same author often caught adult A. gambiae in the farm-yards, and found it in houses only in autumn (at the end of heavy rains) and in spring (after the light rains). Breeding places were discovered in the lower part of the town (railway concession, Kabana river, Filoha plain). In his conclusions, the author asserted that "the only anopheline found is A. gambiae".

In 1950, Giaquinto-Mira resumed the study of Anopheline breeding places. The highest point where breeding places were met was 1950 metres, in the swamps neighbouring Bichoftou. He reports the capture of A. pharoensis at Addis Ababa in the slums of the town (this species is considered by Coradetti as the main vector of malaria in the Dankalic plain).

But Giaquinto-Mira does not report any A. gambiae larvae in the town or its surroundings. He considered that the Anopheline fauna of the town consisted of:

A. christyi and A. cinereus (an endophilic species that rarely bite man). He had doubts about the presence of A. garnhami. As for the A. gambiae, he stated that its capture was an exceptional occurrence and it was only found in its adult form.

3. PRESENT CONTRIBUTION

In 1953 and 1954, Ovazza and Nori studied the Anopheline fauna, specially in Addis Ababa itself and in Akaki.

In Akaki Area: We shall first describe the geographical feature of the Akaki hydro-electric plant area.

At the junction of the big and the small Akaki, at twenty-five kilometres from the capital, a dam has been set up forming an artificial lake upstream. The base of the barrage is situated at 2,062 metres. A discharge canal starting from the dam follows the river course, hugging the shore of a small compensation-lake situated at 2,047 metres that was filled with water in 1954. Four kilometres further the water is directed by means of forced pipes to the mill situated at the bottom of a gorge lying at 1,950 metres altitude.

Every year, a fairly important number of malaria cases are reported among the workers as well as among the inhabitants of the villages surrounding the two artificial lakes and the mill itself. The authors have been able to see a certain number of the sick and found in each case Plasmodium falciparum. The adults and the breeding places have been searched before the establishment of the compensation-lake as well as after its filling with water. Adults do not seem to exist in appreciable quantity except at the end of the rainy season (September) and the following two months when they are found inside dwellings.

A. Breeding places:

At the level of the great lake of the barrage: no anopheline breeding places are found along the shores. The shores are made up of mud and the level of the lake varies daily from ten to twenty centimetres. On the other hand, at the base of the barrage (2,062 metres), among the rocks and the earth holes are found numerous larvae. Culex appears to be present throughout the year while the following Anophelines have been captured only after the rainy season: A. gambiae, A. christyi, A. demeilloni.

At the level of the compensation lake area: before its filling with water (year 1953 and first half of 1954), the breeding places were found mainly at the boundaries of the swamp on which it has been erected. This swamp had a thick vertical vegetation and was not at all deep. At that time the species found were: A. coustani, A. christyi, A. gambiae, A. garnhami, A. cinereus.

Since the filling of the dam with water, the residual part of the swamp has enlarged and led to the formation of a new breeding place. The depth of the swamp is forty centimetres at most; a thick vegetation covers it, consisting of short gramineceae on the banks and high reeds at the centre and along the discharge canal. The larvae collected were.

A. squamosus (the nearest breeding place known previously was at Bichoftou), A. christyi, A. gambiae (very abundant at the end of the rainy season on all the surface of the lake), A. demeilloni, A. coustani (which has become very rare, except among the high reeds).

At the level of the Akaki shores, in the gorge and in the surroundings of the mill: A. coustani, A. christyi, A. gambiae, A. garnhami, and A. cinereus were found.

A. cinereus, A. christyi and A. demeilloni were found in the holes of the rocks as well as in the holes of the soil along the river bank. A. coustani was found only in the fairly stretched swamps at the bottom of the gorge, covered with a fairly thick vertical vegetation.

A. gambiae and A. garnhami were caught only in the ground-holes, the first being prevalent mainly at higher altitudes on the sides of the gorge with relatively hot water springs (24°C). Finally, at fifteen kilometres down-stream in a dead arm of the Akaki, A. gambiae and A. garnhami were abundant.

B. Adult mosquitoes

The anopheline index has never been very high, not exceeding twelve per room in the autumn, of which only

four to seven were A. gambiae. It does not seem that it exists outside the period of the annual epidemic. Three species namely A. coustani, A. pharoensis and A. christyi are regularly found in the evening in all dwellings, near the mill in the gorge as well as on the cliffs and near the cave.

Only the first two are aggressive, A. christyi does not seem to bite man readily.

In Addis Ababa area: Surveys have been carried out in all seasons in the dwellings of the different parts of the city, in garages, stables, pigsties, fowl enclosures., adult anophelines were caught under the bridges and the shelters.

Ovezza and Nori practically agree with the conclusions of Gaquinto-Mira, on the point that the most prevalent species are A. christyi and A. cinereus, of which one can find males and females in all types of shelters. They however seem very rarely aggressive to man and the precipitin tests which were carried out, showed that they contained bovine blood.

Both species are particularly abundant in the adult state from the end of August to December, although they are found practically throughout the year. The breeding places are of an natural reservoirs as well as are artificial collections. Two other species are rather prevalent at Addis Ababa, viz. A. demeilloni and A. germanni; they are however more rural and exophilous, particularly the latter, whose variety "walshi" has been met only at a certain distance from the town. The authors surveyed the river Kabannah, running in a poorly built part of the capital having a rural aspect. The prevailing species there was the A. demeilloni, in addition A. macmahoni larvae were met in the proportion of one to seven or eight larvae of A. demeilloni, only during the period from September to November. The authors never found during the two years' survey any A. gambiae breeding places, although they caught on two occasions females of this species near the railway station (lower part of the town near Filoha). Once at Filoha, the authors found a larva at the second stage and one at the fourth stage of A. coustani, the latter after breeding produced a female of the "ziemanni" variety. This occurred in the autumn of 1953 and did not recur the following year.

4. CONCLUSIONS OF PRESENT CONTRIBUTION

1) Contrary to the assertions of Martin, A. gambiae could not be considered as the only Anopheles found at Addis Ababa. Whilst it is rarely found in the adult stage, no larva of this species could be found by the surveys carried out during the period 1953 - 1955.

ii) The females of A. gambiae were caught in the lower part of the town, near the railway, and at the terminus place of the lorries coming from out of the town.

iii) The malaria cases which appeared to have been contracted in the town came still from this same lower area.

iv) The Akaki area appears, on the other hand, to be a permanent malaria focus and the vector is the A. gambiae.

v) It appears that during the rainy years, imported A. gambiae mosquitoes succeed in breeding in the parts of Addis Ababa lying near point of arrival of transports. This is however an exception, not a rule.

vi) During the last heavy epidemic of malaria (end of 1958 to beginning of 1959) which seriously affected the surroundings of Addis Ababa, the capital itself had only few sporadic cases which could not be compared to the epidemic that prevailed in its immediate surroundings. This suggests that there is a critical altitude lying between the 2,300 metre zone of Akaki and the 2,470 metres of Addis Ababa, and that these 300 metres mark a barrier which so far has not been violated at least from an epidemiological malaria point of view.

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