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THE APPEARANCE OF ANOPHELES SACHAROVI IN THE REPUBLIC OF MACEDONIA (YUGOSLAVIA)

by

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Introduction

Investigations of the distribution of Anopheles species and varieties of the maculipennis group in the region covered by the Republic of Macedonia, during the period between the two world wars, have not shown the presence of Anopheles sacharovi. According to these investigations, A.sacharovi are encountered only in the south of Dalmatia and in Montenegro /Simić (1948) and Simić & Živković (1958)/ Hasselmann (1926), while dealing with the problem of Anopheles in Yugoslavia, had studied the anopheline population in Dalmatia and in the basin of the river Neretva, and established the presence of A.sacharovi in Njivica (the island of Krk) and in Metković. But this identification of species was not made according to eggs but only according to the morphological characteristic of the adult; such findings, therefore, cannot be accepted without reserve. Peus (1942), Stakelberg (1937), Russell (1943), in describing A.sacharovi, have determined the general distribution on the Balkan Peninsula without indicating the limits of distribution of this species.

Teodorović (1949), in his work on the importance of A.maculipennis races in the epidemiology of malaria in Macedonia, gives a summary of a broad study concerning the distribution of the anopheline species and the varieties of the maculipennis group. These investigations show that the maculipennis group is represented by the varieties messeae, typicus, atroparvus and subalpinus, but the elutus variety of A.sacharovi

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species is not found. However, A.maculipennis var.messeae, typicus, subalpinus and A.superpictus are typically found in the regions along the Yugoslav-Greek border. [1]

Investigations

In the village of Stojakovo (Municipality of Bogdanci) a malaria epidemic was reported to have occurred in 1959 although residual spraying had been carried out; 75 malaria cases were at that time registered in Stojakovo. Assuming that residual spraying operations had not been properly conducted, there still is no ground to believe that this might have caused the development of the epidemic. Consequently, a special epidemiological study had to be undertaken.

From 26 to 29 April 1960, an epidemiological survey was carried out in the villages of Stojakovo and Bogorodica and 12 Anopheles were caught in the village of Bogorodica during that period. Of these 12, eggs were obtained from four females, 3 of these were found to be A.maculipennis maculipennis (var. typicus) and one A.sacharovi. Owing to such findings, investigations were carried out in June and July during the same year with the aim of establishing the susceptibility of Anopheles in the following settlements: Gevgelija, Bogorodica, Stojakovo, Palurci, Crničani, Negorci and Novi Dojran (Fig. 1). Simultaneous studies were conducted to establish the relationship between certain members of the A.maculipennis group.

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[1] According to Stone, Knight & Starcke (1959) "Synoptic Catalogue of the Mosquitos of the World" the taxonomic status of the A.maculipennis group is as follows:

A.maculipennis Meigen (= A.typicus Hackett & Missiroli)

ssp. messeae Falleroni

ssp. melanoon Hackett (syn. subalpinus Hackett & Lewis)

A. labranchiae Falleroni

ssp. atroparvus van Thiel

A.sacharovi Favre (syn. elutus Edwards)

The less common synonyms were omitted here. / Editor's remark /

Results

954 female Anopheles were investigated in June and July with the objective of determining the distribution of various members of A.maculipennis group, as well as the presence of A.sacharovi, in the above-mentioned settlements. The results are shown on Fig. 2, from which it can be seen that the following Anopheles were found in the 7 settlements: A.sacharovi, A.maculipennis maculipennis (var. typicus), A.maculipennis messeae, A.maculipennis atroparvus, A.maculipennis subalpinus.

The graph also shows that the relationship of the various members of the maculipennis group varies in each settlement and that the presence of A.sacharovi (a finding that surprised us) was recorded in only 4 of the 7 settlements. Moreover, they appeared in very different percentages.

In investigating the reasons for these considerable differences in the findings of A.sacharovi, the water from anopheline breeding places was tested for salinity. In Bogorodica, at one of the breeding places (a pond of about 1.5 ha), the water salinity amounted to 74 mg/litre, and A.sacharovi accounted for 69 per cent. of the anopheline larval population. While in the village of Palurci, where the water salinity of the anopheline breeding places was 15 to 18 mg/litre (the normal percentage of salinity found in fresh water) A.sacharovi larvae amounted to only 2.6 per cent.

Discussion

The question now arises, why should A.sacharovi appear in areas where previously they were not known to exist? As this species is considered a very important malaria vector, its finding has a particular significance. Moreover, the resistance shown by this species in Greece and Turkey imposes the need for a constant watch of their distribution, as well as investigations of the degree of their susceptibility and tolerance to insecticides.

It is obvious that the discovery of A.sacharovi in the settlements previously mentioned would be insufficient to account for the malaria outbreak in the village of Stojakovo during 1959; nevertheless, this discovery must be taken into consideration.

In addition, one should also bear in mind that from verified information made available from the epidemiological survey carried out during 1959, it was determined that residual spraying had been carried out from 25 June to 10 July, whereas the majority of cases were recorded during August and September (69 out of the total of cases reported for the whole year). Assuming that residual spraying had not been carried out properly (this should certainly be considered), this still does not explain the outbreak of malaria in one village only.

The resistance of A.sacharovi to insecticides of the chlorinated hydrocarbon group was observed in Greece during 1953, and since then a number of papers dealing with this problem have been published. Other investigations of the distribution of A.sacharovi have been carried out in addition to the above-mentioned studies. Thus Belios (1960), in summarizing the problem of A.sacharovi in Greece, gives a map showing the places where investigations of resistance of this kind were conducted. It should be noted that such investigations were carried out in Evsoni which is only ten kilometres distant from the Yugoslav villages of Stojakovo and Bogorodica. Belios also concludes that in more recent times, A.sacharovi are being encountered deep inland, whereas this vector was earlier found near coastal dwellings.

It certainly is difficult to postulate that the migration of A.sacharovi, which has been established, has been exclusively due to the application of insecticides. Even if the insecticide is taken as the influencing factor, it is hard to see how essential is its effect on a migration of this type.

Two questions arise:

(a) Has the decrease in the A.maculipennis group susceptible to insecticides, left more living space for other species such as A.sacharovi?

(b) Is the irritability of A.sacharovi to insecticides the factor which has caused the species to migrate?

Considering that A.sacharovi have been found in great numbers in the settlements investigated and that their relative numbers have been as high as varieties of the A.maculipennis group, such findings cannot be considered as accidental. It must be considered that A.sacharovi are migrating into these areas. Differences in the

proportion of A.sacharovi found in the various settlements could be attributed to the degree of salinity of the water in the anopheline breeding places, high salinity being a favourable factor for their maintenance. On the other hand, the proof that A.sacharovi are migrating from the south is that their appearance has been confined to only along the Greek border and that their presence has been established only in four out of the seven investigated settlements as indicated on Graph 2 and on the map.

Bearing in mind the importance of A.sacharovi in the transmission of malaria and especially their capacity to develop resistance to insecticides, it is considered that special attention should be devoted to the presence of A.sacharovi in Macedonia and that investigations should be continued on their distribution and their susceptibility to insecticides. Only thus can the undesirable consequences to the successful malaria eradication programme in Yugoslavia be prevented.

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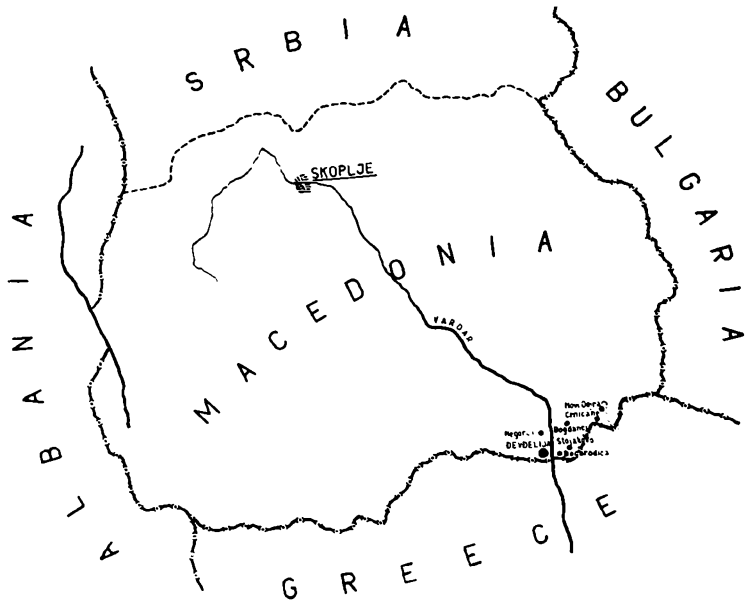

FIG. 1. MAP OF MACEDONIA SHOWING THE LOCALITIES INVESTIGATED

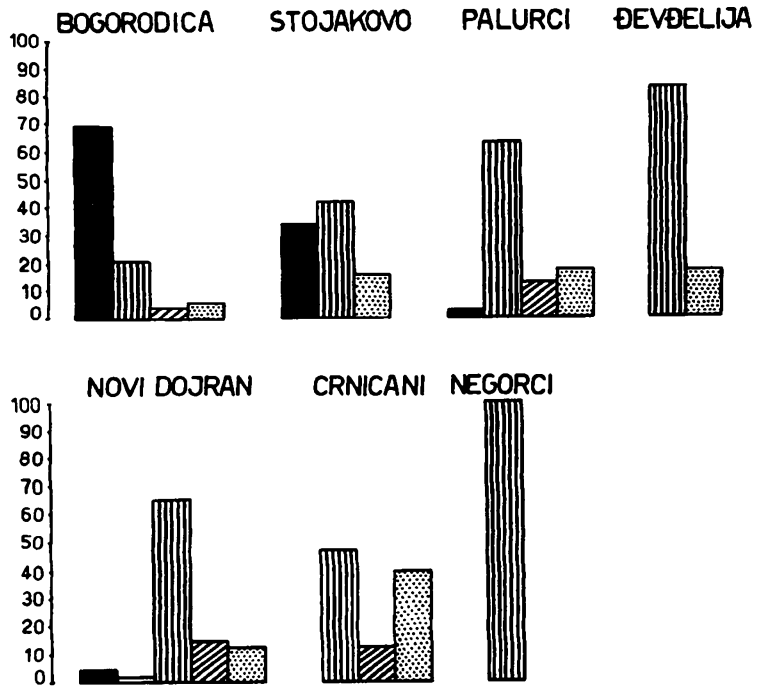

FIG. 2. FREQUENCY DISTRIBUTION OF VARIOUS MEMBERS OF A. MACULIPENNIS GROUP AND A. SACHAROVI IN SEVEN LOCALITIES IN YUGOSLAVIA. (JUNE - JULY 1960)

SACHAROVI
ATROPARVUS
MESSAE
SUBALPINUS
TYPICUS