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RESIDUAL SPRAYS OF MALATHION AND DDT FOR THE CONTROL OF *ANOPHELES BALABACENSIS BALABACENSIS* IN KUALA PENYA DISTRICT, SABAH, MALAYSIA

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INTRODUCTION

Insecticide field trials on the primary malaria vector in Sabah, *Anopheles bal. balabacensis* Baisas were conducted between 1976 — 1978 under the partial auspices of the WHO anti-malaria program for evaluation and testing of new insecticides. The trial area lies in Kuada Penyu district, Sabah, and is 35 km northwest of Beaufort town in a rural area with a relatively stable population. This area comprises 34 kampungs and was previously divided into 3 zones, which were sprayed with sumithion, (Fenitrothion), DDT and malathion in 1976-1977 (Hii, 1979; Hii and Chin, 1979). The last previous insecticide applications were made on July 1977 (for sumithion and DDT) and October 1977 (for malathion). In the extended trial, sumithion was omitted and DDT and malathion were used.

The mean monthly rainfall varies between 34.3 mm and 366 mm with two rainy seasons, the peaks of which occur in June-July and September-November. There is little temperature variation: the minimum indoor temperature vary from 18° to 23°C and the maximum from 32.3° to 34°C. The indoor relative humidity varies from 75% to 92%. The climatological pattern favours perennial malaria transmission. The trial area, topographical features and environmental conditions have been described elsewhere (Farid and Hii, unpublished data). In the modified trial, the territory was divided into two zones consisting of a DDT and a malathion zone each with a human population of 7,000 and 5,500 respectively.

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Materials and Methods

DDT 25% and malathion 84% emulsifiable concentrates were used at a target dosage rate of 2 g/m² of the technical grade. Spraying was carried out in the second week of May 1978 in the two spray zones and was completed by the end of June 1978. Following this cycle, a mop-up team visited the two zones for spraying missed and new houses or structures. Subsequent to these studies this area has continued to be sprayed twice per year with DDT to

date. The entomological evaluation huts situated in Kiaru (DDT) and Menum-bok Darat (malathion) (Fig. 1) were sprayed on 17 and 23 May 1978 respectively. A total of 1416 and 1272 inhabited structures were sprayed in area 1 (DDT) and area 2 (malathion) using 2041.5 litres technical DDT and 462.4 litres technical malathion respectively. During each of the applications of insecticide the house coverage in areas 1 and 2 were 96.1% and 93.8% respectively.

Toxicological observations were made during the spraying operations. All spraymen operating in the malathion zone wore long overalls, rubber boots and gloves, face masks, broad-brimmed hats made of flexible plastic. They were instructed to wash themselves and all protective clothing and equipment after each day's work. No complaints attributable to malathion contamination were recorded among the spraymen or the villagers living in the sprayed zones.

Entomological assessments were conducted every 15 days in the two entomology indicator stations. A detailed description of the experimental huts is given elsewhere (Hii, 1979).

Man-biting rates were determined by making biting catches inside sprayed and unsprayed experimental huts between 2100–2400 hours, and outdoor biting catches between 1800–2400 hrs. All mosquitoes were identified the next day and were also dissected to distinguish the parous from the nulliparous by scoring the presence of tracheal skeins (Detinova, 1962) depending on the stage of development of the ovaries. Biting collections from buffaloes were made in a Magoon trap at each station using one buffalo from 1800 to 0600 hrs.

Window exit traps were used to determine the number of anophelines leaving the huts. They were fixed to the huts in the evening and were removed next morning. The mosquitoes were differentiated according to species, sex and abdominal stage, and the 24-hour survival rates were also noted (W.H.O., 1975). Susceptibility tests were conducted using the WHO techniques for DDT and malathion.

RESULTS AND DISCUSSION

Fig. 1 shows the plan of the trial area and the distribution of the two malaria vectors, *An. bal. balabacensis* and *An. sundanicus* in Kuala Penyu district. *Anopheles bal. balabacensis* is considered to be the main malaria vector in this area and plays an important rôle all year round whereas *An. sundanicus* seemed to have played a more important rôle from January to March.

Pre-spray densities of *balabacensis* were low in the two areas as the surveys were made during the dry months of January to March (rainfall: 124 mm). Vector densities as measured by indoor and outdoor man-biting and Magoon trap catches in the entomology stations are given in Table 1. The densities of *balabacensis* were much lower in the DDT-sprayed hut than the malathion-sprayed hut. On the 43rd day after spraying the density of *balabacensis* in the malathion-sprayed hut was nil. By the 57th day it rose to 0.67 per man-hour and by the 85th day it increased to 3.11 per man-hour. The overall density of *balabacensis* in the malathion hut was 40% of the control hut; whereas that in the DDT hut remained below 5% of the control figure. Despite high outdoor densities in Kiaru (Table 1), *balabacensis* females were caught