

WORLD HEALTH
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a 63276



ORGANISATION MONDIALE
DE LA SANTE

WHO/Mal/371 ✓
9 January 1963

ORIGINAL: ENGLISH

IDENTIFICATION OF ANOPHELES BALABACENSIS INTROLATUS
AS A VECTOR OF MONKEY MALARIA IN MALAYA

by

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It has previously been reported that A. hackeri and A. leucosphyrus are vectors of monkey malaria in Malaya (Wharton & Eyles, 1961; Wharton et al., 1962). The present note records the demonstration that A. balabacensis introlatus, another member of the A. leucosphyrus group, is also a vector.

A naturally infected female of A. balabacensis introlatus was captured using monkey bait in a net trap in the Ulu Gombak area near Kuala Lumpur. After examination of the glands, which had a moderately heavy infection, the sporozoites were injected part into an uninfected rhesus monkey R302 and part into a human volunteer.

The human volunteer did not develop malaria and two sub-inoculations of blood to an uninfected rhesus monkey on the 14th and 20th day after injection indicated that sub-patent infection was not present.

The rhesus monkey injected with the sporozoites (R302) developed an infection of the Plasmodium cynomolgi type on the 11th day after the sporozoites were injected. A very severe infection with a peak parasite density of over 700 000 parasites per mm³ ensued.

Gametocytes were present in abundance during the infection in monkey R302 and the infection was passed to another rhesus monkey R127 by means of the injection of sporozoites from laboratory-reared and infected A. maculatus. This monkey developed an infection with a peak parasite density of 287 000 per mm³ and again gametocytes were produced in large numbers.

From monkey R302 and R127 two additional monkeys were inoculated by means of infected blood. The first of these two monkeys, R58, had had two previous infections with P. cynomolgi bastianellii. The first bastianellii infection in R58 had run its acute course and was treated with chloroquine, subsequent to which it received a second bastianellii inoculation which produced only a low grade parasitaemia. This infection had also been eliminated by the use of chloroquine about 11 weeks prior to the inoculation with the newly isolated strain. In spite of the fact that this monkey had been demonstrated to possess considerable immunity against bastianellii, a severe infection resulted with the new strain with a peak parasite density of 489 000 per mm³.

Although the conclusion is based on only one experiment, it would appear that there is little cross-immunity between the newly isolated strain and P. cynomolgi bastianellii, and the new isolation may be typical P. c. cynomolgi. This conclusion must be supported by studies of the exo-erythrocytic forms which have been shown to differ between the two sub-species (Garnham, 1959; Eyles, 1960).

The second monkey, inoculated by means of infected blood (R140), had had a previous infection with P. coatneyi and P. cynomolgi (sub-species undetermined) which had been eliminated by means of chloroquine. It developed an infection with a peak density of 264 430 parasites per mm³, but the course of the acute infection seemed shortened.

Subsequent to the first finding, two additional naturally infected A. balabacensis introlatus were captured on human bait in the same locality. Again the sporozoites were divided and injected into uninfected rhesus monkeys and human volunteers, but none developed malaria infection. Two conclusions are possible: (1) that the sporozoites were non-infective, perhaps due to handling; or (2) that the sporozoites represented some other animal malaria. Gibbons, which are known to be infected with malaria in Malaya, are common in the locality.

In previous studies (in preparation for publication) on the susceptibility of Malayan mosquitos to infections with P. c. bastianellii it was found that A. balabacensis introlatus from the same locality from which the naturally infected mosquitos came, were rather insusceptible to experimental infection. In a total of 17 dissected only one had been found infected, whereas the control A. maculatus mosquitos showed a 100 per cent. oocyst infection rate, and the oocysts usually matured normally.

Parallel studies were done with the newly isolated strain and it was found that it was quite infective to A. balabacensis introlatus. In a total of seven dissected, all were found infected, as compared with 100 per cent. of the A. maculatus controls. More surprising, infections with the new strain developed normally to the sporozoite stage in A. balabacensis introlatus; whereas, oocysts degenerated and sporozoites frequently failed to mature in A. maculatus.

Thus, in addition to the lack of cross-immunity, there appeared to be differences also in the infectivity to Malayan mosquitos.

The human volunteer who had shown no signs of malaria infection through four weeks after the original inoculation, was reinjected with sporozoites from experimentally infected A. maculatus. No infection resulted, so it was concluded that this individual, at least, was not susceptible to this strain of P. cynomolgi.

Even though the human volunteer did not develop malaria, the present finding of A. balabacensis introlatus as a monkey malaria vector is of interest in the study of monkey malaria as a possible zoonosis. Systematic trapping in the area from which the infected mosquitos came had shown that A. balabacensis introlatus was almost equally attracted to monkeys in net traps in the canopy and to man on the ground. The first of the demonstrated monkey malaria vectors, A. hackeri, bites man very rarely, and would probably not be effective in cross-transmission. The second, A. leucosphyrus, does attack man and is considered a human malaria vector in some areas, but in Malaya does not attack man as readily as does A. balabacensis introlatus.

The present finding is also interesting in that it emphasizes the role of mosquitos of the A. leucosphyrus group as vectors of monkey malaria in Asia. All of the demonstrated vectors are of this group, and in Malaya it is suspected that A. pujutensis may also be a vector. Whether by coincidence or otherwise, the only areas in India and East Pakistan where monkey malaria is found are also areas in which representatives of this group of mosquitos occur.

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