

FAILURE OF *ANOPHELES STEPHENSI* LISTON TO TRANSMIT HUMAN PLASMODIA MECHANICALLY¹

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ABSTRACT. Malaria patients with high asexual *Plasmodium vivax* or *P. falciparum* parasitemias each gave partial blood meals to 30 normal *Anopheles stephensi* Liston. These mosquitoes

were then allowed to complete their meals on two uninfected volunteers. These volunteers did not contract malaria.

INTRODUCTION

The possibility of mechanical transmission of human plasmodia by mosquitoes has been investigated by several workers. Mayne (1928) reported on 4 unsuccessful attempts using *Anopheles quadrimaculatus* Say and *Plasmodium vivax*. P. G. Shute (personal communication) mentioned the failure of additional attempts by B. Mayne, S. P. James and himself using *Anopheles atroparvus* Van Thiel and *P. vivax*. No other mechanical transmission studies employing mosquitoes and other human plasmodia appear to have been reported. In view of the potential importance of this mode of transmission for malaria eradication schemes, it was decided to repeat the above work with *P. vivax* using *Anopheles stephensi* Liston and to initiate a similar study using *Plasmodium falciparum*.

MATERIALS AND METHODS

Informed volunteers, adult male inmates of the Maryland House of Correction, Jessup, Maryland were selected for the study after detailed examinations for mental and physical fitness that included chest radiography, electrocardiogram, and laboratory tests. A particular prerequisite was normality of the baseline blood picture and hepatic and renal function tests. Infec-

tions were initiated either by the intravenous inoculation of 5 to 8 ml of parasitized blood or by challenge with infected mosquitoes. To prevent the possible transfer of hepatitis virus, volunteers receiving parasitized blood were given immune serum globulin intramuscularly, and the donors of the blood were examined to insure normality of liver function and absence of Hepatitis B associated antigen.

Blood films were made daily or more frequently if the condition warranted, and were stained with Giemsa. Patients were admitted to the hospital ward, either on clinical grounds or when parasitemia appeared, and were examined at least daily by physicians. Upon completion of the study, or earlier if desired by the volunteer or considered clinically necessary, radical curative treatment was undertaken and was successful in all cases. Natural infection of the volunteers may be excluded because malaria is not transmitted in the area of the study. The strictest attention was paid at all times to the ethical aspects of the study, these being supervised by independent committees of the University and the sponsoring agency.

MOSQUITOES. The Delhi strain of *A. stephensi* has been maintained in this laboratory since 1969 and serves here as the primary cyclical transmitter of both *P. vivax* and *P. falciparum*.

MALARIA PARASITES. The Chesson strain of *P. vivax* has served as a standard laboratory strain since its isolation in New Guinea over 30 years ago. In 1974 a new isolate of *P. falciparum* transmitted in East Africa was sent to us. This strain has been found to be chloroquine sensitive

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and is designated the Tanzania (Mor.) strain.

PROCEDURE. When malarial parasite donors were shown by blood smear examination to have a high level of young ring-stage trophozoites, normal *A. stephensi* were placed in individual containers and allowed to take a partial meal on the potential malarial donor. After partial engorgement the mosquito was removed and immediately placed upon the uninfected volunteer.

RESULTS

EXPERIMENT I: *P. falciparum*. When the donor volunteer demonstrated an asexual parasitemia of 6,120 per mm³, 30 normal *A. stephensi* were placed in individual cages and split-fed on the donor (blood group O) and an uninfected volunteer. The second volunteer's blood slides remained negative thereafter.

EXPERIMENT II: *P. vivax*. When the donor volunteer demonstrated an asexual parasitemia of 16,920 per mm³, 30 normal *A. stephensi* were placed in individual cages and split-fed on the donor (blood group O) and an uninfected volunteer. The second volunteer's blood slides remained negative thereafter.

DISCUSSION

Under the optimal conditions described above *A. stephensi* failed to transmit either *P. vivax* or *P. falciparum*, therefore it appears unlikely that this species does in fact transmit human malaria either by contamination of the mouth-parts or by fecal ejection of part of the blood meal during feeding. The possibility that other species of mosquitoes might transmit in this way is being investigated.

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Literature Cited

- Mayne, B. 1928. A note on some recent attempts to transmit malaria organisms mechanically through mosquito biting. Indian J. Med. Res. 15:1067-1071.