DETRIMENTAL EFFECTS OF *Plasmodium* INFECTIONS ON THE SURVIVAL RATE OF *Anopheles dirus*

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OBJECTIVES :

1. To determine if the longevity of mosquitoes infected with *Plasmodium* spp. is significantly different from that of mosquitoes that are not infected.

2. To determine if the longevity among mosquitoes with different "infection rates" of *Plasmodium* spp. is significantly different.

3. To determine if the longevity of mosquitoes infected with different *Plasmodium* spp. is significantly different among groups.

BACKGROUND : Malaria transmission in nature is the result of physiological and environmental factors which are dependent on the vector host and the human population. The probability of malaria transmission occurring is the direct result of mosquito density, mosquito susceptibility, anthropophilism, frequency and duration of feeding, the extrinsic cycle. Infectivity of sporozoites, sporozoite rate, susceptibility and infectivity of the human population, and mosquito longevity (1, 2). MacDonald (3) suggested that under natural conditions, i.e.,without the use of pesticides, etc., mosquito mortality assumes the form of a geometric progression, where the death rate does not change with age. He further proposed a mathematical rational for estimating the sporozoite rate based on the fact that the longevity of infected mosquitoes is not different from that of non-infected mosquitoes.

Early investigations on the effects of malarial species on mosquitoes have not been conclusive. A number of workers (4, 5, 6) suggested that the plasmodium parasites have a detrimental effect on the mortality rate of

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mosquitoes. However, other workers (7, 8) have concluded that there is no detrimental effect on the mortality rate of the vector host. More recently, Hacker (9) demonstrated that the fecundity of *Aedes aegypti* (L) is reduced in populations infected with *P. gallinaceum* Brumpt. Schiefer et al., (10) also demonstrated that the flight performance of *Anopheles stephensi* Liston infected with *Plasmodium cynomolgi* Mayer is inversely correlated to the severity of the infection. Gad et al., (11) have provided more conclusive evidence by demonstrating that there is a significant difference in the longevity between non-infected *An. stephensi* and *stephensi* infected with *P. berghei* Vincke and Lips.

The longevity of infected mosquitoes directly affects the malaria transmission rate, making it increasingly important to understand the parasite-vector relationship. Vector longevity studies, based on infection rate, will further our knowledge and provide a better understanding of the epidemiology of human malaria.

MATERIALS AND METHODS : These studies are being conducted with both simian and human malaria parasites. The materials, methods and techniques used in the studies with the simian parasite, *Plasmodium cynomolgi* (B strain), were described in the last annual report (12). The materials and methods used in the human malaria studies are basically the same as those outlined for the simian malaria aspects, except that *Plasmodium falciparum* and *P. vivax* will be used in *Anopheles dirus*. The source of the human parasites is described, and a diagram of the design for these studies is included in another report for this period (13).

RESULTS : The *P. cynomolgi* - *Anopheles dirus* studies were terminated shortly after the beginning of FY 81. Nearly all aspects of the results of those studies were discussed in last year's annual report (12). Since then 2 manuscripts have been prepared and cleared for publication. The 1st (14) describes differences found in the mortality rates of infected versus non-infected groups of *An. dirus*. Briefly, the non-infected mosquitoes exhibit only one peak period of mortality, i.e., between days 43-52, while the infected mosquitoes exhibit 2 peak periods of mortality, i.e., between days 11-18 and again between days 40-48. The 2nd manuscript (15) correlates the differences found in the survival rates of infected and non-infected groups with the infection density (based on mean numbers of oocysts per mosquito). These data show that there is an indirect relationship between survival rates and infection density, i.e., the most heavily infected mosquitoes have the lowest survival rate, while lightly infected mosquitoes have a survival rate comparable to that of non-infected mosquitoes. Both papers stress the impact of these findings on WHO malaria epidemiological models, if the same results are obtained in human malaria studies. Both papers have been submitted to journals for publication.

Human malaria aspects of this project were delayed and only began as of 5 Oct 1981. Results of these studies will be presented in next year's report.

These studies are continuing.

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