Ecology of Malaria Vectors

Principal Investigators: Douglas J. Gould, Ph.D.
Bruce A. Harrison, CPT, MSC
Michael F. Sullivan, CPT, MSC
R.N. Wilkinson, CPT, MSC

Associate Investigators: Prajim Boonyakanist
Larp Panthusiri

OBJECTIVE: To investigate the bionomics and population dynamics of the species of Anopheles which are vectors of human malaria in Southeast Asia. In addition, the relationship of these species to the dissemination of chloroquine resistant strains of P. falciparum are under study.

DESCRIPTION: Specific factors being studied in the attempt to define the actual and potential vector species present in Thailand include determination of host preferences, susceptibility to infection with malaria, flight range, longevity, patterns of biting activity, ovipositional habits and factors influencing egg viability and survival under varying conditions. Studies are also being made in an attempt to determine if 1) chloroquine resistant strains of P. falciparum have a greater reproductive potential in anopheline hosts than do chloroquine sensitive strains; 2) if A. balabacensis is more susceptible to infection with chloroquine resistant strains of P. falciparum than are other species; and 3) if chloroquine treatment in the human enhances the reproductive potential of chloroquine resistant strains of P. falciparum in the mosquito host. Colonized Anopheles balabacensis and Anopheles minimus are fed simultaneously on patients with circulating gametocytes of P. falciparum. The resistant status of the infection is determined prior to treatment with chloroquine by Reickmann's in vitro test and by WHO criteria on days 7, 14, 21 and 28 after treatment. The mean number of oocysts developing in the two vector species are compared with reference to whether the patient was infected with drug sensitive or resistant strains of P. falciparum.

PROGRESS: During this period emphasis was placed on finding a locality with a stable human population and malaria parasite rates of 25% or higher which was accessible during all seasons of the year. During November and December 1970 a total of 97 thick–thin blood films were taken from inhabitants on the island of Koh Chang in Trad province; eighteen (20.6%) were positive for P. falciparum. This area was not considered feasible for field studies because it is inaccessible during part of the year. In January 1971, one hundred and forty six blood films were obtained from school children at two schools in Amphur Chaibadan, Chaiyapoom province; nine (6.1%) of the films were positive for P. falciparum. In addition, two of 15 (14%) films from villagers located near the schools were positive for P. falciparum. On the assumption that malaria rates would rise during the transmission season (June–October) and because of their easy accessibility, these areas were considered as possible sites for long term field studies. The village of Ban Bu Phram in Prajinburi province, which has been highly malarious in previous years, was visited during March 1971. Seventy–six of 211 (36.%) blood films from this site were positive for either P. falciparum or P. vivax. The rates for P. falciparum and P. vivax were 25.6% and 10.4%, respectively. Infected An. balabacensis have been collected in this area. The area has a stable human population of more than 1000 persons and is easily accessible throughout the year. Consequently, major longitudinal human and vector studies are planned for the coming transmission season.

During January an effort was made to recover viable eggs of An. balabacensis from soil samples collected at suspected oviposition sites in areas of Nakorn Rajasima and Prajinburi provinces where adult An. balabacensis had previously been captured. At the time of collection there had been no precipitation for over two months and conditions were extremely dry. Adults of An. balabacensis, An. korhi, and a member of

An. hyrcanus complex as well as adults of three species of Aedes were reared from larvae which emerged when 39 of these soil samples were flooded. In the SMRL laboratory eggs of An. balabacensis have been found viable for up to 18 days when kept on moist filter paper.

Colonized An. balabacensis were fed on patients with falciparum malaria to study growth rates of chloroquine susceptible and resistant strains of P. falciparum in this vector species.

SUMMARY: Sites in Trad, Lopburi, Prajinburi and Nakorn Rajasima provinces were surveyed for feasibility for a long-term study of vector ecology and malaria epidemiology. Viable eggs of three species of Anopheles and three species of Aedes were found in samples of soil taken from dry stream beds in Nakorn Rajasima and Prajinburi provinces. Studies on the growth rate of chloroquine susceptible and resistant strains of P. falciparum in An. balabacensis were initiated.