

**IMPACT OF ANTIMOSQUITO ANTIBODIES AND ASPECTS OF
MOSQUITO PHYSIOLOGY ON THE TRANSMISSION OF PATHOGENS**

A THESIS PRESENTED BY

KANDIAH ALAGARATNAM SRIKRISHNARAJ

in fulfillment of the

requirement for the award of

the degree of

DOCTOR OF PHILOSOPHY (Ph.D)

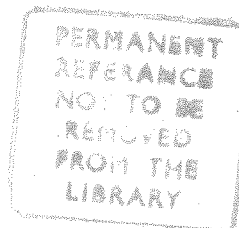
of the

UNIVERSITY OF COLOMBO

SRI LANKA

469582

1997



ABSTRACT

Mosquitoes transmit several diseases to humans. The blood feeding behaviour of the mosquito and its ability to transmit pathogens in the course of blood-feeding are important aspects in the epidemiology of vector-borne diseases. Multiple blood feeding was observed within a single gonotrophic cycle in a laboratory colony of *Anopheles tessellatus* Theobald. Sugar feeding on either glucose or sucrose did not influence the longevity of adults from the colony. Adult *An. tessellatus* derived from larvae reared under different conditions of crowding showed differences in body size and body reserves i.e., carbohydrates, lipids, and proteins. Mosquitoes that resulted from larvae reared in uncrowded conditions were larger than those that resulted from larvae reared under crowded conditions. A large proportion of small mosquitoes required more than one blood meal in single gonotrophic cycle compared to mosquitoes of larger size. The fecundity and blood meal size were affected by the size of the mosquito.

Antimosquito antibodies were raised in rabbits and mice against mosquito antigens derived from the head/thorax, midgut, and abdomen tissues. Antigens derived from sugar-fed mosquitoes were used for immunising rabbits and antigens derived from blood-fed mosquitoes were used to raise antibodies in mice. Murine antibodies to brain tissue of blood-fed *An. tessellatus* were also produced. The effects of these antibodies on the longevity and fecundity of *An. tessellatus* and *Culex quinquefasciatus* Say were investigated. Rabbit antimosquito antibodies reduced the fecundity of *An. tessellatus* and the longevity of *Cx. quinquefasciatus*. Murine

antimosquito antibodies reduced the fecundity of *An. tessellatus*. Murine antibodies to brain tissue of blood-fed *An. tessellatus* when ingested in a blood meal did not influence mosquito mortality and fecundity. It is postulated that antibodies against antigens shared among the head/thorax, midgut, and abdomen tissues are involved in the reduction of fecundity. It is also shown by ultrastructural studies that rabbit antibodies to midgut tissue of *An. tessellatus* inhibited the formation of the peritrophic membrane in the posterior region of the *An. tessellatus* midgut.

The susceptibility of *An. tessellatus* to *Plasmodium vivax* Grassi was reduced when mosquitoes ingested *P. vivax* gametocytes in human erythrocytes suspended in rabbit sera containing anti-*An. tessellatus* antibodies. In the presence of antimosquito antibodies, fewer oocysts of *P. vivax* developed in the mosquito midgut. This reduction in the infectivity of *P. vivax* to *An. tessellatus* was independent of complement. A second blood meal containing antimidgut antibodies, given 48 or 72 hours after the infective blood meal, did not enhance the transmission blocking effect. Immunoglobulin (IgG) purified from antimidgut sera was shown to mediate the transmission blocking effect.

Monoclonal antibodies (MAbs) to antigens derived from the midgut of *An. tessellatus* did not affect the mortality and fecundity of *An. tessellatus* when these MAbs were fed to mosquitoes either in an *in vitro* blood feed, or by direct feeding of mosquitoes on mice producing ascites. The infectivity of *P. vivax* to *An. tessellatus* was also not influenced by an infective blood meal containing these MAbs.