

Vertical stratification of adult mosquitoes (Diptera: Culicidae) within a tropical rainforest in Sabah, Malaysia

ABSTRACT

Background: Malaria cases caused by *Plasmodium knowlesi*, a simian parasite naturally found in long-tailed and pig-tailed macaques, are increasing rapidly in Sabah, Malaysia. One hypothesis is that this increase is associated with changes in land use. A study was carried out to identify the anopheline vectors present in different forest types and to observe the human landing behaviour of mosquitoes. **Methods:** Mosquito collections were carried out using human landing catches at ground and canopy levels in the Tawau Division of Sabah. Collections were conducted along an anthropogenic disturbance gradient (primary forest, lightly logged virgin jungle reserve and salvage logged forest) between 18:00 and 22:00 h. **Results:** *Anopheles balabacensis*, a vector of *P. knowlesi*, was the predominant species in all collection areas, accounting for 70 % of the total catch, with a peak landing time of 18:30–20:00 h. *Anopheles balabacensis* had a preference for landing on humans at ground level compared to the canopy ($p < 0.0001$). A greater abundance of mosquitoes were landing in the logged forest compared to the primary forest ($p < 0.0001$). There was no difference between mosquito abundance in the logged forest and lightly logged forest ($p = 0.554$). A higher evening temperature ($p < 0.0001$) and rainfall ($p < 0.0001$) significantly decreased mosquito abundance during collection nights. **Conclusions:** This study demonstrates the potential ability of *An. balabacensis* to transmit *P. knowlesi* between canopy-dwelling simian hosts and ground-dwelling humans, and that forest disturbance increases the abundance of this disease vector. These results, in combination with regional patterns of land use change, may partly explain the rapid rise in *P. knowlesi* cases in Sabah. This study provides essential data on anthropophily for the principal vector of *P. knowlesi* which is important for the planning of vector control strategies.