DIEL ACTIVITY OF SOME TRINIDADIAN MOSQUITOES AS RELATED TO TRANSMISSION OF ARBOVIRUSES

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Ecological studies on arthropod-borne diseases (i.e. diseases transmitted by insects, ticks and mites) must of necessity involve a study of the behaviour of the vectors. It is of prime importance to know if the vectors obtain their blood meal during the day, in which case they are called diurnal, or during the night (nocturnal), or indeed if they bite only at dusk or dawn (crepuscular).

Some species of mosquitoes are involved in the cycle of certain arthopod-borne viruses (arboviruses) in Trinidad. Consequently over the past several years, ecological studies on some of these mosquitoes have been undertaken by staff members of the Trinidad Regional Virus Laboratory. Part of these studies included the 24-hour activity (diel) cycles of certain species of mosquitoes as there have been few such studies in the Neotropics. Earlier works on diel activity of mosquitoes in the Neotropics concerned species which were involved in the cycle of yellow fever virus and these have been reviewed by de Kruijf (1972). Two recent pertinent papers (Aitken et al., 1968; de Kruijf, 1972) discussed the diel activity of some species which are also included in the present study, but these authors collected mosquitoes off human bait, which may have given biased results, whereas my study involved mechanical traps.

MATERIALS AND METHODS

The study was conducted at Turure Forest, a secondary tropical rain forest in northeastern Trinidad. The area was described by Beard (1946) as of the evergreen seasonal marsh type where the indicator plant species is the palm **Jessenia oligocarpa**. The canopy of palms averages about 20 feet (6.2m) but there are a few emergent hardwoods. Annual mean rainfall is about 100–110 inches (254–280 cm). The area along Turure Road where the studies were conducted has been subsequently cleared for farming purposes.

Alarm-clock activated flap-traps (Worth and Jonkers, 1962) were used throughout this study. These traps operated as follows: two flaps like an open clam shell attached to a wooden frame sit over two adult mice in a wire cage. The mice are used as bait for attracting mosquitoes.

At a designated time, the flaps are activated by an alarm clock and fall over enclosing any mosquitoes which were attacking the mice at that time. Six traps were set at the same time at about 50 feet apart and were operated so as to close at 2-hour intervals. Thus, one trap would close at 0600 hours, another at 0800 hours etc. When the sixth trap was closed, i.e. at the end of the twelfth hour, the mosquitoes were collected, placed in separate jars and traps re-set for another 12 hours. Continuous sampling over a 24-hour period was thus obtained. The traps were operated during the period 1 December 1967 to 13 January 1968 and 20 June to 20 December 1968, one day per week, For analysis, the data were pooled according to hour of collection.

RESULTS

Some 5,800 mosquitoes were caught representing 39 species. Ten species, however, accounted for 94 per cent of the total catch. Of the 10 species, one designated as **Culex** sp No. 17, is not completely identifiable at this time as it may contain a complex of species, so an analysis is only possible for 9 species.

Nocturnal Species (Figs: 1A, 1B, 1C)

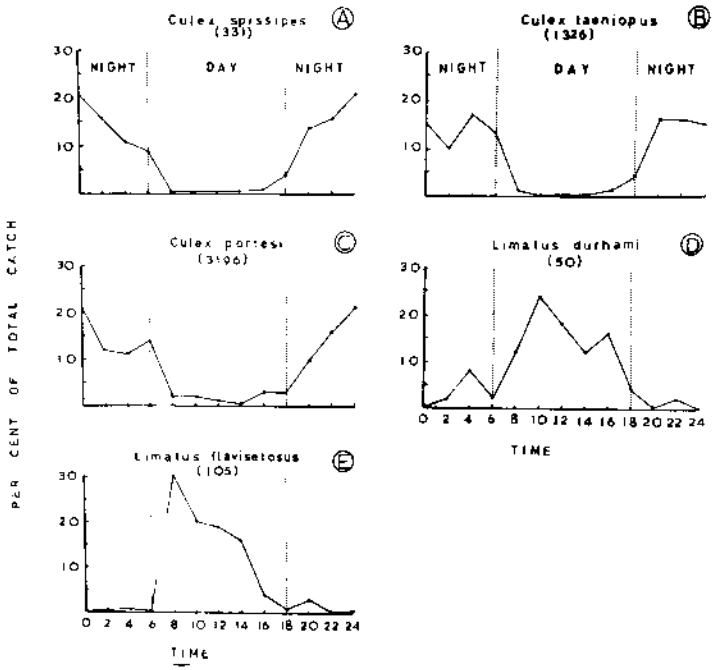

Fig 1 Diel activity of **Culex spissipes, C. taeniopus, C. portesi, Limatus durhami and L. flavisetosus** shown as a percentage of the total catch of each species. The total number of specimens captured for each species is given in brackets.

Culex portesi, C. spissipes and C. taeniopus were decidely nocturnal in their activities. **C. portesi** reached a peak at mid-night. Using human bait at Bush Bush Forest, Trinidad, Aitken et al., (1968) and de Kruijf (1972) in Surinam found this species to be nocturnal, but with peaks of activity occurring at dawn in Trinidad and at both dusk and dawn in Surinam. **Culex spissipes** was also found to have a periodicity similar to **C.** portesi with a peak at mid-night, but Aitken et al., (1968) found a peak at dusk while de Kruijf (1972) recorded peaks at both dusk and dawn. **Culex taeniopus** was active throughout the night reaching a peak about two hours after dusk. A 5 per cent drop in activity was recorded around 0200 hours.

Diurnal Species (Figs: 1D, 1E)

Limatus durhami and L. flavisetosus were active mainly in the daylight hours. Peak activity was recorded at 0800 hours, for **Limatus** flavisetosus, but activity declined steadily thereafter. de Kruijf (1972) found peak activity for this species shortly before noon.

Intermediate Species (Figs: 2A, 2B, 2C, 2D)

Aedes hortator, A. serratus, Culex amazonensis and C. vomerifer, appear to be active during both day and night. The following table compares the proportion of individuals active during the day and those active during the night.

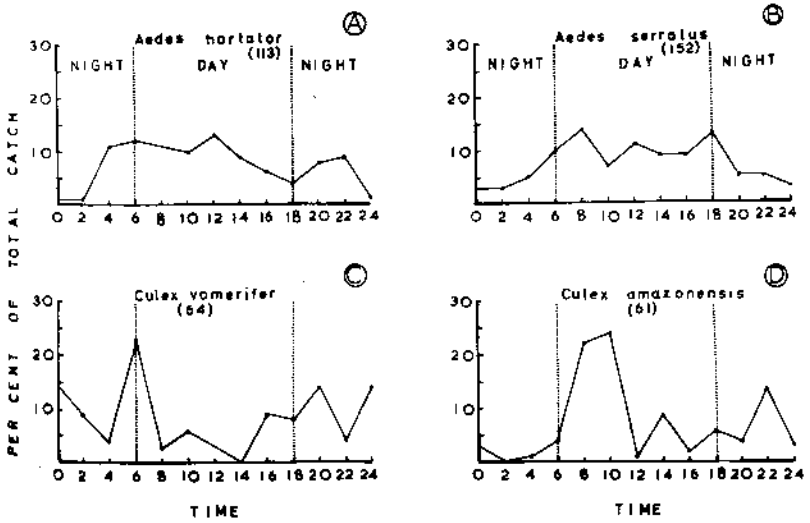

Fig 2 Diel activity of **Aedes hortator, A. serratus, Culex vomerifer and C. amazonensis** shown as a percentage of the total catch of each species. The total number of specimens captured for each species is given in brackets.

Species	No. of Specimens	Day 0600–1600 hrs % of catch	Night 1800–0400 hrs % of catch
Aedes hortator	113	63.7	36.3
Aedes serratus	152	62.5	37.5
Culex amazonensis	61	68.9	31.2
Culex vomerifer	64	45.3	54.7

Neither Aitken et al., (1968) nor de Kruijf (1972) mentions **A. hortator**, but the data given by these authors for **A. serratus** appear to be similar to my own, although de Kruijf (1972) showed a peak at dusk for catches in Surinam.

Although the numbers collected were small, the data for **C. amazonensis** were in general agreement with those of Aitken et al., (1968), but those authors recorded a peak at dawn, whilst my own data showed peaks occurring at 0800 and 1000 hours.

DISCUSSION

Culex portesi is a known vector of several arboviruses in Trinidad (Aitken et al., 1969) of which Venezuelan equine encephalitis (VEE) is probably the most important. This species of mosquito is attracted to small rodents in preference to other vertebrates. Since these rodents are active during the night and have been shown at times to circulate VEE virus in their blood, it is easy to postulate a **Culex portesi**-rodent cycle and suggest that transmission occurs mainly at night. There are other viruses in Trinidad and elsewhere which have a similar cycle and utilize **C. portesi** as a vector.

Culex taeniopus is believed to be involved in the cycle of eastern encephalitis (EEE) virus in Trinidad. The host of this virus is not known, but because **C. taeniopus** was shown to be nocturnal, it may be assumed that transmission of EEE also occurs at night.

Of the remaining species, only **Aedes serratus** yielded viruses with regular frequency (Aitken, 1969). The virus strains invlolved were mainly VEE. While the greater proportion of **A. serratus** were found to be active during the day, it may very well be that the virus isolates were made from the night-flying populations. If it can be shown that this species is actually able to transmit the virus to man, then it becomes a potentially dangerous species, as it may take the virus out of its basic nocturnal transmission cycle to humans who may enter the forest during the day. This may also be true for **Culex amazonensis** and

C. vomerifer as these are active during both day and night. VEE and other viruses have also been isolated from these two species of mosquitoes, but not with regularity.

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REFERENCES

Aitken, T. H. G., Worth, C. B and Tikasingh, E. S. 1968. Arbovirus studies in Bush Bush Forest, Trinidad, W.I., September 1969–December 1964. III. Entomologic Studies, Am. J. Trop. Med. Hyg., 17: 253–268.

Aitken, T. H. G., Spence, L., Jonkers, A. H. and Downs, W. G. 1969. A 10-year survey of Trinidad arthropods for natural virus infections (1953–1963). J. Med. Ent., 6:207–215.

Beard, J. S. 1946. The Natural Vegetation of Trinidad. Oxford Forestry Memoirs No. 20, 1945, Claredon Press Oxford.

de Kruijf, H. A. M. 1972. Aspects of the ecology of mosquitoes in Surinam. Studies on the Fauna of Suriname and other Guyanas. 13 (51): 1–56.

Worth, C. B. and Jonkers, A. H. 1962. Two traps for mosquitoes attracted to small vertebrate animals. Mosquito News 22:18–21.