

MOSQUITO-BORNE INFECTIONS IN FIJI: VI. DIEL PERIODICITY IN THE LANDING OF *Aedes aegypti* ON MAN

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ABSTRACT. The diel activity pattern of *Aedes aegypti* on human host was investigated at a suburban biotope of Suva, Fiji Islands in fortnightly collections between June 1974 to June

Aedes aegypti occurs in most of the islands of the South Pacific where according to Belkin (1962) it is confined mainly to the seaports. The species presumably is more adapted to these urban and suburban communities than the villages in the interior where the supply of artificial containers which are utilized by the mosquito is limited. Even so their numbers in Fiji are apparently small compared to continental areas. Paine (1943) reported that it seldom occurs in great numbers. This was also borne out by a recent investigation by Rakai et al. (1974), who conducted a biting time study in 2 coastal villages, and although they carried out 48 twenty-four-hr catches spread over a period of a year, only 15 *aegypti* adults were collected which was the lowest number of the 11 species captured.

The mosquito is a vector of yellow fever and dengue. Dengue fever has occurred in Fiji periodically over the last 90 years

1975. Males and females were represented in almost equal numbers in these catches. More adults were captured indoors than outdoors, and activity was higher during daylight hours.

(Maguire et al. 1974). The most recent outbreak was reported in the early months of 1975 and there were haemorrhagic fever complications (Maguire, pers.comm.).

The investigations reported here were commenced in June 1974 and completed in June 1975. The main purpose of the study was to examine the diel activity pattern of the species in a suburban area close to a seaport, where the mosquito population was expected to be high.

MATERIALS AND METHODS

STUDY AREA. These studies were conducted in a residential part of Walu Bay area in the capital and main seaport of Fiji, Suva. The residents of this suburb live in low cost housing along the bank of a tidal creek. There is some forest vegetation along the banks of the tidal creek.

CLIMATE. This region of Fiji is exposed to the SE trade winds, which bring in an annual rainfall in excess of 2.54 meters. Summer temperatures range from 25–30°C and winter temperature

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may drop to 20°. Relative humidity ranges from 70–85 percent throughout the year.

METHODS OF SAMPLING. The adults were caught at 3 permanently established stations, located as follows: (1) inside a house (2) outside another house situated approximately 100 meters from the first house and (3) in the bush alongside the suburb.

The day was divided into 8 equal sampling periods of 2 hr each, with an hour interval between sample periods. The initial sampling period began at 0700 hr and was completed by 0900 hr. After an hour's rest, the 2nd period ran from 1000 to 1200 hr and the sampling times continued in the same pattern to the last, or 8th period, from 0400 to 0600 hr.

Mosquito catching was carried out by a 2-man team. One man naked to the waist acted as bait, while the other used a battery operated aspirator to capture adults as they landed. The catch was labelled and transported to the laboratory in a cold box for sorting. During each 2-hr sampling period, 30 minutes were spent at each of the 3 stations. The total time spent in actual mosquito collecting for each 2-hr period was approximately 90 minutes. After 4 periods a fresh 2-man team was assigned. The same individuals participated during most of this survey.

RESULTS

A total of 28 twenty-four hr collections were made at the Walu Bay biotope from

June 1974 to June 1975. The actual time spent in sampling amounted to 12 hr per day; this is equivalent to 336 hr for the 28 days spent in collecting.

In the total of 541 adults captured, 264 (or 48.8 percent) were males and 277 (or 51.2) were females. On the basis of the actual time taken to capture these adults the mean landing rates for males and females were 0.78 and 0.82 per hr respectively. The catches for the 3 stations were pooled and landing rates for the 8 periods were calculated by dividing the actual time (in hrs) spent in catching by the biting rate per hr for that period. The biting rate per hr was converted to $\log(n+1)$ according to Williams (1937) and corresponding values expressed as percentages of total activity (Table 1 and Fig. 1).

The collection data also indicated that the highest landing rates were recorded inside the house. In fact the figure was almost twice the combined total for outside house and bush station catches (Table 2).

DISCUSSION

The data presented in this report relate to mosquitoes caught by collectors as the insects landed on their bodies. Although some females took blood, the Williams mean histogram for females does not necessarily represent the biting pattern for the species. The reason for this is the appearance of 264 (or 49 percent) males out of a total catch of 541 adults. Since the males are non-biting their pres-

Table 1. Mean landing rate per hr for male and female *A. aegypti* over 8 periods of 2-hr duration (expressed as percentages of total activity). Actual numbers of adults in brackets.

Sex	Periods*							
	1	2	3	4	5	6	7	8
Female	18.76 (46)	20.51 (63)	13.91 (42)	21.60 (66)	8.45 (20)	5.25 (12)	7.33 (19)	4.16 (8)
Male	20.06 (56)	25.93 (69)	24.86 (67)	21.86 (59)	2.56 (5)	0.71 (1)	1.84 (3)	2.14 (4)

* Key to periods: 1 = 0700–0900, 2 = 1000–1200, 3 = 1300–1500, 4 = 1600–1800, 5 = 1900–2100, 6 = 2200–2400, 7 = 0100–0300, 8 = 0400–0600 hr (Fiji time, i.e. G.M.T. + 12 hr).

Table 2. A summary of landing rates for the 3 stations in Walu Bay biotope.

	Male	Female
Inside house	174	183
Outside house	18	23
Bush	72	71

ence could indicate some other intrinsic behavior pattern.

The presence of males in human baited catches of *aegypti* has been reported previously. Trpis et al. (1973) who encountered a similar phenomenon in Tanzania, suggest that males pursue young virgin females in a nuptial flight in the presence of a human bait, especially if there are breeding sites nearby. This also appeared to be the case with the Walu Bay biotope where numerous artificial containers of the type commonly utilized by *aegypti* were located. Since the ratio of male to female is almost equal, the behavior pattern presented therefore must be regarded as "landing rate" rather than "biting rate."

To establish the biting pattern of the species, further investigations will be necessary with special emphasis on the actual biting activity.

The 541 adults captured in this study represent a substantial increase over the meager 15 recorded by Rakai et al. (1974) in their earlier studies from the 2 villages in Fiji. An examination of the weather data over the past years did not show any unusual condition which could have contributed to a steep rise in *aegypti* population. It seems more probable that the Walu Bay biotope is more suited to *aegypti* colonization. The findings appear to confirm the generally held views that *aegypti* maintains a low population density in the south Pacific Islands (Paine 1943) and that it is usually associated with seaports (Belkin 1962).

Despite their small numbers, *aegypti* appears to be a highly efficient vector of dengue-haemorrhagic fever in Fiji. Using fluorescent antibody techniques, Maguire (pers. comm.) was able to detect the pres-

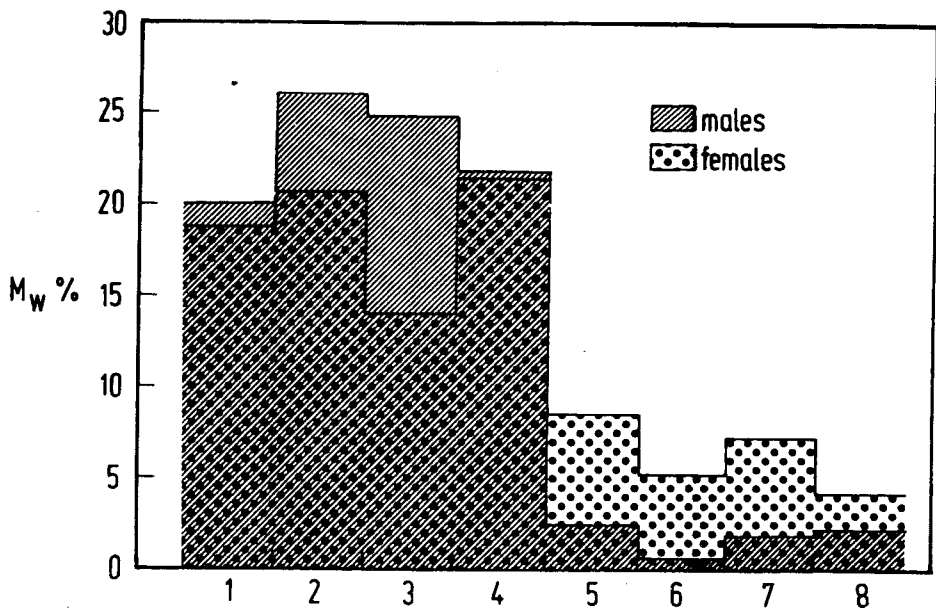


Fig. 1. Williams mean landing rate per hr expressed as percentage of total for males and females *Ae. aegypti* captured.

ence of dengue virus in 11 out of 196 (or 5.6 percent) wild caught *aegypti* females, at the peak of the epidemic in 1975.

In the present study the major part of activity occurred in the daylight hours of 0700 to 1800 (periods 1-4), and activity was low at night (periods 4-8). There was no suggestion of a bimodal curve as reported by Trpis et al. (1974) in Tanzania, though a slight depression in female activity was registered in the 1300 to 1500 hrs segment (period 3). Also in the Tanzanian study the male landing rate was higher at dusk (1800 hrs), but in ours it was at the earlier time of 1000 to 1200 hrs. Apart from any geographic or environmental considerations, these differences could also be due to genetic variations of the 2 populations of *aegypti* the existence of which has been discussed by Trpis et al. 1973. However, assuming that a percentage of females were landing on human hosts in search of a blood meal, it would be logical to assume that the "contact hours" were mainly during the day, which clearly establishes *aegypti* as a diurnal feeder in Fiji.

A breakdown of the captures according to the station as shown in Table 2 is also of some interest. It is evident that nearly two-thirds of the total catches of both sexes, 183F and 174M, were captured indoors as against a total of 94F and 90M, for the combined outside house and bush catches. This does seem to suggest the point of greatest contact between the human host and mosquito is

within the indoor environment in conformance with the general behavior pattern of the species.

ACKNOWLEDGMENTS

We are grateful to Mr. S. C. Ramrakha, the Permanent Secretary for Health, Fiji for his permission to publish this report and to Dr. J. U. Mataika, for providing facilities at the Wellcome Virus Laboratory, Suva, Fiji which was used as a base for the field study. The investigation was supported by funds from the Fiji Ministry of Health.

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