

DIEL PERIODICITY IN THE BITING ACTIVITY OF *Aedes woodi* IN EAST AFRICA¹

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ABSTRACT. *Aedes woodi* Edwards is the only *Stegomyia* species which breeds in plant axils of sedges in permanent swamps and is independent of rainfall. It is very abundant during the dry season in some localities in East Africa. This is the first observation of diel periodicity of *A. woodi* on landing and biting activity on man.

INTRODUCTION. *Aedes (Stegomyia) woodi* Edwards, 1922, is systematically closely related to *A. aegypti*, *A. simpsoni*, *A. subargenteus* and few other *Stegomyia* species. It is distributed mostly on the east coast of Africa: Malawi (Edwards, 1922), Kenya (van Someren, and Harper, 1955; van Someren, *et al.* 1956) and Tanzania (van Someren, 1968). Kaloleni village on the Yatta Plateau in Kenya and Cholo village in Malawi are the places where *A. woodi* occurs in highlands. Harper (1955) reported that larvae of *A. woodi* bred in the axils of *Cyperus grandis*, growing in a waterhole and at the edge of a swamp in the coastal zone of Kenya. Breeding of *A. woodi* in the Mtoni swamp near Mbagala village on the coast of Tanzania was first observed by G. A. H. McClland and M. Trpis in July 1970. The Mtoni swamp is not the only place where *A. woodi* occurs in the Dar es Salaam area. We have collected larvae in

The biting activity was assessed by means of 13 or 24-hour catches. *A. woodi* was shown to be strictly a diurnal biter. If *A. woodi* is proven a vector of yellow fever or other arboviruses, it could become an important vector during the dry season in East Africa.

Cyperus grandis in Pugu forest (20 km SW of Dar es Salaam) and adults (1 ♀) in biting collections on man in Buguruni, one of the Dar es Salaam suburbs. The eggs were located in the V-shape axils of *Cyperus grandis* approximately 25 cm above the water level, where the stem changes from dark-red to green. Larvae occur in a film of water, above the normal swamp water level. The water apparently rises between the leaves by capillary action.

A. woodi is the only *Stegomyia* species known which breeds in plant axils independent of rainfall. The larvae hatch from eggs as soon as the embryonic development is completed. The eggs are not capable of resisting desiccation. This is a rather unique phenomenon in the *Stegomyia* group. *A. woodi* is confined to breeding in permanent swamps in order to survive the dry season of the year. This results in a patchy distribution pattern.

A. woodi females have been collected biting man, in Mbagala village 10 km SW of Dar es Salaam. In April 1970 a 13-hour landing-biting collections revealed that *A. woodi* was attracted to and would feed on man.

METHODS. Mtoni swamp, the breeding site of *A. woodi* is a permanent swamp supplied with water from Mtoni creek, the source of drinking water for part of Dar es Salaam. The swamp is 1.5 km in distance from Mbagala village. The village consists of about 70 houses scattered

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in thick underbrush among mango, cashew, citrus and palm trees. The vegetation between the village and the swamp is rather sparse on the hills and dense in the valleys. Four catching stations 500 m apart were established between the swamp and the village.

Three mosquito catchers, supervised by a senior staff member, served as bait. They sat on the ground in the shade of a large mango tree. Mosquitoes landing on their bodies or biting were collected into test tubes which were plugged with cotton wool. The catch was separated according to hours. One of us (M.T.) identified and recorded the catch. The catchers worked in 7-hour shifts. In August the catches began at 0600 hours (East African Standard Time) and continued for 13 hours. The catches done in September began at 0500 hours and lasted 15 hours. One 24-hour catch was conducted on 7-8 September in order to determine the biting activity during the late night hours.

RESULTS. Three 15-hour catches at the swamp produced no adults. Similarly no adults were caught at the 500 m and 1000 m catching stations. The only place where females were caught biting was the Mbagala village area, and all our results on the diel periodicity in biting activity are based on the village collections.

A. woodi is strictly a diurnal biter. The pattern of the biting cycle was plotted by adding together the combined figures of the seven catches (Table 1). "Williams' Mean" (M_w)⁴ has been calculated for each catching hour and percentage of M_w for the hours of biting activity (from 0600 to 1900) has been expressed in Figure 1. Females started biting immediately after sunrise, and their number increased toward noon, reaching the first peak between 1000 and 1100 hours. There was a sharp drop between 1100 and 1300 hours and then the second peak occurred between 1300 and 1400 hours. At the time

⁴ $\log_{10} (M_w + 1) = \log_{10} (n + 1) / N$
where n represents the actual number of mosquitoes caught in a series of N catches for a given hour.

TABLE 1. The biting activity of *A. woodi* according to one-hour grouping.

Date of biting collection	Number of females collected at hour-interval																Total	Man-hour index
	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000		
20 August 1970	..	1	10	4	4	8	1	1	1	1	1	4	2	1	1	..	39	1.0
25 August 1970	..	10	4	6	4	3	1	1	6	4	1	1	1	0	1	..	42	1.1
28 August 1970	..	5	2	5	6	9	5	4	10	7	0	3	6	6	4	..	66	1.7
3 September 1970	0	0	0	0	0	3	0	0	1	0	2	1	0	0	0	0	7	0.1
7 September 1970	0	1	1	2	3	13	3	5	15	11	6	2	4	5	0	0	71	1.5
15 September 1970	0	0	2	4	5	9	3	2	6	2	4	4	2	0	0	0	43	1.0
17 September 1970	0	1	3	2	6	18	2	0	3	4	6	4	3	0	0	0	52	1.1
22 September 1970	0	2	2	2	4	18	9	5	7	6	6	3	0	0	0	0	64	1.4
Total	0	20	24	25	32	81	24	18	49	35	29	20	16	11	0	0	384	1.1

when both peaks occurred the temperature was fairly high (between 25 and 30° C). During the noon hours (1100–1300 hours), when the noon drop of biting activity occurred the temperature was as high as 35° C. After the second peak between 1300 and 1400 hours the density of the biting females decreased, reaching zero immediately after sunset.

Altogether we had recorded 6 mosquito species at the biting collections in the Mbagala village during the late dry season. The species and numbers of specimens collected are as follows: *Anopheles (M.) gambiae* (1), *Mansonia (M.) uniformis* (9), *Aedes (St.) aegypti* (41), *Aedes (St.) simpsoni* (190), *Aedes (St.) woodi* (310) and *Culex* sp. (530).

DISCUSSION. Peaks in landing-biting activity of *A. woodi* females on man occurred most often in the hours close to noon. All catches have shown definite bimodality (Fig. 1). In none of these catches did perfect symmetry occur. There

were more catches with higher morning peaks than afternoon peaks. However, in three of eight catches the afternoon peak was higher than the morning peak. Bimodality has been observed frequently in other diurnal *Aedes* mosquitoes such as *A. aegypti* (Teesdale 1955; Boorman, 1960; Trpis *et al.* 1973), *A. apicoargenteus* (Haddow and Senkubuge, 1965), and *A. simpsoni* (Lumsden, 1955; Haddow, 1961; Gillett, 1969). Distribution of the 2 peaks in *A. simpsoni* was closer to *A. woodi* than to *A. aegypti* in Mbagala. The morning peak in *A. simpsoni* occurred between 1000 and 1100 hours but the afternoon one was further toward sunset (Trpis unpublished observations). First females landing on man in the morning were observed at sunrise and the last ones at sunset. Landing or biting never occurred during the night hours. This was constant throughout all catches and indicates that *A. woodi* bites only during the daytime.

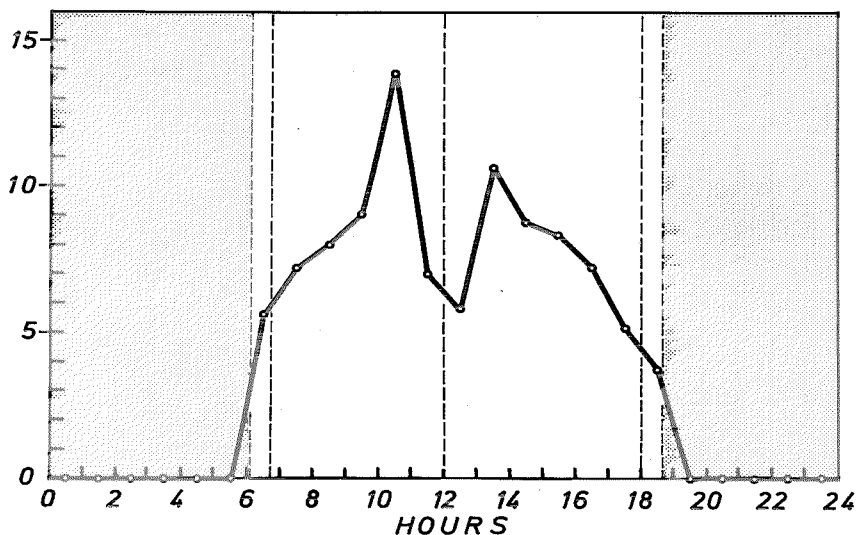


FIG. 1. The biting cycle of *A. woodi* landing on man, expressed as the "Williams' Mean" number per hour, for the series of 13 catches, adjusted to a percentage of the total for 24 hours.

There is a post-teneral pre-reproductive flight from the breeding to the feeding site, indicated by absence of biting females between the swamp and the village. Both sexes were present in the village. They mate either between the swamp and the village or in the village. The purpose of the return flight is undoubtedly for oviposition. If these were simply dispersal flights, biting would occur at the three catching stations located between the swamp and the village. Unlike *A. aegypti*, males of *A. woodi* do not land on man. We do not know whether males accompany females on their flight back to the place of oviposition.

This is the first observation on diel periodicity in biting activity of *A. woodi*. If this mosquito should be proven to be a vector of yellow fever or other arboviruses it may become an important vector during the dry season in East Africa.

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