BITING DENSITY, BEHAVIOR AND AGE DISTRIBUTION OF *CULEX QUINQUEFASCIATUS*, SAY IN MYSORE CITY, INDIA

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Abstract. The seasonal abundance, night indoor biting behavior and parity of *Culex quinquefasciatus* were investigated for a period of one year from June 1988 to May 1989 in Mysore City. Twelve-hour night-time biting catches were carried out from 1800-0600 hours at four selected urban localities. The biting cycle revealed that *Cx. quinquefasciatus* was active throughout the night, with peak activity at 2200-2300 hours. The biting proportion of nulliparous and parous mosquitos during different hours of the night showed that nulliparous mosquitos increased from 1800 to 0600 hours (dusk to dawn), while parous mosquitos (aged) decreased from early night to the morning. One major and two minor biting peaks were encountered here. The maximum density noticed was during March 1989 (147.5 per man night) and the lowest was during July 1988 (58.3 per man night). The biting behavior/density of this important urban mosquito vector under the existing climatic conditions are discussed in the light of the earlier reports elsewhere.

INTRODUCTION

Culex quinquefasciatus is the major vector of Bancroftian filariasis in India (Das, 1976; Sharma, 1976; Rozeboom *et al*, 1968). An understanding on the biting behaviour of this mosquito is very important as the nocturnally periodic biting cycle of *Cx. quinquefasciatus* coincide with the periodicity of microfilariae, efficiently intensify the infection (DeMeillon and Sebastian, 1967). Various authors have studied the biting behavior and host preference of this species at different places. Sasa *et al* (1965) reported that *Cx. quinquefasciatus* preferred to bite indoors in Bangkok, Thailand, whereas in Rangoon (Burma), it preferred biting outdoors (DeMeillon and Sebastian, 1967). Rajagopalan *et al* (1977) observed that the outdoor biting density was higher than the indoor biting density in all months except September in Delhi (India). The present study was undertaken for the first time in Mysore City on the seasonal abundance, biting behavior and age distribution of *Cx. quinquefasciatus*. Though at present the city does not face the problem of filariasis, abundance of this potential vector and the tourists from various endemic areas, may make this place prone to filariasis. As preliminary outdoor biting catches did not yield *Cx. quinquefasciatus*, only indoor collections were made for this study.

MATERIALS AND METHODS

Mysore city is situated in a saucer shaped basin near the Chamundi Hills. The city is spread over an area of 40.05 km^2, with a total population of 6,52,246 persons as per the 1991 census. The study was carried out from June 1988 to May 1989. Monthly indoor biting collections were made from four different urban localities. One man sat inside a house exposing his arms and legs as bait, and collected all the mosquitos attempting to bite the exposed parts. Same bait was engaged throughout the year for all the places. Studies on differential attraction to various age groups, sex and color were not carried out. Hourly catches were kept in separate tubes, and brought to the laboratory, identified and dissected for parity, using the established procedure (Detinova, 1962). This method is based on the presence of ovariole 'skeins' and the number of dilatations formed in a follicular tube of the ovariole following oviposition. Mosquitos which have completed one gonotrophic cycle (GC) possess one dilatation were designated as 1-parous; two GC (two dilatation) as 2-parous etc.

RESULTS

Table 1 shows that a total of 4,111 *Cx. quinquefasciatus* females collected in 48 nights from

Table 1

Percentage of night biting *Cx. quinquefasciatus* collected in different hours of the night in Mysore city (1988-89).

Sl No.	Months	6-7	7-8	8-9	9-10	10-11	11-12	12-01	01-02	02-03	03-04	04-05	05-06	Total	Biting density
1	June '88	0.8	4.1	6.6	9.0	19.8	18.6	7.4	9.5	7.0	6.2	6.2	4.5	242	5.1
2	July	0.4	4.1	5.2	9.4	19.3	20.6	11.6	6.0	5.6	7.3	6.4	3.9	233	4.9
3	Aug	1.7	15.4	5.9	12.1	14.2	13.5	11.6	4.5	5.0	3.4	6.4	5.9	422	8.8
4	Sept	0.6	4.6	11.8	1.6	15.6	10.7	10.7	7.2	9.5	6.4	7.2	4.0	346	7.2
5	Oct	3.0	4.9	9.5	14.4	17.8	11.7	9.5	8.7	6.4	6.4	4.5	3.0	264	5.5
6	Nov	7.9	10.2	8.5	9.2	11.8	15.7	10.2	6.9	7.5	5.9	3.3	3.0	305	6.4
7	Dec	10.0	11.9	13	7.7	15.8	12.6	7.4	6.6	4.9	3.1	3.5	2.5	285	6.0
8	Jan '89	9.0	11.1	11.5	14.3	11.5	8.6	6.6	8.6	5.7	4.5	5.3	3.3	244	5.1
9	Feb	2.7	8.7	8.7	8.4	11.8	11.2	9.1	12.3	8.9	6.6	6.8	4.6	439	9.2
10	Mar	3.7	11.5	14.7	12.9	10.2	8.6	9.3	6.9	6.4	5.8	5.9	3.9	590	12.3
11	Apr	2.7	8.1	10.4	9.2	11.3	11.7	10.9	10.0	8.1	8.6	5.6	3.3	479	10.0
12	May	1.1	8.0	9.2	12.2	13.0	14.1	10.7	9.2	7.6	6.5	5.0	3.4	262	5.5
	Total %	3.6	9.0	10.0	10.9	13.7	12.6	9.7	8.1	7.0	6.0	5.6	3.9	4,111	7.1

r* = 0.4588 (temperature), r = - 0.4229 (relative humidity)*, r* = - 0.2415 (rainfall) (*p > 0.05)

four different localities pooled as there was no significant differences in density among the localities. The highest number of females recorded was during March (590 per four man night) and the lowest during July, being 233 per four man night. The biting density (number of biting female per man hour) ranged from 5.1 (June and January) to 12.3 (March). This increased from 1800 hours and reached a peak between 2200 and 2300 hours. After 2300 hours the density decreased gradually to 3.9% (from 0500 to 0600 hours). Statistical correlation was made between biting density and climatological factors such as temperature, relative humidity and rainfall. The analysis showed insignificant ($p > 0.05$) difference between the biting density and climatological factors.

The biting rhythm expressed as a percentage of William's mean is plotted in Fig 1. The average data for the four zones studied indicate that the biting activity steadily increased during the early three hours (1800-2100 hours) of the night, with a maximum at 2200-2300 hours (Table 1). A maximum of 13.7% of *Cx. quinquefasciatus* attempted to bite between 2200-2300 hours, which indicates the biting activity peak. About 69.5% of the total mosquito bites were between 1800-0100 hours, and the proportion of biting by this mosquito after midnight was less.

Age composition of biting *Cx. quinquefasciatus* and meteorological data are reported in Table 2. It was observed that nearly 55% of the mosquitos collected came for their first blood meal, 31.8% for the second, 12.1% for the third, 0.9% for the fourth and 0.2% for their fifth meal (total % parous - 45%). Since the temperature and relative humidity in Mysore city were moderate, without any extremes, 1-para (5 days) and 2-para (8 days) mosquitos could be collected throughout the year, whereas 3-para (11 days) and 4-para (14 days) mosquitos were frequent from November to Feb-

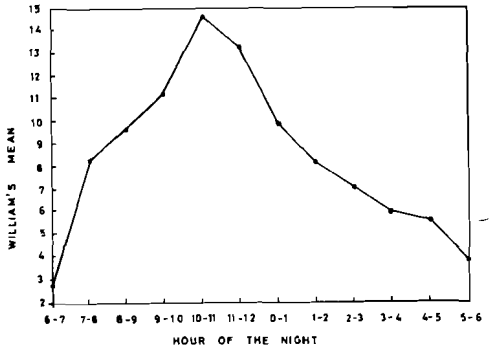

Fig 1—Biting rhythm of *C. quinquefasciatus* in Mysore City.

Table 2

Seasonal variation of nulliparous and parous *Cx. quinquefasciatus* in Mysore city.

Season	No. dissected	Nulliparous (%)	Parous (%)	Temperature°C			Relative humidity (%)			Rain fall
				Max	Min	Mean	0830 h	1730 h	Mean	(mm)
Pre-monsoon (March-May)	1,331	63.1	36.9	33.6	19.1	26.4	79.7	41.3	60.5	78.7
Monsoon (June-October)	1,507	53.6	46.4	28.7	19.4	24.1	85.4	64	74.7	87.4
Post-monsoon (November-February)	1,273	46.3	53.6	29.6	15.8	22.7	74.8	37	55.9	3.5
	4,111	54.9	45.1	30.2	18.2	24.2	80	45	58.9	56.5

* r - values

Temp:	0.9979	-0.9982
RH:	0.1607	-0.1569
Rainfall:	0.7692	-0.7667

(*p > 0.05)

ruary. The number of nulliparous and parous mosquitos obtained in each hour are shown in Fig 3. There were 1,854 (45.1%) parous and 2,257 (54.9%) nulliparous mosquitos. The highest parous rates were observed during June 1989 (67.36%) and January 1989 (61.89%) (Fig 2), when the mean temperature was 23.7°C (June) and 21.9°C (January), and the mean relative humidity 71.0% (June) and 54.5% (January). The number of biting nulliparous mosquitos was high during the early hours of the night with a gradual decrease, whereas

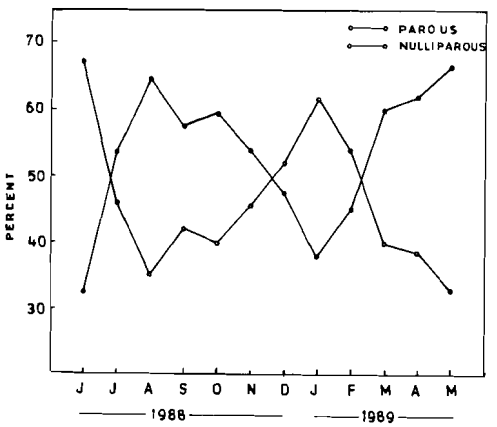

Fig 2—Nulliparous and parous *C. quinquefasciatus* in different months.

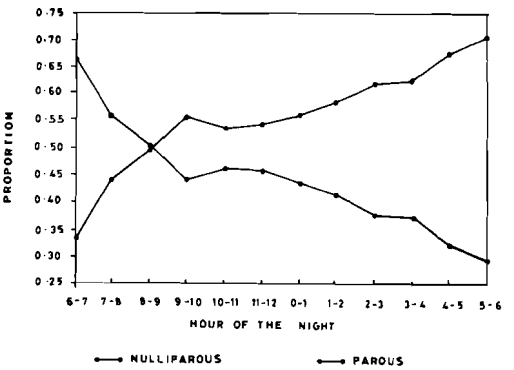

Fig 3—Proportion of nulliparous and parous *C. quinquefasciatus* in the night biting population.

parous mosquitos increased steadily from dusk to dawn (Fig 3).

DISCUSSION

The night biting cycle of mosquitos varies from region to region and from species to species with the influence of microclimate, temperature, human habit, etc. For example, the biting cycle of *Cx. quinquefasciatus* in Bangkok was correlated with

the naturally periodicity of *Wuchereria bancrofti* (Hawking and Thurston, 1951). Sucharit *et al* (1981) also studied the biting cycle of *Cx. quinquefasciatus* in Bangkok and reported that the indoor night biting density was high compared to the outdoor. They have further observed that the peak biting was between 2200 and 2300 hours with two other peaks after midnight, one being at 0100 hours and the other at 0400 hours. In the present study, a similar major peak biting activity was recorded between 2200-2300 hours, but in addition, two other minor peaks were encountered between 2100 and 2200 hours, and between 2300 and 2400 hours. This shows a clear difference in the biting cycle of Mysore population. The present observation also differs from the reports of Brunhes (1975) and Subra (1972) from East Africa and West Africa respectively where the peak bitings were after the midnight, between 0100 and 0200 hours. Samarawickrema (1967) found, in a Sri Lankan strain of *Cx. quinquefasciatus*, that the biting activity increased till midnight (0100 hours); afterwards, it decreased gradually reaching the lowest level between 0500 and 0600 hours. This, alongwith the findings of Hamon (1956) in Reunion, are in line with the present data. This discrepency in the results of various authors might be due to the differences in temperature fall during the night.

Perusal of the literature shows that, the parous rate and longer survival rate of *Cx. quinquefasciatus* are responsible for the transmission of filarial diseases (Hitchcock, 1970). In our study, under the cover of moderate climatic conditions, the species survived upto 4 para during January, with a high parous rate (61.9%). The parous flies bite more in the early hours of the night and then gradually decreased, whereas biting by nulliparous individuals increased gradually from the early hours of the night, reaching a maximum after midnight. This is in contrast to the observation made by Sucharit *et al* (1981) in Bangkok, where the parous mosquitos bit significantly more in the latter half of the night.

The biting density, which is the average number of mosquitos biting a man per hour, was compiled from an all-night collection as an index for comparison. Rajagopalan *et al* (1981) recorded the biting density of *Cx. quinquefasciatus* which ranged from 2.7 in June to 9.9 in October and December for the Pondicherry strain. The high biting density (12.3) as noticed in the present study and variation in the biting rhythm/cycle of nulliparous and parous mosquitos in Mysore are different in contrast to the report from a filariasis endemic place, Pondicherry (India). It may be due to the non-availability of parasitic (*W. bancrofti*) load in the population, Mysore city does not face the filariasis problem. But as the city is a major tourist spot, and with the increasing urbanization, the problem of filariasis being imported in future cannot be ruled out.

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