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DIEL PERIODICITY OF BLOOD FEEDING IN THE MOSQUITO *CULISETA INORNATA* IN THE COACHELLA VALLEY OF SOUTHERN CALIFORNIA

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ABSTRACT. The diel periodicity of blood feeding by *Culiseta inornata* was observed during two 3-night periods, once in December 1975 and again in March 1976. Counts of blood feeding females were taken from a tethered Holstein calf employed as bait. Blood feeding activity in the December study consisted of 2

broad peaks: the first at dusk, followed by a second peak half way through scotophase. In the March 1976 study a single sharp peak of blood feeding activity was observed at dusk. No blood feeding occurred after sunrise during either the December or March study.

INTRODUCTION

Culiseta inornata (Williston) is widely distributed throughout North America, ranging from the tablelands of Mexico in the south (Owen 1942) to the Yukon and Northwest Territory of Canada in the north (Carpenter and LaCasse 1955). In the Colorado Desert of California, which includes the Coachella, Imperial and Palo Verde Valleys, this species is abundant during the fall, winter and early spring (Apperson et al. 1974).

Feeding preference studies of *Cs. inornata* have shown bovines and equines to serve as the principal blood hosts, though dog, pig, man and rodent may occasionally be fed upon (Anderson et al. 1967, Tempelis et al. 1967, Gunstream et al. 1971, Edman et al. 1972, Tempelis 1975).

During the course of a 2-year study of the ecology of *Cs. inornata*, in the Coachella Valley, certain other questions arose regarding this mosquito's biting behavior. As a result, a study was undertaken to determine (1), the time(s) of the diel in which blood feeding activity occurred, and (2), whether or not any type of periodicity was associated with such activity.

MATERIALS AND METHODS.

These studies were conducted in the Coachella Valley of southern California on 2 separate occasions: December 1975 and March 1976.

The same bait, a yearling Holstein calf, was employed during both studies. To observe mosquito feeding activity upon this animal a procedure was employed whereby the investigators' presence was required for only short periods of time. The procedure consisted of the following: 1) The calf was tethered to a stake in an open area and supplied with copious

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amounts of baled alfalfa and water. 2) Every 15 min. once observations began, the animal was approached and counts were made of the numbers of blood feeding adult *Cs. inornata*. A 25 watt red lamp was used for illumination during dark periods. *Cs. inornata* were easily sight identified at such times since this species lacks the white scale patterns of other sympatric, bovine-feeding mosquitoes. 3) Counts were made 4 times per hr and each count required 60 to 90 sec for completion. Counts were routinely made from the entire body, however the majority of blood feeding took place upon the head (eyes, ears and muzzle). 4) When a count was completed the investigator departed, returning only after another 15 min interval had passed. 5) This procedure was repeated, beginning at the times specified below, and continued through the scotophase. Observations were terminated in the morning between 0600 hr and 0700 hr but only after 3 intervals (i.e., 45 min) had passed in which no blood feeding activity had occurred. 6) During the daylight hours not included in the above, observations were made once per hr.

For the December 1975 study, observations were made between 1400 hr and 0745 hr of the following day (sunset: 1637 hr; sunrise: 0640 hr). During the March 1976 study, counts began at 1600 hr and ended at 0700 hr of the next day (sunset: 1750 hr; sunrise: 0600 hr). Times of sunset and sunrise were taken from the Nautical Almanac, U. S. Naval Observatory, for latitude 33°44'N, longitude 116°16'W.

All four 15-min counts made during each 1 hr period of observation were summed for their respective hour. To determine mean numbers of females blood feeding for a given 1 hr period, based on 3 days of observations, the sums for that hour plus 1, for each date, were converted to logarithms, summed again and divided by 3 (=Williams mean or M_w , Trpis et al. 1974). The antilog $M_w - 1$ then represents the mean blood feeding activity for that particular 1 hr observation period. Relative blood feeding rate was determined by calculating the percent of total blood feed-

ing occurring during any 1 hr period. This process was repeated for data from both December and March studies.

Certain meteorological data were recorded during both studies including air temperature, relative humidity, wind speed and wind run. Both studies were scheduled so that prevailing lunar conditions were equivalent.

RESULTS AND DISCUSSION

Table 1 shows the numbers of females feeding during each 1 hr interval for the 3 nights of the December 1975 study. No males of *Cs. inornata* were observed at bait either at night or during the daylight hours.

During the period in which observations were made, air temperatures (Table 2) ranged between a maximum of 23°C and a minimum of 5°C. Relative humidity was usually lowest at dusk, but increased steadily through the scotophase, peaking prior to sunrise. Winds remained below 5 k.p.h. with one exception: on December 13, 1975 winds averaging 10–15 k.p.h., with gusts of 35 k.p.h. inhibited feeding activity completely until their subsidence at 1700 hr. As a result, the values for 1400–1700 hr inclusive (Table 1) on this date were omitted from calculations of mean activity.

Figure 1 shows the biting activity of *Cs. inornata* observed in the December 1975 study. During this period, blood feeding commenced in advance of sundown reaching an initial peak during the dusk period. Following this time activity partially subsided, but increased again beginning at 2000 hr. A second peak of biting activity was attained near 2400 hr. During the a.m. hours, the numbers of females coming to feed declined drastically, diminishing to zero by sunrise.

Table 1 shows the number of females feeding during each 1 hr period for the 3 nights of the March 1976 study. As in the previous study no males were observed at bait at any time either day or night.

Air temperatures occurring during the March study (Table 2) ranged between a maximum of 26°C and a minimum of 4°C.

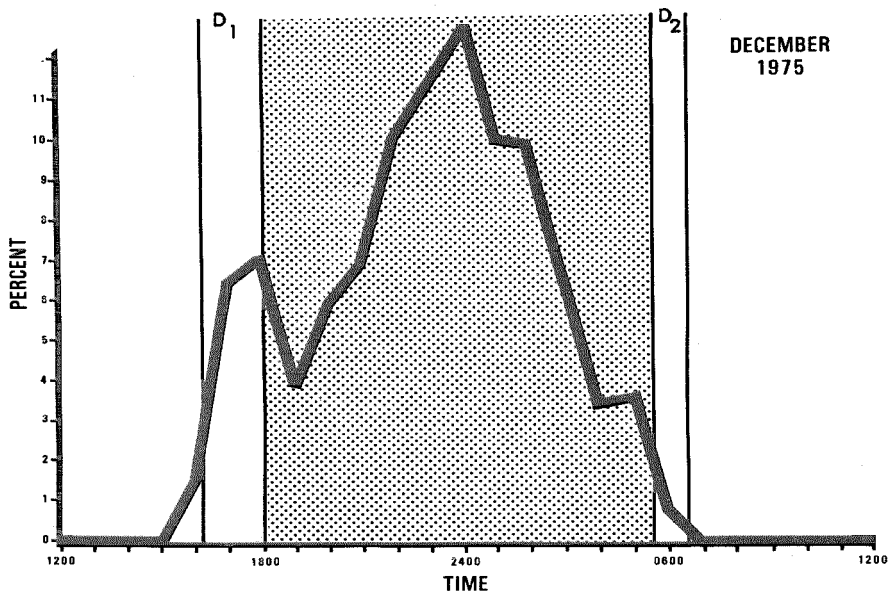


Fig. 1. The biting activity of *Culiseta inornata*, December 1975. Calculated as Williams mean and expressed as a percent of the total. D_1 =dusk, D_2 =dawn.

Relative humidity was lowest prior to sunset and increased through the night. However, RH levels remained lower during the night in the March study than those observed for the December study. Wind speeds remained below 7 k.p.h. at all times.

Figure 2 shows feeding activity of *Cs. inornata* observed during March 1976. Biting patterns obtained at this time differed from those of the December study in 2 respects: (1) No feeding activity was observed prior to sunset. (2) Feeding activity peaked during dusk only and lacked sustained activity throughout the night.

In both studies, *Cs. inornata* actively sought blood during the dusk and dark hours of the night. No feeding activity was observed during the daylight hours (except as noted for December) and males were never observed at or near bait. Gross numbers of female *Cs. inornata* taking blood during the December study were far

greater than those of the March study. In addition, feeding activity in December occurred at high levels throughout the scotophase whereas during March few females were observed at bait in this period.

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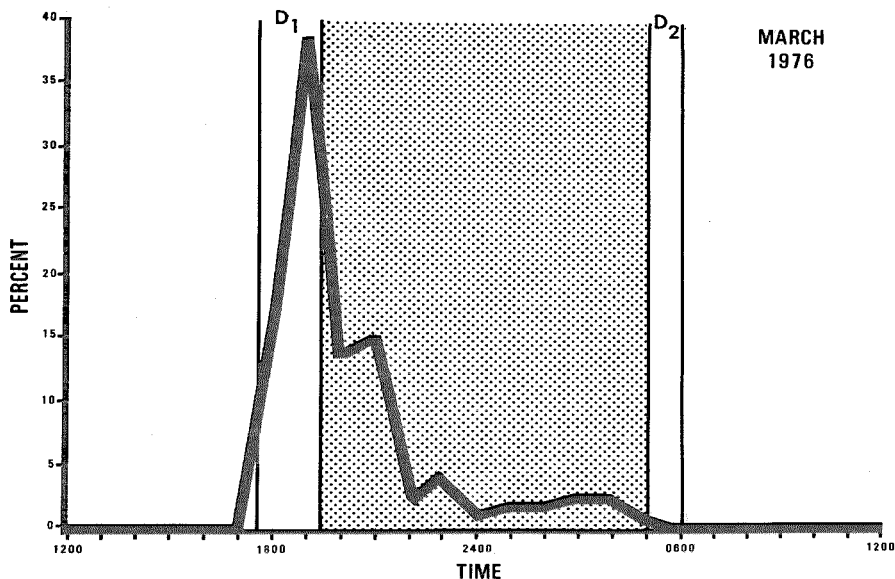


Fig. 2. The biting activity of *Culiseta inornata*, March 1976. Calculated as Williams mean and expressed as a percent of the total. D₁=dusk, D₂=dawn.

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