

SEASONAL AND DIURNAL ACTIVITIES OF FOUR SPECIES OF TRINIDADIAN *CULICOIDES* (DIPTERA: CERATOPOGONIDAE)ELISHA S. TIKASINGH¹

ABSTRACT. Four species of *Culicoides* were collected from human bait at Vega de Oropouche, Trinidad, from April 1966 to May 1967. They show broad seasonal trends of adult activity. *Culicoides diabolicus* and *C. pusillus* occur mainly in the rainy season (June to December), and *C. furens* mainly in the dry season. Large numbers of adults of *C. foxi* are active in most months, except at the beginning of the rainy season.

INTRODUCTION. In 1966 and 1967 special efforts were made to catch *Culicoides* as part of an ecological study of arboviruses in Trinidad. Four species, *Culicoides diabolicus* Hoffman, *C. foxi* Ortiz, *C. furens* (Poey) and *C. pusillus* Lutz, were collected in large numbers, showing distinct seasonal and diurnal activities. This paper records these activities and is intended as a contribution to the knowledge of *Culicoides* in the tropics.

LOCALITY. Collections were made at three stations at Vega de Oropouche, which is situated in northeastern Trinidad where the rainfall averages over 100 inches per year (Fig. 1). One of these collection areas was situated at the edge of a cocoa estate, where a donkey was stabled. The second point was in a citrus estate, while the third area was situated in a clearing between a Mora (*Mora excelsa*) forest and a citrus estate. From the first to the third point, the distance is no more than 2 miles. These three stations are situated along the Vega de Oropouche Road, which runs at certain points close (about ¼ mile) to the Oropouche River. The areas are about 3 to 4 miles west of the sea.

Collections from the three stations were pooled to reduce variations between collections, which may be associated with the sites.

The appearance of *C. diabolicus* mainly in the rainy season was confirmed by the use of a CDC light trap in Turure Forest.

Studies indicated feeding activity peaks appear shortly before sunrise and shortly after sunset for three species, *C. diabolicus*, *C. foxi* and *C. furens*. For *C. pusillus*, the morning peak occurs after sunrise, while the evening peak occurs just before sunset.

Light trap collections were also made at Turure Forest, a secondary tropical rainforest, in northeastern Trinidad (Fig. 1). Turure Forest is about 6 miles west of Vega de Oropouche. The rainfall here also averages more than 100 inches yearly.

MATERIALS AND METHODS. The *Culicoides* were caught either by hand at human bait or with CDC light traps (Sudia and Chamberlain, 1962).

For the human bait collections the collector remained stationary, with a hand net (diameter 9¼ inches), and moved the net around his head and body as the sand flies were flying or attempting to bite. Periodically, they would be aspirated from the nets and transferred to plastic containers (3¼ inches x ¾ inch) fitted with metal caps. Collections were made by the hour with the observer working continuously at one of the designated sites during each study period. Each hourly collection was normally kept in a separate container, but when large collections were obtained, two or three containers were used.

The catches from human bait on which the seasonal activities are based, were made between 05.00 and 08.00 hours, from 13 April 1966 to 31 May 1967, at the three sites which were situated at Vega de Oropouche. At first, collections during each study period were made randomly at these points, but later (starting 1 September 1966), catches were made consecutively at the three sites.

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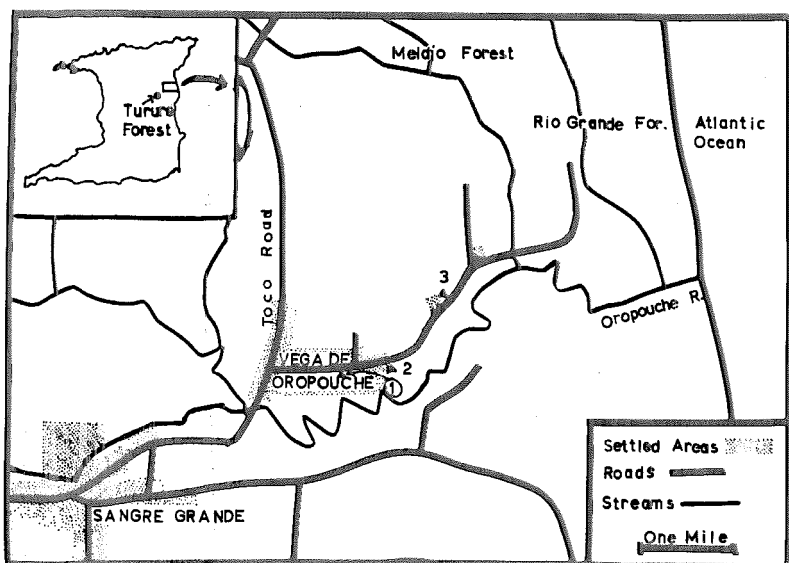


FIG. 1.—Map of Vega de Oropouche, Trinidad, showing location of study areas. Turure Forest is shown in the inset map of Trinidad and its relationship to Vega de Oropouche (rectangle).

The study on diurnal activities was conducted between 05.00 and 12.00 hours one day per week at each of the sites and alternated the following week, from 12.00 to 20.00 hours at the same stations. These times include the periods which the worker

took to remove the sand flies from the nets for transference to the vials, in addition to a half-hour rest period which was usually taken when activity was greatly reduced.

In addition to the above collections, a

TABLE I.—Total numbers of *Culicoides diabolicus*, *C. foxi*, *C. furens* and *C. pusillus* caught at Vega de Oropouche, Trinidad, April 1966–May 1967 together with the total number of man hours expended.

Month	Man Hours	<i>diabolicus</i>	<i>foxi</i>	<i>furens</i>	<i>pusillus</i>	Total
April 1966	31	12	425	2245	773	3455
May	42	64	289	6298	1950	8601
June	54	385	184	4350	13664	18538
July	66	907	1503	1066	21283	24759
August	66	3336	4761	521	35245	43863
September	42	3431	2882	425	8255	14993
October	18	92	449	2	1389	1932
November	33	3902	1818	0	3968	9688
December	24	2943	2259	2	4189	9393
January 1967	NC*	NC*	NC*	NC*	NC*	NC*
February	27	1295	677	7597	1617	11186
March	39	1193	4317	2875	3133	11518
April	12	98	177	2605	640	3520
May	12	99	95	6529	830	7553
Total	466	17757	19836	34515	96936	169044

NC* = No collections.

CDC light trap was operated 2 nights per week in the canopy (50 ft), at Turure Forest from April 1969 to April 1970, but only one species, *Culicoides diabolicus* was caught in sufficient numbers to permit analysis.

At the main laboratory in Port-of-Spain, the sand flies were anaesthetized with tobacco smoke and identifications were made according to wing and thoracic patterns.

RESULTS AND DISCUSSION. A total of 169,044 *Culicoides* was collected in 466 man hours. The largest collections were of

C. pusillus 57.3 percent), followed by *C. furens* (20.4 percent), *C. foxi* (11.7 percent) and *C. diabolicus* (10.5 percent) (Table 1). These collections were made over a period of 14 months, but none was made in January 1967. The smallest catch of all species (1932) came in October 1966, and although this could possibly be correlated with the short dry spell which normally occurs around this time of the year, a clear-cut explanation cannot be advanced at this time.

Collections from the light trap were mainly of *Culicoides diabolicus* and

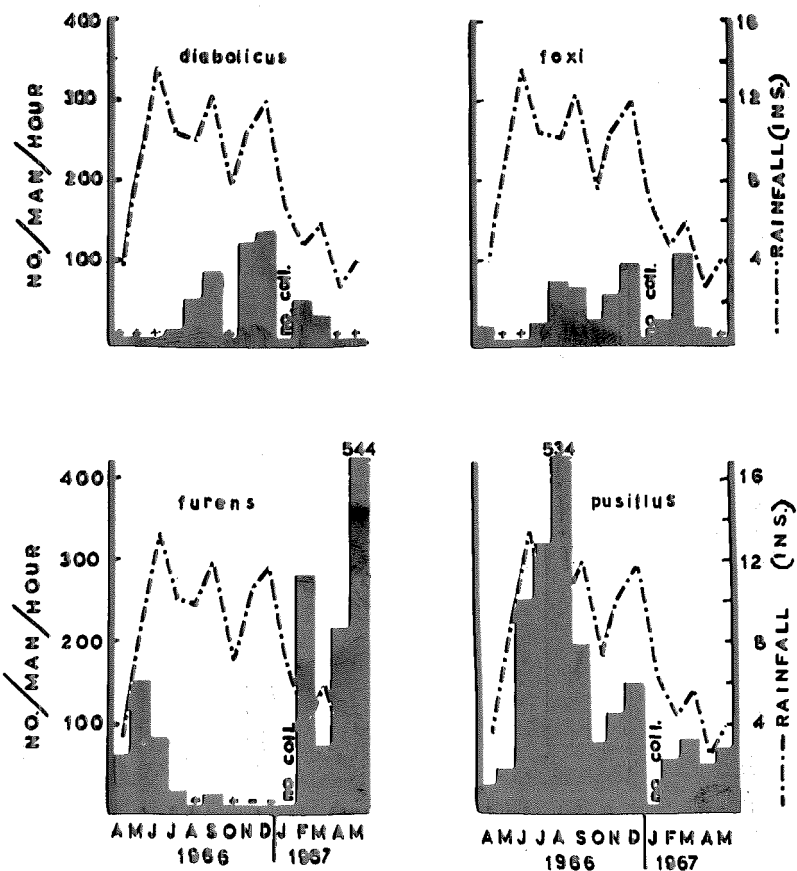


FIG. 2.—Seasonal densities of *Culicoides diabolicus*, *C. foxi*, *C. furens* and *C. pusillus*, based on human bait collections. Rainfall is designated by the broken line.

totalled 15,788 in 117 trap nights. These collections were made in the canopy of the forest where it was found to appear in larger numbers than on the ground. (Tikasingsh and Davies, 1970).

SEASONAL ACTIVITY. *Culicoides diabolicus*. This species appears shortly after the coming of the rains and is most abundant during the height of the rains, with the exception of October (Fig. 2). As pointed out, we have no clear-cut explanation for the drop in numbers in October. There is a gradual buildup from 0.39 female per

man hour in April, to 122 per man hour in December. On the other hand, light trap collections were greater early in the rainy season, reaching a peak in July (Fig. 3), when 473.9 specimens per trap night were recorded. The numbers dropped considerably from October 1969 to April 1970. Nevertheless, both types of collections indicate that there is little activity in the dry season, which is normally from January to May.

C. foxi. Large numbers of this species were collected during most months of

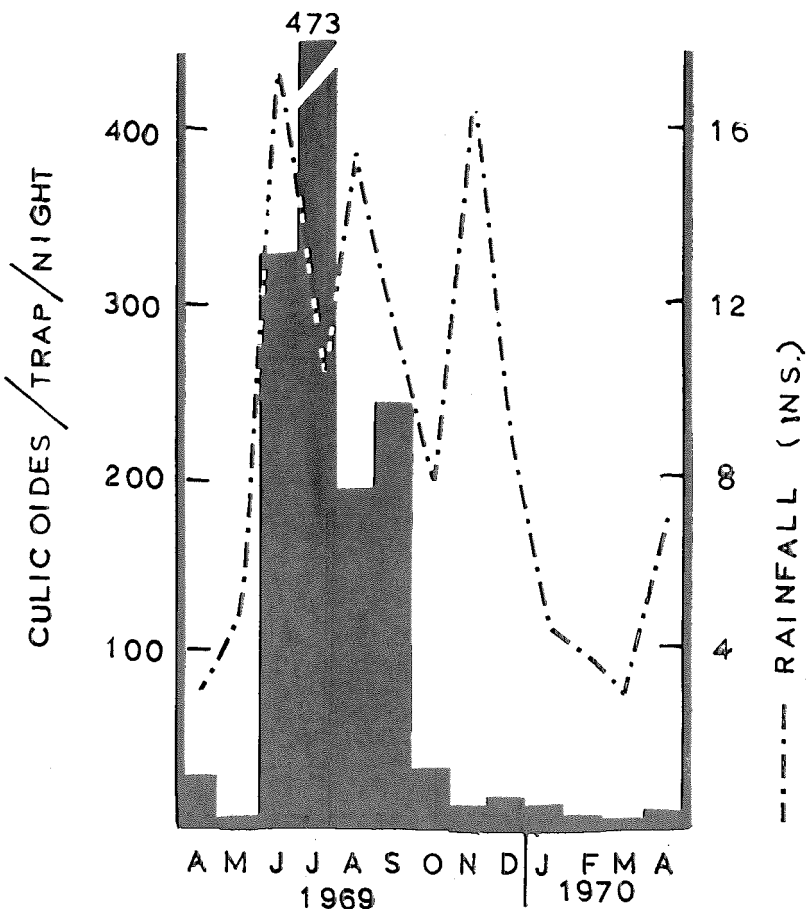


FIG. 3.—Seasonal density of *Culicoides diabolicus* based on CDC light trap collections, shown in relation to rainfall.

the year; lowest densities appeared in the months just prior to the rainy season (Fig. 2), April, May and June (13.7, 6.9 and 3.4 per man hour respectively) in 1966 and 7.9 in May 1967. The peak month was March with 110 per man hour.

C. furens. This appears to be decidedly a dry season species, with a small peak in May 1966 (149.9 per man hour), but the greatest density occurred in May 1967 when 544 flies per man hour were recorded (Fig. 2). In Southern Louisiana, Khalaf (1966), recorded the highest incidence of this species in June and states that

it was recorded only in the summer months. Linley *et al.* (1970), using emergence traps also shows it to occur in the summer in Florida, with peaks in May and June. *C. furens* is known to be a saltmarsh and mangrove swamp breeder and the saltmarsh about 3 to 4 miles east of the collecting areas might have been the source of these *Culicoides*. Further, the high rainfall in the area drained by the Vega de Oropouche river, may flood the swamp in the rainy season, thereby accounting for the great reduction in its numbers during this time of the year.

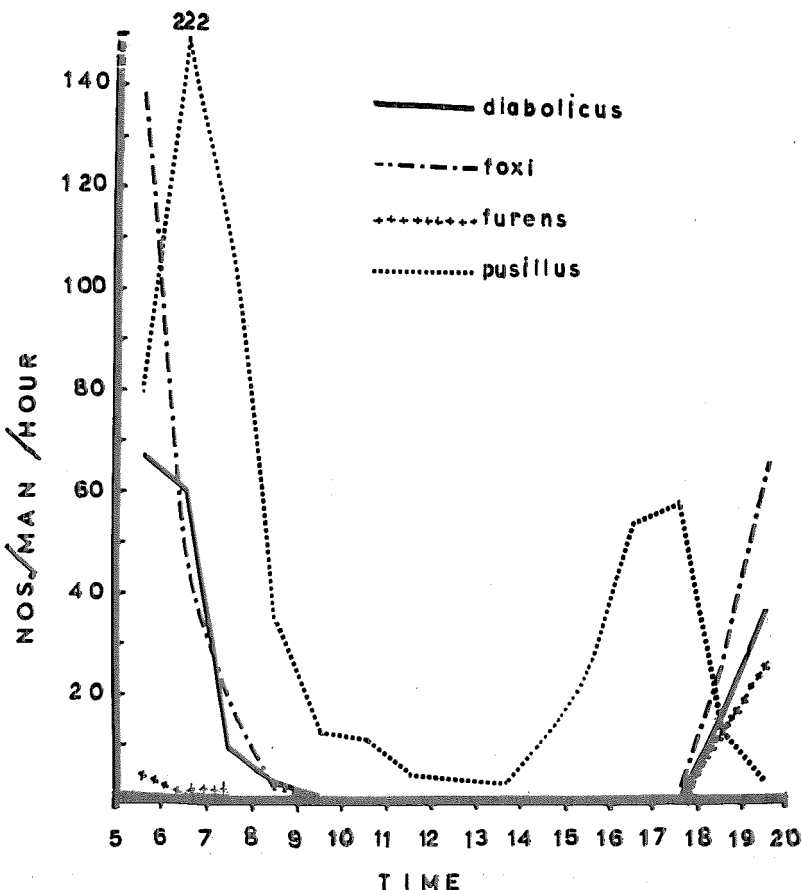


FIG. 4.—Diurnal activity of *Culicoides diabolicus*, *C. foxi*, *C. furens* and *C. pusillus*, based on human bait collections.

Rogers (1962) was indeed able to control breeding of this species in 94 percent of the total larval habitat by flooding an experimental plot.

C. pusillus. This species accounted for 57.34 percent of the total catch. Two peaks were seen; major one (534 per hour) in August and a secondary one in December (174.5 per man hour), but the greatest densities occurred in June, July, August and September, indicating that it is primarily a rainy season species (Fig. 2). Williams (1964) reported the species as breeding in a variety of rotting vegetation in Trinidad. He has also taken it from rain-soaked horse and cow manure. It is therefore, not surprising to find that this species reaches highest densities in the rainy season.

DIURNAL ACTIVITY. Daily flight activity is presented in Fig. 4 for the four species. Sunrise, during this aspect of the study, varied between 0554 and 0555 hours, while sunset varied between 1743 and 1805 hours.² Flight activity of all four species appeared to be heaviest at dawn and dusk, with the former having the greater peaks.

During the day, activity of *fuscus* declined rapidly almost to zero at 0700 hours and did not appear again until 1800 hours, while no individuals of *C. diabolicus* and *C. foxi* were collected between 1000 and 1700 hours. By comparison, *C. pusillus* was collected throughout the day, reaching a low level between noon and 1300 hours, with a rate of 2.00 per man hour. The morning biting activity peak appears 1 hour after sunrise, while the evening peak occurs between 1600 and 1800 hours, just before sunset.

Unfortunately, the study period on daily flight activity coincided with the period when *C. fuscus* was not taken in large numbers. Nevertheless, the findings appear to support those of Kettle (1969) that there is a burst of activity at sunset. According to Kettle (1969) there is also

a burst of activity shortly after sunrise, but I was not able to confirm this.

No attempts were made to study the flight activities of these *Culicoides* during the night, but it would be of interest to make 24-hour catches and correlate these with meteorological conditions, such as those elaborated by Kettle (1969).

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² Interpolated from "The Astronomical Ephemeris for 1966". H.M.S.O., London.