DIURNAL ACTIVITY OF TABANIDAE BASED ON COLLECTIONS IN MALAISE TRAPS [1 2 3]

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ABSTRACT. When Tabanidae collected in Malaise traps baited with CO_2 released at a rate of 1000 ml/min were removed from the traps every hour, the pattern of activity, indicated by the numbers collected, was observed to vary by species. However, all species collected in sufficient numbers for analysis showed major peaks of activity between 6 and 9 p.m. and varying periods of activity during the morning. A comparison of collections made when skies were overcast with collections made when skies were cloudless showed that flight activity is influenced by light intensity.

The present paper reports the continuation of studies (Roberts, 1970a, 1970b, 1971a, 1971b, 1972) made to explore the potential of the Malaise trap as a tool in the study of Tabanidae. In this case, the Malaise trap was used to investigate the diurnal activity of Tabanidae to determine the feasibility of using the trap in plotting diurnal patterns. However, a fortuitous change in the weather just before the last collection period provided additional support for the use of this trap in biological studies of Tabanidae and, also, data concerning the effect of light intensity on the flight activity of Tabanidae.

MATERIALS AND METHODS. Four Malaise traps (Townes, 1962) constructed of natural saran screen and baited with CO_2 released at the optimum attractive rate of 1000 ml/min (Roberts, 1971b) were placed on the shoulder of roads that circumscribed a 1.25 × 0.5 mile (2.01 × 0.80 km) rectangular area located in the Delta Branch Experimental Forest. One trap was placed on each side of the area.

The diurnal activity of adult tabanids was studied by making hourly collections from the traps. From 5 a.m. (CDT) until 10 p.m., the collection in each trap was picked up once an hour. The period from 10 p.m. to 5 a.m. was considered as a single collection period since two preliminary studies failed to show any flight activity during this time. Four such 24-hour studies were made, July 13, 16, 19 and 23, 1971. Each trap was operated from 10 p.m. on the day before these dates and stopped 24 hours later. Temperature and relative humidity records were obtained at each of the trap sites with a hygrothermograph.

RESULTS AND DISCUSSION. The first three collections were made under ideal weather conditions, defined, in this case, as an absence of clouds and a southerly wind movement of less than 10 mph. On these days, temperatures ranged from 72° to 99° F on July 13, from 78° to 101° F on July 16, and from 75° to 94° F on July 19. The minimum occurred on each day around 6 a.m. and the maximum around 3 p.m. Conditions for the fourth collection were quite different. Late on July 22, a northwesterly cool front that moved through the area produced a complete cloud cover and widely scattered but brief showers. The cloud cover lasted throughout the following 24-hour collection period; occasional winds reached 10-15 mph from the northwest; very little rain fell in the study area; and temperature ranged from 71° to 90° F.

Footnotes

[1] In cooperation with the Delta Branch of the Mississippi Agricultural and Forestry Experiment Station, Stoneville, Mississippi 38776.

[2] Mention of a proprietary product in this paper does not constitute an endorsement of this product by the USDA.

[3] Complete collection data available from author on request.

Local sunrise ranged from 6:02 a.m. on July 13 to 6:08 a.m. on July 23. Sunset ranged from 8:09 p.m. to 8:14 p.m.

A total of 19 species was collected. Figures 1 and 2 are graphic representations of the diurnal distribution of the seven most abundant based on the percentage of the total numbers collected during each hourly period. Figure 2 also includes a graphic representation for all tabanids. The solid line represents the total numbers collected July 13, 16, and 19; the dashed line represents the total numbers collected July 23. The total percentage of the total collected for each hour can be determined by adding the corresponding percentages above and below the 0% line.

The major peak of activity July 13, 16, and 19 for each of the seven species occurred during the late afternoon and early evening. However, it varied according to species. For example, *Tabanus sulcifrons* peaked during the hour ending at 6 p.m., *T. lineola* and *T. subsimilis* at 7 p.m., *T. abdominalis*, *T. fuscicostatus*, and *T. proximus* at 8 p.m., and *Chrysops flavidus* at 9 p.m., the hour after local sunset. All species had periods of activity in the morning that varied in length and degree.

On July 23, the morning flight activity of the seven species was either suppressed or postponed to a later time in the morning. The evening period of activity started at an earlier time in the afternoon (as with *T. proximus*). In two cases, *T. fuscicostatus* and *T. subsimilis*, the late morning period fused with the evening period to produce one single long period of activity.

On July 13, 16, and 19, a total of 8,952 female tabanids was collected. Two peaks of activity were found—a major peak from 5 to 9 p.m. and a minor peak from 6 to 10 a.m. The lowest level of activity occurred between 11 a.m. and 2 p.m.

On July 23, a total of 4,705 female tabanids was collected. Adult activity increased slowly during the day, reached a peak between 3 and 5 p.m., then decreased until 7

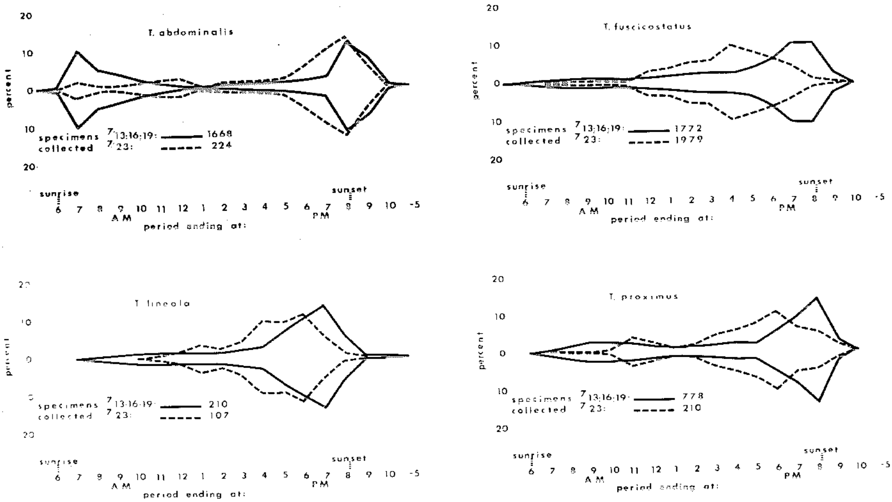

FIGURE 1. Percentages of the total numbers collected (during each period ending at indicated time) of *T. abdominalis* F., *T. fuscicostatus* Hine, *T. lineola* F., and *T. proximus* Walker.

p.m.; at that point, it increased rapidly to a major peak, caused by *C. flavidus*, between 7 and 8 p.m. After 8 p.m., activity decreased rapidly.

Four species, *T. fuscicostatus, T. lineola, T. sulcifrons,* and *C. flavidus,* were collected in greater numbers (trap per day basis) on the overcast day than on the clear days (Table 3). In view of the apparent relationship between light intensity and flight activity, these greater numbers would indicate either that cloudy or overcast conditions stimulate greater flight activity during the period of optimum light or that the level of flight activity was the same on the cloudy day as on the clear days but the optimum light level occurred over a longer period of time. The most obvious factor that would influence the number collected is the overall level of population in the forest on the days the trap samples were taken. These levels are suggested in Table 1, which includes data for a period that spans the diurnal study obtained from a season-long survey study in the forest. The survey trap, though it was operated continuously, was baited with CO_2 at only 100 ml/min. Thus, the numbers collected per trap per day by the two studies should not be directly compared. However, the survey data can be used as an indicator of levels of population. Thus, the sudden increase July 23 in numbers collected per trap per day of *T. fuscicostatus, T. lineola,* and *T. sulcifrons* appears to be more closely related to the effect of the environmental conditions than to population increases. Populations of *C. flavidus* were evidently on the increase during and after July 23, so this factor certainly had an influence on the numbers collected July 23.

Unfortunately, direct measurements of light intensity in foot candles on each collection day were not made; however, measurements of total radiation per day (expressed as Langleys) were available from the National Weather Service Office at Stoneville.

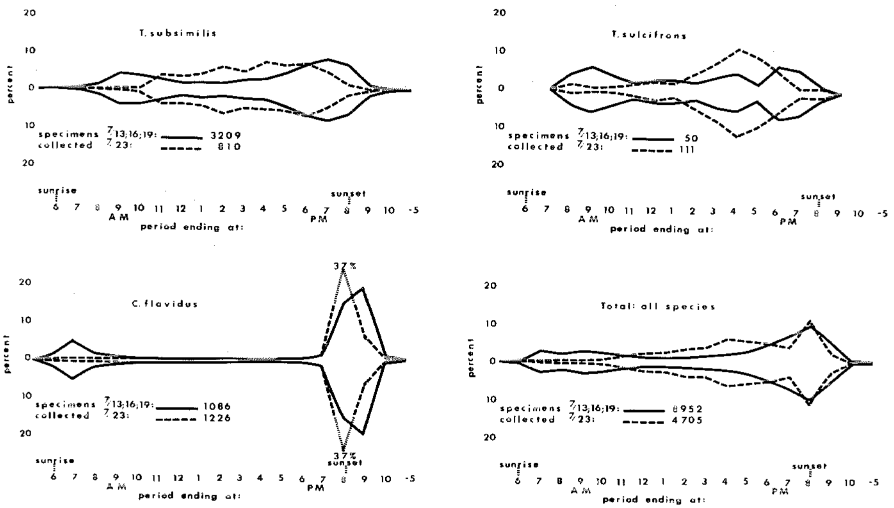

FIGURE 2. Percentages of the total numbers collected (during each period ending at indicated time) of *T. subsimilis* Bellardi, *T. sulcifrons* Macquart, *C. flavidus* Wiedemann, and all tabanids.

TABLE 1. Population trends shown by collections from a survey trap before, during, and after collections for the diurnal study.

Species	Average number collected per trap day in a survey trap baited with CO_2 at 100 ml/min during each weekly interval ending on: July				August	Average number collected per trap day in diurnal study (CO_2 at 1000 ml/min.) July	
	6	13	20	27	3	13, 16, 19	23
Tabanus							
abdominalis	255	197	64	35	24	139	56
fuscicostatus	132	87	106	76	18	148	495
lineola	29	12	9	9	8	18	27
proximus	52	103	74	51	13	65	52
subsimilis	79	96	111	87	29	267	202
sulcifrons	4	2	1	3	7	4	28
Chrysops							
flavidus	58	32	99	149	28	90	306

On July 13, 16, 19, and 23, these values were respectively, 562, 570, 630, and 315. Thus, the overcast conditions probably reduced light intensity by about half that for a clear day.

A possibility exists that relative humidity as well as light intensity could have an effect on flight activity. The relative humidity ranged from 35 to 45% between 1 and 4 p.m. July 13, 16, and 19; on July 23, it ranged from 55 to 60% between 2 and 4 p.m. These higher levels during the middle of the day and the slightly lower temperatures could have affected flight activity. However, in a previous investigation (Roberts, 1969), relative humidity and temperature were found nonsignificant as factors in tabanid collections from a bait animal.

Duke (1958) and Corbet (1964) reported that the flight activity of tabanids is greatest at sunrise or sunset and is apparently influenced by changes in light intensity. The data from the present study strongly support the conclusions that light intensity has an influence on the flight activity of tabanids.

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