sistance in *Culex gelidus* at Bang Khen is possibly the result of the selection pressures imposed on the population through the extensive use of insecticides in that area.

SUMMARY. The susceptibility of *Culex gelidus* from two areas of Thailand to DDT, BHC and dieldrin was tested. Results showed that larvae from Bang Khen near Bangkok were susceptible to DDT, BHC, and dieldrin while the adult population in the same locality was intermediate in resistance to DDT and resistant to dieldrin. By means of the "time in concentration" technique susceptible and resistant phenotypes were recognized for both insecticides in the Bang Khen population. The development of this physiological resistance is attributed to the extensive use of insecticides in the area. Adults tested from Bang Phra in Chon Buri Province were still susceptible to DDT (the only insecticide tested).

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BIOLOGICAL STUDIES OF TABANIDAE: A PRELIMINARY STUDY OF FEMALE TABANIDS ATTTRACTED TO A BAIT ANIMAL [1, 2]

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The propensity of female tabanids to obtain food from cattle is well known. However, observations made during collection of engorged tabanids from a bait animal (Roberts, 1966) indicated that avidity differed between species and that environmental factors such as temperature, relative humidity, and light intensity influenced activity. A preliminary study was therefore made to obtain data on which an experiment to determine the relationship between fly activity and environmental factors could be based. This paper presents the results of that preliminary study.

MATERIALS AND METHODS. A 7-year-old Hereford steer was tethered to one of the few trees in a 20-acre pasture and used as bait. Other cattle were present but did not come near the study area.

Two types of collections were made. A landing collection in which all tabanids that came to the bait animal were collected

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and a feeding collection in which only those tabanids that engorged were collected. The order of collection was alternated every hour. The order was reversed on each succeeding day. The study was conducted from 8 a.m. to 4 p.m. Monday through Thursday for 2 weeks. The flies were collected with hand nets, killed, and returned to the laboratory for identification. Flies that engorged but for only 12 percent of those in the landing collections.

Feeding (Table 1) by the four species that were numerous enough for valid calculation was quite variable. Definite conclusions cannot be drawn because of the limited nature of the study but some interesting points were noted. When total numbers are considered, 22 percent (about one-fifth of the flies) were ready to feed

TABLE 1.—Tabanids collected on a steer during the 8 days July 13–23 (first line=number landing; second line=number feeding; each number a total of 4 collections).

	Flies collected during indicated hour									
	A.M.				P.M.					
Species	8–9	9–10	10–11	11–12	12–1	1–2	2–3	3–4	Total	Percentage feeding
T. abdominalis F.	49	19	14	7	5	10	6	8	118	.....
	18	7	5	4	4	2	2	1	43	36.4
T. americanus	2	1	2	2	0	1	3	2	13	.....
Forster	2	1	1	0	0	0	0	0	4	.....[1]
T. atratus F.	4	7	6	4	3	6	2	1	33	.....
	3	1	2	7	0	3	3	0	19	57.5
T. cymatophora	0	0	1	0	0	0	0	0	1	.....
Osten Sacken	0	0	0	0	0	0	0	0	0	.....
T. fuscicostatus	1	1	0	0	0	0	0	0	2	.....
Hine	0	0	1	0	0	0	0	0	1	.....
T. lineola F.	2	2	2	0	2	0	0	2	10	.....
	0	0	0	0	0	0	0	0	0	.....
T. proximus	4	3	5	4	3	0	3	1	23	.....
Walker	2	6	3	3	1	2	4	4	25	100
T. subsimilis	78	91	66	63	37	40	52	64	491	.....
Bellardi	3	4	8	3	5	4	2	3	32	6.5
Undetermined species that fed	4	2	6	5	5	2	2	2	28	.....
Total landing	140	124	96	80	50	57	66	78	691	.....
Total feeding (%)	32(23)	21(17)	26(27)	22(28)	15(30)	13(23)	13(20)	10(13)	152(22)	.....

[1] Numbers not considered sufficient for calculation of percentage feeding.

escaped are listed in table 1 as "undetermined species that fed."

Wet and dry-bulb temperatures were measured with a sling psychrometer every hour of each day beginning at 8 a.m. and terminating at 4 p.m. Solar radiation was measured for each hour period with a recording pyreheliometer calibrated in langleys.

RESULTS AND DISCUSSION. The eight species of tabanids collected are listed in table 1. Seventy-one percent of the number in the landing collections were *T. subsimilis;* 17 percent were *T. abdominalis.* The remaining six species accounted when they came to the bait animal but *T. subsimilis,* the most numerous species in the landing collection, had a feeding level of only 6.5 percent. The habits of this species on the animal may partly explain this difference. *T. subsimilis* prefer the lower areas of the animal's body and move rapidly in a nervous manner from one location to another before they start to feed. Individuals rarely feed at the initial landing site and flies often leave the animal before feeding, and in some cases, before they attempt to feed. In contrast, *T. proximus* tends to land on the top portion of the animal's body and unless dis-

turbed by the animal nearly always feeds at or near the landing site. *T. abdominalis* and *T. atratus,* which also land on the upper body areas, move about more in selecting a feeding location than do individuals of *T. proximus.* Thus, some species are ready to feed when they are attracted to the animal; others are apparently attracted to the animal before they are ready to feed and may require a secondary stimulus of some type to cause them to commence feeding.

The diurnal activity of the tabanids is indicated by the totals shown for each period. Landing collections were largest in the early morning; minimum activity occurred shortly after noon. However, the feeding collections did not follow as definite a pattern, though a greater percentage of the flies that were active during the middle of the day fed.

The average temperature, relative humidity, and langleys for each hour are shown in table 2. The langleys were included to depict solar radiation and also to indicate degrees of cloud cover and, indirectly, light intensity. Unfortunately, there were insufficient periods of cloudy weather to test the effect of sudden decreases or increases in light intensity on activity.

In the statistical analyses of the landing data, time of day was the only variable that was significant at the 5 percent level. When considered with the multiple correlation coefficient (R^2=0.5099), it appears that flying activity and host seeking by the adult flies, while influenced by the four variables measured, is most closely associated with the time of day.[3] The predictive equation for feeding does not contain the factor for time of day except as nonsignificant quadratic and interaction terms. The only variable in the equation that was significant at the 5 percent level was a negative factor for relative humidity. The multiple correlation coefficient (R^2=0.6028) indicates that relative humidity plays an important part in feeding variability. The mechanism by which decreasing relative humidity influences tabanids to feed is not known; however, speculation does not seem out of order. If we assume that water vapor, together perhaps with other volatile materials given off by the animal's body constitutes a feeding stimulus, then high humidities could mask these vapors either mechanically or by increasing the threshold of detection of water vapor by the flies' sensory receptors.

TABLE 2.—Eight-day average of temperature, relative humidity and langleys for each collection period.

Collection period	Temperature (° F)	Relative humidity (%)	Langleys
A.M.			
8–9	85.6	78.1	48.8
9–10	89.3	60.9	63.2
10–11	90.7	58.5	65.2
11–12	92.0	56.5	68.9
P.M.			
12–1	93.2	53.4	63.1
1–2	94.1	50.2	62.8
2–3	94.3	49.2	46.2
3–4	94.0	51.0	38.8

Although the present study was preliminary in scope, sufficient information was obtained to permit the design of future studies into the relationship between the activity of the tabanids and environmental factors. Among the factors that should have additional study are earlier and later daily collections, a study period extending over a number of weeks to permit a greater range of environmental factors, measurement of light intensity as foot candles as well as solar radiation, wind movement, and more frequent measurements of wet and dry-bulb temperatures.

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[3] The details of the statistical analyses and other related data are available from the author.