SELECTIVE RESPONSE OF *AEDES NIGROMACULIS* (LUDLOW) TO THE MINNESOTA LIGHT TRAP

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Preliminary studies on comparative mosquito catches by American Model (Mulhern, 1953) and Minnesota (Frost, 1952) light traps were reported by Loomis (1958). The studies showed the Minnesota trap collected almost exclusively *Aedes nigromaculis* (Ludlow). Additional tests were conducted to confirm these results, to determine the efficiency of the Minnesota trap at high light intensities, to compare Minnesota and motorless American traps, and to compare collections between Minnesota traps of different size.

MATERIALS AND METHODS. The so-called Minnesota trap was originally designed and used at the University of Minnesota to collect adults of the European corn borer, *Pyrausta nubilalis* Hübner. Hodson (*in litt.*) reported that details of trap design were not available at the University. Construction of the traps, therefore, was after the design shown by Frost (1952). The trap operates without a motor and fan but has a light bulb placed between four reflector plates (baffles) contained within a top hood and funneled bottom (Figure 1). The top and bottom are isometric (16-inch diameter), of 20-gauge galvanized iron, and each contains a sheet metal divider bolted to the spacing rods. The top and bottom are separated by a distance of one foot. Narrow strips of sheet metal, bent to form a groove and spot-welded to the spacing rods, serve to hold the removable aluminum baffles. The baffles are fastened to the dividers by means of sheet metal screws. Insects are collected in a killing jar which is attached to the funnel-shaped bottom. An electric timer may be bolted to the top hood if desired. A one-quarter inch mesh wire screen is placed around the spacing rods to prevent entry of large insects. This model of the trap is designated the large type. A small model was also constructed by making the spacing rods 10 inches long, rather than 14 inches.

Field tests were conducted from July to October in two rural locations in the Central Valley of California. At one location an American trap was compared with a large Minnesota trap. The traps were placed two feet from the wooden walls of a pump house; one was on the south side and the other on the east. A bluff, 150 feet high, was immediately west of the pump house and an irrigated pasture not under mosquito control was immediately east by southeast. Three tests were conducted: A, in which both traps operated with 50-watt lamps; B, in which the Minnesota trap was provided with a 100-watt lamp in order to determine whether the catch of this trap could be increased to equal that of the American trap operating with a 50-watt lamp; C, in which the catch of a motorless American trap was compared with that of a Minnesota trap while both traps operated with 50-watt lamps. The traps were interchanged in position once during test A and at regular intervals during tests B and C.

A large and a small Minnesota trap were placed 20 feet apart under a *Eucalyptus* tree at a second location; one position was on the north side and the other on the east side. Dense foliage obscured the traps from each other. Traps were interchanged in position at frequent intervals and both operated with 50-watt lamps. Urban development was immediately west and south while an irrigated pasture subject to mosquito control was immediately northeast.

All traps were placed six feet above the ground and operated 12 hours each night beginning at 6:00 or 7:00 p.m. Two varie-

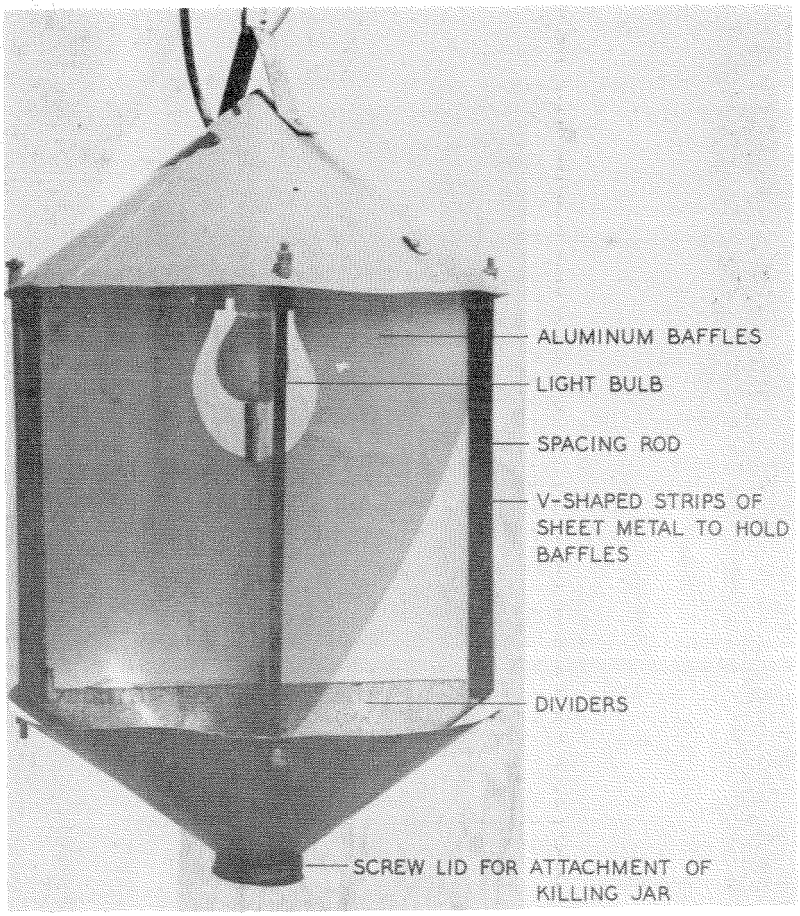

FIG. 1.—Modified Minnesota light trap.

ties of inside-frosted white lamps were used, a 50-watt (60 foot candles), vibration-service type, and a plain 100-watt (105 foot candles).

RESULTS. In Test A (Table 1) the American trap caught more *A. nigromaculis* of both sexes than did the Minnesota trap during the first 13 nights. When the traps were reversed in position for another 13 nights the American trap collected as many males and three times as many females of this species as the Minnesota trap. Although the American trap caught more mosquitoes than did the Minnesota trap, the total trap catches contained 61 percent and 98 percent *A. nigromaculis* respectively. Only the American trap caught considerable numbers of *Aedes melanimon* Dyar and *Culex tarsalis* Coquillett.

By increasing the luminosity in the Minnesota trap in Test B (Table 1), more males of *A. nigromaculis* were taken in this trap than in the American trap. With

TABLE 1.—Number of *Aedes nigromaculis* per trap night[1] in American and Minnesota light traps operated under three sets of conditions at one location, California, 1958

Inclusive dates	Trap position[2]	Males	Females	Trap position[2]	Males	Females
Test A	American trap (50 watt lamp)			Minnesota trap (50 watt lamp)		
July 15–27	South	27	50	East	6	9
August 1–13	East	2	18	South	2	6
Test B	American trap (50 watt lamp)			Minnesota trap (100 watt lamp)		
August 14–17	East	103	229	South	170	43
August 18–21	South	8	104	East	26	35
August 22–24	East	9	142	South	29	157
August 25–27	South	9	51	East	96	97
August 28–31	East	0	33	South	2	20
September 1–4	South	2	37	East	5	17
Test C	American trap (50 watt lamp, motorless)			Minnesota trap (50 watt lamp)		
September 10	South	0	0	East	10	2
September 11	East	0	1	South	18	8
September 15–16	South	96	16	East	130	28
September 19–20	East	10	12	South	70	62
September 21	South	6	9	East	21	24
September 23–24	East	0	0.0[a]	South	2	4
September 25–28	South	0.0	4	East	0.0	6
Sept. 29–Oct. 2	East	0.0	4	South	2	3
October 3–5	South	0	3	East	3	6
October 6–7	East	0.0	0.0	South	1	1

[1] Rounded to nearest whole number.
[2] See text.
[a] Less than five-tenths.

females, however, the American trap generally caught more than did the Minnesota trap. In this test 99 percent of the catch of the Minnesota trap was *A. nigromaculis* and 72 percent of the catch of the American trap was of this species. Large numbers of *A. melanimon* and *C. tarsalis* were again taken only in the American trap. Many more *Aedes vexans* (Meigen) and *Culex peus* Speiser were also caught by the American than by the Minnesota trap.

In Test C (Table 1) the Minnesota trap consistently caught more males and females of *A. nigromaculis* than did the motorless American trap. The proportion of this species in the total collections of the two traps were 96 and 88 percent, respectively. *A. melanimon* was again more common in the catch of the American trap.

In general, collections from both traps showed similar population trends for each sex of *A. nigromaculis*. Peak densities occurred during the latter part of August and in the middle of September.

The comparative data on the relative catches of the large and small Minnesota traps were variable due to the bias of one trap position. It was evident, however, that the two traps caught an approximately

equal number of males and females of *A. nigromaculis*. The total catch of both traps was close to 98 percent *A. nigromaculis* while *C. tarsalis* and *A. melanimon* were taken in extremely low numbers.

DISCUSSION. Although the experimental design of this study took into consideration the factor of trap position, a rotary trap device similar to that described by Dow *et al.* (1957) is preferable in tests of this type in order to randomize the position factor and other variables which affect the relative numbers of mosquitoes captured. The present technique, however, was adequate for determining gross differences in performance resulting from variations in trap design and operation.

In the previous study (Loomis, 1958) the Minnesota trap collected chiefly *A. nigromaculis*, but generally a smaller total number of mosquitoes than did the American trap. The present study confirms these results. When light intensities of the Minnesota trap were increased, larger numbers of *A. nigromaculis* were taken, approximating collections made by the American trap. The two traps were further compared by turning off the fan and motor in the American model; under these conditions the Minnesota trap consistently caught more *A. nigromaculis* than did the American trap. This result may be due to the pattern of lighting produced by the two traps. The American trap illuminates a small circle on the ground beneath the trap while the Minnesota trap projects a wide horizontal beam of light. These and other results suggest that *A. nigromaculis* is highly attracted to light. In preliminary tests made with American light traps operated without light and with light of varying intensities, this species was more positively phototropic than either *C. tarsalis* or *Culex pipiens* Linnaeus (broad sense) (Loomis, unpublished). Reed (1959) also reported that *A. nigromaculis* was collected in light traps (with 25-watt white bulbs) only when the light operated.

Since the Minnesota trap is highly selective for *A. nigromaculis* it should be a useful device for studies of adult population trends of this species. Limiting the trap catch in terms of species results in collections that are more easily processed. Also, the construction cost of the trap is considerably less than that of fan operated traps. The Minnesota trap, however, is not recommended for the collection of any of the several other species collected in the course of this study.

SUMMARY AND CONCLUSIONS. A light trap was constructed from an illustration of the Minnesota trap originally designed to collect European corn borers. This trap, which essentially utilizes a light bulb placed between four reflector plates contained within a top hood and funnel-shaped bottom, was tested against a fan operated American Model trap commonly used to collect adult mosquitoes in California. The Minnesota trap collected *Aedes nigromaculis* almost exclusively, although in smaller numbers than did the American trap. The collection of *A. nigromaculis* by the Minnesota trap can be increased by increasing the light intensity. The pattern of lighting in the Minnesota trap is apparently more selective for *A. nigromaculis* than that in the American trap. Two Minnesota models which differed in size performed about equally well.

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