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MOTH ACTIVITY OF *HELIOTHIS ZEA* (BODDIE) IN WISCONSIN *(LEPIDOPTERA: NOCTUIDAE)*

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ABSTRACT

The results of blacklight (3600 A°) trapping studies conducted for four years indicated that the start of the major corn earworm, *Heliothis zea* (Boddie), moth flight occurred during the last week of August or the first week of September in the Arlington, Wisconsin area. An accumulation of the air temperature was made above a base temperature of 54° F. for each of the four years and results showed that corn earworm moth flight in the Arlington area might be expected to start between 1600 and 1650 thermal unit accumulation. This temperature accumulation was attained within the narrow time span of August 25 to 29.

INTRODUCTION

The corn earworm, *Heliothis zea* (Boddie),—also known by such accepted common names as "cotton bollworm" and "tomato fruitworm"—is rated by Hyslop (1927) as the third most important insect pest in the United States, following only the codling moth and the combined species of cutworms (*Noctuidae*). In North America, the preferred food plant of the corn earworm is undoubtedly corn, *Zea mays* L.

Blanchard (1942) concluded from cage studies within typical cornfields that the corn earworm does not survive the winter north of Central Illinois. He concluded, further, that "circumstantial evidence points to migrations from the South, as the source of infestations that are found in the northern parts of the United States."

Because growers of sweet corn must produce relatively clean corn at minimum cost, they require knowledge of the means of effective insecticidal control of the corn earworm. Such knowledge, in turn, proceeds from positive understanding of the behavior of the insect.

The relative seasonal abundance of corn earworm moths was investigated under field conditions at the University of Wisconsin Arlington Farms from 1961 through 1964.

MATERIALS AND METHODS

Trapping of Moths

The corn earworm moth, like other lepidopterous moths, is nocturnal in its habits and it has been found to respond positively to the radiant energy emitted by blacklight lamps (Pfrimmer, 1955). Accordingly, in this study the entrapment procedure employed an omnidirectional self draining blacklight trap. The insect trap was operated each year, from 1961 through 1964, in order to determine the seasonal abundance of this species in the Arlington, Wisconsin community. The trap had two 15-watt BL fluorescent lamps (3600 Å) located in the middle of a one-plane baffle. Calcium cyanide, retained in a small paper bag, was placed in the hopper below the lights to provide quick kill of the insects. This chemical was replaced twice per week. The trap was put into operation in each of the four seasons in late May or early June. At daily intervals thereafter, into mid-September, the insect catch was examined for corn earworm moths. The trap was located 100 yards away from the sweet corn fields. Captured moths were counted each morning and were recorded for the previous night. No attempt was made to separate sexes. Catches of the corn earworm moths for the years 1961 through 1964 were summed by weekly intervals for each year, are presented in Table 1.

Tabulation of Data

The recorded entrapments were recapped in two ways; that is, (1) by 7-day periods and (2) by 50-unit increments in accumulated thermal units. The thermal unit casting represented an adaptation of the degree-day concept made familiar in recent years by weather forecasters. Earlier applications of thermal data by entomologists include such studies as that by Headlee (1936) on timing of cover sprays for codling moth, *Carpocapsa pomonella* (L), and that by Apple (1952) for utilizing thermal constants in scheduling operations for control of the European corn borer, *Ostrinia nubilalis* (Hbn).

Temperature-development studies as reported by Mangat and Apple (1966), indicate that the theoretical temperature threshold for development of this species is 54.7° F. This study provided the basis for calculation of thermal units. This was adjusted downward to a flat 54° threshold in recognition of the fact that some minimal contribution to growth of the corn earworm is provided at temperatures moderately below 54.7° F.

Calculation of the thermal units (degree-days), therefore, consisted in obtaining the degree difference above 54° F. represented by the arithmetic average of the maximum and minimum temperatures for each day. In exceptional cases, where a daily average failed to exceed 54° thermal units were recorded in accordance with the conversion table developed by Arnold (1960) for that day. Air temperature records for the Arlington area were obtained from official U. S. Weather Bureau records. The earworm moth catches during each of the four years were grouped (Table 2) on the basis of moths caught during a 50 thermal-unit period.

RESULTS

Two early season moths were trapped the week of July 6-12 in 1964 but no early season moths were captured during the other three years. In all the years under study, the start of the major flight occurred during the last week of August or the first week of September. On the average, 1.25 moths or fewer were trapped during seven-day period prior to 23 August but thereafter moths were noticeably more abundant. There was no difference at the 5% level of confidence in the total moths collected during the weeks of August 31-September 6 and September 7-13 (Table 1).

Results from the past four years show rather good agreement between moth activity and temperature accumulations, but for predictive purposes, the four-year average is deemed more useful than any one year. On the average, 1.25 moths or fewer were trapped during a 50 thermal-unit period prior to 1600 thermal units, but thereafter, moths were noticeably more abundant and were essentially continuous in appearance. Major corn earworm moth flight in the Arlington, Wisconsin area might be expected to start between 1600 and 1650 thermal-unit accumulation (Table 2). There was no difference in moth catches between 1650 and 1800 thermal units at 5 percent level of confidence. During this 4-year period, 1650 thermal units accumulated as early as August 25 and as late as August 29.

These results indicate, therefore, that (1) sweet corn varieties which mature before August 20 do not require any treatment (2) in the case of later sweet corn varieties with fresh silk insecticide, treatment should be applied as soon as possible after 1650 thermal units have accumulated (normally at or around August 20).

On the other hand, corn growers can grow late-planted sweet corn without using any treatment so far as the corn earworm is concerned. This can be accomplished by simply planting sweet corn varieties which mature earlier or by planting the "late" varieties 8-15 days earlier. What is to be avoided is to have fresh silks (preferred site for oviposition) available for egg deposition at the time of significant flight (August 20 or later).

The rather uniform periodicity of earworm moths in the major flight during late August suggests the possibility that such moths might be adults from a local population of larvae. Whether these moths migrate from the South or not is being currently investigated by many research workers (including the present author) of several experimental stations under Southern Regional Project S-59.

SUMMARY

A four-year trapping study in the area of Arlington, Wisconsin, resulted in the finding that the appearance of the corn earworm moth in significant numbers is timed by a measurable accumulation of atmospheric thermal units. In the four-year study period, this temperature accumulation was attained within the narrow time-span of August 25 to 29.

TABLE 1: *Corn earworm moths collected in an omnidirectional blacklight trap. Arlington, Wisconsin. 1961-64*[a].

Collection Period	Moths Caught Per Seven Day Period					
	1961	1962	1963	1964	Total	Average
6/29-7/5	0	0	0	0	0	0.00
7/6-7/12	0	0	0	2	2	0.50
7/13-7/19	0	0	0	0	0	0.00
7/20-7/26	0	0	0	0	0	0.00
7/27-8/2	0	0	0	0	0	0.00
8/3-8/9	0	1	0	0	1	0.25m
8/10-8/16	0	1	0	4	5	1.25m
8/17-8/23	0	1	3	0	4	1.00m
8/24-8/30	2	26	20	12	60	15.00m
8/31-9/6	45	36	26	46	153	38.25nm
9/7-9/13	61	29	13	79	182	45.50n

[a]Means followed by the same letter are not significantly different at the 5% level of confidence.

TABLE 2: *Corn earworm moth captures in relation to temperature accumulation at Arlington, Wisconsin (1961-64)*[a].

Thermal Unit Period[b]	Moths Caught Per Thermal Period				
	1961	1962	1963	1964	Average
1250	0	0	0	0	0.00
1300	0	0	0	0	0.00
1350	0	0	0	0	0.00
1400	0	0	0	0	0.00
1450	0	1	0	0	0.25m
1500	0	1	0	4	1.25m
1550	0	1	2	0	0.75m
1600	0	0	1	0	0.25m
1650[c]	0	3	10	6	4.75nm
1700	1	4	18	14	9.25nm
1750	1	29	18	38	21.50nm
1800	3	26	9	77	28.75n

[a]Means followed by same letter are not significantly different at the 5% level of confidence.

[b]Accumulation of effective temperatures above 54° F.

[c]Attained during week of 8/27-8/29 in each of the four years.

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