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Effects of Food, Temperature, and Oviposition Site on Longevity and Fecundity of the Army Cutworm

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Effects of Food, Temperature, and Oviposition Site on Longevity and Fecundity of the Army Cutworm[1]

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Abstract

Longevity of the army cutworm, *Chorizagrotis auxiliaris* (Grote), following mating was inversely related to temperature. Females lived longer than males at all temperatures, and food increased longevity of both sexes. Oviposition occurred at 70° and 55° but not at 32° F. None of the variables tested affected total fecundity but oviposition was completed sooner at 70° than at 55°, in sand as an oviposition site vs. paper toweling and by unfed than by fed moths. Starvation preceding oviposition did not affect fecundity but speeded completion of oviposition when moths were returned to favorable conditions.

The army cutworm, *Chorizagrotis auxiliaris* (Grote), normally deposits its eggs in soil and the moth exhibits preferences for certain oviposition conditions (Pruess 1961). This species has a long preoviposition period which is influenced by temperature and photoperiod (Jacobson & Blakely 1959, Jacobson 1960). Food is essential during this period for development of the fat body which is subsequently utilized in egg or sperm production. Little information is available on the effects of these variables during oviposition. In Nebraska, eggs are laid in late September and October. Wide climatic variations occur at this time on the Great Plains. Preferred oviposition sites may not always be available, nectar sources arc frequently scarce, and freezing temperatures often occur. An experiment was designed in 1961 to investigate the effects of these variables during the oviposition period.

Methods

Moths used in these studies were collected in a black light trap during the fall migration. Moths used in the first experiment on effects of food, temperature, and oviposition site were collected on September 17, while moths used in the starvation experiment were collected October 5. All moths had mated and most of them were in a late preoviposition stage as determined by egg development, fat body, and condition of the bursa copulatrix. Tests were conducted in inverted pint cardboard ice cream cartons. A piece of folded paper toweling was stapled to the side of the carton to provide a resting place. Food (honey and water) or distilled water was provided by a cotton-stoppered vial fitted to the carton. Oviposition sites consisted either of fine sand passing a 60-mesh screen or only the paper toweling. Three temperatures, 70°, 55° and 32° F., were used and controlled within ± 2°. All combinations of food, temperature, and oviposition site were tested with 10 replications of each treatment. Two males and two females were used per replicate. Eggs were counted twice weekly and dead moths removed and dissected to determine number of eggs remaining in the ovaries.

Results

Longevity of moths increased as temperature decreased (table 1). Females lived longer than males at all temperatures, and food increased longevity of both sexes. Moths were observed to feed even at 32°. Presence or absence of sand as an oviposition site resulted in a significant difference in longevity only at 55° (table 2). At this temperature females lived longer when no sand was provided. Subsequent results indicated that this difference was probably related to oviposition rather than to any direct physical effect on the moth.

Table 1. Mean longevity (in days) of fed and unfed army cutworm adults at different temperatures

Temperature (°F.)	Fed		Unfed	
	♂	♀	♂	♀
70	14.2	15.5	6.7	11.8
55	23.6	29.9	13.8	21.2
32	44.0	51.2	38.0	39.4

Table 2. Mean longevity of army cutworm adults (in days) at different temperatures in presence or absence of sand as oviposition site

Temperature (°F.)	Sand		No Sand	
	♂	♀	♂	♀
70	8.9	14.6	9.6	14.1
55	15.8	22.1*	19.5	31.5*
32	38.0	46.0	39.4	49.8

* Significantly different at 5% level.

Total oviposition was not greatly influenced by any of the variables tested except temperature. Very few eggs were laid at 32° (table 3). Slightly, but not significantly, more eggs were laid by unfed than by fed moths or in sand vs. paper toweling, the respective means being 221 vs. 198 and 236 vs. 184.

Table 3. Fecundity of army cutworm adults held at different temperatures

Temperature (°F.)	Eggs per Female		
	Laid	Unlaid	Apparent Potential
70	221	325	546
55	198	280	478
32	3	239	242

All variables, however, affected duration of the oviposition period. Fifty percent completion of oviposition was 10 days later and completion of all oviposition 5 weeks later at 55° than at 70° (fig. 1) but no significant difference in total fecundity occurred at these temperatures (table 3). Although longevity was greatly prolonged at 32°, most moths held at this temperature eventually died without laying eggs. What few eggs were obtained at 32° were dropped on the sand or bottom of the carton instead of being normally deposited.

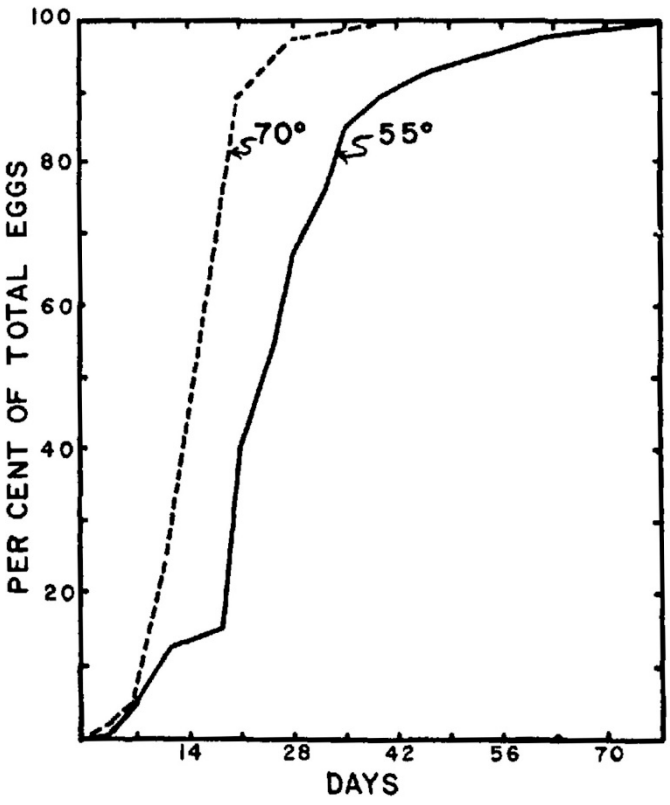

Figure 1. Effect of temperature on rate of oviposition by army cutworm.

Fed moths began oviposition later than unfed moths, and egg laying was conducted over a longer period. Similarly, oviposition began much later and again was prolonged when sand was not provided. When sand was available, eggs were never laid on other surfaces. However, in the absence of a preferred site, eggs were laid on the paper toweling or the cotton stopper of the feeding vial. These differences occurred at both 70° and 55° and were similarly expressed though maximized at the lower temperature. In the absence of sand, there was a 7-day delay in initiation of egg laying by unfed moths and a 17-day delay by fed moths at 55° F. (fig. 2). This response seemed to be the reason for increased longevity in the absence of sand.

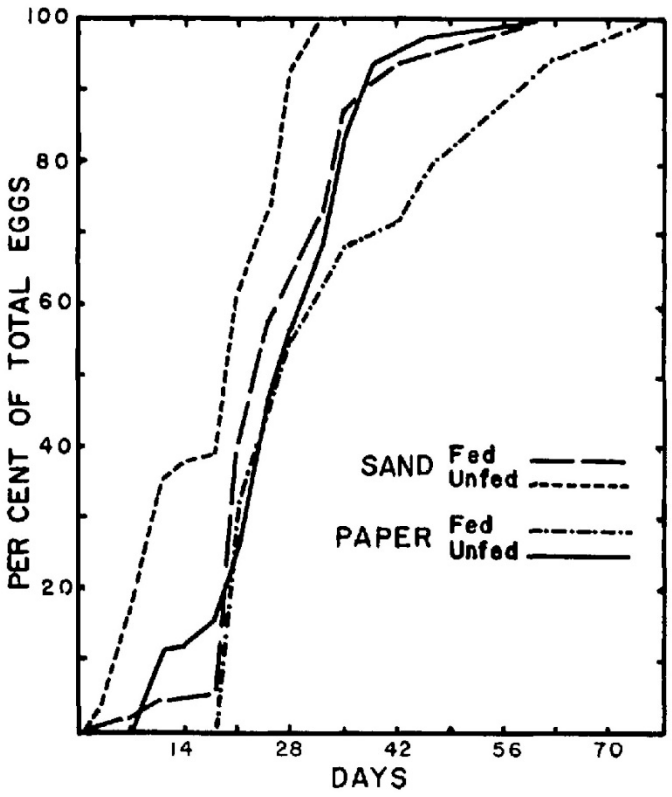

Figure 2. Effect of food and oviposition site on rate of oviposition by army cutworm at 55°F.

Results given in table 3 indicate that fecundity was decreased at the lower temperatures. This result, however, is only an apparent difference since further egg development ceased at 32°. Results of a starvation experiment indicated that moths held at 32° for periods up to 3 weeks, when returned to favorable conditions, resumed eggs development with normal oviposition even in the absence of food during the entire period (table 4). A few moths were held at 32° for 69 days without food. Even these moths, when returned to favorable oviposition conditions at 70°, laid fertile eggs although no chance for additional matings had been provided. Maximum longevity in these tests was 131 days; unmated moths have been maintained much longer.

Table 4. Effect of starvation at different temperatures on fecundity of army cutworm when returned to favorable conditions for oviposition at 70°F.

Days Starved	Temperature (°F.)	Eggs per Female
0	70	234
7	70	261
7	55	230
14	55	282
7	32	385
14	32	193
21	32	300

Moths held under unfavorable conditions for oviposition and without food, when returned to favorable conditions, completed oviposition sooner than moths held continuously under favorable conditions. Oviposition was completed most rapidly when starvation occurred at higher temperatures (fig. 3). This result seems attributable to the fact that egg development continued at 70° during the starvation period but was terminated at 32°. Thus, most eggs were mature and ready for oviposition at 70° while there was a delay in maturing eggs following removal from storage at 32°. There was little difference in rate of oviposition following removal from storage after 7, 14, or 21 days at 32°.

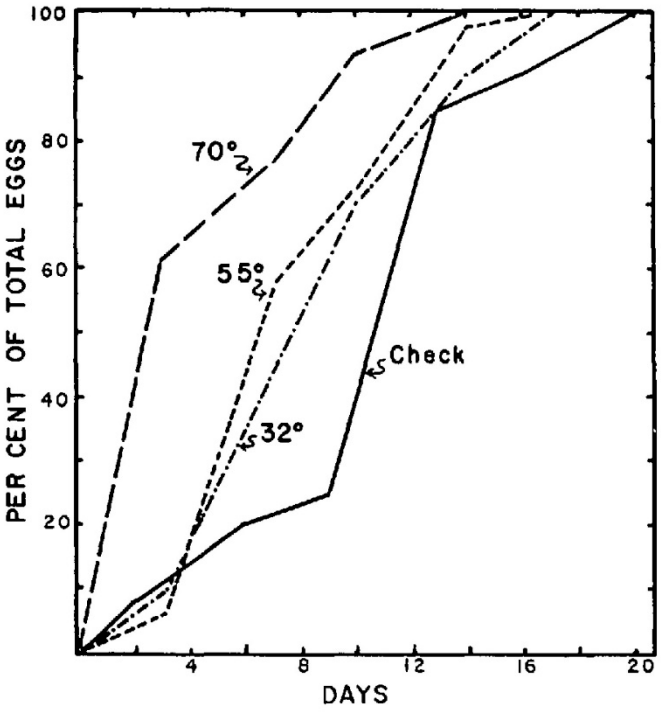

Figure 3. Effect of starvation for 7 days at different temperatures on rate of oviposition by army cutworm when returned to favorable conditions at 70°F. Check line is for moths held continuously at 70°.

These results indicate that food is not essential during the oviposition period in the fall, except insofar as its availability prolongs life under unfavorable conditions for oviposition. A decreased rate of oviposition was accompanied by increased longevity. Moths, though normally depositing their eggs in loose soil, could probably utilize other sites if preferred conditions were not available. Moths can survive prolonged exposure to low temperatures; thus, periods of cold weather, although temporarily terminating oviposition, would not ordinarily have any important effect on the number of eggs laid if another mild period followed. Following periods of starvation under unfavorable conditions for oviposition, reproduction was completed in a shorter period of time than was the case for moths continuously exposed to favorable conditions. This fact suggests that the moth has the ability to utilize brief periods of favorable temperatures effectively during inclement autumns. Certainly the army cutworm is well adapted for survival under the variable climatic conditions occurring on the Great Plains during the oviposition period.

Note

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References Cited

Jacobson L. A. 1960. Influence of photoperiod on oviposition by the army cutworm, *Chorizagrotis auxiliaris*, in an insectary. Ann. Ent. Soc. America 53: 474–75.

Jacobson, L. A., and P. E. Blakely. 1959. Development and behavior of the army cutworm in the laboratory. Ann. Ent. Soc. America 52: l00–105.

Pruess, K. P. 1961. Oviposition response of the army cutworm, *Chorizagrotis auxiliaris*, to different media. Jour. Econ. Ent. 54: 273–74.