BIOLOGY AND CONTROL OF INSECTS AFFECTING COTTON IN ARIZONA

T. F. Watson
D. G. Fullerton
P. H. Johnson

Objectives:

A. To study the field ecology of important cotton pests

B. To conduct field experiments with insecticides for the purpose of developing practical and effective cotton control programs

Summary of Progress:

A. Diapause induction and termination in the pink bollworm

(1) Incidence of diapause

A study was initiated in late August at Phoenix, Arizona to obtain a more reliable diapause curve for the pink bollworm in central Arizona. One thousand half-grown bolls were pulled weekly and held in an insectary for larval emergence. Larvae were collected from each boll sample for approximately one week and held in petri dishes for a period of 30 days to determine the percent in diapause. The sample size for each boll-collection date consisted of approximately 800 larvae.

Results of this study show the incidence of diapause to be at a low level until after mid-September, after which it increases rapidly. Diapause occurred as the following indicates: August 28 - 0.0%; September 8 - 1.25%; September 17 - 5.32%; September 24 - 42.28%; October 1 - 68.25%; October 5 - 82.85%; and, October 12 - 90.58%.

Results from less complete data from the Yuma and Safford areas indicate a slight deviation from the pattern of diapause incidence in the Phoenix area. It appears that the initiation of diapause occurs slightly earlier in the Safford area and somewhat later at Yuma as compared to that at Phoenix. This suggests a slight overriding effect of photoperiod by temperature and/or quality of food.

(2) Factors involved with diapause termination

Several studies were conducted to determine the most significant environmental factors involved in the termination of diapause of overwintering larvae. The tests were conducted in the laboratory in constant temperature cabinets or programmed environators using field-collected diapausing larvae. Temperatures representing the 10-day mid-month period for the months of March, April and May were selected for the study. The larvae were held in dry containers or on moistened filter paper and under photoperiods of either 10 or 14 hours. Temperature means at four-inch soil depth, representing the months of March, April and May at Phoenix, Arizona, were 57°, 72° and 78°F., respectively.

These studies indicated that, in the presence of contact moisture, a typical April or May day provides sufficient temperature units for pupation, whereas March conditions do not unless a diurnal pattern is exhibited to provide heat units above the mean of 57°F.

In the constant temperature studies, 60°F. appeared to be the approximate threshold of development (pupation). As temperatures were increased to 64°, 68° and 72°F., rates of pupation were proportionately increased.

B. Control

(1) Pink bollworm control

A test was initiated on August 27, 1970 at Phoenix, Arizona to determine the economic damage caused by a late-season pink bollworm infestation. Treatments in the test included: (1) untreated check; (2) three applications of Sevin; and, (3) six applications of Sevin. The experimental design was a randomized complete block with four replications.

Sampling on August 24 showed that approximately 80% of the vulnerable bolls were infested with pink bollworms. Spray applications were begun on August 27 and infestation levels were determined prior to each subsequent application. Table 1 shows the effects of the two spray schedules, as compared to the check, on a high pink bollworm infestation. Three applications were required to significantly reduce the infestation level. After the fourth application of the schedule receiving six applications all three treatments differed significantly and following the sixth application the boll infestation was 6.5% as compared to 93.0% in the untreated check and 43.0% in the schedule receiving only three applications. Yields from both sprayed schedules were significantly different from the untreated check but no difference was shown between the two schedules.

(2) Lygus control

A test was conducted at La Palma, Arizona to determine the feasibility of controlling lygus and preserving beneficial insects by using a lower rate of trichlorfon than is currently recommended. Treatments in the replicated experiment included: (1) the untreated check; (2) 0.5 lb./A. trichlorfon; and, (3) 1.0 lb./A. trichlorfon.

Results indicated that control was only temporary as population movement tended to offset treatment effects. Nymphal populations were temporarily suppressed by insecticide applications but resurgence occurred rapidly.

Population trends of several predators were assessed during the course of this study. In general, the 1.0 lb./A. rate of trichlorfon was more detrimental to the predators than the lower rate. The second application had a more prolonged detrimental effect than did the first one. The reduced predator populations in the sprayed plots during the second week of August were accompanied by a large increase in lygus nymphs.

Table 1. Mean infestation levels and yields from various pink bollworm control practices. Phoenix, Arizona. 1970.

Treatment	Pre-treatment 8/24	.05	Post-treatment infestation levels (%) and stat. sig. 9/2	.05	9/8	.05	9/14	.01	9/21	.05	.01	9/29	.01	10/5	.01	Yield/A. and sig.
A) Check	79.0	n.s.	88.0	n.s.	75.0	n.s.	70.0	a	68.5	a	a	86.5	a	93.0	a	1952 a
B) 3 Appl.[1/]	82.5		80.5		63.5		31.0	b	27.0	b	b	32.5	b	43.0	b	2260 b
C) 6 Appl.[2/]	80.0		72.5		63.0		28.5	b	10.5	c	b	12.0	c	6.5	c	2255 b

Application dates: [1/] 8/27, 9/2, 9/9

[2/] 8/27, 9/21, 9/9, 9/15, 9/21 and 9/28

Square damage was reduced slightly by the insecticide treatments but was not significantly affected. There were no significant differences in yields among treatments.

(3) Cotton leaf perforator control

(a) An experiment was conducted at La Palma, Arizona to determine the effectiveness of Lannate and Fundal against the cotton leaf perforator. Lannate was applied at the rate of 0.5 lb. per acre and Fundal at 0.75 lbs. per acre.

Results showed that both insecticides virtually eliminated the cotton leaf perforator for a three-week period. A second application was made after three weeks when the check was averaging 5.71 cotton leaf perforators (4th, 5th and horseshoe stages) per leaf while the treated plots averaged only 0.35 and 0.37 stages per leaf, respectively, for Lannate and Fundal. The test was terminated three days later due to a frost.

This experiment was initiated on October 3 on long staple cotton. The developmental rate of the perforator may have been sufficiently reduced at this time of the year to yield an erroneous impression as to the resurgence capability following treatment. Some question remains therefore, as to the residual effectiveness of these two insecticides.

(b) An experiment at Yuma compared M-E Guthion (0.5/A.), encapsulated methyl parathion (1.0 lb./A.), and Bidrin (0.5 lb./A.) with an untreated check for cotton leaf perforator control. Each insecticide was tested at four- and eight-day application intervals.

Results showed that M-E Guthion and Bidrin significantly reduced the cotton leaf perforator at the four-day schedule but all were poor at the eight-day schedule.

(c) An experiment was conducted in the greenhouse at Tucson using potted cotton plants to determine the period of effectiveness against the cotton leaf perforator of three rates of Temik. Treatments consisted of (1) the untreated check, (2) 10 lbs./A. rate of Temik, (3) 20 lbs. Temik/acre, and (4) 30 lbs. of Temik per acre. Each treatment was replicated five times. Adjacent to the test plants a large number of plants was maintained to provide a continuous source of cotton leaf perforators to reinfest the test plants.

The test was initiated on September 12, 1970 and will continue until cotton leaf perforators are able to survive on all treatments. Weekly readings are taken on four leaves per plant to determine the relative numbers of 4th and 5th instar larvae and horseshoe stages present on the different treatments. Periodically, egg counts are made to verify that the treated plants are equally attractive for oviposition.

During the three-month period of September 12 to December 12 the check plants were completely defoliated, followed by ample re-growth, and practically defoliated a second time. The treated plants showed no cotton leaf perforator damage during this period.