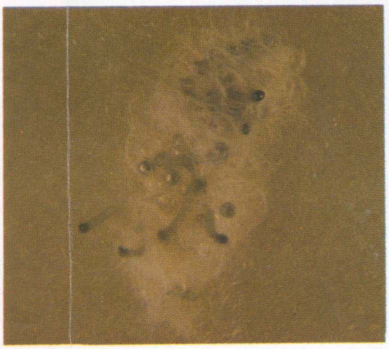

Beet Armyworm

BIOLOGY AND CONTROL

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DURING THE LAST several years, the beet armyworm, *Spodoptera exigua* (Hubner), has become a pest on several economic crops in Alabama. Reports on chemical control research emanating from the southeastern and southwestern regions of the United States indicate differences in chemical susceptibility between the strains found in these two areas. Research by the Auburn University Agricultural Experiment Station demon-

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Different stages of beet armyworm are shown in the title illustration: Egg mass hatching (lower left); larva, side and dorsal view (right); pupa (left center); and adult (left top).

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strated insecticidal resistance in the southeastern strain to several commonly used insecticides.[1] Further field research was conducted at Auburn to determine the biology of the insect and to establish field control techniques.

BIOLOGY

A native of the Orient, the beet armyworm was first detected in the United States as a pest of sugar beets (hence the name) in Oregon late in the 19th century.[2] By the 1920's this insect was present in the Southeast[3] where it has caused sporadic problems since that time. Since 1966 the authors have observed increasingly severe, although still sporadic, damage from this pest. Some of the more important hosts in Alabama are peanuts, soybeans, cotton, corn, forage legumes, and pasture grasses.

The egg of the beet armyworm is ribbed and nearly spheroid. It is greenish-gray when freshly laid, becomes cream colored within a few hours, and later darkens as the developing black larval head becomes more prominent. Under field conditions in Alabama the egg hatches in 3-4 days.

The newly hatched larva is light green, about a millimeter long, and has a relatively large, dark head. The larva molts as it passes from instar to instar and becomes progressively larger until the last instar is about an inch long. Larval color is inconsistent and varies from light green to pinkish gray to almost black. Past the third instar the head is brown. Field identification is facilitated by the presence of a dark spot on each side of the thorax just above the middle leg. The larva has five or six instars and the larval period lasts from 15 to 25 days in the field. The length of time required for larval development decreases at higher temperatures.

Pupation occurs in the ground. The larva bores into the ground at the end of the larval period and constructs a pupal cell about 1 inch below the surface. The pupa is about 5/8 inch long and is light green when newly formed. It gradually turns brown, becoming dark brown at maturity. The pupal stage lasts 6 or 7 days, after which the adult emerges. Egg to adult development is usually completed in about 3 weeks.

The adults are gray to gray-brown moths with a wing expanse of 3/4 to 1 inch. The forewings are mottled gray with a light spot near the center of each. The hindwings are lighter in color than the forewings but have a dark border near the edges. Almost all adult activity takes place at night. Adults usually emerge at night, mate within 24 hours, and begin laying eggs within 48 hours. The moths deposit eggs over about a 5-day period and lay about 500 eggs in clusters of 50-150, usually on the undersides of leaves of host plants. The egg clusters are covered with scales from the female's body and appear "fuzzy."

CONTROL EXPERIMENTS

Procedures

Insecticides were evaluated for effectiveness against the beet armyworm in Coffee County, Alabama. An infestation of approximately 11 worms per foot of row was found in peanuts in early July. Three experiments were conducted: the first on July 9, the second on July 13, and the third on August 11. In each case, 10 or 11 treatments (9 or 10 insecticidal treatments and a check) were used. All treatments were replicated four times in a randomized block design.

The following insecticides were evaluated in one or more of the experiments: methomyl (Lannate® or Nudrin®), methamidophos (Monitor®), monocrotophos (Azodrin®), trichlorfon (Dylox® or Proxol®), carbofuran (Furadan®), azinphos-methyl (Guthion®), tetrachlorvinphos (Gardona®), *Bacillus thuringiensis* (Thuricide® or Dipel®), Pyrellin®, fonofos (Dyfonate®), SD-17250, N-2596, temephos (Bithion®), diazinon, dimethoate (Cygon®), dicofol (Kelthane®),

[1]Cobb, Patricia Powell and Max H. Bass. 1975. Beet Armyworm: Dosage-mortality Studies on California and Florida Strains. *J. Econ. Entomol.* 68(6):813-814.

[2]Harvey, L. F. 1976. New California and Texas Moths. *Canadian Entomologist* 8:54.

[3]Wilson, J. W. 1932. Notes on the Biology of *Laphygma exigua* Huebner. *Florida Entomologist* 16(3):33-39.

TABLE 1. BEET ARMYWORM CONTROL ON PEANUTS, EXPERIMENT 1, COFFEE COUNTY, ALABAMA

Treatment, active ingredient/acre	1 day after treatment		4 days after treatment	
	No. live larvae[1]	Percent control	No. live larvae[1]	Percent control
Methomyl 1.8 L, 1 pound	0.3	98	0.4	98
Methamidophos 4 EC, 1 pound	1.9	83	2.2	86
Monocrotophos 5 EC, 1 pound	6.2	45	8.8	44
Trichlorfon 4 EC, 2 pounds	6.2	45	9.4	40
Carbofuran 4 F, 1 pound	10.1	10	14.2	10
Tetrachlorvinphos 4 EC, 1 pound	11.4	0	15.3	3
Azinphosmethyl 2 EC, 1 pound	11.0	2	16.2	0
Pyrellin®,[2] 1 quart	12.2	0	17.4	0
Thuricide®,[3] 1 quart	11.9	0	17.4	0
Fonofos 4 EC, 2 pounds	13.3	0	19.9	0
Check	11.2	—	15.8	—

[1]Mean number of live larvae per row foot (9 row feet sampled per plot, each treatment replicated four times).
[2]0.6 percent pyrethrins, 0.5 percent rotenone.
[3]*Bacillus thuringiensis.*

phosphamidon, and malathion. All application rates are given as amount of active ingredient per acre.

Most materials were applied as sprays in a 12-inch band over the row using 2-gallon, hand sprayers delivering 12.5 gallons of insecticidal spray per acre. Baits were applied by hand in a 12-inch band over the row. Data were taken from the middle two rows. Counts of both live and dead beet armyworms were made in the following manner: A 3-foot section of row was randomly selected. The peanut plants were vigorously shaken to dislodge beet armyworm larvae. The plants were rolled back from the middles to the row on one side of the row and the number of live and dead larvae was determined and recorded. This procedure was repeated on the other side of the row so that all live and dead worms dislodged in this 3-foot section were counted. This entire procedure was repeated three times in each plot so that a total of 9 feet of row was sampled.

The economic injury threshold, based on number of larvae per foot of row, has not been established for the beet armyworm. For determining adequate effectiveness of materials, however, many researchers have used 80 percent control as an acceptable level. This minimum level of control was used in evaluating materials in the experiments reported here.

RESULTS

In experiment 1, beet armyworm populations were sampled 1 day and 4 days after the application of insecticides, table 1. One day after treatment only methomyl and methamidophos (both at 1 pound per acre) reduced beet armyworm

TABLE 2. BEET ARMYWORM CONTROL ON PEANUTS, EXPERIMENT 2, COFFEE COUNTY, ALABAMA

Treatment, active ingredient/acre	1 day after treatment		3 days after treatment	
	No. live larvae[1]	Percent control	No. live larvae[1]	Percent control
Methomyl 90 SP, 1 pound	0.4	91	0.5	90
Methomyl 1.8 L, 0.5 pound	.3	93	.5	90
Methomyl 90 SP, 0.5 pound	.4	91	.6	89
Methamidophos 4 EC, 1.5 pounds	.6	87	1.0	83
Trichlorfon 4% bait, 1 pound	1.9	55	2.4	57
Thuricide®,[2] 2 quarts	3.9	6	3.5	38
SD-17250 5 WP, 1 pound	3.1	26	3.9	31
N-2596 4 E, 1 pound	3.8	10	5.2	8
Temephos 50 WP, 1 pound	4.7	0	5.6	0
Check	4.2	—	5.6	—

[1]Mean number of live larvae per row foot (9 row feet sampled per plot, each treatment replicated four times).
[2]*Bacillus thuringiensis.*

populations by 80 percent or more. At 4 days post-treatment, again, the application of both methomyl and methamidophos at the 1-pound rate resulted in population reductions greater than 80 percent. The application of some of the remaining insecticides tested produced population reductions, but none approached 80 percent.

Experiment 2 included the materials that had been effective in experiment 1, (methomyl and methamidophos), but materials which had not been effective were dropped and replaced with previously untested compounds. Methomyl 90 SP at 1.0 and 0.5 pound per acre, methomyl 1.8L at 0.5 pound, and methamidophos 4E at 1.5 pounds all reduced populations by more than 80 percent 24 hours after treatment, table 2. No other materials afforded acceptable control. Data taken 3 days after treatment are also presented. The same pattern seen in table 1 is repeated. All rates and formulations of methomyl and methamidophos provided acceptable control. Other materials tested were considerably less effective.

Table 3 presents data from experiment 3. In this experiment, various formulations and rates of methomyl along with several previously untested materials were used. Data were collected at 24 hours only. A 2 percent methomyl bait used at the rate of 1 pound per acre afforded good control, as did 1/2 pound per acre of methomyl 90SP and methomyl 1.8 L. The 1/4-pound rate of methomyl provided acceptable control in one case but not in another. No other treatments resulted in acceptable population reduction.

TABLE 3. BEET ARMYWORM CONTROL ON PEANUTS 1 DAY AFTER TREATMENT, EXPERIMENT 3, COFFEE COUNTY, ALABAMA

Treatment, active ingredient/acre	No. live larvae[1]	Percent control
Methomyl 90 SP, 0.5 lb. .	0	100
Methomyl 1.8 L, 0.5 lb. . .	0	100
Methomyl 2% bait, 1 lb. .	0	100
Methomyl 1.8 L, 0.25 lb. .	1.0	86
Methomyl 90 SP, 0.25 lb.	1.8	76
Diazinon 4 EC, 2 lb.	5.8	23
Dimethoate 1.67 EC, 1 lb.	6.2	17
Dicofol 1.6 EC, 1 lb.	6.5	13
Phosphamidon 8 S, 1 lb. .	6.9	8
Malathion 4 EC, 1 lb.	7.5	0
Check	7.5	—

[1]Mean number of live larvae per row-foot (9 row feet sampled per plot, each treatment replicated four times).

SUMMARY

The use of methomyl 90 SP and methomyl 1.8 L at rates as low as 0.5 pound active ingredient per acre and the use of methamidophos 4 EC at 1 to 1.5 pounds provided consistently acceptable control of the beet armyworm in this series of tests. None of the other 17 materials tested provided acceptable control.