Comparative Toxicity of Some New Insecticides to the Beet Webworm in Colorado, 1951[1 2]

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Xhe beet webworm *(Loxoslege sticticalis* (L.)) is an important pest of sugar beets in the Great Plains and Rocky Mountain States. Its outbreaks are sporadic, as to both season and locality. Pepper and Hastings (1) * and Pepper (2) have shown that sterility is common among females of the beet webworm and that the presence of a large number of moths does not necessarily presage an outbreak of the larvae. Therefore, the degree of sterility is probably as important a factor in governing outbreaks as are favorable host plants, parasitization or weather conditions.

There are normally three generations a year. Generally, only the second generation is of economic importance, but occasionally, according to Maxson (3) , both the June and the August generations may cause serious injury.

Larvae in the first three instars feed largely on the underside of the leaves, but the next two instars may feed anywhere on the aerial parts of the plants. The larvae are most vulnerable to insecticides during the first few days after hatching.

In the infested areas there has probably been more money spent in controlling the beet webworm than any other insect attacking sugar beets. For years Paris green was the standard insecticide for this purpose. Later pyrethrum was used, but because of its instability in storage, lack of availability on short notice, and high cost, a pressing need existed for other effective insecticides. Within the last few years toxaphene has been used to a slight extent, but variable results with this insecticide have been reported.

In an experiment conducted in 1949 at the Twin Falls, Idaho, laboratory of the Bureau of Entomology and Plant Quarantine, parathion was the most effective insecticide tested against the beet webworm. In 1951 two experiments for the control of this insect were conducted at Gill and Longmont, Colorado, in cooperation with the Great Western Sugar Company, the Colorado Agricultural Experiment Station, and sugar beet growers. Several organic phosphorus compounds, several chlorinated hydrocarbons and pyrethrum were included in these tests, which are reported *in* this paper.

Methods

The sugar beet fields selected for treatment contained high and uniform infestations of beet webworms. The plants in Field 1 were small, with leaves from 8 to 10 inches long; those in Field 2 were larger, with leaves from 15 to 18 inches long and almost closing the space between the rows. The webworms in Field 1 were principally of the first and second instars; eggs were also hatching in this field. In Field 2 most of the larvae were in the third and fourth instars.

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[2] R. T. Nelson, the Great Western Sugar Company, and Leslie B. Daniels. Colorado Agricultural Experiment Station, cooperated m these experiments. Glenn E. Critser, Bureau of Enton-ology and Plant Quarantine, assisted in the field work.

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* Numbers in parentheses refer to literature cited.

The randomized block method was used in setting up the experiments. Ten treatments were tested in Experiment 1 and eight treatments in Experiment 2. Each treatment was replicated four times. Check plots were used in the first experiment but not in the second. The rows were 20 inches wide in Field 1 and 22 inches wide in Field 2. Because of the difference in width, Field 1 w-as divided into 16-row and Field 2 into 14-row parallel plots. These plots were 440 and 600 feet long, respectively.

The following insecticides were tested:

Aldrin	Dieldrin	Metacide
Chlordane	EPN	Parathion
Compound 269	Heptachlor	Pyrethrum
Compound 711	Lindane	Toxaphene

Endrin and isodrin are stereoisomers, respectively, of dieldrin and aldrin.

All materials were applied with a mist blower equipped with a U.S.D.A. air-broadcast nozzle (Figure 1). The blower was mounted on a trailer and pulled by a tractor; a different tractor was used in each field.

The sprays were prepared from emulsifiable concentrates added to the spray tank as it was being filled with water. The spray was applied in Field 1 July 3 at the rate of 6.4 gallons per acre and in Field 2 July 5 at 5.6 gallons per acre. Windy and inclement weather prevented more experimental work in the time allocated.

The effectiveness of the materials was determined by comparing pre- and post-treatment counts of larvae per leaf. The leaf samples were taken at random from the outer leaves of the beet plants at a predetermined distance along the center four rows of each plot. Leaf samples were taken two days before treatment and again three and two days after treatment—50 samples in Experiment 1 and 30 in Experiment 2.

Table 1.—Control of the Beet Webworm with Some New Insecticides (Experiment 1).

Insecticides	Toxicant per acre	Control after 5 days
	Pounds	Percent
Toxaphene	1.94	100
EPN	.25	100
Parathion	.25	99.8
Lindane	.21	99.8
Chlordane	1.49	99.5
Heptachlor	.97	98.4
Dieldrin	.19	98
Aldrin	.37	95.5
Pyrethrum	[1]	93
Difference req. for sig. (19:1)		2.7
Difference req. for sig. (99:1)		3.7

[1] 1 quart of a preparation containing not more than 18 percent of pyrethrum extractives.

Results and Conclusions

The results of these experiments are summarized in Tables 1 and 2- Statistical analyses of the data for Experiment 1 showed no significant differ-

Table 2.—Reduction of Beet Webworms with Some New Insecticides (Experiment 2).

Materials	Toxicant per acre	Reduction after 2 days
	Pounds	Percent
Compound 269	0.25	100
Compound 711	.25	99.3
Parathion	.23	98.8
EPN	.23	98.4
Tovaphene	1.10	97.6
Metacide	.54	96.7
Dieldrin	.20	91.6
Heptachlor	1.10	90.6
Difference req. for sig. (19:1)		6.1
Difference req. for sig. (99.1)		8.3

ence in the effectiveness of toxaphene, EPN, parathion, lindane, chlordane, heptachlor and dieldrin. Aldrin and pyrethrum were less effective. On the check plots the average pretreatment population was 2.8 larvae per leaf as compared with 2.3 larvae three days later.

In Experiment 2 there was no significant difference in the effectiveness of compounds 269 and 711, parathion, EPN, toxaphene and Metacide. There was also no significant difference between Metacide and dieldrin, but Metacide was significantly superior to heptachlor.

In comparing the results of the two experiments, it should be noted that, although the larvae were in different instars and were exposed to the insecticides for different periods, there was little difference in the relative effectiveness of the insecticides.

In the second experiment a light cross-wind while the insecticides were being applied resulted in poor coverage of the three outside rows on the windward edge of the plots, so that control was not entirely satisfactory.

These experiments show that chlordane, compounds 269 and 711, EPN, lindane, Metacide, parathion and toxaphene were all very effective, with no significant differences between them. Dieldrin and heptachlor were more

Figure I.—Mist blower used in applying the sprays.

effective against small larvae than against large larvae. Aldrin and pyrethrum were the least effective of any of the insecticides against the small larvae.

Since there is little choice between several materials on the basis of their insecticidal effectiveness, sugar beet growers in selecting and insecticide for beet webworm control should consider other factors, such as cost, availability, quickness of effect, residual effectiveness and personal safety during application. One of the important requirements is to apply the insecticide in such a manner as to obtain a complete coverage of the plants. The use of a mist blower in the experiments reported apparently had an important influence on the favorable results obtained.

Literature Cited

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