

PACIFIC SOUTHWEST Forest and Range Experiment Station

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OAK LEAF ROLLER:

contact toxicity of four insecticides applied to the larvae

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The oak leaf roller (*Archips semififeranus* [Walker]), a defoliator of oak and witch-hazel, is found in large numbers in Massachusetts, New Jersey, New York, Ohio, Pennsylvania; and in southwest Ontario, Canada. It was responsible for the complete defoliation and death of oaks on hundreds of thousands of acres in Pennsylvania in 1970. Larvae were as numerous as 500 per 30-inch branch sample. The following year, about a million acres in north central Pennsylvania were infested.¹

DDT was formerly used for chemical control, but its use in the United States is now banned. Verechagin, *et al.*² reported that DDT killed 98 percent of the oak leaf roller larvae in the forest in Moldavia, Russia.

This note reports laboratory tests of four insecticides as a preliminary step in finding alternatives to DDT for field testing against the oak leaf roller.

METHODS

Larvae were collected near Snow Shoe, Pennsylvania, in June 1972, and shipped to Berkeley, California. Those weighing 30 to 80 mg were treated at once or stored at 5°C for 1 day before treatment; those weighing less were held in 1-pint Nestrice cups lined with moist filter paper and fed red oak (*Quercus coccinea* [Muenchh.]), until they reached the weight range.

Four insecticides were tested: bioethanomethrin, mexacarbate, phoxim, and pyrethrins. Mexacarbate served as the standard. Insecticides were formulated on the basis of wt./vol. concentrations of the active ingredient. Insecticides were formulated in fresh acetone each day. Fresh formulations were prepared for each replication; each insecticide was replicated three times at five dose-levels.

Larvae (average weight: 51.6 mg) were treated in

Abstract: A defoliator of oak and witch-hazel, the oak leaf roller (*Archips semififeranus* [Walker]) is found in large numbers in northeastern United States and in southwest Ontario, Canada. DDT was formerly used to control this insect. As a preliminary step in finding alternatives to DDT for field testing against the oak leaf roller, four insecticides were evaluated in the laboratory. All four—bioethanomethrin, mexacarbate, phoxim, pyrethrins—caused 90 percent kill with less than 1 µg per insect.

Oxford: 145.7x18.28 *Archips semififeranus*: 414.12-015.3.
Retrieval Terms: *Archips semififeranus*; chemical control; insecticides; bioethanomethrin; mexacarbate; phoxim; pyrethrins; *Quercus* spp.; *Hamamelis* spp.

Table 1—Decreasing order of toxicity of four insecticides topically applied to the last two larval stages of the oak leaf roller (*Archips semiferanus*)

Insecticide	Insects treated	LD ₅₀ ¹	95 pct. fiducial limits	LD ₉₀ ¹	95 pct. fiducial limits	Toxicity ² ratio	Probit slope ± S.E.
Bioethanomethrin	210	0.021	0.015-0.027	0.077	0.062-0.103	49.0	2.31±.33
Pyrethrins	154	.19	.096- .29	1.1	.64 -3.6	3.5	1.72±.41
Mexacarbate	342	1.1	.90 -1.3	3.8	3.0 -5.1	1.0	2.36±.24
Phoxim	292	1.3	.94 -1.7	7.7	5.0 -16.0	.49	1.67±.26

¹Dose expression is µg/g body weight

²Toxicity ratio = LD₉₀ mexacarbate ÷ LD₉₀ candidate.

groups of 10 at the dosage of 1 µl per 100 mg body weight. They were treated topically with an ISCO model M microapplicator equipped with a ¼-cc tuberculin syringe fitted with a 27-gauge hypodermic needle. Two days after mortality counts, we measured head capsules to determine the larval stages. The measurements showed that we treated the last two larval stages.

Insecticides were applied topically to the prothoracic tergite of anesthetized (CO₂) larvae. Control insects were treated with acetone in the same manner. Insects were held after treatment in disposable plastic petri dishes (100 by 20 mm) lined with moist filter paper and fed red oak foliage. Both moribund and dead insects were included in mortality counts after 2 days. Data were analyzed by the probit analysis program of Daum.³

RESULTS

The LD₅₀ and LD₉₀ values with 95 percent confidence limits show that bioethanomethrin was significantly more toxic than pyrethrins, mexacarbate, and phoxim (table 1). Pyrethrins were significantly

more toxic than phoxim at LD₅₀ and LD₉₀. Bioethanomethrin was 49 and pyrethrins were 3.5 times more toxic than mexacarbate at LD₉₀. All four candidate insecticides caused 90 percent kill with a dosage of less than 1 µg per insect. The results justify further research on their use in the suppression of oak leaf roller.

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NOTES

¹Nichols, James O. *Cooperative economic insect report*. USDA Agric. Res. Serv. Plant Prot. Div. 21(25): 435. 1971.

²Vereschagin, B. V., S. G. Plugar, and D. V. Kompaniets. *Bor'ba s dubovoi listovertkoi v lesakh Moldavii*. [The control of oak leaf-roller in the forest of Moldavia.] *Biological Abstract* 1961(36): 7252. (English translation).

³Daum, R. J. *Revision of two computer programs for probit analysis*. *Bull. Entomol. Soc. Amer.* 16(1): 10-15. 1970.

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