Toxaphene for Mite Control

effectiveness established as control treatment for cyclamen mite, privet mite, and for mushroom mites

A. Earl Pritchard

Toxaphene—chlorinated camphene—is a relatively new insecticide. In experimental work during the past two years in the San Francisco Bay region, it has shown considerable promise for the control of certain mite pests of ornamental foliage and flowering plants, as well as of mushrooms.

Toxaphene was recommended previously for the control of leaf miners and leafhoppers on asters, the boxwood gall midge, the salt marsh caterpillar—not controlled with DDT—the gladiolus and other thrips, plant bugs, and weevils.

The percentage of active ingredient in toxaphene emulsions varies with the commercial formulation. An emulsion developed specifically for use on plants is now available commercially, and this formulation is reported to form a comparatively stable mixture with water. Toxaphene wettable powders have been very inconsistent in effectiveness.

Experimental work reported here has been with a 60% emulsion containing 1½ pounds actual toxaphene per quart. Most of the commercial trials on plants were made with one quart of this emulsion per 100 gallons of water, but twice this dosage was used on ivy and many other plants in small tests.

Cyclamen Mite

The cyclamen mite—*Tarsonemus pallidus* (Banks)—is one of the most persistent and noxious pests of ornamentals. Toxaphene has proved to be one of the best control materials available. It is effective only on those hosts where the mites are relatively exposed or where the plants can be trimmed to expose remaining mites.

Several applications are necessary—in order to contact new growth as it opens—to kill the mites as eggs hatch. Intervals between treatments vary from seven to 10 days under warm greenhouse conditions to 14 days in the cool lathhouse. Coverage must be as thorough as possible with emphasis placed on centers of new growth.

English ivy is a common host on which the cyclamen mite may be controlled with toxaphene. In a large greenhouse containing thousands of pots of ivy—many of which were heavily infested—the mites were nearly eliminated with three applications. A few plants—variety Sylvan Beauty—harbored the remaining mites, probably because of slow plant growth. Repeated treatments with two quarts of the 60% emulsion per 100 gallons of water has caused no damage to ivy.

African violets are another host on which good control has been obtained. Four applications were made to five greenhouses containing a total of about 50,000 pots of African violets—many infested with the cyclamen mite. Two months following treatment, about 12 scattered plants were found infested, and these were rogued out. No mites were found subsequently. Open blooms were burned by the chemical, but no more severely than by parathion.

Pelargoniums represent another host on which cyclamen mite may be controlled with toxaphene. About 2,000 very severely infested plants were sprayed three times with toxaphene, and no live mites were found afterwards. No damage was observed on any of the 25 varieties treated.

Azaleas harbor the cyclamen mite chiefly in the flower buds, and contact sprays are unable to reach the mites. By pruning the buds and growing tips and then spraying with toxaphene, excellent control has been obtained. About 60,000 greenhouse azaleas—many of them infested—were given four applications of toxaphene after being cut back. No mites were found following treatment. Nineteen varieties of the indica and kurume types were included in these tests. No plant injury was evident.

Bouvardias similarly need to be pruned before spraying for best control. The cyclamen mite was eliminated from a heavily infested greenhouse of bouvardia by cutting off the tips, followed by three applications of toxaphene.

Small scale tests indicate that toxaphene may be used safely and effectively for cyclamen mite control on fuchsias and gynura.

Unfortunately, no effective control has been obtained with toxaphene for cyclamen mite on cyclamen. One greenhouse of infested plants was sprayed twice, and considerable yellowing and wilting of the leaves was caused. Infestation of cyclamen can be prevented by eliminating the source of infestation in a nursery.

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Bouvardia—healthy blooms, *left;* and flowers affected by the cyclamen mite, *right*. Pruning and toxaphene sprays eradicated mites from the greenhouse of infested plants.

WEEVIL

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when the first pods form, about the first part of April, and should continue at about 12-day intervals. If this program is followed growers should obtain about 95% control or better.

Benzene hexachloride and lindane will also keep the cabbage aphid under control. In one experiment at Pescadero it was found that dieldrin did not control this aphid, and so a good aphicide might be necessary if this particular chemical were used.

The adult weevil is about one-eight inch long, and is gray to black in color. The mouth parts are located at the tip of the long snout. The female weevil lays her eggs in the interior of the seedpod by means of punctures made by her snout and mouth parts. The egg then lies adjacent to the developing seeds.

The weevil grubs or larvae hatch from the eggs within a few days and begin feeding on the immature seeds. They feed for three to four weeks and consume or injure five to six seeds apiece. It is this stage of the life cycle that causes economic loss in the form of seed damage. Control is not possible during this stage but must be attempted against the adults, prior to oviposition. Upon reaching maturity the larvae make a circular hole in the shell of the seedpod, preparatory to emergence.

The mature larvae squeeze through the emergence holes in the seedpods and drop to the ground. They work themselves beneath the soil surface to a depth of one-half to two inches and construct a small earthen cell around themselves. The larvae pupate in these cells and remain dormant for about three weeks. At the end of the pupal stage the adults emerge from their cells and come out of the ground.

The weevils overwinter as adults in debris or in the soil. Early in the spring they emerge—the exact date depending upon the season and climatic conditions. The first adults usually emerge during the latter part of March or first part of April—timed with the appearance of the first blossoms of their cruciferous host plants. They are attracted to the flowers, feed to some extent upon pollen, but cause little damage at this time. Mating takes place soon after emergence, and the fertilized female begins laying her eggs in the first small developing seedpods. Hibernating weevils continue to emerge into June and fly into commercial plantings.

Following a single generation, adults emerge from the ground, crawl and fly to the plants and feed upon the flower parts, stems, or pods. They do not oviposit, but continue to emerge from the latter part of May into August. Thus, the next season's generation of weevils is found in association with their parents. The feeding of the new generation of weevils often results in the production of beads of plant sap. This syrupy exudate occurring on the pods at the end of the seedpod growth should not cause undue concern.

When the population of weevils rises to a point that results in 80% to 90% of seedpod infestation, the actual seed loss may reach 40% to 50%. Under these conditions the total seed clean-out after harvest is even greater and causes severe economic loss to the grower. Seed losses of this severity are caused by the occurence of two to four weevil grubs in each infested pod.

The presence of a large number of natural uncultivated hosts or weeds in the vicinity of the commercial seed crops builds up and maintains the weevil population. This source of weevils assures economic losses on commercial crops once the pest has become established, subject of course to some reduction from parasite activity.

Investigations to date indicate that any seed loss of more than 5% to 10% necessitates some control measure. Usually the extent of seed loss will eventually level off at 20% to 25% when there are enough cultivated and uncultivated hosts to maintain a moderate to heavy weevil infestation.

Growers using chemical dusts for control treatment should use adequate respirators during dusting operations, and take other precautions prescribed by the manufacturers of the materials.

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TOXAPHENE

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Poor control has been obtained on Japanese aralia, because the new leaves open so slowly. Methyl bromide fumigation is preferable for this host.

Privet Mite, Mushroom Mites

The privet mite—*Brevipalpus inornatus* (Banks)—is a common pest of azaleas and other plants in California. It is a tiny, flat, bright red mite that feeds on the under surface of the leaves. Parathion or TEPP are of no value for its control. A single application of toxaphene, at a rate of one quart of the 60% emulsion per 100 gallons of water, gave 100% control in small plots of azaleas. About 5,000 lathhouse azaleas, moderately to severely infested with the privet mite, were similarly treated. One live female was found on 50 leaves examined three weeks later, and the infestation had returned one year later. Two spray applications would be preferable when large numbers of plants are involved.

Several species of mites have long been a scourge to mushroom growers. Those belonging to the genus *Anoetus*—formerly known as *Histiostoma*—are the most important in the Half Moon Bay area. Their hypopi—a special migratory stage—may build up in such incredible numbers as to cover the casing soil and mushrooms. Predaceous mites belonging to the family Ascaidae also build up and scar the mushrooms.

Small, replicated plots containing such a mite infestation, were used for screening tests. One hundred per cent control was obtained with toxaphene at a rate of two quarts of the 60% emulsion per 100 gallons of water. Relatively poor control was obtained with parathion, Neotran or K-1875, Ovotran or K-6451, Gen. Chem. 923, and Dimite, at the dosages used.

Subsequent tests in mushroom houses have mostly been with toxaphene as a residual spray for the woodwork and treatment of the compost. In replicated plots of compost treatment on the benches, no adverse effects from toxaphene were noted with regard to either mycelial growth or mushroom production. It is true, however, that mite injury usually rendered the check plots poor comparisons.

In larger scale experiments, several entire houses were treated. In preparing for a new crop, the walls and benches were sprayed thoroughly with the 60% emulsion diluted at a rate of two quarts per 100 gallons of water and applied at a rate of 1½ quarts of the diluted spray per 100 square feet. In this connection, the usual practice of cyanide fumigation and DDT residual sprays was discontinued. After the compost in the benches was heated and just prior to placing the spawn, the surface of the compost and the woodwork were again treated. The casing soil used had been sterilized with chloropicrin.

Mushroom houses thus treated remained practically free of mites—as well as flies and springtails—for the duration of the crop.

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