ACARICIDE TRIALS IN BRITISH COLUMBIA ORCHARDS, 1950[1]

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Although the two acaricides parathion and monoethanolamine dinitro-o-cyclohexylphenolate, presently being recommended for British Columbia orchards, are reasonably effective, each has shortcomings that mark it for replacement as soon as possible. Parathion, first recommended for the control of orchard mites in 1949, has a serious disadvantage in its high toxicity to mammals. Furthermore, it lacks specificity and it is not sufficiently effective against the Willamette mite, *Tetranychus flavus* Ewing. Monoethanolamine dinitro-o-cyclohexylphenolate, commonly called mono-DNP by British Columbia growers, may cause some foliage injury. Although it seems to be a selective acaricide, largely innocuous to parasites and insect predators, it can no longer be used generally because most of the spraying is done by automatic concentrate sprayers and these machines increase phytotoxic effects. A second weakness of mono-DNP is its relatively weak acaricidal effect in cool weather. Hence it cannot be used in the "pink"[3] application, which, in British Columbia, is the most favoured spray against the European red mite, *Metatetranychus ulmi* (Koch). Furthermore, mono-DNP is sometimes injurious to the tender young foliage of the early part of the season even when applied by conventional spray gun.

During the season of 1950, field experiments were undertaken with promising new acaricides against the most troublesome orchard mites in the Okanagan Valley of British Columbia. The new acaricides and their performance in the orchard are discussed herewith.

Acaricides under Trial[4]

C-1006 (50 per cent p-chlorophenyl p-chlorobenzene sulphonate; Dow Chemical Co.).—This compound has a low human toxicity rating but a high phytotoxicity rating. Applied to apples in the pink stage at a concentration of 1.5 pounds[5], it caused severe foliage injury to McIntosh, Delicious, Newtown and Winesap. When applied in August at 1 pound it injured Newtown but not Delicious and Winesap.

EPN 300 (27 per cent ethyl p-nitrophenyl thionobenzene phosphonate; E. I. DuPont Co.).—Although EPN 300 has a lower human toxicity rating than parathion, it is, nevertheless, very poisonous. When applied to apple in the pink stage at 0.75 pounds, it injured foliage of McIntosh but not of Delicious, Newtown or Winesap.

KARATHANE (25 per cent dinitro capryl phenyl crotonate; Rohm and Haas Co.).—As a pink application to apple at 1.5 pounds, this dinitro compound has not caused foliage injury to Delicious, McIntosh, Winesap, Jonathan or Newtown, but applied to Newtown in August at the same concentration it caused a slight amount of foliage injury.

R-242 (50 per cent p-chlorophenyl phenyl sulphone; Stauffer Chemical Co.). — This compound has a low human toxicity rating and as a pink or summer application to apple, at 2 pounds, has not caused injury to Delicious, McIntosh, Newtown, Winesap or Jonathan.

ARAMITE (15 per cent beta-chloroethyl beta-(p-tertiary butylphenoxy) alpha methyl ethyl sulphite; Naugatuck Chemicals).—Aramite is rated low in toxicity to humans; and as a pink or summer application, at 2 pounds, has not injured Delicious, McIntosh, Newtown, Winesap or Jonathan.

Effects of Acaricides on Orchard Mites

European Red Mite, *Metatetranychus ulmi* (Koch).—Since the introduction of DDT, this mite has been one of the

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3 The term pink is used to denote that period of development when the floral buds have just separated in the cluster and before the first flower has opened.

4 All acaricides were used in the wettable powder form.

5 All concentrations are for 100 imperial gallons (approximately 120 U.S. gallons).

most troublesome orchard pests in the Okanagan Valley. Experimental work carried out by officers of the Summerland laboratory has shown that parathion applied at the pink stage of apple development is highly effective against the red mite. In 1950, several of the newer acaricides were applied at that stage for comparison with parathion. No further acaricide applications were made until the first week in September, when acaricides had to be applied for the control of the two-spotted spider mite. Mite populations were sampled two weeks, one month, and two months after spraying. The results from three orchards are averaged and summarized in Table I.

TABLE I

Effects of pink application of acaricides on the European red mite; materials applied by a conventional hand-gun sprayer.

Acaricide	Amount per 100 gal.	Average number of mites per leaf during season
C-1006 (50%)	1.5 lb.	0.17
Parathion (15%)	1.0 lb.	0.34
EPN 300 (27%)	0.75 lb.	0.40
R-242 (50%)	1.5 lb.	0.44
Karathane (25%)	1.5 lb.	1.88
Check—no treatment		6.74

Two-Spotted Spider Mite, *Tetranychus bimaculatus* Harvey; and Pacific Mite, *Tetranychus pacificus* McG.—These mites are considered together because they generally coexisted in 1950 and occurred together in the trial plots.

The two-spotted spider mite was not a major pest of Okanagan Valley orchards until August, 1950, when it became most troublesome and widespread. The Pacific mite was also more abundant than for several years past. In fact, as pests these two mites replaced the European red mite in importance.

An experiment was carried out to compare several new acaricides with parathion for control of these two species of mites on Delicious, Newtown, Winesap, Jonathan and Yellow Transparent apple trees. The results are summarized in Table II.

TABLE II

Effects of acaricides on the two-spotted spider mite and the Pacific mite; materials applied by a conventional hand-gun sprayer in August, 1950.

Acaricide	Amount per 100 gal.	Average mites per leaf		
		Before spraying	After spraying	
		Aug. 29	Sept. 8	Sept. 13
Aramite (15%)	2 lb.	13.7	0.2	0.4
Parathion (15%)	1 lb.	22.3	0.3	0.6
C-1006 (50%)	1 lb.	39.4	1.8	0.5
R-242 (50%)	2 lb.	30.3	2.3	2.9
Karathane (25%)	1.5 lb.	46.4	3.4	3.3
Check—no treatment		8.0	13.4	18.5

Willamette Mite, *Tetranychus flavus* Ewing.—This pest, first reported in the Okanagan Valley in September, 1949, at Summerland, has been found since then at Oliver, Penticton, and Kelowna.

Early in 1950, before the mite had an opportunity to do a great deal of damage, a few materials, some of which were available to the grower, were applied to single limbs of Delicious apple trees in a preliminary experiment. Before and after the materials had been applied, 10 leaves were picked at random from each of the treated limbs. The leaves were examined for mites under a microscope. Results are summarized in Table III.

TABLE III

Effects of acaricides on the Willamette mite: materials applied by a conventional hand-gun sprayer in July, 1950.

Material	Amount per 100 gal.	Average number mites per leaf Before spraying July 5	After spraying July 10
Parathion (15%)	1 lb.	2.3	0
Dinitro-o-cyclohexyl phenol (40%)	5 oz.		
Parathion (15%)	1 lb.	5.3	0
Stove oil[6]	1 qt.		
Parathion (15%)	2 lb.	14.9	0.2
Dinitro-o-cyclohexyl phenol (40%)[7]	5 oz.	9.2	0.2
EPN 300 (27%)	1.5 lb.	19.1	0.5
Check—Water		5.4	10.1

6 34 S.S.U. Vis. 100°F., over 75% U.R.

7 DN-Dry Mix No. 1. Dow Chemical Co., Toronto, Ont.

As an outcome of this experiment, a mixture of 15 per cent parathion, 8 pounds per acre, and 40 per cent dinitro-o-cyclohexylphenol, 2 pounds per acre, was applied to Delicious apple trees by an automatic concentrate sprayer. Excellent control was achieved; the Willamette mite remained at a very low level for seven weeks. Spray injury was confined to sucker growth. In another orchard heavily infested with the Willamette mite, two parathion-dinitro mixtures were applied with an automatic concentrate sprayer. In one plot parathion was maintained at 8 pounds per acre and in a second plot it was reduced to 3 pounds per acre. There was little difference in degree of control between the two plots.

In another experiment three of the new acaricides were compared with parathion alone. Four trees were sampled in each plot of 15 to 20 trees. Samples from each tree consisted of 100 leaves, and an estimation of effectiveness was made from the number of infested leaves. The toxicants were applied with an automatic concentrate sprayer in August, 1950. Results are summarized in Table IV.

TABLE IV

Effects of acaricides on the Willamette mite: materials applied by an automatic concentrate sprayer in August, 1950.

Acarcide	Amount per acre	Percentage infested leaves Before spraying Aug. 24	After spraying Aug. 31	Sept. 1
Aramite (15%)	12 lb.	84.2	1.7	0
Karathane (25%)	12 lb.	97.5	0.5	0.2
R-242 (50%)	12 lb.	99.2	39.0	41.7
Parathion (15%)	8 lb.	90.5	60.2	61.5
Check—no treatment		99.2	96.2	97.0

Summary

(1) During 1950, five new, promising acaricides were compared with parathion for control of various mites in orchards of British Columbia. These were:

C-1006 (50 per cent p-chlorophenyl p-chlorobenzene sulphonate).

EPN 300 (27 per cent ethyl p-nitrophenyl thionobenzene phosphonate).

KARATHANE (25 per cent dinitro capryl phenyl crotonate).

R-242 (50 per cent p-chlorophenyl phenyl sulphone).

ARAMITE (15 per cent beta-chloroethyl beta-(p-tertiary butyl phenoxy) alpha methyl ethyl sulphite).

(2) C-1006 has a low human toxicity rating but a rather high phytotoxicity rating. At 1.5 pounds per 100 gallons, it was the most effective acaricide used in the pink application for control of the European red mite. When used as a summer spray at 1 pound, it

gave excellent control of the two-spotted spider mite and the Pacific mite.

(3) EPN 300 has a high human toxicity rating and a medium phytotoxicity rating. When applied in the pink stage at 0.75 pounds it gave good control of the European red mite although it was somewhat inferior to 1 pound of parathion. At 1.5 pounds it gave considerably better control of the Willamette mite than 1 pound of parathion.

(4) KARATHANE applied at the rate of 1.5 pounds was not so effective as 1 pound of 15 per cent parathion when used as a pink application for control of the European red mite, or when used in summer applications for control of the two-spotted spider mite and the Pacific mite. When applied in the summer by an automatic sprayer at 12 pounds per acre, however, it gave excellent control of the Willamette mite. Although it caused a very slight amount of damage to Newtown apple trees in August, it has a low phytotoxicity rating.

(5) R-242 has a low human toxicity rating and a low phytotoxicity rating. At 1.5 pounds, it was slightly less effective than 1 pound of parathion (15 per cent) when used as a pink application for control of the European red mite. When used in the summer at 2 pounds it was not so effective as 1 pound of parathion for control of the two-spotted spider mite and the Pacific mite. When used at 12 pounds per acre in a concentrate sprayer, however, it was slightly more effective against the Willamette mite than 8 pounds of parathion.

(6) ARAMITE has a low human toxicity rating and low phytotoxicity rating. When applied in the summer at 2 pounds, it gave excellent control of the two-spotted spider mite and the Pacific mite. Also, when applied by a concentrate sprayer at 12 pounds per acre, it gave excellent control of the Willamette mite.

NOTES ON THE SPRING ACTIVITY OF THE ROCKY MOUNTAIN WOOD TICK, DERMACENTOR ANDERSONI STILES (ACARINI: IXODIAE)[1]

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One of the remarkable features in the life-cycle of the Rocky Mountain wood tick, *Dermacentor andersoni* Stiles, in British Columbia is the annual appearance of adults at the beginning of spring and their regular disappearance about the middle of May. Such seasonal periodicity is natural for most insects, of which the adult stage is generally of short duration. However, ticks usually live longer than insects, and it would be expected that adults of the Rocky Mountain wood tick, which are herewith shown to be capable of living for at least 1 year, which continue to be active as long as the weather remained favourable. Such is not the case, however, and though in Alberta and in the damper regions of British Columbia adults of this species may be active as late as June, in the British Columbia dry-belt they disappear regularly in May, regardless of how moist or cool the prevailing atmospheric conditions are. It is suggested that some form of diapause must take effect, releasing its hold only after another winter has passed.

In the Interior of British Columbia the Rocky Mountain wood tick is distributed throughout the greater part of the dry bunch-grass open-land. Its peak abundance may vary, depending on the locality, from sparse populations to heavy concentrations. The latter occur in scattered parts of the Province where host and climatic conditions are apparently particularly ideal for tick development and survival. One such site is at Rayleigh, 10 miles north of Kamloops, B. C., where there is an extensive talus slope backed by a rocky bluff 200 feet high. The narrow belt of vegetation at the base of the cliff, besides harbouring a variety of rodent life, seems regu-

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