PRELIMINARY TRIALS WITH CITRAZON—A SELECTIVE ACARICIDE[1]

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ABSTRACT

Citrazon (Ethyl O-benzoyl 3 chloro-2, 6-dmethoxy benzohydroximate) was compared with two organotin acaricides Plictran and Vendex for mite control on apples and pears. Citrazon controlled the phytophagous European red mite, **Panonychus ulmi** (Koch) as effectively as Plictran and Vendex and all were low in toxicity to the phytoseiid mites, **Typhlodromus occidentalis** Nesbitt and **T. columbiensis** Chant. Unlike Plictran and Vendex, Citrazon was much less toxic to another predatory mite, **Zetzellia mali** Ewing, and to the pear rust mite, **Epitrimerus pyri** (Nal.).

An essential feature of a good acaricide for integrated mite control is that it be selective. The ideal one would be toxic to all harmful mites but innocuous to the beneficial mites. When used at the half-inch green bud stage, mineral oil is very selective as it is toxic to the eggs of the European red mite, *Panonychus ulmi* (Koch), but has little toxicity to the predaceous phytoseiid mites, eg. *Typhlodromus occidentalis* Nesbitt, or to apple rust mite, *Vasates schlechtendali* Nal., (Downing 1967). Rust mites are an important alternate food source for phytosiids as shown by Collyer (1964) and help to make integrated mite control a success. Oil, however is not the ideal acaricide as it can be phytotoxic and cannot be used with safety during the summer season. Propargite and the new organotin acaricides such as Plictran and Vendex are selective as they are toxic to European red mite, McDaniel spider mite, *Tetranychus mcdanieli* McG., and have low toxicity to the predaceous mite *T. occidentalis*. However, these acaricides are toxic to rust mites and to another predaceous mite, *Zetzellia mali* Ewing, and may under certain circumstances do more harm than good. This is a report of laboratory and field trials with a new acaricide, Citrazon.

MATERIALS AND METHODS

Citrazon was introduced by Nippon Soda Co. Ltd., Tokyo, Japan, and is being developed in Canada by Ciba-Geigy Canada Ltd. Its chemical identity is Ethyl 0-benzoyl 3-chloro-2, 6-dimethoxy benzohydroximate. Citrazon, 20% emulsifiable concentrate was compared with the following selective acaricides in laboratory and orchard experiments:

Plictran 50% wettable powder, tricyclohexyltin hydroxide. Vendex 50% wettable powder, Hexakis (beta, beta-dimethylphenethyl)-distannoxane.

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Laboratory and Greenhouse Experiments

Toxicities of Citrazon and Plictran against the native mite predators, *T. occidentalis*, *T. columbiensis* Chant and *Z. mali*, were tested in a Potter Spray Tower. Five predators were placed on waxed black paper. This was floated on cotton saturated with water in petri dishes. Dishes were placed in the spray tower and exposed to 2 ml of the spray mixture. Treatments were replicated 6 times. Examination of the predators with a steremicroscope was made 1, 2, and 3 days after treatment and the percentage mortalities obtained were corrected for natural mortality in the check plots according to the method of Abbot (1925).

European red mites were reared on potted Red Delicious apple trees in a greenhouse and these were sprayed on a turntable with a Kellog-American compressed-air paint gun sprayer that produced a fine even spray at a pressure of 15 lb. per square inch (1 kg per sq. cm). Volume of spray was not measured but each tree was thoroughly sprayed to runoff. Treatments were replicated 5 times. Estimates of mite populations were made 3 and 10 days after spraying by taking 5 leaves from each tree and processing them by the method of Henderson and McBurnie (1943) as modified by Morgan *et al.* (1955).

Orchard Experiments

Sprays were applied with a high volume hand gun sprayer operated at 425 p.s.i. (30 kg per sq. cm) and the trees were sprayed until dripping. Orchard trees were either Red or Golden Delicious on semi-dwarf rootstalk or Bartlett pears, all spaced 7½ ft. by 15 ft. (2.28 m x 4.57 m). Plot size was 3 trees with 3 replicates per treatment except for the experiment summarized in Table 3 in which only 2 replicates were available. Estimates of mite populations were made on 25-leaf samples taken from the middle tree of each replicate and processing these as above.

RESULTS AND DISCUSSION

Laboratory and Greenhouse Experiments

Table 1 shows that neither Citrazon 20% E.C. 0.5 pt (284 ml) nor Plictran 50% W. P. 4 oz. per 100 gal. (25 gm per 100 l) were toxic to the 2 predaceous phytoseiid mites, *T. occidentalis* or *T. columbiensis* Chant: that Citrazon was not toxic to the predaceous stigmaeid mite, *Z. mali*, but Plictran was. *T. occidentalis* is the most important of the 3 predators but under certain conditions the other predators may be valuable in regulating the densities of European red mite. *T. columbiensis* is much more cold-hardy than *T. occidentalis* and sometimes after a very cold winter is the only phytoseiid species that is present in commercial orchards. *Z. mali* unlike *T. occidentalis*, can usually survive when prey densities are very low and is sometimes the only predeaceous mite found in some commercial orchards.

TABLE 1. Corrected percentage mortalities of mites in petri dishes 3 days after application of acaricides in a Potter Spray Tower.

Acaricide per 100 gal.	T. occidentalis	T. columbiensis	Z. mali
Citrazon 20% E. C. 0.5 pt.	0	3	0
Plictran 50% W. P. 4 oz.	0	0	78

Citrazon and Plictran were equal in toxicity to the European red mite and *T. occidentalis* on apple trees in greenhouse trials. Both acaricides controlled the phytophagous mite and allowed some survival of the predaceous mite as shown in Table 2.

Orchard Experiments

Vendex and Citrazon showed a low toxicity level when tested against *T. occidentalis* on Red Delicious apple trees. Even 1 pt per 100 gal. concentration (125 ml per 100 litre) of Citrazon, which is twice the concentration of

TABLE 2. Numbers of mites per 25 leaves after application of acaricides to potted apple trees in a greenhouse.

Acaricide per 100 gal.	European red mite		T. occidentalis	
	3 days	10 days	3 days	10 days
Citrazon 20% E. C. 0.5 pt	12	2	6	1
Plictran 50% W. P. 4 oz.	12	10	1	2
Check - no treatment	260	378	11	17

active ingredient of either Vendex or the lower rate of Citrazon, allowed good survival of this predatory species (Table 3). On Golden Delicious trees, Citrazon gave quicker control of European red mite and was almost non toxic to *Z. mali*. Vendex, on the other hand, was slow in controlling the red mite and quite toxic to the predator *Z. mali* as summarized in Table 4.

Citrazon was compared with Plictran against the pear rust mite, *Epitrimerus pyri* (Nal.), and as shown in Table 5, Citrazon 20% E.C. at 0.5 pt. or 1 pt. per 100 gal. (62.5 ml or 125 ml per 100 l) did not give adequate control whereas control with Plictran was excellent.

TABLE 3. Numbers of **T. occidentalis** per 50 leaves before and after application of acaricides to orchard apple trees with a high volume hand gun sprayer, 18 July 1973.

Acaricide per 100 gal.	Before spraying	After spraying		
	July 17	July 24	Aug. 1	Aug. 9
Citrazon 20% E. C. 0.5 pt	90	21	23	24
Citrazon 20% E. C. 1.0 pt	119	11	9	8
Vendex 50% W. P. 4 oz.	99	15	17	10
Check - no treatment	112	29	28	17

TABLE 1. Numbers of mites per 75 leaves before and after application of acaricides to orchard apple trees with a high volume hand gun sprayer, 26 June 1973.

Acaricide per 100 gal.	Before spraying	After spraying			
	June 26	July 3	July 11	Aug. 3	Sept. 5
	European red mite				
Citrazon 20% E. C. 1 pt	608	0	8	60	96
Vendex 50% W. P. 4 oz.	1208	121	192	7	33
Check - no treatment	688	348	3082	58	0
	Zetzellia mali				
Citrazon 20% E. C. 1 pt	10	8	37	113	204
Vendex 50% W. P. 4 oz.	21	3	0	3	32
Check - no treatment	29	44	251	174	62

This low toxicity to eriophyid mites such as the pear rust mite or its close relative, the apple rust mite, may be more of an advantage for integrated control programs on apple because, as stated earlier, rust mites are an excellent alternate food source for predaceous phytoseiid mites. Citrazon appears to have qualities that will make it an excellent acaricide for integrated mite control programs on apple. It seems to be sufficiently toxic to European red mite to reduce an outbreak to subeconomic levels. The low toxicities of Citrazon to the predaceous mites, *T. occidentalis*, *T. columbiensis* and *Z. mali*, and most likely to the alternate food source for the predators, the apple rust mite are very desirable properties of a selective acaricide and would make Citrazon useful for integrated mite control programs on apple.

TABLE 5. Numbers of pear rust mite per 75 leaves after application of acaricides to Bartlett pears with a high volume hand gun sprayer, 16 July 1974.

Acaricide per 100 gal.	Before spraying	After spraying			
	July 15	July 22	July 26	Aug. 7	Aug. 13
	Pear rust mite				
Citrazon 20% E. C. 0.5 pt	30,500	245	296	417	940
Citrazon 20% E. C. 1.0 pt	19,400	80	170	543	846
Plictran 50% W. P. 4 oz.	30,200	4	8	6	28
Check - no treatment	18,900	3016	2016	1704	2108

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