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CONTROL OF THE FRUIT TREE RED SPIDER MITE PANONYCHUS ULMI KOCH WITH FENPROPATHRIN AND FLUCYTHRINATE IN APPLE ORCHARD

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Among modern pesticides synthetic pyretroids present a very controversial group. Their high effectiveness in controling a wide range of insect pests, low mammalian toxicity and relatively low production cost are major adventages. On the other hand a number of disadvantages are listed, among which stimulating effect on spider mites population is one of the most important [3, 4, 7]. Recently a number of compounds was developed which show a considerable miticidal activity, apart from insecticidal one. First materials with miticidal side effect include fenpropathrin produced by Sumitomo Chem. Co. in Japan, and flucythrinate produced by American Cyanamid Chem. Co. in the USA. Their miticidal properties were reported by Whitney and Wettstein 1979, Nicholls and Peecock 1981, Wettstein 1981, 1983 [6, 10, 11]. Both materials were tested at the Institute of Pomology and Floriculture as commercial preparations under trade name of Meothrin 20 EC and Danitol 10 EC containing fenpropathrin and Cybolt 100 EC containing flucythrinate. In the present paper results of a field test on their acaricidal effectiveness in controling the fruit tree red spider mite, Panonychus ulmi Koch are presented.

MATERIAL AND METHODS

The experimental orchard was located in the Experiment Station Swierklaniec of the Institute of Pomology and Floriculture (near Katowice).

The 15 years old quarter of McIntosh orchard was divided into plots 0,05 ha each. The plots were treated with the same material from 1979 to 1983. The treatments were executed when the mite population exceeded economic treshold e.i. three

mites per leaf in May, June and early July or five mites per leaf in late July, August and September. Mite counts were made in three samples of 50 leaves per plot collected at about two-week intervals. Henderson's and Mc Burnie [2] brushing machine was used for the counts. Results were analysed statistically using R. A. Fisher procedure and Duncan's multiple range test at significance level α = 5%. Additionally Cumulative Indices of Infestation were computed according to Wratten et al. (see [9]) for each year and dose separately:

$$\sum_{0=1}^{n=k-1} \left(\frac{t_n}{2}(x_n + x_{n+1})\right)$$

where k - number of occasions on which the mites were counted; x_n, x_{n+1} - consecutive indices; t_n - time, in days, between the consecutive indices x_n, x_{n+1}. These indices were recalculated into percentages versus index for the check = 100% to allow the comparison between consecutive years. Tetradifon (Roztoczol extra pł. 8), cyhexatin (Plictran 25 W) and azocyclotin (Peropal) were used as reference acaricides.

Additionally in September 1980 leaf injury were estimated according to 5--grade superficial care where 0° indicated to injury and 4° full discoloration of the leaves.

RESULTS AND DISCUSSION

Dose rates of the materials were applied in accordance with the suggestion of the manufacturer. Initially they were rather high but after one or two years of testing they were considerable decreased. Within two initial years of the experiment both materials provided excellent control of the mite, comparable to one obtained with reference acaricides (Tables 1 and 2). Leaf injury estimates obtained in 1980 show completely healthy leaves in pyretroid-treated plots while in acaricide treated ones 1° to $1,5^o$ of injury were noted and complete discoloration (4°) in check plot were recorded (Table 2).

In the third and the fourth year of the experiment number of mites per leaf began to increase after seven or eight weeks post treatment in flucythrinate treated plots, but the population exceeded economic treshold only in 1982, ten weeks after treatment. On tetradifon-treated plots population increase started much sooner so repeated application was necessary on June 25 (Tables 3 and 4). In

Table 1

Average number of mites (mobile stages) per 50 leaves in 1979

Materials tested*	Doses (g a.i. per ha)	Counting dates				
		13.07.	25.07.	10.08.	17.08.	22.08
Check	-	114.3	166.7 c	185,3 c	365.0 d	477,3 d
Fenpropathrin	150	484.0	2.6 a	0.0 a	0.0 a	0.0 a
Flucythrinate	112	179.7	0.0 a	0.0 a	4.0 b	1.9 b
Tetradifon	240	166.7	43.0 b	12.5 b	15.4 c	22.4 c

*Application date: 20 July.
Averages marked with the same letter symbol do not differ from one another at α = 0,05 according to Duncan's multiple rang test.

Table 2

Average number of mites (mobile stages) per 50 leaves in 1980

Material tested*	Doses (g a.i. per ha)	Counting dates						Degree of leaf injury date 15.08
		9.06	19.06	30.06.	9.07.	29.07	12.08	
Check	-	388	274 c	3526 d	1291 c	717 c	406 d	4
Fenpropathrin	150	245	1 a	15 a	0 a	0 a	0 a	0
Flucythrinate	75	226	3 a	28 b	3 a	1 a	8 a	0
Cyhexatin	375	220	16 b	23 a	42 a	14 a	80 b	0
Azocyclotin	375	283	9 b	31 b	28 a	19 a	109 b	1
Tetradifon	240	165	12 b	532 c	137 b	92 b	287 c*	1,5

* Application dates: 16 June and 1 September.
Further explanations as in Table 1.

the fifth year of the experiment there was also a strong increase of the mite population in tetradifon and flucythrinate treated plots. Thus repeated application of tested materials was necessary on August 5. Slight increase of the population density was observed also in other plots, but it was far below economic treshold (Table 5).

Analysis of cumulative indices of infestation also indicates gradual increase of mite problem in flucythrinate-treated plots. The indices grow from 0,4% in 1979 to 18,9% in 1982 and 16,6% despite second applications of the miticide in 1983 (Table 6). There was not such an increase in fenpropathrin and organo tin acaricide-treated plots. However in the tetradifon-treated plots mite control was the poorest and three times in five years the second treatment was necessary. This material, however, is commercially applied in Poland since early sixthies

Table 3

Average number of mites (mobile stages) per 50 leaves in 1981

Materials tested*	Doses (g a.i. per ha)	Counting dates				
		14.07.	17.07.	29.07.	18.08	27.08
Check	-	754.7	-	205.3 d	233.3 d	226.7 c
Fenpropathrin	75	429.3	6.7 a	1.3 a	1.3 a	0.0 a
Flucythrinate	75	892.0	21.3 b	6.7 b	9.3 b	30.7 b
Cyhexatin	375	224.0	0.0 a	1.3 a	4.0 a	8.0 a
Azocyclotin	375	313.6	26.8 b	0.0 a	2.0 a	2.6 a
Tetradifon	240	582.7	122.7 c	73.3 c	80.0 c	292.0 c

*Application date: 15.07.

Table 4

Average number of mites (mobile stages) per 50 leaves in 1982

Material tested*	Doses (g a.i. per ha)	Counting dates							
		31.05	3.06	15.06	9.07	28.07	10.08	21.08.	7.09
Check	-	93.0	87.5 c	900.3 c	365.5 b	913.9 d	1799.4 d	1685.8 d	2127.0 d
Fenpropathrin	75	17.7	0.2 a	0.6 a	0.6 a	7.7 a	51.3 b	125.9 b	133.2 b
Flucythrinate	75	11.0	0.0 a	18.3 a	8.4 a	64.8 c	335.9 c	746.6 c	319.4 c
Cyhexatin	375	5.1	0.0 a	6.2 a	2.0 a	2.9 a	12.0 a	16.6 a	75.7 a
Azocyclotin	375	24.2	0.0 a	4.0 a	2.0 a	0.0 a	6.2 a	21.9 a	161.1 b
Tetradifon	240	56.4	11.8 b	78.2 b	3.6 a**	26.6 b	163.5 b	142.0 b	481.2 c

*Application dates: 1 June. **25 June.

Table 5

Average number of mites (mobile stages) per 50 leaves in 1983

Material tested*	Doses (g a.i. per ha)	Counting dates							
		10.05.	26.05.	4.06.	14.06.	4.07.	15.7.	1.08.	12.08
Check	-	748.4	169.2 c	1527.3 c	1250.8 c	2353.8 c	599.1 c	2240.7 c	1970.8 c
Fenpropathrin	75	283.8	0.0 a	0.0 a	7.1 a	13.3 a	13.8 a	37.0 a	59.9 a
Flucythrinate	75	595.8	26.5 b	336.0 b	33.6 b	118.9 b	178.6 b	998.2 b	123.3 b**
Cyhexatin	375	268.0	2.0 a	0.6 a	0.6 a	5.2 a	7.6 a	28.3 a	25.0 a**
Azocyclotin	375	182.9	2.0 a	0.0 a	0.0 a	1.2 a	0.6 a	24.8 a	30.8 a
Tetradifon	240	446.0	48.7 b	58.5 b	60.3 b	97.4 b	52.1 b	496.0 b	198.0 b

*Application dates: 19.05. **5.08.

Table 6

Cumulative indices of infestation recalculated into percentages of check

Treatment	1979	1980	1981	1982	1983
Check	100	100	100	100	100
Fenpropathrin	0.3	0.2	0.6	3.6	3.2
Flucythrinate	0.4	0.6	4.2	18.9	16.6*
Cyhexatin	-	2.5	0.9	1.2	6.3
Azocyclotin	-	2.6	1.9	1.8	3.8
Tetradifon	9.4	15.8*	35.9	10.7*	14.9*

*Indicates two application of the material in the season.

and certain level of mite resistance can be expected. Although proper test never has been done.

Miticidal activity of fenpropathrin and flucythrinate has been already discussed by many authors including Whitney and Wettstein, Wettstein (see [10, 11, 12]). Some of them indicate an increase of the mite population density after field application of flucythrinate. This increase was attributed to high kill of predatory arthropods [1] and to greater fecundity of females on treated trees (Nowakowski in press). Iftner and Hall [5] however suggest that some other factor (s) so far unknown, might be involved in the mite outbreak following application of pyrethroids. In the reported experiment data seem to indicate a gradual built up of resistance towards the material. However much more research is required to prove this hypothesis.

CONCLUSIONS

Both fenpropathrin and flucythrinate show a strong miticidal activity, which is comparable to that of organo tin acaricides. Thus both might be recommended for controlling insect pest in the orchard with no danger of increased mite injury. There is an urgent need for a study on long term influence of these materials on the mite population.

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DZIAŁANIE FLUCYTRYNATYNY I FENPROPATRYNY NA POPULACJĘ PRZĘDZIORKÓW (PANONYCHUS ULMI KOCH) W SADACH

S t r e s z c z e n i e

W wyniku pięcioletnich badań nad oddziaływaniem flucytrynatyny i fenpropatryny na populację przędziorków stwierdzono wzrost liczebności przędziorków po zastosowaniu flucytrynatyny. W pierwszych dwóch latach badań działanie badanych pyretroidów na przędziorki nie różniło się od działania typowych akarycydów. W trzecim roku badań obserwowano niewielki wzrost populacji po 7 tygodniach od opryskiwania w kombinacji, gdzie stosowano flucytrynatynę. W czwartym roku badań w 8 tygodni po zastosowaniu preparatów liczebność przędziorków przekroczyła próg zagrożenia. W piątym roku badań próg zagrożenia został również przekroczony na wyższym poziomie niż dla Roztoczolu extra pł. 8 i w obydwu kombinacjach przeprowadzono powtórne opryskiwanie. Populacja przędziorków w kombinacjach, gdzie stosowano fenpropatrynę, kształtowała się podobnie jak po stosowaniu typowych akarycydów.

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ДЕЙСТВИЕ ФЛЮЦИТРИНАТИНА И ФЕНПРОПАТРИНА НА ПОПУЛЯЦИЮ ПАУТИННЫХ КЛЕЩЕЙ В ПЛОДОВЫХ САДАХ

Р е з ю м е

В результате пятилетних опытов по действию флюцитринатина и фенпропатрина на популяцию паутинных клещей установлено повышение численности клещей после применения флюцитринатина. В течение первых двух лет исследований действие исследуемых пиретроидов на клещи не разнилось от действия типичных акарицидов. На третий год исследований наблюдался небольшое увеличение популяции на 7-ой неделе после опрыска в варианте с применением флюцитринатина. На четвертый год исследований в 8 недель после применения прератов численность клещей превысила порог угрозы. В пятом году исследований порог угорозы был установлен также на высшем уровне, чем для препарата Розточоль Экстра пл. 8 и поэтому в обоих вариантах был проведен вторичный опрыск. Популяция паутинных клещей в варианте с применением фенпропатрина удерживалась на сходном уровне как после применения типичных акарицидов.