

EVALUATION OF THE PESTICIDES FOR THE CONTROL OF SPIDER MITES  
(ACARI: TETRANYCHIDAE) ON GERBERA

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Spider mites: the twospotted spider mite - *Tetranychus urticae* Koch and the carmine spider mite - *Tetranychus telarius* (L.) are listed among the most common pests of gerbera. The mite feeding damage ranges from yellow - whitish stippled patterns on the upper leaf surface in light infestations to leaf bronzing and webbing of foliage and flowers in heavy infestations.

Investigations conducted in Poland on spider mite control on gerbera showed very good acaricide activity through chlorphenamidin, dicofol, monocrotophos, tetradifon and dinobuton. However, the last two acaricides caused strong damage to gerbera plants [2]. Other experiments carried out in Poland indicated good effectiveness of methiocarb, phosphamidon and also monocrotophos. However, phosphamidon caused a severe phytotoxic effect to leaves and inflorescence and methiocarb caused a residual spotting of flowers [5]. In the GDR against spider mites on gerbera fenazox, amitraz and dichlorvos are recommended [4].

This paper reports results of tests with commercially available, and new acaricides for controlling spider mites on gerbera under greenhouse conditions.

#### MATERIAL AND METHODS

Sixteen trials were carried out from 1975 to 1982 in greenhouses and plastic covers. The effectiveness of 27 pesticides was tested, including 17 specific acaricides, four pyrethroid, four organophosphorus and two carbamate compounds (Table 1). In screening trials were six replicates of each treatment in strip block design with one plant per replication. In commercial greenhouses, plots of 30 m lengths of two or three benches were used for each treatment. The population of

Table 1

## List of pesticides evaluated in tests

Active ingredient	Trade name	Concentration applied in %	No tests performed
Alphamethrin, 10%	Fastac 10 EC	0.05	1
Amitraz, 20%	Mitac 20 EC	0.2	6
Azocyclotin, 25%	Peropal WP 25	0.1	5
Benzoximate, 20%	Citrazon 20 EC	0.2	2
Bromopropylate, 50%	Neoron 500 EC	0.1	4
Chlorphenamidin, 80%	Fundal 800 SP	0.05	1
Chlorfenethol, 25%	Mitran WP 50	0.1	6
and chlorfenson, 25%			
Chlorpropylate, 25%	Rospin 25 EC	0.2	2
Cyhexatin, 25%	Plictran 25 W	0.1	4
Cyhexatin, 60%	Plictran 600 F	0.05	3
Clofentezine, 50%	Apollo 50 WP	0.1	3
Dicofol, 18.5%	Kelthane EC	0.1	1
Dienochlor, 50%	Pentac WP	0.125	2
Fenazox, 40%	Fentoxan	0.2	3
Fenbutatin oxide, 50%	Torque 50 WP	0.05 and 0.1	4 and 1
Fenpropathrin, 20%	Meothrin 20 EC	0.05	6
Flubenzimine, 50%	Cropotex 50 WP	0.1	2
Flucythrinate, 30%	Cybolt 300 E	0.05	4
Methiocarb, 50%	Mesuroil 50 WP	0.1	1
Nitrilacarb, 25%	Accotril 25 WP	0.15	3
Permethrin, 25%	Ambusz 25 EC	0.05	1
Phosalone, 35%	Zolone 35 EC	0.2	2
Propargite, 30%	Omite 30 W	0.1	4
Propargite, 57%	Omite 57 E	0.1	3
Pyridaphenthion, 40%	Ofunack 40 EC	0.125	2
Tetradifon, 8%	Roztoczol extra płynny 8	0.2	1
Vamidothion, 40%	Kilval 40 EC	0.1	2

spider mites was estimated visually by counting mobile forms on 60 leaves for each material. Leaves were sampled by random from 10 plants in screening trials and from 30 plants in commercial greenhouses. The foliage was treated thoroughly using different sprayers to apply the solution of pesticides at a rate equivalent to 25 l/100 m<sup>2</sup>.

In 1975/76 and 1981 (tests from 1 to 4) the effectiveness estimates were based on the number of sprays needed to maintain the number of mites on a pre-established level of 3 active stages per leaf or less. During three months of each trial the number of mites was counted at 10-day intervals.

In 1981 (test 5) acaricides were applied as a single spray and the number of active stages was counted at 3, 7, 14 and 21 days after treatment in screening trials. In this year 9 trials were carried out in three commercial greenhouses located near Skierniewice and Warsaw (Table 4). The number of mobile forms were

assessed in Adamowice and Anin on the 10th or 14th day after treatment; in Stara Miłosna at the 4th and 18th days after application.

In 1982 (tests 6 and 7) each material was applied two times at 7-day intervals. The number of mobile forms were estimated 3 and 7 days after first treatment and 7 and 14 days after second treatment (Table 5).

All results were expressed as the percentage reduction of mite number. The data obtained were analyzed by analysis of variance after transformation according to Bliss function. The multiple range t-Duncan test was used to determine the significant differences between the means at the 5% level of significance.

## RESULTS AND DISCUSSION

Data from supervised control (Table 2) indicated the best miticidal effect of dienochlor, cyhexatin, bromopropylate and propargite, 57%. These acaricides applied from two to four times during 90-114 days controlled the population of spider mites better than standard acaricides: tetradifon, mixture of chlorfenthol with chlorfenson and propargite, 30%. The pretreatment density of mobile forms below 10 mites per leaf kept the spider mite population by using the best acaricides at the assumed level lower than 3 mites per leaf. The poor results gave nonspecific acaricides: phosalone, vamidothion, permethrin, methiocarb, flucythrinate and pyridaphenthion independently of pretreatment density of spider mites.

The efficiency of eight pesticides applied as a single spray was checked from 3 to 21 days after treatment (Table 3). The best initial effect (3 days after spraying) was obtained with amitraz and clofentezine but after 14 days and later following application the population of spider mite significantly increased. The longterm effect (14-21 days after treatment) of azocyclotin, bromopropylate and cyhexatin, 60% was much better than standard acaricides: dicofol, chloropropylate and a mixture of chlorfenethol with chlorfenson.

Applications of pesticides against spider mites on gerbera in commercial greenhouses is shown in Table 4. In all trials good acaricidal effect was obtained with azocyclotin, nitrilacarb, fenpropathrin and dienochlor. The longterm effect of fenpropathrin and dienochlor was shown at Stara Miłosna. These pesticides, after 18 days following application, controlled spider mites much better than propargite, 30% and fenbutatin oxide at 25 g per 100 liters.

In two spray programs (Table 5) populations of mobile forms were effectively reduced after initial treatment of amitraz, azocyclotin, cyhexatin, 60%, fenbutatin oxide at 50 g per 100 liters propargite, 57% and clofentezine in test 7. Additional application of acaricides further suppressed the number of active stages. It was particularly effective with amitraz, clofentezine, cyhexatin, 60%, fenbu-

Table 2

Efficiency of acaricides in the supervised control of spider mites on gerbera

Chemical	No. of sprays during 90-114 days of observation	Avg. no. mobile forms per leaf per day post treatment	Percentage reduction in number of mobile forms
Test 1 - April, 26, 1975 <sup>b</sup>			
Benzoximate	5	5.7 b <sup>a</sup>	64.5 <sup>c</sup>
Bromopropylate	4	5.2 a	76.9
Dienochlor	3	5.0 a	75.3
Propargite, 57%	4	5.4 ab	73.5
Tetradifon	5	5.5 ab	75.7
Test 2 - July, 25, 1976 <sup>d</sup>			
Amitraz	3	2.5 b <sup>d</sup>	67.1 <sup>c</sup>
Chlordimeform	3	1.9 a	75.0
Chlorfenethol with Chlorfenson	3	2.0 a	72.4
Cyhexatin, 25%	2	1.7 a	80.7
Phosalnone	6	2.8 bc	60.6
Pyridaphenthion	4	3.2 c	57.2
Yamidothion	5	3.1 c	63.9
Test 3 - November, 6, 1976 <sup>e</sup>			
Amitraz	6	3.9 bc	62.2 <sup>c</sup>
Benzoximate	7	5.6 d	52.9
Chlorfenethol with Chlorfenson	5	3.2 b	66.0
Cyhexatin, 25%	3	2.4 a	80.2
Permethrin	8	5.8 de	54.3
Phosalone	9	6.5 e	44.5
Pyridaphenthion	6	4.6 c	91.9
Yamidothion	6	3.3 b	71.3
Test 4 - April, 28, 1981 <sup>f</sup>			
Cyhexatin, 60%	3	2.2 a	60.7
Cyhexatin, 25%	4	2.0 a	81.8
Flucythrinate	7	6.8 c	50.7
Methiocarb	8	6.5 c	13.3
Propargite, 30%	6	3.6 b	55.6

a) Values followed by the same letter within a column are not significantly different ( $P = 0.05$ ) according to Duncan's new multiple range test,

b) Pretreatment density of mobile forms 15.8 per leaf,

c) Per cent of mortality adjusted for natural decrease by Henderson and Tilton's formula.

d) Pretreatment density of mobile forms 6.3 per leaf,

e) Pretreatment density of mobile forms 11.8 per leaf.

f) Pretreatment density of mobile forms 9.2 per leaf.

Table 3

Efficiency of pesticides applied as a single spray against spider mites on gerbera

Chemical	Percentage reduction in number of mobile forms at indicated day postinitial treatment			
	3	7	14	21
Test 5 - August, 10, 1981 <sup>j</sup>				
Amitraz	98.3 a	100.0 a	91.3 abc	83.2 cd
Azocytotin	82.6 abc	98.6 ab	99.6 a	98.9 a
Bromopropylate	52.5 c	98.3 ab	95.1 ab	95.6 abc
Clofentezine	90.4 ab	99.7 a	88.3 abc	87.7 bcd
Chlorfenethol and Chlorfenson	71.8 bc	83.2 c	83.2 abc	86.3 bcd
Chloropropylate	61.9 bc	97.4 ab	79.0 bc	94.0 abc
Cyhexatin, 60%	78.1 abc	98.4 ab	98.9 ab	96.6 ab
Dicofol	74.5 bc	93.5 bc	60.5 c	79.3 d

j) Pretreatment density of mobile forms 7.0 per leaf.

tatin oxide at 50 g per 100 liters, fenazox, propargite, 57% and azocytotin in test 7. These pesticides after 14 days following application were eliminated over 97% of active stages indicating good residual action.

Of the 17 specific acaricides dienochlor, cyhexatin, 60%, bromopropylate, propargite, 57%, azocytotin and fenbutatin oxide at 50 g per 100 liters gave the best results in all types of tests. These acaricides show the longterm effect in the spider mites control on gerbera. This is in agreement with results reported by Łabanowski and Jesiotr (in press) in relation to the twospotted spider mite control on roses in greenhouses. However, propargite, 57%, azocytotin and fenbutatin oxide at 50 g per 100 liters were more effective in suppression of spider mites on gerbera than on roses. The higher dose of fenbutatin oxide provided better control than dose of 25 g per 100 liters, it was shown in earlier paper [3]. Somewhat poorer results gave clofentezine and flubenzimine which good miticidal effect was reported by Bryan, Geering and Reid [1], Zoebelien, Dörntlein and Hammann (see [7]) or the control of phytophagous mites.

Of the nonspecific acaricides applied on gerbera which were very effective against spider mites are fenazox, nitrilacarb, fenpropathrin and amitraz as a specific acaricide with side effect on insects. Fenazox and amitraz are recommended in the GDR for the spider mites control on gerbera [4]. Fenpropathrin show better acaricidal effect than flucythrinate. Similar results were demonstrated by Łabanowski and Jesiotr (in press). Both pyrethroids were reported by Smolarz and Suski [6] to be good acaricides against the red spider mite in apple orchards. Alphame-thrin also promised miticidal effect, but it was tested in one test only.

Table 4

Efficiency of pesticides in the control of spider mites on gerbera in commercial greenhouses

Chemicals	Percentage reduction in number of mobile forms at 10-14 days after treatment in:					
	trial 1		trial 2		trial 3	
A. Adamowice, April 30 - May 21, 1981 <sup>g</sup>						
Amitraz	-		0.0 b		-	
Azocyclotin	63.7 a		72.4 a		-	
Chlorfenethol and Chlorfenson	3.1 b		1.4 b		-	
Fenazox	-		-		74.8 ab	
Fenbutatin oxide, 0,05%	-		-		69.2 b	
Nitrilacarb	76.1 a		84.2 a		88.6 a	
B. Anin, March 20 - June 28, 1981 <sup>h</sup>						
Fenbutatin oxide 0.05%	-		-		6.0 b	
Fenpropathrin	84.5 a		69.6 a		72.3 a	
Flucythrinate	36.3 b		40.4 a		70.1 a	
Propargite, 30%	-		-		55.5 a	
C. Stara Miłosna, February 15 - May 13, 1981 <sup>i</sup>						
Chemicals	Percentage reduction in number of mobile forms after treatment:					
	trial 1		trial 2		trial 3	
	4 days	18 days	4 days	18 days	4 days	18 days
Dienochlor	-	-	-	-	96.5 a	99.3 a
Fenbutatin oxide 0,05%	14.8 b	37.8 b	-	-	-	-
Fenpropathrin	99.0 a	95.4 a	98.9 a	93.5 a	96.8 a	97.6 a
Propargite, 30%	97.8 a	11.5 b	90.8 a	38.4 b	-	-

g) Pretreatment density in trials 1, 2 and 3 were 13.5; 45.4 and 65.4 mobile forms per leaf, respectively.

h) Pretreatment density in trials 1, 2 and 3 were 4.0; 5.7 and 22.4 mobile forms per leaf, respectively.

i) Pretreatment density in trials 1, 2 and 3 were 1.6; 6.2 and 6.5 mobile forms per leaf, respectively.

Table 5

Efficiency of two spray program against spider mites on gerbera

Chemicals	Per cent of reduction in number of mobile forms at indicated day after			
	first treatment		second treatment	
	3	7	7	14
Test 6 - August, 2, 1982 <sup>k</sup>				
Amitraz	92.9 ab	99.4 ab	99.5 a	99.0 ab
Azocyclotin	91.2 ab	96.2 abc	89.7 ab	89.7 ab
Bromopropylate	72.7 a-d	73.8 abc	77.3 abc	87.5 ab
Chlorfenethol and Chlorfenson	87.1 ab	99.9 a	95.0 ab	95.3 ab
Chloropropylate	26.6 d	62.5 bcd	65.2 bc	75.0 b
Clofentezine	55.9 bcd	52.6 cd	98.2 ab	98.8 ab
Cyhexatin, 25%	62.0 a-d	71.8 abc	93.3 ab	90.9 ab
Cyhexatin, 60%	98.6 a	99.8 ab	98.9 ab	100.0 a
Fenbutatin oxide 0.05%	60.9 a-d	64.1 a-d	41.9 c	93.3 ab
Fenbutatin oxide 0.1%	91.2 ab	99.5 ab	99.1 a	100.0 a
Fenazox	80.2 abc	76.4 abc	95.8 ab	100.0 a
Flubenzemine	36.3 cd	14.5 d	84.6 abc	92.3 ab
Propargite, 57%	92.2 ab	91.0 abc	100.0 a	99.2 a
Test 7 - September, 7, 1982 <sup>i</sup>				
Alphamethrin	15.4 c	54.1 abc	75.7 abc	85.4 bc
Amitraz	51.1 abc	56.2 abc	87.5 ab	88.1 bc
Azocyclotin	46.0 abc	87.5 a	90.2 a	97.3 ab
Bromopropylate	37.1 bc	29.2 c	70.6 c	83.6 c
Clofentezine	89.3 a	84.7 ab	88.3 ab	95.2 abc
Fenazox	19.5 c	78.8 ab	73.1 bc	94.1 abc
Flubenzemine	77.8 ab	39.4 bc	62.4 c	82.2 c
Propargite, 57%	8.8 c	89.2 a	90.4 a	99.6 a

k) Pretreatment density of mobile forms 2.3 per leaf.

i) Pretreatment density of mobile forms 3.0 per leaf.

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OCENA PREPARATÓW DO ZWALCZANIA PRZĘDZIORKÓW (ACARI: TETRANYCHIDAE)  
NA GERBERZE

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

W latach 1975-1982 oceniano w 16 testach 27 pestycydów do zwalczania przędziorków na gerberze uprawianej pod osłonami. Wśród testowanych preparatów najlepsze wyniki w zwalczaniu przędziorków wykazały: Pentac WP (dienochlor), Plictran 600 F (cyheksatyna), Neoron 500 EC (bromopropylat), Omite 57 E (propargit), Peropal WP 25 (azocyklotyna) i Torque 50 WP (tlenek fenbutacyny) w stężeniu 0,1%. W grupie niespecyficznych akaricydów dobre wyniki uzyskano stosując Mitac 20 EC (amitraz), Fentoxan (fenazox), Accotril 25 WP (nitrilakarb) i Meothrin 20 EC (fenpropatryna). Zmienne i nieco gorsze wyniki od innych preparatów w zwalczaniu przędziorków na gerberze dały Apollo 50 WP (klofentezyna), Crototex 50 WP (flubenzymin) i Cybolt 300 E (flucytrynat).

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ОЦЕНКА ИНСЕКТИЦИДОВ ПРИМЕНАЕМЫХ ПРОТИВ ПАУТИННЫМ КЛЕЩОМ  
(ACARI:TETRANYCHIDAE) НА ГЕРБЕРЕ

Р е з ю м е

В 1975-1984 годах проведено 16 опытов и проверено эффективность 27 препаратов применяемых в борьбе с паутиными клещами на гербере в теплицах. Самыми хорошими были: Пентак 50% с.п., Пликтран 25% с.п., Неорон 50% к.э., Омайг 57% к.э., Перопал 25% с.п. и Торк 50% с.п. в 0,1% концентрации. Из неспецифических акарицидов довольно хорошее действие оказывали: Митак 20% к.э., Фэнтоксан, Ассотрил 25% с.п. и Меотрин 20% к.э. Непостоянные и немного худшие результаты были получены с препаратами Аполло 50% с.п., Кропотекс 50% с.п. и Цибольт 30% к.э.