basic copper sulfate, dicloran (Botran®); pyrazophos, metalaxyl, and vinclozolin. The latter 6 treatments did not provide commercially acceptable disease control.

Experiment 3. Among the 15 treatments that provided the best control, 14 included commercially available compounds and 11 were tank-mix combinations or proprietory products that included a combination of 2 fungicides. All of the 11 combination treatments included a benzimidazole fungicide (benomyl or thiophanate methyl). The combinations also included either mancozeb, captan or chlorothalonil. The latter 3 sprayed alone at 1.5 lb./100 gal as wettable powder formulations also were in the group that gave best control. Benomyl gave surprisingly poor control when sprayed alone at 0.5 and 0.25 lb./100 gal.

Vinclozolin at 1.5 and 1.0 lb./100 gal provided no disease control and benomyl at 0.5 and 0.25 lb./100 gal in this experiment had less than adequate commercial scab control. Plants sprayed with vinclozolin also were retarded in growth and had chlorotic and smaller than normal leaves. Fenarimol at 12 fl. oz/100 gal provided good disease control (numerically was No. 1) but the plants were retarded in growth and had small leaves, some of which were distorted. Rubigan should be evaluated at a lower rate because it provided such good disease control.

Most wettable powder formulations of fungicides leave a splotchy residue on the leaves (Table 3). Generally, the higher the rate of fungicide the greater the residue. The addition of 8 fl. oz/100 gal of Ortho X-77 Spreader to tank mixes of benomyl plus chlorothalonil, mancozeb or captan eliminated the residue problem on the leaves but still provided good disease control (Table 3). The same treatments at the same rates without the spreader all had visible, splotchy, fungicidal residues on the leaves. However, phytotoxicity has occurred on some cultivars when Ortho X-77 Spreader was added to sprays (Paul Ecke, Jr., personal communication). No phytotoxicity occurred on the plants in this experiment.

In summary, the tank mix combinations that contained Benlate benomyl at 0.25 lb. plus chlorothalonil, mancozeb, or captan at 0.75 lb./100 gal consistently provided good disease control at a total of 1 lb. of fungicide. The respective combinations at 0.5 plus 0.5 lb./100 gal gave similar results in Experiment 3. The low total rate has favorable implications both from a residue and cost standpoint. Zyban, which is a mixture of 2 fungicides related to the above, at 1.5 lb. also provided good disease control. Chlorothalonil, mancozeb, and captan, each at 1.5 lb., usually provided good disease control, but splotchy residue was a problem with these fungicides at that rate. Benomyl, which in the tank mix combinations always provided excellent disease control, tended toward weaker disease control when sprayed alone. However, the material should not be sprayed alone anyway because of the numerous reports of resistance of various fungi (but not *Sphaceloma poinsettiae*) to benomyl. Vinclozolin, iprodione, metalaxyl, and pyrazophos all provided less than adequate scab control. Relatively new fungicides such as bitertanol and fenarimol showed sufficient promise to warrant further evaluation. Chlorothalonil has provided good scab control but is not labeled for poinsettia plants. It has, on occasion, caused some phytotoxicity on bracts.

The splotchy residue caused by some fungicides on leaves and bracts may be alleviated by the addition of a spreader. Adding Ortho X-77 Spreader eliminated the residue problem on leaves of plants sprayed once or twice per week from April 7 to July 15, 1983. However, the report (personal communication from Paul Ecke, Jr.) that Ortho X-77 Spreader added to some sprays was phytotoxic on some cultivars would indicate more research needs to be done on the problem.

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FIELD EVALUATIONS OF NEW PESTICIDES FOR CONTROL OF LEAFMINERS, MITES AND APHIDS ON FLOWER CROPS[1]

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Abstract. **Three experiments were performed in 1982 and 1983 to evaluate pyrazophos (Afugan®), cyromazine (Trigard®), avermectin (MK936 or a mixture of 80% avermectin B_1a and 20% avermectin B_1b), and RO 13-5223 (ethyl(2-[phenoxyphenoxy]ethyl) carbamate) for control of leafminers** (Liriomyza trifolii **(Burgess)), twospotted spider mites** (Tetranychus urticae **Koch), the green peach aphid** (Myzus persicae **(Sulzer)), and the chrysanthemum aphid** (Macrosiphoniella sanborni **(Gillette)) in chrysanthemums** (Chrysanthemum x morifolium **Ramat.) and to determine phytotoxic effects of these pesticides to various flower crops. These**

chemicals controlled leafminers but only avermectin provided satisfactory control of twospotted spider mites. Only cyromazine did not control aphids. When RO 13-5223 was applied as a spray, 'Manatee Yellow Iceberg' chrysanthemum leaves became chlorotic. No other pesticide caused this damage to this cultivar. Only cyromazine and avermectin were applied to 29 cultivars of flowering chrysanthemums, 2 cultivars of gerbera (*Gerbera jamesonii* H. Bolus ex Hook.f.), and 4 cultivars of snapdragon (*Antirrhinum majus* L.) with no observed damage. In addition, cyromazine was applied to 153 cultivars of vegetative chrysanthemums with no injury.

Penncap-M® (microencapsulated methyl parathion 2F) was registered in Florida by the 24(c) Special Local Needs process for control of leafminers on chrysanthemums in 1980. This action developed after Ambush® (permethrin 2EC) lost its effectiveness for control of leafminers; the effectiveness of methyl parathion has now diminished significantly. New compounds that may give flower growers necessary levels of control of leafminers have become available and this paper describes the results of recent experiments comparing these new compounds to other pesticides.

Materials and Methods

One experiment was conducted in the fall of 1982 and 2 in the spring of 1983. The 1982 experiment was performed at the Agricultural Research and Education Center (AREC), Bradenton. In 1983, 1 experiment was conducted at the Manatee Fruit Co. flower farm and 1 at the Pan American Plant Co. chrysanthemum cutting farm.

Experiment 1. AREC Bradenton. This experiment was performed in a black polypropylene shadehouse which provided 25% light reduction. Rooted cuttings of 'Manatee Yellow Iceberg' chrysanthemums were planted in fumigated ground beds amended with superphosphate with fritted trace elements at 630 lb./acre and Osmocote 14-14-14 at 450 lb. N/acre. Plants were set on August 25, 1982 and lighted 10:00 PM until 2:00 AM until October 1. Stems were pinched to about 4 nodes on September 10, and water was provided by trickle irrigation and natural rainfall. No maintenance sprays of pesticides were applied.

Experimental plots consisted of 18 plants (ca. 72 stems) spaced in 3 rows of 6 plants each across a bed. Adjacent plots were separated by 2 unplanted and 2 planted rows across the bed. Treatments were replicated 4 times in randomized complete blocks and were applied 7 times at weekly intervals beginning October 20.

Sprays were applied at 225 gal/acre with a 2.5-gal, CO_2 propelled sprayer (with a wand and cone nozzle) maintained at 40 psi. Drench treatments provided to selected plots were applied to the soil surface at 225 gal/acre. The experimental pesticides evaluated were: pyrazophos, an organophosphorous pesticide registered in Europe for control of powdery mildew; cyromazine, an insect growth regulating compound recently developed for control of house flies in poultry houses; EL 462 (applied with pinolene (Nu-Film-17®) spray adjuvant), an experimental miticide; avermectin, a bacterial fermentation product active against certain insects, mites, and nematodes; and RO 13-5223, an insect growth regulating compound. Currently registered products applied as controls were permethrin, methyl parathion, fenbutatin-oxide (Vendex®), and oxamyl (Vydate®). All pesticidal treatments were compared to an untreated check. Formulations and concentrations of pesticidal treatments appear in Table 1.

Random samples of 10 leaves were taken from the middle 1/3 stratum of plots on November 9. Mites were brushed from leaves onto a plate by the method described by Price et al. (2) to determine the average number of mites per leaf. On November 19, all flower peduncles per plant having 5 or more chrysanthemum aphids were recorded. Random samples of 10 leaves per plot were selected from the middle 1/3 stratum of each plot on December 6 when the crop was mature. Mines less than 1/3 inch long were recorded as "small" and those larger were recorded as "medium and large". Observations of phytotoxic effects on chrysanthemum flowers and foliage were made on December 6.

Numbers of peduncles with 5 or more aphids and numbers of medium or large mines were transformed by the square root of $(X+0.5)$. An analysis of variance and mean separation by Duncan's multiple range test were performed on these and the remaining data. Transformed data were retransformed to the original scale for reporting means.

Experiment 2. Manatee Fruit Co. This experiment was

Table 1. Numbers of leafmines, twospotted spider mites and peduncles infested with chrysanthemum aphids in samples taken from 'Manatee Yellow Iceberg' chrysanthemums sprayed with pesticides. Fall 1982. Experiment 1.

Treatment: Trade name	Treatment: Common name and form	Rate (lb. a.i./100 gal)[v]	No. leafmines/10 leaves: Small	No. leafmines/10 leaves: Med. & Lg.[z]	No. motile mites	No. peduncles with aphids[z]
Untreated check			20.3 ab[w]	4.00 ab	44.5 a	14.5 c
Afugan	pyrazophos 2.5EC	0.125	5.8 de	0.25 de	26.0 bcd	3.3 e
Afugan	pyrazophos 2.5EC	0.25	2.5 e	0.00 e	22.3 bcd	0.8 ef
Ambush	permethrin 2EC	0.20	12.0 bcd	7.50 a	2.0 e	0.0 f
Trigard	cyromazine 75WP	0.125/A	17.3 ab	0.00 e	22.3 bcd	25.5 b
Trigard	cyromazine 75WP	0.25 /A	14.5 abc	0.00 e	34.3 ab	45.8 f
EL 462[y] + Nufilm	1.5EC	0.75 /A	19.8 ab	5.75 a	15.0 cde	0.0 f
Penncap-M	m-parathion 2F	0.50	19.5 ab	2.50 bc	30.0 bc	0.5 ef
MK 936	avermectin 0.15EC	0.005/A	9.3 cde	0.00 e	14.3 de	0.3 f
MK 936	avermectin 0.15EC	0.01/A	6.8 cde	0.00 e	11.5 de	1.0 ef
MK 936	avermectin 0.15EC	0.02/A	2.0 e	0.00 e	13.8 de	0.0 f
RO 13-5223[x] WP	25WP	0.83	17.5 ab	1.75 cd	26.0 bcd	0.8 ef
RO 13-5223 WP	25WP	0.83	19.3 ab	2.50 bc	23.0 bcd	16.8 c
RO 13-5223 EC	1.04 EC	0.83	20.5 a	1.50 cde	12.0 de	0.5 ef
Vendex	fenbutatin-oxide 50WP	0.50	19.3 ab	5.75 a	19.0 bcd	7.8 d
Vydate	oxamyl 2L	1.00	2.0 e	0.00 e	11.8 de	0.0 f

[z]Data were transformed by $\sqrt{X + 0.5}$ before analysis and were retransformed to the original scale for reporting means.
[y]N-(2,4-difluorophenyl-N-methyl-2,4-dinitro-6-(trifluoromethyl)) benzenamine.
[x]Ethyl(2-[phenoxyphenoxy]ethyl) carbamate, applied as a drench.
[w]Mean separation within columns by Duncan's multiple range test, 5% level.
[v]Values followed by /A are amounts of active ingredients applied per acre rather than amounts of active ingredients per 100 gal.

performed in a shadehouse similar to the one used in 1982. Plants were grown in 42-inch wide, fumigated, ground beds amended by the grower's customary commercial practices but which were unavailable for this report. Rooted plants (of the species, cultivars, and growth types indicated in Table 2) were set on January 11, 1983, and were not pinched. Lights were operated at night through February 15 and plants were watered by overhead sprinkler irrigation and natural rainfall. Crop maintenence sprays consisted of a rotation of chlorothalonil (Bravo®), zineb, iprodione (Rovral®), or mancozeb (Manzate 200®) on a 4-day schedule. Also, mevinphos (Phosdrin®) was applied 6 times, cupric hydroxide (Kocide®) twice, dienochlor (Pentac®) 3 times, pirimicarb (Pirimor®) once, and oxythioquinox (Morestan®) once during the crop cycle.

Table 2. Cultivars of flowers that were treated with MK 936, Trigard or Penncap-M[z]. Spring 1983. Experiment 2.

Crop Type[y]	Cultivars	Cultivars
Gerbera daisy	Tropic Snow	Tropic Breeze
Chrysanthemum, pot types	Bright Golden Anne	Circus
	Yellow Mandalay	Mountain Peak
	Sunny Mandalay	Paragon
	Mountain Snow	Tip
	Winter Carnival	Red Torch
	Yellow Garland	Yellow Torch
Snapdragon	Kentucky	Oklahoma
	Virginia	Winchester
Chrysanthemum, pompon types	Super White	Accent
	Amber	Pink Marble
	White Marble	Bluechip
	Stingray	Dark Yellow Iceberg
	Beloved	Statesman
	Golden Polaris	Florida Marble
	Polaris	Manatee Iceberg
Chrysanthemum, standard types	Dignity	May Shoesmith
	Escapade	

[z]Concentrations of pesticides were: 0.125, 0.25, and 0.50 lb. a.i./acre for Trigard, 0.005, 0.01, and 0.02 lb. a.i./acre for MK 936; and 0.50 lb. a.i./100 gal for Penncap-M.
[y]Some cultivars are produced commercially as types in addition to that indicated here.

Experimental treatments consisted of an untreated check, 3 concentrations of cyromazine, 3 concentrations of avermectin, and a methyl parathion check in 4 randomized complete blocks. Formulations and specific concentrations are provided in Table 3.

Each plot was 26 ft long and composed of subplots of 35 flower cultivars among 3 species planted in a consistent order (as they appear in Table 2). The order was arranged so that the smallest plants would be grown in the southern ends of plots and large plants would appear successively toward the northern end. By this method, shorter plants were not shaded by larger ones. Pompon and pot types chrysanthemum and snapdragon plants were set 3 per 6 x 8-inch cell resulting in a single row of 21 plants across the 42-inch bed. Standard chrysanthemums were set with only 1 per cell (7 across a bed) and gerberas were set at 3 plants across a bed. Single rows of gerberas across a bed occupied two 8-inch cells along the bed, outherwise there were no unplanted spaces between cultivars or species of plants. Five ft separated large plots along a row.

Experimental treatments were applied February 4, 9, and 23; March 2, 9, 16, 22, and 28; and April 1 and 14, 1983. On April 19, when all flowers were showing color, an additional spray application was applied only to flowers. All spray applications were performed with an FMC sprayer with a handheld gun and a No. 3 disc operated at 150 psi. Sprays were applied to the crop at 133-380 gal/acre depending on the crop size.

Observations of the treatment effects on arthropods and their damage were made when the crop was ready for harvest. Three stems were cut from the western edge of each of 'Manatee Iceberg', 'Dark Yellow Iceberg', 'Golden Polaris', and 'Amber' chrysanthemum plots on April 18. All of the small, medium, and large size leafmines (approximating the mine formed by the 3 instars of the leafminer) were recorded and summed among the 12 stems. On April 18, the numbers of leafmines that could be seen by an observer positioned with his eyes approximately 6 ft above 2 'Tropic Snow' gerbera plants also were recorded. No distinction was made among sizes of mines; however, this method eliminated the smallest mines as they could not be seen from 6 ft.

Table 3. Numbers of *Liriomyza trifolii* leafmines, twospotted spider mites, and green peach aphids found of flower crops sprayed with insecticides. Spring 1983. Experiment 2.

Treatment			Mines/12 chrysanthemum stems[z]						Twospotted spider mites[w]		Aphids[v]
Trade name	Common name and form	Rate (lb. a.i./acre)	Small	Medium	Large	Total	Large mines (%)[y]	Total mines[x] (Gerbera)	(*Chrysanthemum*) Motile mites	Eggs	(Chrysanthemum flowers)
Check			79.3 a[u]	67.8 a	183.0 a	330.0 a	56.1 a	74.3 a	14.5 a	36.0 a	6.0 b
Trigard	cyromazine 75WP	0.125	100.0 a	21.3 cde	3.3 d	124.5 bc	2.6 cd	2.5 de	7.5 ab	40.5 a	15.3 a
Trigard	cyromazine 75WP	0.25	85.0 a	7.8 de	0.8 d	93.5 cd	0.8 d	0.8 e	7.3 ab	36.5 a	10.0 ab
Trigard	cyromazine 75WP	0.50	50.0 b	3.8 e	0.3 d	54.0 d	0.4 d	0.5 e	9.5 ab	25.5 ab	13.0 a
MK 936	avermectin 0.15EC	0.005	88.3 a	33.3 bc	13.0 d	134.5 bc	8.0 c	9.0 cd	1.3 b	4.5 c	1.8 c
MK 936	avermectin 0.15EC	0.01	39.0 b	50.0 b	53.0 c	142.0 bc	38.6 b	10.8 c	1.3 b	1.5 c	0.3 c
MK 936	avermectin 0.15EC	0.02	31.5 b	23.0 cd	31.0 cd	85.5 cd	37.9 b	1.0 e	1.0 b	0.3 c	1.0 c
Penncap-M	m-parathion 2F	0.50/100 gal[t]	22.0 b	38.0 bc	123.5 b	183.5 b	67.3 a	51.0 b	1.8 b	16.8 bc	1.8 c

[z]Values represent average numbers of leafmines recorded from 12 chrysanthemum stems grown in the western cells of plots (3 stems of each of 'Manatee Iceberg,' 'Dark Yellow Iceberg,' 'Golden Polaris,' and 'Amber'). Size categories of mines approximate sizes of mines formed by 1st, 2nd and 3rd instar, respectively.
[y]Represents the portion of all mines that were assigned to the "large" category. Data are averages of percentages calculated for each replication and may not be equivalent to percentages calculated from the totals over all replications. Percentage data were transformed by arcsin $\sqrt{\%/100}$ before analysis and were retransformed to the original scale for reporting means.
[x]Values represent average numbers of mines recorded per 2 'Tropic Snow' gerbera daisy plants by an observer positioned with his eyes 6 ft above the plants.
[w]Values represent average numbers of twospotted spider mites per leaf of 'Dignity' chrysanthemum.
[v]Values represent average numbers of green peach aphids found in samples of 10 'Winer Carnival' chrysanthemum flowers.
[u]Mean separation within columns by Duncan's new multiple range test, 5% level.
[t]The indicated amount was applied per 100 gal of spray volume.

Spider mite densities among treatments were recorded on April 20 when 10 leaves were sampled at random from the middle 1/3 stratum of plots of 'Dignity' chrysanthemums. The average numbers of motile mites or their eggs per leaf were determined by the method used in the earlier experiment.

On April 20, 10 flowers from each plot of 'Winter Carnival' chrysanthemum were sampled at random. Flowers were shredded and washed in soapy water to remove aphids. The water with aphids was filtered through filter paper by a process described by Price et al. (2) and the numbers of aphids collected on the paper were recorded.

Plants and flowers of all cultivars were observed for phytotoxic effects of chemical treatments. Data of arthropods and their damage were analyzed by the methods described for the earlier experiment.

Experiment 3. Pan American Plant Co. This experiment was conducted to determine phytotoxicity among many chrysanthemum cultivars produced for cuttings (Table 4). It was performed in a black polypropylene shadehouse providing 33% shade. Rooted cuttings were planted on February 7, 1983, on ground beds 42 inches wide. The crop was maintained in a vegetative state by incandescent lighting provided nightly throughout the crop's development. All plants were pinched on February 21 and resulting flushes were pinched on April 7. Water was provided to the crop by trickle irrigation and natural rainfall. No maintenence sprays of pesticides were applied but all other cultural practices normally performed on that farm were followed.

Experimental plots consisted of subplots of 6 plants of each of 153 chrysanthemum cultivars. The 6 plants were arranged with 2 plants in each of three 6 x 8-inch cells spaced across a bed. By this arrangement, plants of 2 cultivars occupied the width of a bed.

Experimental treatments were an untreated check and cyromazine applied at 0.125, 0.25, or 0.50 lb. a.i./acre. Each treatment was replicated twice in randomized complete blocks. Spray applications were performed on a weekly schedule from February 19 through April 15 using a tractor drawn sprayer equipped with a drop boom and nozzles and operated at 200 psi.

Observations for phytotoxic responses among the chrysanthemums were performed on April 18. Plants were observed for aberrations in leaf color and structure, overall plant form, and the presence of growth flushes appearing after the second pinch.

Table 4. Chrysanthemum cultivars treated with Trigard[z]. Spring 1983. Experiment 3.

Alpine
Anthem
Arctic
Beauregard
Blue Marble
Bonnie Jean
Bounty
British Gold
Bronze Marble
Bronze Parliament
Burgundy
Candlelight
Chieftain
Constitution
Copper Anne
Copper Hostess
Copper Mine
Coronet
Cream Yellow Princess Anne
No. 2 Darkchip
No. 2 Dark Indianapolis Bronze
Dark Yellow Paragon
Dark Yellow Tokyo
Mrs. Roy
Neptune
Nimrod
Nobhill
Northern Lights
Onward
Orange Bowl
Parliament
Peacock
Pinocchio
Powerhouse
Princess Anne Superb
Promenade
Puritan
Ritz
Royal Trophy
Ruffles Spirit
Showoff
Snow Crystal
Southern Gold
Spice
Spirit
Sunburst Mefo
Sunburst Spirit
Sunlight
Super Yellow
Topaz
Yellow Starlet
Zonta
Stoplight
No. 2 Yellow Iceberg

Dazzler
Deep Hotpink
Dillon Beauregard
Divinity
Dixie
Dolly
Dramatic
Early Golden Hill
Early Yellow
Fantasy
Fiesta
Firebrand
Free Spirit
Frosty
Grant No. 4 Indianapolis White
Grant No. 4 Indianapolis Yellow
Glacier
Glowing Mandalay
Golden Crystal
Golden Nobhill
No. 3 Golden Shoesmith
Goldstar
Hartmann's Dignity
Torch
Treasure
Tuneful
Twilight
Tempo
Wedgewood
Westland Brandy
Westland Orange
Westland Snow
Westland Yellow
Westland Sun
Windsong
Yellow Beauregard
Yellow Dignity
No. 2 Yellow Knight
Yellow Limelight
Yellow Nobhill
Yellow Polaris
Yellow Spinwheel

Aggie
Bruin
Buckeye
Classic
Cloud-9
Cougar
Festive Cushion

Hartmann's Yellow Dignity
Hostess
Iceberg
Illini Mist
Illini Sparkler
Illini Spinwheel
Illini Summer
Illini Sunset
Illini Windmill
Improved Fred Shoesmith
Improved Yellow Bonnie Jean
Independence
Inferno
Jackstraw
Jade
Jasmine
Lexington
Limelight
Loyalty
Mandarin
Minuteman
Moonstone
Fireside Cushion
Goldstrike
Goldtone
Grandchild
Hawkeye
Jackpot
Lipstick
Martian
Minngopher
Minnpink
Minnwhite
Minnyellow
Pancho
Penquin
Powder River
Purple Waters
Rocket
Ruby Mound
Spartan
Starlet
Sunburst Cushion
Tango
Tiger
Tinkerbell
White Grandchild
White Stardom
Wolverine

[z]Concentrations of Trigard applied were 0.125, 0.25 and 0.50 lb. a.i./acre.

Results and Discussion

Experiment 1. AREC Bradenton. Data recorded from this experiment are presented in Table 1. Significantly fewer (p=0.95) small mines occurred in plots treated with pyrazophos at the higher rate of application, avermectin at the highest rate, or oxamyl than in plots not treated or treated with permethrin, cyromazine, EL 462, methyl parathion, RO 13-5223, or fenbutatinoxide. Numbers of small mines from the plots having fewer mines were not significantly different, however, from those recorded from plots treated with pyrazophos at the lower rate of application or avermectin at the 2 lower rates of application.

A relatively small portion of mines from throughout the experiment developed to the medium and large size category, indicating high larval mortality unrelated to the experimental treatments. Significantly fewer mines developed to that size from plots treated with pyrazophos at the higher rate, cyromazine, avermectin, or oxamyl than developed from plots that were not treated or were treated with permethrin, EL 462, methyl parathion, RO 13-5223 WP formulation, or fenbutatin-oxide. Numbers of medium and small mines from the plots with the fewer mines in this category were not significantly different from those recorded from plots treated with pyrazophos at the lower rate or treated with the RO 13-5223 EC formulation.

Fewer motile twospotted spider mites were recorded from plots treated with permethrin, EL 462, avermectin, RO 13-5223 EC formulation, or oxamyl than were recorded from plots treated with cyromazine at the higher rate or left untreated. Fewer peduncles were infested with 5 or more chrysanthemum aphids in plots treated with pyrazophos, EL 462, methyl parathion, avermectin, RO 13-5223 WP applied as a drench, RO 13-5223 EC applied as a spray, or oxamyl than were infested in plots treated with cyromazine, RO 13-5223 WP applied as a spray, fenbutatin-oxide, or in plots not treated.

None of the compounds included in this experiment caused any damage to chrysanthemum flowers even when the materials were applied to open flowers. Spray applications of RO 13-5223 (both formulations) resulted in a chlorotic condition of chrysanthemum leaves that would have affected marketability. Chlorosis was evident after the second application and increased as successive applications were made.

These data show that, under the conditions of this experiment, oxamyl, pyrazophos, cyromazine, and avermectin provided superior reductions in numbers of leafminer larvae that developed to the medium and large developmental stage (second and third instars). Cyromazine and RO 13-5223 did not effectively reduce the numbers of mines that were initiated. Of the above compounds, avermectin and oxamyl also reduced twospotted spider mites. Pyrazophos applied at the higher rate, avermectin, and oxamyl provided excellent control of chrysanthemum aphids in addition. Oxamyl has been available for use by chrysanthemum growers for several years, but under commercial farming conditions in recent years, this compound has not performed as well as these data would suggest.

Experiment 2. Manatee Fruit Co. Data for this experiment are presented in Table 3. The numbers of mines on chrysanthemums that developed to the large stage, an important indicator of pesticidal properties for the reduction of the density of a succeeding generation, show clear demarcations among effects of treatment groups. The greatest numbers of large mines occurred in the untreated check; however, the second highest number of large mines was recorded from plots treated with methyl parathion. The least numbers of large mines developed in plots treated with cyromazine or the low concentration of avermectin. Higher numbers of large mines were recorded from plots treated with avermectin at the intermediate concentration than from plots treated at the lower concentration. Why this occurred is not clear.

A similar pattern of treatment effects was recorded from the total number of mines counted by an observer 6 ft from 2 gerbera plants. The largest number of mines was recorded from plants not treated and the second was recorded from plants treated with methyl parathion. Few mines were recorded from plants treated with cyromazine or with avermectin applied at the highest rate.

There were no significant differences in numbers of motile twospotted spider mites among any of the chemicals tested; 10 miticide applications made by the grower could have obscured some effects though. Nevertheless, there were fewer motile mites on plots treated with avermectin or methyl parathion than on the untreated check. The least numbers of twospotted spider mite eggs were recorded from plots treated with avermectin and the most were from plots treated with cyromazine or from untreated plots. Numbers of mite eggs observed from the plots treated with methyl parathion were not significantly different from those recorded from plots treated with avermectin or cyromazine at the high rate.

There were significantly fewer green peach aphids collected from plots treated with avermectin or methyl parathion than from plots not treated or treated with cyromazine. Numbers of aphids recorded from plots treated with cyromazine at the lowest and highest rates were higher than numbers recorded from the untreated check.

These data indicate that although cyromazine and avermectin effectively reduce leafminers, only avermectin provides control of twospotted spider mites and green peach aphids. No treatment in this experiment caused any noticeable damage to foliage or flowers of any of the 35 cultivars among the 3 species.

Experiment 3. Pan American Plant Co. There were no aberrations in chrysanthemum leaf color or structure nor were there any plants that failed to produce new flushes of growth following treatment with any concentration of cyromazine (Table 4).

Conclusions

Decisions concerning the usefulness of pyrazophos, RO 13-5223, cyromazine, and avermectin to flower growers in Florida will be enhanced by these data. Pyrazophos appears to be nonphytotoxic to 'Manatee Yellow Iceberg' chrysanthemums and effective for leafminer and aphid control but will not be useful for twospotted spider mite control. Producers of this pesticide show little interest in registering pyrazophos for leafminer control in the United States. RO 13-5223 would require additional work to reduce the possibility of damaging chrysanthemum crops before this product could be used safely. However, an experimental EC formulation of RO 13-5223 was safe when applied as many as 6 times to chrysanthemums in California (1). Cyromazine and avermectin should provide effective control of the leafminer without great concern for phytotoxicity in chrysanthemums, gerberas, and snapdragon plants. Producers of cyromazine have recently received an emergency specific exemption under section 18 of the amended Federal Insecticide, Fungicide, and Rodenticide Act to market this insecticide for control of leafminers on chrysanthemums in Florida. Producers of avermectin express great interest in acquiring a label for their product for leafminer control in Florida soon. If cyromazine and avermectin were to be registered for use on horticultural crops, their novel chemistries would give hope that their effectiveness would be longer lived than that of other recently used pesticides.

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