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Integrated Pest Control of Certain Citrus Eriophyid and Tenuipalpid Mites in Egypt

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ABSTRACT

Integrated biological and chemical control showed that release of the predatory mite, *Amblyseius swirskii* (Athias-Henriot) at the rate of 50 or 60 individuals/citrus tree gave excellent control results after 3 months from release in case of Vertimec spray. This resulted in lowest numbers of phytophagous mites. Application of Vertimec spray integrated with *A. swirskii* release at 60 individual/tree also resulted in lowest russeted fruits, their percentages reached 9.4, 12.7, 10.3 and 86.8% for Vertimec, Bio-fly, Dithane compared with the control, respectively.

Key Words: Citrus Eriophyid and Tenuipalpid mites, *Amblyseius swirskii*, Bio-fly, Dithane, Vertimec, Egypt

INTRODUCTION

Eriophyid and tetranychoid mites are considered the most dangerous pests of citrus groves in Egypt (Zaher *et al.*1970 and Zaher1984). Thus, integrated control, both biological and chemical may be the ideal answer for controlling such pests. In this respect, chemicals should be used when necessary and in a manner which is least disruptive to biological control agents. Integrated control requires the augmentation and utilization of natural enemies in pest control programs involving chemical control (Smith and Papacek1991).

This work deals with integrated pest control program against phytophagous mites infesting Baladi orange groves in Menoufiya Governorate, Egypt.

MATERIALS AND METHODS

Experiments were conducted to determine the combined effect of biological and chemical control on phytophagous mites infesting Baladi orange trees. Vertimec (1.8EC40ml/100Lwater), Bio-fly (*Beauveria bassiana* 150ml/100L water) and DithaneM-45 (Manacozeb 720g/600L water) were tested on Baladi orange leaves. Fruit samples, pre- and post-treatments, were collected for mite inspection.

The phytoseiid mite *Amblyseius swirskii* (Athias-Henriot) was used for release after chemical control treatments. For rearing this predatory mite, large aluminum pans 30x20x7 cm were used. In the middle of each, a moistened cotton pad was placed, leaving a space provided with water as a barrier to prevent mite escape. Also, tangle foot was added around the cotton pad.

Citrus leaves were placed on the cotton pads saturated with water. Excised infested bean leaves with *Tetranychus urticae* Koch were provided every other day as a source of food. Pans were kept in an incubator at 28±2°C and 80±10% R.H.

Prior of release predatory mite intended for release were left in a refrigerator at 10°C for 5 minutes to reduce mite activity for handling. Discs of citrus leaves with predatory mites were inserted in vials (1x5cm), closed with cotton stoppers and kept in ice boxes for transfer to the field. Release was carried out 1-2 hours before sunset and 3-4 days after tree irrigation to guarantee suitable temperature and a relative humidity for introduction. Vials containing 30, 40, 50 and 60 adults (4:1females: male) were hung at mid-level of each tree, then opened. Release was applied when the numbers of citrus rust mites, *Brevipalpus phoenicis* (Geijskes) reached 1-3 individuals a citrus flat mite, *Phyllocoptruta oleivora* (Ashmead) 7-12 individuals/30 leaves and 9 fruits.

Four plots for each experiment were arranged in a factorial randomized design. Three of them were sprayed with Vertimec, Biofly and Dithane and the fourth was sprayed with water as a control. Spraying was done in mid-May when the level of infestation was 1, 2/30 leaves for *P. oleivora* and *B. phoenicis*, respectively.

Each plot was divided into five subplots of three trees with a barrier of one untreated tree around the subplot from every direction. When the number of phytophagous mite increased about mid-August, the release of *A. swirskii* was carried out. The five subplots received 0, 30, 40, 50 and 60 predators/tree. The forth plot (control treatment) was untreated.

Samples were taken just before spraying and after that, weekly for a fortnight and then biweekly till the end of the experiment. Each sample included 30 leaves and 9 fruits. The predator was released after about 3 months of chemical spray.

The effect of chemical, biological and integrated control treatment on the number of russeted orange fruits was also investigated and estimated as a percentage. The data of mite numbers and russeted fruits obtained were subjected to analysis of variance test (ANOVA) with a mean separation at the 5 % level of significance according to the method of Snedecor and Cochran (1967). Percentages of reduction of the mite populations were estimated according to the equation of Henderson and Tilton (1955).

RESULTS AND DISCUSSION

Effect of integrated control on *P. oleivora*

Table (1) shows that spraying Bio-fly and Dithane completely eradicated P. *oleivora* populations two days after spraying for 3 weeks after application. Two

weeks after spraying Vertimec spraying began to reduce *P. oleivora numbers*. The residual effect of all compounds kept *P. oleivora* numbers low for six weeks, after which numbers began to increase again at early August. Populations increased gradually from the beginning of the experiment till mid-August (after about 3 months) reaching 28 individuals/30 leaves and 9 fruits. The mite numbers in treatments with the three compounds but without receiving the predatory mite (zero level of release) greatly increased, reaching maximum of 47, 49 and 52 individuals/30 leaves and 9 fruits for Vertimec, Bio-fly and Dithane, respectively. By mid-September, the numbers decreased gradually according to the natural trend of *P. oleivora* populations. *P. oleivora* numbers began to decrease two weeks after releasing *A. swirskii* at the level of 50 and 60 predators/tree, with a large drop evident from mid-October. Numbers of *P. oleivora* in the control increased gradually reaching its peak on 18*th* September, then decreased to lower levels by mid-November. The same results were obtained by Smith and Papacek (1991) who reported that integrating *Amblyseius victoriensis* (Womersley) with Mancozeb reduced the population of *P. oleivora* by 100 %.

Effect of integrated control on *B. phoenicis*

Results in Table (2) revealed that spraying Vertimec, Bio-fly and Dithane eradicated populations of *B. phoenicis* two days after spraying for a six week period after which the numbers began to gradually increase (5-10.5 individuals/30 leaves and 9 fruits in season 2001). Increasing numbers was found in the control. When the numbers reached 4-8 individuals/30 leaves, the release of the predatory mite *A. swirskii* was undertaken at different levels. The number of *B. phoenicis* receiving treatments with sprayed chemicals but not predators (zero level) increased gradually, reaching its maximum by mid-September as the control did (21, 20, 22 and 23 individuals/sample) for Vertimec, Bio-fly, Dithane and control, respectively.

At the level 50 or 60 predators/tree, there was a slight increase in the numbers of *B. phoenicis* one week after spray which decreased gradually reaching its minimum by mid-October (one individual or zero/sample). The trees were free of *B. phoenicis* in November.

In conclusion, data proved that Vertimec sprayed in mid-May followed by release of 50 or 60 predators/tree after about 3 months was the best treatment for controlling *B. phoenicis*. These results ascertained the findings of McCoy *et al.* (1982).

The effect of integrated control on *A. swirskii*

Results in Table (3) showed the effect of different treatments on the numbers of *A. swirskii*. Spraying Vertimec, Bio-fly and Dithane completely eradicated the native *A. swirskii* two days after spraying for six weeks, meanwhile the number of *A. swirskii* increased gradually in the control. Two months after spraying, native *A. swirskii* began to reappear in small numbers. Before releasing *A. swirskii*, its native, numbers ranged between 0 and 4 individuals/sample in all pesticide treatments while it was 7individuals/sample in the control. After release, the overall mean of the predatory mite (native released) ranged between 2.9 and

Table (1): Effect of integrating *Amblyseius swirskii* with chemical and biopesticides for the control of *Phyllocoptruta oleivora* on Baladi orange trees during 2001/2002.

Dates	Number of mites/30 leaves and 9 fruits																			
Treatments	Sampling date before release									Level of release/tree	Sampling date after release									
	15/5*	17/5	24/5	1/6	15/6	1/7	15/7	1/8	13/8		20/8**	27/8	4/9	11/9	18/9	3/10	18/10	3/11	18/11	Mean
Vertimec	1.0	1.0	0.0	1.0	1.0	2.0	3.0	9.0	9.0	0	21.0	29.0	40.0	45.0	47.0	45.0	40.0	30.0	11.0	31.7a
	1.0	1.0	1.0	0.0	0.0	0.0	1.0	11.0	10.0	30	18.0	27.0	31.0	40.0	48.0	44.0	31.0	21.0	8.0	27.8a
	1.0	1.0	0.0	1.0	1.0	1.0	0.0	7.0	15.0	40	17.0	22.0	27.0	37.0	26.0	23.0	18.0	11.0	6.0	20.2ab
	0.0	1.0	0.0	0.0	0.0	0.0	1.0	8.0	11.0	50	12.0	9.0	15.0	8.0	6.0	2.0	1.0	0.0	0.0	6.5c
	1.0	0.0	0.0	0.0	1.0	1.0	2.0	5.0	8.0	60	13.0	9.0	12.0	8.0	0.0	2.0	1.0	0.0	0.0	5.3c
Bio-fly	1.0	0.0	0.0	0.0	1.0	1.0	3.0	6.0	9.0	0	19.0	29.0	39.0	47.0	49.0	41.0	43.0	38.0	17.0	33.1a
	0.0	0.0	0.0	1.0	1.0	2.0	4.0	12.0	11.0	30	19.0	25.0	33.0	41.0	47.0	39.0	21.0	18.0	3.0	25.7ab
	0.0	0.0	0.0	0.0	0.0	1.0	0.0	5.0	11.0	40	18.0	11.0	19.0	21.0	23.0	19.0	13.0	7.0	1.0	14.3b
	0.0	0.0	0.0	0.0	0.0	0.0	6.0	8.0	10.0	50	14.0	8.0	11.0	11.0	18.0	6.0	1.0	0.0	0.0	7.9c
	1.0	0.0	0.0	0.0	1.0	1.0	2.0	6.0	19.0	60	18.0	10.0	12.0	10.0	8.0	2.0	1.0	0.0	0.0	8.0c
Dithane	1.0	0.0	0.0	0.0	0.0	1.0	3.0	10.0	18.0	0	22.0	31.0	37.0	47.0	52.0	48.0	40.0	33.0	11.0	33.9a
	1.0	0.0	0.0	0.0	0.0	0.0	4.0	10.0	22.0	30	25.0	28.0	35.0	34.0	43.0	34.0	27.0	17.0	7.0	27.2a
	1.0	0.0	0.0	0.0	0.0	0.0	5.0	11.0	14.0	40	18.0	11.0	17.0	12.0	15.0	19.0	10.0	6.0	1.0	12.3b
	0.0	0.0	0.0	0.0	0.0	1.0	2.0	13.0	29.0	50	20.0	9.0	12.0	8.0	10.0	6.0	2.0	0.0	0.0	9.6c
	0.0	0.0	0.0	0.0	0.0	1.0	3.0	15.0	21.0	60	16.0	9.0	11.0	6.0	8.0	3.0	1.0	0.0	0.0	7.5c
Control	1.0	1.0	3.0	3.0	5.0	18.0	24.0	28.0	29.0	-	23.0	34.0	38.0	52.0	63.0	52.0	42.0	32.0	13.0	37.8a

*: Pre-chemical application **: Date of predator release

- Means of *P. oleivora* with the same letter are not significantly different ($P < 0.01 = 3.37$), ($P < 0.05 = 2.38$) according to Duncan's multiple range test.

Table (2): Effect of integrating *Amblyseius swirskii* with three chemical and biopesticides for the control of *Brevipalpus phoenicis* on Baladi orange trees during 2001/2002.

Dates	Number of mites/30 leaves and 9 fruits																			
	Sampling date before release										Sampling date after release									
Treatments	15/5*	17/5	24/5	1/6	15/6	1/7	15/7	1/8	13/8	Level of release/tree	20/8**	27/8	4/9	11/9	18/9	3/10	18/10	3/11	18/11	Mean
Vertimec	0.0	0.0	0.0	0.0	0.0	0.0	2.0	4.0	8.0	0	12.0	16.0	18.0	21.0	21.0	13.0	11.0	10.0	7.0	13.7a
	1.0	0.0	0.0	0.0	0.0	0.0	3.0	5.0	7.0	30	8.0	14.0	17.0	22.0	17.0	13.0	8.0	2.0	1.0	10.9a
	1.0	0.0	0.0	0.0	0.0	0.0	2.0	3.0	6.0	40	8.0	11.0	13.0	15.0	7.0	6.0	6.0	0.0	1.0	7.3c
	0.0	0.0	0.0	0.0	0.0	1.0	2.0	2.0	6.0	50	7.0	5.0	4.0	3.0	2.0	1.0	1.0	0.0	0.0	2.9d
	1.0	0.0	0.0	0.0	0.0	1.0	2.0	3.0	5.0	60	7.0	6.0	4.0	2.0	1.0	1.0	0.0	0.0	0.0	2.6d
Bio-fly	1.0	0.0	0.0	0.0	0.0	0.0	2.0	5.0	8.0	0	11.0	14.0	17.0	19.0	20.0	18.0	15.0	9.0	6.0	13.7a
	0.0	0.0	0.0	0.0	0.0	0.0	1.0	4.0	7.0	30	9.0	16.0	16.0	18.0	14.0	11.0	6.0	2.0	1.0	10.0b
	0.0	0.0	0.0	0.0	0.0	0.0	2.0	5.0	8.0	40	10.0	11.0	12.0	14.0	8.0	6.0	5.0	2.0	0.0	7.6c
	1.0	0.0	0.0	0.0	0.0	1.0	2.0	4.0	10.0	50	10.0	7.0	4.0	4.0	3.0	1.0	0.0	0.0	0.0	3.9cd
	0.0	0.0	0.0	0.0	0.0	0.0	1.0	5.0	8.0	60	8.0	5.0	3.0	4.0	4.0	2.0	1.0	0.0	0.0	3.5cd
Dithane	1.0	0.0	0.0	0.0	0.0	1.0	3.0	5.0	4.0	0	11.0	15.0	19.0	25.0	22.0	20.0	16.0	11.0	7.0	15.0a
	0.0	0.0	0.0	0.0	0.0	0.0	3.0	3.0	4.0	30	12.0	18.0	21.0	24.0	15.0	15.0	10.0	6.0	2.0	12.7a
	1.0	0.0	0.0	0.0	0.0	0.0	2.0	6.0	7.0	40	9.0	11.0	12.0	15.0	8.0	6.0	5.0	3.0	0.0	7.6c
	0.0	0.0	0.0	0.0	0.0	0.0	2.0	4.0	8.0	50	11.0	7.0	2.0	4.0	3.0	1.0	0.0	0.0	0.0	3.6cd
	2.0	0.0	0.0	0.0	1.0	1.0	2.0	4.0	5.0	60	8.0	8.0	3.0	3.0	1.0	1.0	0.0	0.0	0.0	2.9d
Control	1.0	1.0	0.0	1.0	1.0	7.0	11.0	12.0	11.0	-	15.0	17.0	21.0	27.0	23.0	16.0	13.0	9.0	5.0	15.7a

* : Pre-chemical application ** : Date of predator release

- Means of *B. phoenicis* with the same letter are not significantly different (P < 0.01 = 3.37), (P < 0.05 = 2.38) according to Duncan's multiple range test.

Table (3): Effect of integrating *Amblyseius swirskii* and three chemical and biopesticides on *A. swirskii* numbers on Baladi orange trees during 2001/2002.

Dates	Numbers of mites / 30 leaves and 9 fruits																			
	Sampling date before release										Sampling date after release									
Treatments	15/5*	17/5	24/5	1/6	15/6	1/7	15/7	1/8	13/8	Level of release/tree	20/8**	27/8	4/9	11/9	18/9	3/10	18/10	3/11	18/11	Mean
Vertimec	2.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	2.0	00	2.0	3.0	2.00	4.00	4.00	5.00	4.00	6.00	6.00	3.8a
	3.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	2.0	30	3.0	3.0	4.00	4.00	5.00	7.00	11.0	13.0	11.0	6.3ab
	2.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	2.0	40	6.0	8.0	8.00	7.00	6.00	8.00	11.0	17.0	19.0	9.2b
	4.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	50	3.0	4.0	6.00	9.00	11.0	13.0	17.0	25.0	27.0	11.5bc
	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	60	4.0	4.0	7.00	9.00	9.00	11.0	19.0	21.0	30.0	11.5bc
Bio-fly	4.5	0.0	0.0	0.0	0.0	0.0	1.0	1.0	2.0	0	2.0	1.0	2.00	2.00	3.00	3.00	5.00	4.00	5.00	2.9a
	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30	3.0	2.0	3.00	4.00	6.00	5.00	9.00	11.0	11.0	5.4ab
	2.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	2.0	40	5.0	7.0	6.00	9.00	6.00	8.00	10.0	12.0	14.0	7.9ab
	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	50	2.0	4.0	5.00	8.00	10.0	15.0	18.0	26.0	32.0	12.1bc
	6.0	0.0	0.0	0.0	0.0	0.0	2.0	1.0	4.0	60	3.0	4.0	6.00	11.0	13.0	14.0	15.0	23.0	27.0	12.0bc
Dithane	5.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	2.0	0	1.0	2.0	2.00	4.00	3.00	2.00	4.00	6.00	4.00	3.0a
	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	30	3.0	5.0	3.00	4.00	6.00	6.00	9.00	12.0	13.0	6.2ab
	4.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	2.0	40	4.0	5.0	7.00	6.00	8.00	10.0	9.00	14.0	17.0	8.2ab
	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50	2.0	3.0	4.00	8.00	13.0	16.0	18.0	30.0	27.0	12.0bc
	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	60	2.0	2.0	4.00	7.00	11.0	16.0	19.0	23.0	26.0	11.0bc
Control	3.0	4.0	2.0	4.0	3.0	4.0	6.0	7.0	7.0	-	9.0	8.0	10.0	9.00	9.00	10.0	11.0	13.0	9.00	9.5b

*: Pre-chemical application **: Date of predator release

- Means of *B. phoenicis* with the same letter are not significantly different (P < 0.01 = 2.12), (P < 0.05 = 1.71) according to Duncan's multiple range test.

Table (4): Average numbers and percentages of russeted citrus fruits after spraying different compounds during 2001/2002.

Treatments	Fruits in the 3 replicates									Grand Total		Aver age R %
	1			2			3					
	Total	Russeted	R %	Total	Russeted	R %	Total	Russeted	R %	Total	Russeted	
Vertimec	135.0	48.0	35.6	152.0	68.0	44.7	178.0	66.0	37.1	465.0	182.0	39.1b
Bio-fly	196.0	80.0	40.8	163.0	51.0	31.3	171.0	61.0	35.7	530.0	192.0	36.2b
Diathane	153.0	51.0	33.3	181.0	53.0	29.3	172.0	66.0	38.4	506.0	170.0	33.6b
Vertimec + oil	184.0	48.0	26.1	166.0	41.0	24.7	145.0	34.0	23.4	495.0	123.0	24.8c
Control	149.0	114.0	76.5	167.0	140.0	83.8	192.0	149.0	77.6	508.0	403.0	79.3a

- Average of russeted percentages of fruits with the same letter are not significantly different ($P < 0.01 = 5.99$), ($P < 0.05 = 3.48$) according to Duncan's multiple range test.

Table (5): Average numbers and percentages of russeted citrus fruits after releasing of *Amblyseius swirskii* during 2001/2002.

Fruits in the 3 replicates												Average R %
1			2			3			Grand total			
Total	Russeted	R %	Total	Russeted	R %	Total	Russeted	R %	Total	Russeted		
138.0	57.0	41.3	186.0	78.0	41.9	175.0	68.0	38.9	499.0	203.0		40.7b
147.0	56.0	38.1	174.0	64.0	36.8	169.0	68.0	40.2	490.0	188.0		38.4b
191.0	63.0	33.0	172.0	55.0	30.2	163.0	51.0	31.3	536.0	169.0		31.5c
167.0	47.0	28.1	135.0	42.0	31.1	178.0	52.0	29.2	480.0	141.0		29.4c
157.0	125.0	79.6	184.0	153.0	83.2	172.0	138.0	80.2	513.0	41.6		81.1a

• Average of russeted percentages of fruits with the same letter are not significantly different ($P < 0.01 = 5.99$), ($P < 0.05 = 3.48$) according to Duncan's multiple range test.

Table (6). Average numbers and percentages of russeted citrus fruits after integrating *Amblyseius swirskii* with different compounds during 2001/2002.

Treatments	Average of release/ tree	Fruits in the 3 replicates									Grand Total		Aver age R %
		1			2			3					
		Total	Russeted	R %	Total	Russeted	R %	Total	Russeted	R %	Total	Russleted	
Vertimec	0	143.0	48.0	33.6	173.0	65.0	37.6	157.0	58.0	36.9	473.0	171.0	36.2b
	30	170.0	58.0	34.1	159.0	44.0	27.7	173.0	55.0	31.8	502.0	157.0	31.3b
	40	164.0	31.0	18.9	190.0	45.0	23.7	178.0	38.0	21.3	532.0	114.0	21.4c
	50	171.0	18.0	10.5	151.0	12.0	7.90	157.0	15.0	9.60	479.0	45.0	9.4d
	60	158.0	9.00	5.70	174.0	21.0	12.1	165.0	17.0	10.3	497.0	47.0	9.5d
Bio-fly	0	171.0	58.0	33.9	183.0	72.0	39.3	177.0	74.0	41.8	531.0	204.0	38.4b
	30	162.0	51.0	31.5	137.0	39.0	28.5	149.0	47.0	31.5	448.0	137.0	30.6b
	40	166.0	36.0	21.7	146.0	32.0	21.9	181.0	51.0	28.2	493.0	119.0	24.1c
	50	178.0	21.0	11.8	135.0	18.0	13.3	169.0	22.0	13.0	482.0	61.0	12.7d
	60	156.0	23.0	14.7	152.0	17.0	11.2	148.0	18.0	12.2	456.0	58.0	12.7d
Dithane	0	184.0	68.0	36.9	156.0	42.0	26.9	169.0	64.0	37.8	509.0	174.0	34.2b
	30	179.0	66.0	36.8	147.0	41.0	27.8	173.0	60.0	34.7	499.0	167.0	33.5b
	40	168.0	50.0	29.8	181.0	61.0	33.7	134.0	21.0	15.6	483.0	132.0	27.3c
	50	153.0	11.0	7.10	161.0	14.0	8.70	193.0	27.0	13.9	507.0	52.0	10.3d
	60	187.0	27.0	14.4	155.0	12.0	7.70	169.0	19.0	11.2	511.0	58.0	11.4d
Control		194.0	167.0	86.1	175.0	154.0	88.0	190.0	164.0	86.3	559.0	485.0	86.8a

- Average of russeted percentages of fruits with the same letter are not significantly different ($P < 0.01 = 2.74$), ($P < 0.05 = 2.04$) according to Duncan's multiple range test.

3.8 individuals/sample when pesticides were used without release, while the overall means ranged between 5.4 and 6.3 individuals/sample when pesticide was integrated with releasing of 30 predators/tree. No differences were seen between the predatory mite numbers among 0 and 30individuals as levels of release. Predators populations in all treatments increased gradually at 6 different ratios depending on the level of release. At 40 predators/tree integrated with pesticides, the overall numbers of *A. swirskii* ranged between 7.9 and 9.2 individuals/sample. At levels of 50 or 60, the overall mean numbers of *A. swirskii* were nearly the same for the three pesticides treatments. There were no significant differences between *A. swirskii* numbers in control and in all treatments except for the trees sprayed without receiving predatory mites (Vertimec + zero level, Bio-fly + zero level, and Dithane + zero level release of *A. swirskii*). These results agreed with the findings of El-Halawany *et al.* (1987), Iskander (1993), Ibrahim (1994&1998) and Iskander and Darwish (1994), and Iskander (2000).

Average percentages of russeted citrus fruits

Results in Tables (4-6) indicate that spraying the tested pesticides decreased the percentages of russeted fruits from 79.3 % in the control to 24.8-39.1 %. When chemicals were used, these percentages were nearly the same as when the predatory mite, *A. swirskii* or *Phytoseiulus plumifer* (C. & F.) was used at the level of release ranging from 30 to 60 predators/tree. However, spraying the same compounds integrated with releasing *A. swirskii*, especially at the level of 50 or 60 individuals/tree, reduced the average russeted fruit percentages from 86.8 % in the control to 9.4-12.7%. Therefore, using biocides, especially Vertimec to control phytophagous mites and the release of *A. swirskii* at the level of 60 individuals/tree is recommended to control phytophagous mite, to reduce russeted fruits, and to restore the predatory mite population for the next season. This is in agreement with Smith and Papacek (199).

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