

A PRELIMINARY STUDY OF BIOLOGICAL CONTROL OF *TETRANYCHUS URTICAE* KOCH ON CUCUMBER (ACARI: TETRANYCHIDAE)

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Abstract

A preliminary study was carried out to control the two-spotted spider mite, *Tetranychus urticae* Koch on cucumber in a net greenhouse and in open field by releasing the predatory mite, *Phytoseiulus macropilis* (Banks). The *T. urticae* reduction in the greenhouse reached about 90 % after 24 and 28 days from the predator release at the rate of 4 and 2 individuals/pot, respectively. Maximum reduction of the pest in open field was 85 and 90 % after 4 weeks from the predator release at the rate of 5 and 10 individuals/pot, respectively. The previous study indicated the possibility to control the two-spotted spider mite, *T. urticae* on cucumber by using *P. macropilis* as a biocontrol agent.

INTRODUCTION

Cucumber is considered one of the important vegetables mainly for local market. Its cultivated area of cucumber in Egypt was about 30000 feddan in summer and 10000 in winter. Exportation of cucumber fruits is expected to be increased in the coming years. This require to obtain healthy clean fruits without chemical pesticide treatments. The two-spotted spider mite, *Tetranychus urticae* Koch is one of its important pests, where recommended acaricides are still the only method its control. Many trials were done by several authors to control this acarine pest on certain plants by releasing the predatory mite *Phytoseiulus macropilis* (Banks) (Hamlen, 1978; Hamlen & Poole, 1980; Price, 1981; Watanabe *et al.*, 1994; Ramos & Rodriguez, 1995; Heikal & Mowafi, 1998; Heikal *et al.*, 2000; Heikal & Ibrahim, 2001).

Therefore, the present work is a preliminary trial to control the two-spotted spider mite, *T. urticae* on cucumber plants under a net greenhouse and in an open field conditions by the aforementioned predator.

MATERIAL AND METHODS

A. The greenhouse experiment: 18 cucumber cv. Madona nursery were planted in 1 : 1 peat moss-vermiculite mix in 20 cm diameter plastic pots. When foliage of plants became suitable (about 10 days from planting) plants were inoculated with the two-spotted spider mite, *T. urticae* (10 females and 2 males/pot). Stems of cucumber plants were ringed with a sticky material (Tangle-foot) to prevent escaping of mites. Cucumber pots were maintained under a net greenhouse established at Plant Protection Research Institute at Dokki district.

After 5 days, cucumber plants were divided into three groups each with six pots. The first group of pots was released with the predatory mite, *P. macropilis* at the rate of 2 individuals/pot and the second group was released with 4 predator individuals/pot, while the third group was left without releasing as control. Both the prey and predator individuals were transferred to the cucumber leaves by using a camel's hair brush. Counts of motile stages of both *T. urticae* and *P. macropilis* were estimated in each pot just before predator release and then every 4 days by a special magnified hand lens (20X). Henderson and Tilton equation (1955) was applied to calculate the reduction of *T. urticae* populations.

B. The open field experiment: An area of about 2 kirats (350 m²) cultivated with cucumber variety Madona on Feb. 25, 2002 was chosen at Ismailia Governorate and left without any pesticide treatments. Nine cucumber lines were selected and divided into three treatments each with three lines (considered as replicates). Additional cucumber lines were left between the previous selected lines as intermediate plants to serve as buffer plants. Release of the predator kept in 0.5 x 1.5 cm gelatin capsules occurred on March 12, 2002 at the rate of 5 individuals/bit on lines of the first treatment and 10 individuals/bit in the second treatment, while lines of the third treatment were left free as check. Randomized samples of 10 leaves/replicate were taken just before the predator release as pre-count. Then five post-counts were taken at weekly intervals where motile stages of *T. urticae* and *P. macropilis* were counted in the field with the aid of hand lens (20X). The equation of Henderson and Tilton (1955) was also applied.

RESULTS AND DISCUSSION

In general, when the predatory mite, *P. macropilis* was released on cucumber plants infested with the two-spotted spider mite, the pest population decreased in a positive relation with the level of predator release (2 or 4 individuals/pot, Table 1. Population of the *T. urticae* (on the release pot) generally remained at nearly its initial level for about 24 days after the predator release.

Then rapidly decreased until the end of the experiment to reach 25 and 3 individuals/pot in the release rate of 2 and 4 predators/pot, respectively. On the opposite, the pest population gradually increased in the control plots to reach its highest level in the last inspection (1277 individuals/pot). These results indicated that releasing the predatory mite, *P. macropilis* was able to reduce the mean number of *T. urticae* in the release pots to be 53 and 39 individuals/pot when the predator was released at the rate of 2 and 4 predators/pot, respectively, compared with 492 individuals/pot for the no-release pots. The two predator release rates affected the *T. urticae* populations with a relatively rapid reduction in the high predator release, Table, 1. The pest reduction reached about 60 % after 12 days at release rate of 4 individuals/pot, while it attained the same level after 16 days at release rate of 2 individuals/pot. In the same manner, the *T. urticae* reduction reached about 90 % after 24 and 28 days when predator at release rate of 4 and 2 individuals/pot, respectively. The maximum pest reductions were 100 and 47 % at the end of the experiment in January 12 at the previous predator rates, respectively. However, mean reductions of the two-spotted spider mite over the growing season were 61 and 69 % when the predator was released at the rate of 2 and 4 individuals/pot, respectively.

This agreed with the findings of Hamlen and Poole (1980) who indicated that population of *T. urticae* infesting *Diffenbachia maculatus* in the greenhouse in Florida was significantly reduced 2 weeks of the release of the predaceous mite, *P. macropilis* and that the numbers of predator introduced had a direct effect on the time required to bring about reductions in spider mite populations and the maintenance of high-quality plants.

Population of *P. macropilis* increased gradually throughout the inspection dates to reach its highest level after about 28 days from the predator release (174 and 197 predator individuals/pot at the two release levels 2 and 4 individuals/pot, respectively, with general means of 91 and 101 predator individuals/pot.

The open field experiment: Populations of the two-spotted spider mite, *T. urticae* were generally low in the pre-count (just before the predator release). Therefore, 1.2, 1.0, 1.1 and 1.1 individuals/leaf in plots A, B, C and D, respectively, Table 2. After releasing the predator individuals, the *T. urticae* population continued at apparently the same levels or slightly increased in the release plots and 7 highly increased in the no release plots to reach high populations in the fourth post-count, then reducing maximum at the last post-count in April 20 to averaging 7.8, 7.5, 47.7 and 22.1 individuals/leaf in plots A (5 predators/bit), B (10 predators/bit), C (no release) and D (buffer plants), respectively. Total means of *T. urticae* population throughout the experiment were

Table 1. Release of *P. macropilis* on pots of cucumber nursery maintained under a net greenhouse conditions.

Sampling date	Rate of <i>P. macropilis</i> release/pot	No. mites/pot		Reduction of <i>T. urticae</i> %
		<i>T. urticae</i>	<i>P. macropilis</i>	
Dec. 14, 2001 (Date of release, pre-count)	2 individuals	55	2	-
	4 individuals	62	4	-
	No-release	75	-	-
	(check)			
Dec. 18 (1st post-count)	2 individuals	55	10	17
	4 individuals	53	28	28
	No-release	88	0	0
Dec. 22 (2nd post-count)	2 individuals	66	34	6
	4 individuals	62	36	20
	No-release	94	0	0
Dec. 26	2 individuals	76	50	47
	4 individuals	62	70	61
	No-release	193	0	0
Dec. 30	2 individuals	60	68	66
	4 individuals	43	77	73
	No-release	200	0	0
Jan. 3, 2002	2 individuals	55	80	22
	4 individuals	50	85	77
	No-release	261	0	0
Jan. 7	2 individuals	59	100	85
	4 individuals	34	120	92
	No-release	544	0	0
Jan. 11	2 individuals	36	174	96
	4 individuals	4	197	100
	No-release	1280	0	0
Jan. 14	2 individuals	25	92	97
	4 individuals	3	105	100
	No-release	1277	0	0
Mean	2 individuals	53	91	61
	4 individuals	39	101	69
	No-release	492	0	-

Table 2. Release of *P. macropilis* on cucumber plants under open field conditions.

Sampling date	Rate of <i>P. macropilis</i> release/pot	No. mites/pot		Reduction of <i>T. urticae</i> %
		<i>T. urticae</i>	<i>P. macropilis</i>	
Mar. 12, 2002 (Pre-count, date of release)	(A) 5 indiv.	-	-	-
	(B) 10 indiv.	1.2	-	-
	(C) No release (check)	1.0	-	-
	(D) Intermediate plants	1.1	-	-
Mar. 19 (1st post-count)	(A)	0.8	0.2	54
	(B)	0.6	0.1	59
	(C)	1.6	0.0	0
	(D)	1.4	0.0	0
Mar. 26 (2nd post-count)	(A)	2.5	0.2	62
	(B)	1.8	0.1	67
	(C)	3.4	0.0	0
	(D)	4.6	0.1	23
Apr. 4	(A)	2.3	0.1	65
	(B)	1.8	0.2	67
	(C)	6.0	0.1	0
	(D)	3.3	0.1	45
Apr. 13	(A)	2.6	0.3	85
	(B)	1.4	0.1	90
	(C)	15.6	0.0	0
	(D)	5.7	0.2	63
Apr. 20	(A)	7.8	0.2	85
	(B)	7.5	0.3	82
	(C)	47.7	0.0	0
	(D)	22.1	0.0	54
Mean	(A)	3.2	0.2	70
	(B)	2.6	0.2	72
	(C)	15.4	0	0
	(D)	7.3	0	46

3.2, 2.6, 15.4 and 7.3/leaf in the previous bits, respectively.

Reduction percentage of the two-spotted spider mite populations were also estimated. Data in Table 2 indicated that the two levels of predator release affected pest populations. The *T. urticae* reduction reached about 60 % in the second inspection (after two weeks from the predator release). The maximum reduction of the pest occurred in the fourth inspection (4 weeks from the predator release) where they were 85, 90 and 63 % in bits A, B and D, respectively. Mean reductions of the pest over the growing season were 78, 72 and 46 % in the previous plots, respectively.

The predator individuals appeared on the sampled leaves in the release plots from the first post-count (March 19) till the last post-count (April 20) ranged from 0.1-0.3 predator/leaf with a mean of 0.2 predator/leaf in plots A and B. The predator individuals appeared on the buffering plants from the second inspection (2 weeks from the predator release) with relatively reduced the *T. urticae* population.

The present results showed the possibility of controlling the two-spotted spider mite, *T. urticae* on cucumber under greenhouse or open fields by releasing the predatory mite, *P. macropilis*. However, additional experiments are needed to assure these results and to study the suitable time and rate of release during winter and summer seasons.

REFERENCES

1. Hamlen, R.A. 1978. Biological control of spider mites on greenhouse ornamentals using predaceous mites. Proc. Fla. State Hortic. Soc., 91 : 247-249.
2. Hamlen, R.A. and R.T. Poole. 1980. Effect of a predaceous mites on spider mite populations of *Diffenbachia* under greenhouse and anterior environments. Hort-science, 15 (5) : 611-612.
3. Heikal, I.H. and G.A. Ibrahim. 2001. Release of *Phytoseiulus macropilis* (Banks) to control *Tetranychus urticae* Koch on strawberry in Ismailia Governorate, Egypt (Acari: Phytoseiidae & Tetranychidae). Egypt. J. Agric. Res., 79 (3): 893-906.
4. Hikal, I.H. and M.H. Mowafi. 1998. Biological control of *Tetranychus urticae* on bean plants by two introduced predators. Al-Azhar J. Agric. Res., 27 : 185-196.
5. Heikal, I.H., M.M. Fawzi, H.M. Ebrahim and G.A. Ibrahim. 2000. Biological control of *Tetranychus urticae* Koch on strawberry by the predaceous mite, *Phytoseiulus macropilis* (Banks) (Acari: Tetranychidae and Phytoseiidae). Egypt. J. Agric. Res., 78 (4) : 1517-1523.
6. Henderson, C.F. and E.W. Tilton. 1955. Test with acaricides against the brown wheat mites. J. Econ. Entomol, 48 : 157-161.
7. Ramo, M. and H. Rodriguez. 1995. Efficiency of control of *Tetranychus tumidus* (Banks) by *Phytoseiulus macropilis* (Banks) in banana. 1- Greenhouse trials. Revista de Proteccion Vegetal, 10 : 207-211.
8. Watanabe, M.A., G.J. de Morales, I. Gastaldo, Jr. and G. Nicoletta. 1994. Biological control of two-spotted spider mite with predatory phytoseiids (Acari: Tetranychidae, Phytoseiidae) on cucumber and strawberry. Scientia Agricola, 51 (1) : 7581.

دراسة ميدانية لمكافحة العنكبوت الأحمر

Tetranychus urticae Koch على الخيار

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أجريت دراسة ميدانية لمكافحة العنكبوت الأحمر *Tetranychus urticae* Koch على نباتات الخيار تحت ظروف الصوب الشبكية والحقل المفتوح بإطلاق المفترس الأكاروسي *Phytoseiulus macropilis* (Banks). وقد وصل النقص في تعداد العنكبوت الأحمر إلى حوالي ٩٠٪ بعد ٢٤ و ٢٨ يوماً من إطلاق المفترس بمعدل ٤ و ٢ فرد للإصيص الواحد في الصوبة، على التوالي. بينما حدث اعلا معدل لنقص العنكبوت الأحمر في الحقل المفتوح بعد أربعة أسابيع من إطلاق المفترس حيث وصلت نسبة الخفض إلى ٨٥، ٩٠٪ عند إطلاق المفترس بمعدل ١٠، ٥ أفراد للجورة، على التوالي. وعليه فقد دلت النتائج السابقة عن إمكانية مكافحة العنكبوت الأحمر على نباتات الخيار تحت ظروف الصوبة الشبكية أو الحقل المفتوح. إلا أن هذه النتائج تحتاج إلى تجارب أخرى لتأكيدتها مع تحديد أنسب مواعيد ونسبة الإصابة عند بدأ المكافحة.