

Annals Of Agric. Sc., Moshtohor,
Vol. 42(1): 357-364, (2004).

**BIOLOGICAL CONTROL OF THE TWO-SPOTTED SPIDER MITE
 (ACARI : TETRANYCHIDAE) WITH *Phytoseiulus persimilis*
 (ACARI : PHYTOSEIIDAE) ON COMMERCIAL CUCUMBER
 IN SHARKIA GOVERNORATE
 BY**

Fawzy, M.M.H.; Abd El-Wahed, N. M. and El-Sayied, K.M.
 Plant Protection Research Institute, Agriculture Research Centre, Dokki, Giza, Egypt

ABSTRACT

Biological control of *Tetranychus urticae* Koch in Sharkia Governorate's commercial cucumber fields is possible by using of the predacious mite, *Phytoseiulus persimilis* Athias-Henriot.

During the two successive seasons, 2003 and 2004 the predator mite, *P. persimilis* A.-H. was released at a rate 20-25 individuals/bit to control the two-spotted spider mite, *Tetranychus urticae* Koch in about 196 m² planted with commercial cucumber variety; Botaseed in El-Gahpharia, Sharkia Governorate.

In the first season 2003, the reduction of spider mite reached 98% after 7 weeks from release compared with the control while in the second season 2004 the reduction reached 97% after about 8 weeks from release. Immigration of the predator to the buffer area contributed reduction of pest. The cost is likely to be lower than that of chemical control and cucumber yield not reduced.

INTRODUCTION

Cucumber is considered an important vegetable eaten fresh with salads and as pickles. It covers the local market requires all over the year seasons and exported to Arab countries with a considerable amount. Its cultivated area in Egypt reached about 30000 feddans in summer and 10000 feddans in winter. Exportation of cucumber fruits is expected to be increased in future and this requires to obtain healthy clean fruits without chemical pesticide residues.

The two-spotted spider mite, *Tetranychus urticae* Koch is one of important economic pest, acaricides are still the main method for its control.

Many trials were done by several authors to control this acarine pest on certain plants by releasing the predator mite *Phytoseiulus persimilis* A.-H. (Oatman & McMurtry, 1966; Oatman *et al.*, 1967; *Amblyseius californicus* (McGregor); and *Typhlodromus occidentalis* Nesbitt (Oatman *et al.*, 1977); Watanabe *et al.*, 1994 on cucumber, Heikal & Mowafi, 1998 on bean, Heikal *et al.*, 2003 on strawberry and Heikal & Fawzy 2003 on cucumber.

The present work aimed to control the two-spotted spider mite, *T. urticae* on a cucumber field by the phytoseiid predator, *P. persimilis* A.-H.

MATERIALS AND METHODS

A culture of *P. persimilis* A.-H. was reared in the laboratory on bean plant leaves (*Phaseolus vulgaris* L.), while mass rearing was carried out on bean plants, infested with the spider mite, *T. urticae* Koch according the technique followed by El-Halawany *et al.* 2000 in a 540 m², greenhouse.

Therefore, large number of plants were grown (about 1600 plants/greenhouse) and subsequently inoculated with the *T. urticae*. As soon as the level of the spider mite reached 2-3 individuals/leaflet member of the laboratory reared predator was released at the rate of 5 individuals/bit.

After about 3 weeks the rate of predator increased to reach 20-25 individuals/leaflet (32000-40000 predators/greenhouse) and these leaflets were used to release the predator in the experimented cucumber field.

Biological control experiment:

Two experiments were conducted, in an area of about 196 m² planted with commercial cucumber variety (Botaseed) at El-Gahpharia district, Sharkia Governorate in seasons 2003 and 2004 and was left without any pesticide treatment. The area of 196 m² was divided into 28 beds, each with 1 meter width. Every bed has two rows, each row cultivated with 15 bits of cucumber.

Twenty five cucumber rows were chosen and divided into four replicates and a control, each replicate had five rows. There were six rows between each replicate and thirteen rows between control and treated replicates as a buffer plants

The predatory mite, *P. persimilis* A.-H., which was reared in the greenhouse was collected on leaflets of bean, each with 20-25 moving stages and released as one leaflet/bit, amounting about 320000-400000 individuals/feddan. Release of the predator at a rate of one bean leaflet carrying 20-25 individuals/bit occurred in the first season on July 29th, 2003 and in the second season on April 6th, 2004. Randomized samples of 20 leaves were taken from each replicate, as well as buffer area and the control then examined with field lens (10X). The number of *T. urticae* and *P. persimilis* motile stages were recorded for each leaflet. Count was undertaken just before release, then at weekly intervals.

The reduction in two spotted spider mite population were calculated according to the equation of Henderson and Tilton (1955).

RESULTS AND DISCUSSION

Percentage of infestation of cucumber leaves with the two-spotted spider mite, *T. urticae*, just before the predator, release ranged between 91 and 97% of samples.

Results in Table (1) indicated that in the first season the pre-count of the two-spotted spider mite population was 264-266 moving stages/20 leaves on the predator release plants with mean 13.2 motile stages/leaf, while the number of *T. urticae* in buffer area was 260 motile stages/20 leaves with mean 13 motile stages/leaf.

After a week from the predator release on 29 July 2003, population density of *T. urticae* decreased to 175 individuals/ 20 leaves with reduction 51.16%, while in buffer was 200 mites/20 leaves with reduction 43%. In the same time, population in control increased from 266 to 359 moving stages/ 20 leaves.

After two weeks from predator release population of acarine pest decreased in release area, while highly increased in the control (106 and 506 individuals, respectively). The decreased of population was low because high density of *T. urticae* before releasing the predator. The reduction in the pest population appeared after one week of the predator release in buffer area between the treated replicates but with low level 43% and this might be due to increase of rate of release (20-25 predators/bit) and dispersal of the predator. The population of the pest two-spotted spider mite decreased continued its decrease but this was highly occurred in the fourth count on 17 September 2003; 21 moving stages/20 leaves with reduction 98%, while the population in buffer area was 165/ 20 leaves with reduction 80%. Population of the two-spotted spider mite continued its increase in the control reaching 854 moving stages/ 20 leaves (Table, 1).

These findings agreed with those obtained by Decon (1994), El-Halawany *et al.*, 2001 and Heikal & Fawzy 2002. They advised growers to have patience to allow the predator to affect spider mite population. Results in Table 2 revealed that in the second season the population of *T. urticae* was 103 moving stages/20 leaves in pre-count on 6 April 2004 in the predator release area, while was 129 moving stages/20 leaves, in the control. After a week from predator release, the population of *T. urticae* decreased to 42 moving stages/20 leaves in the first count giving 73% reduction, while in the buffer area the population decreased to 100 moving stages/20 leaves with 38% reduction. On the opposite, pest population increased in the control to reach 198 moving stages/20 leaves.

The population of pest then decreased gradually to reach 12 moving stages/ 20, leaves in the 6th week on 30 May 2004 with reduction 97%, while in buffer area the population was 37 moving stages/ 20 leaves with 90% reduction.

In the control pest population increased to 444 moving stages/20 leaves. Concerning the predatory mite, as shown in Table (1), its population totaled 153 predators/20 leaves after a week from release then decreased to 120 predators/ 20 leaves due to its dispersal. After that population increased gradually to reach 190 predators/ 20 leaves at the end of season.

Table (1): Population density and reduction percentage of *T. urticae* Koch before and after release of *P. persimilis* (A.-H.) on cucumber plants, (variety Botaseed) in the first season (29 July to 17 September 2003).

Sampling date	Number and reduction % of motile stages/20 leaves								<i>P. persimilis</i> /total	<i>P. persimilis</i> X/leaf
	Release area			Buffer area			Control			
	Total <i>T. urticae</i>	X/leaf	Reduction %	Total <i>T. urticae</i>	X/leaf	Reduction %	Total <i>T. urticae</i>	X/leaf		
29 July, 2003	264	13.2		260	13.0		266	13.3		
5 Aug.	175	8.75	51.16	200	10.0	43	359	17.9	153	7.65
12 Aug.	106	5.3	79.0	190	9.5	62	506	25.3	120	6.0
19 Aug.	58	2.9	91.0	180	9.0	73	679	33.9	165	8.25
17 Sept.	21	1.05	98.0	165	8.25	80	854	42.7	190	9.5

Table (2): Population density and reduction percentage of *T. urticae* Koch before and after release of *P. persimilis* (A.-H.) on cucumber plants, (variety Botaseed) in the second season (6 Apr. to 30 May 2004).

Sampling date	Number and reduction % of motile stages/20 leaves								<i>P. persimilis</i> /total	<i>P. persimilis</i> X/leaf
	Release are			Buffer area			Control			
	Total <i>T. urticae</i>	X/leaf	Reduction %	Total <i>T. urticae</i>	X/leaf	Reduction %	Total <i>T. urticae</i>	X/leaf		
6 Apr., 2004	103	5.15		105	5.25		129	6.45		
13 Apr.	42	2.1	73	100	5.0	38	198	9.8	165	8.25
21 Apr.	37	1.85	77	79	3.95	52	202	10.1	147	7.35
29 Apr.	35	1.75	82	60	3.0	69	240	12.0	170	8.5
16 May	26	1.3	87	54	2.7	73	244	12.2	198	9.9
23 May	18	0.9	91	40	2.0	80	249	12.45	220	11.0
30 May	12	0.6	97	37	1.85	90	444	22.2	212	10.6

P. persimilis population followed similar trend in second season 2004 as it was 165 individuals/20 leaves on 13 April, 2004, after a week from release, then it decreased due to dispersal to reach 147 predators/20 leaves in the second count of 21 Apr. After that population grew up to reach 212 predators/20 leaves at the end of the season on 30 May, 2004.

Examining the adjacent plants on beds near the site of experiment and associated weeds it was found to harbour high population of *P. persimilis* from which it could disperse to adjacent plants or the next crop. This coincides with the findings of Heikal and Mowafi (1998) concerning the predator *P. macropilis* when released to control *T. urticae* on bean plants.

However, the present results proved that this experiment assured the possibility of using the predatory mite, *P. persimilis* as a biological control agent against the two-spotted spider mite, *T. urticae* in commercial cucumber fields. It could be advisable to release the predator individuals when *T. urticae* population is at moderate or low density to offer a suitable chance for the predator to play its role successfully. Also, one feddan usually needs to 320000-400000 predators moving stages in order to obtain a good control of the noxious acarine pest *T. urticae*.

ACKNOWLEDGEMENT

The author wishes to express his deep gratitude to Prof. Dr. M. El-Said El-Halawany, Professor of Acarology, Plant Protection Research Institute for revision the manuscript and providing us with the predator.

REFERENCES

- Decou, G.C. (1994): Biological control of the two-spotted spider mite (Acarina : Tetranychidae) on commercial strawberries in Florida with *Phytoseiulus macropilis* (Acarina : Phytoseiidae). Flo-Entomol., 77 (1): 33-41.
- Halawany, M.E.; Abdel-Samad, M. A. and Ebrahim, H.N. (2000): Biological control of the spider mite, *Tetranychus urticae* Koch by the Phytoseiid mite, *Phytoseiulus persimilis* A.-H. compared with chemical control. Bull. Ent. Soc. Egypt, Econ. Ser., 27: 63-71.
- Heikal, I.H. and Mowafi, M.H. (1998): Biological control of *Tetranychus urticae* on bean plants by two introduced predators. Al-Azhar J. Agric. Res., 27 : 185-196.
- Heikal, I.H. and Pawzy, M.M. (2003): A preliminary study of biological control of *Tetranychus urticae* on cucumber (Acari : Tetranychidae). Egypt J. Agric. Res., 81 (1), 2003 .
- Heikal, I.H.; Ebrahim, G.A.; El-Sayed, K.M. and El-Ghobashy, M.S. (2003): Biological control of *Tetranychus urticae* Koch in strawberries open field and greenhouses by releasing *Phytoseiulus macropilis* (Banks) (Acari : Tetranychidae & Phytoseiidae). Egypt. J. Agric. Res., in press.

- Henderson C.F. and Tilton, E.W. (1955): Test with acaricides against the brown wheat mite. J. Econ. Entomol., 48 : 157-161.
- Oatman, E.R.; and McMurtry, J.A. (1966): Biological control of the two-spotted spider mite on strawberry in southern California. J. Econ. Entomol., 59 (2): 423-429.
- Oatman, E. R.; McMurtry, J. A.; Shorey, H. H. and Voth, V. (1967): Studies on integrating *Phytoseiulus persimilis* releases, chemical applications, cultural manipulations and natural predation for control of the two-spotted spider mite on strawberry in southern California. J. Econ. Entomol., 60 (5): 1344-1351.
- Oatman, E. R.; McMurtry, J. R.; Gilstrap, F. E. and Voth, V. (1977): Effect of release *Amblyseius californicus*, *Phytoseiulus persimilis* and *Typhlodromus occidentalis* on the two-spotted spider mite on strawberry in southern California. J. Econ. Entomol., 70 : 45-47.
- Watanabe, M.A.; Jde Morales, G.; Gastaldo, I. Jr, and Nicoletta, G. (1994): Biological control of two-spotted spider mite with predatory Phytoseiids (Acarina : Tetranychidae), Phytoseiidae) on cucumber and strawberry. Scientia Agricola, 51 (1): 75-81.

المكافحة البيولوجية للعنكبوت الأحمر العادي على الخيار التجاري بمحافظة الشرقية
بأستخدام المفترس الأكاروسي *Phytoseiulus persimilis*

مجدي محمد حسين فوزي، نزيه محمد عبد الواحد، كرم السيد محمد السيد
معهد بحوث وقاية النباتات - مركز البحوث الزراعية - الدقي - الجيزة - مصر

أجريت دراسة لمدة موسمين متتاليين على نباتات الخيار بمنطقة الجعفرية بمحافظة الشرقية لمكافحة العنكبوت الأحمر العادي *Tetranychus urticae* Koch بأطلاق المفترس الأكاروسي *Phytoseiulus persimilis* A.-H. بمعدل ٢٠-٢٥ مفترس لكل جورة من نبات الخيار على مستوي اصابة من الآفة الأكاروسية بمعدل ١٣,٢ فرد/ورقة في الموسم الأول ٥,١٥ فرد/ورقة في الموسم الثاني. وتم الإطلاق بوريقات الفاصوليا التي تحوي ٢٠-٢٥ مفترس/وريقة ووضعت واحدة لكل جورة. وقد دلت النتائج على إمكانية مكافحة العنكبوت الأحمر العادي *T. urticae* على نبات الخيار. كما ظهر أن اطلاق واحدة للمفترس كانت كافية لمكافحة هذه الآفة الأكاروسية. وتشير النتائج المتحصل عليها في الموسم الأول ٢٩ يوليو ٢٠٠٣ بأن نسبة الخفض في تعداد العنكبوت الأحمر بعد ثلاث أسابيع من الإطلاق كانت ٩١% أما في المساحة التي تركت بين المعاملات وصل الخفض في تعداد الآفة الي ٧٣%. أما بعد ٤٩ يوما من اطلاق المفترس زادت هذه النسبة الي ٩٨% في منطقة الإطلاق في حين كانت ٨٠% في المنطقة الفاصلة بين مناطق الإطلاق.

أما في الموسم الثاني تم اطلاق المفترس بتاريخ ١٦ أبريل ٢٠٠٤ وسجلت نسبة الخفض في تعداد الآفة الأكاروسية ٩١% بعد ٤٧ يوما من الإطلاق أما في المنطقة التي تركت بين المعاملات كانت نسبة الخفض ٨٠% وزادت هذه النسبة

المنوية في الخفض في تعداد الآفة الي ٩٧% ، ٩٠% علي الترتيب في منطقة الإطلاق وفي المنطقة الفاصلة بين المعاملات بعد ٥٤ يوما من الإطلاق. وحيث أن الفدان به ١٦ ألف نبات (جورة) ومعدل إطلاق امفترس من ٢٠- ٢٥ مفترس للجورة فإن الفدان يحتاج الي ٣٢٠ ألف الي ٤٠٠ ألف فرد من المفترس دفعة واحدة.