

## Biological and Chemical Control of three Plant Piercing - Sucking Insect Pests on Cucumber in Plastic Houses

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### ABSTRACT

Cucumber plants in plastic houses are usually infested with the insect pests, *Thrips tabaci* Lind., *Aphis gossypii* Glover, *Bemisia tabaci* (Genn.). Control of these pests was conducted by releasing the four phytoseiid mites, *Neoseiulus cucumeris* (Oudemans), *N. zaheri* (Yousef & El-Borolossy), *N. californicus* (McG.) and *Phytoseiulus macropilis* (Banks) on two cucumber cultivars, Heikal & Sahm in the two years, 2004 and 2005 in Nubaria, Beheira Governorate, Egypt. Heikal cultivar was highly infested with the three mentioned pests. *N. cucumeris* reduced *T. tabaci* and *A. gossypii* populations with reduction percentages of 89.21 & 84.96% and 78.61 & 67.77% on Heikal and Sahm cultivars, respectively. *N. zaheri* greatly affected *B. tabaci* with reduction percentages of 68.45 & 90.00% on the two cultivars, respectively, during 2004 season. Chemical control with the biocide Abamectin (Vertemic) 1.8% EC and the acaricide Phenproximate (Ortus) 5% SC gave reduction percentages of 72.37 & 64.0% for *T. tabaci*; 75.31 & 84.73% for *A. gossypii* and 89.73 & 58.70% for *B. tabaci*, respectively on Heikal cultivar during 2004 season. Similar results were noted on Sahm cultivar. Generally, releasing the three Phytoseiid mite species gave promising results against the three plant insect pests infesting cucumber cultivars in plastic houses.

**Key Words:** Phytoseiid mites, Piercing-sucking insects, Biological and chemical control.

### INTRODUCTION

Cucumber, *Cucumis sativus* L. (Family: Cucurbitaceae) is one of the important vegetable crops in Egypt. It is usually infested with several pests of which the two spotted spider mite, *Tetranychus urticae* Koch as well as the thrips, *Thrips tabaci* Lind: the aphid, *Aphis gossypii* Glover and the whitefly, *Bemisia tabaci* (Genn.) which cause economic damage to plants and fruits.

On the other hand, some phytoseiid mites were known to predate successfully on mite and insect pests and were used as bio-control agents (El-Badry & Zaher, 1961; Pecher *et al.*, 1987; Rizk *et al.*, 1990 and Workman *et al.*, 1994). Studies on biological control using phytoseiid predators showed that several predatory species are able to maintain effective control of some mite and insect pest species (McMurtry & Croft, 1997). Thus, the present work was conducted to study the efficacy of releasing the four predatory phytoseiid species; *Neoseiulus cucumeris* (Oudemans), *N. zaheri* (Yousef & El-Borolossy), *N. californicus* (McG.) and *Phytoseiulus macropilis* (Banks) as well as chemical control by the bio-pesticide (Vertemic) and the chemical acaricide (Ortus) against the plant piercing and sucking insect pests; *T. tabaci*, *A. gossypii* and *B. tabaci* infesting cucumber plants in plastic houses.

### MATERIALS AND METHODS

#### Mass Rearing of Four Predatory Phytoseiid Species

Four predatory phytoseiid species of which the two indigenous, *N. cucumeris* and *N. zaheri*, collected from weeds in Dakahlia Governorate and the other two exotic, *P. macropilis* and *N. californicus* were mass-reared in the laboratory. The latter was obtained from Plant Protection Department, National Research Center, Giza. The aforementioned four predatory species were mass reared using aluminum pans, 30x20x7cm with wet cotton pads at the bottom. Groups of females and males of each of the four predatory species were transferred to leaves of ficus, *Ficus dicora* L. placed on cotton pads in aluminum pans and kept in an incubator at 30±2°C and 70±5% R.H. Moving stages of *T. urticae* were offered as prey. For predator release, groups of females and males from each predator species were transferred to potted bean plants *Phaseolus vulgaris* L. infested with *T. urticae* as prey and kept in muslin cages.

#### Release of Predatory Mites

Mite predators release started on 8<sup>th</sup> February during the seasons 2004 and 2005, when cucumber plants were about 60-100cm long and leaf area about 50-60cm<sup>2</sup>. The ratio between predator and prey adapted was 1:10 (Heikal and Fawzy 2003). Bean leaves with each of the predatory mite species together with *T. urticae* slight infestation were put in plastic bags and kept in ice box at 8°C until reaching the plastic house. The

release was carried out 1-2 hours before sunset by hanging the bean leaves with known numbers of predatory mites on cucumber leaves by pins. A pre-release and after releasing, samples were taken weekly and the numbers of the three insect pests were assessed.

### Chemical Control Experiments

An experiment was conducted using a biocide Abamectin (Vertemic) 1.8% EC, 40cm/100 liters water and Phenproximate (Ortus) 5% SC acaricide 50cm/100 liters water, against the three tested plant insect pests: *T. tabaci*, *A. gossypii* and *B. tabaci* on the two cucumber cultivars (Sahm and Heikal) grown in plastic houses in Nubaria during 2004 and 2005 seasons. Spraying acaricides was applied by using a compressor sprayer (20 liters capacity). Samples of 20 cucumber leaves were taken randomly, just before spraying then at weekly intervals for 11 weeks, carefully examined and numbers of the alive three insect pests were recorded. Reduction percentages of the three insects' species were determined according to Henderson and Tilton (1955).

Data were statistically analyzed.

## RESULTS AND DISCUSSION

### Biological Control

The release was conducted on cucumber plants on the 8<sup>th</sup> February after two weeks from planting seedlings and when full grown plants reached 60-100cm long and the number of pests pre-release averaged 3.75 & 3.98 *T. tabaci*; 5.85 & 5.81 *A. gossypii* and 6.78 & 6.90 *B. tabaci* individuals /leaf for Sahm cultivar during 2004 & 2005 seasons. For Heikal cultivar, these averages were 1.65 & 1.75; 2.45 & 2.46 and 0.35 & 0.36 individuals/leaf for the aforementioned insect species, respectively.

The four phytoseiid predatory mites; *N. cucumeris*, *N. zaheri*, *N. californicus* and *P. macropilis* differently reduced the numbers of three insect pests, (Table 1). Through 11 weeks after releasing the aforementioned predators, numbers of the three pests on Sahm cultivar were reduced recording a total average/leaf of 1.96, 5.70, 9.10 & 9.83 *T. tabaci*; 4.69, 7.54, 10.25 & 12.64. *A. gossypii* and 11.41, 2.08, 12.37 & 12.97 *B. tabaci*, respectively in 2004.

In 2005 season, the total averages were 2.05, 6.06, 10.07 & 9.71 *T. tabaci*; 5.62, 7.55, 10.44 & 11.85 *A. gossypii* and 10.55, 2.00, 11.69 & 11.98 *B. tabaci* on Sahm cultivar, respectively. On the other hand, the total averages of the pests in the control were 10.82, 12.09 & 15.17 in 2004 season and 10.18, 12.46 & 14.19 in 2005 season. Similar results were obtained for Heikal cultivar during 2004 & 2005 seasons (Table 1). Reduction percentages as a result of the four predatory mites releases, proved that *N. cucumeris* recorded the highest reduction percentage of *T. tabaci* and *A. gossypii*. On Sahm cultivar, it resulted in 84.96 & 67.77% and 80.37 & 55.87% reduction in 2004 and 2005 seasons, respectively. On Heikal cultivar, these percentages were 89.21 & 78.16% in 2004 and 96.21 & 89.52% in 2005 season.

*N. zaheri* ranked the second as it gave reduction percentages of 34.89 & 44.87 and 42.29 & 39.40 in 2004 and 2005 seasons on Sahm cultivar, while on Heikal cultivar these percentages were 50.79 & 55.51 and 42.80 & 41.71 for the aforementioned insect species, respectively. On the other hand, the same predator preferred

Table (1): Effect of releasing four phytoseiid predatory mites on three plant piercing-sucking insects infesting two cucumber cultivars during the two seasons 2004 and 2005.

Cultivars	Average number and reduction percentage of three plant insect pests/leaf during 11 weeks															
	<i>Thrips tabaci</i>					<i>Aphis gossypii</i>					<i>Bemisia tabaci</i>					
	N.	N.	N.	P.	Control	N.	N.	N.	P.	Control	N.	N.	N.	P.	Control	
	<i>cucu.</i>	<i>zaheri.</i>	<i>calif.</i>	<i>macr.</i>		<i>cucu.</i>	<i>zaheri.</i>	<i>calif.</i>	<i>macr.</i>		<i>cucu.</i>	<i>zaheri.</i>	<i>calif.</i>	<i>macr.</i>		
Sahm	2004	N 1.96d	5.70c	9.10b	9.83b	10.82a	4.69c	7.54d	10.25c	12.64a	12.09b	11.41b	2.08c	12.37b	12.97b	15.17a
	%	84.96	34.89	5.97	12.82	--	67.77	44.87	33.39	17.69	--	24.18	90.0	20.09	18.11	--
Sahm	2005	N 2.05c	6.06b	10.07a	9.71a	10.18a	5.62c	7.55d	10.44c	11.85ab	12.46a	10.55b	2.00c	11.69b	11.98b	14.19a
	%	80.37	42.29	4.87	9.39	--	55.87	39.40	26.55	13.49	--	27.40	89.86	33.25	15.97	--
Heikal	2004	N 0.51d	2.30c	3.41c	5.09b	6.45a	1.98c	2.23c	4.36ab	5.63ab	6.05a	2.34bc	1.69c	2.99abc	3.78ab	4.36a
	%	89.21	50.79	40.78	15.64	--	78.16	55.51	35.61	16.10	--	3.22	68.45	0.0	0.0	--
Heikal	2005	N 0.41d	3.05c	5.23b	5.31b	6.73a	4.78a	0.82b	5.39a	5.44a	6.46a	3.85a	0.95b	4.23a	4.26a	4.57a
	%	96.21	42.80	34.96	23.37	--	89.52	41.71	11.86	10.18	--	33.05	73.96	8.81	8.72	--

N = average number during 11 weeks

% = reduction percentage

Table (2): Effect of the two pesticides, Vertemic and Ortus, on three plants piercing - sucking insect populations on two cucumber cultivars during season 2004.

Cultivars	Average number and reduction percentage of three plant sucking insects/leaf									
		<i>Thrips tabaci</i>			<i>Aphis gossypii</i>			<i>Bemisia tabaci</i>		
		Vertemic	Ortus	Control	Vertemic	Ortus	Control	Vertemic	Ortus	Control
Sahm 2004	N	5.80c	10.20b	24.53a	5.36b	12.12a	57.64c	7.19c	15.87b	54.62a
	%	65.04	34.14	--	69.10	24.79	--	44.36	79.32	--
Heikal 2004	N	5.13b	7.95b	43.61a	9.00b	17.75b	97.55a	12.88b	20.77b	98.17a
	%	72.37	64.00	--	75.31	84.73	--	89.73	58.70	--

N = average number during 11 weeks

% = reduction percentage

feeding on *B. tabaci* resulting in the best reduction percentages on both cultivars in the two years averaging 90.00 & 89.86 on Sahm cultivar and 68.45 & 73.96 on Heikal cultivar, respectively. Begunov and Sturozhkov 1986 controlled *T. urticae* and *T. tabaci* on cucumber by *P. persimilis* release, while Castagnoli *et al.* 1990 used *N. cucumeris* against *T. tabaci* and *Frankliniella occidentalis*. Shipp and Wang 2003 evaluated effectiveness of releases of *Amblyseius cucumeris* and *Orius insidiosus* (Say) for the control of *F. occidentalis* on green house tomatoes.

### Chemical Control

Spraying Abamectin (Vertemic) and Phenproximate (Ortus) on Sahm cultivar during 2004 season against the three tested plant insect pests reduced their populations, but Abamectin sharply reduced the three insect numbers.

Application of pesticides started as the population of the three aforementioned insect pests averaged 43.0, 25.18 and 49.35 individuals per leaf, respectively.

The total averages at the end of the experiment (after 11 weeks) were 5.80 & *T. tabaci*, 5.36 *A. gossypii* and 7.19 *B. tabaci* for Abamectin on Sahm cultivar during 2004, (Table 2). Reduction percentages of the pests were 65.04; 69.10 and 44.36 %. On Heikal cultivar similar results were obtained (Table 2). Thus Vertemic resulted better control of the three plant insects than Ortus. These findings agree with those of Braejeul and Trotin 1998.

Finally, it could be concluded that the four phytoseiid predators showed different prey preference. *N. cucumeris* gave the highest reduction percentages of *T. tabaci* followed by *A. gossypii*, while *N. zaheri* enhanced the most promising control of *B. tabaci*. Also, Hassan *et al.* (2007) indicated that *N. californicus* and *P. macropilis* greatly reduced the populations of the acarine pest *T. urticae* on cucumber, while *N. cucumeris* and *N. zaheri* had lower effect. Also, predatory phytoseiid mites release assured better control results for the tested insect pests than chemicals

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### الملخص العربي

#### المكافحة البيولوجية والكيماوية للأفات الحشرية الثاقبة الماصة التي تصيب الخيار في الصوب البلاستيكية

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يصاب الخيار في الصوب البلاستيكية ببعض الافات الحشرية الضارة الثاقبة الماصة لذلك اختبر استخدام المكافحة البيولوجية باطلاق اربعة انواع من الاكاروسات المفترسة التابعة لفصيلة الفايوتسيدي منها نوعين محليين وهما *Neoseiulus cucumeris*، *N. zaheri* ونوعين مستوردين *Phytoseiulus macropilis*، *N. californicus* على صنفين من الخيار (هيكل، سهم) المزروعين في الصوب البلاستيكية بمحافظة البحيرة خلال الموسمين ٢٠٠٤-٢٠٠٥ وذلك لمكافحة التريس، المن، الذبابة البيضاء وأوضحت النتائج أن الصنف سهم أكثر إصابة بالحشرات الثلاثة عن الصنف هيكل وبدأت فيه الإصابة مبكراً. اعطى المفترسان *N. zaheri*، *N. cucumeris* أعلى نسبة خفض في مكافحة التريس حيث بلغت نسبته أكبر في الصنف هيكل عن الصنف سهم وبلغت ٨٩،٢١ ، ٥٠،٧٩% (الصنف هيكل)، ٨٤،٩٦ ، ٣٤،٨٩% (الصنف سهم) في حين حقق المفترس *N. cucumeris* أكبر نسبة خفض لحشرة المن يليه المفترس *N. zaheri* حيث بلغت ٧٨،١٦ ، ٥٥،٥١% للصنف هيكل، ٦٧،٧٧ ، ٤٤،٨٧% للصنف سهم. بالنسبة للذبابة البيضاء فقد حقق المفترس *N. zaheri* أكبر نسبة خفض حيث بلغت ٩٠،٠٠ ، ٦٨،٤٥ في الصنفين سهم وهيكل خلال موسم ٢٠٠٤ على التوالي. اعطت هذه المفترسات موسم ٢٠٠٥ نتائج مماثلة في نفس الاتجاه. كما تم اختبار المكافحة الكيماوية باستخدام نوعين من المركبات احدهما حيوي (فيرتيميك ١،٨% EC) والاخر مبيد اكاروسي (اورتس ٥٠% SC) حيث سجل الفيرتيميك نتائج جيدة في خفض تعداد الحشرات الثلاثة خاصة على الصنف هيكل والذي بلغت فيه نسبة الخفض على حشرات التريس والمن والذبابة البيضاء ٧٢،٣٧ ، ٧٥،٣١ ، ٨٩،٧٣% في حين بلغت على الصنف سهم ٦٥،٠٤ ، ٦٩،١٠ ، ٤٤،٣٦% خلال موسم ٢٠٠٤ على التوالي. وبمقارنة استخدام المكافحة البيولوجية بالمكافحة الكيماوية وجد ان المكافحة البيولوجية باستخدام المفترسات الاكاروسية اعطت أعلى نسبة خفض للحشرات الثلاثة الثاقبة الماصة لذلك ننصح باستخدامها لكفائها وعدم ضررها بالبيئة.