BIOLOGICAL CONTROL OF CITRUS BROWN MITE *EUTETRANYCHUS ORIENTALS* USING PREDATORY MITE, *NEOSEIULUS CALIFORNICUS* (MCGREGOR) (ACARI: TETRANYCHIDAE& PHYTOSEIIDAE) ON CITRUS TREES

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Abstract

The citrus brown mite, *Eutetranychus orientalis* (Klein) (Family: Tetranychidae) is considered one of the important mite pest attacking citrus trees causing serious damage to leaves and fruits especially during the last three seasons (2000-2003). To enhance the exportation of citrus fruits and reduce the applications numbers of pesticides. We concern in this study to use phytoseiid mite, *Neoseiulus californicus* as biocontrol agent for controlling this dangerous mite pest on citrus trees. The predatory mite was reared on the two-spotted mite, *Tetranychus urticae* Koch and released at three levels 40, 50 and 70 individuals per tree at average level infestation 4.64, 5.06, and 4.70 mite per leaf, respectively, while it was in un release tree 4.69 individuals/leaf. After releasing the predator mite the mite pest, *E. orientalis* population generally declined gradually and percentage reduction in the population of mite pest after four months of releasing reached 57.84, 73.76 and 88.25%, respectively.

Conclusion: The above mentioned results indicated the possibility of controlling the citrus brown mite, *E. orientalis* on citrus trees by releasing the predatory mite, *N. californicus* with the rate of 70 predators per tree without any damage on leaves, resulting good production free of acaricide reduces.

INTRODUCTION

In Egypt, citrus is considered one of the great economic, importance crop for local consumption and exportation, which helps to increase the national and growers income.

Citrus trees belonging to ever green trees thus they are subjected to be attacked by many serious mite pests where the citrus brown mite, *Eutetranychus orientalis* (Klein) may causes considerable damages for the production quality and quantity.

This study aimed to avoid application numbers of acaricides to prevent the pollution for the production and environmental factors, depending on the predatory mite, *Neoseiulus californicus* (McGregor) in controlling the previous mite pest.

Many successful trails have been applied using different phytosiid mite predators as a biocontrol agents against different tetranychid mite pests infesting different orchard trees, ornamental plants and vegetable crops, resulting good biocontrol in different countries of the world as following: McMurtry, 1997; Dover *et al.* 1992; Friese and Gilstrap, 1982; Croft and Macrae, 1992; Duso, 1992; Croft, 1994; Castagoli and Simoni, 1999; Jolly, 2000; Heikal and Ibrahim, 2001 and Heikal *et al.* 2003.

MATERIALS AND METHODS

The predator mite, *Neoseiulus californicus* (McGregor)=[*Amblyseius californicus*] was presented from England, it is using on commercial level as a biocontrol agent against different mite species, It evaluate it's ability on citrus brown mite on citrus trees for the first time.

Mass rearing of the predatory mite, *N. californicus* and its prey *Tetranychus urticae* Koch:

A. Mass rearing of the predatory mite, *N. californicus* and its prey *T. urticae*::

In this study we used the two-spotted spider mite as a prey during rearing process because it is consider the most preferable prey for mass rearing of many different species of mites and insects predators.

Strong culture of this mite should be available during the rearing time to maintain the predator process.

Twenty plastic trays (30 X 40 X 15 cm) contained (vermiculite and peutmos) were used for planting bean seeds, *Phaseolus vulgaris* L. which cauted with 0.1% Vitavax W.P. as fungicide), the bean seeds were planted at 1-2 cm deep and supplied with irrigation and fertilizers as required. When the first true leaflets appear, leaves of castor oil heavily infested with spider mites were added for bean seedling and left for two weeks until the population of the spider mite increase to suitable number for rearing the predator.

B. Mass rearing of the predator:

Ten plastic trays were prepared as above mentioned in rearing system of prey. When the population density of the prey reached to suitable density different number of arenas previously prepared for rearing a stock culture of the predator were transferred to plastic trays of the predator and then left until the predator numbers increase, the plastic trays of the predator were added daily with prey as they require, after three weeks approximately the predator became suitable for collecting.

C. Release of the predatory:

The leaflets of the mass rearing plants with predator were left in refrigerator at 10ºC for 5 minutes to eliminate mite activity in order to help for mite handling.

Ten adult stages of the predator were transferred to leaf discs (1.5 cm) of *Phaseolus vulgaris* using brushes and then inserted in vials 2 x5 cm, which were closed by small piece of cotton to prevent the mites from escaping, then the vials were kept in ice boxes for transferring to the field.

The release process was carried out 1-2 hours before sunset and after 3-4 days of irrigation to provide suitable relative humidity for the predator mite.

The vials were fixed around the middle level of the tree at three levels of release 40, 50 and 70 individuals per tree.

The vials were opened after hanging to allow distribution of the predator.

D. Experimental design and sampling procedure:

Citrus orchard trees slightly infested with citrus brown mite, *E. orientalis* was chosen (presented in Belbes district, Sharkia governorate) and divided into four treatments including control, using for three levels of release 40, 50 and 70 individuals of predator per tree.

Each treatment comprise of three replicates including five citrus trees, all replicates were distributed in randomized complete blocks.

Samples of 45 leaves were inspected for each treatment, sample was inspected just before release as pre-count and another samples were inspected after release at two weeks intervals as shown in Tables 1, 2, 3.

The release process starts in June, 5, 2003.

The reduction percentages of mite pest were calculated according to the equation of Henderson and Tilton (1955).

RESULTS AND DISCUSSION

1- Biological control of citrus brown mite, *Eutetranychus orientalis* (Klein) using the predatory mite, *Neoseiulus californicus* (McGregor) at level of release 40 individuals per tree:

Revealed data in Table 1 cleared that, when the predator mite, *N. californicus* was released at rate of 40 individuals per tree on citrus tree at Sharkia, the *E. orientalis* population were generally low in the pre-count. They were 209 and 211 moving stages/45 leaves in released and non released trees, respectively, after releasing the predator mite, the mite pest population generally declined gradually in released tree, the pest population reached after four months 162 individuals/45 leaves, while in non-release tree it became 388 individuals/45 leaves.

The percent reduction in the pest population gradually increased from 7.67 after two weeks of release to 57.84 after four months of release, and the percentages of leaves infested with the mite pest reduced from 64 to 38, while in non-release trees it increased from 59 to 91.

2- Biological control of citrus brown mite, *E. orientalis* using the predatory mite, *N. californicus* at level of release 50 individuals per tree:

Revealed data in Table 2 demonstrated that, when the predator mite was released at rate of 50 individuals per tree on citrus tree at Sharkia, the mite pest population were generally low in the pre-count with average 4.68 and 5.066 individuals per leaf in release and non-release trees, respectively. After releasing the predator mite, the percent of infested leaves decreased in the released tree from 72 to 42, while in non-released trees, increased from 59 to 91.

Also, the population of the mite pest decreased from 228 to 110 individuals per 45 leaves in release tree, while it increased from 211 too 388 in control and the percent reduction in the population gradually increased from 26.44 after two weeks of release to 73.76 after four months of release.

3- Biological control of citrus brown mite, *E. orientalis* using the predatory mite, *N. californicus* at level of release 70 individuals per tree:

Revealed data in Table (3) indicated that the predatory mite *N. californicus* when released with 70 individuals per tree gave high reduction in the population of the mite pest, reached after two weeks of release 19.56% and increased gradually, reaching to 88.25 after four months of release, The total numbers of mite pest in released tree decreased from 213 to 64 individuals/ 45 leaves while in unreleased trees the total number of mite pest increased from 211 individuals/45 leaves to 388 individuals/45 after four months of start of the experiment.

Also, data in Table (3) cleared that the percent of infested leaves in released trees reduced from 73 to 25, while in control it increased from 59 to 91.

Data in Table (4) cleared that in comparison between the three levels of release, the efficiency of the predator mite in suppressing the population density of the mite pest increased with increasing the level of release. Resulting 57.89% at level of 40 individuals per tree, to 88.25 at level of release 70 individuals per tree.

Table 1. Evaluation the efficiency the predator mite, *Neoseiulus californicus* (McGregor) against citrus brown mite, *Eutetranychus orientalis* (Klein) on citrus tree with level of release 40 individual per tree.

Sampling date	Treatments	Infested leaves%	No.mites/45 leaves		Reduction% of mite pest
			E. orientalis	*N. californicus*	
June, 5, 2003 (pre-count) date of release	Release control	64 59	209 211	- -	- -
June, 19, 2003 1st post-count	Release control	59 64	214 243	21 -	7.67 -
July, 3, 2003	Release control	50 69	198 256	26 -	22.83 -
July, 17, 2003	Release control	46 72	192 298	24 -	34.95 -
July, 31, 2003	Release control	44 76	188 332	20 -	42.83 -
August,14, 2003	Release control	42 81	178 351	27 -	48.80 -
August,28, 2003	Release control	40 85	169 364	36 -	53.13 -
Sept., 11, 2003	Release control	38 91	162 388	48 -	57.84 -

Table 2. Biological control using the predator mite, *Neoseiulus californicus* (McGregor) against citrus brown mite, *Eutetranychus orientalis* (Klein) on citrus tree with level of release 50 individual per tree.

Sampling date	Treatments	Infested leaves%	No.mites/45 leaves		Reduction% of mite pest
			E. orientalis	*N. californicus*	
June, 5, 2003 (pre-count) date of release	Release control	72 59	228 211	- -	- -
June, 19, 2003 1st post-count	Release control	74 64	186 234	28 -	26.44 -
July, 3, 2003	Release control	68 69	175 256	32 -	36.73 -
July, 17, 2003	Release control	63 72	162 298	30 -	49.69 -
July, 31, 2003	Release control	54 76	149 332	42 -	58.46 -
August,14, 2003	Release control	44 81	122 351	52 -	67.83 -
August,28, 2003	Release control	46 85	112 364	48 -	71.52 -
Sept., 11, 2003	Release control	42 91	110 388	49 -	73.76 -

Table 3. Biological control using the predator mite, *Neoseiulus californicus* (McGregor) against citrus brown mite, *Eutetranychus orientalis* (Klein) on citrus tree with level of release 70 individual per tree.

Sampling date	Treatments	Infested leaves%	No.mites/45 leaves		Reduction% of mite pest
			E. orientalis	*N. californicus*	
June, 5, 2003 (pre-count) date of release	Release control	73 59	213 211	- -	- -
June, 19, 2003 1st post-count	Release control	72 64	190 234	36 -	19.56 -
July, 3, 2003	Release control	68 69	162 256	38 -	37.31 -
July, 17, 2003	Release control	53 72	142 298	29 -	52.80 -
July, 31, 2003	Release control	48 76	123 332	42 -	63.30 -
August,14, 2003	Release control	38 81	98 351	56 -	70.76 -
August,28, 2003	Release control	32 85	88 364	52 -	76.05 -
Sept., 11, 2003	Release control	25 91	64 388	64 -	88.25 -

Table 4. Comparison effect of different levels of predator release against citrus brown mite, *Eutetranychus orientalis* (Klein) on citrus tree at Sharkia governorate.

Levels of release individuals/tree	Level infestation in control		Average infestation before release	Average of infestation after 4 months of release	Percent reduction after release with 4 months
	Before	After			
40	4.68	8.62	4.64	3.6	57.84
50	4.68	8.62	5.066	2.4	73.76
70	4.68	8.62	4.7	1.02	88.25

Ultimately, this predator can be use in controlling this mite pest on citrus trees at level of release70 individuals per tree because of it reduced the average density of the mite pest to 1.02 individuals per leaf, thus it is considered one of the biocontrol agent against this mite pest on leaves or fruit in citrus orchard trees. This obtained results agree with Croft, 1994; Duso, 1992 and Friese *et al.* 1982.

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المكافحة الحيوية لأكاروس الموالح البني بأستخدام المفترس الأكاروسي نيو سيوليوس كاليفورنيكس علي أشجار الموالح

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يعتبر أكاروس الموالح البني أحد الآفات الأكاروسية الهامة التي تصيب أشجار الموالح مسببا لها أضرار بالغة للأوراق والثمار والأكثر من ذلك يسبب تشوهات للثمار مما يعيق عملية التصدير.

وقد لوحظ في الثلاثة أعوام الأخيرة انتشار هذه الآفة علي أشجار الموالح مما يضطر المزراعين الي الاستخدام المكثف للمبيدات المتخصصة فيزيد من التكاليف وتلوث الثمار.

لذا اتجهنا في هذا البحث الي استخدام أحد العناصر الحيوية في مكافحة هذه الآفة بالأكاروس المفترس نيوسيوليوس كاليفورنيكس.حيث تم إطلاق هذا المفترس علي أشجار الموالح بمعدل ٤٠، ٥٠ ، ٧٠ فرد للشجرة عند متوسط مستويات إصابة ٤,٦٤، ٥,٠٦٦، ٤,٧ علي الورقة علي التوالي.

وبعد أربعة أشهر من إطلاق المفترس انخفضت متوسط مستويات الإصابة الي ٣,٦، ٢,٤، ١,٠٢ فرد علي الورقة علي التوالي وأدي المفترس الي نسبة مئوية للخفض في الإصابة بلغت ٥٧,٨٤، ٧٣,٧٦، ٨٨,٢٥% علي التوالي ومما سبق يتضح أن أنسب مستوي إطلاق لمكافحة هذه الآفة هو ٧٠ فرد مفترس للشجرة وفي نفس الوقت توضح النتائج أن هذا المفترس له قدرة فائقة في مكافحة هذه الآفة وبذا يمكن استخدام هذا المفترس خلال برامج المكافحة المتكاملة للآفات علي أشجار الموالح التي تهدف الي ترشيد استخدام المبيدات وتشجيع المكافحة الحيوية والحفاظ علي التوازن البيئي وخفض نسبة التلوث بالمبيدات.