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Biological Control of *Tetranychus urticae* Koch and *Aphis gossypii* Glover Using the Phytoseiid Mite, *Neoseiulus californicus* (Mcgregor) *on Phaseolus vulgaris* (L.) in Under greenhouse

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ABSTRACT

Neoseiulus californicus was released in three levels 10, 20, 30 against *T.urticae* and *A.gossypii* separately and compared their percentage reduction in case exist together on the same host. The percentage reduction of *N.californicus* under the area in greenhouse cultivated with *phaseolus vulgaris* and infested with*T.urticae* only at the level of releasing 10 individuals per plot were 11.5, 21.6, 33.8, 35 and 39.5 compared with 12.3, 26, 41.8, 47.7 and 58.7 from the plot infested with *T.urticae* and *A.gossypii* together.

The data revealed that the percentage reduction as a result of *N.californicus* release against *A.gossypii* only at level of releasing 10 individuals per plot were 9, 21.9, 35.6, 37 and 42.8 compared with 15.7, 20.7, 28.8, 29.3 and 36 from the plot infested with *T.urticae* and *A.gossypii* together on of the same host plant. Also the percentage reduction of *A.gossypii* at levels of releasing 20 and 30 individuals per plot were 14.2 , 31.3 , 39.5 , 44.3 , 55.9 and 14 , 43.8 , 47.4 , 60 and 72 , respectively compared with 16.3 , 20.6 , 40 , 41.2 and 51.5 , 15.7 , 25.5 , 55 , 62.5 and 72.6when *A.gossypii* was with *T.urticae* on of the same host plant. *N. californicus* has proved to be a promising candidate for biological control of *T.urticae* and *A.gossypii*. The percentage reduction of the predator mite is higher when the two previous pests occurred together on the same host plant than separately.

INTRODUCTION

In Egypt, *A.gossypii* has been known as its economically important for its potential to plant sap-sucking and its ability to be vector many plant viral disease. Aphis species cause damage to fruit trees, medicinal plants and grain besides many other host plants. The two-spotted spider mite, *Tetranychus urticae*is aubiquitous polyphagous arthropod herbivore. It acts an important economic pest of many economic value crops such as citrus orchard trees and annual field crops such as maize, cotton, soybean. *T.urticae* is a polyphagous pest that makes it an important agricultural pest. It has a tendency to develop resistance to a wide array of insecticides and acaricides that are used for its control. The predatory mite *Neoseiulus californicus* (McGregor) has the ability to be used as a generalist predatory mite where it prefers Tetranychids as food and also consume other mite species. *N. californicus* has a broad diet range that includes various arthropods, (McMurtry& Croft 1997).

Chemical pesticides are generally used to control mite and insect pests. The large scale use of chemicals led to the development of resistance to target pests, and consequently also has a negative effect on natural enemies and other benefits causing disruption of biodiversity (Akram Saleh Alghamdim, 2018).

This study was aimed to evaluate the effective suppression of the predatory mite *N.californicus*as a generalist predator against *T.urticae* and *A.gossypii* separately and compared the obtained result with the reduction rate of synchronizing presence of the two previous pests on the same host plant. This experiment was carried out through three levels of releasing 10, 20 and 30 individuals on each replicate.

MATERIALS AND METHODS

The experiment was conducted on bean Plants, *Phaseolus vulgaris* (L.) under greenhouse conditions. The plants were cultivated ' fertilized and watered according to standard organic agricultural practices. The area was divided into three similar treatments each of which divided into four replicates. Three of them as treatment and the fourth one was left as a control. All replicates were separated from each other by 0.50 cm as a free zone area. The first replicate was infested with an indefinite number of *T.urticae*'the second with *A.gossypii* and the third with *T.urticae* and *A.gossypii* together. All treatments were left for forty days until increasing the population of the two pests. First samples of 20 leaves /replicate were taken from all treatments and control just before releasing and counted as a pre-count.*Neoseiulus californicus* was obtained from the National research center. *N. californicus* was released in three levels 10, 20, 30 per treatment. Random samples of 25 leaves were collected every 15 days from each treatment and inspected. The number of prey was recorded at the end of the experiment and the reduction percent was calculated.

RESULTS AND DISCUSSION

Table(1) revealed that the predator mite *N. californicus* was released on April 10-2018 at three levels 10 , 20 and 30 individuals against *T.urticae*. The numbers of the prey before releasing the predator were 230, 250 and 240 in the treatment plots and 220 in the control plot per 25 leaves. The reduction percentages of *T.urticae* after 75 days of release were 39.5, 74.9 and 80.4% at the previous levels of releasing' respectively.

Table1: Evaluation of the predator mite *Neoseiulus californicus* on leaves infested only with *Tetranychus urticae*

Samples date	The number and reduction % of movable stages of *T.urticae*/25 leaves after the predator release						Control
	10 individuals of the predator		20 individuals of the predator		30 individuals of the predator		
	No.	R%	No.	R%	No.	R%	
Pre-account 10April 2018	230	-	250	-	240	-	220
25 April 2018	222	11.5	200	26.7	170	35	240
10 may 2018	205	21.6	185	34.9	120	56	250
25 may 2018	180	33.8	160	45.8	100	64.7	260
10 June 2018	180	35	140	53.5	90	68.9	265
25 June 2018	177	39.5	80	74.9	60	80.4	280

Data in table(2) demonstrated that releasing the same predators. *N.californicus* in the same period and at the same three levels of releasing against *A.gossypii*. The numbers of

prey before releasing the predator were 127, 128 and 125 in the same treatment plot and 120 in the control plot per 25 leaves.

The reduction percentages of *A.gossypii* after 75 days of release were 42.8, 55.9 and 72% at the previous levels of releasing' respectively.

Table2: Evaluation of the predator mite *Neoseiulus californicus* on leaves infested only with *Aphis gossypii*

Samples date	The number and reduction % of movable stages*T.urticae*/25 leaves after the predator release						Control
	10 individuals of predators		20 individuals of predators		30 individuals of predators		
	No.	R%	No.	R%	No.	R%	
Pre-account 10April 2018	127	-	128	-	125	-	120
25 April 2018	125	9	119	14.2	110	14	130
10 may 2018	124	21.9	110	31.3	90	43.8	150
25 may 2018	122	35.6	100	39.5	87	47.4	155
10 June 2018	110	37	98	44.3	70	60	165
25 June 2018	103	42.8	80	55.9	50	72	170

Data in table (3) show the impact of the predatory mite *N.californicus* on*T.urticae*in presence *A.gossypii* on the same host plant. From results obtained, it is generally noticed that *N.californicus* gave a higher percentage reduction of *T.urticae* in presence of *A.gossypii* than that obtained from table (1). Table (1)showed percentage reduction as a result of releasing *N.californicus* under the area in greenhouse cultivated with bean and infested with*T.uricae* only at the level of releasing 10 individuals per plot were 11.5 ,21.6 , 33.8 ,35 and 39.5 compared with 12.3 , 26 , 41.8 , 47.7 and 58.7 from the plot infested with *T.urticae* and *A.gossypii* together on the same host plant. Also the percentage reductions at levels of release 20 and 30 individuals per plot were 26.7 , 34.9 , 45.8 , 53.5 , 74.9 and 35 , 56 , 64.7 , 68.9 and 80.4 , respectively compared with 28.7 , 45.5 , 63.6 76.1 , 88.2 and 30.8 , 48.6 , 72 , 92 and 91.9 in table (3). In these experiments,*N. californicus* proved to be a promising candidate for biological *T.urticae* control of when its presence with *Aphis gossypii* compared with its exist alone.

These results agreed with those of Gillespie (1989); Hansen(1989); Ader (1990); Castagnoli *et al.* (1990); Jarosik and Pliva (1995); Courcy –Williams (2001) and Sengonca*et al.* (2004). Magdy, Y. El-Kholy and El Sayed, M. A. K. El-Saiedy(2009).

Table3: Evaluation of the predator mite *Neoseiulus californicus* against *Tetranychus urticae* on leaves infested with *Aphis gossypii* and *Tetranychus urticae* together

Samples date	Number and reduction % of movable stage of per 25 leaves after*T.urticae* release the predator						Control
	10 individuals of the predator		20 individuals of the predator		30 individuals of the predator		
	No.	R%	No.	R%	No.	R%	
Pre-account 10April 2018	220	-	220	-	200	-	240
25 April 2018	209	12.3	170	28.7	150	30.8	260
10 may 2018	190	26	140	45.5	120	48.6	280
25 may 2018	160	41.8	100	63.6	70	72	300
10 June 2018	155	47.7	70	76.1	45	92	320
25 June 2018	140	58.7	40	88.2	25	91.9	370

On the other hand. through the same previous host plant, the reduction percentage of *A.gossypii* was counted separately,(table4). The data revealed that in *A.gossypii* presence on the same leaves infested with *T.urticae*, the predator mite *N.californicus* gave a lower percentage reduction of *A.gossypii* at the beginning of the experiment. The percentage reduction of *A.gossypii* reached72% at the level of releasing 30 individuals per plot after 75 days table(2).

The data presented in Table (2) show percentage reduction as a result of releasing the predatory mites *N.californicus* under the area in greenhouse cultivated with bean and infested with *A.gossypii* only at the level of releasing 10 individuals per plot were 9, 21.9 , 35.6 , 37 and 42.8 compared with 15.7 , 20.7 , 28.8 , 29.3 and 36 from the plot infested with *T.urticae* and *A.gossypii* together on of the same host plant. Also the percentage reduction at levels of releasing 20 and 30 individuals per plot were 14.2 , 31.3 , 39.5 , 44.3 , 55.9 and 14 , 43.8 , 47.4 , 60 and 72 , respectively compared with 16.3 , 20.6 , 40 ,41.2 and 51.5 , 15.7 , 25.5 , 55, 62.5 and 72.6(Table 4). In these experiments,*N. californicus* has proved to be a promising candidate for biological control of *T.urticae* when its presence with *Aphis gossypii* compared with its exist alone.

Table4: Evaluation of the predator mite *Neoseiulus californicus* against *Aphis gossypii* on leaves infested with *Aphis gossypii* and *Tetranychus urticae* together.

Samples date	Number and reduction % of movable stages of *T.urticae* 25 leaves after release the predatory mite						Control
	10 individuals of the predators		20 individuals of the predators		30 individuals of the predators		
	No.	R%	No.	R%	No.	R%	
Pre-account 10April 2018	120	-	125	-	100	-	120
25 April 2018	118	15.7	122	16.3	99	15.7	140
10 may 2018	115	20.7	120	20.6	90	25.5	145
25 may 2018	114	28.8	100	40	60	55	160
10 June 2018	113	29.3	98	41.2	50	62.5	160
25 June 2018	112	36	88	51.5	40	72.6	175

Magdy Y. El-Kholy (2009) found that the predatory mite species, *Phytoseiulus persimilis* (Athias-Henriot), *Neoseiulus cucumeris* (Oudemans) and *Neoseiulus californicus* (McGregor) were evaluated as potential biological control agents for *Thrips tabaci* (lind.) and *Aphis gossypii* (Glover) on two eggplant cultivars in the open field at Behaira Governorate. Field releases of different numbers of mites per plant during 2008 season showed that *Neoseiuluscucumeris* reduced the number of thrips and aphid on two cultivars of eggplant. Healso found that earlier releases (averages from 20-25 individuals/leaf) resulted in reducing thrips and aphids numbers and lowering their damage. Liza .J. canlas (2006)studied the life history characteristics and predation of the Japanese *Neoseiuluscalifornicus* (McGregor) strain on the two-spotted spider mite, *Tetranychusurticae* Koch, were studied in the laboratory under 60–70% RH and 16L: and found that female consumed more eggs, larvae, and nymphs than adult male or female of T. urticae. As *T. urticae* density increased, prey consumption likewise increased. However, increasing the number of an adult male or female prey did not increase the number of eggs laid by a female predator. The results were used to assess the effectiveness of the Japanese *N. californicus* strain as an important biological control agent against *T. urticae*. Abd El-Wahed(2011) studied under field control the biological control of European red mite,

Panonychusulmi(Koch) on apple trees in Dakahlia Governorate using the predacious mite *Neoseiulus cucumeris* (Oud.). The European red mite P. ulmi is considered one of the important mite pests attacking apple trees causing serious damage to leaves and fruits. The predatory mite was reared on the two-spotted spider mite *Tetranychu surtica* Koch and released at three levels. 50, 100 and 150 individuals per tree at average level infestation 5.65, 5.78 and 5.51 mite per leaf, respectively, while it was in control tree 8.92 individual per leaf. The reduction percent of P. ulmi population on apple trees reached 90.16 after four months from release at the level of release 150 individuals per tree. The above-mentioned results indicated the possibility of controlling the European red mite P. ulmi on apple trees using the predatory mite *N. cucumeris* as a biocontrol agent.

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ARABIC SUMMARY

المكافحة البيولوجية للعنكوبت الأحمر ذات النقتطين ومَن القطن بأستخدام المفترس الأكاروسى *Neoseiulus californicus* على نبات الفاصوليا تحت صوبة زراعية.

خالد عياد و عادل أمين و أحمد عبد المجيد
معهد بحوث وقاية النباتات – مركز البحوث الزراعية- الدقى– جيزة – مصر

تم إطلاق المفترس الأكاروسى *N. californicus* على ثلاث مستويات من الأطلاق هما على الترتيب 10 و 20 و30 فرد على الأفات التالية العنكبوت الأحمر ومن القطن كلا على حده. ثم تم مقارنة النسبة المئوية للخفض فى حالة تواجد الأفاتين معا فى وقت واحد وقت الأطلاق على نفس العائل . وكانت نسبة الخفض فى المستوى الأطلاق الأول عشرة أفراد فى كل مكررة كانت 11.5 و 21.6 و 33.8 و 35 و 39.5 على التوالى بالمقارنة بالنسبة المئوية للخفض فى حالة وجود الأفتين معاً فكانت 12.3 و 26 و 41.8 و 47.7 و 58.7 على التوالى على نفس العائل النباتى.

وأظهرت نتائج الدراسة أيضاً أن النسبة المئوية لخفض من القطن عند مستوى إطلاق عشرة أفراد بنفس المفترس موضوع الدراسة كان 9 و 21,9 و 35,6 و 37 و 42,8 على التوالى ولكن بمقارنة هذه النسبة بنسب الخفض عندما تم الأطلاق مع موجود من القطن و العنكبوت الأحمر معاً على نفس العائل النباتى كانت النتائج كالتالى 15.7 و 20,7 و 28,8 و 29,3 و 36 على التوالى .

وأيضاً كانت نسب الخفض لمن القطن عند مستوى إطلاق عشرون فرد من المفترس على نفس العائل النباتى كانت 30 و 14,2 و 31,3 و 39,5 و 44,3 و 55,9 و كانت عند مستوى ثلاثون فرد 14 و 43,8 و 47,4 و 60 و 72 علىالتوالى وبمقارنة هذه النتائج بنسب الخفض عند مستوى إطلاق عشرون فرد عند تواجد الأفتين معاً كانت 16,3 و 20,6 و 40 و 41,2 و 51,5 وكانت نسبة الخفض عند مستوى إطلاق ثلاثون فرد من المفترس 15,7 و 25,5 و 55 و 62,5 و 72 . ودلت النتائج أن المفترس الأكاروسى *N. californicus* ينصح بأستخدام كأحد العوامل البيولوجية ضد من القطن والعنكبوت الأحمر وقد أعطى هذا المفترس كفائة أكبر عند أطلاقه عندما يتزامن تواجد الأفتين معاً على نفس العائل النباتى .