BIOLOGICAL CONTROL OF TWO-SPOTTED SPIDER MITE, *TETRANYCHUS URTICAE* KOCH USING THE PREDATORY MITE, *NEOSEIULUS CALIFORNICUS* (MCGREGOR) (ACARI : TETRANYCHIDAE & PHYTOSEIIDAE) ON SOME CUCUMBER CULTIVARS UNDER GREENHOUSES

ABD EL-WAHED, N. M., K. M. EL-SAYED AND M. M. EL-SEBAEY

Plant Protection Research Institute, ARC, Dokki, Giza

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Abstract

The predatory mite, *Neosiulus californicus* (McGregor) was released to control the two-spotted spider mite, *Tetranychus urticae* Koch infesting cucumber cultivars (Hisham and Fahd) under greenhouses with the rates of 5 and 10 individuals/bit at average level infestation 164 and 183 mite per 20 leaves for the first and second season at Kafr Bedway district, Dakahlia Governorate. The reduction percentages of acarine mite population in cucumber cultivars Hisham and Fahd were (95.26 & 91.54%) and (97.41 & 94.53%) in levels 1 and 2 in the first season, respectively, while in the second season the reduction percentages were (97.37&98.67%) and (95.18&97.13%), respectively. The above mentioned results indicated that the possibility of controlling *T. urticae* on cucumber plants under greenhouses, by releasing *N. californicus,* without any damage on leaves and good production, free from pesticide residues.

INTRODUCTION

Cucumber is considered an important vegetable crop, where it consumption or with salads and as pickles. The cultivated area reached 5163400 feddan, with an average producing 62182 tons, with mean production rate 12.04 ton/feddan (Ministry of Agriculture of Statistics Institute, 2008).

The predatory mite, successfully used in controlling different pets, such as *T. urticae, Panonychus ulmi, Polyphagotarsomonus latus* and *Eutetarnychus orientalis* under laboratory and open fields by several authors, Oatman *et al.* (1977), Friese and Gilstrap (1982), Castagnoli and Amato (1991), Castagnoli and Falchini (1993), Castagnoli and Simoni (1999), Jolly (2000), Ibrahim *et al.* (2005) and Heikal *et al.* (2008)The present study aimed to control the two-spotted spider mite, *T. urticae* infesting cucumber plants under greenhouse conditions by releasing the phytoseiid mite, *N. californicus.*

MATERIALS AND METHODS

1. Mass rearing of the predatory mite, *Neoseiulus californicus* and its prey, *Tetranychus urticae*

The culture of *N. californicus* was reread in the laboratory on bean plant leaves, *Phaseolus vulgaris* L. as stuck on *T. urticae.* The predatory mite was reared on *T. urticae* on bean plants in small greenhouse (6 m wide X 9 m long).

The small greenhouse was cultivated with host plant, when the first true leaflets appear, then adding heavily infested castor oil leaves with *T. urticae* to bean seedling and left for two weeks until the population of *T. urticae* increase to suitable number for rearing the predator. After that, transmit the predator from the stuck culture to the *T. urticae* culture, which prepared before. Follow up the relation between the numbers of predator and its prey inside the greenhouse, as well as the population of prey sufficient the predator consumption. After about four weeks when the rate of predator numbers increased to reach about 10 individuals/leaflet. The predatory mite packed in small bags with few prey on bean leaves and transferred inside ice box to experimental cucumber greenhouse.

2. Experimental design and sampling procedure

The greenhouse experiment was about (60 m X 90 m) planted with two cucumber cultivars (Fahd and Hisham).

Releasing the predator mite, *N. californicus* in the two treatments with the rate of 5 and 10 individuals/bit. Randomized samples of 20 cucumber leaves/replicate were investigated before the predator individuals release to record the number of motile stages of *T. urticae* as pre-count, while post-count were undertaken weekly. moving stages of *T. urticae* were counted in the greenhouse with aid of hand lens (20X) and the equation of Henderson and Tilton (1955) was applied to calculate the reduction percentages in spider mite population.

RESULTS AND DISCUSSION

1. Release the predatory mite, *Neoseiulus californicus* on cucumber cultivars Hisham to control *Tetranychus urticae* during spring season, 2009

Data in Table (1) demonstrated that, in the first season of the study, the pre-count of *T. urticae* population were 164 and 183 moving stages/20 leaves on the predator release plants with mean 8.2 and 9.1 moving stages/leaf in levels 1 and 2, respectively. While, the number of *T. urticae* in control was 176 moving stages/20 leaves.

After one week from the predator release, population density of *T. urticae* decreased to 156 and 159 individuals/20 leaves with reduction percentages 15.45 and 22.79 in the levels 1 and 2, respectively. In the same time population in control increased from 176 to 198 moving stages/20 leaves.

Table 1. Utilizing the predatory mite, *Neoseiulus californicus* on cucumber cultivar Hisham to control *Tetranychus urticae* under greenhouse during spring season, 2009

Sampling date	Level (1)			Level (2)			Control
	No. of *T. urticae*/20 leaves	X̄/ leaf	Reduction %	No. of *T. urticae* /20 leaves	X̄/ leaf	Reduction%	
Jan, 2, 2009 pre-count	164	8.2	-	183	9.1	-	176
Jan, 9 Post-count	156	7.8	15.45	159	7.9	22.79	198
Jan, 16 Post-count	137	6.8	34.36	131	6.5	43.75	224
Jan, 23 Post-count	118	5.9	50.73	101	5.1	62.20	257
Jan, 30 Post-count	94	4.7	65.33	78	3.9	74.22	291
Fab., 6 Post-count	76	3.8	74.02	59	2.9	81.93	314
Fab., 13 Post-count	47	2.3	85.12	36	1.8	89.79	339
Fab., 20 Post-count	29	1.4	91.47	21	1.1	94.47	365
Fab., 27 Post-count	21	1.1	94.24	15	0.8	96.31	391
Mar., 6 Post-count	18	0.9	95.26	11	0.6	97.41	408

Level (1) =5 individuals/bit Level (2) = 10 individuals/bit

X̄ = averege of infestation per leaf

After two weeks from predator mite, *N. californicus* release population of acarine pest decreased in treatment, while highly increased in the untreated (137, 131 and 224) individuals, respectively.

The population of the two-spotted spider mite continued its decrease, but this was highly occurred in 6th March 2009, 18 and 11 moving stags/20 leaves with reduction 95.26% and 97.41% in levels 1 and 2, respectively. Population of *T. urticae* continued its increase in the control reaching 408 moving stages/20 leaves.

2. Effect of release the predatory mite, *Neoseiulus californicus* on cucumber cultivar Fahd to control *Tetranychus urticae* during spring season, 2009

Data in Table (2) indicated that, the two-spotted spider mite, *T. urticae* population were 203 and 192 moving stages/20 leaves with an average 10.1 and 9.6 mites/leaf in cucumber Fahd cultivar at the rate of 5&10 predatory mites, respectively.

While, in control the number of *T. urticae* was 196 moving stages/20 leaves with an average 9.8 mites/leaf.

The decreased of population was low because high density of *T. urticae* before releasing the predator. The reduction in the pest population appeared after four weeks of the predator release reached 50.43% and 56.19% in the levels 1 and 2, respectively.

The population of pest decreased gradually to reach 36 and 22 moving stages/20 leaves in the 9th weeks on 6th March, 2009 with reduction 91.54 and 94.53% in the levels 1 and 2, respectively. While, the untreated area population increased to 411 moving stages/20 leaves with an average 20.55 mites/leaf.

Table 2. Utilizing the predatory mite, *Neoseiulus californicus* on cucumber cultivar Fahd to control *Tetranychus urticae* under greenhouse during spring season, 2009

Sampling date	Level (1)			Level (2)			Control
	No. of *T. urticae*/20 leaves	X̄/ Leaf	Reduction %	No. of *T. urticae* /20 leaves	X̄/ leaf	Reduction%	
Jan, 2, 2009 pre-count	203	10.1	-	192	9.6	-	196
Jan, 9 Post-count	182	9.1	15.52	173	8.6	15.09	208
Jan, 16 Post-count	171	8.5	26.29	152	7.6	30.73	224
Jan, 23 Post-count	153	7.6	37.14	129	6.4	43.96	235
Jan, 30 Post-count	134	6.7	50.43	112	5.6	56.19	261
Fab., 6 Post-count	121	6.1	60.39	96	4.8	66.78	295
Fab., 13 Post-count	103	5.2	68.33	72	3.6	76.59	314
Fab., 20 Post-count	76	3.8	78.54	58	2.9	82.69	342
Fab., 27 Post-count	52	2.6	86.82	31	1.3	91.69	381
Mar., 6 Post-count	36	1.8	91.54	22	1.1	94.53	411

3. Biological control of spider mite, *T. urticae* using the predatory mite, *N. californicus* on cucumber cultivar Hisham during summer season, 2009

Data in Table (3) demonstrated that, in the second season of the study in the level 1, the pre-count of spider mite population was 214 moving stages/20 leaves while the predator mite, *N. californicus* release plants with mean 10.7 moving stages/leaf, while, the number of *T. urticae* in level (2) was 227 moving stages/leaf with mean 11.3 moving stages/leaf .

After one week from the predator release in the level (1), population density of *T. urticae* decreased to 168 individuals/20 leaves with reduction percentage 30.02. While in the level (2), population density decreased to 151 individuals/20 leaves with reduction percentage 40.70. In the same time, population in control increased from 197 to 221 individuals/20 leaves.

After two weeks from predator release population of acarine pest decreased in release greenhouse, while highly increased in the control (146 and 257) individuals, respectively. After that population decreased gradually to reach 13 predatory/20 leaves with mean 0.7 individuals/leaf at the end of season with reduction percentage 97.37 in levels (1). While, in the second level the reduction percentage was 98.67 with mean 0.4 individuals/leaf.

4. Biological control of spider mite, *T. urticae* using the predatory mite, *N. californicus* on cucumber cultivar Fahd during summer season, 2009

Data in Table (4) indicated that, in summer season when the predatory mite, *N. californicus* was released at the rate about of 5 and 10 individuals/bit in cucumber cultivar Fahd under greenhouse, the *T. urticae* population was generally high in pre-count. They were 226, 236 and 186 moving stages/20 leaves in released level (1), level (2) and control, respectively.

Table 3. Utilizing the predatory mite, *Neoseiulus californicus* on cucumber cultivar Hisham to control *Tetranychus urticae* under greenhouse during summer season, 2009

Sampling date	Level (1)			Level (2)			Control
	No. of *T. urticae*/20 leaves	$\bar{X}$/ leaf	Reduction %	No. of *T. urticae* /20 leaves	$\bar{X}$/ leaf	Reduction %	
Aug. 6, 2009 pre-count	214	10.7	-	227	11.35	-	197
Aug. 13 Post-count	168	8.4	30.02	151	7.5	40.70	221
Aug. 20 Post-count	146	7.3	47.70	123	6.1	58.46	257
Aug. 27 Post-count	109	5.4	65.16	94	4.7	71.67	288
Sept. 3 Post-count	81	4.1	76.40	75	3.7	79.40	316
Sept., 10 Post-count	52	2.6	85.96	43	2.1	89.06	341
Sept. 17 Post-count	31	1.5	92.33	26	1.3	93.93	372
Sept. 24 Post-count	24	1.2	94.45	19	0.9	95.86	398
Oct. 1 Post-count	16	0.8	96.52	12	0.6	97.54	423
Oct. 8 Post-count	13	0.7	97.37	7	0.4	98.67	456

$\bar{X}$ = averege of infestation per leaf

Table 4. Utilizing the predatory mite, *Neoseiulus californicus* on cucumber cultivar Fahd to control *Tetranychus urticae* under greenhouse during summer season, 2009

Sampling date	Level (1)			Level (2)			Control
	No. of *T. urticae*/20 leaves	X'/ leaf	Reduction %	No. of *T. urticae* /20 leaves	X'/ leaf	Reduction %	
Aug. 6, 2009 pre-count	226	11.3	-	236	11.8	-	186
Aug. 13 Post-count	225	11.2	17.69	228	11.4	20.13	225
Aug. 20 Post-count	201	10.1	37.34	195	9.7	41.78	264
Aug. 27 Post-count	180	9.0	50.29	178	8.9	52.92	298
Sept. 3 Post-count	141	7.1	65.05	124	6.2	70.56	332
Sept., 10 Post-count	119	5.9	73.18	97	4.8	79.05	365
Sept. 17 Post-count	87	4.3	81.96	64	3.2	87.29	397
Sept. 24 Post-count	54	2.7	89.78	35	1.7	93.66	435
Oct. 1 Post-count	38	1.9	93.33	26	1.3	95.63	469
Oct. 8 Post-count	29	1.4	95.18	18	0.9	97.13	495

After releasing, the population of *T. urticae* generally declined gradually and reached 29 and 18 individuals/20 leaves after about 9 weeks from the predator release at the level (1) and level (2), respectively.

Reductions of the spider mite population were weekly estimated in the first post-count and then at one week intervals. *T. urticae* reduction percentage reached more than 80% after the sixth weeks of predator release. The reduction percentage gradually increased to reach 95.18 and 97.13 at the end of experiment. Obtained results agree with that obtained by Otman *et al.* (1977), Duso (1992), Jolly (2000), Ibrahim *et al.* (2005), Fawzy *et al.* (2004 and 2006) and Ibrahim *et al.* (2006).

The present results proved that this experiment assured the possibility of using the predatory mite, *N. californicus* as a biological control agent against the two-spotted spider mite, *T. urticae* infesting in cucumber plots under greenhouse, at rate of about 10 predators/bit using bean leaflets harboring the predator. It could be advisable to release the predator individuals when *T. urticae* population is low density to offer a suitable chance for the predator to play its role successfully.

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المكافحة الحيوية للعنكبوت الأحمر العادي ذو البقعتين بإستخدام المفترس الأكاروسي *Neoseiulus californicus* علي بعض أصناف الخيار تحت الصوب

نزيه محمد عبد الواحد ، كرم السيد محمد ، ممدوح محمد السباعي

معهد بحوث وقاية النباتات– مركز البحوث الزراعية – وزارة الزراعة – الدقي – جيزة

أجريت مكافحة حيوية للعنكبوت الأحمر العادي *Tetranychus urticae* لمدة موسمين متتاليين علي نباتات الخيار المنزرعة في الصوب صنفي فهد وهشام في منطقة كفر بدواي – محافظة الدقهلية وذلك بإطلاق المفترس الأكاروسي *Neosiulus californicus* بإستخدام مستويين من الإطلاق ٥، ١٠ أفرد للجورة.

وتشير النتائج المتحصل عليها في الموسم الأول بأن نسبة الخفض في تعداد العنكبوت الأحمر العادي بعد ٩ أسابيع من الإطلاق علي الخيار في الصوب صنف هشام بلغت ٩٥،٢٦%، ٩٧،٤١% عند مستوي إطلاق ١٠،٥ أفراد مفترس للجورة علي التوالي أما بالنسبة للخيار صنف فهد فقد بلغت نسبة الخفض ٩١،٥٤%، ٩٤،٥٣% عند مستوي إطلاق ١٠،٥ أفراد مفترس للجورة علي التوالي.

أما في الموسم الثاني فقد بلغت نسبة الخفض في تعداد العنكبوت الأحمر العادي بعد الإطلاق بالنسبة لصنف هشام ٩٧،٣٧%، ٩٨،٦٧% عند مستوي إطلاق ١٠،٥ أفراد مفترس للجورة علي التوالي أما بالنسبة للخيار صنف فهد فقد بلغت نسبة الخفض ٩٥،١٨%، ٩٧،١٣% عند مستوي إطلاق ١٠،٥ أفراد مفترس للجورة علي التوالي.

علي ضوء هذه النتائج فإنه يمكن استخدام المفترس الأكاروسي *N. californicus* في برامج المكافحة المتكاملة للآفات علي نباتات الخيار داخل الصوب وترشيد استخدام المبيدات وتشجيع المكافحة الحيوية.