EVALUATING THE EFFICIENCY OF DIFFERENT LEVELS OF *NEOSEIULUS CALIFORNICUS* (MC GREGOR) RELEASED FOR CONTROLLING THE SPIDER MITE *TETRANYCHUS URTICAE* KOCH AND EUROPEAN RED MITE *PANONYCHUS ULMI* (KOCH) ON YOUNG APPLE TREES

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Abstract

Evaluating the efficiency of release different levels of the predatory mite *N. californicus* (McGregor) for controlling of *T. urticae* and *P. ulmi*. The predatory individuals were 10, 20 and 30/ young apple. The predatory mite *N. californicus* released on young apple for controlling *T. urticae* in 2nd April 2006 when spider mite *T. urticae* infestation reached about 3.73,3.06 and 4 individuals/ leaf, while the predatory mite released for controlling *P. ulmi* in 10th April 2006 when its infestation reached about 3, 2.93 and 3.23 individuals / leaf at levels at the same levels of predators/ apple tree, respectively.

After release the predatory mite *N. californicus* for control the two spotted spider mite *T. urticae*. The percent of redaction was 54.37, 60.81 and 66.89% at levels 10, 20 and 30 predators/ apple trees after four months of release, while after release the predatory mite for control *P. ulmi* on apple tree the percent of redaction was 64.35, 70.20 and 77.66% at the same levels after four months of release.

INTRODUCTION

Apple fruit trees are heavily infestation with phytophagous mites. *T. urticae* Koch, *P. ulmi*(Koch) (Family: Tetranychidae) and *Aculus schlechtendali* (Nalepa) are the most important mite species infesting apple trees mainly in lower Egypt. This mites cause serious injury to apple, preferring the lower leaf surface and the new shoots (Abdel-Wahed 2003) these mite pests causes considerable damage for the production quantity and quality.

Ibrahim *et al*., 2004 indicated that, the predatory mite *N. californicus* is important to control the citrus brown mite *Eutetranychus orientalis* (Klein) when released *N. californicus* at three levels of 40, 50 and 70 individuals per trees at level infestation 4.64, 5.06, and 4.70 mite per leaf, respectively, while it was in unreleased tree 4.69 individuals/leaf. After releasing the predator mite the mite pest, *E. orientalis* population generally declined gradually and percentage of reduction in the population of pest mite after four months of releasing reached 57.84, 73.76 and 88.25%, respectively.

El-Ghobashy, 2006 released the predator mite *Phytoseiulus persimilis* (A.-H.) to control the two spotted spider mite *T. urticae* on young peach orchards at Adam Village, El-Nobaria province, El-Behera Governorate,. During the season 2005 at the rate of (30-40), (40-50) and (50-60) predator mites/peach trees in the three treated area on (Feb. 24th) by bean leaflets harboring the predator individuals. The reduction percentage of the two spotted spider mites reached 76.36, 79.60 and 87.01% for the three tested treatments, respectively.

Heikal *et al.,* 2008 study the efficiency of different stages of the predatory mite, *N. californicus* on *T. urticae* and *P. ulmi* all motile stages of the predatory mite feeding on all stages of *T. urticae* and *P. ulmi* , the predatory mite play an important role as bio-control agent for controlling the two tetranychide mites *T. urticae* and *P. ulmi* on mulberry leaf arenas in the laboratory *N. californicus* .

Croft *et al.* 1998 indicated that *N. californicus* is a more generalist feeder than *Neoseiulus fallacies* (Graman) and added that generalist feeders can on pollen.

Vilajeliu& Vilarnau 1992 reported that *N. californicus* (=*A. californicus*) was greatest at the time of maximum activity of *P. ulmi*.

Many successful trails have been applied using different phytoseiid mite predators as a bio-control agents against different tetranychide mite pests infesting different orchards trees and crops (Mori and Satio 1979, Pickett and Gilstrap 1986, Sekita and Kinota 1990,Mifsud 1997, Kerguelen and Hoddle 1999, Hoddle *et al*. 2000, Walzer and Schausberger 2000, Ebrahim *et al.*,2001, El-Saiedy 2003, Ibrahim *et al.* 2005and El- Mahgoob 2006).

This study aim to confirm the role of the predatory mite *N. californicus* in controlling the pests *T. urticae* and *P. ulmi* on Young apple trees at Qalubia Governorate.

MATERIALS AND METHODS

Design of experiment

The experiment was carried out using eighty Young apple trees (about four year) divided into four groups each one of twenty trees as four treatments, three levels of release 10, 20 and 30 and control.

Mass rearing of predatory mite *N. californicus*

Bean plant *Phaseoulus vulgaris* L. used as host plant. Bean seeds were planted in plastic trays (40x40x12cm) with the rate of 20 seeds per trays. These trays were used in rearing the predator mite, which used as nucleation of the predator for releasing in the green house of mass rearing. Small greenhouse divided to three isolated parts: a) rearing of clean bean plants, b) clean plants at the stage of 12

leaves were artificially infested with *T. urticae*, c) one week later, five females of predatory mite *N. californicus* transferred to each bean plant, we follow up the relation between the predator and the prey inside the greenhouse, when it need for prey we were supported it with more prey. About one month when the rate of predator increased to reach 15-25 individuals/ leaflet. The predatory mite was picked in small paper bags with few prey on bean leaves and transferred inside ice box. El-Sayed (1994).

Predators release

When the number of predator increased for suitable number to collect and release. The leave of the beans peering the predator and small number of prey were picked in paper bag and transmitted to the seedling in ice box and the predator release on the apple trees with three levels 10, 20 and 30 individuals. Random samples of 30 leaflet were collected every ten days from each treatments and inspected using aid stereomicroscope. First samples collected just before release and the next collected every 10 days. The number of prey and predator were recorded to the end of experiment and the percent reduction was calculated according to equation of Henderson and Tilton, 1955.

RESULTS AND DISCUSSION

1- Biological control of *Tetranychus urticae* Koch using the predatory mite *N. californicus* (McGregor) on Young apple trees in 2006.

Results in Table (1) indicated that, the predatory mite *N. californicus* was released against the two-spotted spider mite *T. urticae* under three levels of 10, 20 and 30 predators/ apple tree. The first release of the predatory mite was at population density of mite pest 112 and 96 individuals/ 30 leaves in the release and control, respectively.

First level of release

The predatory mite *N. californicus* gave 10.9, 28.2, 39.2, 55.2, 66.3 and 68.9% reduction pest population in Apr. 12th, Apr. 22nd , May 2nd, May 12th,May 22nd and June 1st at number of the predatory mite 7, 10, 13, 15, 20 and 38 individuals/ 30 leaves, respectively. The highest reduction of *T. urticae* observed in June 11th, after 70 days of release the predatory mite *N. californicus* reached 76.3% reduction at level 10 predators/ tree. After that activity of predatory mite decreased to 50.8% in July 31st at number of predatory mite 3 individuals/ trees at level of release 10 predators/ seedling the percent reduction averaged 54.37% in the end of experiment.

Statistical analysis in Table (1) indicated that there was significant positive correlation between the population density of predatory and Temperature (0.64*) while

non-significant negative correlation between the predatory population and relative humidity (-0.33).

Second level of release

The predatory mite *N. californicus* was released on apple seedling at level 20 predator in Apr. 2nd 2006 when number of *T. urticae* was 92 individuals/ 30 leaves, while the number of mite pest in control plots as 96 individuals/ 30 leaves.

The percent reduction of the mite pest increased gradually reaching its highest percent reduction 75.7% in June 11th at average temperature of 27.5ºC and 56.1% relative humidity.

Also reviled data cleared that percentage reduction fluctuated as 69.6, 65.2, 63, 56.6 and 66.2 at June 21st , July 1st, July 11th July 21st and July 31st at number of predatory mite 73, 44, 29, 11 and 2 individuals/ 30 leaves, respectively.

The average of percent reduction of *T. urticae* was 60.81% of four months after release the predator mite *N. californicus* at 20 predators/ seedling.

Statistical analysis in Table (1) cleared that there was positive significant correlation between the population density of predator mites and Temperature (0.58*) while there was non-significant negative correlation between the predatory mite population and relative humidity (-0.15).

Third level of release

Results in Table (1) indicated that the predatory mite *N. californicus* was released at level 30 predators/ apple tree at number of *T. urticae* as 120 and 96 individuals/ 30 leaves on released and unreleased seedling. After releasing the predatory mite, the population of *T. urticae* slightly decreased in the first post-count in April 12th then the pest population gradually declined rapidly from April 22nd to reach its lowest population in June 1st with reduction 80.8% at number of predatory mite 90 individuals/ 30 leaves. On the opposite, the pest population increased gradually in control plots, and reach 581 individuals/ 30 leaves in July 31st at temperature 24.6º and 63% R. H. at percent reduction 75.6%.

From above mentioned results, it could be concluded that release the predatory mite *N. californicus* gave an average reduction 66.89% of pest mite population on apple trees under field condition after four months of release.

Statistical analysis indicated that there was non-significant positive correlation between the predatory mite population and temperature (0.46), while non-significant negative correlation between the predatory mite and relative humidity.

These results were in accordance with, Mori and Satio 1979, Pickett and Gilstrap 1986, Sekita and Kinota 1990,Mifsud 1997, Kerguelen and Hoddle 1999,

Hoddle *et al*. 2000, Walzer and Schausberger 2000, Ebrahim and Abdel-samad 2001, El-Saiedy 2003, Ibrahim *et al.* 2005and El- Mahgoob 2006.

Table 1. Biological control of *Tetranychus urticae* Koch using of the predatory mite *Neoseiulus californicus* (McGregor) on young apple trees in 2006.

Sampling date	Number and redaction % of motile stages of *T. urticae*/30 leaves after release of the predator.									control	Temp. °C	R.H %
	10 adult predators/ seedling		No. of pred.	20 adult predators/ seedling		No. of pred.	30 adult predators/ seedling		No. of pred.			
	No.	R.%		No.	R.%		No.	R.%				
Pre-count before release April 2nd	112	-	-	92	-	-	120	-	-	96	23.0	54.4
April 12th	108	10.9	7	79	20.7	10	109	16.1	14	104	24.0	56.5
April 22nd	103	28.2	10	66	44	15	91	40.8	19	123	24.6	63
may 2nd	96	39.3	13	57	56.6	17	80	53.3	31	137	25	57.1
May 12th	80	55.2	15	50	65.9	22	66	65.5	44	153	26	56.3
May 22nd	69	66.3	20	46	72.7	42	52	76.4	55	176	26.5	56.9
June 1st	68	68.9	38	48	73.3	50	46	80.4	78	188	27	57.2
June 11th	63	76.7	45	54	75.7	66	55	81	89	232	27.5	56.1
June 21st	75	76.3	58	78	69.9	73	65	80.8	90	271	27.8	57.0
July 1st	130	64.2	41	104	65.2	44	84	78.5	68	312	28	57.2
July 11th	210	61.1	21	164	63	29	132	77.2	51	463	23.0	54.4
July 21st	274	54.6	17	215	56.6	11	147	77.1	25	518	24.0	56.5
July 31st	333	50.8	3	188	66.2	2	177	75.6	12	581	24.6	63
mean	134.08	54.37	24	95.75	60.81	31.75	92	66.89	48	231.1	25.5	56.9

No.=Number R.%=Reduction Temp.=Temperature

R.H.= Relative humidity

Correlation coefficient

moving stages of the predator at level 10 predator	0.64*	-0.33
moving stages of the predator at level 20 predator	0.58*	-0.15
moving stages of the predator at level 30 predator	0.46	-0.20

2- Evaluating the efficiency of different levels of release of the predatory mite *N. californicus* (McGregor) against *Tetranychus urticae* Koch on young apple trees

Obtained data recorded in table (2) showed that the mean percentage reductions in population of *T. urticae* were 54.37, 60.18 and 66.89% at average number of predator as 24, 314.75 and 48 individuals at levels of release 10, 20 and 30 predators per apple tree.

There were significant differences between the three levels 10, 20 and 30 predators. The most efficient of release 30 predators per apple tree to control *T. urticae* on seedling it produced the highest percent of reduction recording 66.89% of the mite pest.

These results were in accordance with, El-Saiedy 2003, Ibrahim *et al.*2004, Ibrahim *et al.* 2005, El-Ghobashy, 2006 and El- Mahgoob 2006.

Table 2. The mean reduction of Tetranychus urticae Koch as a result of releasing the predatory mite Neoseiulus californicus (McGregor).

Rate of release	*T. urticae*	Reduction	*N. californicus*
10	134.08 a	54.27 a	24 a
20	95.75 b	60.18 b	31.75 b
30	92.00 b	66.89 c	48 c
F. value	8.14	17.50	35
P.	0.0023	0.0001	0.0001
L.S.D.0.05	25.14	4.06	6.37

3- Biological control of the European red mite *Panonychus ulmi (*Koch) using the predator mite *N. californicus* (McGregor) on young apple trees in 2006

The predatory mite *N. californicus* was released in April 10th, 2006 at three levels 10, 20 and 30 predators per apple tree.

First level of release

Data presented in Table (3) cleared that, the predatory mite *N. californicus* was released on apple trees at 10 predatory per young tree when the number of mite pest 90 and 103 individuals/ 30 leaves in released treatment and unreleased on apple trees, respectively. The first post-count after ten days of releasing the predatory mite reached 23%in April 20th. After that percentage reduction increased gradually it was 30.1, 42.7, 49.8, 65.2, 69.9, 72.9 and 82.8 in Apr. 30th, May 10th, May 20th, June 9th, June 19th and June 29th at number of predatory mite 11, 14, 13, 17, 20, 28 and 34 individuals/ 30 leaves. The height reduction percentage of mite pest recorded in July 9th with 86.1% at number of predatory mite 35 individuals/ 30 leaves at average temperature 27.5ºC and 56.1% R.H., after that the reduction percentage decreased to 81.2% in Aug. 8th, the average percentage reduction of *P. ulmi* was 64.35% after four months of release the predatory mite *N. californicus* at 10 predator/ trees .

Statistical analysis data from Table (3) showed that there was highly significant positive correlation between temperature and population density of predatory mite (0.94***) while there was non-significant positive correlation between the predatory mite and relative humidity at level 10 predators / tree.

Second level of release

The predatory mite was released in April 10th 2006 at 20 predators per apple seedling when the number of mite pest P. ulmi was 88 and 103 individuals/ 30 leaves on release and untreated area.

The reduction percentage of mite pest gradually increased after releasing the predatory mite N. californicus were 25, 36.5, 50.2, 62.2, 70.7, 79.7, 85.2, 88.7, 88.6, 88.7, 84.8 and 82.2% reduction in Apr. 20th, Apr. 30th, May 10th, May 20th, May 30th, June 9th, June 19th, June 29th, July 9th, July 19th , July 29th and Aug. 8th at number of predators 9, 13, 16, 19, 23, 27, 31, 38, 29, 25, 17 and 11 individuals/ 30 leaves, respectively.

The average percentage of reduction of P. ulmi after four months was 70.2% after release the predatory mite N. californicus at 20 predators/ young tree.

Statistical analysis of data obtained in Table (3) showed that there was highly significant positive correlation between the population density of predatory mite and temperature (0.91***), while there was non-significant positive correlation between the predatory mite population and relative humidity (0.44).

Third level of release

Also, as shown in Table (3) data demonstrated that the predatory mite N. californicus was released in April 10th, 2006 at 30 predators/young apple tree at level of infestation 97 and 103 individuals/ 30 leaves in release and unreleased treatment.

The percentage reduction in the population of mite pest after one and two months of release were 61.4 and 85.2% in May 10th and June 9th at number of predators 16& 30 individuals/ 30 leaves at average of temperature 24& 26 ºC and 56.5& 56.3%,R.H. respectively, and reached maximum reduction in June 29th with reduction 96.2% at number of predatory mite 38 individuals/ 30 leaves, then decreased to 92.1% in August 8th at end of experiment.

Finally rate of release 30 predators/ apple tree, the reduction percentages averaged 77.66%.

Statistical analysis of data in table (3) showed that there was highly significant positive correlation (0.92***) between the population density of predatory and Temperature while there was, non-significant positive correlation between the predatory mite population and relative humidity (0.46).

4- Evaluating the efficiency of different levels of release of the predatory mite *N. californicus* (McGregor) against *Panonychus ulmi* (Koch) on young apple tress

The predator mite N. californicus was released at three levels 10, 20 and 30 predators/ apple tree as recorded in (Table 4) indicated that, the average percentage reductions in populations of P. ulmi were 64.35, 70.20 and 77.66% as mean numbers were 50.25, 40.5 and 32 individuals where average numbers of predator were 18.41, 21.50 and 21.33 individual at levels 10, 20 and 30 predator/ tree. There were significant differences between the three levels of release. While the high percent of reduction was produced at release level of 30 predators / tree.

Table 3. Biological control of Panonychus ulmi (Koch) using the predatory mite Neoseiulus californicus (McGregor) on young apple trees in 2006.

Sampling date	Number and redaction % of motile stages of *P.ulmi*/30 leaves after release of the predator.									control	Temp. ºC	R.H %
	10 adult predators/ seedling		No. of pred.	20 adult predators/ seedling		No. of pred.	30 adult predators/ seedling		No. of pred.			
	No.	R.%		No.	R.%		No.	R.%				
Pre-count before release April 10th	90	-	-	88	-	-	97	-	-	103	17.8	56.4
April 20th	84	23	5	80	25	9	82	30.3	7	125	21.7	51.2
April 30th	80	30.1	11	71	36.5	13	66	46.5	12	131	23.7	54.2
May 10th	73	42.7	14	62	50.2	16	53	61.4	16	146	24	56.5
May 20th	68	49.8	13	50	62.2	19	45	69.2	21	155	24.6	63
May 30th	51	65.2	17	42	70.7	23	32	79.8	28	168	25	57.1
June 9th	47	69.9	20	31	79.7	27	25	85.2	30	179	26	56.3
June 19th	43	72.9	28	23	85.2	31	16	90.6	33	182	26.5	56.9
June 29th	30	82.8	34	19	88.7	38	7	96.2	38	197	27	57.2
July 9th	25	86.1	35	20	88.6	29	10	94.8	45	206	27.5	56.1
July 19th	29	84.8	22	21	88.7	25	13	93.7	16	218	27.8	57.0
July 29th	33	83.7	15	30	84.8	17	17	92.2	8	232	28	57.2
August 8th	40	81.2	7	37	82.2	11	18	92.1	2	244	29	56.0
mean	50.25	64.35	18.41	40.50	70.20	21.50	32.0	77.66	21.33	170.2	24.96	56.6

No.=Number R.%=Reduction Temp.=Temperature

R.H.= Relative humidity

Correlation coefficient

moving stages of the predator at level 10 predator 0.94*** 0.34

moving stages of the predator at level 20 predator 0.91*** 0.44

moving stages of the predator at level 30 predator 0.92*** 0.46

Table 4. The mean reduction of Panonychus ulmi (Koch) as a result of releasing the predatory mite Neoseiulus californicus (McGregor) release.

Rate of release	*P. ulmi*	Reduction	*N.. californicus*
10	50.25 a	64.35 a	18.41 a
20	40.50 b	70.20 b	21.a
30	32.00 c	77.66 c	21.33 a
F. value	54.32	81.06	2.15
P.	0.0001	0.0001	0.1407
L.S.D.0.05	3.65	2.28	3.64

CONCLUSION

All the previous results cleared that, the efficiency of the predator increased as well as increasing the rate of release also results indicated the possibility of controlling the two-spotted spider mite *T. urticae* and European red mite *P. ulmi* on apple trees, the main point is that, starting the release of the bio-control agents at the low level of infestation to have good control in very short time after releasing is a must.

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تقييم كفاءة إطلاق مستويات مختلفة من المفترس *Neoseiulus californicus* لمكافحة كل من العنكبوت الأحمر العادى والأكاروس الأحمر الأوروبى على أشجار التفاح الصغيرة

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تم تقييم كفاءة إطلاق مستويات مختلفة من المفترس الأكاروسى *Neoseiulus californicus* على أشجار التفاح الصغيرة (عمر أربعة سنوات) ١٠ ، ٢٠، ٣٠ مفترس لكل شجيرة ، عندما تم إطلاق المفترس الأكاروسى على شجيرات التفاح لمكافحة العنكبوت الأحمر العادى فى ٢ أبريل ٢٠٠٦ عند مستوى إصابة من العنكبوت الأحمر العادى ٣,٧٣، ٣,٠٦، ٤ أفرد لكل ورقة على مستوى ١٠ ، ٢٠، ٣٠ مفترس لكل شجيرة وبعد اربعة أشهر من الإطلاق وصلت نسبة الخفض فى التعداد إلى ٥٤,٣٧، ٦٠,٨٠، ٦٦,٨٩% على التوالى. فى حين تم إطلاق المفترس الأكاروسى *Neoseiulus californicus* لمكافحة الأكاروس الأحمر الأوروبى فى ١٠ أبريل عندما كان مستوى تعداد الأفراد على الأوراق ٣، ٢,٩، ٣,٢٣ فرد لكل ورقة ووصلت نسبة الخفض فى تعداد الأكاروس الأحمر الأوروبى بعد أربعة أشهر من الإطلاق إلى ٦٤,٣٠، ٧٠,٢، ٧٧,٦٦% على التوالى.

من النتائج السابقة يتبين أن المفترس الأكاروسى كان له دور كبير فى خفض تعداد كل من العنكبوت الأحمر العادى والأكاروس الأحمر الأوروبى على شجيرات التفاح إلى مستوى منخفض من الإصابة فيمكن إكثار هذا المفترس ونشرة فى بساتين الفاكهة والخضر والمحاصيل الحقلية لمكافحة العديد من الآفات الأكاروسية الضارة.