

**REARING THE TWO PREDATORY MITES, *NEOSEIULUS CALIFORNICUS* AND *PHYTOSEIULUS MACROPILIS* ON THE TWO-SPOTTED SPIDER MITE, *TETRANYCHUS URTICAE* AND DIFFERENT KINDS OF POLLEN (ACARI:PHYTOSEIIDAE & TETRANYCHIDAE)**

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**Abstract**

The two predatory mites, *Neoseiulus (Amblyseius) californicus* (McGregor) and *Phytoseiulus macropilis* (Banks) were mass reared in the laboratory on mulberry leaf arenas infested with the two-spotted spider mite as animal diet and pollen as plant diet. Both predators were successfully maintained and mass reared on the two-spotted spider mites. The rate of increase of *N. californicus* on the two-spotted spider mite were 8.1, 12.0 and 23.5 fold after 6, 12 and 15 days, respectively. While that of *P. macropilis* they were 17.9, 33.6 and 53.1 fold. Pollen of apricot, palm, peach and apple were unsuitable for rearing the predatory mite, *P. macropilis*, but proved to be suitable for the predatory mite, *N. californicus*. However, the rate of the predator increase were comparatively low when compared with rearing on the two-spotted spider mite, *Tetranychus urticae* Koch. They were 1.2, 3.6, 1.5 and 1.8 fold after 15 days when reared on pollen of apricot, palm, peach and apple, respectively.

**INTRODUCCION**

In Egypt, attention has been focused in the recent years on the possibility of using biological control methods against mite pests attacking some economic plants. Predaceous phytoseiid mites are important biological control agents against pest mites affecting many crops in different parts of the world (Helle & Sabelis, 1985). The two phytoseiid predators, *Phytoseiulus macropilis* (Banks) and *Neoseiulus (Amblyseius) californicus* (McGregor) were introduced in Egypt several years ago. The first predator was successfully mass reared and produced on the two-spotted spider mite under screen houses and proved to be an effective bio-control agent against the two-spotted spider mite, *Tetranychus urticae* Koch on certain crops (Heikal & Ibrahim, 2001 and 2002, Heikal *et al.* 2003 and Heikal *et al.* 2007). The second predator (*N. californicus*) is considered to be an effective predator against tetranychid mites in the Mediterranean area (Castagnoli & Simoni, 1994). Its low food requirement and low tendencies for cannibalism, broad range of food on which production is possible and

high activity mite contribute to stabilizing predator- prey system at low average densities (McMurtry & Croft ,1997) .

The present work discusses the rearing of the two predatory mites, *N.californicus* and *P. macropilis* on the two-spotted spider mite, *T. urticae* as animal diet and different kinds of pollen as plant diet.

## MATERIALS AND METHODS

I- Rearing the predatory mite, *Neoseiulus californicus* on the two-spotted spider mite, *Tetranychus urticae* and different kinds of pollen:

Arenas of detached leaves were used in this study to assess the productivity of the predatory mite, *N. californicus* on the two-spotted spider mite, *T. urticae* (as animal diet) and various kinds of pollen (as plant diets). Excised mulberry leaves, *Morus alba* L., each about 10 cm diameter, were placed upside down on cotton wool saturated with water in glass Petri dishes. A thin layer of tangle foot was painted around each arena as a barrier to confine the mites to a definite area. Individuals of the spider mite, *T. urticae*, from a laboratory culture were provided as food.

To study the possibility of rearing this predator on plant diets, four kinds of pollen were tested for their acceptability to *N. californicus*, these were: apricot, palm, peach, and apple pollen. Flowers of the previous plants were collected during February and March from grown trees at El-Mahala Kobra (El-Gharbia Governorate). Anthers of these flowers were cut and put on sheets of paper to release pollen. The pollen preferably has a low water content to reduce molding during storage. The four kinds of pollen were left 2 – 3 days to dry under room temperature ( $25 \pm 2^{\circ}\text{C}$ ), then used or stored in the refrigerator.

Twenty arenas for each treatment of pollen and the two-spotted spider mites were used. Each arena was provided with three females and one male of *N. californicus*. A thin layer of tangle foot was printed around each arena as a barrier to confine the mites to a definite area. Arenas were kept at laboratory temperature of about  $25^{\circ}\text{C}$  and about 70% R.H. on racks. Each rack was provided with 2-tupes, 40-W fluorescent light with a daily 16 hours photoperiod. Holders of the stands were put on suitable plastic jars filled with water and sides of the stands were covered with muslin to keep away other predators and insect pests. Arenas were inspected with the aid of a dissecting microscope at the first, sixth, twelfth, and fifteenth days to add additional food when required or to transfer the predator to new arenas.

11- Rearing the predatory mite, *P. macropilis* on the two-spotted spider mite, *T. urticae* and different kinds of pollen..

The same technique was applied when rearing the predatory mite, *P. macropilis* on the two-spotted spider mite, *T. urticae* and different kinds of pollen.

## RESULTS AND DISCUSSION

I. Rearing the predatory mite, *Neoseiulus californicus* on the two-spotted spider mite, *Tetranychus urticae* and different kinds of pollen:

Data of rearing the acarine predator, *N. californicus*, are presented in Table (1). When the red spider mite, *T. urticae* was used as food on mulberry leaf arenas, the predator individuals increased by 8.1, 12.0 and 23.5 fold (as the initial numbers) on the 6<sup>th</sup>, 12<sup>th</sup> and 15<sup>th</sup> day from the introduction of the predator, respectively.

These values greatly decreased when pollen of apricot, palm, peach and apple used as food on mulberry leaf arenas to reach 3.3, 3.3 and 1.2 fold with Apricot pollen from the same periods, respectively. While with the palm pollen they were 3.3, 3.7 and 3.6 fold from the previous periods, respectively. These values decreased with peach pollen to reach 3.1, 2.4 and 1.5 fold. The apple pollen attained 3.7, 3.0 and 1.8 fold from the previous periods, respectively.

From the above mentioned data it could be concluded that the predatory mite, *N. californicus* could feed and reproduce on certain pollen and the tested pollen were suitable as diet for this acarine predator as its individuals able to utilize of the served pollen. This finding agrees with that reported by Schausberger and Croft (1999) who reported that *N. californicus* larvae can eat pollen. In addition, Croft *et al.* (1998) stated that *N. californicus* is more of a generalist feeder than *N. fallacies* and that generalist feeder can feeds on pollen. While McMurtry and Rodriguez (1987) stated that generalists feed on mites, insects, pollen and even plant juice. McMurtry and Scrives (1965) estimated the number of adult females of *Oligonychus punicae* (Hirst) consumed by adult females of *Amblyseius hibisci* (Chant) on excised leaves in the presence and absence of pollen at four different prey densities found that less preys were consumed in the presence of pollen at all prey densities.

However, spider mites proved to be the most suitable diet for rearing and maintaining *N. californicus*. In addition, the tested pollen especially in absence of preferable spider mite prey can be used as alternative diet for maintaining *N. californicus*, and that needs additional studies.

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Table 1. Population counts of *N. californicus* when fed on *T. urticae* and different kinds of pollen on mulberry leaf arenas.

Food provided	Means no. of predators/rearing unit after:												Rate of increase ( fold ) after:		
	1 <sup>st</sup> days			6 <sup>th</sup> days			12 <sup>th</sup> days			15 <sup>th</sup> days			6 days	12 days	15 days
	M.S	Eggs	Totals	M.S.	Eggs	Totals	M.S.	Eggs	Totals	M.S.	Eggs	Totals	days	days	days
<i>T. urticae</i>	4.0	0.0	4.0	25.0	7.5	32.5	35.2	13.0	48.2	49.8	44.0	93.8	8.1	12.0	23.5
Apricot pollen	4.0	0.0	4.0	10.5	2.8	13.3	10.7	2.5	13.2	4.0	0.9	4.9	3.3	3.3	1.2
Palm pollen	4.0	0.0	4.0	9.3	3.8	13.1	11.0	3.6	14.6	12.6	1.8	14.4	3.3	3.7	3.6
Peach pollen	4.0	0.0	4.0	8.5	4.0	12.5	7.4	2.3	9.7	4.8	1.3	6.1	3.1	2.4	1.5
Apple pollen	4.0	0.0	4.0	10.9	3.9	14.8	8.3	3.6	11.9	5.5	1.7	7.2	3.7	3.0	1.8

M.S. = Moving stages

11- Rearing the predatory mite, *P. macropilis* on the two-spotted spider mite, *T. urticae* and different kinds of pollen:

Data of rearing the acarine predator, *P. macropilis*, are presented in Table (2). When the red spider mite, *T. urticae* was used as food on mulberry leaf arenas, the predator individuals increased by 17.9, 33.6 and 53.1 fold (as the initial numbers) on the 6<sup>th</sup>, 12<sup>th</sup> and 15<sup>th</sup> day from the introduction of the predator, respectively.

On the other hand, none of the predator individuals were recorded by the 6<sup>th</sup>, 12<sup>th</sup> and 15<sup>th</sup> days of predator inoculation when pollen of apricot, palm, peach and apple served as food on mulberry leaf arenas. Also, no predator eggs were found. This indicated that the tested pollen were not suitable as food for the predator individuals.

From the above mentioned data it could be concluded that the tested pollen were not suitable as diet for this mite predator as its individuals might not be able to accept and utilize any of the served pollen. This finding agrees with that reported by (McMurtry, 1977) for *P. persimilis* and with that of Ali (1998) who found that the adult of *P. macropilis* failed to feed on date palm pollen and added that immature stages of *P. macropilis* fed and developed to adult stage and oviposited on *T. urticae* eggs and immatures, while it developed to adult on *Eutetranychus orientalis* (Klein) immatures but the females failed to lay eggs and died within 2 to 3 days. The deutonymphs failed to develop to adulthood on *Cisaberoptus kenyae* Keifer, *Bemisia tabaci* (Gennadius) and date palm pollen. However, spider mites proved to be most suitable diet for rearing and maintaining *P. macropilis*. On the other hand, the red spider mites are easy to be reared or obtained in great numbers. This finding agrees with that reported by several authors who indicated that the genus *Phytoseiulus* Evans is a small group of phytoseiid mites which strongly depend on the species of the genus *Tetranychus* Dufour (McMurtry *et. al.*, 1989, Takahashi & Chant, 1992 and McMurtry & Croft, 1997). Kropczynska (1973) referred that *P. macropilis* were better adapted to feed upon phytophagous mites and did not able to utilize pollen.

Table 2. Population counts of *P. macropilis* when fed on *T. urticae* and different kinds of pollen on mulberry leaf arenas.

Food provided	Means no. of predators/rearing unit after:												Rate of increase ( fold ) after:		
	1 <sup>st</sup> days			6 <sup>th</sup> days			12 <sup>th</sup> days			15 <sup>th</sup> days			6 days	12 days	15 days
	M.S	Eggs	Totals	M.S.	Eggs	Totals	M.S.	Eggs	Totals	M.S.	Eggs	Totals			
<i>T. urticae</i>	4.0	0.0	4.0	47.2	24.2	71.4	81.5	53.0	134.5	99.1	103.2	212.3	17.9	33.6	53.1
Apricot pollen	4.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Palm pollen	4.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Peach pollen	4.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Apple pollen	4.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

M.S. = Moving stages

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تربية المفترسين الأكاروسيين نيوسولس كاليفورنيكس وفيتوسولس ماكروبيليس  
*Neoseiulus (Amblyseius) californicus* و *Phytoseiulus macropilis*  
 على العنكبوت الأحمر *Tetranychus urticae* وبعض أنواع حبوب اللقاح

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تم تربية المفترسين الأكاروسيين نيوسولس كاليفورنيكس وفيتوسولس ماكروبيليس باستخدام ورق التوت على العنكبوت الأحمر ذو البقعتين كغذاء حيواني و عدة أنواع من حبوب اللقاح كغذاء نباتي . وكان معدل الزيادة للنوع نيوسولس كاليفورنيكس على العنكبوت الأحمر هو ٨,١ و ١٢,٠ و ٢٣,٥ بعد ١٢ و ١٥ يوماً ، على التوالي . بينما كان معدل الزيادة للنوع فيتوسولس ماكروبيليس هو ١٧,٩ و ٣٣,٦ و ٥٣,١ بعد ١٢ و ١٥ يوماً، على التوالي. كما أظهرت الدراسة أن حبوب لقاح المشمش والنخيل والخوخ والتفاح كانت غير مناسبة لتربية النوع فيتوسولس ماكروبيليس، ولكن أثبتت أنها مناسبة لتغذية النوع نيوسولس كاليفورنيكس . ومع ذلك ، فإن معدل زيادة المفترس كانت أقل بالمقارنة عند التربية على العنكبوت الأحمر . وكان معدل الزيادة للمفترس هو ١,٢ و ٣,٦ و ١,٥ بعد ١٥ يوماً عند التربية على حبوب لقاح المشمش والنخيل والخوخ والتفاح ، على التوالي .