

**Effect of low temperatures on the biological aspects of the predatory mite, *Phytoseiulus macropilis* (banks) (acarina: phytoseiidae: gamasida)**

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**ABSTRACT**

Biological studies on the predatory mite, *Phytoseiulus macropilis* (Banks). Showed that the female lived longer than of the male; whereas female and male longevity averaged 14.72 and 11.5 days, respectively. The predator efficiency of consumed immature stages of *Tetranychus urticae* Koch, increased during the predator developmental stages as well as the adult female and male consumed 77.4 and 27.5 immatures of *T.urticae*, respectively. At cold storage of *P.macropilis* eggs at 10 and 5°C, respectively when the stored eggs transferred at 25°C.

The biological aspects of the predator *P.macropilis* after cooling storage of its eggs at 5°C, respectively when the stored eggs transferred at 25°C.

The biological aspects of the predator *P.macropilis* after cooling storage of its eggs at 5°C for one week, compared with the biological aspects of *P.macropilis* at 25°C indicated that female longevity decreased to 8.9 + 1.74 days comparing with 14.5 + 1.5 days for control. Female fecundity reduced in cooling treatment, which the number of deposited eggs per female was 19.36 + 6.6 eggs and it was 45.4 + 4.99 eggs per female in control.

**INTRODUCTION**

Members of the family phytoseiidae are usually, expected to be found associated with both mites and insects infestations, they are most efficient against mites, for controlling the associated pests (El-Badry, 1967). Laing (1968) noted that when *P.persimilis* was fed on eggs of *T.Urticae* at 20°C, the total developmental time for female and male averaged 7.4 and 7.5 days, respectively. El-Laithy (1991) studied the biology of the predatory mite *P.persimillis* under temperature which would prevail in spring season in protective cultivation in Egypt. Eggs of *P.persimillis* develop to the adult stage after 3.35 and 3.60 days for female and male, respectively. Female deposited an averaged 2.87 eggs per day. Immature stages of the predatory female and male consumed 17.0 and 10.33 eggs of the prey *T.urticae*/day, respectively. Shoeib (1996) reported that a cold storage of 10 and 5°C for one to four weeks, egg hatchability percentage decreased from 91% to 60% and from 79% to 44%, incubation period prolonged from 5.3 to 10.2 days and from 6.4 to 13.0 days after storage, total number of deposited eggs/female decreased from 43 to 2 eggs, respectively, from one to four weeks at 10°C; while at 5°C, it decreased from 5 to zero eggs after three weeks.

The aim of the present work is to throw light on some biological aspects of the predatory mite , *P.macropilis* under low temperature.

## MATERIALS AND METHODS

### Rearing of the Predatory mite, *P.macropilis* (Banks)

Each *P.macropilis* (Banks) was reared on strawberry leaf discs (3cm, in diameter). These discs were placed in petri-dishes, on pieces of wet cotton wool; water was daily added to maintain suitable moisture. Individuals of each *P.macropilis* (Banks) singly reared, and examined twice daily. Known numbers of prey were introduced; the devoured individuals were counted, and replaced by another alive one. Individuals of *P.macropilis* (Banks) were fed during its life span on immature stages of *T.urticae*. All experiments were carried out in an incubator at 25°C and 65% R.H.

### The effect of low temperature storage at 10°C & 5°C on eggs hatchability and biological aspects of *P.macropilis*

High number of newly deposited eggs of the predator *P.macropilis* were collected from a laboratory culture and placed on strawberry leaf discs on moistened cotton wool in small Petri-dishes. Four Petri dishes as group were kept in the incubator at 5°C and other at 10°C for four weeks and transferred to incubator at 25°C . Another group of Petri dishes were kept at the two temperatures (10 and 5°C) for three, two, one week and then transferred to incubator at 25°C. Hatchability percentage was recorded.

Also, newly emerged larvae were reared singly on a Petri-dish supplied with immature stage of *T.urticae* and kept in the refrigerator at 5°C for one week and studied the biological aspects of *P.macropilis* compared with biological aspects of *P.macropilis* kept at 25°C.

## RESULTS AND DISCUSSION

### Biological aspects of the predatory mite *P. macropilis* when fed on immature stages of spider mite, *T. urticae* at 25°C and 60% R.H

Results showed that when predatory mite *P. macropilis* fed on immature stages of *T.urticae*, the incubation period averaged 3.60±0.10 days for female and 3.43±0.03 days for male. The duration of female and male active larva lasted 0.51±0.023 and 0.485±0.038 days; the duration of total immature stages of the predatory mite *P. macropilis* averaged 3.33±0.10 and 3.20±0.02 days for female and male, respectively, these findings coincide with those obtained by El-Laithy (1991).

The pre-oviposition, oviposition and post-oviposition periods of *P. macropilis* lasted 2.02±0.02, 10.8±0.83 and 1.90±0.22 days, respectively . The female and male longevity averaged 14.72±0.97 and 11.5±0.70 days, respectively, (Tables 1).

### Food consumption

The total average of consumed immature stages of *T. urticae*, increased with successive developmental stages. The predator female and male larva did not feed, but female and male protonymph destroyed an equal prey averaged 2.0±1.41 & 2.0±1.4 while deutonymph could and attack 6.8±3.2 & 5.0±1.4 individuals prey, respectively, Table (2).

During immature stages, female and male consumed an average 7.8+3.2 and 7.0+2.8, preys for female and male respectively.

During pre-oviposition, oviposition and post-oviposition period, the total number of prey consumed by the female predator averaged 11.0+5.24, 62.6+10.3 and 3.8+1.3 immatures of *T. urticae*, respectively, (Table 2).

The adult female of the predatory mite *P. macropilis*, fed on about three times as much as those attacked by the male, the adult female and male consumed 77.4+11.10 and 27.5+2.12 immatures of *T. urticae*, respectively, during longevity period (Table 2).

**Fecundity of the predatory mite *P. macropilis*:**

Result in Tables (3) showed that, the female predator attacked 62.6 + 10.3 individuals of immature stages of *T. urticae*, and during oviposition period and deposited 35.6 + 1.80 eggs, during 10.8 + 0.83 days, with a dialy mean of 3.29 eggs (Table, 3).

**Table 1: Biological aspects of the predatory mite *P. macropilis* when fed on immature stages of spider mite, *T. urticae* at 25°C and 65% R.H.**

Developmental Stages of Predator	Average (in days) when feed on immature stages of <i>T. urticae</i>	
	Female	Male
Incubation period	3.6 + 0.10	3.43 + 0.03
Active larva	0.51 + 0.023	0.485 + 0.038
Quiescent larva	0.35 + 0.03	0.395 + 0.09
Active protonymph	0.61 + 0.09	0.487 + 0.024
Quiescent Protonymph	0.43 + 0.03	0.45 + 0.10
Active deutonymph	0.93 + 0.04	0.90 + 0.02
Quiescent deutonymph	0.51 + 0.04	0.49 + 0.02
Total immature stages	3.33 + 0.10	3.20 + 0.02
Life cycle	6.93 + 0.55	6.63 + 0.78
Pre-oviposition	2.02 + 0.02	-
Generation	8.95 + 0.87	-
Oviposition	10.8 + 0.83	-
Post-oviposition	1.90 + 0.22	-
Longevity	14.72 + 0.97	11.5 + 0.7
Life span	21.56 + 2.45	18.13 + 0.84

**Table 2: Food consumption of immature stages of *Phytoseiulus macropilis* female and male when fed on immature stages of *Tetranychus urticae* Koch at 25°C and 65% R.H.**

Developmental Stages of Predator	Average (in days) when feed on immature stages of <i>T. urticae</i>	
	Female	Male
Lava	-	-
Protonymph	2.00 + 1.41	2.00 + 1.40
Deutonymph	6.80 + 3.20	5.00 + 1.40
Total immature	7.80 + 3.20	7.00 + 2.80
Pre-oviposition	11.0 + 5.24	-
Oviposition	62.6 + 10.30	-
Post-oviposition	3.8 + 1.30	-
Longevity	77.4 + 11.10	27.5 + 2.12
Life span	85.2 + 8.78	34.5 + 6.56

**Effect of low temperature (10&5°C) storage on egg hatchability percentages of *P.macropilis***

**Cold storage at 10°C**

Data in Table (4) indicated that when the eggs of the predatory mite, *P.macropilis* stored at 10°C for one, two, three and four weeks, the hatchability percentage reached 2.7, 8.57, 25.0 and zero%, respectively, and when stored eggs transferred at 25°C, the hatchability percentage increased to 100, 87.5 and 70.0%, respectively, in case of storage for one, two and three weeks; but in case of storage four weeks it produced zero%.

The result clears that the predatory eggs can be stored at 10°C to one, and two weeks, successfully.

**Cold storage at 5°C**

Data present in Table (5) reported that when the eggs of the predatory mite *P.macropilis* stored at 5°C for one, two, three and four weeks, the percentage of hatchability reached zero, 21.87, zero% and 5.71%, respectively, and when the stored eggs transferred to incubator at 25°C the percent hatchability were 84.9, 10.0, 2.5 and zero%, respectively, as the same previous time of storage.

From the above mentioned result, can be recommend that the proper time for storage the egg stages of the predatory mite at 5°C is for one week only.

These finding results is in agreement with Aly (1994) who stated that the low temperature affect on egg incubation and hatchability.

**Table 3. Female oviposition period and fecundity of *phytoseiulus macropilis* (Banks) A. at 25°C and 65% R.H.**

Duration of oviposition period	Food consumption during oviposition period	Number of deposited eggs	
		Total	Daily rate
10.8 + 0.83	26.6 +10.3	35.6	3.296

**Table 4. Effect of different time of cold storage of egg stage of *Phytoseiulus macropilis* (Banks) on percent hatchability at 10°C and after incubation on 25°C.**

Time of storage	Cold storage at 10°C				At 10°C after cold storage			
	Total number	No. of unhatched eggs	No. of hatched eggs	% of hatchability	Total number	No. of unhatched eggs	No. of hatched eggs	% of hatchability
One week	37	36	1	2.70	36	Zero	36	100
Two week	35	32	3	8.57	32	4	28	87.5
Three weeks	40	30	10	25.0	30	9	21	70.0
Four weeks	41	41	-	Zero	41	41	-	Zero

**Effect of storage eggs at low temperature on the biological aspects of predatory mite *P.macropilis***

Data in Table (6) indicated that the incubation period lasted  $1.60 \pm 0.51$  and  $2.74 \pm 0.44$  days, for cooling and uncooling eggs, respectively. Total immature period increased in cooling treatment averaged  $3.70 \pm 0.80$  days, but in uncooling treatment it slightly decreases to  $3.24 \pm 0.44$  days.

The generation period slightly decreased with treatment than with untreated which averaged  $6.71 \pm 0.7$  and  $6.91 \pm 0.6$  days, respectively, while the oviposition period highly decreased to  $6.11 \pm 1.7$  days, but untreated increased to  $12.53 \pm 1.4$  days. Also, the same trend was obtained with longevity, this period lasted  $8.9 \pm 1.74$  days in cooling treatment and 14.50 days in uncooling treatment. Female life span for treated eggs averaged  $14.32 \pm 1.70$ , while in control it lasted  $20.4 \pm 0.99$  days.

**Table 5. Effect of different time of cold storage of egg stage of *Phytoseiulus macropilis* (Banks) on percent hatchability at 5°C and after incubation on 25°C , 65% R.H.**

Time of storage	Cold storage at 10°C				At 10°C after cold storage			
	Total number	No. of unhatched eggs	No. of hatched eggs	% of hatchability	Total number	No. of unhatched eggs	No. of hatched eggs	% of hatchability
One week	86	86	Zero	Zero	86	13	73	84.9
Two week	64	50	14	21.87	50	45	5	10.0
Three weeks	40	40	Zero	Zero	40	39	1	2.5
Four weeks	35	33	2	5.71	33	33	Zero	Zero

**Table 6. Biological aspects of the predatory mite *phytoseiulus macropilis* (Banks) at 25°C 65 H.R. after cold storage of eggs at 5°C for one week.**

Parameter	Treated	Control
Incubation period	$1.60 + 0.51$	$2.74 + 0.44$
Active larva	$0.56 + 0.24$	$0.50 + 0.0$
Quiescent larva	$0.50 + 0.0$	$0.50 + 0.0$
Active protonymph	$0.56 + 0.17$	$0.50 + 0.0$
Quiescent deutonymph	$0.50 + 0.0$	$0.50 + 0.0$
Active deutonymph	$1.14 + 0.46$	$0.71 + 0.41$
Quiescent protonymph	$0.54 + 0.133$	$0.52 + 0.11$
Total immatures	$3.70 + 0.8$	$3.24 + 0.44$
Pre-oviposition	$1.23 + 0.42$	$0.97 + 0.13$
Generation period	$6.71 + 0.7$	$6.91 + 0.6$
Oviposition	$6.11 + 1.7$	$12.53 + 1.4$
Post-oviposition	$1.50 + 0.7$	$1.00 + 0.0$
Longevity	$8.90 + 1.74$	$14.50 + 1.5$
Life span	$14.32 + 1.7$	$20.40 + 0.99$
Total eggs/female	$19.36 + 6.6$	$45.40 + 4.99$

Female fecundity reduced whereas the number of deposited eggs per female were  $19.36 \pm 6.60$  with treated eggs but it were  $45.40 \pm 4.99$  with untreated eggs per female.

In conclusion, the cold storage of eggs of the predatory mite, *P. micropilis* at 5°C for one week causing reduction in female fecundity reached about 42.2%, so that it can be recommend that, must not make this storage except in obligated case when their are a high number of predatory eggs.

These results are coincided with Aly (1994), Shoeib (1996) and El-Khategia, Heikal et al (1996), Heikal et al., (2001)

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## دراسات بيولوجية للمفترس الأكاروسي *Phytoseiulus macropilis* (Banks)

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أوضحت الدراسات البيولوجية على المفترس الأكاروسي *Phytoseiulus macropilis* أن الإناث تعيش فترة حياة أطول من الذكور، حيث بلغت ١٤.٧٢ و ١١.٥٠ يوماً على التوالي. كفاءة المفترس في التغذية على الأطوار غير الكاملة للعنكبوت الأحمر العادي تزداد مع تطور الأطوار المختلفة للمفترس، حيث بلغت النسبة ٧٧.٤ و ٢٧.٥ طور غير كامل لكل من إناث وذكور المفترس على التوالي.

تم دراسة تأثير تخزين بيض المفترس *P. macropilis* عند درجتي حرارة ١٠°م و ٥°م وذلك لمدة (١، ٢، ٣، ٤) أسبوع ومعرفة تأثيرهما على نسبة فقس البيض فكانت نسبة فقس البيض ١٠٠، ٨٧٥، ٧٠، صفر% عند التخزين على درجة ١٠م على التوالي عند نقل البيض على درجة حرارة ٢٥°م، بينما في حالة التخزين عند ٥°م كانت نسبة الفقس ٨٤.٩، ١٠٠، ٢٠٥، صفر% عند نقلها على درجة ٢٥°م.

تم دراسة المظاهر البيولوجية للمفترس بعد تخزين البيض لمدة أسبوع على درجة ٥°م ونقل البيض إلى الحضانة على درجة ٢٥°م ومقارنة ذلك بالمظاهر البيولوجية لأفراد من المفترس تم تربيتها في الحضان على درجة ٢٥°م، فقد لوحظ تأثر حياة الإناث بدرجة كبيرة حيث قصرت وبلغت ٨.٩ يوماً في حين كانت ١٤.٥ يوماً في المقارنة، كما انخفض معدل وضع البيض للإناث من ٤٥.٤ بيضة في المقارنة إلى ١٩.٣٦ بيضة في المعاملة.

### قام بتحكيم البحث

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