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INFLUECNE OF THE PREY TYPE ON THE BIOLOGY AND LIFE TABLE PARAMETERS OF THE PREDATORY MITE *Phytoseiulus macropilis* (BANKS) (ACARI: PHYTOSEIIDAE).

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ABSTRACT

The predatory mite *Phytoseiulus macropillis* (Bank) was fed on eggs, nymphs and adult stages of *Tetranychus urticae* Koch and *Tetranychus cucurbitacearum* (Sayed). Prey spider mites were collected from growing cucumber plants in plastic tunnels in Nubaria provinces during summer of 2003 and 2004. Reproduction rates were almost similar on both of *T. urticae* and *T. cucurbitacearum*, however feeding on nymph stages of either of the prey species resulted in the lower ones.

INTRODUCTION

The two-spotted spider mite *Tetranychus urticae* is known world wide as the main pest attacking greenhouse crops such as ornamentals (Vrie, 1985), vegetables (Hussey & Scopes, 1985; El-laithy, 1992). In Egypt the red spider mite *T. cucurbitacearum*, coexisted as a secondary pest endangering some summer field crops such as maize, Soya bean, cotton and peanuts as mentioned by (Abou-Awad, 1980;; Osman *et al.*, 1985; Yassin, 1997). However recent practices of the IPM program in plastic tunnels in Egypt revealed the presence of both *Tetranychus* species not only on vegetables grown near northern coastal areas but also on greenhouse roses in Delta during summer months (El-laithy 2005). The present investigation aims to study the biology and life table parameters of the predatory mite *Phytoseiulus macropillis* (Banks) using different types of preys under laboratory condition.

MATERIALS AND METHODS

1. Stock culture of *T.urticae and T. cucurbitacearum*:

Rearing of *T. urticae* Koch and *T. cucurbitacearum* (sayed) were carried out on beans *Phaseolus vulgaris* L. cultivated in pots in isolated compartments (1.5 x 2 m) in an experimental glasshouse in the National Research Center.

2. Rearing of the predatory mites:

The exotic predatory mites *Phytoseiulus macropillis* was reared using methods modified by McMurtry and Scriven (1965). Large plastic boxes (26 x 15 x 10 cm) were used. Cotton pads were put in the middle of each box, leaving a space provided with water as a barrier to prevent predatory mites from escaping. In addition, a tangle-foot strip was placed at the edges of the boxes. Bean leaves highly infested with *T. urticae* were provided every other day as food sources. Plastic boxes were kept in an incubator at 28 °C ± 2 and 70 ± 10. Life span and life table parametrs estimations were carried out for *P. macropillis* by feeding on eggs, nymphs and adult females for both of *T. urticae and T. cucurbitacearum.*

Experimental procedures:

Experimental arenas were prepared as follows. A clean disc of mulberry leaf (10 cm in diameter) were placed on wet tissue paper rested on a water-saturated pad of plastic foam (12 cm in diameter) inside a Petri dish (140 mm x 15 mm). Approximately 25 adult females of *P. macropillis* were transferred from the stock culture to a leaf arena and provided with a surplus food of the previous preys to obtain the suitable number of eggs needed for life span studies. Newly laid eggs were singly transferred to arenas using small leaf discs (3 cm in diameter). The aforementioned prey stages were offered to the hatched larvae during their life span as follows: monocultures of each of egg, nymph and adult females of both *T. urticae* and *T. cucurbitacearum* were obtained using the rearing arenas. However the average period for getting each separate stage was considered to avoid overlapping between developing stages

Observations were carried out twice daily and different biological aspects were recorded. Life table parameters were calculated according to Birch (1948) using the Basic computer program of Abou-Setta *et al.* (1986). Predatory mite colonies as well as all experimental arenas were carried out in the laboratory under room temperature during July to September 2005.

Statistical analysis:

The obtained data were subjected to the analysis of variance test (ANOVA) with mean separation at 5% level of significance following the method of Snedicor and Cochran (1967) using t test.

RESULTS AND DISCUSSION

Bionomics

The predatory mite *Phytoseiulus macropillis* pass through five developmental stages: egg, larva, two nymphs and adult stage (Table 1). It was relatively possible to sex immature stages because of the bright reddish color of stages fed on *T. cucurbitacearum* stages, in addition to the characteristically small size of male immature and adult stages of *P. macropillis* and other related phytoseiid mites (Schulten 1985). Among phytoseiid mites, mating usually took place immediately after adult female emergence. Also, adult females did not start oviposition without accession to adult male, as mentioned by Dosse (1955), Elbadry and Zaher (1961), and McMurtry and Scriven (1964). As shown in Table 1 the feeding on *T. cucurbitacearum* adult resulted in the shortest total developmental time (egg-to-adult or life cycle) of 114 h. whilst nymphs resulted the longest period of 132 hrs. Feeding on *T.* urticae stages did not reflect changes in egg to adult developmental period Table 1. On the other hand, adult female longevity was shorter when feed on *T. cucurbitacearum* (Table 1). Similarly longevity of adult female of *P. macropillis* fed on eggs, nymphs and adult stages of both of *T. cucurbitacearum* and *T. urticae* ranged between 24 .0 days to 30 days. Longevity period of adult female was very inconsistent in case of *T. cucurbitacearum* (24.69 to 26.46 days) Table 1.

Table 1a*. Duration of developmental periods of the predatory mite *P. macropilis* fed on egg ,immature ,adult of *T.cucurbitacearum*.

Food type	Duration in hours of the female postembryonic stages				
	Eggs	Larvae	Protonymph	Deutonymph	Life cycle
Egg	72	12	12	18	114
Nymph	72	24	12	18	132
Adult	72	12	12	18	115

Table 1b*. Duration of developmental periods of the predatory mites *P. macropilis* fed on egg, immature, adult of *T. urticae*.

Food type	Duration in hours of the female postembryonic stages				
	Eggs	Larvae	Protonymph	Deutonymph	Life cycle
Egg	72	12	12	18	117
Nymph	72	12	12	18	118
Adult	72	12	12	18	116

*** (statistical analysis using pairing t –test showed non significant differences between Egg to adult developmental period of *P. macropilis* when fed on either of *T. urticae* and *T. cucurbitacearum* . calculated t values were 0, 0.56, 0.04 and P at 0.05 were 1, 0.57, 0.96**

Table 2a*. Durations in days of adult female (longevity) and life span of the predatory mite *P. macropilis*. fed on egg, immature, adult of *T. cucurbitacearum*

Food type	Preoviposition	Oviposition	Postoviposition	Adult longevity	Life span
Egg	1±0	22.54±3.65	1.154±0.361	24.69±3.428	29.44±3.428
Nymph	1.6±0.49	23.6 ± 4.65	1.1 ± 0.3	26.3 ± 4.92	31.6±4.92
Adult	1 ± 0	24.43± 4.456	1.203 ±0.4	26.464 ±4.557	31.39±4.557

0.57 and 0.96

Table 2b*. Durations in days of adult female (longevity) and life span of *P. macropilis* fed on egg ,immature ,adult of *T. urticae*.

Food type	Preoviposition	Oviposition	Postoviposition	Adult lo1vity	Life span
Egg	1 ± 0	21.667 ±1.97	1.33 ± 0.47	24 ± 2.256	28.75±2.256
Nymph	1± 0	22 ± 3.5	1.2 ± 0.4	24 ±3.5	29±3.7
Adult	1 ± 0	28 ± 3.28	1.5 ± 0.49	30 ± 3.45	35±0

***(statistical analysis using pairing t –test showed non significant differences between adult female longevity of *P. macropilis* when fed on either of *T. urticae* and *T. cucurbitacearum* . calculated t values were 0.15, 0.39, 0.52 and P at 0.05 were 0.87, 0.69, 0.59**

Life table parameters:

As shown in Table 3 the total eggs laid per female of *Phytoseiulus macropilis* reached a max. of 62.58 eggs /♀ when fed on *T. urticae* eggs while eggs of *T. cucurbitacearum* resulted in 44.69 eggs /female. The lowest number of total eggs were laid when *P. macropilis* females fed on nymphs of either of the prey species i.e. 28.0 eggs /♀. Moderate amount of eggs were obtained by *P. macropilis* females by feeding on adult of *T. urticae* and *T. cucurbitacearum* 40 and 49 eggs /♀, respectively.

Table 3. Life table parameters and fecundity rates of the predatory mite *Phytoseiulus macropilis* fed on eggs, nymphs and adult stages of both *Tetranychus urticae* and *T. cucurbitacerum*

Food type / life table statistics	*Tetranychus urticae*			*T. cucurbitacerum*		
	Eggs	Nymphs	adults	Eggs	Nymphs	adults
Mean daily fecundity (eggs/ ,/day	2.89±2.895	1.3±0.3	1.5±0.3	2.01±0.53	1.19±0.21	2.19±0.51
Total fecundity (eggs/ ;)	62.58±7.86	28±5.9	40.9±12.7	44.69±12.48	28.2±7.81	49.06±13.7
Intrincic rate of natural increase r_m	.40	.33	0.35	0.38	0.33	0.39
Finit rate of increase λ	1.5020	1.3961	1.42926	1.47565	1.39	1.48
Net reproductive Rate R_0	49.728	25.274	34.6491	37.51769	26.8	41.82
Mean generation time (in days) T	9.603	9.678	9.926	9.333	9.88	9.48

Table 4. *Average number of consumed prey of *T. curbitacearum* and *T.urticae* egg, nymph and adult stages by different developmental stages of *P. macropilis*

Stage of *p. macropillis*	Stages *of Tetranychus urticae*						Stages of *T. cucurbitacerum*					
	Eggs		Nymphs		adults		Eggs		Nymphs		adults	
	Total	daily	Total	daily	Total	daily	Total	daily	Total	daily	Total	daily
Protonymph	11	21.67	9.8	19.6	1	2	17.36	34.6	9.48	18.8	1	2
Dytonymphn	24.58	30.73	19	21.88	2.75	2.5	26.	232.78	. 14.3	15.37	1	1.25
Pre ov. P.	20.66	20.67	27	26.9	2.2	2.2	56.7	56.7	58.9	39.9	1.46	1.26
Ov. P.	602.33	27.76	316	13.05	28.5	0.9	422.	18.94	293	12.7	38.2	1.47
Post ov. P.	5	3.54	0.0	0.0	1.4	1.4	4.84	4.26	4.1	3.7	1.2	1.2

Total values of consumed prey in particular by protonymph and deutonymph of *P. macropilis* are lower than values of the daily because of the duration of theses stages are decimal of one day i.e. 12h or 18 h.

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The highest value of the intrinsic rate of natural increase (r_m) for *P. macropillis* 0.4 was obtained by feeding on *T. urticae* eggs whilst the lowest one (0.33) was obtained using nymphs of each of *T. urticae* or *T. cucurbitacearum* (Table 3) . Feeding on *T. urticae* stages caused the higher female multiplication rate R0 25.27- 49.7 comparing to 26.8 to 41.8 for *T. cucurbitacearumadult* (Table 3). The results of the current study are in line with Ali (1996) and Ali and El-laithy (2005) .

The predatory mite *Phytoseiulus macropillis*:

Eggs were orange elongate-oval, their color became darker before hatching and coloration continued in the following stages. Males were smaller than females and their color was progressively darker. The duration of developmental stages was not obviously affected by prey species *T. urticae or T. cucurbitacearum.* Female completed their developmental stages within 114-132 hrs. and within 116-118 hrs. while feeding on the different stages of *T. cucurbitacearum* and *T. urticae* respectively (Tables 1,2). Likewise adult female longevity was almost identical when fed on *T. cucurbitacearum*, it ranged between 24.0 to 26.6 days while feeding on *T. urticae* adult stage elongate the period to 30. The duration of egg development and the total number of eggs laid per female as well as adult female longevity in the present study vary in value to the same parameters found in Ali (1998) due to the fluctuated climatic condition in the laboratory herein than his study under constant temperatures. However, results obtained by Prasad (1967) when *P. macropillis* was fed on all stages of *Tetranychus tumidus* Banks are very close to that in the present study.. Life table parameters shown in Table 3 indicate that *feeding of P. macropillis* on either of *T. urticae* or *T. cucurbitacearum* has not any significant impact for its population growth rate of Prey consumption rates: Daily or total consumption rates of *P. macropillis* of the food types egg, nymph and adult stages of either *T. urticae* or *T. cucurbitacearum* shown in Table 4 are similar to that of Takafuji and Chant (1976 in Sablis 1985). The daily rates of consumption recorded herein for gravid females surpassed all other stages of and the lowest one were that of non gravid adult females (adult female during post oviposition period). However total prey consumed from *T. cucurbitacearum* seems relatively lower than that in case of *T. urticae*. But both values of consumed prey follow the assumption of Sabelis (1985) that rates are reversal to prey size.

Results obtained herein are useful for people working in mass rearing industry of predatory mites in particular problems encountered in mass of production *T. urticae*.

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بيولوجي الحلم المفترس فيتوسيليس ماكروبيليس (بانكس)(أكاري:فيتوسيدي) متغذيا على تترنيكس أورتيكا كوخ و تترنيكس كيوكيربيتسيرم (سيد)

سهير إبراهيم عبد الرحمن و عبلة عبد الوهاب إبراهيم

معهد بحوث وقاية النباتات قسم بحوث أكاروس القطن والمحاصيل.

تم تربية المفترس فينوسيليس ماكروبيلس على أطوار مختلفة (البيض – والحوريات – الإناث البالغة) للعنكبوت الأحمر ذو البقعتين بنوعيه الأحمر والأخضر

واتضح من النتائج :-

١- أن أقصر مدة لدورة حياة كانت ١١٤ ساعة بتغذية المفترس على إناث بالغة للحلم ذو البقعتين النوع الأحمر (كيوكيربيتسيرم) بينما زادت هذه المدة إلى ١٣٢ ساعة بتغذية المفترس على الحوريات ولم تتأثر عند تغذية المفترس على حوريات الحلم ذو البقعتين النوع الأخضر.

٢- بالتغذية على أطوار النوع الأخضر تراوحت فترة حياة الأنثى من ٢٤,٥ – ٣٠ يوما بينما كانت بفروق غير معنوية عند التغذية على أطوار النوع الأحمر من ٢٤,٦٩ – ٢٦,٤٦ يما وكانت أقصر فترة حياة لإناث المفترس ٢٤,٠ يوما متغذيا على حوريات النوع الأحمر وأطولها ٣٠,٠ يوما متغذيا على الطور البالغ للنوع الأخضر.

٣- أظهرت جداول الحياة

أ- وضعت إناث المفترس أكبر عدد للبيض ٢٦,٥٨ متغذيا على الإناث البالغة للنوع الأخضر وأقل عدد ٤٤,٦٩ بيضة عند التغذية على الإناث البالغة للنوع الأحمر بمتوسط ٤٠ ، ٤٩ بيضة للنوعين على الترتيب وأقل عدد ٢٨ بيضة بالتغذية على حوريات الحلم بنوعيه.

ب- أعلى معدل لزيادة الخصوبة rm ٠,٤ بالتغذية على بيض النوع الأخضر وأقل قيمة ٠,٣٣ بالتغذية على حوريات النوعين الاحمر والأخضر.

٤- ووجدت زيادة فى معدل استهلاك المفترس لجميع المواد الحلم بنوعيه الأحمر والأخضر فى فترة وضع البيض، بينما كانت منخفضة فى فترة ما بعد وضع البيض.

وعموما كان معدل استهلاك المتفرس لجميع الموارد النوع الأخضر أكبر من النوع الأحمر.