Biological Studies on the Two Predaceous Mites, *Phytoseiulus macropilis* (Banks) and *Typhlodrompis capisicum* Mostafa

Dalia, A. Waked
Plant Protec. Res. Inst., Agric. Res. Center, Dokki, Giza, Egypt.

ABSTRACT

The biology of *Phytoseiulus macropilis* and *Typhlodrompis capisicum* fed on three preys; *Tetranychus urticae, Panonychus ulmi* and *Eutetranychus oriantalis* was studied at 27°C. Total consumption, as well as predation capacity was estimated. *T. urticae* was more favorable than the other preys for *P. macropilis*, its fecundity was (31.06, 20.53 and 13.93eggs for *T. urticae, E. oriantalis* and *P. ulmi*, respectively. No significant differences in the fecundity of *T. capisicum* when fed on *T. urticae* and *E. oriantalis*, 21.38 and 19.73 eggs, respectively. The life cycle duration was shorter (11.60 days) when *P. macropilis* fed on *T. urticae* than the other two preys, 17.93 days and 21.40 days for *E. oriantalis* and *P. ulmi*, respectively; while no significant differences in life cycle duration of *T. capisicum* when fed on *T. urticae* and *E. oriantalis* being shorter compared with feeding on *P. ulmi* which increased the life cycle. The consumption rate of predators increased with increasing prey densities at three levels 5,10 and 15 individuals for both predators. Also, deposited eggs of the two predators increased by increasing food. Net reproductive rate (R_o) and Intrinsic rate of increase (r_m) values were the best values when *P. macropilis* fed on *T. urticae* and the mean generation time (T) decreased compared with the other preys.

Key words: *Phytoseiulus macropilis*; *Typhlodrompis capisicum*; Biology; Different preys.

INTRODUCTION

The phytoseiids are the most studied because plant inhabiting predatory mites of their importance in the control of phytophagous mites on agricultural crops, Helle and Sabelis (1985). Many predaceous phytoseiids are now used as biological control agents in various agricultural ecosystems being important predators of phytophagous mites populations in IPM programs outdoor and greenhouse crops. *Phytoseiulus* species all have probably highest potential for population increase, in the Phytoseiidae Zhang (1995). They have a short development time, Sabelis and Janssen (1994), along with high fecundity, resulting in intrinsic rate of increase (r) values sometimes exceeding 0.4 Takahashi and Chant (1992).

Phytoseiulus macropilis is one of the most important generalist indigenous predators of tetranychids and widely found on various crops. Thus, the aim of this study was to investigate the biological life table and intrinsic rate of natural increase of *P. macropilis* and *T. capisicum* at three food types of mite species, *Tetranychus urticae, Panonychus ulmi* and *Eutetranychus oriantalis*.

MATERIALS AND METHODS

Feeding of predaceous mites on different preys of phytophagous mites:

Seminated newly adult females of predaceous mites, *T. capisicum*, and *P. macropilis* were transferred singly from the established culture to leaf mulberry discs, one inch in diameter as each rearing arenas in Petri-dishes on water saturated cotton. Every female was supplied with sufficient known number of the prey (adult of phytophagous mites, *T. urticae, E. oriantalis* and *P. ulmi*). Petri-dishes were placed in an incubator at 27±2°C and 65±5% R.H. Adult longevity, fecundity and rate of consumption were calculated.

Effect of prey density on egg laying, longevity and feeding behavior of predaceous mites:

Stock laboratory cultures of the predatory mite species, *P. macropilis* and *T. capisicum* were separately maintained on mulberry leaves with *T. urticae*, Basha *et al.*, 2007. Mature virgin females and newly emerged males of the two species (which were within 24 – 48hr. after the final molt) were given sufficient time to mate on mulberry leaves with abundant preys. The experiments were conducted on upside down mulberry leaf discs of 4cm in diameter on water saturated cotton wool pads in Petri- dishes and bordered with wet strip of cotton wool. Adult *T. urticae* females were used as prey in three different densities 5, 10 and 15 per leaf disc. Newly mated females of each predator caged together transferred singly to each leaf disc through three experimental series with 15 – 20 replicates individually of each prey density. Leaf discs were examined daily and the number of consumed preys and deposited eggs per two predatory females were registered. All the attcked preys were removed and replaced with alive ones. The experiments were carried out under laboratory conditions of 27±2°C and 65±5% R.H.

Life tables:

An experiment was conducted for the influence of food types on the life table parameters of *P. macropilis* and *T. capisicum* using the most suitable

prey and calculated according to the life 48 computer program Abou-Setta *et al.* (1986)

Statistical analysis:

Data were subjected to statistical analysis using one way analysis of variance, ANOVA Duncan (1955).

RESULTS AND DISCUSSION

Feeding on different preys:

Predaceous mites, *P. macropilis* and *T. capisicum* are considered predators of certain phytophagous mites, *T. urticae, E. oriantalis* and *P. ulmi*. Data in Table (1) showed that, food consumption of *P. macropilis* female was significantly affected by prey species and stage of the prey i.e. adult of *T. urticae, E. oriantalis* and *P. ulmi*. During adulthood, predator female consumed greater number of adult prey species. *T. urticae* prey was more favorite compared with the other two preys. Therefore, feeding on *T. urticae* significantly prolonged predator longevity and increased eggs production. The fecundity of *P. macropilis* was 31.06, 20.53 and 13.93 eggs for *T. urticae, E. oriantalis* and *P. ulmi*, respectively. In addition, total devoured prey were obviously increased with fed on *T. urticae* compared with the other two preys; the consumption of the prey *E. oriantalis* and *P. ulmi* were similar. *P. macropilis* fed on *P. ulmi* lived for a shorter period than those fed on the other two. Generally, the highest significant effect on longevity, consumption and fecundity was detected with *T. urticae*.Net reproductive rate (R_o) and Intrinsic rate of increase (r_m) were the best values when *P. macropilis* fed on *T. urticae* 16.13 times; while were 12.42 times and 7.06 times on *E. oriantalis* and *P. ulmi*, respectively. The mean generation time (T) decreased when fed on *T. urticae* compared with the other preys. Theintrinsic rate of increase (r_m) was in descending order 0.14, 0.11 and 0.07 individual /♀/ day.

Table (2) showed that *T. capisicum* female the life cycle differed significantly with food types being the shortest, 13.66 days, on *T. urticae* and the longest, 19.13 days on *P. ulmi*. There was no significance in longevity of *T. capisicum* when fed on the three types of food. Females of *T. capisicum* gave nearly similar number of deposited eggs when fed on *T. urticae* 21.38 eggs and *E. oriantalis*19.73 eggs; while on *P. ulmi* gave the lowest number 15.90 eggs. Predator female consumed significantly more two-spotted spider mite, 53.15 individuals /female, than *E. oriantalis*44.18 individuals/female, and *P. ulmi* 32.41 individuals /female. Net reproduction rate (R_o) by was the highest when the predator mite fed on *E. oriantalis* 15.71 times followed by *T. urticae* 13.54 times and *P. ulmi* 10.12 times. The intrinsic rate of increase (r_m) was0.12, 0.11 and 0.08 individual/female/day when the predator mite, *T. capisicum* fed on *T. urticae, E. oriantalis* and *P. ulmi*, respectively. The mean generation time (T) was the highest 20.86 days in *P. ulmi*; while was near similar in *E. oriantalis* 17.22 days and *T. urticae* 18.73 days. These results support the findings of Zaher *et al.* (2007) who reared *Typhlodrompis swirskii* on different preys where *T. urticae* immatures were more favorite than *Cenopalpus pulcher* and *Eutetranychus oriantalis* that consumed high number from *T. urticae* immatures and Van de Vrie and Boersma (1970) for *Typhlodrompis potentillae* that preferring immatures of the spider mite.

Effect of prey densities on some biological aspects of predacious mites:

Consumption, oviposition rates and longevity of the two predaceous mites, *P. macropilis* and *T. capisicum* reared on mulberry leaf discs. Table (3) showed that consumption rate increased with increasing prey densities at three levels 5, 10 and 15 preys for both predators. No significant differences occurred at the rate consumption of levels 10 and 15preys. The deposited eggs of the two predators increased by increasing offered food. Longevity

Table (1): Life table parameters of *P. macropilis* feeding on *T. urticae*, *E. oriantalis* and *P. ulmi*

Biological aspects	Sex	Food		
		T. urticae	*E. oriantalis*	*P. ulmi*
Life cycle(days)	♀	11.60±1.34^{c}	17.93±1.26^{b}	21.40±1.13^{a}
	♂	10.20±1.05 ^{c}	15.00±1.34 ^{b}	20.73±1.86 ^{a}
Longevity (days)	♀	19.06±2.09^{a}	14.32±1.73^{b}	12.46±1.92^{b}
	♂	14.13±1.52^{a}	10.73±1.03^{b}	8.20±0.76^{b}
Consumption	♀	95.17±2.91^{a}	76.54±2.31^{b}	69.13±1.92^{b}
	♂	67.26±1.98^{a}	52.06±1.57^{b}	40.53±1.31^{c}
Total eggs / ♀		31.06±2.11^{a}	20.53±2.09^{b}	13.93±1.29^{c}
Net reproductive rate (R_o)		16.13	12.42	7.06
Mean generation time (T)		17.46	19.31	22.00
Intrinsic rate of increase (r_m)		0.14	0.11	0.07
Expected rate of increase (λ)		1.20	1.17	1.16

Means in rows followed by the same letter are not significantly different at p≤5% ± standard error.

Table (2): Life table parameters of *T. capisicum* fed on *T. urticae*, *E. oriantalis* and *P. ulmi*

Biological aspects	Sex	Food		
		T. urticae	*E. oriantalis*	*P. ulmi*
Life cycle(days)	♀	13.66±1.25[b]	15.40±1.12[b]	19.13±1.04[a]
	♂	12.60±1.17[b]	12.86±1.15[b]	16.93±1.24[a]
Longevity (days)	♀	15.33±1.32[a]	12.40±1.16[a]	13.60±1.03[a]
	♂	8.80±0.76[a]	7.33±0.43[a]	7.13±0.23[a]
Consumption	♀	53.15±2.34[a]	44.18±2.10[b]	32.41±2.14[c]
	♂	29.53±1.76a	22.33±1.45	14.86±1.01
Total eggs / ♀		21.38±1.89[a]	19.73±1.37[a]	15.90±1.81[b]
Net reproductive rate (R_o)		13.54	15.71	10.12
Mean generation time (T)		18.73	17.22	20.86
Intrinsic rate of increase (r_m)		0.12	0.11	0.08
Expected rate of increase (λ)		1.19	1.18	1.14

Means in rows followed by the same letter are not significantlydifferent at p≤5% ± standard error.

Table (3): Influence of three prey levels of *T. urticae* adult on the number of prey consumed, female predator longevity and egg laying

Species	Prey densities	Total consumption	Longevity (days)		Eggs laid	
P. macropilis	5	45.10±3.07[b]	10.25±1.30[b]		17.20±0.12[c]	
	10	176.47±5.34[a]	21.43±1.25[a]		37.73±1.13[b]	
	15	180.89±4.70[a]	22.57±1.06[a]		44.52±1.57[a]	
L.S.D5%		15.06	2.36		6.01	
T. capisicum	5	39.56±3.30[b]	8.68±1.22[b]		15.75±1.14[c]	
	10	121.20±3.50[a]	16.50±1.35[a]		28.65±1.13[b]	
	15	123.62±2.90[a]	19.95±1.15[a]		33.06±1.30[a]	
L.S.D5%		9.12	4.19		3.93	
			P. macropilis	*T. capisicum*	*P. macropilis*	*T. capisicum*
P. macropilis +*T. capisicum* (Caged together)	5	36.20±1.12[c]	10.47±0.95[b]	4.94±0.87[b]	14.37±1.12	2.56±0.42
		182.73±2.53[a]	19.00±1.14[a]	17.61±1.35[a]	32.61±1.87	20.48±1.22
	15	169.41±3.08[b]	20.25±1.72[a]	14.20±1.62[a]	43.09±2.36	27.67±1.47
L.S.D5%		10.11	6.34	4.62		

Means in columns followed by the same letter are not significantly different at p≤5% ± standard error.

fluctuated on other predaceous at 5, 10 and 15 prey density. No significant difference for the longevity of two predators when fed on levels of 10 and 15 prey individuals. Obtained results nearly similar to that of Sharma and Sadana (1987) who studied the effect of prey densities on the predation rate and daily fecundity of the phytoseiid, *Amblyseius finlandicus* fed on *Eutetranychus orientalis* at 27.3 – 30.5℃; the number of consumed prey increased with increase of predator density; at predator: prey ratios of 1: 10 to 1: 30 but then decreased with increase in predator density. Greco *et al.* (2005) found significant differences between consumption behaviors of the phytoseiid mite, *Neoseiulus californicus* and prey densities of *T. urticae*. When two predaceous females caged together consumption increased with increasing prey.

When preys were scarce at level of 5 prey individuals competition was succeed between predaceous mites. Also *P. macropilis* fed on some individuals of *T. capisicum* so the total consumption decreased. These results are nearly similar with that of Al-Garhy (2008) who determined daily prey consumption and oviposition rates of the two phytoseiid species E. *metwalli* and *T. capsicum* as influenced by competition. Generally competition succeded when prey densities decreased.

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