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Biological Studies and Life Table Parameters of *Phytoseiulus persimils* and *Amblyseius swirskii* and Their Efficiency in Controlling *Tetranychus urticae*

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Abstract: Predatory mites belonging to Phytoseiidae are one of the main natural enemies of phytophagous mites, thus allowing for their use as a biological control. *Phytoseiulus Presimils* and *Amblyseius swirskii* Athias- Henriot (Acari: Phytoseiidae) are the main species of predatory mites used for this purpose. *Tetranychus urticae* kotch (Acari: Tetranchidae) is considered to be one of the most important species of mite pests attacking over 1, 100 species of plants in 140 families with economic value. The objective of the present study was to investigate the life table parameters and the biological aspects of the predatory mites *P. presimils* and *A. swirskii* when fed on *T. urtica*. The study showed that, the longivety of *P. persimils* and *A. swirskii* were 30, 33 & 27.67 respectively and the fecundity was higher in *P. presimils* than in *A. swirkii* and the life table parameter was (R , (T), (rm), (exp rm) were32.76, 17.10 & 12.11, 13.91 & 0.67, 0.54, for two species respectively and the Efficiency of predatory mite *P. persimilies* was more than *A. swirkii* it was 67.78 & 55.56 respectively, but when combined the two species the total mortality was 86.67.

Key words: *Tetranychus* spp. · *Phytoseiulus persimilis* and *Amblyseius swirskii* · Life table · Agriculture acarolgy

INTRODUCTION

The two-spotted spider mites, *Tetranychus urticae* Koch (Acari: Tetranychidae) is a major pest of greenhouse and farms around the world [1, 2]. Chemical control is the most efficient method to control two–spotted spider mite damages on crops [3, 4]. However, this management approach can be hazardous to water, environment, soil and health of human society [5, 6]. Therefore, biological control tactics are crucial to manage the populations of two-spotted spider mite [7].

Among their predators, phytoseiid mites are effective biological control agents that are commercially used in IPM programs and biological control [8].

Several species of phytoseiid mites are specialists and feed mainly on tetranychid mites but others are generalists and can feed on different types of preys (mites and insects such as thrips and whiteflies) and plant pollens [9]. Field observations showed that *Amblyseius swirskii* Athias-Henriot (Acari: Phytoseiidae) is often found in association with phytophagous tetranychid mites, whiteflies and scale insects [10].

Behavioural evidence that the predatory mite *P. persimilis* is attracted to *T. urticae*-induced plant volatiles has been presented for lima bean (Fabaceae), tomato (Solanaceae), cucumber (Cucurbitaceae), gerbera (Asteraceae), ground ivy (Lamiaceae), cotton (Malvaceae) and for rose, pear and apple (Rosaceae) [11-13]. Moreover, it was shown that the predatory mite *P. persimilis* is not attracted to odours from the spider mite *T. urticae* [14]. This means that the attraction of the predatory mite *P. persimilis* to *T. urticae*-infested plants cannot be explained by herbivore-derived volatiles but is caused by plant-derived volatiles.

The present work was aimed to evaluate the life cycle and life table parameters of *P. persimilis* and *Amblyseius swirskii* when fed on *T. urticae* and their predacious efficiency of the two predators.

MATERIALS AND METHODS

Rearing Mites: *T. urticae* were collected from unsprayed vegetable fields and reared, in laboratory, at 25± 2°C and 60± 5%RH.

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Application Method

The Experiment on Predator Efficiency Individually with the Prey Was Conducted as Follow: Leaf discs of castor plant (4 cm in each) were placed singly with upper surface down on cotton wool saturated with water, in Petri dishes as for the stock cultures for spider mites as aprey *T. urtica*. newly emerged protonymphs or deutonymphs of spider mites, *T. urticae* were used. Newly-emerged protonymphs and deutonymphs were harvested directly from the laboratory reared population. A stock colony of *P. persimilis and A. swirskii* were obtained from Plant Protection Research Institute, Agriculture Research Center. For biological experiment there are three replicates for each predator (leaf discs of castor plant 4 cm) to experimentation neonate adult females [maximum 2 days old; distinguished from older mites by their appearance (white, slim, even dorsal shield)] of *A. swirskii* and *P. persimilis* were taken from the rearing to be individually transferred to a smaller rearing arenas (diameter: 2 cm) for starvation for 24 h.

For the Experiment of Existence the Two Predators with Each Other: After egg deposition, females for each predator were transferred to stock culture. Hatched larvae were reared during their life span. rearing individual were examined daily and the developmental stages: The durations of egg, larval, protonymphal, duetonymphal stages were calculated, in addition to the time periods of total immatures, life cycle, longevity period were measured. The number of eggs laid per female was counted. The individuals were transferred to new leaf discs upon the first sign of deterioration. Tested two predators were used with the prey to show the effect of each one on the other.

Results were analyzed by life table program [15] and L.S.D. values were calculated by costat program [16].

RESULTS AND DISCUSSION

Biological Aspects: Data in Table (1) showed that, the incubation period, total immature stages and the total life cycle of *A. swirskii* increased than *P. persimilis*. The incubation period was 1.9 and 1.7 days with *A. swirskii* than *P. persimilis*, respectively, but the increase was not significant. The total immature stages with *A. swirskii* and *P. persimilis* were 5.4 and 3.5 days, respectively and this increase was significant. Also, the total life cycle of *A. swirskii* increased significantly than that of *P. persimilis* which was 7.3 and 5.2 days for *A. swirskii* and *P. persimilis* respectively.

Also, in Table (1) generation period increased significantly with *A. swirskii* than *P. persimilis* which was 9.97 and 8.53 days, respectively. While life span increased non significantly with *P. persimilis* than *A. swirskii* and it was 35.53 and 34.9, respectively. Least significant difference (L.S.D.) was also detected for all stages as described in Table (1). The obtained results were in agreement with Heung [17].

Table 1: The difference between different stages of *P. persimilis* and *A. swirskii*.

Stages	*Phytoseiulus persimilis*	*Amblyseius swirskii*	L.S.D
Incubation period	1.7 ± 0.48 a	1.9 ± 0.32 a	0.38
Larvae duration	1.2 ±0.42 a	1.0 ± 0.00 a	0.28
Protonymph	0.9 ± 0.21 b	2.3 ± 0.48 a	0.35
Dutonymph	1.4 ± 0.52 b	2.1 ± 0.32 a	0.40
Total immature	3.5 ± 0.47 b	5.4 ± 0.52 a	0.46
Life cycle	5.2 ± 0.35 b	7.3 ± 0.48 a	0.40
Longevity	30.33 ± 0.58 a	27.67 ± 1.15 b	2.07
Generation period	8.53 ± 0.57 b	9.97 ± 0.58 a	1.31
Life span	35.53 ± 0.58 a	34.9 ± 1.15 a	2.07

Table 2: The difference between longevity and fecundity of *P. persimilis* and *A. swirskii*.

Stages		*Phytoseiulus persimilis*	*Amblyseius swirskii*	L.S.D.
Average duration (days)	Pre oviposition Period	3.33 ± 0.58 a	2.67 ± 0.58 a	1.31
	Oviposition period	20.33 ± 0.56 a	19.00 ± 1.00 a	1.85
	Post oviposition Period	6.67 ± 0.56 a	6.00 ± 1.00 a	1.85
Longevity (Days)		30.33 ± 0.57 a	27.67 ± 1.15 b	2.07
Fecundity	Egg / Female	60.67 ± 3.06 a	31.67 ± 3.10 b	6.93
	Daily Rate	2.98 ± 0.08 a	1.66 ± 0.08 b	0.17

Table 3: The difference between life table of *P. persimilis* and *A. swirskii*.

Parameters	*Phytoseiulus persimilis*	*Amblyseius swirskii*
Net reproduction rate (R_o)	32.76	17.10
Mean generation time (T)	12.11	13.91
Intrinsic rate of increase (r_m)	0.67	0.54
Finite rate of increase (exp_{rm})	1.95	1.71
Generation doubling time (days)*	2.11	2.62

Generation doubling time (days) = ln_2 / r_m

Table 4: Efficiency of the two predators *P. persimilis* and *A. swirskii* individually and combined:

	Mortality after treatments				
	Five days	Ten days	Fifteen days	Total	Total Mortality %
Phytoseiulus persimilis	7	11	2	20	
	8	10	2	20	
	7	13	1	21	
Total	22	34	5	61	67.78
Amblyseius swirskii	6	8	3	17	
	5	6	4	15	
	6	8	4	18	
Total	17	22	11	50	55.56
Phytoseiulus persimilis + Amblyseius swirskii	14	6	6	26	
	15	7	5	27	
	11	6	8	25	
Total	40	19	19	78	86.67

In Table (2), the female longevity of *P. persimilis* increased significantly than *A. swirskii* which was 30.33 and 27.67 days, respectively. Fecundity of female and the number of eggs/ female of *P. persimilis* increased very significantly with *P. persimilis* than *A. swirskii* which were 60.67 and 31.67, respectively. Souza [18] proved that also.

Table (3) showed that, the net reproductive rate (R_0) was high with *P. persimilis* than *A. swirskii* which was 32.76 and 17.10, respectively. Also, the intrinsic rate of increase (r_m) (0.67 and 0.54) and finite rate of increase (exp_{rm}) (1.95 and 1.71) were high with *P. persimilis* than *A. swirskii*, respectively. While the mean generation time (T) increased with *A. swirskii* than *P. persimilis* and was 13.91 and 12.11, respectively. Also, generation doubling time was high with *A. swirskii* than *P. persimilis* and was 2.62 and 2.11 days, respectively. Souza [18]. proved same results.

Existence the Two Predators with Each Other: In Table (4), the total mortality increased when *P. persimilis* used individually on *T. urticae* which reached 67.78 %. While *A. swirskii*, when used individually on *T. urticae*, it recorded 55.56% mortality and this percent was low. However, when the two predators used with each other, the mortality percent become very high, 86.67%. So the application of the predators with each other is very useful in control of *T. urticae.* Van der [5] proved that *P. persimilis* attracted to *T. urticae.* Alberto [19] proved that both of *P. persimilis* and *A. swirskii* were very effective in control of *T. urticae*.

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