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Biology and Predatory Potential of *Amblyseius deductus* (Acarina: Phytoseiidae) on Different Densities of *Tetranychus urticae (Acarina: Tetranychidae)*

[1]*Muhammad Ashraf Ali,* [1]*Wali Muhammad,* [2]*Muhammad Wasim Abbas,* [2]*Muhammad Hamid Bashir,* [3]*Muhammad Afzal,* [1]*Abdul Haye,* [1]*Ahmad Nawaz and* [2]*Muhammad Jaffar Hussain*

[1]Pest Warning and Quality Control of Pesticides Wing of Agriculture Department Govt. of Punjab, Pakistan
[2]Department of Entomology, University of Agriculture, Faisalabad, Pakistan
[3]Faculty of Agriculture, University of Sargodha, Pakistan

Abstract: Mites of the family Phytoseiidae are potential predators of various species of Phytophagous mites throughout the world. The aim of this work was to study the developmental period, fecundity rate and predatory potential of *Amblyseius deductus* after feeding different prey densities of two spotted spider mites (*Tetranychus urticae*). There were three treatment with the ratio of predator and prey i.e. T_1(1:5), T_2(1:7) and T_3(1:9). The effect of T. urticae on the developmental period of *A. deductus* showed non significance differences means at larval, protonymphal, deutonymphal and post-oviposition period in all three treatments but showed significance differences means in pre-oviposition and oviposition period. The maximum fecundity was recorded inT_3(1:9). third treatment i.e. 24.33±1.33 as compared to other two treatments means after feeding on *T. urticae*. The predatory potential of larval and protonymphal stages of *A. deductus* showed non significant differences means while deutonymph, pre-oviposition, ovoposition and post-oviposition showed significances differences means in all three treatments.

Key words: Fecundity · Prey ratio · *Tetranychus urticae* · Life cycle

INTRODUCTION

Two spotted spider mite *Tetranychus urticae* (Acari: Tetranychidae) is considered to be one of the most economically important pest. They suck the cell sap with the help of their needle like cheliceral stylets. Their feeding results in stippling, blotching or bronzing of leaves which is generally followed by leaf fall, early dropping of fruits, thus affecting quality and quantity of products [1]. Their attack results in premature fruit dropping and small sized fruits with low yield [2]. Tetranychid mites attack different crop viz., cotton, peanut, bean, eggplant, squash, cucumber, corn, apple, peach, citrus, papaya, strawberry, castor, mulberry, rose and many other ornamental plants [3, 4]. Traditionally *T. urticae* has been controlled with acaricides, resulting in problems of pesticides resistance in the consumed products [5, 6] Biological control is economically viable and environmentally safe to control insect and mites pests [7, 8]. Among the predatory mites the member of family phytoseiidae are potential bio-control agents for the control of phytophagous mites and soft bodied insects [9]. Predatory mites of the genus *Amblyseius*(Acari: Phytoseiidae) are important predator of spider mites [10].

The objective of this research was to determine the comparative biological parameter (Duration of different life stages e.g larvae, protonymph, deutonymph, preoviposition, oviposition, post oviposition period, incubation period, fecundity rate and also predatory potential of different life stages) of *Amblyseius deductus* after feeding on different densities of *T. urticae* under controlled laboratory condition.

MATERIALS AND METHODS

The experiments were conducted in the Acarology Research Laboratory, Department of Agri. Entomology, University of Agriculture, Faisalabad at 27± 2 °C with 70±5 % RH.

Corresponding Author: Wali Muhammad, Pest Warning and Quality Control of Pesticides Wing of Agriculture Department Govt. of Punjab, Pakistan.

Collection: For the studies of biology and predatory potentials, cultures of spider mites and phytoseiid mites were maintained in the laboratory. Adults of *Amblyseius deductus* were collected from leaves of Bakain (*Melia azaderch*) located in vicinity of University of Agriculture, Faisalabad. The leaves having predatory mites were brought in laboratory for rearing purpose. Similarly adults of spider mites were collected from Bakain also and reared in arena for mass culture.

Rearing Techniques for *Tetranychus urticae*: For rearing of spider mites, water soaked cotton arena were used for rearing of these mites. This arena consisted of a water soaked cotton ring placed on fresh leaf. This leaf was placed on moist cotton in a Petri dish of 9 cm diameter. The cotton was kept moist by capillary action via piece of cotton dipped in water soaked. Cotton ring was used as a barrier to prevent the escape of mites from cell. Moist cotton kept the leaf fresh for 3-4 days.

Rearing Techniques for *Amblyseius deductus*: For mass rearing, water soaked cotton arena or cells were used for rearing of phytoseiid mites. This arena consisted of two plastic sheets (7×7cm) with a piece of blotting paper. The upper plastic sheets contained four rearing holes having 1 cm width and 1.2 cm depth. In between the blotting paper and upper plastic sheet, fresh leaves of Bakain plant were placed. Lower plastic sheet contained one small hole in which piece of cotton was fixed and other end was dipped in beaker containing water. Blotting paper remained moist through capillary action of water via piece of cotton that was dipped in water source. Moist blotting paper kept the leaves moist for 5-6 days. The old leaves in arena were replaced by fresh leaves after 5-6 days. The same arenas were used to record the observations. Observations were recorded at 8 hours interval during the course of study. During observation different aspects of biological parameters were recorded.

A comparative study of biology of *Amblyseius deductus* was carried out in the laboratory by feeding on different densities of spider mites (*T. urticae*) as prey. The predator prey ratio in each treatment was fixed as,

T1= 1:5
T2=1:7
T3=1:9

It means one predatory mite and different densities of spider mites were released @ 5, 7 and 9 in each treatment respectively.

Data were recorded at 8 hours intervals and the consumed/killed preys were counted and replaced with new ones to maintain predator prey ratio in each treatment. Each treatment contained twelve replications but six successful replications were used for further analysis.

A single *A. deductus* adult was released in the rearing cell with the help of camel hair brush. This female was removed from cell after egg laying. After hatching of first egg, remaining eggs were also removed from the arena. Data was started from hatching. After hatching of egg, specific spider mites nymph and adult were added in each treatment. The data regarding life history parameters like duration of different life stages, predatory potential and total fecundity of *A.deductus* after feeding on different densities of *T. urticae* were recorded under controlled laboratory condition. During Oviposition period, eggs laid by the adult were counted and removed daily. Data on different parameters were analyzed by using one way ANOVA.

RESULTS AND DISCUSSION

The study was carried out to determine the biology and predatory efficacy of *Amblyseius deductus* by using threeprey densities of *T. urticae* following different as a diet under controlled laboratory conditions. Effect of diet on the biology of *A. deductus* at third treatments showed a high predatory potential and higher fecundity rate than those fed on 2nd and 1st treatments.

The results regarding duration of immature stages of *A. deductes* including egg, larvae, protonymph, deutonymph and incubation periodlasted for an average of 7.49 days when fed on different prey densities of *T. urticae* at an average temperature of 27±2 °C, 70±5 % RH (Table 1). These findings are closed to the Zaher *et al* 1969[11].who work on phytoseius plumifer could developed and reproduce when feed on different stage of re spider mites.the female immature stage lasted for an average of 4.8,3.8,and 4.5 days when fed on eggs , immature and adult of prey at average temperature 29.5±1°C.

The results observed that average duration of egg,larval, protonymph, deutonymph and incubation period of *A. deductus* were egg 1.64 ± 0.1; larva, 1.74 ± 0.13; protonumph, 1.84±0.5 and deutonymph 2.27±0.14 days, respectively. *Amblyseius longispinosus* required approximately the same timefrom egg, larval, protonymph, deutonymph when fed on *Eotetranychus cendanai* as reported by Thongtab *et al* 2001….[12].

Table 1: Duration (days) of different stages of *Amblyseius deductus* after feeding on different prey densities of *T. urticae*

	Means ± S.E		
Stages	T1 (1:5)	T2 (1:7)	T3 (1:9)
Larval Period	1.70±0.17	1.72±0.13	1.80±0.09
Protonympal Period	1.89±0.71	1. 79 ±0.71	1.83.±0.07
Deutonymphal Period	2.22±0.22	2.17±0.07	2.44±0.14
Pre-oviposition Period	4.50±0.14	3.56±0.18	3.72±0.31
oviposition Period	9.11±0.54	8.33±0.17	8.72±0.70
Post-oviposition Period	3.89±0.36	4.56±0.44	4.11±00.46
Total life Span	23.31±2.14	22.13±1.70	22.62±1.77
Incubation Period (egg)	1.611±0.10	1.611±0.10	1.72±0.10
Total Fecundity	20.0±1.71	22.0±0.97	24.33±1.33

Table 2: Total Number of Prey Consumed by all Stages of *Amblyseius deductus*at different prey densities of *T. urticae*

	Means ± S.E		
Stages	T1 (1:5)	T2 (1:7)	T3 (1:9)
Larvae	5.00±0.45	6.17±0.54	6.67±0.42
Protonymph	11.67±1.36	13.00±0.46	15.67±0.98
Deutonymph	17.50±1.67	19.17±1.17	24.83±2.14
Preoviposition	36.17±3.03	40.67±2.80	47.17±1.71
Oviposition	117.33±5.34	119.33±2.68	137.83±5.92
Postoviposition	31.50±3.22	41.67±3.06	44.17±4.10

The results regarding developmental period from egg to adult of *A.deductus* required 7.49 days in the laboratory at an average temperature of 27±2 °C, 70±5 % RH, that is approximately similarwith the Bin *et al* 2004[13] who foundthe developmental time of phytoseiid mite that were reared on fresh leaves of bakain an optimum temperature 25-30 °C from egg to adult i.e. 6-7 days

The average durations of the developmental stages of *A. deductus* were; incubation period of egg: 1.64±0.1 days; larva: 1.74±0.13 days; protonymph:1.84±0.5 days and deutonymph: 2.27±0.14 days. Average total number of eggs per female (fecundity) was 22.11±1.33. Average female longevity was 22.68 ± 1.87 days. *A. deductus* fed on all stages *T. urticae*, but it has less difficulty feeding on the immature stages than on adult mites that is supported by Rodriguez and Ramos, 2004[14] who observed the duration of life stages, oviposition and feeding behaviour of *Amblyseius largoensis* by feeding on *Polyphagotarsonemus latus* (Acari: Tarsonemidae) the duration of total average developmental period of immature stages of *A. deductus* when reared on *T. urticae* in the laboratory was 7.49±0.87 days with an average temperature of 27±2 °C, 70±5% RH. These findings are closed to the results [15] who found The number of eggs laid during whole life duration at oviposition stage by *A. deductus* showed that maximum fecundity was at 3rd treatment.

Total average fecundity of *A. deductus* was 22.0±1.33, over a period of 8.72 days during oviposition stage. When prey consumption increased by predatory mite then fecundity rate also increased. These results are in agreement with Zhang *et al.*[16] who observed total fecundity of *A. cucumeris* (Acari: Phytoseiidae) by feeding on *Schizotetranychus nanjingensis* (Acari: Tetranychidae) are reported that number of eggs produced was directly correlated with number of prey consumed.

Total fecundity of *A. deductus* averaged 20±1.71, 22±0.97 and 24.33±1.33 in each treatment, respectively. These findings are contradictory to the results [15] who reported that mated females laid 17.1 eggs over their entire life time at 30°C. These differences between the studies may be due to the variation in food and to geographical differences between populations.

The total number of*T. urticae* consumed by *A. deductus* during immature stages including larvae, protonymph and deutonymph was 13.3±1.02 (Table 2). These results are in agreement with Abdallah *et al.* [17] who observed the predatory efficacy in the laboratory at 25±1°C and 60 ± 15% RH the total number of *T. urticae* consumed by *A. deductus* during adult stage including pre-oviposition, oviposition and post-oviposition stages were 41.33±2.51, 124.83±4.65 and 39.11±3.46 respectively. These results can be compared with Abdallah *et al.* [17] who observed predatory efficacy in the laboratory at 25±1°C and 60±15% RH.

The number of prey consumed by *A. deductus* was the highest in the oviposition period (124.83±4.65), lower in the pre-oviposition period (41.33±2.51) and the lowest in the post-oviposition period (39.11±3.46).These results are in line with Abdallah *et al.* [17]. The data was analysed by using ANVOA.

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