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DENSITY AND EFFICACIOUS STAGES OF SOME PREDATOR AGAINST TWO SPOTTED SPIDER MITE, *TETRANYCHUS URTICAE* KOCH

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Abstract

The two spotted spider mite, *Tetranychus urticae* Koch (Acari : Tetranychidae) is a one of the most important mite pests of vegetable and ornamentals crops in greenhouses as well as several other agricultural outdoor/indoor crops. It is well adapted to various environmental conditions, causing qualitative and quantitative losses in yield or death of plants by sucking the contents of cells sap. A number of natural enemies were reported to predate on the spider mites. Among these predator coccinellid genus; *Stethorus*, Staphylinid, *Oligota* sp. and phytoseiid mite, *Amblyseius longispinosus* (Evans) contributing the chief predatory fauna on spider mites. Hence, present investigations were carried out to study the influence of different predator prey densities on the efficacy of predators *viz.*, the predatory coccinellid, *Stethorus pauperculus* Weise, staphylinid, *Oligota* sp. and phytoseiid mite, *Amblyseius longispinosus* (Evans) against *T. urticae* on brinjal. The results of the study revealed that the predator prey ratio of suitable for both *Stethorus pauperculus* and *Oligota* sp. Among the predators, *S. pauperculus* recorded the highest consumption of 17.97 ± 4.13, 39.57 ± 6.27, 118.03 ± 10.23, 124.73 ± 11.00 and 147.87 ± 10.98 number of *T. urticae* adults per day against first, second, third, fourth instar grubs and adults, respectively at a predator prey ratio of 5:150. The predatory staphylinid, *Oligota* sp. grubs fed significantly more *T. urticae* (133.93 ± 11.76 per day) than adults (49.42 ± 7.12 per day). Similarly, maximum consumption was recorded in 5:50 ratio of *A. longispinosus* and *T. urticae* where nymph fed were 13.93 ± 3.99 per day and adult fed were 16.32 ± 4.12 per day.

Key words : Density, efficacy, predators, *Tetranychus urticae* Koch.

Introduction

Okra (Bhendi), *Abelmoschus esculentus* is one of the most important vegetables widely cultivated as a summer crop in North India and also as winter crop in Gujarat, Andhra Pradesh, Karnataka and Tamil Nadu. Though, it is mainly used as a fresh vegetable, it is also consumed as canned, dehydrated or frozen forms. The okra was infested by a number of insect pest in which the *Tetranychus urticae* is one of them. Kumaran *et al*. (2007) was reported that, besides insect pests, several species of mites belonging to the genus *Tetranychus* causes a loss of 7 to 48% in okra fruit yield. Mondel and Ara (2006) reported that two spotted spider mite, *Tetranychus urticae* Koch one of the important mite pests of vegetable crops and ornamentals in greenhouses and of several other agricultural outdoor crops. It is well adapted to various environmental conditions, causing quantitative and qualitative losses by sucking out the contents of cells sap. Wide arrays of natural enemies were reported to feed on the spider mites. Van Leeuwen *et al*. (2005) were reported that the high reproductive potential and extremely short life cycle, combined with frequent acaricide applications, facilitates resistance development. So that, the natural enemies were an important component in management and cropping system point of view. Among the natural enemies, the phytoseiid predatory mite, *Amblyseius longispinosus* (Evans) and predatory coccinellid of the genus *Stethorus* and staphylinid, *Oligota* sp. contribute the chief predatory fauna on spider mites. The genus *Stethorus* is unique among the coccinellids with specific preference for mites. *Stethorus* is also found in a variety of habitats, including many agricultural and forest ecosystems. All known species of the genus, *Stethorus* are predators of spider mites and are found to have high potential as biological control agents in agricultural crops was reported by Biddinger *et al*. (2009).

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Table 1 : Predatory potential of *Stethorus pauperculus* at different predator prey ratio against *T. urticae* adults in okra.

Predator : Prey ratio	Stage of *Stethorus pauperculus*				
	I Instar	II Instar	III Instar	IV Instar	Adult
1:150	4.47±2.17	9.21±2.97	43.93±6.53	67.12±8.12	99.93±7.93
2:150	7.99±2.73	18.14±4.39	77.99±8.79	73.93±8.53	122.73±10.32
3:150	12.09±3.42	25.13±5.03	86.53±9.12	86.97±9.12	134.89±11.42
4:150	15.27±3.93	32.97±5.93	99.89±9.92	111.87±10.27	141.23±11.89
5:150	17.97±4.13	39.57±6.27	118.03±10.23	124.73±11.00	147.87±10.98

Table 2: Predatory potential of *Amblyseius longispinosus* and *Oligota* sp. at different predator prey ratio against *T. urticae* adults in okra.

A. longispinosus : Prey ratio	Stage of *A. longispinosus*		*Oligota* sp.: Prey ratio	Stage of *Oligota* sp.	
	Nymph	Adult		Grub	Adult
1:50	4.20±1.92	5.04±1.21	1:150	64.90±7.92	19.04±4.21
2:50	6.25±2.11	7.21±2.97	2:150	77.25±9.71	29.21±4.97
3:50	10.07±3.21	11.12±3.32	3:150	110.97±10.21	34.05±5.32
4:50	11.32±3.91	13.87±4.62	4:150	122.32±11.21	37.87±6.32
5:50	13.93±3.99	16.32±4.12	5:150	133.93±11.76	49.42±7.12
1:50	4.20±1.92	5.04±1.21	1:150	64.90±7.92	19.04±4.21

Now days for the management of phytophagous mites huge and unjudicious amount of pesticides are used, resultants the populations of phytophagous mites quickly develop resistance to these pesticides, enhancing their potential as pests; about 71 species of the 540 arthropods known to be resistant to pesticides are mites (Michigan State University, 2002). However, there are not so much studied carried out on the predator's efficacy against *T. urticae* on crops. So that kept in mind, the present investigations were carried out to study the effects of different predator prey densities on the efficacy of predators against *T. urticae* on okra.

Materials and Methods

The two spotted spider mites, *T. urticae* were collected from okra fields, mass reared and maintained in the glass house. The mites were transfer to uninfected leaf of okra. Then freshly potted plants were transferred besides the older plants at periodic intervals to transfer the mites from older one to fresh so as to maintain the continuous culture of *T. urticae*.

Mass culturing was carried out by using the prey mites, *T. urticae* two spotted spider mite infested leaves were collected along with different stages of the predator, *S. pauperculus* from okra field and was maintained in the laboratory at room temperature (28-35^{O}C) and relative humidity (65-75 per cent). Newly male and female beetles were collected and transfer into the glass container having mite infested okra leaves with moist cotton at the bottom for copulation and container was covered with white muslin cloth and tight with rubber band. Mated females were transferred to separate container for oviposition. The females were allowed to lay the eggs on the surface of mite infested leaves. The egg laden leaves were transferred regularly and placed on the moisten cotton kept in other glass container for hatching. After hatching the larval instars were provided with mite infested okra leaves for feeding on alternate days. The pupae were collected from the containers and kept separately for adult emergence with the help of brush, and the cycle was repeated. The staphylinid (*Oligota* sp.) predator, were the grub and the adult stages collected from the okra fields were used for the studies. The *T. urticae* was used as the prey mite for culturing the predatory mite (*A. longispinosus)* on the okra leaves and mass culturing of this predator. The spider mites were released on these plants when they had three compound leaves. Nine days after the release of spider mites, the predators were released at the rate of ten per plant. After twelve days, the predators were harvested and used for further experiments. The cycle was thus repeated to maintain the culture continuously. The data obtained from

different laboratories experiments were subjected to analysis of standard deviation of ten observations and data were statistically analyzed following, Gomez and Gomez (1976).

Results and Discussion

The investigation was carried out to know the effects of different predator prey densities on the efficacy of predators during 2010-11. The *T. urticae* adults cultured on okra was offered separately to the most voracious stages *viz.*, third, fourth instar grubs and adults of *S. pauperculus* at a ratio of 1:150, 2:150, 3:150, 4:150 and 5:150. Similar ratio were taken in case of staphylinid, *Oligota* sp., while the predatory mite, *A. longispinosus* against *T. urticae* cultured on okra at a predator prey ratio of 1:50, 2:50, 3:50, 4:50 and 5:50 within four replications, which are given in tables 1 and 2, respectively. The experiment was conducted on okra leaf disc kept over a petri dish (10 cm diameter) lined with moist cotton wool with four replications in Completely Randomized Design (CRD). Observations on the number of prey consumed were worked out after 24 hour.

Influence of predator density on the predatory efficiency

The studies showed that there was a significant difference in predation, between different predator prey ratios. Among the different densities tested for the *S. pauperculus*, the predator prey ratio of 5:150 was found to be highly significant, which recorded maximum consumption of 17.97 ± 4.13, 39.57 ± 6.27, 118.03 ± 10.23, 124.73 ± 11.00 and 147.87 ± 10.98 number of *T. urticae* per day for first, second, third, fourth instar grubs and adults, respectively (table 1). The rate of predation increased with the increase in predator density. Similar results were also reported by Arbabi and Singh (2008) on *Stethorus punctillum* against *Tetranychus ludeni*.

Consumption by the predatory staphylinid, *Oligota* sp. was also significantly high at a predator prey ratio of 5:150. The grubs fed significantly more *T. urticae* (133.93 ± 11.76 per day) than adults (49.42 ± 7.12 per day) (table 2). These result are similar to the third instar larvae of *O. kashmirica benefica* was reported to have much higher prey consumption than the adults (Shimod *et al*., 1997). Kishimoto and Adachi (2008) were reported that the *Oligota kashmirica benefica* increased greatly with increasing prey density, indicating that prey density was the most important factor in predation and oviposition.

In case of predatory mite (*A. longispinosus*), maximum consumption was recorded at ratio (5:50) and predate the nymph of *T. urticae* 13.93 ± 3.99 numbers per day and adult fed 16.32 ± 4.12 per day (table 2). Opit *et al.* (2005) was reported that the predator prey ratio of 1:20 was very effective and for greatest reliability. The ratio should be maintained at 1:4 for *P. persimilis* and *T. urticae*. Same outcomes also reported by Canalas *et al*. (2006) the consumption of *T. urticae* by the *Neoseiulus californicus* increased with the increase in the prey density. This is in close agreement with our findings.

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