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Effect of Releases of *Phytoseiulus persimilis* in the Control of Two Spotted Spider Mite on French Beans

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ABSTRACT

The effect of 2 different rates of release of an exotic predatory mite, *Phytoseiulus persimilis* of Athias - Henriot on two-spotted spider mite, *Tetranychus urticae* Koch. on French beans was investigated. Release of predatory mite significantly reduced the population of spider mites in release plots compared to check. A release rate of 10 adults per plant gave better control than did 5 adults per plant. The mean fruit yield was also significantly higher in release plots than the check.

KEY WORDS: *Phytoseiulus persimilis, Tetranychus urticae*, control, french beans

Red spider mites are well known pests of many horticultural crops. They are difficult to control especially when they develop resistance to pesticides. Resistant mite populations usually require frequent acaricidal treatments during the growing season. Biological control was often been suggested to suppress the population of spider mites in view of the success that was achieved. According to Chant (1961), Bravenboer and Dosse (1962) and Smith *et al.* (1963), the predacious phytoseiid mite, *Phytoseiulus persimilis* Athias-Henriot might be the most promising predator in the biocontrol of mites.

The stock culture of *P. persimilis* was received from the Glass house Crops Research Institute, Little hampton, West Sussex, U.K. in 1984 for trials against red spider mite attacking horticultural crops in India under the All India Coordinated Research Project on Biological Control of Crop Pests and Weeds (Krishnamoorthy, 1988). A field study was made to assess the performance of this exotic predator in the control of *Tetranychus urticae* Koch. on french beans (*Phaseolus vulgaris* L.) cv. Arka komal and the results are presented in this paper.

MATERIALS AND METHODS

French beans was planted during October, 1987 at the farm premises of Indian Institute of Horticultural Research, Bangalore, India. The lay out consisted of 9 vertical rows (A to I), each 21m long with seven beds of $3m^2$. Sowing was restricted to alternate beds (beds of 1,3,5 and 7 in rows of A,C,E,G and I) on either side so that the empty beds would serve as buffer zones. Each sown bed consisted of five rows with a mean of 150 plants. Spider mites were inoculated in the field by distributing *T. urticae* - infested leaves. Four treatments *viz.*, no release (check), 5 predators/plant, 10 predators/plant and dicofol @ 0.05% were included in a randomized complete block design and replicated five times. All agronomic practices were carried out as recommended.

The predator *P. persimilis* was mass-reared as described by Krishnamoorthy (1988). Adults of the predator were collected into tubes made from plastic drinking straws the ends of which were plugged with cotton. Release was effected once on the 42nd day of sowing. The plastic straws with the adults were distributed on the plants with one of the ends opened which permitted the predator to disperse naturally. Thus a total of 750 and 1500 adults of *P. persimilis* were released in each replicate where release of 5 and 10 adults/plant respectively were envisaged.

Populations of *T. urticae*, *P. persimilis* and other indigenous predators (if any) were recorded weekly from release beds. Observations were made on the populations of spider mite and indigenous predators in check and chemical control treatments. On each sample date, a leaflet from a trifoliate leaf was collected from each of the 10 randomly chosen plants in each bed. The leaf-let samples thus collected from each bed were held inside a butter paper cover and transported to the laboratory where they were held at 7°C until microscopically examined within 24 h. Active stages (all stages except eggs) of the spider mites and all stages of *P. persimilis* and indigenous

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predators were counted directly by examining each leaflet under a dissecting microscope. The number of leaflets infested by prey (even if one active stage was present) and predators were also recorded. Yield data were obtained and compared between treatments. Data were statistically analysed using 'F' test.

During the period of study, the mean minimum and maximum temperatures were ranging from 15.1 to 18.1°C and 24.8 to 26.2°C respectively and mean RH ranged from 67.64 to 88.70%. Total rainfall recorded during the period was 139.9 mm.

RESULTS AND DISCUSSION

Two spotted spider mite populations were al-

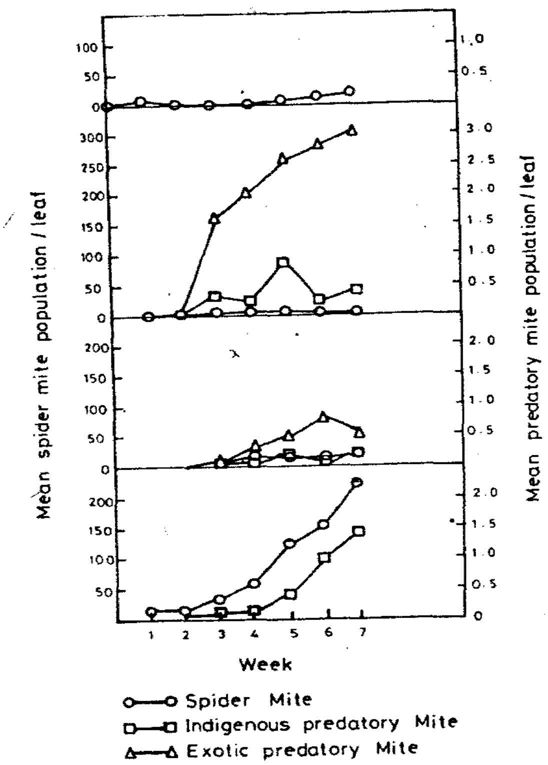

Fig. 1 Population growth curves for Two - Spotted spider Mite and predaceous mites in different treatments.

lowed to sufficiently build up during the first six weeks after sowing. The pre-treatment count revealed a mean of 1.2,0.6,0.4 and 4 active stages of spider mite populations per leaflet in check, 5 predators/plant, 10 predators/plant and chemical control treatment respectively (Fig.1). The population of *T. urticae* reached a peak of 221.8 active stages/leaflet in control in six weeks as against 13.6, 2.2 and 18.0 active stages/leaflet in 5 and 10 predators/plant and chemical control treatments respectively. The mean number of twospotted

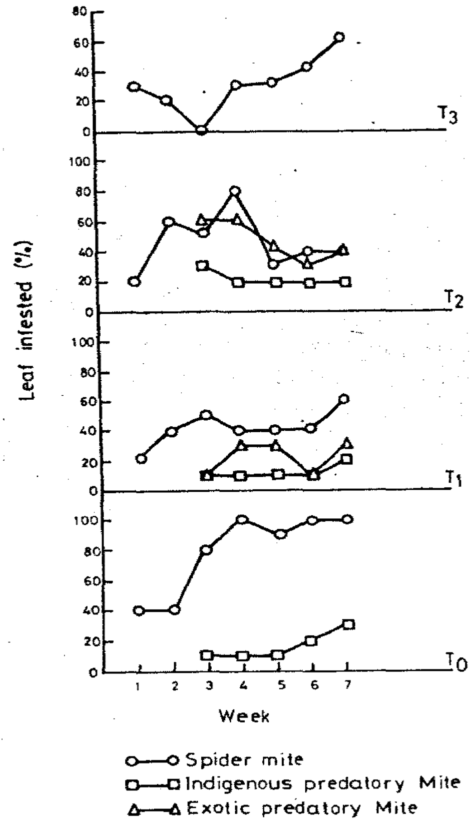

Fig. 2 The percentage of leaves infested by the Two - Spotted mite and the Predaceous mites in different treatments

spider mites in the predator-release beds were significantly lower than the check but did not differ from each other significantly (Table 1).

The percentage of leaflets infested by *T. urticae* reached 100 in check by 9th week of sowing and remained in between 90 and 100 thereafter (Fig.2) and eventually this population killed the plants. In 5 and 10 predators-release beds as well in chemical control bed, the percentage of leaflets infested reached 60,40 and 60 respectively

TABLE 1: Effect of releases of *P. persimilis* in the control of *T. urticae* on french beans.

Treatment	Mean @ population per leaflet*				Mean yield kg/bed
	T. urticae	*Amblyseius spp.*	*P. persimilis*	Pooled	
Check	82.93[a]	0.43[a]	0.0	0.43[a]	0.940[a]
5 predators/plant	8.76[b]	0.10[b]	0.31[a]	0.41[a]	1.350[b]
10 predators/plant	2.34[b]	0.29[a]	1.73[b]	2.02[b]	1.820[b]
Dicofol @ 0.05%	5.20[b]	0.0[c]	0.0	0.0[c]	1.470[b]

* Mean of 50 leaflets

@ Mean values in each column suffixed with same alphabets are not significantly different ($P < 0.05$) by L.S.D.

towards the end of the study. Plants were found healthy even at this stage because the number of *T.urticae* present in these leaflets was very less compared to control. Release rates of 5 and 10 predators/plant were found to be on par with chemical control. Thus the population of *T. urticae* was suppressed in all the treatments except in control.

Combined population of indigenous Phytoseiid predators (*Amblyseius* sp. and *A. tetranychivorus* Gupta) was initially low and slowly increased in check (Fig.1). The population of indigenous predatory mites (IPM) remained in between 0.0 and 0.2/leaflet in 5 predators/plant-treatment and 0.0 and 0.9/leaflet in 10 predators/plant treatments. Due to toxic nature of dicofol, no IPM population was observed throughout in chemical control beds. The mean number of IPM population was on par in check and 10 predators/plant-release treatments. While it was significantly low in 5 predator/plant release-treatment (Table 1). IPM population did not migrate very well along with the spider mite population. At the end of the study, only 30% of leaflets had IPM in check beds while it was 20% in release beds (Fig.2). No other indigenous predators were recorded in the experimental field during the entire study period.

The exotic predatory mites (EPM) reached a maximum of 0.8 and 3.0/leaflet in 5 predators/plant and 10 predators/plant treatments respectively towards the end of the study. During the entire study period, the mean number of *P. persimilis* was 0.31 and 1.73/leaflet in 5 and 10 predators/plant treatments respectively (Table 1). Due to the release of EPM, the population of EPM was higher than the population of IPM in release beds. Among the two release rates, the beds which received 10 predators/plant had more number of *P. persimilis* per leaflet compared to 5 predators/plant release beds. Thus a higher population of *P. persimilis* resulted in a lower population of two spotted spider mites. The data in table 1 also revealed that a mean of 0.41 predator/leaflet reduced the *T. urticae* population in 5 predators/plant release beds compared to 0.43 predator/leaflet in check beds. This was because the release plot had 0.31 EPM population/leaflet (0.10 IPM + 0.31 EPM = 0.41). Presence of IPM in treatments did not really contribute in reduction of *T. urticae* population. EPM has very good migrating habit along with the population of *T. urticae*. Thirty and 60 per cent of the leaflets had the population of *P. persimilis* towards the end in 5 and 10 predators/plant treatment respectively (Fig.2).

The mean fruit yields in the release and chemical control treatments were significantly higher than the check but did not differ from each other (Table 1). The effectiveness of release of *P. persimilis* in suppressing the population of *T. urticae* was although reflected in men fruit yields, highest yield was obtained when 10 predators/plant were released. Thus it may be deduced that a release rate of 10 predators/plant would be ideal in suppressing *T. urticae* on French beans. Many factors are known to affect yield and therefore, this phase of the study must be thoroughly investigated for several years to assess the relationship between spider mite damage and French bean yield.

P. persimilis has been successfully used in the control of *T. urticae* on cucumbers (Bravenboer and Dosse, 1962), on beans (Chant, 1961), on field and greenhouse roses (Smith, *et al.* 1963) on strawberries (Oatman *et al.*, 1968; 1976) on white clover (Mori and Moriyama, 1970) and on tomatoes (Foster, 1979). As in the present study, a release rate of 5-10 adults per plant gave good control of *T. urticae* strawberries (Gould and Vernon, 1978). A release rate of 10 predators of *A. californicus* (Mc Gregor) per plant similarly gave good control of *T urticae*(Oatman *et al.*, 1977). The success of releases of *P. persimilis* in the control of *T. urticae* under the present experimental conditions suggest that mass release programme for the control of this pest may be economically feasible.

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