Evaluation of three entomopathogenic fungi for the control of red spider mites.

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Summary

The red spider mite, *Oligonychus coffeae* (Nietner) (Tetranychidae) is an important pest of tea in India. Formulations of the entomopathogenic fungi *Verticillium lecanii, Paecilomyces fumosoroseus* and *Hirsutella thompsoni* were tested against this pest in the laboratory and field. Fungal suspensions at the concentration of 10^6, 10^7 and 10^8 spores per ml were sprayed on leaf discs containing nymphs and adults. Both the life stages were susceptible to all the three fungal pathogens at the tested concentrations. At 10^7 spores/ml, nymphs suffered 95 % mortality whereas adult mortality was comparatively low at 85 %. Application of *V. lecanii, P. fumosoroseus* and *H. thompsonii* @ 3500 g formulation per ha significantly reduced the population density of red spider mites in the field. The efficacy of *P. fumosoroseus* formulation @ 2500 g/ha was almost comparable to that of *V. lecanii* and *H. thompsonii* applied @ 3500g formulation/ha. Though the percentage of mite control achieved by the application these fungal formulations was less in comparison to that of conventional acaricides, these biocontrol agents are recommended for use in tea fields in view of their role in reducing the pesticide load on tea.

Key words Red spider mite, bio control, entomopathogenic fungi

Introduction

Tea in India is subjected to the attack of several insect and mite pests. Among them, *Oligonychus coffeae* (Nietner) (Acarina:Tetranychidae) the red spider mite is known from the early days of tea cultivation. They occupy the upper surface of mature leaves and consequent to their feeding, the maintenance foliage turns ruddy bronze, making red spider mite infested fields distinct even from a distance. Severe infestation by this mite leads to crop loss, ultimately resulting in the defoliation of bushes.

Acaricides such as dicofol, ethion, fenpropathrin and formulations of sulphur are recommended for the control of red spider mites (Muraleedharan and Selvasundaram, 1996). However, extensive use of some of these synthetic pesticides leads to the presence of undesirable residues in black tea. In view of this, formulations of azadirachtin and paraffinic spray oil are also being recommended for use. As a part of our programme to incorporate environmentally safe micopesticides, certain entomopathogenic formulations were evaluated for their bioefficacy in the laboratory and field, against red spider mites.

Materials and methods

Red spider mites obtained from the field were reared in the laboratory and a stock culture was maintained throughout the course of this study. For the bioefficacy study in the laboratory, leaf disc method was adopted. Leaf discs of 2 cm diameter were cut from leaves and sprayed with the particular fungal suspension. Three different species of entomopathogenic fungi, *Verticillium lecanii, Paecilomyces fumosoroseus* and *Hirsutella thompsonii* were applied at the concentration of 10^6, 10^7 and 10^8 spores per ml. Spraying was done with a fine atomizer. Unsprayed discs were kept as control. Their bio-efficacy was determined on 5th, 7th, 10th & 12th day after imposing the treatments.

The field experiment against red spider mite was conducted in randomized block design in an estate in Munnar (Idukki Dist. Kerala) from December 2000 to April 2001. The treatments were *V. lecanii* @ 3500g/ha *P. fumosoroseus* @ 2500 & 3500g/ha, *H. thompsonii* @ 3500g/ha, mixture of all the three entomopathogens @ 1170g each, profenofos 50 EC @ 500 ml/ha, dicofol 18.5 EC @ 1000 ml/ha and untreated control. All treatments were replicated in three plots, each of 100 tea bushes. Spraying was done with hand operated knapsack sprayer using a spray volume of 400 l/ha. Two sprays were given at an interval of two weeks. Mite populations were assessed at weekly interval by collecting 25 leaves at random from each block and from each leaf, mites were counted. The data were subjected to analysis of variance.

Results and Discussion

Data from the laboratory on the pathogenicity of the fungi are given in Table 1. The study revealed that there was a distinct difference in the susceptibility of nymphs and adults to different fungal pathogens.

Table 1. Evaluation of *Verticillium lecanii, Paecilomyces fumosoroseus* and *Hirsutella thompsonii* against red spider mites of tea in the laboratory

Treatment	Dosage Spores/ml	Life stage	Percentage mortality after*			
			5th day	7th day	10th day	12th day
V. lecanii	10^6	nymph	62.50	73.40	78.60	80.00
	10^7		67.50	78.20	88.40	94.30
	10^8		70.20	80.30	92.70	95.90
	10^6	adult	57.70	68.80	71.40	77.30
	10^7		64.50	70.60	79.50	84.90
	10^8		67.10	77.40	80.70	85.40
P. fumosoroseus	10^6	nymph	60.80	68.20	72.50	74.20
	10^7		63.30	67.80	74.70	80.50
	10^8		68.10	72.20	80.50	82.40
	10^6	adult	55.40	58.20	62.70	72.50
	10^7		60.20	67.50	69.80	78.00
	10^8		62.50	67.80	72.10	78.60
H. thompsonii	10^6	nymph	56.40	57.50	64.00	67.50
	10^7		58.20	62.40	69.60	74.70
	10^8		59.50	64.80	68.40	75.30
	10^6	adult	52.00	55.50	60.20	62.00
	10^7		58.80	59.40	64.70	70.40
	10^8		59.20	62.50	65.50	72.90

* Mean of five replications

A very high nymphal mortality of 95.9% was observed when leaf discs were treated with *V. lecanii*. When *P. fumosoroseus* was applied, nymphal mortality was 82.4 % and in the case of *H. thompsonii* it was 75.3 %. The overall mortality of adults was low when compared to that of nymphs. Similar results were reported with *Beauveria bassiana* in the case of shot hole borer, *Euwallacea fornicatus* (Selvasundaram *et al.*, 2001a). The study also showed that mortality increased with the increase in spore concentration. Efficacy of the suspension @ 10^7 spores/ml was comparable to that of 10^8 spores/ml. Both the dosages were more effective than the lower

spores/ml. Both the dosages were more effective than the lower dosage rates and caused highest nymphal and adult mortality. Mycelial growth was noticed on the dead nymphs and adults within 10 days from the date of application.

Analysis of data from the field trial revealed that the application of *V. lecanii*, *P.fumosoroseus* and *H.thompsonii* @ 3500 g formulation per ha significantly reduced the population density of red spider mites (Table 2). Though all the three formulations of fungal pathogens were equally effective in controlling this pest in the field, *P. fumosoroseus* inflicted slightly higher mortality towards the third and fourth weeks, after application.

Table2. Evaluation of certain entomogenous fungi against red spider mites

No. Treatment	Dosage/ha ml or g	Number of red spider mites / 75 leaves						
		Pre-treatment	I week after I spray	II week after I spray	I week after II spray	II week after II spray	III week after II spray	IV week after II spray
1. *V.lecanii*	3500 g	337 (31.88)	77 (15.49)b	50 (12.46)a	49 (12.41)a	126 (19.54)d	153 (21.57)d	122 (19.34)c
2. *P.fumosoroseus*	2500 g	340 (32.02)	60 (13.55)b	50 (12.56)a	41 (11.43)a	84 (16.05)bc	81 (15.87)b	80 (15.77)b
3. *P.fumosoroseus*	3500 g	336 (31.86)	59 (13.53)b	30 (09.57)a	34 (10.48)a	57 (13.40)ab	67 (14.49)ab	59 (13.61)a
4. *H.thompsonii*	3500 g	339 (32.01)	71 (14.73)b	41 (11.46)a	45 (11.95)a	80 (15.74)bc	78 (15.55)b	76 (15.37)b
5. Mixture of three fungal formulations	1170 g each	333 (31.60)	78 (15.44)b	47 (11.48)a	41 (11.14)a	94 (16.95)cd	119 (19.10)c	116 (18.85)c
6. Profenofos 50 EC	500 ml	338 (31.95)	32 (10.05)a	61 (13.18)a	46 (11.69)a	54 (13.01)ab	50 (12.57)a	58 (13.50)a
7. Dicofol 18.5 EC	1000 ml	338 (31.91)	12 (06.71)a	22 (08.59)a	29 (09.77)a	44 (11.82)a	51 (12.70)a	52 (12.84)a
8. Untreated control	---	342 (31.97)	293 (29.70)c	328 (31.38)b	248 (27.44)b	293 (29.79)e	293 (29.80)e	287 (29.49)d
CD P = 0.05		NS	3.37	4.76	3.79	3.27	2.05	1.41

Dates of chemical application : I spray - 20.12.2000 II spray - 04.01.2001
Figures in parenthesis are transformed values of $\sqrt{X+1}$
Figures followed by the same letter in a vertical column are not significantly different at 5 % level

Recently, the efficacy of these fungal formulations against the pink mite (*Acaphylla theae*) of tea was studied and the results were similar to that of the present study (Selvasundaram *et al*, 2001b). High humidity helps in achieving good efficacy of these entomopathogens and therefore, the ideal time for spray will be when the temperature is below 28° C and the relative humidity is between 80 and 85 %. Spraying during evening hours was found more effective. Tea plantations in India generally experience a temperature below 28° C and high humidity during the evening hours. Though the percentage of mite control achieved by the spraying of these entomopathogenic fungi was low in comparison to that of a conventional acaricide like dicofol, these fungal formulations must be considered for use in tea fields in view of their role in reducing the pesticide load on tea.

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