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Field efficacy of bio-pesticides against *Thrips tabaci* (Lindeman) in onion

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ABSTRACT

Studies on the effect of three fungal and one bacterial based bio-pesticides against onion thrips, *T. tabaci* were conducted at Agronomy Farm, Junagadh Agricultural University, Junagadh during 2006-07. Spinosad 0.009 %, endosulfan 0.07 % and spinosad 0.0045 % + endosulfan 0.035 % were found the most effective in reducing the thrips population. Combinations of *B. bassiana* @ 1.0 kg/ha + endosulfan 0.035 % and *V. lecanii* @ 1.0 kg/ha + endosulfan 0.035 % were found middle in order of their efficacy whereas, *V. lecanii* @ 2.0 kg/ha, *B. bassiana* @ 2.0 kg/ha and *P. fumusoroseus* @ 2.0 kg/ha alone were found least effective in reducing the thrips population. The highest (1:61.38) cost benefit ratio was found in the treatment of endosulfan 0.07 %, followed by *B. bassiana* @ 1.0 kg/ha + endosulfan 0.035 % (1:40.35) and *V. lecanii* @ 1.0 kg/ha + endosulfan 0.035 %. It was lowest in spinosad 0.009 % (1:18.44).

Key words : Onion, thrips, biopesticides

Onion is the most important vegetable crop because of its outstanding characteristics of pungency, mild flavour, medicinal qualities and spice value. India is the second largest producer next to China and third largest exporter of onion to the world. Area under onion cultivation in the world is about 20 lakh hectares. Area under this crop has been increasing year by year owing to its high demand in the market and for obtaining higher remunerative price. Among the various factors responsible for limiting crop yield, insect pests are considered as the major constrains. The onion crop is attacked by the thrips, *Thrips tabaci* (Lindeman) that is the most common and serious pest, causing considerable damage to the crop. Chemical insecticides have been already recommended to manage the thrips in onion; however, minimization of insecticide load in onion ecosystem is highly required to confirm the export quality. For sucking insects, entomopathogenic fungi are appropriate microbial agents as they infect the insect cuticle directly through contact and do not require to be ingested for infection to set in. Fungal pathogens, *Verticillium lecanii*, *Beauveria bassiana* and *Paecilomyces fumosoroseus* have been reported pathogenic to *T. tabaci* (Vesterguard *et al.*, 1997). Hence, the investigation was conducted to determine the bioefficacy of bio-pesticides against *T. tabaci* that leads to have an alternate strategy for its management.

MATERIALS AND METHODS

To find out the suitable and effective control strategy for management of *T. tabaci* of onion an experiment was conducted during *rabi* 2006-07 at Agronomy Farm, Junagadh Agricultural University, Junagadh. The experiment was laid out in Randomized Block Design with three replications and ten treatments. The crop was transplanted in plots of 4.0 × 2.10 m with spacing of 15 × 10 cm. All the recommended agronomical practices were followed. Four bio-pesticides *viz.*, *V. lecanii* @ 2.0 kg/ha, *B. bassiana* @ 2.0 kg/ha, *P. fumosoroseus* @ 2.0 kg/ha and spinosad 0.009 % and, combinations of these bio-pesticides at half recommonended doses with endosulfan 0.035 % were evaluated and compared with already recommended endosulfan 0.07 % against *T. tabaci*. The spray was carried out, when the pest population crossed the economic threshold level (15 thrips/leaf), whereas the subsequent spray was done after one month of 1st

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spray. Spray of bio-pesticides was done with the help of knapsack sprayer with 500 lit of water per hectare. The care was taken to obtain the uniform coverage of biopesticide in each plot. Observations on thrips population were recorded from five randomly selected and tagged plants in each plot before spray and after 3, 5, 7 and 10 days of spraying. Three inner leaves of each of the selected plants were observed to count the number of thrips. The data were converted to percent mortality by using the formula given by Abbott (1925). The data thus obtained were transformed into Arcsin percentage and analyzed statistically. The yield of onion bulbs from each net plot was recorded separately and data were subjected to statistical analysis. Cost benefit ratio (CBR) was worked out to compare the economics of different treatments.

RESULTS AND DISCUSSION

The per cent mortality of thrips (Table 1) recorded at 3rd DAS revealed that spinosad 0.0045 per cent + endosulfan 0.035 per cent proved to be significantly superior and most effective treatment as it gave 81.94 per cent mortality of the pest. However, it was statistically at par with spinosad 0.009 per cent and endosulfan 0.07 per cent as they also registered 77.08 and 75.59 per cent mortality, respectively. The treatments of *B. bassiana* @ 1.0 kg/ha + endosulfan 0.035 per cent, *V. lecanii* @ 1.0 kg/ha + endosulfan 0.035 per cent and *P. fumosoroseus* @ 1.0 kg/ ha + endosulfan 0.035 per cent were the next best treatments, which gave 57.65, 55.48 and 51.48 per cent mortality, respectively. In case of entomopathogenic fungi *V. lecanii*, it registered the highest mortality of 46.47 per cent, followed by *B. bassiana* and *P. fumosoroseus* as they registered 42.37 and 37.75 per cent mortality, respectively. Similar trend of mortality was recorded at 3rd, 5th, 7th and 10th days after spraying. Similar results were also found after second spraying.

The results showed that the nymphal mortality in chemical insecticides alone was attributed immediately *i.e.*, after one day of treatment. Fungal bio-pesticides, initially less effective, their efficacy slowly increased and caused considerable mortality. However, the nymphal in all the treatments was increased with the increase in day intervals following the fungal treatment. The effectiveness of endosulfan 0.0035 % against *T. tabaci* has been reported by Butani and Kapadia (1999). However, Mustaq *et al.* (2001) and Zezlina and Blazic (2003) have reported the superiority of spinosad to control the *T. tabaci*. Gindin *et al.*, (1996) indicated that *T. tabaci* was susceptible to *V. lecanii, B. bassiana, P. fumosoroseus* and *Metarhizium anisopliae*. Similarly *T. tabaci* was susceptible to *V. lecanii* (Trujillo *et al.*, 2003) and *B. bassina* (Castineiras *et al.*, 1996).

The yield of onion bulbs in different treatments varied from 29286 to 42857 kg/ha and they were found significantly superior to the control. The highest yield of onion bulbs (42857 kg/ha) was recorded in the treatment with spinosad 0.009 %. However, it was statistically at par with spinosad 0.0045 % + endosulfan 0.035 % (41429 kg/ha). The moderate yield of onion bulb was obtained from the treatments of endosulfan 0.07 % (37143 kg/ha), *B bassiana* @ 1.0 kg/ha + endosulfan 0.035 % (35000 kg/ha), *B bassiana* @ 2.0 kg/ha (34286 kg/ha), *V. lecanii* @ 1.0 kg/ha + endosulfan 0.035 % (33714 kg/ha) and *V. lecanii* @ 2.0 kg/ha (33571 kg/ha). Whereas, low yields were recorded from the treatments of *P. fumosoroseus* @ 2.0 kg/ha (32857 kg/ha) and *P. fumosoroseus* 1.0 kg/ ha + endosulfan 0.035 % (32143 kg/ha). While, significantly the lowest yield (29286 kg/ha) was recorded from the water sprayed plot.

The highest cost benefit ratio (1: 61.38) was obtained in the treatment of endosulfan 0.07 % and it was followed by *B. bassiana* 1.0 kg/ha + endosulfan 0.035 % (1: 40.15), *V. leacanii* @ 1.0 kg/ha + endosulfan 0.035 % (1: 34.33), *V. leacanii* @ 2.0 kg/ha (1: 32.96) and *B. bassiana* @ 2.0 kg/ha (1: 31.91). Whereas, the low cost benefit ratios were obtained from the treatments, spinosad 0.0045 % + endosulfan 0.035 % (1: 28.11), *P. fumosoroseus* @ 2.0 kg/ha (1: 22.79), *P. fumosoroseus* @ 1.0 kg/ha + endosulfan 0.035 % (1: 20.07) and spinosad 0.009 % (1: 18.44).

CONCLUSION

Based on results obtained in the study it is concluded that the application of *B. bassiana* or *V. lecanii* @ 1 kg/ha combined with endosulfan 0.035 % is more effective in controlling the *T. tabaci* as compared to the individual spores of fungal pathogens at higher doses. The reason for obtaining the higher mortalities may be attributed to the increased susceptibility of insects to fungal infection when exposed to insecticides. Therefore, joint action of fungal pathogens and insecticides is practically useful to narrow down the complete dependence on synthetic compounds and also useful in reducing the environment pollution and other hazards to beneficial organisms and human beings caused by them. Hence, using the insecticides in combination with bio-pesticides is advocated in IPM.

Table 1 Mortality of *T. tabaci* as influenced by different treatments on onion in field during *rabi* 2006-07

Sr. No	Treatments	First Spray					Second Spray					Onion bulb yield (kg/ha)	CBR
		3 DAS	5 DAS	7 DAS	10 DAS	Mean	3 DAS	5 DAS	7 DAS	10 DAS	Mean		
1	*B. bassiana* @ 2.0 kg / ha	40.61 (42.37)	42.17 (45.08)	43.12 (46.72)	44.74 (49.55)	42.66 (46.03)	43.32 (47.06)	44.99 (49.97)	45.72 (51.26)	47.21 (53.85)	45.31 (50.54)	34286	1:32.91
2	*Verticillium lecanii* @ 2.0 kg / ha	42.97 (46.71)	44.70 (49.48)	47.77 (54.82)	50.72 (59.92)	46.54 (52.67)	43.94 (48.15)	45.78 (51.35)	47.92 (55.08)	50.29 (59.18)	46.98 (53.44)	33571	1:32.96
3	*P. fumosoroseus* @ 2.0 kg / ha.	37.91 (37.75)	39.81 (41.00)	41.56 (44.01)	43.61 (47.57)	40.72 (42.58)	38.88 (39.39)	40.47 (42.13)	43.65 (47.65)	45.27 (50.47)	42.07 (44.91)	32857	1:22.79
4	Spinosad 0.009 %	61.40 (77.08)	62.48 (78.64)	63.50 (80.09)	63.84 (80.56)	62.81 (79.09)	62.60 (78.82)	62.88 (79.22)	63.28 (79.79)	64.62 (81.63)	63.35 (79.87)	42857	1:18.44
5	Endosulfan 0.07 %	0.40 (75.59)	60.45 (75.68)	61.56 (77.72)	61.81 (77.69)	61.06 (76.57)	60.33 (75.50)	61.67 (77.48)	62.38 (78.51)	63.42 (79.99)	61.95 (77.87)	37141	1:61.38
6	*B. bassiana* @ 1.0 kg / ha + Endosulfan 0.035 %	49.40 (57.65)	50.14 (58.93)	51.98 (62.06)	53.70 (64.96)	51.31 (60.90)	49.02 (56.99)	50.42 (59.41)	52.75 (63.36)	54.58 (66.41)	51.69 (61.54)	35000	1:40.41
7	*V. lecanii* @ 1.0 kg / ha + Endosulfan 0.035 %	48.15 (55.48)	50.14 (58.92)	50.73 (59.92)	51.44 (61.15)	50.11 (58.87)	46.42 (52.47)	48.04 (55.30)	51.79 (61.74)	52.92 (63.64)	49.79 (58.29)	33714	1:34.33
8	*P. fumosoroseus* @ 1.0 kg / ha + Endosulfan 0.035 %	45.85 (51.48)	46.42 (52.48)	47.66 (54.64)	48.44 (55.98)	47.09 (53.65)	45.13 (50.23)	47.44 (54.25)	48.37 (55.86)	49.33 (57.33)	47.57 (54.47)	32143	1:20.07
9	Spinosad 0.0045 % + Endosulfan 0.035 %	64.85 (81.94)	65.18 (82.38)	65.50 (82.80)	65.39 (82.65)	65.23 (82.44)	63.70 (80.36)	64.83 (81.92)	66.72 (84.38)	66.88 (84.58)	65.53 (82.81)	41429	1:28.11
10	Control (Water spray)	6.20 (1.17)	6.99 (1.48)	6.96 (1.47)	7.8 (1.84)	6.99 (1.49)	7.02 (1.49)	6.85 (1.42)	7.23 (1.58)	7.62 (1.76)	7.18 (1.56)	29286	—
S. Em±		2.13	2.21	2.39	2.43	—	1.99	2.21	2.39	2.31	—	1136	—
C. D. at 5 %		6.32	6.56	7.11	7.22	—	5.92	6.58	7.11	6.85	—	3298	—
C. V. %		8.04	8.16	8.62	8.56	—	7.50	8.10	8.46	7.95	—	8.60	—

Arcsin percentage transformation. Figure in the parentheses are retransformed values DAS = Days after spraying

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