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To evaluate the field efficacy of biopesticides and insecticides combinations against onion thrips at Bilaspur (Chhattisgarh)

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Abstract

The field experiment was conducted at Instructional farm of BTC CARS, Bilaspur, (C.G.) during *Rab*i 2022-23, to know the field efficacy of biopesticides and insecticides combinations against onion thrips. The mean on number of thrips/plant recorded after first and second spray showed that *Metarhizium anisopliae* 10% (1×10^8 CFU/ml) + 50% dose of Spinetoram 11.5 SC recorded the lowest thrips (7.91 thrips/plant) was shown to be substantially superior to all other treatments. *Metarhizium anisopliae* 10% (1×10^8 CFU/ml) + 50% dose of Imidacloprid 17.8 SL (8.81 thrips/plant) was the second best treatment followed by Spinetoram 11.5 SC (9.43 thrips/plant), Imidacloprid 17.8 SL (9.68 thrips/plant). Whereas, in untreated control (27.23 thrips/plant) were observed.

Keywords: Efficacy, experiment, field, instructional, Spinetoram, thrips

Introduction

Onion is a most important spice and bulb crop which belongs to the family Amaryllidaceae (Alliaceae) and genus *Allium*. Onion cultivation is carried out both during the wet season from June to October and during the dry season from December to May (Ebenebe 1980). Onion is a cool season crop. However, it can be grown under a wide range of climatic conditions. It grows well under mild climate without extreme heat or cold or excessive rainfall. In India, it is cultivated during the *Rabi, kharif,* and late *kharif* seasons, with *Rabi* season having the largest area under cultivation. With over 1.94 million hectares of growing area and an annual production of 31.12 million tons of onions, India is the second largest onion producer in the world. (Indiastat - 2021-22).

Many insect pests, like thrips, onion fly, cutworms, and tobacco caterpillars attack the onion plant. Among them Onion thrips, *Thrips tabaci* L. (Thysanoptera: Thripidae), is the major insect pest that cause severe yield losses. Onion thrips are polyphagous and have been recorded on more than 300 species of plants (Straub and Emmett, 1992) [8]. John and Mann (1963) [4] considered them to be the most severe pests of onion and their allies.

The onion thrips feeds directly on the leaves, leaving blotches, as well as it feeds on the bulbs, and converts them into undersized causing a yield loss of more than 50%. If onion thrips are not controlled, damage can routinely reduce bulbs yield by 30 to 50 per cent (Nault and Shelton, 2010) [7] and onion yield reductions can reach up to the levels from 34 to 50 per cent (Fournier *et al.,* 1995). Onion thrips causes direct damage to crops through feeding on plants and transmission of harmful plant viruses. They are difficult to control because of their small sizes and cryptic. In addition, *Thrips tabaci* is a very prolific species with many overlapping generations (Nault and Shelton, 2010) [7]. Failure to control of this pest by timely and effective means causes considerable losses by remarkable reduced yield. (Karuppiah *et al.,* 2022) [5].

Pesticide over use has frequently resulted in the emergence of undesired problems such as destructing of natural enemies, pest rebound, and the failure of control measures leading to an outbreak of insect pests in onions. The development of efficient pest management techniques against sucking pests, particularly onion thrips (*Thrips tabaci* L.), is thus necessary, in this context for the sustained management of crops and the provision of nutritious food.

The use of new generation insecticides (Imidacloprid, Spinetoram) in combination with biopesticides (*Beauveria bassiana*, *Metarhizium anisopliae*, *Lecanicillium lecanii*, etc.), provides an alternative to reduce the negative effects of conventional insecticides. The new class of pesticides is more user - and environmentally-friendly because they are selectively toxic to insects and safe for natural enemies.

Materials and Methods

A field experiment was conducted at Horticultural Research Farm of BTC CARS, Bilaspur, (C.G.) during *rabi* season of 2022-23 under field condition to know the field-efficacy of biopesticides and insecticides combinations. Pre - treatment observations will be recorded one day before the application of treatment, whereas post - treatment observations will be recorded at 3,7,10 and 15 days after spraying. *Thrips tabaci* L. will be counted on 5 randomly selected plants in each plot. The onion variety, Nasik Red with a spacing of 15 × 10 cm was transplanted on 6th December, 2022 with following recommended practices.

Experimental details

- **Location:** Horticultural Research Farm of BTC CARS, Bilaspur
- **Season:** *Rabi*, 2022-23
- **Design:** RBD (Randomized Block Design)
- **Replications:** 3
- **Treatments:** 9
- **Plot size:** 4.05 m x 3 m
- **Spacing:** 15 cm x 10 cm

Results and Discussion

First Spray

The data on number of thrips/plants recorded at three days after first spray presented in Table 1 and depicted in Fig. 1 showed that average thrips survival population per plant ranging from 13.80 to 17.20, compared to 20.93 in the untreated control. In chemical and biopesticides check treatment, *Metarhizium anisopliae* 10% (1×10^8 CFU/ml) + 50% dose of Spinetoram 11.5 SC recorded the lowest thrips (13.80 thrips/plant) and was shown to be substantially superior to all other treatments. *Metarhizium anisopliae* 10% (1×10^8 CFU/ml) + 50% dose of Imidacloprid 17.8 SL (14.20 thrips/plant) was the second best treatment, followed by *Beauveria bassiana* 10% (1×10^9 CFU/ml) + 50% dose of Spinetoram 11.5 SC (14.27 thrips/plant), Imidacloprid 17.8 SL (15.13 thrips/plant) and *Beauveria bassiana* 10% (1×10^9 CFU/ml) + 50% dose of Imidacloprid 17.8 SL (15.47 thrips/plant). The next best treatments were Spinetoram 11.5 SC (15.93 thrips/plant), and *Lecanicillium lecanii* 10% (1×10^9 CFU/ml) + 50% dose of Spinetoram 11.5 SC (16.47 thrips/plant) and *Lecanicillium lecanii* 10% (1×10^9 CFU/ml) + 50% dose of Imidacloprid 17.8 SL (17.20 thrips/plant) treatments were effective in lowering thrips population and substantially superior to the untreated control (20.93 thrips/plant).

The data on number of thrips/plant recorded at seventh day after first spray presented in Table 1 and depicted in Fig. 1 showed that average thrips survival population per plant ranging from 11.07 to 16.67, compared to 22.33 in the untreated control. In chemical and biopesticides check treatment, *Metarhizium anisopliae* 10% (1×10^8 CFU/ml) + 50% dose of Spinetoram 11.5 SC recorded the lowest thrips (11.07 thrips/plant) and was shown to be substantially superior to all other treatments. *Metarhizium anisopliae* 10% (1×10^8 CFU/ml) + 50% dose of Imidacloprid 17.8 SL (12.07 thrips/plant) was the second best treatment, followed by Spinetoram 11.5 SC (12.87 thrips/plant), Imidacloprid 17.8 SL (13.40 thrips/plant), *Beauveria bassiana* 10% (1×10^9 CFU/ml) + 50% dose of Spinetoram 11.5 SC (14.07 thrips/plant) and *Beauveria bassiana* 10% (1×10^9 CFU/ml) + 50% dose of Imidacloprid 17.8 SL (14.87 thrips/plant). The next best treatments were *Lecanicillium lecanii* 10% (1×10^9 CFU/ml) + 50% dose of Spinetoram 11.5 SC (15.53 thrips/plant) and *Lecanicillium lecanii* 10% (1×10^9 CFU/ml) + 50% dose of Imidacloprid 17.8 SL (16.67 thrips/plant) treatments were effective in lowering thrips population and substantially superior to the untreated control (22.33 thrips/plant).

The data on number of thrips/plant recorded at ten day after first spray presented in Table 1 and depicted in Fig. 1 showed that average thrips survival population per plant ranging from 7.33 to 11.40, compared to 24.07 in the untreated control. In chemical and biopesticides check treatment, *Metarhizium anisopliae* 10% (1×10^8 CFU/ml) + 50% dose of Spinetoram 11.5 SC recorded the lowest thrips (7.33 thrips/plant) and was shown to be substantially superior to all other treatments. *Metarhizium anisopliae* 10% (1×10^8 CFU/ml) + 50% dose of Imidacloprid 17.8 SL (8.33 thrips/plant) was the second best treatment which was at par with Spinetoram 11.5 SC (8.73 thrips/plant). The next best treatments were *Lecanicillium lecanii* 10% (1×10^9 CFU/ml) + 50% dose of Spinetoram 11.5 SC (9.67 thrips/plant) which was at par with Imidacloprid 17.8 SL (9.93 thrips/plant). The next best treatments were *Beauveria bassiana* 10% (1×10^9 CFU/ml) + 50% dose of Spinetoram 11.5 SC (14.47 thrips/plant) which was at par with *Beauveria bassiana* 10% (1×10^9 CFU/ml) + 50% dose of Imidacloprid 17.8 SL (14.80 thrips/plant). The next best treatments were *Lecanicillium lecanii* 10% (1×10^9 CFU/ml) + 50% dose of Imidacloprid 17.8 SL (11.40 thrips/plant) treatments were effective in lowering thrips population and substantially superior to the untreated control (24.07 thrips/plant).

The data on number of thrips/plant recorded at fifteen day after first spray presented in Table 1 and depicted in Fig. 1 showed that average thrips survival population per plant ranging from 7.93 to 14.33, compared to 25.60 in the untreated control. In chemical and biopesticides check treatment, *Metarhizium anisopliae* 10% (1×10^8 CFU/ml) + 50% dose of Spinetoram 11.5 SC recorded the lowest thrips (7.93 thrips/plant) and was shown to be substantially superior to all other treatments. *Metarhizium anisopliae* 10% (1×10^8 CFU/ml) + 50% dose of Imidacloprid 17.8 SL (9.33 thrips/plant) was the second best treatment which was at par with Spinetoram 11.5 SC (9.67 thrips/plant). The next best treatments were Imidacloprid 17.8 SL (10.80 thrips/plant) followed by *Beauveria bassiana* 10% (1×10^9 CFU/ml) + 50% dose of Imidacloprid 17.8 SL (12.00 thrips/plant) which was at par with *Beauveria bassiana* 10% (1×10^9 CFU/ml) + 50% dose of Spinetoram 11.5 SC (12.67 thrips/plant). The next best treatments were *Lecanicillium lecanii* 10% (1×10^9 CFU/ml) + 50% dose of Spinetoram 11.5 SC (13.00 thrips/plant) followed by *Lecanicillium lecanii* 10% (1×10^9 CFU/ml) + 50% dose of Imidacloprid 17.8 SL (14.33 thrips/plant) treatments were effective in lowering thrips population and substantially superior to the untreated control (25.60 thrips/plant).

Second Spray

The data on number of thrips/plants recorded at three day after second spray presented in Table 2 and depicted in Fig. 2 showed that average thrips survival population per plant ranging from 8.27 to 12.80, compared to 27.07 in the untreated control. In chemical and biopesticides check treatment, *Metarhizium anisopliae* 10% (1×10^8 CFU/ml) + 50% dose of Spinetoram 11.5 SC recorded the lowest thrips (8.27 thrips/plant) was shown to be substantially superior to all other treatments which was at par with *Metarhizium anisopliae* 10% (1×10^8 CFU/ml) + 50% dose of Imidacloprid 17.8 SL (8.80 thrips/plant). The next best treatments were Spinetoram 11.5 SC (9.40 thrips/plant) which was at par with Imidacloprid 17.8 SL (10.00 thrips/plant). The next best treatments were *Beauveria bassiana* 10% (1×10^9 CFU/ml) + 50% dose of Spinetoram 11.5 SC (10.80 thrips/plant) which was at par with *Beauveria bassiana* 10% (1×10^9 CFU/ml) + 50% dose of Imidacloprid 17.8 SL (11.67 thrips/plant). The next best treatments were *Lecanicillium lecanii* 10% (1×10^9 CFU/ml) + 50% dose of Spinetoram 11.5 SC (12.27 thrips/plant) which was at par with *Lecanicillium lecanii* 10% (1×10^9 CFU/ml) + 50% dose of Imidacloprid 17.8 SL (12.80 thrips/plant) treatments were effective in lowering thrips population and substantially superior to the untreated control (25.60 thrips/plant).

The data on number of thrips/plant recorded at seventh day after second spray presented in Table 2 and depicted in Fig. 2 showed that average thrips survival population per plant ranging from 5.73 to 9.47, compared to 29.93 in the untreated control. In chemical and biopesticides check treatment, *Metarhizium anisopliae* 10% (1×10^8 CFU/ml) + 50% dose of Spinetoram 11.5 SC recorded the lowest thrips (5.73 thrips/plant) was shown to be substantially superior to all other treatments which was at par with *Metarhizium anisopliae* 10% (1×10^8 CFU/ml) + 50% dose of Imidacloprid 17.8 SL (6.20 thrips/plant). The next best treatments were Spinetoram 11.5 SC (6.80 thrips/plant) which was at par with Imidacloprid 17.8 SL (7.07 thrips/plant). The next best treatments were *Beauveria bassiana* 10% (1×10^9 CFU/ml) + 50% dose of Spinetoram 11.5 SC (7.60 thrips/plant) which was at par with *Beauveria bassiana* 10% (1×10^9 CFU/ml) + 50% dose of Imidacloprid 17.8 SL (8.13 thrips/plant). The next best treatments were *Lecanicillium lecanii* 10% (1×10^9 CFU/ml) + 50% dose of Spinetoram 11.5 SC (8.87 thrips/plant) followed by *Lecanicillium lecanii* 10% (1×10^9 CFU/ml) + 50% dose of Imidacloprid 17.8 SL (9.47 thrips/plant) treatments were effective in lowering thrips population and substantially superior to the untreated control (29.93 thrips/plant).

The data on number of thrips/plant recorded at ten day after second spray presented in Table 2 and depicted in Fig. 2 showed that average thrips survival population per plant ranging from 4.13 to 8.00, compared to 33.00 in the untreated control. In chemical and biopesticides check treatment, *Metarhizium anisopliae* 10% (1×10^8 CFU/ml) + 50% dose of Spinetoram 11.5 SC recorded the lowest thrips (4.13 thrips/plant) was shown to be substantially superior to all other treatments. *Metarhizium anisopliae* 10% (1×10^8 CFU/ml) + 50% dose of Imidacloprid 17.8 SL (6.00 thrips/plant) was the second best treatment which was at par with Imidacloprid 17.8 SL (6.07 thrips/plant), Spinetoram 11.5 SC (6.53 thrips/plant), *Beauveria bassiana* 10% (1×10^9 CFU/ml) + 50% dose of Imidacloprid 17.8 SL and *Lecanicillium lecanii* 10% (1×10^9 CFU/ml) + 50% dose of Spinetoram 11.5 SC (6.73 thrips/plant) and *Beauveria bassiana* 10% (1×10^9 CFU/ml) + 50% dose of Spinetoram 11.5 SC (6.87 thrips/plant). The next best treatments were *Lecanicillium lecanii* 10% (1×10^9 CFU/ml) + 50% dose of Imidacloprid 17.8 SL (8.00 thrips/plant) treatments were effective in lowering thrips population and substantially superior to the untreated control (33.00 thrips/plant).

The data on number of thrips/plant recorded at fifteen day after second spray presented in Table 2 and depicted in Fig. 2 showed that average thrips survival population per plant ranging from 5.00 to 7.93, compared to 34.93 in the untreated control. In chemical and biopesticides check treatment, *Metarhizium anisopliae* 10% (1×10^8 CFU/ml) + 50% dose of Spinetoram 11.5 SC recorded the lowest thrips (5.00 thrips/plant) was shown to be substantially superior to all other treatments which were at par with Imidacloprid 17.8 SL (5.07 thrips/plant) followed by *Metarhizium anisopliae* 10% (1×10^8 CFU/ml) + 50% dose of Imidacloprid 17.8 SL and Spinetoram 11.5 SC (5.53 thrips/plant). The next best treatments were *Beauveria bassiana* 10% (1×10^9 CFU/ml) + 50% dose of Spinetoram 11.5 SC (6.27 thrips/plant) followed by *Beauveria bassiana* 10% (1×10^9 CFU/ml) + 50% dose of Imidacloprid 17.8 SL (7.33 thrips/plant) which were at par with *Lecanicillium lecanii* 10% (1×10^9 CFU/ml) + 50% dose of Spinetoram 11.5 SC (7.53 thrips/plant) and *Lecanicillium lecanii* 10% (1×10^9 CFU/ml) + 50% dose of Imidacloprid 17.8 SL (7.93 thrips/plant) treatments were effective in lowering thrips population and substantially superior to the untreated control (34.93 thrips/plant).

Overall mean of number of thrips/plant (average of two spray)

The mean on number of thrips/plant recorded after first and second spray presented in Table 3 showed that *Metarhizium anisopliae* 10% (1×10^8 CFU/ml) + 50% dose of Spinetoram 11.5 SC recorded the lowest thrips (7.91 thrips/plant) was shown to be substantially superior to all other treatments. *Metarhizium anisopliae* 10% (1×10^8 CFU/ml) + 50% dose of Imidacloprid 17.8 SL (8.81 thrips/plant) was the second best treatment followed by Spinetoram 11.5 SC (9.43 thrips/plant), Imidacloprid 17.8 SL (9.68 thrips/plant). The next best treatments were *Beauveria bassiana* 10% (1×10^9 CFU/ml) + 50% dose of Spinetoram 11.5 SC (10.38 thrips/plant) followed by *Beauveria bassiana* 10% (1×10^9 CFU/ml) + 50% dose of Imidacloprid 17.8 SL (10.88 thrips/plant), *Lecanicillium lecanii* 10% (1×10^9 CFU/ml) + 50% dose of Spinetoram 11.5 SC (11.26 thrips/plant). The next best treatments were *Lecanicillium lecanii* 10% (1×10^9 CFU/ml) + 50% dose of Imidacloprid 17.8 SL (12.23 thrips/plant) treatments were effective in lowering thrips population and substantially superior to the untreated control (27.23 thrips/plant).

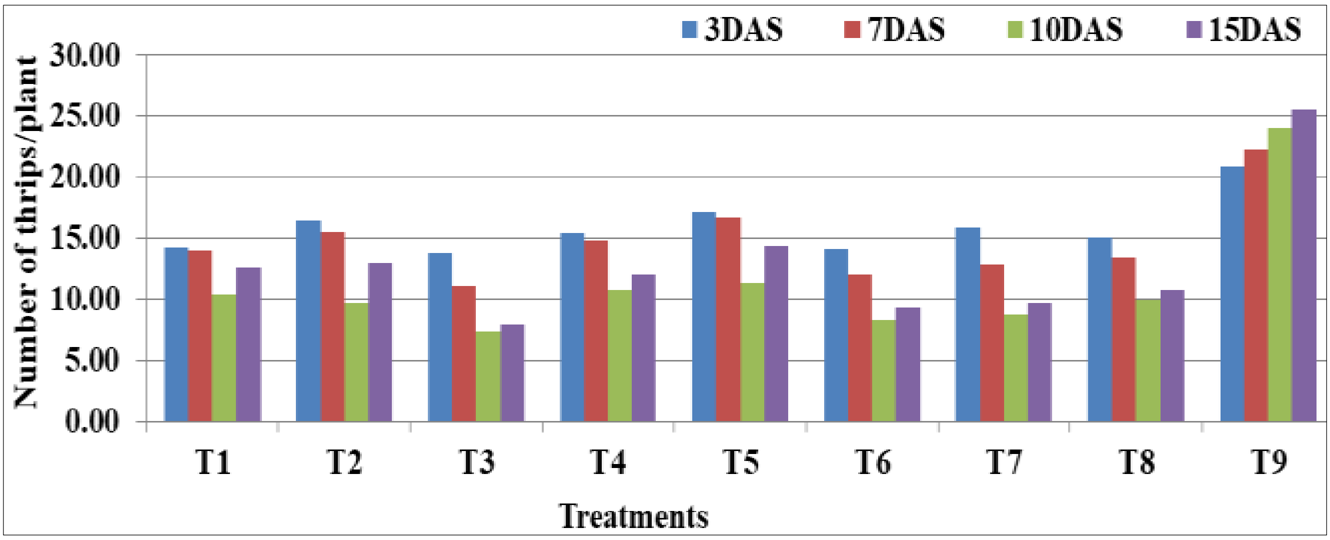

Fig 1: Number of thrips/plant after first spray

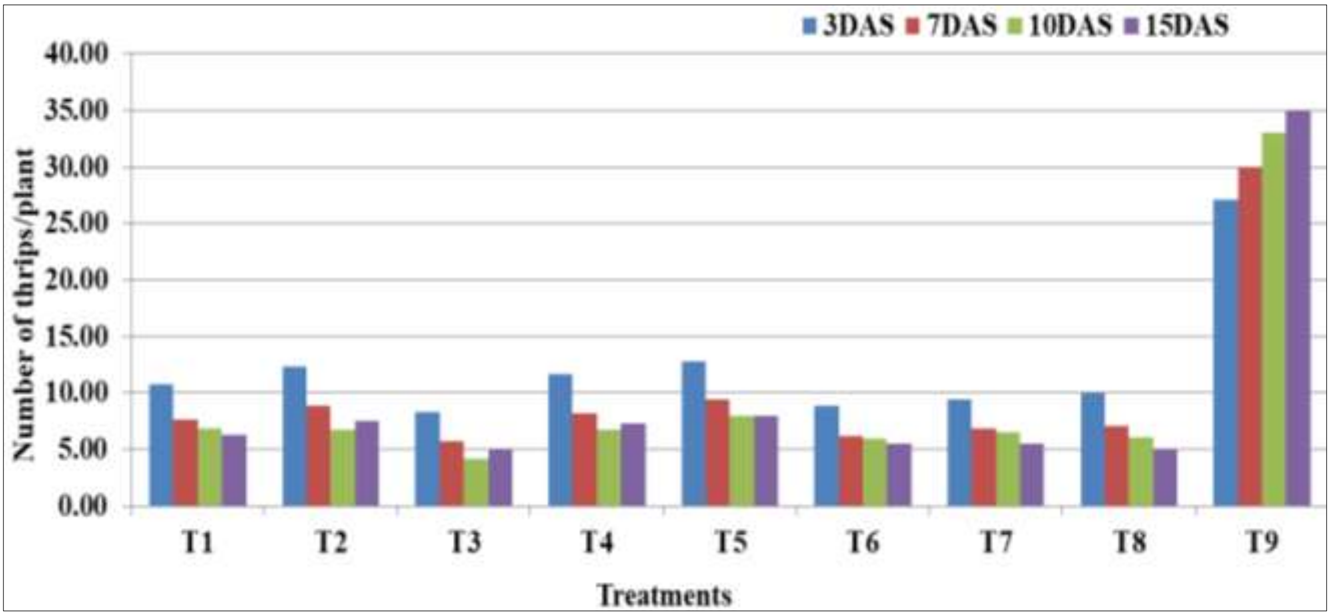

Fig 2: Number of thrips/plant after second spray

Table 1: Effect of different biopesticide and insecticides combinations on onion thrips (*Thrips tabaci* L.) after first spray

Sr. No.	Treatment	Pre count	Number of thrips/plant				Overall mean
			3 DAS	7 DAS	10 DAS	15 DAS	
T_1	*Beauveria bassiana* 10% (1×10^9 CFU/ml) + 50% dose of Spinetoram 11.5 SC	19.67 (4.53)	14.27 (3.90)	14.07 (3.88)	10.47 (3.38)	12.67 (3.63)	12.87
T_2	*Lecanicillium lecanii* 10% (1×10^9 CFU/ml) + 50% dose of Spinetoram 11.5 SC	17.07 (4.25)	16.47 (4.18)	15.53 (4.06)	9.67 (3.18)	13.00 (3.64)	13.67
T_3	*Metarhizium anisopliae* 10% (1×10^8 CFU/ml) + 50% dose of Spinetoram 11.5 SC	18.27 (4.39)	13.80 (3.84)	11.07 (3.47)	7.33 (2.89)	7.93 (2.95)	10.03
T_4	*Beauveria bassiana* 10% (1×10^9 CFU/ml) + 50% dose of Imidacloprid 17.8 SL	20.27 (4.60)	15.47 (4.05)	14.87 (3.98)	10.80 (3.43)	12.00 (3.53)	13.28
T_5	*Lecanicillium lecanii* 10% (1×10^9 CFU/ml) + 50% dose of Imidacloprid 17.8 SL	18.40 (4.40)	17.20 (4.25)	16.67 (4.20)	11.40 (3.48)	14.33 (3.84)	14.90
T_6	*Metarhizium anisopliae* 10% (1×10^8 CFU/ml) + 50% dose of Imidacloprid 17.8 SL	21.20 (4.71)	14.20 (3.88)	12.07 (3.61)	8.33 (3.05)	9.33 (3.16)	10.98
T_7	Spinetoram 11.5 SC	19.53 (4.53)	15.93 (4.11)	12.87 (3.72)	8.73 (3.12)	9.67 (3.21)	11.80
T_8	Imidacloprid 17.8 SL	20.33 (4.61)	15.13 (4.00)	13.40 (3.79)	9.93 (3.31)	10.80 (3.38)	12.32
T_9	Untreated Control	20.07 (4.59)	20.93 (4.65)	22.33 (4.80)	24.07 (4.95)	25.60 (5.12)	23.23
	C.D. (5%)	N/A	N/A	0.446	0.872	0.776	
	SE(m)	0.155	0.194	0.147	0.288	0.256	
	C.V.	5.942	8.198	6.472	14.601	12.323	

*Figures in parentheses are the square root transformed values

Table 2: Effect of different biopesticide and insecticides combinations on onion thrips (*Thrips tabaci* L.) after second spray

Sr.no.	Treatment	Number of thrips/plant				Overall mean
		3DAS	7DAS	10DAS	15DAS	
T_1	*Beauveria bassiana* 10% (1×10^9 CFU/ml) + 50% dose of Spinetoram 11.5 SC	10.80 (3.43)	7.60 (2.93)	6.87 (2.80)	6.27 (2.68)	7.88
T_2	*Lecanicillium lecanii* 10% (1×10^9 CFU/ml) + 50% dose of Spinetoram 11.5 SC	12.27 (3.64)	8.87 (3.14)	6.73 (2.75)	7.53 (2.89)	8.85
T_3	*Metarhizium anisopliae* 10% (1×10^8 CFU/ml) + 50% dose of Spinetoram 11.5 SC	8.27 (3.04)	5.73 (2.59)	4.13 (2.26)	5.00 (2.45)	5.78
T_4	*Beauveria bassiana* 10% (1×10^9 CFU/ml) + 50% dose of Imidacloprid 17.8 SL	11.67 (3.56)	8.13 (3.02)	6.73 (2.77)	7.33 (2.86)	8.47
T_5	*Lecanicillium lecanii* 10% (1×10^9 CFU/ml) + 50% dose of Imidacloprid 17.8 SL	12.80 (3.69)	9.47 (3.24)	8.00 (2.98)	7.93 (2.95)	9.55
T_6	*Metarhizium anisopliae* 10% (1×10^8 CFU/ml) + 50% dose of Imidacloprid 17.8 SL	8.80 (3.13)	6.20 (2.68)	6.00 (2.63)	5.53 (2.56)	6.63
T_7	Spinetoram 11.5 SC	9.40 (3.22)	6.80 (2.79)	6.53 (2.74)	5.53 (2.55)	7.07
T_8	Imidacloprid 17.8 SL	10.00 (3.31)	7.07 (2.84)	6.07 (2.64)	5.07 (2.42)	7.05
T_9	Untreated Control	27.07 (5.08)	29.93 (5.50)	33.00 (5.76)	34.93 (5.95)	31.23
	C.D. (5%)	0.995	0.577	0.894	0.646	
	SE(m)	0.329	0.191	0.296	0.214	
	C.V.	15.978	10.358	16.872	12.202	

*Figures in parentheses are the square root transformed values

Table 3: Effect of different biopesticide and insecticides combinations on onion thrips (*Thrips tabaci* L.) (Avg. of two spray)

Sr. No.	Treatment	Number of thrips/plant
T_1	*Beauveria bassiana* 10% (1×10^9 CFU/ml) + 50% dose of Spinetoram 11.5 SC	10.38
T_2	*Lecanicillium lecanii* 10% (1×10^9 CFU/ml) + 50% dose of Spinetoram 11.5 SC	11.26
T_3	*Metarhizium anisopliae* 10% (1×108 CFU/ml) + 50% dose of Spinetoram 11.5 SC	7.91
T_4	*Beauveria bassiana* 10% (1×10^9 CFU/ml) + 50% dose of Imidacloprid 17.8 SL	10.88
T_5	*Lecanicillium lecanii* 10% (1×10^9 CFU/ml) + 50% dose of Imidacloprid 17.8 SL	12.23
T_6	*Metarhizium anisopliae* 10% (1×108 CFU/ml) + 50% dose of Imidacloprid 17.8 SL	8.81
T_7	Spinetoram 11.5 SC	9.43
T_8	Imidacloprid 17.8 SL	9.68
T_9	Untreated Control	27.23

Conclusion

The next best treatments were *Beauveria bassiana* 10% (1×10^9 CFU/ml) + 50% dose of Spinetoram 11.5 SC (10.38 thrips/plant) followed by *Beauveria bassiana* 10% (1×10^9 CFU/ml) + 50% dose of Imidacloprid 17.8 SL (10.88 thrips/plant), *Lecanicillium lecanii* 10% (1×10^9 CFU/ml) + 50% dose of Spinetoram 11.5 SC (11.26 thrips/plant). The next best treatments were *Lecanicillium lecanii* 10% (1×10^9 CFU/ml) + 50% dose of Imidacloprid 17.8 SL (12.23 thrips/plant) treatments were effective in lowering thrips population and substantially superior to the untreated control (27.23 thrips/plant).

References

1. Bharani GN, Kohilambal H, Sivasubramanian P, Banuprathap G. Comparative efficacy of bio pesticides and insecticides against tomato thrips (*Thrips tabaci* Lind.) and their impact on coccinellid predators. The Bioscan. 2015;10(1):207-210.
2. Ebenebe AC. In search of the causal agent of the 'Onion Twister' Disorder. Samaru Misc. 1980;2(1):16-20.
3. Fournier F, Boivin G, Stewart RK. Effect of *Thrips tabaci* on yellow onion yields and economics thresholds for its management. J Econ. Entomol. 1995;88:1401-1407.
4. Jones HA, Mann LK. Onions and their Allies, Botany, Cultivation and utilization. Leonard Hill Inter Science, London; c1963 p. 286.
5. Karuppaiah V, Soumia PS, Thangasamy A, Yogesh PK, Mahajan V, Singh M, et al. Defoliator pests of onion and their management. Agriculture and environment. 2022;3(1):1-5.
6. Mane OS, Galande SM, Tamboli ND, Bhalekar SG. Efficacy of different botanical and biopesticide against onion thrips (*Thrips tabaci* L.). The Pharma Innovation Journal. 2021;10(12):656-663.
7. Nault BA, Shelton AM. Impact of insecticide efficacy on developing action thresholds for pest management: A case study of onion thrips on onion. J Econ. Entomol. 2010;103:1315-1326.
8. Straub RW, Emmett B. Pests of monocotyledon crops. In: Mc Kinlay, R.G. (Editor). Vegetable Crop; c1992.
9. Visalakshy G, Krishnamoorthy A. Comparative field efficacy of various entomopathogenic fungi against *Thrips tabaci*: Prospects for organic production of onion in India. N Acta Horticulture. 2012;2(1):433-438.