The Pharma Innovation Journal 2023; 12(7): 3084-3088

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(7): 3084-3088

www.thepharmajournal.com
Received: 27-04-2023
Accepted: 29-05-2023

Lavkush Salame
Ph.D. Research Scholar, Department of Entomology, IGKV, Raipur, Chhattisgarh, India

Birjhu
Ph.D. Research Scholar, Department of Entomology, IGKV, Raipur, Chhattisgarh, India

Kamal Narayan
Department of Entomology, BTC CARS, Bilaspur, Chhattisgarh, India

Corresponding Author:
Lavkush Salame
Ph.D. Research Scholar, Department of Entomology, IGKV, Raipur, Chhattisgarh, India

Efficacy of bio-pesticides (Entomopathogenic fungi and botanicals insecticides) against the onion thrips (*Thrips tabaci* L.)

Lavkush Salame, Birjhu and Kamal Narayan

Abstract
Field investigation were laid out to test the efficacy of bio-pesticides against onion thrips during 2019-20 at Horticultural farm of BTC College of Agriculture and Research Station, Bilaspur, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.). Eight treatments (entomopathogenic fungi and botanicals insecticides) were evaluated for their efficacy against onion thrips. The treatments were Spinosad 45 SC @ 0.016% was found to be most effective against onion thrips, with lowest population of thrips (7.83 nymph and adults/plant), and maximum 61.72% population reduction of thrips. Garlic extract 5% was next best treatment (12.58 thrips/plant) with 38.57% reduction in thrips population. Next best treatment was *Beauveria bassiana* 10.00% WP ($1x10^9$ CFU/g min) @ 10 ml/lit. of water (13.23 thrips/plant) with reduction 35.44% population, *Metarhizium anisopliae* 10.00% WP ($1x10^9$ CFU/g min) @ 10 ml/lit. of water (13.58 thrips/plant) with reduction 33.69% population, *Lecanicillium lecanii* 10.00% WP ($1x10^9$ CFU/g min) @ 10 ml/lit. of water (13.74 thrips/plant) with reduction 32.91% population and next better treatment was NSKE 5% (14.01 thrips/plant) 31.59% reduction population and least control by Plain water @ 500 $lit.ha^{-1}$ (16.95 thrips/plant) and control (20.48 thrips/plant) reduction 17.24% population over to control.

Keywords: Bio-pesticides, efficacy, onion thrips, population, treatment

Introduction
The onion thrips (*Thrips tabaci* L) (Thysanoptera: Thripidae) is a major insect pest that causes significant yield losses. In India, it is an important insect pest that affect onion yield by direct feeding as well as reducing the quality and quantity by rasping and sucking the leaves and other tissues of onion crops. Onion thrips has become a global pest of increasing concern in commercial onion production, because of its development of resistance to insecticides, ability to transmit plant pathogens and frequency of producing more generations at high temperature. Onion thrips feed directly on leaves, causing 3 blotches as well as distort the bulbs and convert them into under size causing yield loss >50% but can be even more problematic by transmitting viral disease like Iris yellow spot virus (IYSV) (Diaz-Montano *et al.*, 2011) [2] Among the insect pest complex of onion, *Thrips tabaci* is most serious insect-pest infesting onion causes up to 34-43 percent loss of yield (Kumar *et al.*, 2001) [5], Heavy yield loss caused even 90 percent has also been reported on onion when thrips attack the early crop stages of crop growth (Anon., 1984) [1]. Nymph and adult both are caused infestation on sheath portion of plant due to because of its destructive rasp to cell saps leads to oozing, leaves become dry and twisted from apex developing into white patches. High level of resistance to the conventional insecticides, hazardous to human beings and beneficial insects, undesirable level of residues exaggerates the problems due to pesticide use have resulted in renewed the interest in the research for exploring the opportunities of using biopesticides. Biopesticides such as *Bacillus thuringiensis*, *Beauveria bassiana*, NSKE 5% etc. can provide an alternative, more environment friendly option to control these insect pests (Jeyarani and Karuppuchamy, 2010) [3]. Looking to the destructiveness, pest status, farmers compulsion for frequent applications of insecticides in order to control the onion thrips, (*Thrips tabaci* L) 4 and manage them to minimum, based on safer and eco-friendly management strategies

Methods and Materials
The field trial was conducted in the Instructional Farm of BTC CARS, Bilaspur (C.G.) during Rabi season 2019-20.

The experiment was laid out in a randomized block design, replicated thrice with seven biopesticides and botanicals treatment along with one untreated plot. The onion variety Nasik red was sown in a plot size of 3.45 m × 2.60 m with planting distance of 15 cm × 10 cm, during first week of December, 2019 with following all the improved recommended package of practices for raising the crop for evaluating the bio-efficacy of different biopesticides and botanicals against the onion thrips. In each treatment, total two sprays of biopesticides and botanicals were applied with the help of knapsack sprayer at an interval of 15 days; first application was initiated when thrips population reached to ETL.

Seven bio-pesticides including plain water spray were evaluated for the management of *Thrips tabaci* L. Pre-treatment observations were recorded one day before the application of bio-pesticides, whereas post-treatment observations were recorded 3, 7, 10 and 15days after spraying. *Thrips tabaci* L. were counted with the help of magnifying lance on 10 randomly selected plants in each plot. To evaluate the bio efficacy of entomopathogenic fungi, botanicals for the management of onion thrips (*Thrips tabaci* L.).

Different biopesticide namely *Beauveria bassiana* 10% WP 1×10^9 CFU/gm min), *Metarhizium anisopliae* 10% WP 1×10^9 CFU/gm min), *Lecanicillium lecanii* 10% WP 1×10^9 CFU/gm min) provided by state Biocontrol Laboratory (IGKV, BTC CARS, Bilaspur) Chorbhatti, Seesal Farm Kota Road, Bilaspur (C.G) and other NSKE 5%, Spinosad 45 SC were purchased from local market. Garlic extract was prepared from garlic cloves.

Table:1: Treatment details

S. No.	Name of treatment	Strain/Chemical Name	Concentration	Dose/ lit. water
1	*Beauveria bassiana* 10.00% WP (1×10^9 CFU/gm min)	*Beauveria bassiana*	10.00% WP (1×10^9 CFU/g min)	10 ml
2	*Metarhizium anisopliae* 10.00% WP (1×10^9 CFU/gm min)	*Metarhizium anisopliae*	10.00% WP (1×10^9 CFU/g min)	10 ml
3	*Lecanicillium lecanii* 10.00%WP (1×10^9 CFU/gm min)	*Lecanicillium lecanii*	10.00% WP (1×10^9 CFU/g min)	10 ml
4	NSKE	*Azadirachta indica*	5%	50 ml
5	Garlic Extract	*Allium sativum*	5%	50 ml
6	Spinosad 45SC	*Saccharopolyspora spinosa*	0.016%	0.35 ml
7	Plain water spray @ 500 lit./ha.	_	_	_
8	Control	_	_	_

Result and Discussion

Observation after first spray

The pre-treatment observations showed non-significant differences among the various treatments. Nymph and adults' population of onion thrips were observed between 4.70 to 6.70 thrips/ plant.

Three days after first spray

Data presented in table 4.10 revealed that there is significant difference in onion thrips population among different treatments after three days of first spray. The lowest population of onion thrips (01.77 nymph and adults/ plant) was observed in Spinosad 45SC @ 0.016%, which was significantly superior over other treatments. The treatment *L. lecanii* 10.00% WP ($1x10^9$ CFU/g min) was recorded next best treatment with 05.00 thrips/plant, but closely followed by Garlic extract 5% (05.13 thrips/plant). Neem Seed Kernel Extract 5% (05.80 thrips/plant), plain water spray (5.86 thrips/ plant), *B. bassiana* 10.00% WP ($1x10^9$ CFU/g min) (06.10 thrips /plant), *M. anisopliae* 10.00% WP ($1x10^9$ CFU/g min) thrips 06.57/plant were placed in decreasing order in their efficacy. The maximum population of onion thrips (08.20 thrips/plant) was recorded in untreated control plot.

Seven days after spray

The seven days after first spray Spinosad 45SC @ 0.016% was again proved to be the best treatment (01.43 thrips/ plant). Among the bio-pesticides and botanicals, Garlic extract 5% (04.17 thrips/plant) and *L. lecanii* 10.00% WP ($1x10^9$ CFU/g min) 04.37 thrips/plant were found best among the bio-pesticides and botanicals followed by NSKE 5% (04.77 thrips/plant), *M. anisopliae* 10.00% WP ($1x10^9$ CFU/g min) thrips 05.03/plant, *B. bassiana* 10.00% WP ($1x10^9$ CFU/g min) 05.07 thrips /plant and plain water spray (05.90 thrips/ plant), while highest population (10.70 thrips/ plant) was observed in untreated control plot.

Ten days after spray

After ten days of first spray data showed that there is significant difference between treatments. Among different treatments, Spinosad 0.016% was the most effective treatment, reported the least onion thrips population (10.40 thrips/plant) which was at par with Garlic extract 5% (11.23 thrips/plant), *B. bassiana* 10.00% WP ($1x10^9$ CFU/g min) 12.10 thrips /plant) and *L. lecanii* 10.00% WP ($1x10^9$ CFU/g min) 13.37 thrips/plant among the bio-pesticide and botanicals. *M. anisopliae* 10.00% WP ($1x10^9$ CFU/g min) thrips 14.86/plant, plain water spray (15.93 thrips/ plant), Neem Seed Kernel Extract 5% (16.33 thrips/plant) were observed less effective while highest onion thrip population (18.47 thrips/plant) was recorded in an untreated plot.

Fifteen days after first spray

The fifteen days after first spray data exhibited the significant difference between the treatments. Among different treatments, Spinosad 0.016% which recorded with least onion thrips population (19.77 thrips /plant) was the most effective treatment. Garlic extract 5% (22.80 thrips/plant) was the next in order of efficacy and at par with, NSKE 5% (23.00 thrips/plant), *M. anisopliae* 10.00% WP ($1x10^9$ CFU/g min) thrips 23.83/plant, *B. bassiana* 10.00% WP ($1x10^9$ CFU/g min) 24.17 thrips /plant and *L. lecanii* 10.00% WP ($1x10^9$ CFU/g min) 24.85 thrips/plant. Plain water spray (26.23 thrips/ plant) was found at par with untreated control (27.53 thrips/plant).

First spray mean

The mean data after first spraying showed that all the

treatments were significantly superior over untreated control. Among different treatments, the most effective treatment was Spinosad 0.016% which recorded least onion thrips population (08.34 thrips /plant), Garlic extract 5% (10.83 thrips/plant) was the next best treatment in order to their efficacy however, it was at par with all the bio-pesticides and botanicals, *L. lecanii* 10.00% WP ($1x10^9$ CFU/g min) 11.82 thrips/plant, *B. bassiana* 10.00% WP ($1x10^9$ CFU/g min) 11.86 thrips /plant, Neem Seed Kernel Extract 5% (12.48 thrips/plant) and *M. anisopliae* 10.00% WP ($1x10^9$ CFU/g min) thrips 12.57/plant. Plain water spray (13.48 thrips/ plant) was recorded with second highest onion thrips population next to the untreated control (16.22 thrips/plant).

First spray mean

The mean data after first spraying showed that all the treatments were significantly superior over untreated control. Among different treatments, the most effective treatment was Spinosad 0.016% which recorded least onion thrips population (08.34 thrips /plant), Garlic extract 5% (10.83 thrips/plant) was the next best treatment in order to their efficacy however, it was at par with all the bio- pesticides and botanicals, *L. lecanii* 10.00% WP ($1x10^9$ CFU/g min) 11.82 thrips/plant, *B. bassiana* 10.00% WP ($1x10^9$ CFU/g min) 11.86 thrips /plant, Neem Seed Kernel Extract 5%(12.48 thrips/plant) and *M. anisopliae* 10.00% WP ($1x10^9$ CFU/g min) thrips 12.57/plant. Plain water spray (13.48 thrips/ plant) was recorded with second highest onion thrips population next to the untreated control (16.22 thrips/plant).

Second Spray

Observation after second spray

The mean nymph and adult population of onion thrips in the pre-treatment observation were ranged from 28.80 to 29.16 thrips/plant. Differences in mean onion thrips populations in different treatments were non-significant, suggest a more or less uniform distribution in the field of experimentation.

Three days after second spray

The data after three days of second spray showed that there were significant differences in the mean population of onion thrips between different treatments. The lowest population of onion thrips (18.03 thrips/plant) was recorded in Spinosad 45SC @ 0.016 percent. All the bio-pesticides and botanicals were found at par to each other however lowest onion thrips population (31.47 thrips/plant) was observed in Garlic extract @ 5%. The onion thrips population in remaining treatments were 31.70 thrips /plant in *B. bassiana* 10.00% WP ($1x10^9$ CFU/g min), 31.77 thrips /plant in plain water spray, 32.40 thrips/ plant in *M. anisopliae* 10.00% WP ($1x10^9$ CFU/g min), 33.60 thrips/plant in Neem Seed Kernel Extract 5% and 33.80 thrips/plant in *L. lecanii* 10.00% WP ($1x10^9$ CFU/g min). The highest population of onion thrips (37.37/plant) was recorded in untreated control plot.

Seven days after second spray

The seven days after second spray data showed that the variations in the mean population of onion thrips between different treatments were found significant. The lowest onion thrips population (06.03/plant) was recorded in plots treated with Spinosad 45SC @ 0.016 percent which was significantly superior over rest of the treatments. *M. anisopliae* 10.00% WP ($1x10^9$ CFU/g min) 12.43 thrips/plant was next treatment followed by Garlic extract 5% (13.23 thrips/plant), *B. bassiana* 10.00% WP ($1x10^9$ CFU/g min) 13.63 thrips /plant, Neem Seed Kernel Extract 5% (14.50 thrips/plant) and *L. lecanii* 10.00% WP ($1x10^9$ CFU/g min) 15.10 thrips/plant. Plain water spray was recorded with 29.77 thrips/ plant. The highest population of onion thrips (37.53/plant) was recorded in untreated control plot.

Ten days after second spray

Ten days after second spray data showed that variations in the mean population of onion thrips between different treatments were significant. The lowest onion thrips population (04.20/plant) was recorded in Spinosad 45SC @ 0.016 percent treated plots. Among the different bio-pesticides and botanicals all the treatments were more or less same as they were at par to each other with minimum thrips population 11.20 thrips/plant in Garlic extract 5% followed by *B. bassiana* 10.00% WP ($1x10^9$ CFU/g min) 11.37 thrips/plant, *M. anisopliae* 10.00% WP ($1x10^9$ CFU/g min) thrips 11.83/plant and *L. lecanii* 10.00% WP ($1x10^9$ CFU/g min) 11.93 thrips/plant while the Neem Seed Kernel Extract 5% was recorded with 12.63 thrips/plant. Plain water spray and untreated control were observed with17.83 thrips/ plant and 20.73 thrips/ plant respectively.

Fifteen days after second spray

Fifteen days after second spray data showed that there were significant variations in the mean population of onion thrips among different treatments. The lowest onion thrips population (01.07 thrips /plant) was recorded in Spinosad 45SC @ 0.016 percent treated plots which was closely followed by Garlic extract 5% (01.33 thrips/plant). Neem Seed Kernel Extract 5% (01.47 thrips/plant), *B. bassiana* 10.00% WP ($1x10^9$ CFU/g min) 01.60 thrips /plant, *M. anisopliae* 10.00% WP ($1x10^9$ CFU/g min) 1.70 thrips/plant and *L. lecanii* 10.00% WP ($1x10^9$ CFU/g min) 01.83 thrips/plant were the bio-pesticides and botanicals decreasing in order in their bio-efficacy against onion thrips. Plain water spray plots, onion thrips population was 02.33 thrips/ plant. The highest population of onion thrips (03.33 thrips/ plant) was recorded in untreated control plot.

Second spray mean

After 2nd spray mean population data showed that least population 7.33 thrips /plant was observed in Spinosad 45SC @ 0.016% treatment, significantly superior over bio-pesticides and botanicals. Garlic extract 5% (14.33 thrips /plant) was found next best treatment and followed by *B. bassiana* 10.00% WP ($1x10^9$ CFU/g min) 14.58 thrips /plant, Neem Seed Kernel Extract 5% (15.60 thrips/plant), *L. lecanii* 10.00% WP ($1x10^9$ CFU/g min) 15.60 thrips/plant, *M. anisopliae* 10.00% WP ($1x10^9$ CFU/g min) 16.34 thrips /plant. Plain water spray (20.43 thrips/ plant) was at par with all the bio-pesticides and botanicals except Garlic extract 5% (14.33 thrips /plant). The highest population of onion thrips (24.73 thrips/ plant) was recorded in untreated plot.

Following the first and second spray of biopesticides, it was clearly indicated that Spinosad 45SC 0.016% @ 0.35 ml/ lit. of water followed by Garlic extract 5% @ 50 ml /lit. of water were the most effective treatments against onion thrips, whereas plain water @ 500 lit. ha^{-1} was least effective treatment with maximum population of thrips per plant in onion crop.

Overall mean

The combined data analysis obtained after two sprays suggested that Spinosad 0.016 percent was found to be most successful against onion thrips, as it observed with lowest population of onion thrips (07.83 nymph and adults/plant) and maximum 61.72% reduction in thrips population, followed by Garlic extract 5% (12.58 thrips/plant) with 38.57% reduction, *Beauveria bassiana* 10.00% WP (1x10^9 CFU/g min) 13.21 thrips /plant with 35.40% reduction, *Metarhizium anisopliae* 10.00% WP (1x10^9 CFU/g min) thrips 13.58/plant with 33.69% reduction, *Lecanicillium lecanii* 10.00% WP (1x10^9 CFU/g min) 13.74 thrips/plant with 32.91% reduction, NSKE 5% (14.06 thrips/plant) with 31.59% reduction and plain water spray (16.95 thrips/ plant) with only 17.24% reduction in thrips population. The highest population of onion thrips (20.48 thrips/plant) was recorded in an untreated control plot.

Following the first and second spray of biopesticides, it was clearly indicated that Spinosad 45SC 0.016% @ 0.35 ml/ lit. of water accompanied by Garlic extract 5%@ 50 ml /lit. of water were the most effectively controls thrips population, whereas plain water @ 500 lit./ha^{-1} was least effective treatment. It is clear that all treatments for biopesticides effectively reduced the onion thrips and enrolled higher yield of onion bulb compared to untreated control.

The present findings are in contrary with the findings of Visalakshy and Krishnamoorthy (2017) [7] and Prema *et al.*, (2018) [6] who reported, *M. ansiopliae* as best treatment at a concentration of 1×10^9 spores/ml with 58% reduction in thrips population while reported NSKE 5% @ 50 ml/lit. of water (51.67%) with highest mortality compared to all other treatments against to thrips palmi. The present findings are in accordance with Kalola *et al*., (2017) [4] where Spinosad 45SC 0.009% @ 02 ml/10 lit. of water was found effective against onion thrip. Kumar *et al*., (2012) [5] observed *Beauveria bassiana* (Bals) @ 1x 10^{9}spores/ml twice was found to be best treatment with lowest mean thrips population (9.53/plant) with highest per cent reduction (64.15) confirms the present findings.

Table 2: Efficacy of different biopesticides against onion thrips (*Thrips tabaci* L.) (1st spray)

Average thrips population/plant								
S.N.	**Treatment**	**Dose ml or gm (lit. of water)**	**PTO**	**3 DAT**	**7 DAT**	**10 DAT**	**15 DAT**	**Mean**
T_1	*Beauveria bassiana* 10.00%WP (1x 10^9 CFU/gm min)*	10 ml	05.67 (02.40)	06.10 (02.47)^{bc}	05.07 (02.25)^{ab}	12.10 (03.47)^{bcd}	24.17 (04.91)^{bc}	11.86 (03.28)^{bc}
T_2	*Metarhizium anisopliae* 10.00%WP (1 x10^9 CFU/gm min)	10 ml	05.13 (02.26)	06.57 (02.55) ^{b}	05.03 (02.24)^{bc}	14.86 (03.83)^{abc}	23.83 (04.88)^{bc}	12.57 (03.39)^{bc}
T_3	*Lecanicillium lecanii* 10.00%WP (1×10^9 CFU/gm min)*	10 ml	06.70 (02.58)	05.00 (02.23)^{c}	04.37 (02.08)^{c}	13.37 (03.65)^{bcd}	24.53 (04.95)^{bc}	11.82 (03.23)^{bc}
T_4	NSKE 5%	50 ml	05.17 (02.27)	05.80 (02.40)^{bc}	04.77 (02.18)^{c}	16.33 (04.01)^{ab}	23.00 (04.80)^{c}	12.48 (03.10)^{bc}
T_5	Garlic extract 5%	50 ml	04.70 (02.16)	05.13 (02.27)^{bc}	04.17 (02.03)^{c}	11.23 (03.35)^{cd}	22.80 (04.77)^{c}	10.83 (03.10)^{c}
T_6	Spinosad 45SC @ 0.016%	0.35 ml	06.17 (02.51)	01.77 (01.32)^{d}	01.43 (01.20)^{d}	10.40 (03.21)^{d}	19.77 (04.44)^{d}	8.34 (02.55)^{d}
T_7	Plain water@ 500lit.ha^{-1}	-	06.60 (02.56)	05.86 (02.42)^{bc}	05.90 (02.43)^{b}	15.93 (03.97)^{ab}	26.23 (05.12)^{ab}	13.48 (03.49)^{b}
T_8	Control	-	05.07 (02.25)	08.20 (02.85)^{a}	10.70 (03.27) ^{a}	18.47 (04.30)^{a}	27.53 (05.25) ^{a}	16.22 (03.92)^{a}
	SEM±		NS	00.06	00.05	00.11	00.05	00.05
	CD 5%			00.30	0.24	00.57	00.27	00.30

Table 3: Efficacy of different biopesticides against onion thrips (*Thrips tabaci* L.) (2ndspray)

S. No.	**Treatment**	**Dose gm or ml /liter**	**PTO**	**3 DAT**	**7 DAT**	**10 DAT**	**15 DAT**	**Mean**
T_1	*Beauveria bassiana* 10.00%WP (1x 10^9 CFU/gm min)	10 ml	28.97 (05.38)	31.70 (05.63)^{b}	13.63 (03.63)^{c}	11.37 (03.37)^{c}	01.60 (01.26)^{cde}	14.58 (03.49)^{bc}
T_2	*Metarhizium anisopliae* 10.00%WP (1 X 10^9 CFU/gm min)	10 ml	29.00 (05.38)	32.40 (05.70)^{b}	12.43 (03.52)^{c}	11.83 (03.44)^{c}	01.70 (01.30)^{cd}	16.34 (03.72)^{bc}
T_3	*Lecanicillium lecanii* 10.00%WP(1×10^9 CFU/gm min)	10 ml	29.16 (05.40)	33.80 (05.81)^{b}	15.10 (03.88)^{c}	11.93 (03.45)^{c}	01.83 (01.35)^{c}	15.67 (03.62)^{bc}
T_4	NSKE 5%	50 ml	28.80 (05.40)	33.60 (05.79)^{b}	14.50 (03.81)^{c}	12.63 (03.55)^{c}	01.47 (01.21)^{de}	15.60 (03.60)^{bc}
T_5	Garlic extract 5%	50 ml	28.93 (05.36)	31.47 (05.61)^{b}	13.23 (03.64)^{c}	11.30 (03.36)^{c}	01.33 (01.15)^{ef}	14.33 (03.44)^{c}
T_6	Spinosad 45SC (0.016%)	0.35 ml	28.93 (05.37)	18.03 (04.22)^{c}	06.03 (02.43)^{d}	04.20 (02.04)^{d}	01.07 (01.03)^{f}	07.33 (02.45)^{d}
T_7	Plain water@ 500lit./ha^{-1}	-	29.06 (05.39)	31.77 (05.63)^{b}	29.77 (05.46)^{b}	17.83 (04.22)^{b}	02.33 (01.53)^{b}	20.43 (04.21)^{ab}
T_8	Control	-	29.13 (05.40)	37.37 (06.11)^{a}	37.53 (06.13) ^{a}	20.73 (04.56)^{a}	03.33 (01.82)^{a}	24.73 (04.65)^{a}
SEm ±			NS	00.054	00.075	00.039	0.026	00.27
CD 5%				00.28	00.39	00.21	00.13	00.68

Note: Figures in parentheses are square root transformed values, NS= Non significant, PTO = Pre-treatment observation, DAT = Day After Transplanting.

Table 4: Efficacy of different biopesticides against onion thrips (*Thrips tabaci* L.)

S.N.	Treatment	Spray 1st (mean)	Spray 2nd (mean)	Overall mean	Population reduction % over control
T_1	*Beauveria bassiana* 10.00%WP (1x 10^9 CFU/gm min)*	11.86 (03.28)^{bc}	14.60 (03.49)^{c}	13.23 (03.38)^{c}	35.44
T_2	*Metarhizium anisopliae* 10.00%WP (1 X 10^9 CFU/gm min)	12.57 (03.39)^{bc}	14.59 (03.49)^{c}	13.58 (03.44)^{c}	33.69
T_3	*Lecanicillium lecanii* 10.00%WP (1×10^9 CFU/gm min)*	11.82 (03.23)^{bc}	15.67 (03.63)^{bc}	13.74 (03.43)^{c}	32.91
T_4	NSKE 5%	12.48 (03.23)^{bc}	15.55 (03.59)^{bc}	14.01 (03.48)^{c}	31.59
T_5	Garlic extract 5%	10.83 (03.11)^{c}	14.33 (03.44)^{c}	12.58 (03.27)^{c}	38.57
T_6	Spinosad 45SC @ 0.016%	8.34 (02.55)^{d}	7.33 (02.45)^{d}	7.84 (02.50)^{d}	61.72
T_7	Plain water@ 500lit.ha^{-1}	13.48 (03.49)^{b}	20.43 (04.20)^{ab}	16.95 (03.85)^{b}	17.24
T_8	Control	16.22 (03.92)^{a}	24.74 (04.65)^{a}	20.48 (04.29)^{a}	-
CD 5%		00.30	00.66	00.36	-
SEm±		00.06	00.15	00.12	-

Reference-

1. Anonymous. Annual Report. Associated Agricultural Development Foundation; c1984. p. 95-98.
2. Diaz-Montano J, Fuchs M, Nault BA, Shelton AM. Onion Thrips (Thysanoptera: Thripidae) A global pest of increasing concern in onion, J of Economics Entomology. 2011b;104(1):1-13.
3. Jeyarani S, Karuppuchamy P. Bioefficacy of neem and Bt against pod borer, *Helicoverpa armigera* in chickpea, Journal of Biopesticides. 4(1):87.
4. Kalola NA, Patel VN, Bhadani DJ. Efficacy of different insecticides on onion thrips. Journal of Entomology and Zoology Studies. 2017;5(6):1505-1509.
5. Kumar NK, Veeregowda R, Sriniwas Rao E, Moorthy, KPN. Response of onion genotype for thrips, *T. tabaci* L. resistance. Proceeding of the second National Symposium on IPM in Horticultural crops New Molecule Pesticide, Biopesticide, Bagalore, India; c2001. p.17-19.
6. Prema MS, Ganapathy N, Renukadevi P, Mohan Kumar S, Kennedy JS. Efficacy of different botanical extract on *Thrips palmi* in cotton. Journal of Pharmacognosy and Phytochemistry. 2018;7(2):2824-2829.
7. Visalakshy G, Krishnamoorthy A. Comparative field efficacy of various entomopathogenic fungi against *Thrips tabaci*: Prospects for organic production of onion in India; c2012. DOI: 10.17660/ActaHortic.2012.933.56.