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Bioefficacy of insecticides against onion thrips (*Thrips tabaci* Lindeman)

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Abstract
Field experiments were undertaken at the Department of Agril. Entomology, Post Graduate Institute, MPKV, Rahuri, India to study bioefficacy of Basil oil *(Ocimum tenuiflomm* syn. *O. sanctum)* (0.2%), geranium oil (0.2%) along with commonly used synthetic insecticides *viz.*, fipronil 5 SC (0.005%) profenophos 50 EC (0.05%), acephate 75 SP @ (0.075%), N.S.E (4%) and dimethoate @ (0.06%) against onion thrips, *Thrips tabaci* Lind, during 2013-14 and 2014-15. The data revealed that fipronil 0.005 per cent excelled over all other treatments and was effective in controlling thrips population.

Keywords: *Geranium*, neem, *Ocimum*, onion thrips, *Thrips tabaci*

Introduction
Onion, thrips, *Thrips tabaci* Lindeman has been identified as a pest of national importance in India. The pest is active throughout the year and found on onion and garlic from November to May. The infested leaves get twisted and develop white patches. The crop may suffer heavy losses even up to 50 per cent (Rahman & Batra, 1945) [10]. However, they are effectively controlled by using synthetic insecticides other alternative strategies are also adopted for managing this pest. Neem Seed Kernel Extract (N.S.K.E) was found effective against *T. tabaci* on onion Vijayalakshmi *et al.* (1995) [13], Krishna Kumar *et al.* (2008) [6]. Besides, these essential oils are also finding increased attention as alternatives to the use of synthetic insecticides in recent years, Isman (2000) [4]. Krishna Moorthy *et al.* (2013) [7] reported that fipronil was most effective treatment in reducing thrips population with increased yield, also *basil* and *Geranium* oil significantly reduced pest incidence. Therefore, field experiments were conducted to test the bio-efficacy of the N.S.E and essential oils of *Basil, Ocimum tenuiflorum* (syn. *O. sanctum)* commonly called as *Tulsi*, and scented *Geranium* (*Pelargonium graveolens*) against onion thnps during *(summer)* and 2014-15 *(late kharif).* The results of the two trials are reported here.

Materials and methods
The field experiment on bioefficacy of newer insecticides against thrips on onion, was conducted at Research Farm of the Department of Agricultural Entomology, Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth Rahuri, Dist. Ahmednagar, Maharashtra during 2013-14 *(summer)* and 2014-15 *(late-kharif).* Onion variety N-2-4-1 was transplanted in flat beds at 15 cm × 10 cm distance during 2013-14 and 2014-15 respectively.
During first season, first spray was given at 35 days after transplanting (DAT) and during the second season spray was given only after 45 DAT. Sprays were given at 10 days interval, three times during 2013-14 and 2014-15. Before spraying, a commercially available sticker (Sandovit @ 0.5 ml/lit.) was added in spray fluid in spray tank. In case of oils, soap was used as emulsifier. The pulverised neem seed powder 40 g was soaked in 200 ml water overnight, filtered through double layered muslin cloth and volume was made to one liter to prepare 4 per cent solution for spraying. Oils were supplied by M/s. Samartha Aromatics, Mumbai.
The experiment design was Randomized Block Design (RBD) with three replications. Observations were recorded by using the non-destructive method by carefully examining the inner leaf sheaths and growing parts of the plants. For this purpose, 10 plants were selected in random in each plot and carefully observed. Yield of onion bulbs was recorded at the time of harvesting from each treatment plot and then computed to yield per hectare. The data on average survival population of thrips were transformed into square root values ($x + 0.5$) and then data were subjected to statistical analysis as suggested by Panse and Sukhatme (1985) [8].

Results And Discussion
The-pest- incidence under different treatments and corresponding yield during the two years

are provided in Tables 1**,** 2 and 3**.** During both years, the results indicated that fipronil was the best treatment recorded least thrips population. The treatments geranium oil and NSE was at par with each other during all three sprays. Considering the mean survival of thrips population after first spray, fipronil and profenophos recorded 8.23 thrips/plant, while basil oil recorded 8.78 thrips/plant which were found to be at par with each other. During second and third spray profenophos, basil oil and dimethoate were found to be at par with each other. As far as yield is considered fipronil recorded highest yield (22.44 t/ha). It was next followed by acephate, dimethoate and profenophos. However, basil oil, geranium oil and NSE treated plot recorded 20.80, 18.80 and 18.00 t/ha respectively.

The results of year 2014-15 revealed that, in all three sprays, fipronil proved to be the excellent treatment against *T. tabaci* by recording least population of thrips and highest yield (25.03 t/ha) along with highest cost benefit ratio. By considering the mean survival of thrips population after first spray acephate 0.075 per cent was found to be the next effective treatment in controlling onion thrips with 4.40 thrips/plant and recorded yield of 24.00 t/ha and was at par with dimethoate which recorded 4.93 thrips/plant. Basil oil and profenophos were at par with each other during second and third spray. Geranium oil and NSE were also effective in controlling thrips and increasing yield as compared to control and recorded yield 20.71 and 19.00 t/ha, respectively.

The effectiveness of fipronil against onion thrips was also reported by Sule (2006) [11], Hosamani *et al*. (2011) [3] and Krishna Moorthy *etal.* (2013) [7]. Pandey *et al*. (2013) found that fipronil 5 SC recorded the lowest thrips population with highest cost benefit ratio and increased the yield of *rabi* onion which supports the present findings.

In present studies, acephate 0.075 per cent was found to be the next effective treatment against *T. tabaci* which is in agreement with Krishna Moorthy *et al*. (2013) [7] who concluded that acephate 0.075 per cent recorded numerically low population of thrips. Khaliq *et al*. (2014) [5] also reported that acephate was the most effective synthetic insecticide against onion thrips.

The treatment, dimethoate 0.06 per cent was next in the order of effectiveness. Similar results in respect of effectiveness of this insecticide against *T. tabaci* was obtained by Zaman (1989) [14] and Chandramohan and Nanjan (1993) [2] who revealed that dimethoate was most effective against thrips.

Besides chemicals, basil oil 0.2 per cent and geranium oil 0.2 per cent were also effective in reducing onion thrips. The effectiveness of basil oil 0.2 per cent and geranium oil 0.2 per cent against onion thrips was earlier documented by Krishna Moorthy *et al.* (2013) [7]. These findings lend support to the present findings.

In the present investigation, N.S.E. 4 per cent was found to be least effective against *T. tabaci* in onion. These results are in agreement with Suresh *et al.* (2006) [12], Ambekar and Nayakwadi (2008) [1] and Pokharkar *et al.* (2011) [9] who reported that the neem was found less effective against onion thrips.

Present study has shown that fipronil was the most effective treatment in controlling thrips and in recording highest yield of onion bulbs. Basil oil, geranium oil and neem products like NSE can also be used for effective control of thnps. Further essenyial oils like *Basil* and *Geranium* also have good potential as components in thrips IPM programmes.

Table 1: Bioefficacy of insecticides against onion thrips (*Thrips tabaci* Lindeman) (2013-14)

Sr. No.	Treatment	Conc.	Nymphs/plant						Mean Per cent reduction over control	Nymphs/plant					Mean Per cent reduction over control	Nymphs/plant					Mean Per cent reduction over control
			Precount	1 DAS	3 DAS	5 DAS	10 DAS	Mean		1 DAS	3 DAS	5 DAS	10 DAS	Mean		1 DAS	3 DAS	5 DAS	10 DAS	Mean	
1	Profenophos 50 EC	0.05%	21.30 (4.67)	4.90 (2.32)	6.20 (2.59)	9.60 (3.18)	12.20 (3.56)	8.23 (2.95)	63.39	5.40 (2.43)	6.00 (2.55)	7.10 (2.76)	10.60 (3.33)	7.28 (2.79)	71.82	2.60 (1.76)	3.60 (2.02)	5.90 (2.53)	9.00 (3.08)	5.28 (2.40)	81.11
2	Fipronil 5 SC	0.005%	22.20 (4.76)	2.60 (1.76)	3.00 (1.87)	5.40 (2.43)	10.20 (3.27)	5.30 (2.41)	76.42	1.30 (1.33)	1.90 (1.55)	4.00 (2.12)	8.30 (2.97)	3.88 (2.09)	84.98	0.10 (0.77)	1.80 (1.52)	3.60 (2.02)	7.00 (2.74)	3.13 (1.90)	88.80
3	Acephate 75 SP	0.075%	22.70 (4.82)	4.00 (2.12)	5.40 (2.43)	8.10 (2.93)	11.00 (3.39)	7.13 (2.76)	68.28	3.00 (1.87)	3.20 (1.92)	5.20 (2.39)	8.90 (3.07)	5.08 (2.36)	80.33	1.20 (1.30)	2.60 (1.76)	4.70 (2.28)	8.40 (2.98)	4.23 (2.17)	84.87
4	Dimethoate 30 EC	0.06%	21.50 (4.69)	4.10 (2.14)	5.80 (2.51)	8.30 (2.96)	11.40 (3.45)	7.40 (2.81)	67.08	4.10 (2.14)	4.80 (2.30)	7.50 (2.83)	11.00 (3.39)	6.85 (2.71)	73.48	2.40 (1.70)	2.80 (1.82)	5.40 (2.43)	9.20 (3.11)	4.95 (2.33)	82.29
5	Basil oil	0.20%	21.50 (4.69)	6.00 (2.55)	6.90 (2.72)	9.80 (3.21)	12.40 (3.59)	8.78 (3.05)	60.94	5.70 (2.49)	6.30 (2.61)	7.90 (2.89)	11.10 (3.41)	7.75 (2.87)	70.00	3.80 (2.07)	4.00 (2.12)	6.10 (2.57)	9.60 (3.17)	5.88 (2.52)	78.96
6	Geranium oil	0.20%	22.00 (4.74)	6.80 (2.70)	8.30 (2.96)	10.60 (3.33)	14.00 (3.81)	9.93 (3.23)	55.83	5.90 (2.53)	7.10 (2.76)	8.90 (3.07)	12.00 (3.53)	8.50 (3.00)	67.09	4.40 (2.21)	4.60 (2.26)	6.00 (2.54)	10.30 (3.29)	6.33 (2.61)	77.35
7	N.S.E.	4.00%	21.60 (4.70)	7.30 (2.79)	8.50 (3.00)	11.10 (3.41)	13.00 (3.67)	9.98 (3.24)	55.60	6.60 (2.66)	7.70 (2.85)	9.50 (3.16)	12.80 (3.64)	9.13 (3.10)	64.65	5.00 (2.34)	5.70 (2.49)	7.80 (2.88)	10.80 (3.36)	7.33 (2.80)	73.77
8	Untreated control		21.10 (4.58)	21.40 (4.68)	22.00 (4.74)	22.50 (4.80)	24.00 (4.95)	22.48 (4.79)		25.00 (5.05)	25.60 (5.11)	25.90 (5.13)	26.80 (5.21)	25.83 (5.13)		27.80 (5.31)	28.10 (5.35)	27.60 (5.30)	28.30 (5.36)	27.95 (5.33)	
	S.E.±		0.19	0.05	0.06	0.06	0.07	0.03		0.07	0.06	0.08	0.11	0.05		0.09	0.07	0.08	0.06	0.09	
	C.D. at 5%		NS	0.15	0.18	0.19	0.22	0.09		0.21	0.19	0.24	0.35	0.16		0.27	0.21	0.25	0.18	0.27	

*Figures in parenthesis are ($\sqrt{x + 0.5}$) transformed value
DAS- Days after spraying
NS – Nonsignificant

Table 2: Bioefficacy of insectcicdes against onion thrips (*Thrips tabaci* Lindeman) (2014-15)

Sr. No.	Treatment	Conc.	Nymphs/plant						Mean Per cent reduction over control	Nymphs/plant					Mean Per cent reduction over control	Nymphs/plant					Mean Per cent reduction over control
			Precount	1 DAS	3 DAS	5 DAS	10 DAS	Mean		1 DAS	3 DAS	5 DAS	10 DAS	Mean		1 DAS	3 DAS	5 DAS	10 DAS	Mean	
1	Profenophos50 EC	0.05%	17.80 (4.28)	3.80 (2.07)	4.10 (2.14)	5.60 (2.47)	8.50 (3.00)	5.50 (2.45)	73.37	3.20 (1.92)	3.80 (2.07)	5.30 (2.41)	7.00 (2.74)	4.83 (2.31)	79.33	2.40 (1.68)	3.30 (1.95)	3.70 (2.05)	5.60 (2.47)	3.75 (2.06)	85.63
2	Fipronil5 SC	0.005%	15.90 (4.05)	0.50 (0.99)	0.90 (1.17)	3.90 (2.10)	5.90 (2.53)	2.80 (1.82)	86.44	0.30 (0.89)	0.60 (1.05)	1.80 (1.51)	3.70 (2.04)	1.60 (1.45)	93.15	0.10 (0.77)	0.60 (1.04)	1.40 (1.37)	2.40 (1.70)	1.13 (1.27)	95.67
3	Acephate 75 SP	0.075%	19.70 (4.48)	1.80 (1.51)	3.20 (1.92)	5.00 (2.33)	7.60 (2.85)	4.40 (2.21)	78.69	1.40 (1.37)	2.20 (1.64)	3.00 (1.87)	6.60 (2.66)	3.30 (1.95)	85.88	1.00 (1.22)	1.40 (1.38)	2.40 (1.69)	4.80 (2.30)	2.40 (1.70)	90.80
4	Dimethoate30 EC	0.06%	16.00 (4.06)	2.00 (1.58)	3.30 (1.95)	5.90 (2.53)	8.50 (3.00)	4.93 (2.33)	76.13	2.00 (1.58)	2.60 (1.76)	4.80 (2.30)	7.60 (2.84)	4.25 (2.18)	81.81	1.30 (1.34)	1.80 (1.52)	4.30 (2.19)	6.70 (2.68)	3.53 (2.01)	86.47
5	Basil oil	0.20%	19.40 (4.46)	5.00 (2.34)	5.70 (2.49)	7.60 (2.85)	10.50 (3.32)	7.20 (2.77)	65.13	4.50 (2.23)	5.20 (2.39)	6.60 (2.66)	8.00 (2.91)	6.08 (2.56)	73.98	2.60 (1.76)	2.90 (1.84)	5.30 (2.41)	7.10 (2.75)	4.48 (2.23)	82.83
6	Geranium oil	0.20%	16.70 (4.14)	4.80 (2.30)	6.80 (2.70)	8.40 (2.98)	13.00 (3.67)	8.25 (2.96)	60.04	5.50 (2.44)	6.00 (2.55)	7.40 (2.82)	9.80 (3.21)	7.18 (2.77)	69.28	3.50 (2.00)	4.00 (2.12)	6.20 (2.59)	8.20 (2.95)	5.48 (2.44)	79.00
7	N.S.E.	4.00%	18.80 (4.39)	6.10 (2.56)	7.30 (2.79)	9.80 (3.21)	12.30 (3.58)	8.88 (3.06)	57.00	5.20 (2.39)	6.40 (2.63)	8.20 (2.95)	10.00 (3.24)	7.45 (2.82)	68.13	4.70 (2.28)	5.40 (2.43)	6.70 (2.68)	7.60 (2.85)	6.10 (2.57)	76.62
8	Untreated control		19.00 (4.42)	19.90 (4.52)	20.10 (4.54)	21.00 (4.64)	21.60 (4.70)	20.65 (4.60)		22.80 (4.83)	23.07 (4.85)	23.60 (4.91)	24.00 (4.95)	23.37 (4.88)		25.00 (5.04)	25.80 (5.13)	26.20 (5.17)	27.30 (5.27)	26.09 (5.16)	
	S.E.±		0.12	0.07	0.09	0.08	0.05	0.04		0.07	0.05	0.06	0.07	0.06							
	C.D. at 5%		NS	0.22	0.27	0.24	0.15	0.12		0.21	0.16	0.18	0.21	0.19							

Table 3: Influence of different insectcicdes and oils on yield of the onion (2013-14 and 2014-15)

Treatment	Conc.	Yield		Average yield(t/ha)	Additional produce over control (t/ha)	Additional incomeover control (Rs.)	Cost of insecticides+ labour charges (Rs.)	Net profit(Rs.)	ICBR
		2013-14	2014-15						
Profenophos 50 EC	0.05%	20.10	22.00	21.00	6.13	61300	2925	58375	1:19.96
Fipronil5 SC	0.005 %	22.44	25.03	23.74	8.87	88700	3225	85475	1:26.50
Acephate 75 SP	0.075 %	21.90	24.00	22.92	8.04	80400	2925	77475	1:26.49
Dimethoate 30 EC	0.06%	20.58	23.33	21.92	7.05	70500	3000	67500	1:22.50
Basil oil	0.20%	20.08	21.89	20.95	6.07	60700	19800	40900	1:2.07
Geranium oil	0.20%	18.80	22.76	20.71	5.83	58300	22800	35500	1:1.56
N.S.E.	4.00%	18.00	20.10	19.00	4.13	41300	2100	39200	1:18.67
Untreated control		14.05	15.83	14.87					

Labour charges : Rs 1800/-(for three sprays)
Rate of onion- Rs 10,000 per tonne
Cost of insecticides/litre: 1) Profenophos 50 EC Rs.750/- 5) Basil oil 0.20%Rs. 6000/-
2) Fipronil 5 SC Rs. 950/- 6) Geranium oil 0.20% Rs. 7000/-
3) Acephate 75 SP Rs. 750/- 7)N.S.E. 4.00%Rs. 300/-
4) Dimethoate 30 ECRs. 400/-

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