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Management of onion thrips by sequential strategy

SA Pawar, CS Patil and MN Bhalekar

Abstract
Field experiments were carried out during *rabi* season for three years of (2016-17, 2017-18 and 2018-19) for the management of onion thrips by sequential strategy. In the sequential strategy the insecticides consists of dimethoate 30 EC @ 200, lambda-cyhalothrin 5 EC @ 15 and quinalphos 25 EC @ 300 g a.i./ha; bipesticide: *Metarhizium anisopliae* 1.15 wp @ 5 g and botanical: NSE 5% and these were tested alternatively for control of onion thrips with untreated control. Among the sequential strategy, lambda-cyhalothrin 5 EC @ 15 g a.i./ha, followed by *Metarhizium anisopliae* 1.15 wp @ 5 g/l. followed by NSE 5% found most effective for control of thrips of onion at 3rd, 7th and 14th days after spray and this strategy recorded av. survival of thrips in the range 6.67-16.67 thrips/plant as against 28.67-31.33 thrips/plant in untreated control showing 1.2 rating of white patches on leaves. There was remarkable impact of this sequential strategy in on the yield of onion *i.e.* 261.73 q/ha marketable onion bulbs as against 160.65 q/ha in untreated control with ICBR ratio 1:17.38 and B:C ratio 1:1.59.

Keywords: *Allium cepa*, *Thrips tabaci* L., sequential strategy

1. Introduction
Onion (*Allium cepa* L.) is the most important vegetable crop in India and ranked second in its importance as a vegetable in tropics. Maharashtra is the largest producer of onion in the country. There are various factors responsible for reducing the crop yield of which insect pest is one which cause considerable loss in the yield of onion. According to Hill (1983) [7], in sect pests attacking the onion are onion thrips: *Thrips tabaci* Lindeman, Groundnut thrips: *Caliothrips Indus* Baganall, Cutworm: *Agrotis ypsilon* Roth and Leaf miner: *Liriomyza* trifolii Burgess. Among the pests of onion, thrips (*Thrips tabaci* L.) is the major injurious pest and reported to be most serious on onion. It causes considuerble losses in quality as well as yield (Mote, 1977) [8]. Thrips cause 40 to 60 per cent foliage injury and 10 to 20 perent yield losses annually (Hajdu and Nagyimre, 1984) [5]. Onion thrips lacerate the tissues and suck the oozing cell sap resulting in blightening of the whole plant (Ayyar, 1940) [2].
At present, onion thrips are being managed by several insecticides like imidacloprid 0.002% and carbosulfan 0.025% (Anonymous, 2003) [1]. Shitole *et al.*, (2002) [11] evaluated fipronil, lambda cyhalothrin and imidacloprid against onion thrips and reported that these insecticides did not show encouraging results. As development of insect resistance against insecticide has been reported from various parts of the world, so it is essential to screen insecticides, biopesticide and botanical insecticides in sequential strategy for their efficacy against onion thrips. The present investigation were carried out to find out effective sequential strategy for the control of onion thrips so as to avoid the economic losses caused by this pest in *Rabi* season.

2. Materials and Methods
A field trial with six sequential strategy alongwith untreated control (Table 1) were carried out in Randomized Block Design with three replications, during *Rabi* 2016-17, 2017-18 and 2018-19 at All India Coordinated Research Project on Vegetable Crops at MPKV, Rahuri for the management of onion thrips. Cv. N-2-4-1 was transplanted every year in the first week of January in a plot size 3.0 x 2.0 m. with plant spacing 15 x 10 cm. In each sequential strategy, three sprays were applied at fortnight interval by using 500 lit. of water per hector with the help of hand operated knapsack sprayer as the thrips population reached to ETL. The treatments are illustrated in (Table 1). The evaluated performance of each treatment was assessed by recording nymphs of thrips on five plants from each treatment plot, which were selected randomly.

The observations were recorded a day before treatment as per count and then at 3rd, 7th and 14th days after each spray as post counts. Every year harvesting was done in between 120-130 days after transplanting at maturity. The yield of each plot (kg/plot) was converted to quintal per hectare. The data on average survival population of pest was translated in to sequare root formation $\sqrt{x+0.5}$ and then subjected to statistical analysis as suggested by Panse and Sukhatme (1989) [9]. Finally, Incremental Cost Benefit Ratio (ICBR) and B:C ratio was worked out for each treatment.

3. Results and Discussions

It is revealed from the pooled data (Table-1-6), that all the sequential strategy treatments were found significantly superior over untreated control for control of thrips on onion.

The treatment with sequential strategy (T_3) Lambda-cyhalothrin 5 EC @ 15 g a.i./ha, followed by *Metarhizium anisopliae* 1.15% WP @ 5 g/l followed by NSE 5% was most superior for control of thrips in onion at 3rd, 7th and 14th days after spray and this strategy recorded av. survival thrips population in the range (6.67-16.67 thrips/plant) as against (28.67-31.33 thrips/plant) in untreated control showing 1.2 rating of white patches on leaves.

However, the sequential strategy (T_1) with dimethoate 30 EC @ 200 g a.i./ha, followed by *Metarhizium anisopliae* 1.15% WP @ 5 g/l followed by NSE 5% was found at par with sequential strategy (T_3) and recorded the av. survival population of thrips in the range (7.67-18.11 thrips/plant) and the intensity of white patches due to feeding of thrips was shown in the rating 1.5.

The sequential strategy (T_3) with lambda-cyhalothrin 5 EC @ 15 g a.i./ha, followed by *Metarhizium anisopliae* 1.15% WP @ 5 g/l followed by NSE 5% was recorded highest *i.e.* (261.73 q/ha) marketable yield of onion bulbs as against (160.65 q/ha) in untreated control with ICBR 1:17.38 and B:C ratio 1.59. However, the sequential strategy (T_1) with dimethoate 30 EC @ 200 g a.i./ha, followed by *Metarhizium anisopliae* 1.15% WP @ 5 g/l followed by NSE 5% and strategy (T_4) with quinalphos 25 EC @ 25 EC @ 300 g a.i./ha, followed by *Metarhizium anisopliae* 1.15% WP @ 5 g/l followed by NSE 5% were found equally effective with this treatment and recorded 256.90 and 252.90 q/ha yield of onion bulbs with ICBR 1:16.08, 1:14.70 and B:C ratio 1:1.57, 1:1.54, respectively.

Among the sequential strategy, lambda-cyhalothrin 5 EC @ 15 g a.i./ha, followed by *Metarhizium anisopliae* 1.15% WP @ 5 g/l followed by NSE 5% (T_3) was found most superior for control of onion thrips at 3rd, 7th and 14th days after spray and this strategy recorded av. survival of thrips in the range 6.67-16.67 thrips/plant as against 28.67-31.33 thrips/plant in untreated control showing 1.2 rating of white patches on leaves and higher (261.73 q/ha) yield of onion bulbs during the period of investigation.

The insecticides, dimethoate 30 EC @ 200 g a.i./ha and lambda-cyhalothrin 5 EC @ 15 g a.i./ha were noticed relative effective in reducing the thrips population in the present investigation. These observations are in confirmatory with those of Bocak (1995) [3] who reported that lambda-cyhalothrin 5 EC @ 12.5 g a.i./ha reduced the thrips population significantly. Goncalves and Guimaraes (1995) [4] reported that lambda-cyhalothrin 5 g a.i./ha at 7th days interval given better results. Hazarea *et al.*, (1999) [6] evaluated the efficacy of lambda-cyhalothrin, endosulfan, imidacloprid and profenofos against thrips and recorded 61.6, 86.6, 51.2 and 97.6% mortality of the pest, respectively after three days of insecticidal application.

Tadele and Mulugeta (2014) [13] evaluated the effect of insecticides and botanical (*Azadirachta indica* L.) on onion thrips the fresh leaf extracts with foliar application gave promisning mortality rate when used as alternative control measures for onion thrips. Singh *et al.*, (2011) [12] tested different entomopathogens for the management of onion thrips. Among the entomopathogens, *Metarhizium anisopliae* @ 0.5% was found most effective in reducing thrips population and increasing gross yield (221 q/ha) followed by *V. lecanii* @ 0.4% (215 q/ha). Salunkhe (2018) [10] evaluated the biopesticides *viz.*; *Lecanicillium lecanii*, *Metarhizium anisopliae* and *Beauveria bassiana* against onion thrips and found effective next to other chemical pesticides. Among these three biopesticides *L. Lecanii* @ 5 g/lit. was most effective followed by *M. anisopliae* @ 5 g/lit. and *B. bassiana* @ 5 g/lit.

Thus, the results documented by earlier workers in respect of insecticides, biopesticides and botanicals used for reducing the population of onion thrips and increase in yield of onion bulbs are confirmatory with the study of sequential strategy results and are agreement with present findings.

Table 1: Management of onion thrips by sequential strategy (2016-17, 2017-18 & 2018-19).

Sr. No.	Treatments	Pre count	Av. Survival population of thrips/plant			Infestation of white patches	Yield (q/ha)	ICBR	B:C ratio
			3 DAS	7 DAS	14 DAS				
1	Dimethoate 30 EC @ 200 g a.i./ha, fb *Metarhizium anisopliae* 1.15 WP @ 5 g/lit, fb NSE 5%.	37.33 (6.15)	18.11 (4.31)	7.67 (2.85)	9.67 (3.18)	1.5	256.90	17.25	1:1.57
2	NSE 5%, fb *Metarhizium anisopliae* 1.15 WP @ 5 g/lit, fb lambda-cyhalothrin 5 EC @ 15 g a.i./ha.	38.67 (6.26)	22.00 (4.73)	12.00 (3.51)	13.67 (3.75)	2.2	235.40	13.54	1:1.43
3	Lambda-cyhalothrin 5 EC @ 15 g a.i./ha, fb *Metarhizium anisopliae* 1.15 WP @ 5 g/lit, fb NSE 5%.	38.00 (6.20)	16.67 (4.14)	6.67 (2.67)	8.44 (2.98)	1.2	261.73	18.66	1:1.59
4	Quinalphos 25 EC @ 25 EC @ 300 g a.i./ha, fb *Metarhizium anisopliae* 1.15 WP @ 5 g/lit, fb NSE 5%.	38.33 (6.23)	19.44 (4.46)	8.11 (2.93)	10.67 (3.34)	2.0	252.90	15.73	1:1.54
5	Foliar spray of *Metarhizium anisopliae 1.15 WP* @ 5 g/lit, fb Soil application of *Metarhizium anisopliae* 1.15 WP @ 25 kg/ha, fb NSE 5%.	37.00 (6.12)	22.22 (4.76)	11.67 (3.47)	14.11 (3.81)	2.3	231.74	7.14	1:1.41
6	Soil application of *Metarhizium anisopliae* 1.15	37.33	23.11	13.89	16.11	2.6	225.80	6.46	1:1.38

	WP @ 25 kg/ha, fb NSE 5%, fb Foliar spray of *Metarhizium anisopliae* 1.15 WP @ 5 g/lit.	(6.15)	(4.85)	(3.78)	(4.07)				
7	Untreated control	37.33 (6.15)	28.67 (5.39)	29.44 (5.47)	31.33 (5.64)	3.7	160.65	--	1:0.98
	S.E. ±	0.05	0.07	0.08	0.07	--	7.33	--	--
	C.D. 5%	N.S.	0.21	0.25	0.21	--	22.82	--	--

* Figures in parentheses are $\sqrt{x+0.5}$ transformed values.
Used sticker @ 1 ml/lit. water for each spray.

Table 2: Cost of onion bulbs Rs. 1000/q

Sr. No.	Cost of insecticides	Quantity required for sprays	Quantity required for sprays (Rs)	Application charges (Rs)	Total cost (Rs)
1	Dimethoate 30 EC @ Rs. 450/lit	650 ml.	300	4350	5635
	M. anisopliae @ Rs.150/kg	2.5 kg	375		
	NSE 5% @ Rs.10/kg	25 kg	250		
	Sticker @ 240/lit.	1.5 lit	360		
2	NSE 5% @ Rs.10/kg	25 kg	250	4350	5500
	M. anisopliae @ Rs.150/kg	2.5 kg	375		
	Lambdacyhalothrin 5 EC @ Rs.550/lit	300 ml.	165		
	Sticker @ 240/lit.	1.5 lit	360		
3	Lambdacyhalothrin 5 EC @ Rs.550/lit	300 ml.	165	4350	5500
	M. anisopliae @ Rs.150/kg	2.5 kg	375		
	NSE 5% @ Rs.10/kg	25 kg	250		
	Sticker @ 240/lit.	1.5 lit	360		
4	Quinalphos 25 EC @ Rs.450/lit	1.2 lit.	540	4350	5875
	M. anisopliae @ Rs.150/kg	2.5 kg	375		
	NSE 5% @ Rs.10/kg	25 kg	250		
	Sticker @ 240/lit.	1.5 lit	360		
5	*M. anisopliae* @ Rs.150/kg	2.5 kg	375	4350	9085
	M. anisopliae @ Rs.150/kg	25 kg	3750		
	NSE 5% @ Rs.10/kg	25 kg	250		
	Sticker @ 240/lit.	1.5 lit	360		
6	*M. anisopliae* @ Rs.150/kg	25 kg	3750	4350	9085
	NSE 5% @ Rs.10/kg	25 kg	250		
	M. anisopliae @ Rs.150/kg	2.5 kg	375		
	Sticker @ 240/lit.	1.5 lit	360		

* Used sticker @ 1 ml/lit. water each spray.

Table 3: Incremental cost benefit ratio

Sr. No.	Yield q/ha	Additional yield over control (q)	Additional income (Rs.)	Additional cost Rs.	Gross yield (Rs./ha)	Net profitable income Rs.	ICBR	B:C ratio
1	256.90	96.25	96250	5635	256900	90615	16.08	1.57
2	235.40	74.75	74750	5500	234000	69250	12.59	1.43
3	261.73	101.08	101080	5500	261730	95580	17.38	1.59
4	252.90	92.25	92250	5875	252900	86375	14.70	1.54
5	231.74	71.09	71090	9085	231740	62005	6.82	1.41
6	225.80	65.15	65150	9085	225800	56065	6.17	1.38
7	160.65	--	--	--	160650	--	--	0.98

* Cost of cultivation Rs.1,64,000/ha.

Table 4: Management of onion thrips by sequential strategy (2016-17).

Sr. No.	Treatments	Pre count	Av. Survival population of thrips/plant			Infestation of white patches	Yield (q/ha)
			3 DAS	7 DAS	14 DAS		
1	Dimethoate 30 EC @ 200 g a.i./ha, fb *Metarhizium anisopliae* 1.15 WP @ 5 g/lit, fb NSE 5%.	34.00 (5.87)	16.00 (4.05)	6.00 (2.54)	8.67 (3.02)	1.6	258.73
2	NSE 5%, fb *Metarhizium anisopliae* 1.15 WP @ 5 g/lit, fb lambda-cyhalothrin 5 EC @ 15 g a.i./ha.	33.00 (5.79)	18.33 (4.34)	8.00 (2.91)	10.00 (3.24)	2.0	235.40
3	Lambda-cyhalothrin 5 EC @ 15 g a.i./ha, fb *Metarhizium anisopliae* 1.15 WP @ 5 g/lit, fb NSE 5%.	35.00 (5.96)	15.00 (3.93)	5.33 (2.41)	7.00 (2.73)	1.4	262.06
4	Quinalphos 25 EC @ 25 EC @ 300 g a.i./ha, fb *Metarhizium anisopliae* 1.15 WP @ 5 g/lit, fb NSE 5%.	34.67 (5.93)	17.00 (4.18)	6.67 (2.68)	9.33 (3.13)	1.8	254.40
5	Foliar spray of *Metarhizium anisopliae 1.15 WP* @ 5 g/lit, fb Soil application of *Metarhizium anisopliae* 1.15 WP @ 25 kg/ha, fb NSE 5%.	33.33 (5.82)	19.67 (4.49)	9.00 (3.08)	11.67 (3.48)	2.0	232.07
6	Soil application of *Metarhizium anisopliae 1.15 WP* @ 25 kg/ha, fb NSE 5%, fb Foliar spray of *Metarhizium*	35.00 (5.96)	20.00 (4.53)	10.33 (3.29)	13.00 (3.67)	2.4	227.74

	anisopliae 1.15 WP @ 5 g/lit.						
7	Untreated control	33.33 (5.82)	25.00 (5.05)	26.33 (5.18)	28.00 (5.34)	4.0	161.60
	S.E. ±	0.07	0.12	0.10	0.33	--	8.16
	C.D. 5%	N.S.	0.37	0.30	5.32	--	25.15

* Figures in parentheses are $\sqrt{x+0.5}$ transformed values.
Used sticker @ 1 ml/lit. water for spray.

Table 5: Management of onion thrips by sequential strategy (2017-18)

Sr. No.	Treatments	Pre count	Av. Survival population of thrips/plant			Infestation of white patches	Yield (q/ha)
			3 DAS	7 DAS	14 DAS		
1	Dimethoate 30 EC @ 200 g a.i./ha, fb *Metarhizium anisopliae* 1.15 WP @ 5 g/lit, fb NSE 5%.	37.00 (6.12)	18.00 (4.30)*	7.67 (2.86)	10.00 (3.24)	1.5	254.90
2	NSE 5%, fb *Metarhizium anisopliae* 1.15 WP @ 5 g/lit, fb lambda-cyhalothrin 5 EC @ 15 g a.i./ha.	38.00 (6.20)	23.00 (4.84)	13.67 (3.76)	15.00 (3.93)	2.2	233.74
3	Lambda-cyhalothrin 5 EC @ 15 g a.i./ha, fb *Metarhizium anisopliae* 1.15 WP @ 5 g/lit, fb NSE 5%.	39.00 (6.28)	17.00 (4.18)	6.67 (2.67)	9.33 (3.13)	1.0	259.90
4	Quinalphos 25 EC @ 25 EC @ 300 g a.i./ha, fb *Metarhizium anisopliae* 1.15 WP @ 5 g/lit, fb NSE 5%.	38.33 (6.23)	19.00 (4.41)	8.00 (2.91)	10.33 (3.29)	2.0	251.07
5	Foliar spray of *Metarhizium anisopliae 1.15 WP* @ 5 g/lit, fb Soil application of *Metarhizium anisopliae* 1.15 WP @ 25 kg/ha, fb NSE 5%.	39.00 (6.28)	24.00 (4.95)	14.00 (3.81)	16.00 (4.06)	2.3	229.91
6	Soil application of *Metarhizium anisopliae 1.15 WP* @ 25 kg/ha, fb NSE 5%, fb Foliar spray of *Metarhizium anisopliae* 1.15 WP @ 5 g/lit.	37.67 (6.18)	24.33 (4.98)	15.00 (3.93)	17.33 (4.22)	2.6	223.74
7	Untreated control	38.00 (6.20)	29.33 (5.46)	30.00 (5.51)	32.00 (5.70)	3.7	158.27
	S.E. ±	0.09	0.10	0.09	0.06	--	8.80
	C.D. 5%	N.S.	0.31	0.27	0.20	--	26.10

Figures in parentheses are $\sqrt{x+0.5}$ transformed values.
Used sticker @ 1 ml/lit. water for spray.

Table 6: Management of onion thrips by sequential strategy 2018-19)

Sr. No.	Treatments	Pre count	Av. Survival population of thrips/plant			Infestation of white patches	Yield (q/ha)
			3 DAS	7 DAS	14 DAS		
1	Dimethoate 30 EC @ 200 g a.i./ha, fb *Metarhizium anisopliae* 1.15 WP @ 5 g/lit, fb NSE 5%.	41.00 (6.44)	19.33 (4.45)	9.00 (3.08)	11.33 (3.43)	1.4	257.06
2	NSE 5%, fb *Metarhizium anisopliae 1.15 WP* @ 5 g/lit, fb lambda-cyhalothrin 5 EC @ 15 g a.i./ha.	39.00 (6.28)	24.67 (5.00)	14.33 (3.84)	16.00 (4.06)	2.4	237.07
3	Lambda-cyhalothrin 5 EC @ 15 g a.i./ha, fb *Metarhizium anisopliae* 1.15 WP @ 5 g/lit, fb NSE 5%.	40.00 (6.36)	18.00 (4.29)	8.00 (2.91)	10.00 (3.24)	1.2	263.23
4	Quinalphos 25 EC @ 25 EC @ 300 g a.i./ha, fb *Metarhizium anisopliae* 1.15 WP @ 5 g/lit, fb NSE 5%.	42.00 (6.52)	20.00 (4.51)	9.33 (3.13)	12.00 (3.53)	2.2	253.23
5	Foliar spray of *Metarhizium anisopliae* 1.15 WP @ 5 g/lit, fb Soil application of *Metarhizium anisopliae* 1.15 WP @ 25 kg/ha, fb NSE 5%.	38.67 (6.26)	23.00 (4.54)	12.00 (3.53)	14.67 (3.89)	2.6	233.24
6	Soil application of *Metarhizium anisopliae* 1.15 WP @ 25 kg/ha, fb NSE 5%, fb Foliar spray of *Metarhizium anisopliae* 1.15 WP @ 5 g/lit.	39.33 (6.31)	25.00 (5.05)	16.33 (4.10)	18.00 (4.30)	2.8	225.91
7	Untreated control	40.00 (6.36)	31.67 (5.67)	32.00 (5.70)	34.00 (5.87)	3.4	162.10
	S.E. ±	0.07	0.16	0.12	0.10	--	7.66
	C.D. 5%	N.S.	0.49	0.36	0.31	--	23.66

* Figures in parentheses are $\sqrt{x+0.5}$ transformed values.
Used sticker @ 1 ml/lit. water for spray.

4. Conclusion

The present studies envisaged the use of sequential strategy, lambda-cyhalothrin 5 EC @ 15 g a.i./ha, followed by *Metarhizium anisopliae* 1.15 WP @ 5 g/l, followed by NSE 5% for the effective control of onion thrips with good marketable yield of onion bulbs (261.73 q/ha) with 1:17.38 ICBR and B:C ratio 1:1.59.

5. References

1. Anonymous. Evaluation of new insecticide against onion thrips and reduction of germplasm to (*T. tabaci* L.). Annual Report, DOGR, Rajgurunagar, Pune, Maharashtra 2003, 37-38.
2. Ayyar TVR. A hand book of Entomology Govt. Press Madras 1940, 240.
3. Bocak L. The efficacy of different insecticides against *T.*

tabaci on onion J Econ. Entomol. 1995; 22(3):73-75.
4. Goncalves PA, Guimaraes DR. Chemical control of *T. tabaci* in onion. Horticulture Brasileria. 1995; 13(1):28-31.
5. Hajdu J, Nagyimre. Control of onion foliage pests. Rev. of Appl. Entomol. (Series A): 1984; 73(1):902.
6. Hazarea AH, Shakel M, Khan T, Iqbal M, Khan S. Effects of chemical methods and botanical insecticides on onion thrips. *Thrips tabaci* L. in onion crop in Balochistan. Sarbad J. Agriculture. 1999; 15(6):619-625.
7. Hill DS. Tropical crops and their pest spectra. In Agricultural Insect Pests of the tropical and their control. Cambridge University Press, London 1983, 614.
8. Mote UN. Active and feeding period of onion thrips and proper time of application of endosulfan for their control. Veg.Sci. 1977; 5(2):143-144.
9. Panse VG, Sukhatme PV. Statistical methods for Agricultural workers, 4th Edition, ICAR, Publication New Delhi, 1989.
10. Salunkhe SA. Evaluation of different insecticides and biopesticides against thrips (*Thrips tabaci* L.) infesting onion. M.Sc. (Agri) Thesis submitted to Mahatma Phule Krishi Vidyapeeth, Rahuri. (Unpublished), 2018.
11. Shitole DM, Shankar G, Mithyantha MS. Evaluation of certain new insecticides against onion thrips (*T. tabaci* L.). Pestology. 2002; 26(2):49-52.
12. Singh BK, Pandey JG, Gupta RP, Verghese A. Efficacy of entomopathognic fungi for the management of onion thrips *Thrips tabaci* L. Pest Manag. Ecosyst. 2011; 17(2):92-98.
13. Tadele, Mulugeta N. Evaluation of insecticides and botanicals against onion thrips *Thrips tabaci* (L.). Entomol. Appl. Sci. Lett. 2014; 1(2):26-30.