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Integrated management of foliar diseases and thrips in onion seed production

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ABSTRACT

Stemphylium blight and thrips are the common problem in onion that affects the yield reduction in the Maharashtra region of India. So, the field trials were conducted on onion variety Agrifound Light Red during rabi 2017-18, 2018-19, and 2019-20 at Regional Research Station, NHRDF, Nashik, Maharashtra, for management of foliar diseases and thrips in onion seed crop through an integrated approach. The combined data of last three years trial revealed that soil application of Trichoderma viride + Pseudomonas fluorescens @ 5.0 kg/ha each at the time of bulb planting followed by combined and sequential spray of Fipronil @ 1ml/L+Chlorothalonil @ 2g/L at 45 days after planting, Carbosulphan 2ml/L+Propineb @2g/L at 60 DAP, Profenofos @ 1 ml/L+Mancozeb @ 2.5g/L at 75 DAP and Cypermethrin 1 ml/L+Carbendazim @ 1g/L at 90 DAP performed superior for integrated management in onion seed crop with lowest stemphylium blight intensity (7.29%), thrips population (31.11 nymphs/plant) and highest seed yield (8.81 q/ha).

Keywords: *Onion, Seed, Foliar Diseases, Stemphylium Blight, Thrips, Management, Incidence, Intensity, PGPR, Insecticides, Pesticides*

INTRODUCTION

Seed is an important component of crop production as well as productivity as the seeds interacts with the micro-environment around it and determines the health of the plant. If the environment is conducive and the seed is poor, production is likely to be affected. Seed quality is a crucial determining factor of yield and quality of onion bulb production.

Onion (*Allium cepa,* L) is one of the export-oriented bulbous vegetable crops grown in the country. India occupies the second position in onion production in the world; however, the productivity of onion is quite low in comparison to other countries. Onion bulb and seed crop suffer mainly from foliar diseases like stemphylium blight (*S.vesicarium*), purple blotch (*Alternaria porri*) and thrips (*Thrips tabaci*) [4],[3],[7],[8]. The chemical pesticides may affect the honey bees'activity as well as microbial biodiversity in the ecosystem. The association of thrips with purple blotch infection was reported on onion plants caused by *Alternaira porri*. The leaves of onion plant infested by thrips are more susceptible to infection by foliar pathogens viz, *Stemphyllum vesicarium* and *Alternaria porri* than uninfected plants and disease severity could be higher on onion. Scanty information is available on seed production of onion by approaching the integrated crop management by use of botanical products, bio and chemical pesticides, pesticides and planting of trap crop for management of thrips and foliar diseases. The resistance development by pathogens can be avoided through alternate spray of botanicals and chemical pesticides alongwith soil application of bio-pesticides. Botanicals like neem oil, neem cake, bio-pesticides such as *Trichoderma viride*, and *Pseudomonas fluorescens* have antagonistic capacity against plant pathogens as well as promote the plant growth and *Beauveria bassiana* used for thrips management. Many workers have reported that *Ps. fluorescens* help in induced systemic resistant, biological control of pathogens as well as improves the plant growth [2],[5]. Ganeshan and Kumar (2005) [1] reviewed the activities of *Ps. fluorescens* and stated that fluorescent Pseudomonas belongs to plant growth promoting rhizobacteria (PGPR), that play a major role in plant growth promotion, induced systemic resistant and biological control of pathogens. Marigold is an attractive trap crop to thrips. Trap cropping is the plants that are more attractive to certain pests than the target crop *i.e.* onion [6]. view of the above, the present study has been conducted to evaluate the combination of botanicals, bio and chemical pesticides, and trap crops for management of thrips and foliar diseases in onion seed crops under field conditions in *rabi* season at Nashik, Maharashtra.

MATERIALS AND METHODS

The trial was conducted at Regional Research Station, NHRDF, Nashik, Maharashtra in three consecutive years (2017-18, 2018-19 and 2019-20) on rabi onion seed crop variety Agrifound Light Red for integrated management of thrips and foliar diseases in seed crop of onion. Split Plot Design (SPD) was followed with 3 replications. The bed size was kept as 3.0m x 1.80m.

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The onion A-grade bulbs (45 to 55 mm diameter) were planted at 30 cm x 45 cm in the experimental plot. *T. viride+Ps. fluorescens* @ 5.0 kg/ha applied in soil as per treatments at the time of bulb planting. Twenty-five days old seedlings of marigold (variety-Indra) as trap crop transplanted on bunds at the beds at 30 cm distance (Plant to plant) simultaneously of bulb onion planting. A total of 4 sprays of botanicals/chemical-fungicide/chemical-insecticide/bio-pesticide were done as per the treatment schedule during the cropping period on the seed crop. The recommended agronomical and cultural practices will be performed in the experimental plots of onion seed crop. The data on thrips population (nymphs/plant), foliar disease incidence and intensity in treatments wise were recorded [13],[4],[7]. Disease scoring was done by using 0-5 scale and the intensity or Percent Disease Index was drawn [13]. The umbels were harvested as per seed maturity in April of every year. The umbels are kept in net bags and kept for 8 to 10 days of the same bag for sun drying of seed. The manual threshing was performed and the treatment wise onion seed yield. The data of three years are combined, analyzed and presented in Table 1 and 2.

Details of treatment:
(A)Trap crop (Main plot)
T_1-Marigold trap crop
T_2- No trap crop
(B) Application of bio-pesticides, chemical pesticides and botanical (Sub plot)

Treatments	Soil amendments	Spray schedule			
		1st spray (45 DAP)	2nd spray (60 DAP)	3rd spray (75 DAP)	4th spray (90 DAP)
S_1	Carbofuran @ 25kg/ha	Azadirachtin@ 4ml/L	Spinosad@0.3ml/L	*B.bassiana*@ 5g/L	Spinosad @0.3 ml/L
S_2	*T.viride+Ps.fluorescens* @5 kg/ha	Azadirachtin@ 4 ml/L	*T.viride*@ 5g/L	*Ps.fluorescens*@5g/L	*T.viride* @ 5g/L
S_3	*T.viride+Ps.fluorescens* @5kg/ha	Fipronil@1ml/L +Chlorothalonil@2g/L	Carbosulfan@2 ml/L+Antracol @2 g/L	Profenofos@1ml/L+Mancozeb@2.5 g/L	Cypermethrin@ 1ml/L+Carbendazim @1g/L
S_4	*T.viride+Ps.fluorescens* @5kg/ha	Spinosad@0.3ml/L+Nofungicide	Carbosulfan@2 ml/L+ Antracol @ 2 g/L	*B.bassiana*@5.g/L+No fungicide	Cypermethrin@1ml/L+Carbendazim@1g/L
S_5	No soil amendment & spray				

RESULTS AND DISCUSSION

Effect of bio-pesticides, pesticides, and botanicals on thrips, foliar disease and seed yield

The combined data presented in Table 1 revealed that the significantly lowest thrips population (60.79 nymphs/plant) at 45 DAP was recorded in S_1 (Soil application of Carbofuran @25 kg/ha + sequential spray of Azadirichtin @ 4.0ml/L at 45 DAP, Spinosad @ 0.3 ml/L. at 60 DAP, *B. bassiana* @ 5.0g/L at 75 DAP Spinosad @ 0.3 ml/L at 90 DAP and it was found at par with S_2 (Soil application of *T. viride+Ps. fluorescens* @ 5 kg/ha+ sequential spray of Azadirachtin @ 4.0 ml/L at 45 DAP, *T. viride* @ 5.0g/L at 60 DAP*Ps. fluorescens* @ 5.0g/L at 75 DAP, *T. viride* @ 5.0g/L at 90 DAP and S_4 (Soil application of *T. viride+Ps.fluorescens* @ 5 kg/ha+ sequential spray of Spinosad @ 0.3 ml/L at 45 DAP, Carbosulphan @ 2ml/L at 60 DAP. *B. bassiana* @ 5g/L at 75 DAP, Cypermethrin @ 1ml/L+ Carbendazim @ 1 g/L at 90 DAP. Thereafter, the lowest thrips population at 60 DAP (60.77 nymphs/plant), 75 DAP (39.03 nymphs/plant) and 90 DAP (31.02 nymphs/plant) were recorded in S_3 (Soil application of *T.viride+Ps.fluorescens* @ 5 kg/ha+sequential spray of Fipronil @ Iml/L+Chlorothalonil @ 2g/L at 45 DAP, Carbosulphan @ 2ml/L+Propineb @ 2g/L at 60 DAP, Profenofos @ 1 ml/L+Mancozeb @ 2.5g/L at 75 DAP, Cypermethrin @ 1 ml/L+Carbendazim @ 1g/L at 90 DAP) and it was found at par with S_4 at 75 as well as 90 DAP.

The lowest stemphylium blight intensity at 45 DAP (1.16%), 60 DAP (3.89%), 75 DAP (5.84%) and 90 DAP (8.07%), were recorded in S_3. The lowest stemphylium blight incidence at 45 DAP (14.44%), 60 DAP (32.22%). 75 DAP (47.78%) and 90 DAP (51.11%), were also recorded in S_3 and it was found at par with S_4 at 60, 75 and 90 DAP. The highest thrips population (532.15 nymphs/plant) at 75 DAP and stemphylium blight intensity (17.96%) with incidence (90.56%) at 90 DAP were recorded in S_5 (Untreated control). The highest onion seed yield (8.03 q/ha) was also recorded in S_3 however, the lowest seed yield (4.09 q/ha) was recorded in S_5 (Untreated control). Gupta *et.al*. (2021) [3] reported that the combined spray of different fungicide groups of insecticides performs better for the management of foliar diseases namely stemphylium blight and purple blotch in onion. Priya *et.al*. (2015) [9] reported that non- systemic and systemic fungicides control the foliar diseases of onion. Vijaya and Rahman (2004) [12] conducted a field experiment and found that fungicides effectively control the leaf blight disease of onion. Pathak *et. al*. (2020) [8] evaluated different insecticides for the management of onion thrips in Nashik conditions of Maharashtra and reported that chemical insecticide effectively minimizes the thrips population in onions.

Effect of trap crop on thrips and seed yield

The combined data of three years trial conducted during *rabi*, 2017-18, 2018-19 and 2019-20 and data presented in Table 2, revealed that the lowest thrips population and stemphylium blight intensity as well as incidence were recorded in the observations during the cropping period on onion seed crop in T_1 (Marigold as a trap crop) as compared with T_2 (Non-trap crop). Further, the significantly lowest thrips population at 45 DAP (66.75 nymphs/plant), 60 DAP (167.88 nymphs/plant), 75 DAP (205.87 nymphs/plant), and 90 DAP (94.37 nymphs/plant) on onion seed crop in T_1. Stemphylium blight was recorded on onion seed crop as foliar disease during the entire observational

period. The lowest intensity and incidence of stemphylium blight at 45 DAP (1.58% & 19.33%), 60 DAP (7.26% & 45.56%), 75 DAP (9.0% & 60.89%) and at 90 DAP (11.15% & 64.22%) were recorded in T_1. The highest onion seed yield (6.84 q/ha) was recorded also in T_1 however, the seed yield was recorded as 5.24 q/ha in T_2. Marigold found effective as trap crop of thrips in the main crop of onion. Trap crop or plants that are more attractive to certain pests than the target crop like onion [6]. Tol *et. al*. (2007) [11] conducted studies on thrips trapping and reported that the plant odours with potential for a push-pull strategy to control the onion thrips.

Interaction of trap crop and bio-pesticides, chemical pesticides and botanicals (TxS)

The data on the interaction effect of trap crop, bio-pesticides, pesticides, and botanicals (T X S) on thrips and foliar disease are presented in table 1 and 2 revealed that the lowest thrips population at 45 DAP (59.0 nymphs/plant) was recorded in T_1S_1 and it was found at par with all the interaction except T_2S_5. Further, the lowest thrips population at 60 DAP (53.70 nymphs/plant), 75 DAP (35.02 nymphs/plant) and 90 DAP (26.97 nymphs/plant) in T_1S_3, and it was found at par with T_1S_1, T_1S_4, T_2S_1, T_2S_3, and T_2S_4, at 75 DAP, whereas at par with T_1S_4, T_2S_3, and T_2S_4, at 90 DAP. The lowest stemphylium blight intensity at 45 DAP (0.93%), 60 DAP (3.24%), 75 DAP (4.93%) and 90 DAP (7.29%), were recorded in T_1S_3. The lowest incidence at 45 DAP (11.11%), 60 DAP (31.11%), 75 DAP (47.78%) and 90 DAP (51.11%) were recorded in T_1S_3, and it was found at par with incidence at 60 DAP, 75 DAP with T_1S_4, T_2S_3, and T_2S_4, whereas at par 90 DAP with T_1S_1,T_1S_2,T_1S_4, T_2S_3, and T_2S_4. The interaction data indicates that the highest onion seed yield was recorded in T_1S_3 (8.81 q/ha) followed by T_1S_4 (7.59 q/ha) and T_2S_3 (7.25 q/ha). The lowest seed yield (3.43 q/ha) was recorded in T_2S_5.

Table-1 Incidence and intensity of stemphylium blight and seed yield of onion (Combined data of rabi, 2017-18, 2018-19 & 2019-20)

Treatments	Stemphylium Blight														Seed yield (q/ha)
	45 DAP				60 DAP				75 DAP				90 DAP		
	(%) Incidence#		(%) Intensity*		(%) Incidence#		(%) Intensity*		(%) Incidence#		(%) Intensity*		(%) Incidence#		(%) Intensity*		
T1	19.33	(21.76)	1.58	(1.35)	45.56	(42.36)	7.26	(2.70)	60.89	(51.68)	9.00	(3.01)	64.22	(53.75)	11.15	(3.36)	6.84
T2	24.67	(25.14)	1.96	(1.46)	48.44	(44.22)	7.98	(2.84)	62.67	(53.00)	10.10	(3.20)	67.11	(57.04)	12.33	(3.54)	5.24
S.Em±	**-**	**0.21**	**-**	**0.001**	**-**	**0.60**	**-**	**0.001**	**-**	**0.47**	**-**	**0.001**	**-**	**1.08**	**-**	**0.001**	**0.14**
CD at 5%	**-**	**0.42**	**-**	**0.001**	**-**	**1.20**	**-**	**0.001**	**-**	**0.94**	**-**	**0.002**	**-**	**2.17**	**-**	**0.003**	**0.28**
S1	23.89	(24.72)	1.49	(1.34)	48.89	(44.36)	7.87	(2.89)	62.78	(52.47)	9.71	(3.19)	66.11	(54.45)	12.59	(3.61)	5.64
S2	23.33	(24.38)	1.67	(1.39)	48.33	(44.04)	7.60	(2.84)	62.78	(52.47)	9.44	(3.15)	66.11	(54.45)	11.60	(3.47)	5.64
S3	14.44	(18.52)	1.16	(1.23)	32.22	(34.40)	3.89	(2.08)	47.78	(43.72)	5.84	(2.50)	51.11	(45.64)	8.07	(2.91)	8.03
S4	19.44	(21.94)	1.53	(1.35)	33.33	(35.05)	4.24	(2.17)	50.00	(45.00)	6.24	(2.58)	54.44	(47.56)	8.49	(2.98)	6.78
S5	28.89	(27.67)	3.00	(1.72)	72.22	(58.62)	14.51	(3.87)	85.56	(68.04)	16.49	(4.12)	90.56	(74.88)	17.96	(4.29)	4.09
S.Em±	**-**	**0.42**	**-**	**0.001**	**-**	**1.20**	**-**	**0.001**	**-**	**0.93**	**-**	**0.002**	**-**	**2.17**	**-**	**0.003**	**0.28**
CD at 5%	**-**	**0.84**	**-**	**0.003**	**-**	**2.40**	**-**	**0.003**	**-**	**1.87**	**-**	**0.004**	**-**	**4.35**	**-**	**0.005**	**0.57**
Interaction (T*S)																	
T1S1	22.22	(23.71)	1.42	(1.32)	48.89	(44.36)	7.78	(2.87)	62.22	(52.14)	9.56	(3.17)	65.56	(54.11)	12.33	(3.57)	6.40
T1S2	20.00	(22.38)	1.51	(1.34)	47.78	(43.72)	7.51	(2.83)	62.22	(52.14)	9.02	(3.08)	65.56	(54.11)	11.20	(3.42)	6.63
T1S3	11.11	(16.14)	0.93	(1.15)	31.11	(33.74)	3.24	(1.93)	47.78	(43.72)	4.93	(2.32)	51.11	(45.64)	7.29	(2.78)	8.81
T1S4	16.67	(20.16)	1.33	(1.28)	33.33	(35.05)	3.60	(2.02)	50.00	(45.00)	5.20	(2.38)	53.33	(46.92)	7.56	(2.83)	7.59
T1S5	26.67	(26.39)	2.71	(1.65)	66.67	(54.95)	14.18	(3.83)	82.22	(65.41)	16.27	(4.09)	85.56	(67.95)	17.38	(4.23)	4.75
T2S1	25.56	(25.72)	1.56	(1.36)	48.89	(44.36)	7.96	(2.90)	63.33	(52.80)	9.87	(3.21)	66.67	(54.78)	12.84	(3.64)	4.88
T2S2	26.67	(26.39)	1.82	(1.43)	48.89	(44.36)	7.69	(2.86)	63.33	(52.80)	9.87	(3.21)	66.67	(54.78)	12.00	(3.53)	4.65
T2S3	17.78	(20.90)	1.38	(1.30)	33.33	(35.05)	4.53	(2.23)	47.78	(43.72)	6.76	(2.68)	51.11	(45.64)	8.84	(3.04)	7.25
T2S4	22.22	(23.71)	1.73	(1.41)	33.33	(35.05)	4.89	(2.32)	50.00	(45.00)	7.29	(2.78)	55.56	(48.21)	9.42	(3.14)	5.96
T2S5	31.11	(28.95)	3.29	(1.79)	77.78	(62.29)	14.84	(3.91)	88.89	(70.67)	16.71	(4.15)	95.56	(81.81)	18.53	(4.36)	3.43
S.Em±	**-**	**0.84**	**-**	**0.003**	**-**	**2.39**	**-**	**0.003**	**-**	**1.87**	**-**	**0.004**	**-**	**4.34**	**-**	**0.005**	**0.56**
CD at 5%	**-**	**1.68**	**-**	**0.005**	**-**	**4.79**	**-**	**0.006**	**-**	**3.75**	**-**	**0.007**	**-**	**8.69**	**-**	**0.011**	**1.13**

Data shows in parenthesisarcsine transformed value, Inc - Incidence, Int - Intensity, DAP - Days after Planting

Table 2. Thrips (T.tabaci) population in seed crop of onion (combined data of rabi, 2017-18, 2018-19 & 2019-20)

Treatments	Thrips (Nymphs/plant) at			
	45 DAP	60 DAP	75 DAP	90 DAP
Trap crop (T1) and None Trap (T2) crop				
T1 (Trap crop)	66.75	167.88	205.87	94.37
T2 (Non-trap)	72.94	189.19	246.45	108.82
S.Em±	**2.37**	**0.69**	**7.81**	**5.55**
CD at 5%	**4.76**	**1.39**	**15.66**	**11.13**
Application of bio pesticides, chemical pesticides and botanicals (S)				
S1	60.79	222.67	86.53	81.80
S2	69.13	222.79	432.93	142.44
S3	70.79	60.77	39.03	31.02
S4	69.89	71.56	40.16	50.94
S5	78.62	314.87	532.15	201.77
S.Em±	**4.75**	**1.38**	**15.62**	**11.11**
CD at 5%	**9.52**	**2.77**	**31.31**	**22.27**

Interaction (T*S)				
T1S1	59.00	209.42	78.37	78.53
T1S2	65.01	214.74	410.78	128.96
T1S3	68.28	53.70	35.02	26.97
T1S4	66.21	62.23	35.96	48.41
T1S5	75.23	299.29	469.22	188.99
T2S1	62.59	235.91	94.70	85.07
T2S2	73.24	230.83	455.08	155.93
T2S3	73.30	67.84	43.03	35.07
T2S4	73.57	80.89	44.36	53.47
T2S5	82.00	330.46	595.08	214.56
S.Em±	**9.50**	**2.77**	**31.24**	**22.21**
CD at 5%	**19.04**	**5.55**	**62.62**	**44.54**

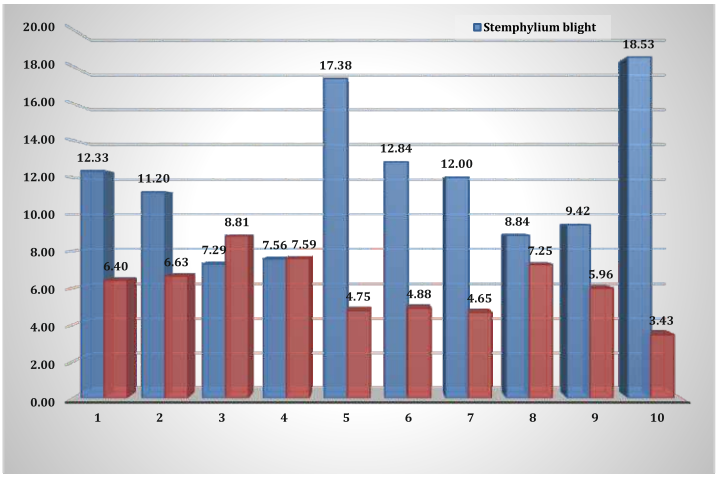

Figure-1: Stemphylium Blight intensity (%) in onion seed crop

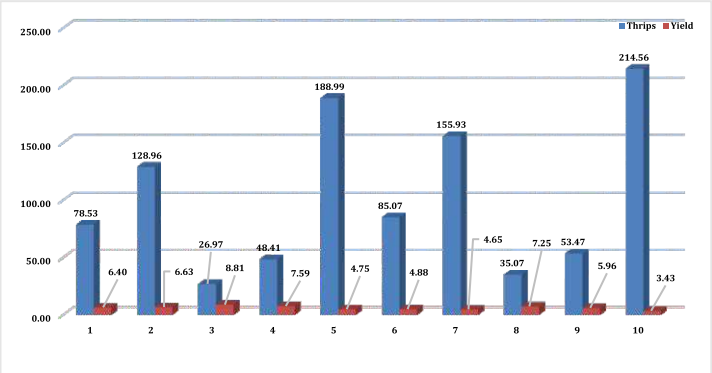

Figure-2: Thrips (Nymphs/plant) in onion seed crop with yield

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Conflict of Interests

This research paper is for honestly reporting research results and useful for farmers, students and researcher of garlic crop.

Future Scope of Study

More studies on new formulations of pesticides on controlling stemphylium blight and thrips should be done.

References

1. Ganeshan, Girija and Kumar Manoj, A. (2005). *Pseudomonas fluorescens*, a potential bacterial antagonist to control plant diseases. *Journal Plant Interactions*, 1(3): 123-134.

2. Glick, B. R. (1995). The enhancement of plant growth by free living bacteria. *Can. J. Micobiol*. 41:109-117.

3. Gupta, R. C., Pandey, M. K., Pathak, M. K., Singh, S. and Gupta, P. K. (2021). Effect of different fungicide groups with insecticides for control of foliar diseases of onion and their residue in bulbs after harvest. *Int. J. Curr. Microbiol. App. Sci*. 10(06) xx:.1-10.

4. Gupta, R.P., Srivastava, P.K., and Sharma, R.C. (1996). Chemical control of purple blotch and stemphylium blight diseases of onion. *NHRDF News Letter*, 16(3):14-16.

5. Hoffland, E., Hakulinen, J. and Vanpelt, J. A. (1996). Comparison of systemic resistance induced by a virulent and nonpathogenic Pseudomonas species. *Phytopathology*. (86) 757-762.

6. Luis, Claudio Paterno Silveria, Evoneo Berti Filho, Leonardo Santa Rosa Pierre, Fernando, Salies Cunha Peres and Julio, Neil Cassa Louzada (2009). Marigold (*Tagetes erecta* L.) as an attractive crop to natural enemies in onion fields.

7. Pathak, M. K., Pandey, M. K., Gupta, R. C. and Gupta, P. K. (2018). Evaluation of different insecticides against onion thrips in Onion seed production. *Int. J. Curr. Microbiol. App. Sci*., 7 (7):42941-4207.

8. Pathak, M. K., Pandey, S., Pandey, M. K., Gupta, R. C., Sharma, H.P. and Gupta, P. K. (2020). Evaluation of different insecticides for management of onion thrips (Thrips tabaci Lindeman). *J. Entomology and Zoology Studies*, 8 (1):1463-1468.

9. Priya, R. U., Sataraddi, A. and Darshan, S. (2015). Efficacy of non-systemic and systemic fungicides against purple blotch of onion (*Allium cepa* L.) caused *Alternaria porri* (Ellis) Cif. *Int. J. Recent. Scientific. Res*., 6:6519-6521.

10. Thind, T.S. and Jhooty, J.S. (1982). Association of thrips with purple blotch infection on onion plants caused by *Alternaira porri*. *Indian Phytopath*., 35:696-698.

11. Tol, R. W. H. M., Van James, D. E., De Kogel, W. J. and Teulon, D. A. J. (2007). Plant odours with potential for a push-pull strategy to control the onion thrips. *Entomologia Experimentalis Applicata*, 122:69-76.

12. Vijaya, M. and Rahman, M. A. (2004). Efficacy of fungicides in control of leaf blight disease of onion (*Allium cepa* L.). *J. Myeol. Pl Pathol*, 34 (2) 654-655.

13. Wheeler, B.E.J. (1969). *An Introduction to Plant Diseases*, First Edition, John wiley & sons Ltd., London, UK, 301 pp.