Evaluation of Onion (*Allium cepa* L.) Genotypes for Tolerance to Thrips (*Thrips tabaci* L.) and Purple Blotch [*Alternaria porri* (Ellis) Ciferri]

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Abstract

The study was conducted in onion to identify the advanced lines or varieties tolerant to onion thrips and/or purple blotch disease with high yield potential. Twenty one varieties and advanced lines along with five national checks were evaluated during *rabi*, 2009-10 against onion thrips and purple blotch disease at Sambalpur, Odisha, India under AINRP on Onion and Garlic by adopting RBD with three replications. The data on thrips infestation were transformed and subjected to statistical analysis. The results indicated that NRCRO-3, NRCWO-3, NRCWO-4 and VG-19 showed tolerance to both thrips (25.91 to 28.28 thrips plant^{-1}) as well as purple blotch (PDI of 42.83 to 51.66%). The cultivars, Bhima Super, NRCWO-3, NRCRO-4 and the control, Arka Niketan produced significantly high total bulb yield (325.41 to 376.00 q ha^{-1}) having better tolerance to thrips (25.91 to 32.42 thrips plant^{-1}) and Purple Blotch (42.83 to 56.50%). The cultivar with high yield potential having tolerance to both onion thrips and purple blotch disease identified for Odisha condition are Bhima Super, NRCRO-4, NRCWO-3 of DOGR, Pune and Arka Niketan of IIHR, Bangalore.

1. Introduction

Onion (*Allium cepa* L.) is one of the commercial vegetable and spice crops of India. India produces 159.30 lakh MT of onion from 11.10 lakh ha area (FAOSTAT, 2011). India ranks first in area, second in production and third in export in the world. In India, onion is predominantly cultivated during *rabi* (60%) followed by 20% each in *kharif* and late *kharif* season. For commercial cultivation of onion, both thrips and foliar diseases play the key role in reducing the bulb yield and quality of produce. Among the various foliar diseases affecting leaves and bulbs, purple blotch incited by *Alternaria porri* Ell (Ciferri), while thrips (*Thrips tabaci* L.) among the insects are the most devastating and prevalent in many parts of India (Gupta et al., 2011), including in Odisha. This is more important due to change in climatic conditions during the growing season. Hence, cultivation of resistant and/or tolerant varieties against onion thrips and/or purple blotch as a control measure not only become more economical but also environmentally safer than rest of the chemical control measures. The present study, was, therefore, conducted in onion to identify the variety and/or advanced lines resistant or tolerant to onion thrips and/or purple blotch disease with high yield potential during both *kharif* as well as *rabi* seasons under field conditions.

2. Materials and Methods

The field experiments were conducted at All India Network Research Project on Onion and Garlic, College of Horticulture (OUAT), Chiplima, Sambalpur, Odisha, India during *rabi*, 2009-10. Twenty one cultivars along with five national check varieties of onion received from both public and private sectors through Directorate of Onion and Garlic Research (ICAR), Rajgurunagar, Pune were evaluated by adopting Randomized Block Design with three replications in plot size of 3×2 m^2 with a spacing of 15×10 cm^2. The details of sources of cultivars are presented in Table 1. Onion seedlings of 6-7 weeks old were transplanted on 25th November, 2009. All the recommended package of practices was adapted uniformly to all the tested cultivars. The screening was done under the normal epiphytotic conditions adopting only need based plant protection measures. The crop was observed for both onion thrips as well as purple blotch disease at 15 days intervals commencing from 30 days after transplanting. The data on disease incidence were recorded and the % of disease intensity was calculated by adopting 0-5 point scale such as 0=no disease, 1=1-10%, 2=11-20%, 3=21-30%, 4=31-50% and 5=51-100%. The data on thrips infestation were transformed and subjected to statistical analysis. The total bulb yield for each cultivar was recorded and

statistically analysed as per the standard procedure (Sukhatme and Amble, 1995).

3. Results and Discussion

The data presented in Table 2 indicated significant variations among the varieties and advanced lines with respect to vegetative growth and bulb quality (TSS). The plant height varies from 52.17 cm (Bhima Super) to 65.60 cm (Sel-157) with a mean value of 60.05 cm. The line, Sel-157 of IARI, New Delhi had produced significantly highest plant height of 65.60 cm than rest of the tested lines or varieties, except, NOL-115, VG-18, VG-19, Syn-6, Soyal-2009, NRCRO-4, RO-252, sel-397, Bhima Raj, N-2-4-1, Arka Niketan and L-28 (59.80 to 65.60 cm) which were statistically at par. The number of leaves plant^{-1} varies from 7.07 (COLL 652) to 10.00 (Sel-397) and collar thickness from 12.21 cm (COLL 652) to 18.31 cm (Sel-397) among the tested lines. However, statistically parity was recorded with NRCRO-4, VG-18, Syn-06, Soyal-2009, RO-252, Bhima Raj, L-28 and Arka Niketan with significantly heist value of Sel-397 for both the parameters. In onion for better keeping quality, the cultivar should have minimum neck thickness, a desirable parameter. In the present study, significantly lowest neck thickness was observed in Arka Niketan (0.42 cm) than rest of the tested advance lines or cultivars. However, statistical parity was recorded with the cultivars such as Bhima Super, NRCWO-4, RO-282, NOL-103, NOL-115, Bhima Raj, Bhima Red, N-2-4-1 and L-28 (0.42 to 0.62 cm) with Arka Niketan. The TSS, another parameters of quality bulb indicated significant variations among the tested lines, which ranges from 8.83% (Soyal-2009) to 11.33 (Arka Niketan). The lines such as Bhima Super, VG-18 and Syn-06 recorded significantly higher TSS except the heist value of Arka Niketan which was statistically at par.

The data on yield and yield attributing parameters presented in Table 3 indicated significant variations among the tested lines or cultivars. The average bulb weight (ABW) varies from 26.39 g (Soyal-2009) to 82.33 g (NRCWO-3). Significantly highest

Table 1: Details of source of cultivars evaluated during *kharif* season

Sl. No.	Entries	Source
1.	Bhima Super	DOGR, Pune
2.	NRCRO-3 (RGO-53)	DOGR, Pune
3.	NRCRO-4 (1168)	DOGR, Pune
4.	NRCWO-3 (W-302)	DOGR, Pune
5.	NRCWO-4 (W-009)	DOGR, Pune
6.	VG-18	IIHR, Bangalore
07.	VG-19	IIHR, Bangalore
08.	SYN-06	IIHR, Bangalore
09.	Soyal -2009	IIHR, Bangalore
10.	Col. 652	NHRDF, Nashik
11.	RO-252	Durgapura
12.	RO-282	Durgapura
13.	Sel-157	IARI, NewDelhi
14.	Sel-397	IARI, NewDelhi
15.	NOL.103	Nirmal Seeds
16.	NOL. 115	Nirmal Seeds
17.	Bhima Raj (C)	DOGR, Pune
18.	Bhima Red (C)	DOGR, Pune
19.	N-2-4-1 (C)	MPKV, Rahuri
20.	L-28 (C)	NHRDF, Nashik
21.	Arka Niketan (C)	IIHR, Bangalore

Table 2: Performance of onion cultivars for vegetative growth and bulb quality

Sl. No.	Advance line or variety	PH (cm)	NL	CT (cm)	NT (cm)	TSS (%)
1.	Bhīma Super	52.17	7.57	14.47	0.47	10.33
2.	NRCRO-3-(RGO-53)	57.13	8.27	14.01	0.83	9.26
3.	NRCRO-4 (1168)	63.13	9.43	16.75	0.88	10.27
4.	NRCWO-3 (W-302)	57.03	8.37	14.69	0.53	9.93
5.	NRCWO-4 (W-009)	56.53	8.37	16.36	0.80	8.87
6.	VG-18	61.17	8.90	16.04	0.68	10.67
7.	VG-19	61.10	8.33	14.05	0.64	10.13
8.	Syn-6	62.87	8.80	15.55	0.70	10.50
9.	Soyal-2009	63.90	9.53	15.76	0.72	8.83
10.	COLL-652	55.77	7.07	12.21	0.63	10.23
11.	RO-252	65.20	8.63	17.99	0.74	9.03
12.	RO-282	53.57	7.90	15.08	0.52	10.23
13.	SEL.157	65.60	8.30	16.98	0.66	8.80
14.	SEL. 397	64.33	10.00	18.13	0.69	9.93
15.	NOL. 103	55.77	7.70	13.13	0.54	9.80
16.	NOL. 115	59.80	7.60	16.79	0.62	10.17
17.	Bhīma Raj (C)	62.07	9.83	17.97	0.51	9.03
18.	Bhīma Red (C)	53.07	7.83	14.07	0.43	9.27
19.	N-2-4-1 (C)	64.40	8.17	16.96	0.62	8.97
20.	L-28 (C)	64.27	9.83	18.21	0.60	8.87
21.	Arka Niketan (C)	62.10	8.63	15.60	0.42	11.33
Grand Mean		60.05	8.53	15.75	0.63	9.74
SEm±		4.26	0.77	1.74	0.10	0.53
CD (p=0.05)		8.34	1.50	3.40	0.20	1.05

PH: Plant height, NL: Number of leaves; CT: Collar thickness; NK: Neck thickness; TSS: Total soluble solids

bulb weight of 82.33 g was recorded in NRCWO-3 than rest of the tested lines, except Bhima Super, NRCRO-4 and VG-19 (74.94 g to 79.47 g) which were statistically at par. Similarly, marketable bulb yield varies from 25.58 q ha^{-1} (Soyal-2009) to 241.28 q ha^{-1} (Arka Niketan) with a mean value of 129.22 q ha^{-1}. The check variety, Arka Niketan recorded significantly highest marketable bulb yield (241.28 q ha^{-1}) than rest of the lines tested. However, statistical parity was observed with Bhima Super (240.02 q ha^{-1}) and NRCWO-3 (226.33 q ha^{-1}).

The total bulb yield of onion indicated significant variations among the tested lines or varieties which varies from 88.24 q ha^{-1} (Soyal-2009) to 376.00 q ha^{-1} (Bhima Super) with an average value of 212.42 q ha^{-1} under Odisha condition. Significantly highest total bulb yield was recorded in Bhima Super (376.00 q ha^{-1}), closely followed by NRCRO-4 (337.12 v), NRCWO-3 (328.96 q ha^{-1}) and Arka Niketan (325.41 q ha^{-1}) than rest of the tested lines or cultivars. The variations in the bulb yields of different varieties of onion have also been reported from several places (Patil, et al., 1991; Bhonde et al., 1992; Khan, 1997; Mohanty and Prusty, 2002). Superiority of Bhima Super and Bhima Red as *kharif* onion has also been reported by Lawande et al. (2011)

The results presented in Table 3 also indicated significant variations among the tested cultivars with respect to both infestation of thrips (25.03 to 42.60 thrips plant $^{-1}$ with average of 30.57 thrips plant $^{-1}$) as well as incidence of purple blotch disease (42.83 to 63.97% with average of 54.75%). The line NOL-103 recorded significantly lowest thrips population (25.03 thrips plant $^{-1}$) than the rest of cultivars. However, statistical parity was observed with the cultivars such as Bhima Super, NOL-115, NRCRO-3, NRCWO-3, NRCWO-4, VG-19, Sel-397, Sel-157, Bhima Raj, Bhima Red and L-28(25.03 to 29.10 thrips plant $^{-1}$). The cultivar, NRCWO-3 recorded significantly lowest incidence of disease (42.83%) than rest of the cultivars except NRCRO-3, NRCRO-4, NRCWO-4, VG-19, Syn-6, RO-252 and Arka Niketan, which were statistically at par. Similar results were also reported by Raghupati et al. (2011).

With regards to the reactions of cultivars to both thrips and purple blotch disease incidence revealed that among the tested cultivars during *rabi* season, the cultivars like NRCRO-3, NRCWO-3, NRCWO-4 of DOGR, Pune and VG-19 of IIHR, Bangalore showed better tolerance as compared to rest of the

Table 3: Screening of onion cultivars for onion thrips and purple blotch disease

Sl. No.	Advance line or variety	Marketable yield (q ha^{-1})	Total yield (q ha^{-1})	Average marketable bulb weight (gm)	Plant disease index of purple blotch (%)	Thrips Reaction (number plant^{-1})
1.	Bhīma Super	240.02	376.00	76.88	56.50	28.69
2.	NRCRO-3(RGO-53)	109.64	171.20	50.51	49.38	28.28
3.	NRCRO-4 (1168)	200.21	337.12	79.47	45.28	30.23
4.	NRCWO-3 (W-302)	226.33	328.96	82.33	42.83	25.91
5.	NRCWO-4 (W-009)	121.86	182.08	50.83	46.90	26.18
6.	VG-18	90.62	155.76	54.46	55.81	30.52
7.	VG-19	188.46	291.09	74.94	51.66	27.39
8.	Syn-6	182.71	266.24	54.49	44.80	40.76
9.	Soyal-2009	25.58	88.24	26.39	56.24	42.60
10.	COLL-652	52.71	115.45	37.35	63.97	31.09
11.	RO-252	59.04	128.50	42.79	54.05	35.73
12.	RO-282	86.86	156.95	49.06	61.89	33.44
13.	SEL.157	141.48	233.40	64.39	55.36	29.67
14.	SEL. 397	72.95	99.92	54.53	57.43	28.90
15.	NOL. 103	124.45	218.09	63.09	59.03	25.03
16.	NOL. 115	52.89	130.34	44.69	58.21	27.93
17.	Bhīma Raj (C)	200.89	297.18	68.70	62.79	29.10
18.	Bhīma Red (C)	79.56	169.88	48.94	55.22	25.58
19.	N-2-4-1 (C)	112.39	205.44	57.68	58.48	33.48
20.	L-28 (C)	103.69	183.50	53.30	60.04	29.00
21.	Arka Niketan (C)	241.28	325.41	66.53	53.86	32.42
Grand Mean		129.22	212.42	57.21	54.75	30.57
SEm±		18.17	26.54	5.36	6.18	2.63
CD (p=0.05)		35.62	52.01	10.50	12.11	5.16

cultivars. These results can be utilized for future breeding programme for resistance breeding in onion.

4. Conclusion

Under Odisha condition, the varieties like Bhima Super, NRCRO-4, NRCWO-3 of DOGR, Pune and Arka Niketan of IIHR, Bangalore may be recommended cultivation to obtain maximum total bulb yield (325.41 to 376.00 q ha^{-1}) with better tolerance to onion thrips (25.91 to 32.42 thrips $plant^{-1}$) as well as purple blotch disease (42.83 to 56.50%). However, tolerance lines to both thrips and purple blotch disease identifies were NRCRO-3, NRCWO-3, NRCWO-4 and VG-19, which ranges from 25.91 to 28.28 thrips $plant^{-1}$ and 42.83 to 51.66%, respectively.

5. Further Research

There is urgent need for further study on stability analysis for yield and reactions to thrips as well as purple blotch for improvement programme in high value crop, the onion crop.

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7. References

Bhonde, S.R., Srivastava, K.J., Singh, K.N., 1992. Evaluation of varieties for late *kharif* crop of onion in Nasik area. News Letter-Associated Agricultural Development Foundation 12(1), 1-2.

FAOSTAT, 2011. Food and Agriculture Organization of the United Nations. Available from http://faostat.fao.org/site/567/DesktopDefault.aspx? PageID=567#ancor.

Gupta, R.C., Yadav, S.P., Srivastava, K.J., 2011. Studies on management of foliar diseases of onion (*Allium cepa* L.) through recommended pesticides and their residue status after harvest. In: National Symposium on Alliums: Current Scenario and Emerging Trends. 12-14 March, Pune, 234-235.

Khan, I.A., 1997. Performance of onion (*Allium cepa* L.) cultivars in mid hill conditions of Uttar Pradesh. Progressive Horticulture 29(1-2), 97-99.

Lawande, K.E., Mahajan, Vijay, KrsihnaPrasad, V.S.R., Khar, A., 2011. Bhima Super-a new red onion variety for *kharif* season from DOGR. In: National Symposium on Alliums: Current Scenario and Emerging Trends, 12-14 March, Pune. 160.

Mohanty, B.K., Prusty, A.M., 2002.Varietal performance of Onion in Rainy season. Indian Journal of Agricultural Research 36(3), 222-224.

Patil, D.R., Hebbara, M., Naganagoud, A., 1991. Performance of onion varieties on black soils. Karnataka Journal of Agricultural Sciences 4(1-2), 54-56.

Raghupati, N., Pughalendi, L., Gayatri, S., 2011. Population dynamics of Onion thrips. In: National Symposium on Alliums: Current Scenario and Emerging Trends. 12-14 March, Pune. 250.

Sukhatme, P.V., Amble, V.N., 1995. Statistical Methods for Agricultural Workers. ICAR, New Delhi, 145-156.