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Identification of elite genotypes of onion against purple blotch disease

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Abstract

This study was conducted during in 2017, under natural epiphytotic conditions. Screening and evaluation of 37 onion genotypes carried out against purple blotch disease. The disease severity was ranging from 8.00% to 80.00% among genotypes during the experiment 2017. The analyzed data of all the 37 genotypes showed different degrees of resistant against disease. The experimental results indicates that one genotype was found to be resistant, 11 genotypes were found moderately resistance, other 11 genotypes were found moderately susceptible, another ten genotypes were found susceptible and four other genotypes were found highly susceptible. Minimum and maximum disease severity were observed in in Arka Kalyan MST-764 (PBR) (8.00%) and Bellary Local-816 (80.00%) respectively. Moderate resistance found in the genotypes viz., Sangam Selection (10.67%), (L₁) ms-603 (ms-65) old (12.00%), Bhima Super (13.33%), Komta Local (14.67%), Bhima Red (14.67%) and 15-RHRO-57. None of the genotypes were found to be immune. Therefore, the resistance and moderately resistance genotypes identified during the investigation can be used in future breeding programs for the development of purple blotch resistant hybrids and varieties in onion.

Keywords: genotype, disease severity, purple blotch and resistance

Introduction

Onion (*Allium cepa* L., 2n=16) is an ancient crop that is thought to have originated in Central Asia and has been cultivated for over 5000 years. Onion belongs to the family Alliaceae is one of the most important commercial vegetable crops, grown in temperate [6], sub-tropical [7] and tropical climate [8]. It is very important in cookery; hence, it is called the *Queen of Kitchen* by the Germans. The nutritive value of onion varies among the varieties and generally 100g of bulb contains moisture (86.8g), carbohydrates (11.0g), protein (1.2g), fibre (0.6g), minerals (0.4g), calcium (180g), phosphorus(50g), Vitamin-C (11g), iron (0.7g), nicotinic acid (0.4g) and it is a part of many diets as a flavouring agent. Primarily the bulb is the edible portion but in some places, green leaves are also eaten, raw as well as cooked. It is also used as processed products like flakes, powder, paste, crush and pickle. Oil and pectin are extracted from onions. It possesses innumerable medicinal properties like an expectorant, stimulant, removes toxins, revitalizes the blood and stimulates blood circulation in the body. Globally, onion occupies an area of 4.73 million hectares with an annual global production of 163.96 million tonnes [3]. It is one of the important cash crops of India, contributing foreign exchange earnings of about Rs. 3169.61 crore. Maharashtra is leading in respect area (50.79 thousand ha) and production (8.854 lakh MT) in onion but Gujarat having the highest productivity (25.4.MT/ha) [5]. In India it is cultivated in an area of 12.84 lakh hectares with a production of 23.3 million tonnes with an average yield of 16.1 metric tonnes per hectare [4]. Among the different vegetables, 77% of the onion produced is being exported, thus earning valuable foreign exchange to the country. It is grown almost all over India; the major onion growing states are Maharashtra, Madhya Pradesh, Karnataka, Gujarat, Bihar, Andhra Pradesh, Rajasthan, Haryana, Tamil Nadu, and Odisha. our productivity levels are constrained by the occurrence of various diseases such as leaf blight, downy mildew, purple blotch, white rot, neck rot and basal rot among which purple blotch caused by *Alternaria porri* (Ellis) Cif. is a major one. Purple blotch has been reported on common onion (*Allium cepa*), the Egyptian onion (*A. proliferum*), Welsh or Spanish onion (*A. fistulosum*), leek (*A. ampeloprasum*), false shallot, and possibly other species of *Allium*. Purple blotch disease first appears as small, whitish sunken lesions and almost instantaneously, the spots turn brown, enlarge, zoned,

somewhat sunken and more or less purplish. The disease was first reported by [2] from Bombay caused by *Macrosporium* sp. In the same year, he reported the same disease but the pathogen was identified as *Alternaria* sp. Later the species of the causal organism was identified and confirmed as *Alternaria porri* [10]. This disease is one of the severe diseases of onion affecting both bulb and seed crop. The disease is more serious in *Kharif* season (disease incidence 62%) than in *Rabi* season (disease incidence 38%) as reported by [11]. Hence, breeding for disease resistance through conventional / molecular approaches will help to achieve this major biotic stress in onion [9]. The details of plant materials and experimental methodology adopted during the research programme are described below.

Material and Methods

The experimental study was conducted at the Vegetable Research Farm (Block # 8) of the Division of Vegetable Crops, ICAR-Indian Institute of Horticultural Research (IIHR), Hessarghatta Lake- Post, Bengaluru, during 2017. The experimental site is situated at 13° 58" North latitude and 78° East longitudes and at an elevation of 890 meters above mean sea level. The materials used and methods adopted during the period of experimentation are furnished below. Design and layout of the experiment with statistical Analysis. The experiment was conducted in a Randomized Block Design (RBD) with three replication for 37 genotypes. Seedling of each entry was planted in a row with spacing of 10 x15 cm² and plot size of 2 x 1.8 m² was followed and the crop was raised as per the recommended package of practices of UAS, GKVK Bangalore. PDI of screening data were subjected in INDOSTAT transformation for statistical analysis, package available at ICAR-IIHR, Bengaluru. The research programmed comprises series of field and laboratory experiments. The investigation entitled Development of male sterility based onion F₁ hybrids for purple blotch disease

resistance, bulb yield and quality traits was undertaken to know and identification of resistant genotypes for purple blotch disease. Screening of onion germplasm to selecting the resistance source for purple blotch disease in onion The observations on disease severity will be recorded using 0-5 scale at seven days intervals (when the disease development is at maximum extent) [13]

Table 1: Scale adopted to indicate degree of resistant against purple blotch of onion

Si. No.	Disease severity	Category	Reaction
1	<5	0	Immune
2	5-10	I	Resistance
3	11-20	II	Moderately Resistant
4	21-40	III	Moderately Susceptible
5	41-60	IV	Susceptible
6	>60	V	Highly susceptible

Percent disease index (PDI) will be calculated by the following formula given by [16].

$$PDI = \frac{\text{Total Sum of numerical ratings}}{\text{Number of observations}} \times \frac{100}{\text{Maximum disease rating}}$$

The details of 0-5 scale [13]

0. No disease symptom
1. A few spots towards tip covering 10 percent leaf area
2. Several purplish brown patches covering upto 20 percent of leaf area
3. Several patches with paler outer zone covering upto 40 percent leaf area.
4. Leaf streaks covering upto 75 percent leaf area or breaking of the leaves from center and
5. Complete drying of the leaves or breaking of leaves from the center.

Table 2: Scoring and percent disease infection of onion genotypes against purple blotch disease

Scoring	Percent disease infection	Category	Reaction
0	1-5%	0	Immune
1	5-10%	I	Resistance
2	11-20%	II	Moderately Resistant
3	21-40%	III	Moderately Susceptible
4	41-60%	IV	Susceptible
5	>60%	V	Highly susceptible

Table 3: List of germplasm used in the research programme

SI. No.	Germplasm/Line	Source
1	(L ₁)MS-603 (MS-65) Old	IIHR, Bengaluru and Karnataka
2	(L ₂)MS-604 (MS-48)Old	IIHR, Bengaluru and Karnataka
3	(L ₃)MS-560 (MS-65) New	IIHR, Bengaluru and Karnataka
4	(L ₄)MS-48 (MS-48) New	IIHR, Bengaluru and Karnataka
5	SANGAM SELECTION	IIHR, Bengaluru and Karnataka
6	ARKA SWADISHTA-56	IIHR, Bengaluru and Karnataka
7	IIHR-597-64	IIHR, Bengaluru and Karnataka
8	W-448-BR-4-69	IIHR, Bengaluru and Karnataka
9	ARKA KALYAN MST-764 (PBR)	IIHR, Bengaluru and Karnataka
10	BSS-262-UJJWAL-773	IIHR, Bengaluru and Karnataka
11	ARKA BINDU-776	IIHR, Bengaluru and Karnataka
12	ARKA UJJWAL-778	IIHR, Bengaluru and Karnataka
13	ARKA SONA-779	IIHR, Bengaluru and Karnataka
14	ARKA NIKETAN-789	IIHR, Bengaluru and Karnataka
15	ARKA PRAGATI-814	IIHR, Bengaluru and Karnataka
16	BALLERY LOCAL-816	IIHR, Bengaluru and Karnataka
17	KUMTA LOCAL-819	IIHR, Bengaluru and Karnataka

18	8-SELECTION-383	IIHR, Bengaluru and Karnataka
19	16-B-780-5-2-2	IIHR, Bengaluru and Karnataka
20	17-B-78-5-3-1	IIHR, Bengaluru and Karnataka
21	18-AFT	IIHR, Bengaluru and Karnataka
22	13-LIW-28C	IIHR, Bengaluru and Karnataka
23	SUDARSHAN-45	IIHR, Bengaluru and Karnataka
24	SUPER RED-761	IIHR, Bengaluru and Karnataka
25	BHIMA SUPER	DOGR, Rajgurunagar and Maharashtra
26	BHIMA RED	DOGR, Rajgurunagar and Maharashtra
27	BHIMA SHAKTI	DOGR, Rajgurunagar and Maharashtra
28	RGO-53	RAU, Udaipur and Rajasthan
29	14-RO-59	RAU, Udaipur and Rajasthan
30	15-RHRO-57	RAU, Udaipur and Rajasthan
31	10-JNDWO-2	AAU, Junagadh, Gujarat
32	20-JNDW-85	AAU, Junagadh, Gujarat
33	PREMA -178	East-west seed, Company
34	SAMRUDHI	Kalash seeds
35	6-PRO-6(2006)	PAU, Ludhiana, Punjab
36	NASIK RED(N-53)	NHRDF, Nasik, Maharashtra
37	12-PKV- SELECTION	PDKV, Akola, Maharashtra

Table 4: Onion genotype and their responded to purple blotch disease resistance

Sl. No.	Germplasm/Line	Mean and PDI (%)	Category	Reaction
1	(L ₁)MS-603 (MS-65) Old	0.60(12.00%)	II	MR
2	(L ₂)MS-604 (MS-48)Old	0.80(16.00%)	II	MR
3	(L ₃)MS-560 (MS-65) New	0.93(18.67%)	II	MR
4	(L ₄)MS-48 (MS-48) New	0.93(18.67%)	II	MR
5	SANGAM SELECTION	0.53(10.67%)	II	MR
6	ARKA SWADISHTA-56	2.33(46.67%)	IV	S
7	IIHR-597-64	3.73(74.67%)	V	HS
8	W-448-BR-4-69	3.53(70.67%)	V	HS
9	RGO-53	2.80(56.00%)	V	HS
10	ARKA KALYAN MST-764 (PBR)	0.40(8.00%)	I	R
11	BSS-262-UJJWAL-773	1.47(29.33%)	III	MS
12	ARKA BINDU-776	2.47(49.33%)	IV	S
13	ARKA UJJWAL-778	2.00(40.00%)	III	MS
14	ARKA SONA-779	1.93(38.67%)	III	MS
15	ARKA NIKETAN-789	2.07(41.33%)	IV	S
16	ARKA PRAGATI-814	1.60(32.00%)	III	MS
17	BALLERY LOCAL-816	4.00(80.00%)	V	HS
18	KUMTA LOCAL-819	0.73(14.67%)	II	MR
19	8-SELECTION-383	2.13(42.67%)	IV	S
20	16-B-780-5-2-2	0.73(14.67%)	II	MR
21	17-B-78-5-3-1	0.87(17.33%)	II	MR
22	18-AFT	1.83(36.67%)	III	MS
23	13-LIW-28C	2.20(44.00%)	IV	S
24	BHIMA SUPER	0.67(13.33%)	II	MR
25	BHIMA RED	0.73(14.67%)	II	MR
26	BHIMA SHAKTI	1.53(30.67%)	III	MS
27	14-RO-59	2.33(46.67%)	IV	S
28	15-RHRO-57	0.73(14.67%)	II	MR
29	10-JNDWO-2	1.67(33.33%)	III	MS
30	20-JNDW-85	2.07(41.33%)	IV	S
31	PREMA -178	1.93(38.67%)	III	MS
32	SAMRUDHI	1.80 (36.00%)	III	MS
33	6-PRO-6(2006)	1.40 (28.00%)	III	MS
34	NASIK RED(N-53)	2.40(48.00%)	IV	S
35	SUDARSHAN	1.73(34.67%)	III	MS
36	SUPER RED-761	3.07(61.33%)	V	HS
37	12-PKV- SELECTION	2.27 (45.33%)	IV	S
	Mean	35.11		
	S.E.M	5.82		
	CD (5%)	16.40		
	CV	28.70		

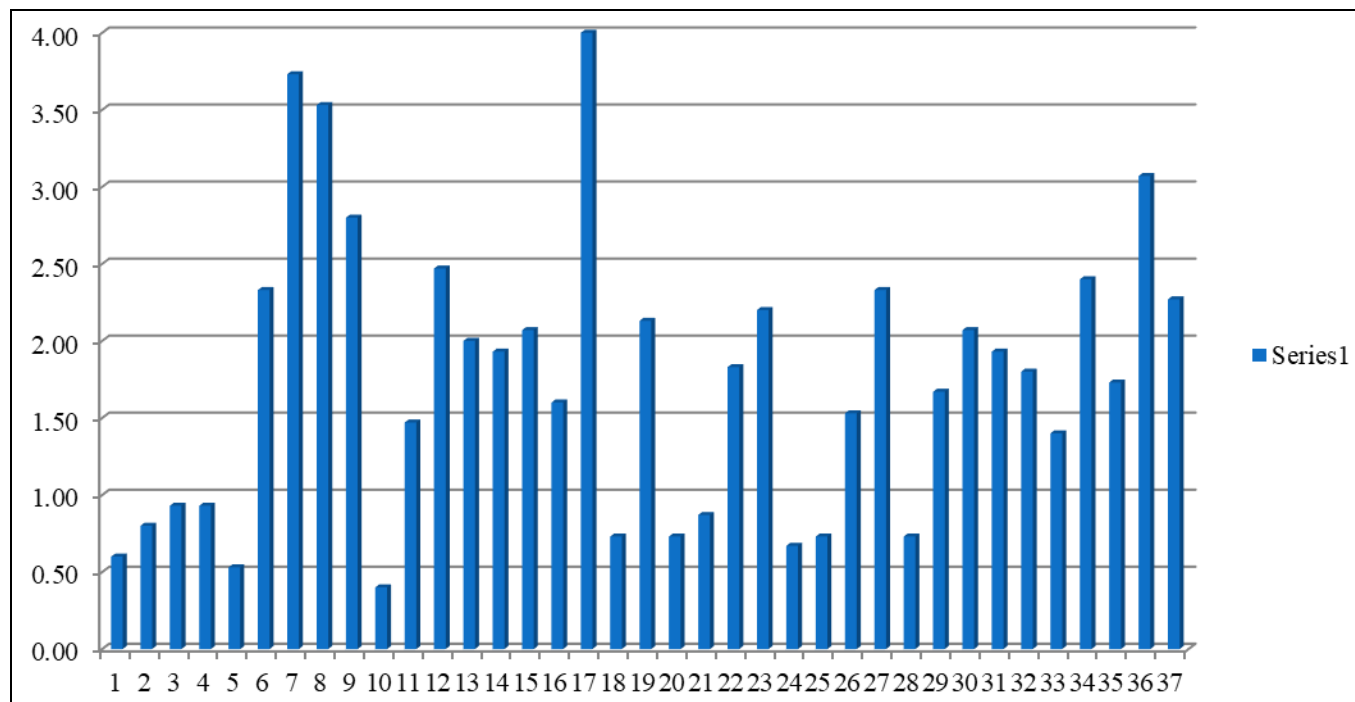


Fig 1: Evaluation of different onion genotypes against purple blotch disease

Results and Discussion

This study was conducted during in 2017, under natural epiphytotic conditions. Screening and evaluation of 37 onion genotypes carried out against purple blotch disease [Table 3]. The disease severity was ranging from 8.00% to 80.00% among genotypes during the experiment 2017. The analyzed data of all the 37 genotypes showed different degrees of resistant against disease [Table 4 and Fig 1]. The experimental results indicate that one genotypes were found to be resistant, 11 genotypes were found moderately resistance, other 11 genotypes were found moderately susceptible, another ten genotypes were found susceptible and four other genotypes were found highly susceptible. Minimum and maximum disease severity were observed in Arka Kalyan MST-764 (PBR) (8.00%) and Bellary Local-816 (80.00%) respectively. Moderately resistance were found in the genotypes viz., Sangam Selection (10.67%), (L_1) ms-603 (ms-65) old (12.00%), Bhima Super (13.33%), Komta Local (14.67%), Bhima Red (14.67%) and 15-RHRO-57. None of the genotypes were found to be immune. the similar results founded by ^[1] screened five open pollinated onion cultivars against *Alternaria porri* and reported that the cultivars Koumarsa, Kaharda and Red Creole had lower disease incidence. Out of 8 genotypes evaluated by ^[12], only one genotype-409 showed minimum disease severity. Among 310 onion accessions screened by ^[14] against purple blotch disease; none of them were found resistant or immune. ^[15] Reported that 23 genotypes of onion were screened against purple blotch disease where none of the genotypes were found to be immune. Hence, the resistance and moderately resistant genotypes identified during the investigation can be utilized for promising resistant donors in future breeding programs for the development of purple blotch resistant varieties.

Conclusion

Hence, the resistance and moderately resistant genotypes identified during the investigation can be utilized for promising resistant donors in future breeding programs for the development purple blotch resistant varieties.

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