Original Research Article

Identification of Garlic Genotypes for Resistant Sources against Purple Blotch Disease

ABSTRACT

Garlic is an herbaceous annual bulbous plant in the family Amaryllidaceae grown for its pungent and edible bulb. Among the various biotic factors hindering the production and productivity, purple blotch play a predominant role in changing the crops morpho-physiological characters thus deteriorating the metabolic activity in turn affecting the yield considerably. Fungicides have been recommended for the control of the disease,however use of fungicides is expensive and not eco-friendly. The best approach to control the disease is by using resistant genotypes. Hence, 37 genotypes were field screened at AINRPOG (All India Network Research Project on Onion and Garlic), MARS (Main Agricultural Research Station), Dharwadagainst purple blotch disease under artificial epiphytotic conditions during *Kharif*, 2019 to identify the resistant sources. The results revealed that twenty genotypes …found to be resistant and ten genotypes were immune however, five genotypes were found moderately resistant in reaction. The remaining two genotypes *viz*., HRG Local and DOGR409 were found moderately susceptible with …maximum grade of 3 in (0-5) scale. None of the genotypes showed susceptible or highly susceptible reaction to purple blotch. Breeders can make use of these identified resistant lines in developing high yield purple blotch disease resistant varieties.

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Keywords: Genotypes, garlic, artificial screening, Alternariaporri, disease reaction

1. INTRODUCTION

Garlic (*Allium sativum* L.) is one of the most popular spice crops having higher nutritive value than other bulb crops. All parts of the garlic plant are edible but the fresh leaves and the dried cloves are the parts mostly used in cooking [1]. It is vegetatively propagated by cloves or bulbils. Some cultivars are reported to produce flowers but there is no seed setting. Garlic cultivars differ in maturity, bulb size, clove size and number, scale colour, bolting and flowering habits. However, it encounters number of diseases which attack the crop during its growth and development resulting in low yield thus causing economic loss. Among several diseases that affect garlic, purple blotch caused by *Alternariaporri* (Ellis) Ciferri has been emerging as a serious disease affecting both foliage and bulb development. Since, it is a foliar pathogen it alters the metabolic processes by decreasing the photosynthetic activity. A foliar infection upto 90 per cent has been reported in susceptible cultivars of garlic are grown. Complete damage to the leaf tissues is observed at the time of bulb maturity followed by blackening of scales resulting in reduced shelf life of the bulb [2]. Significant reduction in bulb yield (25-60 %) due to drying of leaves has been observed in garlic[3].

Overall the purple blotch in garlic has been reported as economically important disease in Gujarat [4], Maharashtra [5], Andhra Pradesh [6}, Haryana, Karnataka [7], Odisha [8] and Himachal Pradesh [9]**.** Purple blotch initially starts as numerous tiny, white, circular or irregular spots. These spots gradually increase in size, become oval-shaped or irregular and white coloured spot eventually changing to violet colour. Later stages of development show the central portion of the spots changing to purple, surrounded by a pale yellow orange to salmon band beyond which is a pale green zone. The dark purple colour is the most distinctive symptom of the disease. A distinct yellowing usually extends from both ends of the spots, often reaching the tips and bases of the leaves [10].Host plant resistance is an effective, economic and environmentally safe component in an integrated approach. To overcome the breakdown of resistance, an alternate option is to cultivate varieties with durable resistance. Therefore, an attempt was made to identify resistant sources with a view to mitigate loss in farmers' field.

2. MATERIAL AND METHODS

Totally thirty seven garlic genotypes collected from ICAR-DOGR (Directorate of Onion and Garlic), Rajgurunagar, Pune and ICAR-IARI, New Delhi along with local genotypes were subjected for field screening during *Kharif* 2019 against purple blotch at AINRPOG (All India Network Research Project on Onion and Garlic), MARS (Main Agricultural Research Station), Dharwad. All the genotypes were sown in two rows of two meter length. All the recommended agronomic practices were followed, except disease management practices. Inoculum of *Alternariaporri*(2×10^6 spores/ml) was uniformly sprayed during evening hours at 30 days after sowing to create uniform disease pressure throughout the field. The disease severity was recorded at 90 days after sowing using 0-5 scale [7] by randomly selecting ten plants in each genotype. Based on their reaction, genotypes were categorized into immune (0 %), resistant (1-10 %), moderately resistant (11-20 %), moderately susceptible (21-40 %), susceptible (41-75 %) and highly susceptible (75-100 %).

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Chart 1: Disease scoring scale (0-5 grade) for purple blotch of garlic

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Disease score	Per cent leaf area infected	Disease reaction
0	No disease symptoms	Immune
1	A few spots towards tip covering 10 per cent leaf area	Resistant
2	Several dark purplish brown patches covering 11 to 20 per cent leaf area	Moderately resistant
3	Several patches with pale outer zone covering 21 to 40 per cent leaf area	Moderately susceptible
4	Yellow streaks covering 41 to 75 per cent leaf area	Susceptible
5	Complete drying of the leaves or breaking of leaves from centre	Highly susceptible

3. RESULTS AND DISCUSSION

Thirty seven genotypes grouped into different reaction types based on the results obtained from the study (Table 1). Among 37 genotypes, five genotypes (DOGR81W, DOGR150, DOGR517, DOGR534 and DOGR543) showed immune reaction whereas, 20 genotypes (DOGR51, DOGR75, DOGR102, DOGR113, DOGR119, DOGR181, DOGR325, DOGR353, DOGR389, DOGR426, DOGR548, DOGR569, DOGR604 and DOGR744) showed resistant reaction and 10 genotypes (Godavari, GG2, GG4, G41, DWG1, DOGR185, DOGR228, DOGR329, DOGR440 and DOGR756) showed moderately resistant reaction while, remaining two genotypes (DOGR409 and HRG Local) were found moderately susceptible to purple blotch of garlic. However, none of the genotypes showed susceptible or highly susceptible reaction to purple blotch (Table 2).

Management of the disease through host plant resistance has been the best choice in all crop improvement programmes. Utilization of resistant cultivars in farming system is the most simple, effective and economical method in the management of plant diseases. Besides this, the resistant cultivars conserve the natural resource and reduce the cost, time and energy when compared to the other methods of disease management [11].

The results are in agreement with previous reports which demonstrated that, only a few lines are immune while the majority have resistance to purple blotch under natural infestation in open field condition [12]. Sugha*et al*. [13] evaluated 94 onion genotypes under natural conditions and designated just two varieties, IC39178 and IC49371 as resistant to purple blotch. In the same context, Behera*et al*. [14] observed VG-18 cultivar as resistant and another 12 lines as moderately resistant to purple blotch. The present findings are in line with Agarwal and Tiwari [15], Nandini*et al*. [16] and Kowser*et al*. [17] who screened different garlic genotypes against purple blotch and they noted that per cent disease index was negatively and significantly correlated with the bulb yield and keeping quality. Although, the field screening of different genotypes showed variable response to purple blotch, it is required to be further confirmed through evaluating in multi-location hotspot areas for purple blotch in order to determine their efficiency as pre-breeding lines.

Table 1: Reaction of garlic genotypes to purple blotch caused by *Alternariaporri*during *Kharif* 2019

Sl. No.	Genotypes	Disease grade	Sl. No.	Genotypes	Disease grade
1	G41	2	20	DOGR181	1
2	G50	1	21	DOGR185	2
3	G282	1	22	DOGR228	2
4	GG2	2	23	DOGR325	1
5	GG4	2	24	DOGR329	2
6	BhimaOmkar	1	25	DOGR353	1
7	Bhima Purple	1	26	DOGR389	1
8	Godavari	2	27	DOGR409	3
9	PhuleBaswant	1	28	DOGR426	1
10	Gadag Local	1	29	DOGR440	2
11	HRG Local	3	30	DOGR517	0

12	DWG1	2	31	DOGR534	0
13	DOGR51	1	32	DOGR543	0
14	DOGR75	1	33	DOGR548	1
15	DOGR81W	0	34	DOGR569	1
16	DOGR102	1	35	DOGR604	1
17	DOGR113	1	36	DOGR744	1
18	DOGR119	1	37	DOGR756	2
19	DOGR150	0			

Table 2: Grouping of garlic genotypes based on reaction to purple blotch caused by *Alternariaporri*

Disease grade	Per cent leaf infection	Genotypes	Disease reaction	No. of Genotypes
0	0	DOGR81W, DOGR150, DOGR517, DOGR534 and DOGR543	Immune	5
1	1-10	G50, G282, BhimaOmkar, Bhima Purple, Gadag Local, PhuleBaswant, DOGR51, DOGR75, DOGR102, DOGR113, DOGR119, DOGR181, DOGR325, DOGR353, DOGR389, DOGR426, DOGR548, DOGR569, DOGR604 and DOGR744	Resistant	20
2	10-20	G41, GG2, GG4, Godavari, DWG1, DOGR185, DOGR228, DOGR329, DOGR440 and DOGR756	Moderately Resistant	10
3	21-40	HRG Local and DOGR409	Moderately susceptible	2
4	40-75	-	Susceptible	Nil
5	More than 75	-	Highly susceptible	Nil

4. CONCLUSION

The results of screening of garlic genotypes against purple blotch reveal that, out of 37 genotypes screened under artificial epiphytotic condition, five genotypes showed immune reaction and five genotypes showed resistant reactionwhereas, ten genotypes showed moderately resistant and the remaining two genotypes showed moderately susceptiblein reaction while, none of the genotypes showed susceptible and highly susceptible reaction.So, farmers can cultivate those immune and resistant genotypes in place of local cultivars in the management of purple blotch disease to get higher bulb yield.

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