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Screening of Genotypes against *Alternaria* Leaf Spot [*Alternaria cucumerina* (Ellis and Everh.) Elliott] and Anthracnose [*Colletotrichum lagenarium* (Pass.) Ellis and Halsted] Diseases in Bottle Gourd [*Lagenaria siceraria* (Mol.) Standl.]

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A B S T R A C T

Cultivation of resistant genotypes seems to be the best alternative and most economical to keep the activity of the pathogens under control. Thirteen bottle gourd genotypes were evaluated against the leaf spot disease caused by *Alternaria cucumerina and anthracnsoe* under natural epiphytotic conditions. The genotype Arka Bahar registered lowest PDI (24.87%) followed by the genotypes Bot G-1 (28.87%) and Bot G-2 (30.13%) and BL-4 (30.96%). Maximum PDI of 45.01 was noticed in the genotype BL-10 followed by the genotype BL-5 (41.82) and Bot G-4-1 (39.45). The genotype Arka Bahar registered lowest Per cent Disease Incidence (26.50) for anthracnose followed by the genotype BL-9 (28.20). Maximum Per cent Disease Incidence of 53.24 was noticed in the genotype P cyl L BL-3 followed by the genotype BL-4 (50.00) and Bot G-4-1 (48.09). Therefore the genotype Arka Bahar and BL-9 were found to be moderately resistant to the disease. Genotype Arka Bahar was found to be moderately resistant and remaining genotypes were susceptible to the disease.

Introduction

Bottle gourd [*Lagenaria siceraria* (Mol.) Standl.] is one of the important cucurbitaceous vegetable crops, which belongs to the family Cucurbitaceae having the chromosome number 2n=22. It is a warm season crop, monoecious climber and propagated through seeds. In India, it is cultivated in an area of 149 thousand hectare with production of 2458 thousand metric tonnes (Anon, 2017). In Karnataka, bottle gourd is cultivated in an area

of 0.65 thousand hectare with production of 8.36 thousand metric tonnes and (Anon, 2017). The fruits harvested at mature stage are used for making a wide range of articles of common use, including bowls, bottles, containers and musical instruments (Thamburaj and Singh, 2001). As per nutrient data base of USDA 100g of bottle gourd consists water (96%), carbohydrate (2.9%), protein (0.2%), fat (0.5%), mineral matter (0.5%), 20 mg calcium, 10 mg phosphorous, 11mg of vitamin C per 100g fresh weight and traces of vitamin A and vitamin B with a calorific value of 1.2 cal. The crop is affected by various fungal, bacterial and viral diseases. Among them *Alternaria* leaf spot caused by *Alternaria* sp. is more destructive and prevalent in major bottle gourd growing areas. Losses caused by them are always considered to be a limiting factor for yield in bottle gourd (Maheshwari *et al.,* 2017). Ill effects of the diseases are observed on foliage as well on fruits (Seebold, 2010). Alternaria leaf blight alone reported to cause 100% yield loss in cucurbits caused by *Alternaria cucumerina* (Watt, 2004). Bhargava and Singh (1985) reported that in bottle gourd plant infected by *A. cucumerina*, initial infection was yellow to brown spots, with yellow hallow.

Mundkur (1937) explained the symptoms of *Colletotrichum lagenarium* on leaves, stem, fruits, sometimes on the entire seedling and rarely on stem. Layton (1937) reported that the symptoms appeared as small, raised, water soaked areas on the leaves located along the vines near the crown of the plant. The centre of the spot contains saucer shaped fruiting body acervuli. This disease was first described during 1867 on gourd fruits in Italy. The bottle gourd anthracnose was first reported by Gardner in 1918 from USA, and was described as *Colletotrichum lagenarium* (Pass.) Ell. and Halst. In India it was first reported by Mundkur on long melon (*Cucumis melo var. utilissimus Roxb.*) and bottle gourd (*Lagenaria siceraria* Mol. Standl) to be very serious near Ferozepur in Punjab in 1937. The disease is reported to occur severely in USA, Hungary, Netherlands, Canada, India (Madaan and Grover, 1978) and Japan (Kobayashi *et al.,* 1998).

Chemical control is expensive and adversely affects the environment. The residual effect of fungicides causes health hazards to the human being. Breeding for disease resistance has been an effective, economical and practical method of disease control. Cultivation of resistant genotypes seems to be the best alternative and most economical to keep the activity of the pathogens under control. In all crop improvement programmes, growing of resistant varieties have been found to be appropriate choice to combat the disease. So far, the information available on the availability of resistant sources is scanty, thus there exists a need to identify the resistant sources. Keeping all these points in view, the present research work was undertaken on screening of genotypes against *Alternaria* leaf spot and anthracnose in bottle gourd.

Materials and Methods

A field experiment was conducted at Haveli Farm, College of Horticulture, Bagalkot to find out the source of resistance for leaf spot disease in bottle gourd. A total of 13 genotypes were collected from Dr. Shashikanth Evoor, Assistant Professor, Department of Vegetable Science, College of Horticulture, Bagalkot. Genotypes were sown with a spacing of 3 x 0.9 m. Observations were recorded on severity of the *Alternaria* leaf spot disease at a week's interval and converted in to PDI by following 0 to 5 scale given by Mayee and Datar (1986). The highest score indicating more severity of the disease.

Observations were made on Per cent Disease Incidence for anthracnose disease by counting

total number of healthy and infected fruits in each treatment and per cent disease incidence was calculated by using following formulae

$$\text{Per cent Disease Incidence} = \frac{\text{No. of infected fruits in a treatment}}{\text{Total number of fruits in a treatment}} \times 100$$

Observations were recorded on severity of the anthracnose disease at regular interval and converted in to Per cent Disease Incidence by following 0 to 5 scale given by Singh *et al.,* 1993.

Results and Discussion

Thirteen bottle gourd genotypes were evaluated against the leaf spot disease caused by *A. cucumerina* under natural epiphytotic conditions.

The results presented in Table 1 indicated that the genotype Arka Bahar registered lowest PDI (24.87) followed by the genotypes Bot G-1 (28.87) and Bot G-2 (30.13) and BL-4 (30.96). Maximum PDI of 45.01 was noticed in the genotype BL-10 followed by the genotype BL-5 (41.82) and Bot G-4-1 (39.45).

Based on the reaction of the different genotypes to the disease, it was observed that none of the varieties were resistant. However, the genotype Arka Bahar was found to be moderately resistant to *Alternaria* leaf spot. These results are in agreement with the Maheshwari *et al.*, (2015), where Arka Bahar showed moderately resistant reaction with 4.87–8.62 per cent disease severity.

Sinha (2014) screened ten varieties against *Alternaria* leaf spot disease in cabbage, concluded that one variety *i.e.* Pusa Mukta was found moderately resistant reaction (MR) with minimum disease intensity of 9.8 per cent. Yousuf (2009) screened twenty cucumber cultivars against *Alternaria* leaf spot disease, only four cultivars Pusa Sanyug, Green Express and Marketer-76 were rated as tolerant (rating 1-10%). Six cultivars *viz.,* Sweet Delight, CH-20, Priya, Hybrid-5, S-5 and Poinsette were moderately tolerant (11-25%). Remaining cultivars were moderately susceptible and susceptible.

Thirteen genotypes were evaluated against the anthracnose disease caused by *C. lagenarium* under natural epiphytotic conditions. Table 2, depicts Per cent Disease Incidence of anthracnose disease on bottle gourd fruits was recorded. The results indicated that that the genotype Arka Bahar registered lowest Per cent Disease Incidence (26.50 %) followed by the genotype BL-9 (28.20%). Maximum Per cent Disease Incidence of 53.24 was noticed in the genotype P cyl L BL-3 followed by the genotype BL-4 (50.00 %) and Bot G-4-1 (48.09 %).

Based on the reaction of the different genotypes to the diseases, it was observed that none of the varieties were resistant. However, the genotype Arka Bahar and BL-9 were found to be moderately resistant to the anthracnose disease.

Screening of germplasm resistance/ susceptible to anthracnose in bottle gourd was also done by the earlier workers. Chauhan (2002) evaluated 22 genotypes of bottle gourd against anthracnose disease. GH-3, GH-9 and Winter Ghiya-1 recorded resistant reaction with 1-5 per cent disease intensity. Remaining showed moderately susceptible, and susceptible reaction. Chauhan and Bhatia (2013) screened 22 genotypes of bottle gourd against anthracnose disease under natural and artificial inoculation condition (Table 3 and 4).

Table.1 Details of the disease reaction for *Alternaria* leaf spot disease

Reaction Category	Disease severity (%)	Grade (0-5)
Immune	0	0
Resistant	1-10	1
Moderately resistant	11-25	2
Moderately susceptible	26-50	3
Susceptible	51-75	4
Highly Susceptible	76-100	5

Table.2 Details of disease reaction for anthracnose disease

Reaction Category	Disease incidence (%)	Grade (0-5)
Immune	0	0
Highly Resistant	0.1-5.0	1
Resistant	5.1-10.0	2
Moderately resistant	10.1-50.0	3
Susceptible	51.1-90.0	4
Highly Susceptible	>90.0	5

Table.3 Screening of bottle gourd genotypes for resistance to *Alternaria* leaf spot disease

Sl. No.	Genotype	*Alternaria* leaf spot disease		
		Per cent Disease Index	Maximum Disease Grade	Disease reaction
1	Bot G-1	28.87	3	Moderately susceptible
2	Bot G-2	30.13	3	Moderately susceptible
3	P cyl L BL-3	37.29	3	Moderately Susceptible
4	BL-4	30.96	3	Moderately susceptible
5	Bot G-4-1	39.45	4	Susceptible
6	BL-5	41.82	4	Susceptible
7	Bot G-6	32.04	3	Moderately susceptible
8	Bot G-6-2	36.69	3	Moderately Susceptible
9	Bot G-7-1	31.97	3	Moderately susceptible
10	BL-9	38.05	3	Moderately susceptible
11	BL-10	45.10	4	Susceptible
12	Arka Bahar	24.87	2	Moderately resistant
13	Kolkata Collection	33.49	3	Moderately susceptible
	S. Em ±	1.11		
	CD @ 5%	3.40		

Table.4 Screening of bottle gourd genotypes for resistance to anthracnose disease

Sl No.	Genotype	Per cent Disease Incidence	Maximum Disease Grade	Disease reaction
1	Bot G-1	28.87	4	Susceptible
2	Bot G-2	30.13	4	Susceptible
3	P cyl L BL-3	37.29	4	Susceptible
4	BL-4	30.96	4	Susceptible
5	Bot G-4-1	39.45	4	Susceptible
6	BL-5	41.82	4	Susceptible
7	Bot G-6	32.04	4	Susceptible
8	Bot G-6-2	36.69	4	Susceptible
9	Bot G-7-1	31.97	4	Susceptible
10	BL-9	38.05	3	Moderately resistant
11	BL-10	45.10	4	Susceptible
12	Arka Bahar	24.87	3	Moderately resistant
13	Kolkata Collection	33.49	4	Susceptible
	S. Em ±	1.11		
	CD @ 5%	3.40		

In natural conditions four genotypes *viz.* GH-3, GH-9, GH-10 and GH-25, under artificial inoculation conditions, three genotypes *viz.* GH- 9, GH-3and Winter ghiya-1 were found resistant with 1-5 per cent disease intensity. Ankit kumar *et al.,* (2016) screened 24 cultivars/germplasm against anthracnose of bottle gourd.

Three genotype *viz.* K-92420, GH-3 and GH-11 were found resistant with 0-5 per cent disease intensity and remaining genotypes were moderately susceptible and susceptible to the disease.

The genotype Arka Bahar registered lowest PDI (24.87) followed by the genotypes Bot G-1 (28.87) and Bot G-2 (30.96) and BL-4 (30.96). Maximum PDI of 45.01 was noticed in the genotype BL-10 followed by the genotype BL-5 (41.82) and Bot G-4-1 (39.45). Therefore the genotype Arka Bahar was found to be moderately resistant to both the diseases.The genotype BL-9 was found to be moderately resistant to anthracnose disease.

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