



Screening of French Bean (*Phaseolus vulgaris* L.) Genotypes against *Alternaria* Leaf Spot Caused by (*Alternaria alternata*) under Dryland Conditions of Kashmir

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Sixty-three genotypes of french bean was screened against leaf spot (*Alternaria alternata*) in sick plots at Research Farm of Dryland Agriculture Research Srinagar, Rangreth during Kharif 2018 and 2019. The highest mean disease incidence ranged from 0.00 to 85.00 per cent with the mean disease intensity ranged from 0.00 to 53.26 per cent. One genotype namely 'Local Pulwama' was highly susceptible in their disease reaction. Among the screened germplasm, 'Highly Resistant' genotypes was SKU-R-601, SKUA-R-105, SKU-R-927, DARS-25, DARS-66, DARS-R-615, while as 'Susceptible' genotypes was DARS-8, DARS-12, DARS-11, SKUAST-R-155, SKU-R-928, DARS-7, DARS-R-4, Bhaderwah (L), Local Kupwara black and Raj Jawala. Local Pulwama was found to be a highly susceptible (HS) genotype. Twenty nine genotypes namely., DARS-16, DARS-

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9, DARS-54, DARS-39, VL-125, DARS-63, ENTO-504, SKUAST-204, SKU-R-925, DARS-60, DARS-109, DARS-43, DARS-44, SKU-R-23, DARS-4, DARS-74, SKU-R-105, DARS-40, DARS-23, DARS-18, SKU-R-71, WB-341, SKU-R-605, Uri local, Shopian (L), SKU-R-23, DARS-71, SSGB-729, DARS-R-19 showed resistant reaction to disease. The selection for resistance was based on the reaction of varieties on leaves.

Keywords: *Alternaria alternata*; disease incidence; disease intensity; French beans; genotypes; resistance

1. INTRODUCTION

French bean (*Phaseolus vulgaris* L.) is one of the important leguminous crop grown for the tender green pods, green beans (shelled) and dry beans (*Rajmash*). It is rich in proteins, carbohydrates, phosphorus, iron, calcium and vitamins [1]. Among the different countries, India is the largest producer and consumer of pulses accounting about 33 per cent of the global area and total of 22 per cent of the world production of pulses. Kashmir has been famous for the production of quality pulses especially French bean (*Phaseolus vulgaris* L.). French bean crop, as vegetable is grown in Kashmir over an area of 2000 ha with an annual production of 4000 metric tonnes [2]. The intensive cultivation and monoculture of both bush and pole type french beans in vegetable growing belts of the Kashmir valley with the continual use of non-certified, diseased seeds and farmer's own saved seed resulted in the frequent occurrence of many fungal, bacterial and viral diseases. Among the fungal diseases such as root rots [*Rhizoctonia solani* (Kuhn), *Fusarium oxysporum* f.sp.*phaseoli* (Kendrick & Synder) *Fusarium solani* f. sp. *phaseoli* (Burk) Synder and Hansen], angular leaf spot (*Phaeoisariopsis griseola* (Sacc.) Ferr., anthracnose (*Colletotrichum lindemuthianum* (Sacc. & Magn.) Scribe, rust (*Uromyces phaseoli* (Rehen) Wint., leaf spot (*Alternaria alternata* (Fr.) Keissler) and web blight [*Thanatephorus cucumeris* (Frank) Donk] which usually remain confined to specific environments [3]. Among these diseases, *Alternaria* leaf spot caused by *Alternaria alternata* (Fr.) Keissler] is one of the important disease of French bean crop under the temperate conditions of Kashmir. Symptoms of *Alternaria* leaf spot appear as lesions with tan spots on the leaves. The centre of lesions become black with fungal sporulation. Faint, concentric rings may occasionally be visible in older leaves. As the disease progresses, lesions on the leaves may merge with each other forming to large blighted areas and premature leaf drop may occur resulted in

yield losses. Yield loss, often exceeds more than 50 per cent [4-5]. From few years, an increasing consciousness and importance about environmental pollution due to chemicals and development of fungicide-resistant strain in plant pathogens has challenged the plant pathologists to search for non-toxic fungicides for substituting the recommended chemicals. Therefore, this is the most cost effective and eco-friendly management strategy selecting the genotypes possessing the resistant/tolerant reaction against the disease. Studies conducted on *alternaria* blight of French bean and its various aspects indicated that there are lot of gaps in the understanding of the disease, the variability of pathogen and the control aspects and very scanty information is available on these aspects [6]. Hence, keeping in view all the aspects, need to devise its management with emphasis on use of resistant genotypes, in the present study, an attempt was made to identify sources of resistance to the disease in available germplasm of French bean under temperate climatic conditions of Kashmir valley.

2. MATERIALS AND METHODS

Sixty three French bean genotypes/ lines collected from various places were screened against the pathogen under natural epiphytotic conditions at Research farm of Dryland Agriculture Research Station, SKUAST-K for two consecutive years. (Kharif, 2018 and 2019). The experiment was laid out in RBD with three replications. Each line was sown in a two metre long row (15 plants/row) with a plant to plant distance of 15 cm. Each test row was followed by a row of highly susceptible French bean cultivar. The plot was flanked on both sides with double row of a highly susceptible variety 'Local Pulwama' and each test row was followed by a row of the same susceptible cultivar 'Local Pulwama' After germination, the crop was regularly watched for first appearance of disease. Five plants from each genotype were tagged for taking the observations. The screening was done

in the month of August when the disease was its peak stage. The per cent disease incidence on leaves was calculated by using the following formula:

$$\text{Per cent disease incidence} = \frac{\text{Number of infected leaves}}{\text{Total number of leaves or pods assessed}} \times 100$$

The Per cent disease intensity (PDI) was calculated as per the formula:

$$\text{Per cent disease intensity} = \frac{\text{Sum of all numerical ratings}}{\text{Total number of leaves or pods assessed} \times \text{Highest value of rating}} \times 100$$

The observation on disease intensity was recorded using a progressive 0-5 scale, [6] where 0 denotes completely disease free leaves and 5 denotes the extent of infection covering more than 50 per cent leaf area covered. The genotypes were classified into highly resistant (0.0% disease intensity), resistant (5.0-10% disease intensity), moderately resistant (11.0-25.0% disease intensity), moderately susceptible (26.0-50.0% disease intensity), susceptible (51.0-75.0 % disease intensity) and highly susceptible (more than 75% disease intensity) categories.

3. RESULTS AND DISCUSSION

The screening of French bean genotypes against alternaria leaf spot indicated that on the overall mean basis, disease incidence and disease intensity on leaves varied from 0.00 to 85.00 per cent and 0.00 to 53.26 per cent, respectively. On the basis of two years of experimentation, shown in Table 1 and Table 2 revealed that six genotypes of French bean, namely SKU-R-601, SKUA-R-105, SKU-R-927, DARS-25, DARS-66, DARS-R-615 were Highly resistant (HR) while

29 genotypes viz., DARS-16, DARS-9, DARS-54, DARS-39, VL-125, DARS-63, ENTO-504, SKUAST-204, SKU-R-925, DARS-60, DARS-109, DARS-43, DARS-44, SKU-R-23, DARS-4, DARS-74, SKU-R-105, DARS-40, DARS-23, DARS-18, SKU-R-71, WB-341, SKU-R-605, Uri local, Shopian (L), SKU-R-23, DARS-71, SSGB-729 and DARS-R-19 were Resistant (R). Seventeen genotypes namely DARS-58, IC/B/1002, DARS-3, DARS-17, DARS-72, DARS-10, DARS-36, SKU-R-928, DARS-69, DARS-38, Local Shopian, SKU-R-104, DARS-R-47, DARS-R-53, Chiniya, Local Kupwara bold, Rajmash mudwan while was Moderately resistant (MR) in disease reaction. Ten genotypes viz., DARS-8, DARS-12, DARS-11, SKUAST-R-155, SKU-R-928, DARS-7, DARS-R-4, Bhaderwah (L), Local Kupwara black and Raj Jawala was found susceptible (S) while a genotype Local Pulwama was found highly susceptible (HS) in disease reaction. In the present investigations /screening, the selection for resistance was purely based on the reaction of varieties on leaves. It is necessary to test the reaction of the varieties at all stage because French bean crop become progressively more susceptible to *Alternaria alternata* with increasing age [7-9]. The difference in behaviour of varieties/ genotypes at different locations may be attributed to prevalence of different environmental conditions and existence of different strains/races of *Alternaria alternata* [10]. These results are in conformity with the results of research conducted by [12-13] [14-15]. In the present screening investigation, two years of experimentation six French bean genotypes showed highly resistance to *Alternaria* leaf spot under Kashmir conditions, which can be directly used as introductions/selection or alternatively as sources of resistance in any hybridization programme.

Table 1. Screening of French bean (*Phaseolus vulgaris* L.) genotypes against alternaria leaf spot caused by *Alternaria alternata* during Kharif 2017 and 2018 at DARS, Budgam

S. no	Germplasm	Overall mean Disease incidence (%)	Overall mean Disease intensity (%)	Disease response
1.	DARS-58	25.00	11.23	MR
2.	DARS-16	30.00	7.12	R
3.	DARS-9	25.00	6.13	R
4.	SKUA-R-601	0.00	0.00	HR
5.	IC/B/1002	38.33	19.51	MR
6.	DARS-8	46.66	29.22	S
7.	DARS-12	45.00	25.13	S
8.	SKUA-R-105	0.00	0.00	HR
9.	DARS-11	68.33	37.32	S
10.	DARS-3	30.00	18.45	MR

S. no	Germplasm	Overall mean Disease incidence (%)	Overall mean Disease intensity (%)	Disease response
11.	SKUAST-R-155	70.00	49.75	S
12.	DARS-54	28.33	8.42	R
13.	DARS-39	16.66	6.33	R
14.	VL-125	16.66	6.84	R
15.	DARS-63	20.00	6.00	R
16.	ENTO-504	10.00	6.48	R
17.	SKUAST-204	18.33	5.50	R
18.	DARS-17	38.33	17.82	MR
19.	SKU-R-925	25.00	6.50	R
20.	DARS-60	16.66	7.53	R
21.	SKU-R-928	68.33	29.50	S
22.	DARS-109	35.00	9.50	R
23.	DARS-43	28.33	9.46	R
24.	DARS-44	25.00	5.50	R
25.	DARS-72	50.00	11.84	MR
26.	DARS-10	28.33	13.76	MR
27.	SKU-R-927	0.00	0.00	HR
28.	SKU-R-23	20.00	7.45	R
29.	DARS-36	26.66	11.43	MR
30.	SKU-R-982	40.00	12.42	MR
31.	DARS-4	30.00	8.46	R
32.	DARS-74	26.66	7.86	R
33.	SKU-R-105	38.33	9.50	R
34.	DARS-40	25.00	7.00	R
35.	DARS-23	40.00	9.23	R
36.	DARS-69	31.66	13.84	MR
37.	DARS-38	35.00	12.50	MR
38.	DARS-25	0.00	0.00	HR
39.	DARS-18	16.66	6.14	R
40.	DARS-7	55.00	28.43	S
41.	Local Shopian	35.00	18.34	MR
42.	DARS-66	0.00	0.00	HR
43.	SKU-R-71	21.00	6.20	R
44.	SKU-R-104	38.33	15.43	MR
45.	DARS-R-47	40.00	21.12	MR
46.	DARS-R-4	38.16	23.72	S
47.	WB-341	32.00	9.47	R
48.	SKU-R-605	12.00	6.40	R
49.	Uri-local	22.00	8.80	R
50.	Shopian(L)	22.00	9.06	R
51.	SKU-R-23	18.16	6.67	R
52.	DARS-71	30.00	9.69	R
53.	DARS-R-53	21.00	11.43	MR
54.	Bhaderwah (L)	40.00	21.42	S
55.	SSGB-729	37.16	11.64	R
56.	DARS-R-19	32.00	9.43	R
57.	DARS-R-615	0.00	0.00	HR
58.	Local Pulwama	85.00	53.26	HS
59.	Chinya	22.00	10.50	MR
60.	Local Kupwara black	65.00	22.46	S
61.	Local Kupwara bold	55.00	18.43	MR
62.	Raj Jawala	35.00	13.45	S
63.	Rajmash mudwan	35.00	14.06	MR

Table 2. Categorization /Classification of of sixty three French bean genotypes on the basis of disease reaction types on leaves at DARS, Budgam during Kharif 2017 and 2018

Category	Disease intensity range(%)	Genotype
Highly resistant (HR)	0.0	SKU-R-601, SKUA-R-105, SKU-R-927 , DARS-25, DARS-66, DARS-R-615
Resistant (R)	5.0-10.0	DARS-16, DARS-9, DARS-54, DARS-39, VL-125, DARS-63, ENTO-504, SKUAST-204, SKU-R-925, DARS-60, DARS-109, DARS-43, DARS-44, SKU-R-23, DARS-4, DARS-74, SKU-R-105, DARS-40, DARS-23, DARS-18, SKU-R-71, WB-341, SKU-R-605, Uri local, Shopian (L), SKU-R-23, DARS-71, SSGB-729, DARS-R-19
Moderately resistant (MR)	11.0- 25.0	DARS-58, IC/B/1002, DARS-3, DARS-17, DARS-72, DARS-10, DARS-36, SKU-R-928, DARS-69, DARS-38, Local Shopian, SKU-R-104, DARS-R-47, DARS-R-53, Chiniya, Local Kupwara bold, Rajmash mudwan
Susceptible (S)	26.0-50.0	DARS-8, DARS-12, DARS-11, SKUAST-R-155, SKU-R-928, DARS-7, DARS-R-4, Bhaderwah (L), Local Kupwara black, Raj Jawala
Moderately susceptible	51.0- 75.0	-
Highly susceptible (HS)	More than 75.00	Local Pulwama,

4. CONCLUSION

This study recommends continuous screening of different French bean genotypes in other agro-climatic zones in Kashmir and using races of *Alternaria alternata* for the purpose to broaden the findings on resistance, and resistant genes to *Alternaria* leaf spot in French beans grown in Kashmir.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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