

SCREENING OF FRENCH BEAN GERMPLASM AGAINST ANGULAR LEAF SPOT (*PHAEOSARIOPSIS GRISEOLA*)

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Abstract: Eighteen cultivars or germplasm lines of French bean were screened for resistance to angular leaf spot under natural epiphytotic and artificial inoculation conditions. Six cultivars were found to be moderately susceptible, nine susceptible and three highly susceptible in disease reaction. None of the cultivar showed resistant reaction. Average apparent infection rate of moderately susceptible cultivars varied from 0.054 to 0.077 unit/day and that of highly susceptible cultivars varied from 0.169 to 0.195 unit/day.

Keywords: French bean, Screening, angular leaf spot of bean, *Phaeoisariopsis griseola*.

Introduction

French bean (*Phaseolus vulgaris* L.) is one of the most important leguminous kharif pulse and vegetable crop, grown throughout the hills of India. The area under this crop has increased tremendously. In India, it occupies an area of 137.54 thousand hectares with a production of 1370.21 thousand MT (Anonymous, 2014). It is commercially grown in Himachal Pradesh over an area of 3436 hectares with production of 40879 MT (Anonymous, 2014). Bean production is however, constrained by several biotic and abiotic factors. Amongst the biotic factors, angular leaf spot caused by *Phaeoisariopsis griseola* (Sacc.) Ferraris is one of the most widely distributed and damaging disease of common bean, causing yield losses as high as 80 percent (Ponnappa *et al.*, 1976; Gupta and Shyam, 1998; Shukla and Sharma, 2009). The disease affects the foliage and pods throughout the growing season and is particularly destructive in areas where warm, moist conditions are accompanied by abundant inoculum from infected plant residues and contaminated seeds. Though the angular leaf spot of bean can be controlled to some extent by the use of selective fungicides yet the pathogen is acquiring resistance with their continuous use. Moreover, the usage of chemicals are also posing residual problem in ultimate consumption of the produce and also cost involved is very high. The use of host resistance is the only feasible means of managing the disease. Therefore, present study was conducted to screen French bean germplasm/cultivars against angular leaf spot for resistance reaction, if any.

Materials and Methods

During 2014 crop seasons, 18 germplasm lines or cultivars of bean were screened against angular leaf spot at the experimental farm of Department of Plant Pathology in Dr. Y.S Parmar University of Horticulture and Forestry, Nauni, under natural epiphytotic conditions. Further to confirm the resistance if any, these cultivars/germplasm lines were further screened under laboratory conditions through artificial inoculation.

French bean germplasm, including 7 pole type and 11 bush type available in the Department of Vegetable Science of the University and some other varieties obtained from different research institutes were sown in 2 m long rows in replicated field trial during crop season 2014 maintaining row to row distance of 45 cm and plant to plant distance of 15 cm. Highly susceptible cv. "Lakshmi" was planted in two rows around the experimental plots as well as in a single row alternating with 10 rows of cultivars/lines. The severity of the disease was recorded on a (1-9) scale (Muhuku *et al.*, 2003) where 1 = Plants with 1-10% of the leaf area with lesions; 3 = Plants with < 25% of the leaf area infected with lesions and sporulation and > 5 per cent area of pods covered with lesions ; 5 = Plants with upto 50% of the leaf area with lesions and sporulation associated with chlorosis and necrosis and 15 per cent pod area covered with lesions; 7 = Numerous spots reaching upto 1cm in diameter more than 50 per cent of leaf area covered under lesions and associated with chlorosis and necrosis and >25 per cent pod area covered with lesions; 9 =90% of leaf area with lesions frequently associated chlorosis, necrosis and defoliation and > 50 per cent area of pods. Percent disease intensity was calculated according to formula given by Mckinney (1923).

The different cultivars/germplasm lines were graded as highly resistant (1-10%), resistant (11-25%), moderately susceptible (26-50%), susceptible (>50%), highly susceptible (defoliation) respectively. The apparent infection rate for each cultivar or germplasm was calculated as per Van der Planck (1963).

Under artificial inoculation conditions, the plants of all 18 cutivars/germplasm lines were raised in plastic pots (10 cm dia.) treated with 5 per cent formalin and washed in running tap water, were filled in with sterilized soil (with formalin 5%) consisting of soil + sand + FYM in 2:2:1 ratio (w/w/w). In each pot, 3 seeds of bean were sown and after seedling emergence, two plants per pot were maintained. After 21 days, plants were subjected to inoculation with the test pathogen by spray inoculation method (Stenglein *et al.*, 2003). Inoculated and control plants were placed in a humidity and temperature control cabinet with a 12h photoperiod, $24\pm 1^{\circ}\text{C}$ temperature and 95 ± 5 per cent relative humidity. After 48h the

plants were shifted to the green house having a temperature range of 24 -30°C for symptom development. Plants were observed regularly for the appearance of the symptoms. Severity of the disease for all the cultivars/ germplasm lines were recorded.

The data recorded were subjected to statistical analysis. The differences exhibited by the treatments in various experiments were tested for their significance by employing Completely Randomized Design (CRD) and Randomized Block Design (RBD) as per the details given by Gomez and Gomez (1983).

Results and Discussion

From the perusal of the data (Table 1) it is evident that none of the cultivar showed resistant reaction, though Kentucky Wonder, HAPB-3, Pusa Hemlata, DWDFB-1, VLFB-130, IIHR-909 were found to be moderately susceptible to the disease while SVM-1, HAPB-3, HAPB-4, Swarnlata, Solan Selection, Arka Anoop, VLFB-2003, UHF-30, PANT-FB, UHF-29 exhibited susceptible reaction. Lakshmi, Solan Naina and Contender were highly susceptible under natural epiphytotic conditions. Levels of resistance and susceptibility of different cultivars revealed that irrespective of the spread of the disease on leaves, apparent infection rate increased with the progressive decrease of resistance falling into a category of highly susceptible disease reaction (Table 1).

The moderately susceptible cultivars Kentucky Wonder, HAPB-3, Pusa Hemlata, DWDFB-1, VLFB-130, IIHR-909 exhibited minimum infection rate 0.054 to 0.095/unit/day, respectively. Highest 'r' values i.e. 0.169 to 0.195 unit/day were observed in case of highly susceptible cultivars Lakshmi, Solan Naina and Contender. It is also evident from the Table 1 that the lines exhibiting moderately susceptible reaction exhibited lower values of apparent infection rates i.e. 0.05 to 0.077 units/day compared to the cultivars ranging in their reactions from susceptible (0.093-0.156 units/day) to highly susceptible (0.169-0.194 units/day). The results of the studies on relationship between levels of resistance/ susceptibility of the cultivars apparent infection rate (r) for the development of the disease further indicated that the apparent infection rate was inversely proportional to the degree of resistance. Similar finding were reported by Gupta *et al.* (2000) where Kentucky Wonder and SVM-1 were found susceptible cultivars against angular leaf spot of French bean.

The foregoing discussion clearly indicates that none of the cultivar was found resistant. The cultivar Kentucky Wonder, HAPB-3, Pusa Hemlata, DWDFB-1, VLFB-130, IIHR-909 showed moderately susceptible reaction under field as well as artificial inoculation conditions.

Table 1: Reaction of French bean cultivars/germplasm against angular leaf spot disease under natural epiphytotic and artificial inoculation conditions

Germplasm	Disease intensity (%)		Disease reaction		Apparent infection rate (r) (unit/day)
	Natural epiphytotic conditions	Artificial inoculation conditions	Natural epiphytotic conditions	Artificial inoculation conditions	
Pole Type					
Lakshmi	68.8 (56.19)	80.2 (63.59)	HS	HS	0.169
Kentucky Wonder	41.4 (40.03)	50.0 (46.75)	MS	MS	0.054
SVM-1	57.2 (49.15)	65.7 (54.17)	S	S	0.093
HAPB-3	33.9 (35.59)	40.6 (39.54)	MS	MS	0.063
HAPB-4	57.2 (49.18)	57.6 (49.36)	S	S	0.105
Swaranlata	58.7 (50.05)	63.7 (52.98)	S	S	0.128
Pusa Hemlata	38.1 (38.09)	45.1 (42.20)	MS	MS	0.077
Bush Type					
Solan Naina	80.7 (63.97)	83.8 (66.43)	HS	HS	0.195
Solan Selection	62.1 (51.99)	72.3 (58.26)	S	S	0.117
Contender	77.2 (61.49)	77.5 (61.70)	HS	HS	0.188
DWDFB-1	45.8 (42.57)	45.1 (42.18)	MS	MS	0.095
Arka Anoop	52.4 (46.40)	53.0 (46.75)	S	S	0.101
VLFB-130	48.4 (44.06)	44.3 (41.69)	MS	MS	0.078
IIHR-909	42.1 (40.45)	44.9 (42.04)	MS	MS	0.072
VLFB-2003	54.4 (47.55)	64.1 (53.18)	S	S	0.110
UHF- 30	53.3 (46.88)	59.2 (50.33)	S	S	0.105
PANT- FB	52.8 (46.60)	58.7 (50.04)	S	S	0.157
UHF-29	53.4 (46.95)	65.0 (53.77)	S	S	0.121
CD_{0.05}	4.2071	4.6005			

Values in in parentheses are arcsine-transformed values

MS = Moderately Susceptible S = Susceptible HS = Highly Susceptible

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