Screening bell pepper germplasm for resistance against Phytophthora leaf blight and fruit rot disease

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ABSTRACT

Fifteen genotypes of bell pepper were screened for resistance against Phytophthora leaf blight and fruit rot disease at the experimental farm of Department of Vegetable Science, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan, HP during summer season of 2012. Observations were recorded for the disease at weekly interval. Analysis of variance indicated significant differences among genotypes for the disease under study. Genotypes Feroz and LC-1 were found to be moderately resistant to disease. Apparent infection rate was lowest for lines Feroz and LC-1 and highest for Kannaul Collection.

Keywords: Bell pepper; Phytophthora; fruit rot; leaf blight; screening; germplasm

INTRODUCTION

Bell pepper is a high value vegetable and an important cash crop of temperate regions. It is used as salad, cooked as vegetable, pickled or processed and is appreciated worldwide for its aroma, flavour and colour. Mid hills of Himachal Pradesh are leading suppliers of fresh market bell pepper of excellent quality due to congenial climate which produce big sized blocky fruits with high flavour and shiny skin to the plains during summer and rainy seasons and sells at good premium thus bringing lucrative returns to the hill farmers. Phytophthora leaf blight and fruit rot disease causes severe losses to the crop in mid hills of Himachal Pradesh. This disease has been reported to cause losses up to 100 per cent in hills. To manage the disease an elaborative spray schedule has to be adopted in the field. Due to growing environmental concerns breeding for resistance varieties is an approach for the effective management of the disease. There is need to screen different genotypes of bell pepper having resistance to Phytophthora leaf blight and fruit rot disease. Keeping this in view the present study was undertaken to screen the available germplasm for resistance against this disease.

MATERIAL AND METHODS

The present investigation was carried out in summer season 2012 at the experimental farm of Department of Vegetable Science, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan, HP. The area falls under the mid hill zone of the state. The climate here ranges from sub-tropical to sub-temperate. It experiences 1,100-1,300 mm rainfall annually most of which occurs during monsoon season. Fifteen genotypes (Feroz, UHF-14, US-818, LC-1, California Wonder, Solan Bharpur, HC-201, PC-1, Local Collection, Yolo Wonder, Gazio, Kandaghat Selection, EC-579997, ACC-16 and Kannaual Collection) of bell pepper were screened against Phytophthora leaf blight and fruit rot disease under field conditions. The experiment was laid out in a randomized block design with three replications. Plants were transplanted in first week of May 2012 at a spacing of 60 x 45 cm. The standard cultural practices were followed as per cultural practices given in the package of practices for growing vegetable crops in Himachal Pradesh.

The fruit rot incidence and leaf blight severity were recorded at weekly intervals by adopting following methods:

$$\text{Fruit rot incidence (\%)} = \frac{\text{Number of diseased fruits}}{\text{Total number of fruits}} \times 100$$

On leaves the severity was recorded by using the following scale adopted by James (1974):

Disease rating	Disease on leaves (%)	Description of symptoms
1	0.0	Plants completely healthy with no blight symptoms
2	25.0	Plants show slight infection roughly one in every four leaves infected, disease mainly on lower leaves
3	50.0	Nearly 50% leaves including upper ones infected, the plants appear to be blighted
4	75.0	Nearly 75% of the foliage infected, the plants appear to be blighted
5	100.0	Almost all the leaves are infected, plants completely defoliated leaving behind the main stem

The per cent leaf blight severity was calculated according to McKinney (1923) formula given below:

$$\text{Leaf blight severity (\%)} = \frac{\text{Sum of all disease ratings}}{\text{Total number of ratings x maximum disease grade}} \times 100$$

The disease reaction for individual plants was derived using following scale:

Grade	Fruit rot incidence or leaf blight severity (%)	Disease reaction
1	0.0 5.0	Resistant (R)
2	5.1 - 25.0	Moderately resistant (MR)
3	25.1- 50.0	Susceptible (S)
4	>50.0	Highly susceptible (HS)

The apparent infection rate for each cultivar/germplasm line was calculated (Van der Plank 1963) as:

$$r = \frac{1}{(t_2 - t_1)} \ 2.303 \log \ \frac{x_2 (1- x_1)}{x_1 (1- x_2)}$$

where r is apparent infection rate and x_1 and x_2 are disease severity at time t_1 and t_2 respectively.

RESULTS AND DISCUSSION

Significant differences were found among genotypes for the disease under study. Under natural epiphytotic conditions out of fifteen genotypes viz Feroz, UHF-14, US-818 and LC-1 were found to be moderately resistant to Phytophthora leaf blight whereas California Wonder, Solan Bharpur, HC-201, PC-1, Local Collection, Yolo Wonder and Gazio were susceptible (Table 1). Kandaghat Selection, EC-579997, ACC-16 and Kannaual Collection were highly susceptible to this disease. For Phytophthora fruit rot Feroz and LC-1 were moderately resistant whereas California Wonder, Solan Bharpur, HC-201, Yolo Wonder, PC-1, Local Collection, Gazio, UHF-14 and US-818 were susceptible. Kandaghat Selection, EC-579997, ACC-16 and Kannaual Collection were found to be highly susceptible to the disease. Levels of resistance and susceptibility of different cultivars/lines revealed that irrespective of the spread of the disease apparent infection rate increased with the progressive decrease of resistance fading into a category of highly susceptible disease reaction (Table 1). It is evident from the data that the lines exhibiting moderately

Table 1. Reaction of capsicum genotypes to Phytophthora leaf blight and fruit rot disease under natural epiphytotic conditions and level of resistance/susceptibility in relation to apparent infection rate

Genotypes	Phytophthora leaf blight severity			Phytophthora fruit rot incidence		
	Diseases severity (%)	Apparent infection rate (r)/ unit/day	Diseases reaction	Diseases incidence (%)	Apparent infection rate (r)/ unit/day	Diseases reaction
Feroz	17.86 (25.00)	0.104	MR	18.80 (25.70)	0.095	MR
California Wonder	22.35 (28.21)	0.132	S	35.32 (36.46)	0.165	S
Kandaghat Selection	60.20 (50.89)	0.324	HS	65.40 (53.97)	0.231	HS
Solan Bharpur	38.28 (38.22)	0.160	S	43.54 (41.29)	0.197	S
HC-201	32.15 (34.54)	0.125	S	34.50 (35.97)	0.154	S
Yolo Wonder	25.78 (30.51)	0.116	S	33.12 (35.13)	0.114	S
LC-1	22.15 (28.07)	0.113	MR	25.60 (30.39)	0.089	MR
PC-1	27.24 (31.46)	0.140	S	28.10 (32.01)	0.144	S
Local collection	22.80 (28.52)	0.106	S	28.52 (32.28)	0.140	S
Gazio	30.57 (33.57)	0.037	S	40.56 (39.56)	0.189	S
EC-579997	65.50 (54.05)	0.278	HS	75.80 (60.60)	0.285	HS
ACC-16	65.30 (53.93)	0.259	HS	70.18 (56.94)	0.278	HS
Kannaul Collection	64.27 (53.29)	0.305	HS	68.26 (55.71)	0.334	HS
UHF-14	24.54 (29.69)	0.024	MR	32.50 (34.75)	0.137	S
US-818	23.43 (28.95)	0.092	MR	28.30 (32.14)	0.193	S
CD$_{0.05}$	1.54			1.85		

resistant reaction exhibited lower values of apparent infection rates compared to the cultivars/lines ranging in their reactions from susceptible to highly susceptible. The moderately resistant cultivars/lines exhibited minimum infection rate ranging from 0.024 to 0.113/unit/day while susceptible cultivars/lines exhibited infection rate from 0.160 to 0.197/unit/day respectively. Highest r (0.231 to 0.334/unit/day) values were observed in case of highly susceptible cultivars/lines.

Seven cultivars/lines including cv California Wonder and cv Yolo Wonder were susceptible for both the diseases viz leaf blight and fruit rot. Susceptible reaction of cv California Wonder has also been reported by Saleem et al (1999). Six strains of north-western Spanish *P nicotianae* were virulent on cv Yolo Wonder (Andres et al 2006). Moderate resistance and lowest apparent infection rate exhibited by lines HC 201 and Feroz under field conditions have been reported by Gupta et al (2007). The results of the studies on relationship between levels of resistance/susceptibility of the cultivars/lines 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.

The foregoing discussion clearly indicates that among the 15 cultivars/lines screened for resistance against the pathogen moderate resistance to both forms of the disease was observed in Feroz and LC-1. These two accessions could be used in breeding programmes for resistance against Phytophthora leaf blight and fruit rot disease.

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