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SCREENING OF RECOMBINANT INBREED LINES OF FRENCH BEAN (*PHASEOLUS VULGARIS* L.) FOR BEAN COMMON MOSAIC VIRUS (BCMV) RESISTANCE

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Abstract

The production and productivity of the french bean has been greatly affected by large number of diseases. Bean Common Mosaic Virus (BCMV) diseases is one of severe disease on the french bean, which greatly limits yield. There is a need for development and identification of french bean genotypes resistance to bean common mosaic virus. Keeping these things in view, present investigation was carried out during 2013-215. French bean RIL's population comprising of 44 genotypes (F_5), which were developed by crossing different lines were used for the study. These 44 genotypes along with two checks *viz*. Ring bean and Arka suvida were evaluated in randomized block design (RCBD) with two replications. French bean plant, which is totally free from virus is scored as 0 and it is considered as highly resistant, whereas plant with more than 75 per cent affected leaves is scored as 4 and it is rated as highly susceptible to BCMV. In the present investigation, out of 46 genotypes, 4 genotypes (Line 3-2, Line 6-1, Line 7-1 and Ring bean) were found to be highly resistant with no CBMV infection. Ten genotypes were resistant, 17 genotypes were moderately resistant, 10 genotypes were susceptible and 5 genotypes were found to be highly susceptible to BCMV infection with maximum score of 4.

Key words : French bean, RILs, BCMV, resistance, susceptible.

Introduction

French bean (*Phaseolus vulgaris* L.) belongs to family Fabaceae with a chromosome number 2n = 22. It is a nutritious vegetable consumed as tender pods, shelled beans and dry beans. It is also called by different names like snap bean, haricot bean, kidney bean and rajmash. French bean is one of the most important vegetable legumes for human consumption grown in subtropical or temperate regions throughout the world (Singh, 2007). A majority of bean production occurs under low input agriculture on small-scale farms in developing countries particularly in Latin America and Africa. In India, it is grown for tender vegetable, while in USA, it is grown for processing in large quantities. Hundred gram of French bean contains 1.70 g protein, 0.10 g fat, 4.50 g carbohydrate, 1.80 g fiber and is also rich in minerals and vitamins. It also possesses some medicinal properties, which is useful in controlling diabetics and certain cardiac problems and it is a good natural cure for bladder burn. It has both carminative and reparative properties against constipation and diarrhoea, respectively. In India, it is grown on an area of 1,55,000 ha with an annual production of 4,25,000 tonnes with a productivity of 2800 kg/ha. In Karnataka, the crop is grown on an area of 15,702 ha with an annual production of 1,67,860 tonnes (Anonymous, 2014).

Economically, french bean is one of the important crop, but its production and productivity is greatly affected various pest and diseases. Viral diseases are a major limiting factors for bean production, among which mosaic diseases far the most prevalent one. When undetected, it can accompany crop genes into breeding progenies. They also constitute biological time bombs and threaten cultivar development (Nalini *et al*., 2006). Economic losses vary greatly, during severe epidemics, yields of susceptible varieties may be reduced by one-third or more. So there is a need of development of resistant French bean genotypes for bean yellow mosaic virus. Keeping these things in view, present investigation was planned with a objectives of identification resistant source for bean yellow mosaic virus in newly developed recombinant inbreed lines of french bean.

Materials and Methods

Studies were undertaken to test the resistance of newly developed RILs of French bean genotypes against bean common mosaic virus disease. Material for the present study consist of newly developed french bean RIL's population comprising of 44 genotypes (F_5), which were developed by crossing different lines. These 44 genotypes along with two checks *viz*. Ring bean and Arka suvida were evaluated in randomized block design (RCBD) with two replications, consisting of 10 plants per row of each RIL. Irrigation, weed control and other cultural practices were followed as per the packages of practices. Under natural disease pressure condition, every plant in each genotype of each replication was scored for BCMV using the following score card :

Description	Severity grade	Reaction
Plant free from BCMV	0	Highly resistant
Up to 25% leaves affected	1	Resistant
26-50% leaves affected	2	Moderately resistant
51-70% leaves affected	3	Susceptibility
More than 75% leaves affected	4	Highly susceptibility

French bean plant, which is totally free from CBMV scored as 0 and it is considered as highly resistant, where as plant with more than 75 per cent affected leaves is scored as 4 and it is rated as highly susceptible to BCMV.

Results and Discussion

The recombinant inbred lines (RIL's) are developed by crossing two inbred strains followed by repeated selfing or sibling mating to create a new inbred line, whose genome is a mosaic of the parental genomes. As each RIL is an inbred strain and so can be propagated eternally, a panel of RIL's for genetics has number of advantages. The newly developed RILs of french bean, which are used for screening under field condition for resistance against bean yellow mosaic virus are presented in table 1. Response of RILs to bean common mosaic virus under field condition is presented in the table 2. From the table, it is evident that, response of the RILs to bean common mosaic virus infection varied considerably. Some of the genotypes were totally free from virus, whereas many genotypes were infected by virus. Among the 46 genotypes screened, 4 genotypes (Line 3-2, Line 6-1, Line 7-1 and ring bean) have scored 0, indicating that they are highly resistant to bean common mosaic virus. Ten genotypes (1-1, 1-5, 2-2, 2-5, 3-1, 4-1, 4-4, 7-2,7-3,and Arka suvida) scored 1 with 25% of leaf infection , indicating that they are resistant (table 3). Seventeen

Table 1 : List of RIL's and their pedigree used for BCMV resistance screening.

S. no.	RILs No.	Pedigree
1.	1-1	Arka Komal × Arka Suvida
2.	1-2	Arka Komal xArka Suvida
3.	1-3	Arka Komal × Arka Suvida
4.	1-4	Arka Komal × Arka Suvida
5.	1-5	Arka Komal × Arka Suvida
6.	1-6	Arka Komal × Arka Suvida
7.	2-1	Arka Komal × Black Seed
8.	2-2	Arka Komal × Black Seed
9.	2-3	Arka Komal × Black Seed
10.	2-4	Arka Komal × Black Seed
11.	2-5	Arka Komal × Black Seed
12.	3-1	Arka Komal × Gokak Local
13.	3-2	Arka Komal × Gokak Local
14.	3-3	Arka Komal × Gokak Local
15.	3-4	Arka Komal × Gokak Local
16.	4-1	Arka Suvida × Black Seed
17.	4-2	Arka Suvida × Black Seed
18.	4-3	Arka Suvida × Black Seed
19.	4-4	Arka Suvida × Black Seed
20.	4-5	Arka Suvida × Black Seed
21.	4-6	Arka Suvida × Black Seed
22.	5-1	Arka Suvida × Gokak Local
23.	5-2	Arka Suvida × Gokak Local
24.	5-3	Arka Suvida × Gokak Local
25.	6-1	Arka Suvida × Arbhavi Local
26.	6-2	Arka Suvida × Arbhavi Local
27.	6-3	Arka Suvida × Arbhavi Local
28.	6-4	Arka Suvida × Arbhavi Local
29.	6-5	Arka Suvida × Arbhavi Local
30.	6-6	Arka Suvida × Arbhavi Local
31.	7-1	Black Seed × Arbhavi Local
32.	7-2	Black Seed × Arbhavi Local
33.	7-3	Black Seed × Arbhavi Local
34.	7-4	Black Seed × Arbhavi Local
35.	8-1	Black Seed × Ring Beans
36.	8-2	Black Seed × Ring Beans
37.	8-3	Black Seed × Ring Beans
38.	8-4	Black Seed × Ring Beans
39.	9-1	Gokak Local × Arbhavi Local
40.	9-2	Gokak Local × Arbhavi Local
41.	9-3	Gokak Local × Arbhavi Local
42.	10-1	Gokak Local × Ring Beans
43.	10-2	Gokak Local × Ring Beans
44.	10-3	Gokak Local × Ring Beans
45.	-	Arka Suvida
46.	-	Ring Bean

Table 2 : Response of RIL's (F_5) of french bean to Bean common mosaic virus (BCMV) under natural disease pressure condition.

S. no.	RILs No.	CBMV (0-4 Scale)
1.	1-1	1
2.	1-2	2
3.	1-3	2
4.	1-4	2
5.	1-5	1
6.	1-6	2
7.	2-1	3
8.	2-2	1
9.	2-3	3
10.	2-4	2
11.	2-5	1
12.	3-1	1
13.	3-2	0
14.	3-3	2
15.	3-4	3
16.	4-1	1
17.	4-2	2
18.	4-3	3
19.	4-4	1
20.	4-5	2
21.	4-6	2
22.	5-1	4
23.	5-2	4
24.	5-3	4
25.	6-1	0
26.	6-2	2
27.	6-3	3
28.	6-4	4
29.	6-5	2
30.	6-6	3
31.	7-1	0
32.	7-2	1
33.	7-3	1
34.	7-4	2
35.	8-1	3
36.	8-2	2
37.	8-3	2
38.	8-4	3
39.	9-1	2
40.	9-2	2
41.	9-3	3
42.	10-1	4
43.	10-2	3
44.	10-3	2
45.	Arka Suvida	1
46.	Ring Bean	0

Table 3 : Categorization of French bean RILs based on BCMV infestation.

Reaction	No. of genotypes	RILs No.
Highly resistant (Plant free from BCMV)	4.	3-2, 6-1, 7-1, Ring bean
Resistant (Up to 25% leaves affected)	10	1-1, 1-5, 2-2, 2-5, 3-1, 4-1, 4-4, 7-2, 7-3, Arka suvida
Moderately resistant (26% to 50% leaves affected)	17	1-2, 1-3, 1-4, 1-6, 2-4, 3-3, 4-2, 4-5, 4-6, 6-2, 6-5, 7-4, 8-2, 8-3, 9-1, 9-2,10-3
Susceptibility (51% to 70% leaves affected)	10	2-1, 2-3, 3-4, 4-3, 6-3, 6-6, 8-1, 8-4, 9-3, 10-2
Highly susceptibility (More than 75% leaves affected)	5	5-1, 5-2, 5-3, 6-4, 10-1

genotypes (1-2, 1-3, 1-4, 1-6, 2-4, 3-3, 4-2, 4-5, 4-6, 6-2, 6-5, 7-4, 8-2, 8-3, 9-1,9-2,10-3) have recorded score 2 with 26% to 50% leaf infection, which are grouped as moderately resistant. Ten genotypes (2-1,2-3,3-4,4-3,6-3,6-6,8-1,8-4,9-3,10-2) exhibited susceptible reaction. Five genotypes (5-1, 5-2, 5-3, 6-4, 10-1) have scored 4, indicative of high susceptibility to bean common mosaic virus. Similar type of varietal screening were previously done by many researchers *viz.,* Ittah and Binang (2012), Mahalakshmi (2005), Gumedzoe (1993), identified the resistance source in cowpea varieties against black eye cowpea mosaic Potyvirus (BICMV). Narayan and Dhawan (1987) reported screening of 64 field bean varieties against Bean mosaic and Bean yellow mosaic disease of Hyacinth bean under green house conditions and reported six tolerant genotypes. Nalini *et al*. (2006) tested fifteen accessions and varieties of french bean for their reaction to Bean common mosaic potyvirus (BCMV) by mechanical inoculations on the 10 days old seedlings in the screen house and identified twelve resistant genotypes. The resistant RILs identified in the present study will be utilized further for the development of high yielding french bean genotype with bean common mosaic virus resistance.

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