International Journal of Basic and Applied Biology
p-ISSN: 2394-5820, e-ISSN: 2349-2539, Volume 4, Issue 2; April-June, 2017, pp. 140-142

http://www.krishisanskriti.org/Publication.html

Screening of Soybean Varieties for Resistance to Frogeye Leaf Spot (FLS) Disease Caused by *Cercospora sojina* Hara in West Bengal, India

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Abstract—*Frogeye leaf spot (FLS) of soybean [Glycine max (L.) Merr.] caused by Cercospora sojina Hara is an important disease that causes significant seed yield loss in warm, humid regions of the world. The study was conducted with the objective to assess the resistance source against Frogeye leaf spot (FLS) in soybean at RRS, Gayespur, Bidhan Chandra krishi Viswavidyalaya, Nadia, West Bengal, India during Kharif, 2016 and 2017. Frogeye leaf spot (FLS) is a major disease of soybean, which can cause up to 33 % yield loss. Twenty six varieties including one susceptible check were screened against FLS under natural condition. Percent Disease Index was worked out and it varied from 4.00 % to 31.00 %. No variety was found Immune (Disease severity 0%). Fifteen varieties i.e., RKS 18, PK 564, PS 1241, PK 1092, Indira Soya 9, PS 1029, NRC 37, PS 1347, MAUS 71, PK 1024, PK 472,PK 416, Alankar, Ankur, JS 335 were observed to be resistant (Disease severity 1% to 10%). Eight varieties (NRC 37, PS 19, PK 327, RAUS 5, PK 1042, JS 9752, Shilajeet, JS -20-29) were categorized as moderately resistant (Disease severity 10% to 20%) and two varieties (Kalitur and Bragg) were showed under moderately susceptible (Disease severity 20% to 30%). Only one variety i. e., PK 262 was found susceptible (Disease severity 30% to 50%). None of the varieties was found highly susceptible (Disease severity above 50.1%). These resistant and moderately resistant varieties can be used as good donor for evolving resistant varieties against Frogeye leaf spot disease in soybean.*

Keywords*: Frogeye leaf spot (FLS), Resistance, Screening, Soybean.*

1. INTRODUCTION

Soybean (*Glycine max* L.) is the unique grain legume globally known for its dual purpose use as pulse and oilseed containing 38-44% protein and 18-22% oil. Soybean also finds place as the key component in a diverse range of industrial products like solvents, adhesives, inks, lubricants and insulating foams etc. In a large section of vegetarian people in country like India, soybean plays an important role as a rich source of protein. Occupying an area of 12.03 million ha with total production of 12.98 metric tonne and productivity 1079 kg /ha soybean finds an important place in the Indian agriculture (Anonymous, 2013). India is the third largest importer of soya oil in the world and is one of the major exporters of soya meal to the other Asian countries (Anonymous, 2013). The south and central India particularly the state of Madhya Pradesh and Maharashtra are the hubs of soybean production in India, where soybean has already been established as an important industrial crop. Among other factors, pest and diseases are the most important ones for such low productivity. Frogeye leaf spot of soybeans caused by *Cercospora sojina* Hara, is a very severe disease in the warm and humid tropical and subtropical regions of the world. Frogeye leaf spot is primarily a disease of foliage even though stems, pods and seeds may also be infected. Frogeye leaf spot (FLS) causes yield loss range from 23.7% to 32.5% in India (Mittal, 2001). These decreases in yield are a result of reduced photosynthetic area, premature defoliation and reduced seed size. Since it is a fungal disease, its control through chemical practice is not effective, nor is it environment friendly. Various fungicides control the disease with dissimilar cost-benefit ratio (Das, 2015). Deployment of genetic resistance is the best approach for management of FLS disease. For such approach to be effective, it is important to understand the genetic control of the disease. The resistance of genotypes may vary from region to region depending upon the strain of fungus prevalent in the area. The present study was therefore, designed to evaluate a large number of soybean varieties in Gayespur Farm, BCKV to identify useful sources of resistance to Frogeye leaf spot disease of soybean.

2. MATERIALS AND METHODS

Field screening for Frogeye leaf spot (FLS) disease resistance in soybean varieties were carried out at the RRS Farm, Gayespur, Bidhan Chandra Krishi Viswavidyalaya, Nadia during the *kharif* season in the year 2015 and 2016. Twenty six different soybean varieties were screened in the field under natural condition to find the resistance potentials of the genotypes. Each entry is sown in five rows of four meter length with the spacing of 30 cm × 10 cm in two replications.

Seeds were sown on 24th June, 2015 and 29th June, 2016. All the recommended agronomic practices were followed. Disease incidence was recorded periodically and Percentage Disease Index was worked out using the formula PDI = [Sum of numerical rating /total number of observations taken x maximum disease score] x 100. The genotypes were categorized using (0-5) arbitrary scale as Immune (I), Resistant (R), Moderately Resistant (MR), Moderately Susceptible (MS), Susceptible (S) and Highly Susceptible (HS) based on disease severity (Table 1).

3. RESULTS AND DISCUSSION

Evaluation of resistant varieties is considered to be the most feasible and durable solution of controlling FLS disease of soyabean. Screening soyabean varieties against FLS disease under natural condition is the first step in identifying the resistant donors for development soybean varieties with FLS resistance. Percent Disease Index was worked out and it varied from 4.00 % to 31.00 %. No variety was found Immune (Disease severity 0%). Fifteen varieties i.e., RKS 18, PK 564, PS 1241, PK 1092, Indira Soya 9, PS 1029, NRC 37, PS 1347, MAUS 71, PK 1024, PK 472,PK 416, Alankar, Ankur, JS 335 were observed to be resistant (Disease severity 1% to 10%). Eight varieties (NRC 37, PS 19, PK 327, RAUS 5, PK 1042, JS 9752, Shilajeet, JS -20-29) were categorized as moderately resistant (Disease severity 10% to 20%) and two varieties (Kalitur and Bragg) were showed under moderately susceptible (Disease severity 20% to 30%). Only one variety i. e. PK 262 was found susceptible (Disease severity 30% to 50%). None of the varieties was found highly susceptible (Disease severity above 50.1%) (Table 3). It could be noticed that the resistant level was relatively quite high as compared to susceptible status (Fig. 1). Among the screened varieties 58% found resistant, 31% moderately resistant, 7% moderately susceptible and 4% susceptible against FLS disease (Fig. 1). The results of present screening were in accordance with several other findings. Khati *et al.* (2007) screened 78 soybean germplasms, among them 16 genotypes found resistant, twenty three genotypes showed moderately resistant reaction having spots on few plants only. Thirty genotypes were found moderately susceptible and nine genotypes susceptible to disease. Similar type of observation was done by Chanda, 2012. These resistant and moderately resistant varieties can be used as good donor for evolving resistant varieties against Frogeye leaf spot disease in soybean.

Table 1: Disease scale and Grouping of Soybean varieties against FLS on the basis of Disease severity scale at Gayespur Farm, B. C. K. V. (West Bengal)

Scale	Disease Severity percent	Disease Reaction	Number	Name
0	0.0	Immune (I)	00	--
1	0.1-10.0	Resistant (R)	15	RKS 18, PK 564, PS 1241, PK 1092, Indira Soya 9, PS 1029, NRC 37, PS 1347, MAUS 71, PK 1024, PK 472, PK 416, Alankar, Ankur, JS 335
2	10.1-20.0	Moderately Resistant (MR)	08	NRC 37, PS 19, PK 327, RAUS 5, PK 1042, JS 9752, Shilajeet, JS 20-29
3	20.1-30.0	Moderately Susceptible (MS)	02	Kalitur, Bragg
4	30.1-50.0	Susceptible (S)	01	PK 262
5	Above 50.1	Highly Susceptible (HS)	00	--

Table 2: Percent disease index (PDI) and disease reaction of FLS in soybean varieties under natural condition during *kharif*, 2015 and *kharif*, 2016

Sl.No.	Variety	Percent Disease Index (2015)		Percent Disease Index (2016)		Percent Disease Index (Pooled)		Disease Reaction
1	RKS 18	5.0	(12.9)	3.0	(10.0)	4.00	(11.5)	R
2	NRC 37	17.0	(24.4)	12.0	(20.3)	14.50	(22.4)	MR
3	PS 19	18.0	(25.1)	13.0	(21.1)	15.50	(23.2)	MR
4	PK 327	20.0	(26.6)	15.0	(22.8)	17.50	(24.7)	MR
5	Kalitur	22.0	(28.0)	19.0	(25.8)	20.50	(26.9)	MS
6	RAUS 5	21.0	(27.3)	15.0	(22.8)	18.00	(25.1)	MR
7	PK 1042	17.0	(24.4)	16.0	(23.6)	16.50	(24.0)	MR
8	JS 9752	20.0	(26.6)	15.0	(22.8)	17.50	(24.7)	MR
9	Shilajeet	20.0	(26.6)	16.0	(23.6)	18.00	(25.1)	MR
10	PK 564	7.0	(15.3)	5.0	(12.9)	6.00	(14.2)	R
11	PS 1241	5.0	(12.9)	6.0	(14.2)	5.50	(13.6)	R
12	PK 1092	7.0	(15.3)	6.0	(14.2)	6.50	(14.8)	R
13	Indira Soya 9	9.0	(17.5)	6.0	(14.2)	7.50	(15.9)	R
14	PS 1029	9.0	(17.5)	4.0	(11.5)	6.50	(14.8)	R
15	NRC 37	10.0	(18.4)	6.0	(14.2)	8.00	(16.4)	R

16	PS 1347	9.0	(17.5)	6.0	(14.2)	7.50	(15.9)	R
17	JS 20-29	13.0	(21.1)	11.0	(19.4)	12.00	(20.3)	MR
18	MAUS 71	2.0	(8.1)	7.0	(15.3)	4.50	(12.2)	R
19	PK 1024	4.0	(11.5)	8.0	(16.4)	6.00	(14.2)	R
20	PK 472	4.0	(11.5)	5.0	(12.9)	4.50	(12.2)	R
21	PK 416	5.0	(12.9)	7.0	(15.3)	6.00	(14.2)	R
22	Alankar	7.0	(15.3)	7.0	(15.3)	7.00	(15.3)	R
23	Bragg	21.0	(27.3)	23.0	(28.7)	22.00	(28.0)	MS
24	Ankur	5.0	(12.9)	4.6	(12.4)	4.82	(12.7)	R
25	JS 335	6.0	(14.2)	5.0	(12.9)	5.50	(13.6)	R
26	PK 262 (SC)	31.0	(33.8)	31.0	(33.8)	31.00	(33.8)	S
	SEm(±)	**2.608**	**2.785**					
	CD (0.05)	**7.60**	**8.114**					

*Fig. in parentheses are angular transformed values

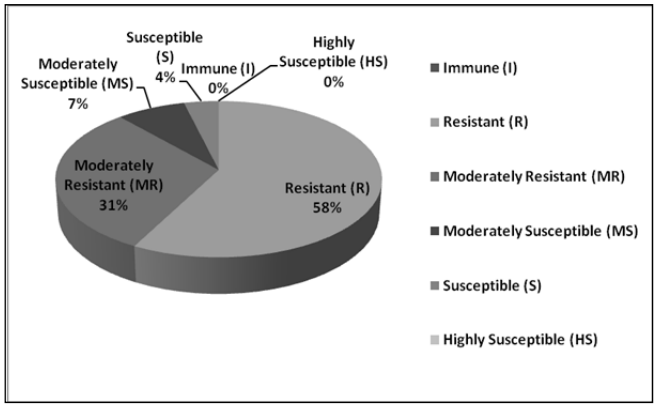

Fig. 1: Percentage of screened varieties on the basis of reactions to FLS (*Kharif*, 2015 and 2016)

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