Vol.2 No. 1, 99-104 (2013)
Received Nov.Aug.2012; Accepted Mar. 2013

Effect of *Rhizoctonia bataticola* Isolates on Mortality, Root Index and Root Mortality of Soybean Cultivar

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Abstract

About 22 isolates of *Rhizoctonia bataticola* (*Macrophomina phaseolina)* were collected from various soybeans growing area of Madhya Pradesh for their reactions against soybean cultivars. On the basis of their Pathogenecity two isolates $I_{2\ and}$ I_{10} were identified as a highly virulent isolates. Both isolates of *Rhizoctonia bataticola* are tested against seventy seven cultivars of soybean. Out of seventy seven entries tested against I_2 isolate of *Rhizoctonia bataticola*, 65 entries exhibited disease rating 9 (HS), 10 as 7 (S), 2 as 5 (MS) and none below 5. Mortality percentage varied from 23.00 per cent to 88.50 per cent. JS 93-05 had minimum (23.00%) mortality followed by JS 97-52 (27.00 %) and NRC 76 (40.66 %).Similarly all of these seventy seven entries also tested against I_{10} isolate of *Rhizoctonia bataticola*, 66 entries exhibited disease rating 9 (HS), 9 as 7 (S), 2 as 5 (MS) and none below 5. Mortality percentage varied from 17.00 Per cent to 87.50 per cent. JS 93-05 had minimum (17.00 %) mortality followed by JS-97-52 (29.00 %) and JS 335 (32.00 %).

Key words: *Rhizoctonia bataticola,* isolates, mortality, root index soybean cultivar

Introduction

Soybean (*Glycine max* L. Merrill) has become an important oil yielding crop with a steady increase in worldwide population. Major soybean producing countries are U.S.A. Brazil, Argentina, China and India. In India, it has occupied first place. The crop covered an area of 7.71 m ha with an annual production of 7.14 m tonnes. The productivity of soybean is 1018 kg/ha. Madhya Pradesh is largest soybean producing state in the country. It is cultivated in the state in an area of 4.45 m ha, producing 3.94 m tonnes with a productivity of 885 kg/ha which is covered about 60 % of the country.The average productivity 1067kg/ha of soybean in India is very low when compared to world average productivity of 2388 kg/ha. Among them various biotic and abiotic factors influencing the yield and quality of soybean [4].

Root rot caused by *Rhizoctonia bataticola* and collar rot caused by *Sclerotium rolfsii* are the important soil borne disease of soybean and causes considerable losses in yield [6].Losses in yield to 50% has been experienced in northern part of the state Parana and also in USA up to 20%. An estimated annual loss in soybean of 25.2 million bushels is attributed to charcoal rot from 1989 to 1991 in North Central region. In India 70% loss caused by charcoal rot has been reported. The disease is common

in M.P., Maharashtra, Rajasthan, Uttranchal, Punjab and Delhi. The pathogen has a very broad host range of 500 crops and weeds species, Department of Plant Breeding and Genetics, Jabalpur. Present investigation were attempt to additional information regarding diversity within this pathogen will help the development and release of disease-resistant soybean cultivars and contribute to understanding the population biology of this organism.

Materials and Method

The experiment was conducted at JNKVV, College of Agriculture, Jabalapur during 2009. About 22 isolates of *Rhizoctonia bataticola* (*Macrophomina phaseolina)* were collected from various soybeans growing area of Madhya Pradesh for their reactions against soybean cultivars. Fresh earthen pots (29.5 cm) were used thought out experimentation. Black cotton soil, sand and farm yard manure (9 kg) in the ratio 5:2:2 were admix thoroughly and then sterilized in an autoclave at 2.1 kg pressure per square inch (30 lbs pressure p.s.i) for two hours than air dried, kept to cool and filled in the pots. After sowing the crop was irrigated every alternate day five hundred milliliter of water, partially sterilized by boiling, was poured in to each pot. Seeds of soybean cultivars JS 95-60, JS 93-05 and other entries were obtained from All India Co-ordinate Research Project on Soybean.

Seed germination papers (45X30 cm) were purchased from Ajay Kumar and Sons, New Delhi. Blotter paper technique as described by ISTA[3] was employed to screen soybean genotypes for resistance. To conduct the Pathogenecity test 20 surface sterilized (35 second in 2.5% sodium hypo-chlorides) seeds of the test line of varieties of soybean were sown in autoclaved riverbed sand in pots. The two mycelial mats of *Rhizoctonia bataticola* were grown on P.D.A. medium for five days and macerated in a warring blender for 100 ml. The five days old seedling were uprooted and the root system was washed in running water followed by rinsing in sterilized distilled water and then dipped in inoculum solution for 30 seconds up and down. After the inoculation seedlings were placed side by side on a blotter paper. The tray was placed in an incubator at 30ºC for eight days having12 hours artificial light. The blotter paper was moistened adequately every alternate day. At the end of incubation period (8 days) examined the seedling for the extent of root damage and for the mortality.

Results and Discussion

All the twenty two isolates were tested for pathogenecity on soybean plants, on the basis of their pathogenecity two isolates $I_{2 \text{ and }} I_{10}$ were identified as a highly virulent isolates. Both isolates of *Rhizoctonia bataticola* are tested against seventy seven cultivars of soybean. The data presented in Table 2 clearly indicated that out of 77 entries tested against I_2 isolate of *Rhizoctonia bataticola*, 65 entries exhibited disease rating 9 (HS), 10 as 7 (S), 2 as 5 (MS) and none below 5 . Mortality percentage varied from 23.00 per cent to 88.50 per cent. JS 93-05 had minimum (23.00%) mortality followed by JS 97-52 (27.00 %) and NRC 76 (40.66

%). Maximum mortality percentage was recorded in DS 2613 (88.50 %) and Himso 1521 (87.50 %). Percentage root index ranged between 18.40 per cent to 79.30 per cent, minimum of 18.40 and 23.00 was recorded in JS 93-05 and B 1664 respectively, whereas maximum of 79.30 was recorded in VLS 73 followed by 77.50 in MACS 1039, It was also noted that 0.65 per cent root mortality per unit exhibit by NSO 383 followed by 0.82 per cent in JS 95-60. Maximum of 4.11 and 3.02 per cent was observed in Himso 1521 and AMS 99-33 respectively The data presented in Table 3 clearly indicated that out of 77 entries tested against I_{10} isolate of *Rhizoctonia bataticola*, 66 entries exhibited disease rating 9 (HS), 9 as 7 (S), 2 as 5 (MS) and none below 5.

Mortality percentage varied from 17.00 Per cent to 87.50 per cent. JS 93-05 had minimum (17.00 %) mortality followed by JS-97-52 (29.00 %) and JS 335 (32.00 %). Maximum mortality percentage was recorded in JS-99-89 (87.50%) and MACS 1039 (86.80 %). Percentage root index ranged between 15.00 to 76.80 per cent. Minimum of 15.00 and 23.12 was recorded in JS 93-05 and Himso 1676 respectively, whereas maximum of 76.82 was recorded in MACS 1184 followed by 76.50 in VLS 71. It was also noted that 0.13 per cent root mortality per unit exhibit by EC 325099 followed by 0.14 per cent in MAUS 282. Maximum of 3.57 and 3.22 per cent was observed in Himso 1521 and AMS 99-33 respectively. The results were more or less similar to the results reported by many investigators [1, 2, and 5].

Table 1. Collection of isolates from various districts of Madhya Pradesh state

District	**Locality of collection of isolates**	**Designation of isolates of *Rhizoctonia bataticola***
Jabalpur	1 Adhartal	I_1
	2 Khamriya	I_2
Narsingpur	3 KVK	I_3
	4 Farmer field	I_4
	5 Farmer field	I_5
Gadarwara	6 Farmer field	I_6
	7 Farmer field	I_7
Chhindwara	8 Chaurai	I_8
	9 K.V.K.	I_9
Seoni	10 K.V.K.	I_{10}
	11 Farmer field	I_{11}
Betul	12 Farmer field	I_{12}
	13 K.V.K.	I_{13}
	14 Betul Bazar	I_{14}
Hoshangabad	15 Farmer field	I_{15}
	16 K.V.K.	I_{16}
	17 Farmer field	I_{17}
Sehore	18 K.V.K.	I_{18}
	19 Farmer field	I_{19}
	20 Farmer field	I_{20}
Sagar	21 K.V.K.	I_{21}
	22 Farmer field	I_{22}

Table 2: Reaction of I_2 of *Rhizoctonia bataticola* against 77 entries of soybean

S.No.	Entries	Morta-lity (%)	Root inde (%)	Root Mortalit % Pe unit	Disease Score (1 – 9) (Charcoal rot)
1.	SL 738	73.75	59.37	1.24	9
2.	JS 99 77	72.50	67.50	1.07	9
3.	JS 20 22	61.87	63.75	0.97	9
4.	SL 747	66.25	65.65	1.00	9
5.	PK 1225	70.60	44.37	1.59	9
6.	SL 96	75.60	33.12	2.28	9
7.	SL 710	85.62	63.12	1.35	9
8.	SPC 175	55.60	42.50	1.30	9
9.	JS 20 24	68.75	56.87	1.20	9
10.	NSO 15	71.80	42.50	1.68	9
11.	JS 20 20	75.60	63.12	1.19	9
12.	JS 20 19	73.00	45.00	1.62	9
13.	RKS 48	74.30	37.50	1.98	9
14.	AGS 48	76.20	24.37	3.12	9
15.	EC-325099	75.60	59.37	1.27	9
16.	JS 20 15	76.20	60.00	1.27	9
17.	EC-396053	75.00	40.00	1.87	9
18.	NRC 56	77.50	68.75	1.12	9
19.	JS 99 89	81.20	49.37	1.64	9
20.	JS 82 180	76.20	53.12	1.43	9
21.	JS 99 78	74.30	54.37	1.36	9
22.	JS 20 2	85.60	59.37	1.44	9
23.	EC – 250607	80.00	39.37	2.03	9
24.	AMS - 99 33	81.20	26.87	3.02	9
25.	PK 768	84.30	63.75	1.32	9
26.	Himso 1521	87.50	21.25	4.11	9
27.	JS 75 52	83.00	44.37	1.87	9
28.	JS 98 63	77.50	54.37	1.42	9
29.	JS 20 23	66.87	60.62	1.10	9
30.	JS 98 62	76.87	67.50	1.13	9
31	JS 20 25	58.12	61.25	0.89	9
32.	JS 95 56	75.62	35.00	2.16	9
33.	B 16 64	59.37	23.00	2.58	9
34.	DSb 11	71.80	67.50	1.06	9
35.	JS(SH) 2002-11	75.60	75.60	1.00	9
36.	MAUS-417	78.10	74.30	1.05	9
37.	VLS 73	73.10	79.30	0.92	9
38.	Himso 1678	80.00	76.80	1.04	9
39.	PS 1454	86.80	76.80	1.13	9
40.	MACS 1039	84.30	77.50	1.08	9
41.	BAUS 96	87.50	76.20	1.14	9
42.	DS 2613	88.00	75.00	1.17	9
43.	MAUS - 282	78.00	37.50	2.08	9
44.	JS 20-14	75.00	40.60	1.84	9
45.	PS 1444	77.50	42.50	1.82	9
46.	TS 5	70.60	43.70	1.61	9
47.	Himso 1677	75.60	56.20	1.34	9
48.	MACS 1184	80.00	72.50	1.10	9
49.	NRC 80	83.00	70.60	1.17	9
50.	VLS 71	77.50	68.70	1.12	9
51.	RKS 54	73.70	68.10	1.08	9
52.	MACS 1140	75.60	50.00	1.51	9
53.	JS(SH) 2002-14	78.00	40.00	1.95	9
54.	TS 2	78.70	58.10	1.35	9
55.	PS 1450	82.50	66.80	1.23	9
56.	DS 2614	75.60	67.50	1.12	9
57.	NRC 79	78.00	45.60	1.71	9
58.	AMS 1	78.70	42.50	1.83	9
59.	KDS 321	55.60	63.70	0.87	9
60.	NSO 383	39.30	60.00	0.65	7
61.	RKS 52	42.50	43.10	0.98	7
62.	Himso 1676	45.00	25.62	1.75	7
63.	JS 20-18	47.50	32.50	1.46	7
64.	MACS 1188	45.60	50.00	0.91	7
65.	NRC 81	52.50	58.10	0.90	9
66.	JS 20-05	55.00	38.10	1.44	9
67.	NSO 29	53.00	36.20	1.46	9
68.	AMS 19	58.75	46.25	1.27	9
69.	JS 20 9	37.33	36.66	1.01	7
70.	NRC 76	40.66	38.00	1.07	7
71.	RKS 39	44.66	48.00	0.93	7
72.	RKS 45	51.33	52.66	0.97	9
73.	JS 97-52	27	25.7	1.05	5
74.	JS 335	47	43.5	1.08	7
75.	JS 95-60	43	52.3	0.82	7
76.	JS 93-05	23	18.4	1.25	5
77.	Bragg	77	67	1.14	9

Table 3. Reaction of I_{10} of *Rhizoctonia bataticola* against 77 entries of soybean

S. No.	Entries	Mortality (%)	Root index (%)	Root Mortality % Per unit	Disease Score (1 – 9) (Charcoal rot)
1.	SL 738	75.00	57.50	1.30	9
2.	JS 99 77	71.87	60.00	1.19	9
3.	JS - 20 22	59.37	61.25	0.96	9
4.	SL 747	73.75	71.25	1.00	9
5.	PK 1225	71.25	49.37	1.44	9
6.	SL 96	77.5	38.12	2.03	9
7.	SL 710	83.12	65.62	1.26	9
8.	SPC 175	61.87	46.87	1.32	9
9.	JS 20 24	71.25	63.12	1.12	9
10.	NSO 15	70.00	45.00	1.55	9
11.	JS 20 20	73.70	64.37	1.14	9
12.	JS 20 19	71.80	44.37	1.61	9
13.	RKS 48	73.00	40.00	1.82	9
14.	AGS 48	74.30	28.12	2.60	9
15.	EC 325099	73.70	56.87	0.13	9
16.	JS 20 15	74.30	67.50	1.10	9
17.	EC 396053	76.20	35.62	2.13	9
18.	NRC 56	76.20	66.25	1.15	9
19.	JS 99 89	87.50	45.62	1.91	9
20.	JS 82 180	70.60	60.00	1.17	9
21.	JS 99 78	75.60	66.87	1.13	9
22.	JS 20 2	83.00	61.25	1.35	9
23.	EC 250607	83.70	41.25	0.21	9
24.	AMS 99 33	82.50	25.62	3.22	9
25.	PK 768	80.60	71.25	1.13	9
26.	Himso 1521	85.00	23.75	3.57	9
27.	JS 75 52	84.30	48.12	1.75	9
28.	JS 98 63	75.60	50.00	1.51	9
29.	JS 20 23	64.37	64.37	1.00	9
30.	JS 98 62	80.62	62.50	1.28	9
31	JS 20 25	61.25	56.87	1.07	9
32.	JS 95 56	77.50	40.00	1.93	9
33.	B 16 64	61.87	23.12	2.67	9
34.	DSb 11	74.30	69.00	1.07	9
35.	JS(SH)2002 -11	63.10	73.70	0.85	9
36.	MAUS 417	76.80	76.20	1.00	9
37.	VLS 73	76.80	76.20	1.00	9
38.	Himso 1678	85.60	74.30	1.15	9
39.	PS 1454	85.00	75.60	1.12	9
40.	MACS 1039	86.80	76.40	1.13	9
41.	BAUS 96	83.10	75.00	1.10	9
42.	DS 2613	86.20	75.60	1.14	9
43.	MAUS 282	76.20	41.80	0.14	9
44.	JS 20-14	75.60	43.70	1.72	9
45.	PS 1444	78.80	43.00	1.83	9
46.	TS 5	75.00	45.00	1.66	9
47.	Himso 1677	72.50	65.00	1.11	9
48.	MACS 1184	81.80	76.80	1.06	9
49.	NRC 80	79.30	67.50	1.17	9
50.	VLS 71	76.20	76.50	0.99	9
51.	RKS 54	76.20	70.60	1.07	9
52.	MACS 1140	73.00	47.50	1.53	9
53.	JS(SH) 2002-14	79.00	38.10	2.07	9
54.	TS 2	75.00	55.60	1.34	9
55.	PS 1450	79.30	70.00	1.13	9
56.	DS 2614	71.80	75.00	0.95	9
57.	NRC 79	75.60	48.10	1.57	9
58.	AMS 1	71.50	43.70	0.17	9
59.	KDS 321	40.60	61.20	0.66	7
60.	NSO 383	38.00	58.10	0.65	7
61.	RKS 52	41.20	42.50	0.96	7
62.	Himso 1676	44.30	23.12	1.91	7
63.	JS 20-18	44.30	35.60	1.24	7
64.	MACS 1188	54.37	46.20	1.17	9
65.	NRC 81	51.20	56.80	0.90	9
66.	JS 20-05	52.50	43.10	1.21	9
67.	NSO 29	51.80	37.50	1.38	9

68.	AMS 19	66.87	48.12	1.38	9
69.	JS 20 9	40.66	36.00	1.12	7
70.	NRC 76	54.00	44.66	1.20	9
71.	RKS 39	50.66	48.36	1.04	9
72.	RKS 45	48.66	40.60	1.19	7
73.	JS 97-52	29	23.7	1.22	5
74.	JS 335	32	46.8	0.68	7
75.	JS 95-60	37	27.3	1.35	7
76.	JS 93-05	17	15	1.13	5
77.	Bragg	83	73	1.13	9

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