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Screening of Basmati Rice Germplasms against Rice Root-knot Nematode, *Meloidogyne graminicola*

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The rice root-knot nematode infests rice plant and cause considerable yield loss to the tune of 17–30 per cent to rice cultivation. In order to identify resistant source, the field experiments were conducted during *kharif*-2014 and 2015 at crop research centre SVPUAT, Meerut to evaluate 50 basmati rice germplasms against *Meloidogyne graminicola*. The result revealed that the germplasms show varying degrees of responses. Out of 50 germplasms, Pusa 1637-18-7-6-20 was found to be resistant with scale 2, while, 2 germplasms Shaan (Hybrid) and UPR 3805-12-2-7 were evaluated to be susceptible with scale 4 in cropping season *Kharif,* 2014 and 2015.

Keywords: *Meloidogyne graminicola,* Screening, Basmati rice germplasms,

Rice (*Oryzae sativa L.)* is one of the most important cereal crop of India and is a staple food of more than 65 per cent of its population, it accounts for about 43 per cent of total food grain production and 55 per cent of cereal production in the country, contributing 20-22 per cent of the agriculture G.D.P. (Singh 2009). Rice root-knot nematode, *Meloidogyne graminicola* has attained wide importance due to its potential to infect and cause serious damage to cereals, especially rice, in many countries (Prot and Matias, 1995; Padgham *et al.,* 2004; Pokharel *et al.,* 2007). It has become an emerging problem in the nurseries and transplanted rice along with direct seeded rice (DSR). *Meloidogyne graminicola* also cause serious damage in the upland rice but has been recently found to be widespread in the deepwater rice, in many states of India (Rao *et al*., 1986; Bridge *et al.,* 1990). The root-knot nematodes, *M. graminicola* cause serious losses to rice crops in some areas in north India (Gaur *et al.,* 1996). Infestations are particularly severe where two crops of rice are taken in a year, or where graminaceous weeds are abundant between two rice crops. Pockets of heavy infestation of rice nurseries and transplanted crop have been noticed in north-Indian plain zones including Jammu (J&K), Punjab, HP, Haryana, Delhi and UP (Gaur *et al*., 1996, Pankaj *et al.,* 2006). *Meloidogyne graminicola* is the most common RKN species infecting rice. In India, it is reported to cause 17-30 per cent yield loss due to poorly filled kernels (Jain *et al.,* 2007). The use of resistant cultivars is a low cost and sustainable option for the control of nematodes in the long term which does not impose unwanted changes in traditional agronomic practices (Amoussou *et al.,* 2004). Identification of sources of resistance to *M.*

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graminicola in rice must be performed under environmental conditions favorable for maximum damage by this nematode (Tandingan *et al.,* 2000).

MATERIALS AND METHODS

The field experiments were conducted at crop research centre, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (U.P.) during *kharif* 2014 and 2015. 50 basmati rice germplasms (Table-2) were screened against rice root-knot nematode under natural field condition. Observations were recorded after 40 days of seed sowing the number of galls/plant, root length and shoot length in each germplasms. Ten seedlings were pulled out carefully from the field, roots were washed under tap water for visual identification of galls. Incidence of root-knot disease was measured by root gall index the number of galls present and rated for their resistance/susceptibility as per the following scale (Taylor and Sasser, 1978). (Table 1)

Table 1. Root-Knot Index 0 to 5 scales for *Meloidogyne* spp.

Scale	Description	Reaction
0	No galls	Immune
1	1-2 galls / root system	Resistant
2	3-10 galls / root system	Moderately resistant
3	11- 30 galls / root system	Moderately susceptible
4	31-100 galls / root system	Susceptible
5	>100 galls / root system	Highly susceptible

Table 2. List of basmati rice germplasms with their entry number and description

S. No.	Entry No.	Germplasms Description	S. No.	Entry No.	Germplasms Description
1	2601	CR 3699-16-4	26	2629	SJR 70-3-2
2	2602	MAUB-2014-2	27	2630	UPR 3889-7-1-1
3	2603	RDN 02-01-8-18-11-9	28	4201	RP 5885-HP1-IR68144-2B-2-2-3-1-120
4	2604	RP 5900-16-8-4-2-1	29	4202	R- RHZ-2
5	2605	KMR-1-41	30	4203	IR 64
6	2606	Shaan (Hybrid)	31	4204	Chittimuthyalu
7	2607	Pusa RH 10	32	4205	RP 5885- HP 2-IR68144-2B-2-2-3-1-127
8	2608	HKR 10-579	33	4206	RP 5886-HP 3-IR80463-B39-3
9	2609	PAU-6307-2	34	4207	Samba Mahsuri
10	2610	Taroari Basmati	35	4209	RP Bio 5477 – NH 686
11	2611	NP-973-8	36	4210	Kalanamak
12	2612	UPR 3805-12-2-7	37	2501	NPH 2004
13	2613	NP-973-3	38	2502	P 1568-05-6-4-153
14	2615	SJR 76-1-1	39	2503	Pusa RH 101
15	2616	NDR 6257	40	2505	Pusa RH 102
16	2618	RP 5900-28-11-5-3-2-2	41	2506	Pusa RH 103
17	2619	NDR 6158	42	2507	Pusa 1718-14-2-150
18	2620	RP 5900-89-5-3-2-1-1	43	2508	Pusa 1718-19-8-152
19	2622	MAUB-2014-1	44	2510	Pusa 1883-28-16-360
20	2623	PAU-6297-1	45	2511	Pusa 1883-19-9-408
21	2624	SJR 129-2-2	46	2512	Pusa 1637-18-7-6-20
22	2625	NP-973-2	47	2513	Pusa 1637-12-8-20-5
23	2626	Pusa 1485-06-8-10-5-15-11	48	2515	Pusa 1879-6-17
24	2627	UPR 3886-9-1-1	49	2516	Pusa 1879-3-18
25	2628	RDN 04-15-17-11-11-7	50	2518	HKR 08-425

Table 3. Reaction of Basmati rice germplasms against *Meloidogyne graminicola during Kharif, 2014*

Root knot index	Germplasms/Entry No.	Reaction
1	2618 and 2512	Resistant
2	2505, 2608, 2610, 2616, 2620, 2626, 2627, 2628, 2629, 2630, 4201, 4202, 4205, 4206, 4207, 4210, 2501, 2508, 2510 and 2511	Moderately resistant
3	2601, 2602, 2603, 2604, 2609, 2611, 2613, 2619, 2622, 2624, 4203, 4204, 4209, 2502, 2503, 2507, 2513, 2515, 2516 and 2518	Moderately susceptible
4	2606, 2607, 2612, 2515, 2623, 2625, 2505 and 2506	Susceptible

Table 4. Reaction of Basmati rice germplasms against *Meloidogyne graminicola during Kharif, 2015*

Root knot index	Germplasms/Entry No.	Reaction
1	2616, 2512, 4205 and 4207	Resistant
2	2603, 2608, 2610, 2618, 2627, 2628, 2629, 2630, 4201, 4202, 4206, 2502, 2507, 2510 and 2518	Moderately resistant
3	2601, 2602, 2604, 2605, 2607, 2611, 2613, 2615, 2619, 2620, 2623, 2625, 2626, 4204, 4209, 4210, 2501, 2506, 2508, 2511, 2513, 2515 and 2516	Moderately susceptible
4	2606, 2612, 2622, 2624, 4203, 2503 and 2505	Susceptible

RESULTS AND DISCUSSION

Kharif 2014

During *Kharif* 2014 under natural field condition 50 germplasms were evaluated against rice RKN. Out of 50 germplasms RP 5900-2811-5-3-2-2 and Pusa 1637-18-7-6-20 were recorded to be resistant with root knot index scale 1, while 20 germplasms were found moderately resistant with scale 2, and another 20 germplasms were found moderately susceptible with scale 3, however, 8 germplasms were evaluated to be susceptible with root knot index scale 4 (Table 3). The maximum length of root and shoot were also recorded in Pusa 1637-18-7-6-20 followed by RP 5900-2811-5-3-2-2. (Fig. 1)

Kharif 2015

During *Kharif* 2015 out of 50 germplasms screened it was found that NDR 6257, Pusa 1637-18-7-6-20, RP 5885- HP 2-IR68144-2B-2-2-3-1-127 and Samba Mahsuri were resistant of *M. graminicola* with root knot index scale 1 and 16

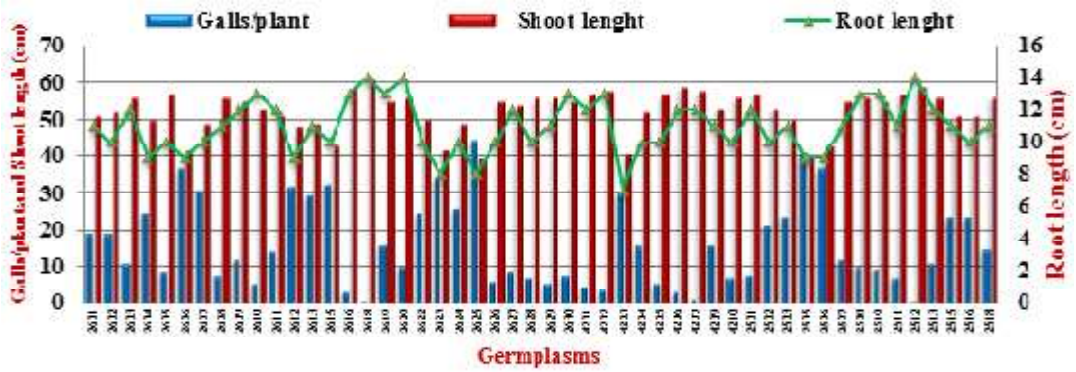

Fig. 1. Screening of selected basmati rice germplasms against RKN, *Meloidogyne graminicola* during *Kharif, 2014*

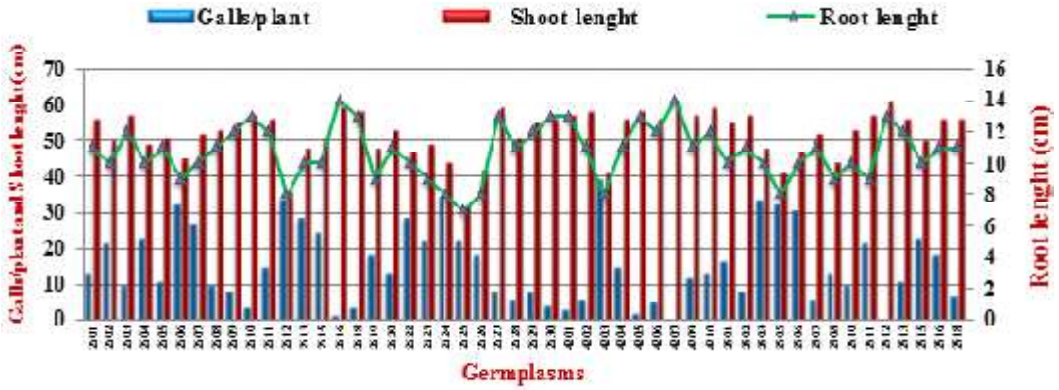

Fig. 2. Screening of selected basmati rice germplasms against RKN, *Meloidogyne graminicola* during *Kharif, 2015*

Plate 1. Infected rice root with *M. graminicola* on basmati rice germplasms

germplasms were recorded to be Moderately resistant with scale 2. It has also been noticed that 23 germplasms were evaluated moderately susceptible with root knot index scale 3 and susceptible germplasms were Shaan (Hybrid) , UPR 3805-12-2-7, MAUB-2014-1, SJR 129-2-2 , IR 64, Pusa RH 101 and Pusa RH 102(Table 4). The maximum length of root and shoot were also recorded in Pusa 1637-18-7-6-20 followed by NDR 6257. (Fig. 2)

These experiments were laid out in order to screen the promising basmati rice germplasms having desired characters for tolerance/resistance against rice root-knot nematode. Data indicated that out of 50 germplasms, Pusa 1637-18-7-6-20 was found to be resistant with scale 2, while, 2 germplasms Shaan (Hybrid) and UPR 3805-12-2-7 were evaluated to be susceptible with scale 4 in cropping season *Kharif,* 2014 and 2015.

Similar study by various scientists on screening of rice germplasms against rice root-knot nematode *Meloidogyne graminicola.* In order to identify resistant source against RKN, Berliner *et al*., (2014) who tested 414 rice cultivars, only two entries from breeding lines, 127-28-1-1-1 &183-6-1-1-3 were found resistant with score 2. Two lines from NBPGR collection and 4 aerobic cultivars were tolerant to root-knot nematode leaving all other in susceptible and highly susceptible category. Ravindra *et al*., (2015) who screened 135 cultivars out of 135 cultivars, 32 cultivars were found to be highly resistant, while, 45 varieties read were resistant. However, 40 varieties were evaluated to be moderately resistant and nine varieties susceptible.

CONCLUSION

Out of 50 germplasms, Pusa 1637-18-7-6-20 found to be most promising germplasm against rice RKN to reduce the number of galls/plant and increasing the root and shoot length during both cropping season. So the germplasm can be use for further study to develop a resistant rice cultivar against root knot nematode.

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