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Screening of available germplasm lines of ridge gourd against root-knot nematode

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Abstract

The initial root-knot nematode population in soil was 1000 J₂/pot and six weeks after inoculation, the nematode population of susceptible lines was lower than the highly susceptible lines. The germplasm lines like Punjab sadabahar, RG-113, Pusa nasdar, Solapur local, RG-109, MHRG-7, RG-111, Kaveri, Vaishali, Krishna-51 and BSS-1036 were found to be susceptible to root-knot nematode. Remaining all germplasm lines were found to be highly susceptible to root-knot nematode. The number of root galls/egg masses recorded in highly susceptible lines ranged from 107.67 (Hare-1) to 161.33 (RG-116) per plant. The gall index recorded in these lines was 5.00/plant. The number of root galls/egg masses recorded in susceptible lines ranged from 45.67 (MHRG-7) to 90.67 (BSS-1036) per plant. The gall index recorded in these lines was 4.00 per plant. The susceptible germplasm lines like, Punjab sadabahar, RG-113, Pusa nasdar, Solapur local, RG-109, MHRG-7, RG-111, Kaveri, Vaishali, Krishna-51 and BSS-1036 recorded the multiplication factor of 2.11, 2.18, 2.07, 2.15, 2.24, 2.03, 2.54, 2.17, 2.10, 2.20 and 2.70 respectively.

Keywords: ridge gourd, root- knot nematode, germplasm, inoculaton, *Meloidogyne incognita*

Introduction

India is the second largest producer of vegetables next to China. Even though, the importance of growing vegetable crops has not been fully realized and hardly about 3 per cent area of the total cultivated crops is occupied by vegetables (Salunkhe and Kadam, 2005) [6]. Ridge gourd, *Luffa acutangula* is an important vegetable crop that belongs to the family cucurbitaceae. Amongst the cucurbits, ridge gourd is the most commonly preferred vegetable by the Indian people. In India, ridge gourd is grown in an area of about 10,040 ha. with a production of 1,28,310 tonnes and productivity of 12.78 t/ha. Many varieties of ridge gourd have been developed for commercial cultivation in India, which include varieties like Pusa Nasdar, Desi Chaitali, Co-1, Co-2, PKM 1, Phule Sucheta, Konkan Harita, Arka Summet, Arka Sujath, Neeta and Anitha (Anonymous, 2012-13) [1]. The root-knot nematode, *Meloidogyne* spp. is one of the major constraint in vegetable production. It causes an annual monetary loss to the tune of Rs. 547.50 million in cucurbits (Jain *et al.*, 2007) [3]. The host range of root-knot nematodes is extensive and more than two thousand plant species have been reported as hosts for this nematode (Sasser, 1980) [7]. This nematode is sedentary endoparasite and produce disease symptoms both on above and below ground plant parts. Foliar symptoms include stunting, premature wilting, and leaf chlorosis and below ground symptoms include root galls or knots on the roots, which affect nutrient uptake by plant. The root-knot nematodes causes severe damage thus leads to dramatic yield losses up to 24 per cent (Sikora and Fernandez, 2005) [8]. Screening of seventeen germplasm lines of ridge gourd against root-knot nematode, *M. incognita* was done in glasshouse with a view to search for the source of resistance for recommendation to the farmers for cultivation and or to the breeders for incorporating the resistance in high yielding and ultimately to release it to farmers for cultivation in fields infested with *M. incognita*. The information on various aspects of nematode management is scanty, scattered as there is no systematic work on damage potential of root-knot nematode on ridge gourd. Therefore, the investigation was undertaken with the screening of available germplasm lines of ridge gourd against root-knot nematode.

Materials and Methods

A statistically designed experiment for screening of different germplasm lines of ridge gourd against root-knot nematode was conducted during *Kharif* season of the year 2019 in the

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glasshouse of AICRP on Nematodes, Department of Agril. Entomology, M.P.K.V., Rahuri. The seeds of seventeen germplasm lines of ridge gourd as listed in Table 1 were obtained from Senior Vegetable Breeder, AICRP on Vegetable Improvement Scheme M.P.K.V. Rahuri. All the germplasm lines of ridge gourd were sown in 15 cm diameter earthen pots containing 1 kg mixture of autoclaved soil and FYM in 3:1 proportion. Thinning was done after germination so as to maintain only one healthy seedling in each pot. Each germplasm line was inoculated with 1000 freshly hatched larvae (2nd stage juveniles) of root-knot nematode. For inoculation, stock culture of root-knot nematode was maintained on brinjal in the earthen pots as well as in the field. Inoculation was done by pouring the freshly hatched nematode suspension obtained from the egg masses of stock

culture in three holes prepared around the plants and on roots exposed by removing the top layer of the soil, which were later on covered by the moist autoclaved soil. Before inoculation nematode count per ml of suspension was taken under microscope and required quantity of the suspension poured in to the pots. The plants were watered as and when required. The details of the experiment are given below.

Details of experiment

Design : Completely Randomized Design

Replications : Three

Treatments : Seventeen

Date of sowing : 22/07/2019

Date of inoculation : 03/08/2019

Date of termination : 17/09/2019

Table 1: List of germplasm lines of ridge gourd screened against root-knot nematode, *M. incognita*

Sr. No.	Germplasm line	Sr.No.	Germplasm line
1	Punjab sadabahar	10	RG 116
2	RG 113	11	Rohini
3	Pusa nasdar	12	RG 106
4	Solapur local	13	Vaishali
5	RG 109	14	Hare 1
6	MHRG 7	15	Krishna 51
7	RG 111	16	BSS 1036
8	Aarati	17	Harsha
9	Kaveri		

Method of recording observations

Six weeks after inoculation, each germplasm line of ridge gourd was uprooted carefully and the adhering soil was washed properly under clean tap water. The plants were then cut at the base and observations like number of root galls and egg masses present on roots were counted. To count egg masses, staining of egg masses was done by dipping the roots

in 1 per cent solution of trypan blue for two minutes. After dipping, roots were washed two to three times under tap water to remove the stain of the roots. The gall index 1 to 5 scale was worked out by considering the number of root galls and eggs masses/plant. On the basis of gall index the lines were categorized in different reactions as below in Table 2.

Table 2: Gall index categories

Gall index	No. of root galls/egg masses/plant	Reaction
1	0	Highly resistant (HR)
2.	1 to 10	Resistant (R)
3.	11 to 30	Moderately resistant (MR)
4.	31 to 100	Susceptible (S)
5.	> 101	Highly susceptible (HS)

Analysis of the experimental data

In order to find out the significant difference in the different germplasm lines of ridge gourd, all the experimental data were statistically analyzed. The significance of different lines was assessed at 5 per cent level.

Results and Discussions

Screening of seventeen germplasm lines of ridge gourd against root-knot nematode, *M. incognita* was done in glasshouse with a view to search for the source of resistance for recommendation to the farmers for cultivation and or to the breeders for incorporating the resistance in high yielding but susceptible varieties/lines and ultimately to release it to farmers for cultivation in fields infested with *M. incognita*.

The observations on root galls/egg masses recorded six to eight weeks after inoculation are presented in Table 3. However, from these observations each line was rated for its reaction to nematode as described earlier in materials and methods.

It could be seen from the Table 4 and 5 that out of seventeen germplasm lines of ridge gourd screened against root-knot nematode, none was found to be resistant to the pest. However, eleven and six lines were susceptible and highly susceptible to root-knot nematode, respectively. The number of root galls/egg masses recorded in these lines ranged from 45.67 (MHRG 7) to 161.33 (RG 116) per plant. The gall index recorded in these lines ranged from 4.00 to 5.00 per plant.

Among the germplasm lines Punjab sadabahar, RG-113, Pusa nasdar, Solapur local, RG-109, MHRG-7, RG-111, Kaveri, Vaishali, Krishna-51 and BSS-1036 were found to be susceptible to root-knot nematode. Remaining all germplasm lines were found to be highly susceptible to root-knot nematode. The number of root galls/egg masses recorded in highly susceptible lines ranged from 107.67 (Hare-1) to 161.33 (RG-116) per plant. The gall index recorded in these lines was 5.00/plant. The number of root galls/egg masses recorded in susceptible lines ranged from 45.67 (MHRG-7) to 90.67 (BSS-1036) per plant. The gall index recorded in these

lines was 4.00 per plant.

It could also be seen from the data presented in Table 3 that the initial root-knot nematode population in soil was 1000 J_2 /pot and six weeks after inoculation, the nematode population of susceptible lines was lower than the highly susceptible lines. The susceptible germplasm lines, Punjab sadabahar, RG-113, Pusa nasdar, Solapur local, RG-109, MHRG-7, RG-111, Kaveri, Vaishali, Krishna-51 and BSS-1036 recorded the multiplication factor of 2.11, 2.18, 2.07, 2.15, 2.24, 2.03, 2.54, 2.17, 2.10, 2.20 and 2.70 respectively.

These results are in conformity with findings of Pandey and Nayak (2018) [5] who tested fifty two varieties of ridge gourd and found that only six varieties were resistant reaction, seven

varieties were moderately resistant, thirty two varieties were susceptible and five varieties were highly susceptible.

These results are in accordance with findings of Das and Sinha (2005) [2] who screened twenty cultivars of okra and found that only two cultivars were susceptible while other eighteen cultivars were highly susceptible. These results are in agreement with Nayak and Pandey (2015) [4] who tested one hundred fifty varieties of brinjal and reported only twenty varieties were resistant, fifty eight varieties were moderately resistant, forty seven varieties were susceptible and twenty five varieties were highly susceptible among all one hundred fifty brinjal varieties.

Table 3: Effect of different germplasm lines of ridge gourd on root-knot nematode, *M. incognita* population

Sr. No.	Germplasm lines	Initial root-knot nematode population (J_2)/pot	Root-knot nematode population (J_2)/pot at termination				Multiplication factor
			R1	R2	R3	Mean	
1.	Punjab sadabahar	1000	1960	2110	2270	2113.33	2.11
2.	RG-113	1000	2290	2140	2120	2183.33	2.18
3.	Pusa nasdar	1000	2010	1970	2250	2076.67	2.07
4.	Solapur local	1000	2210	2160	2080	2150	2.15
5.	RG-109	1000	2030	2450	2250	2243.33	2.24
6.	MHRG-7	1000	2120	2050	1900	2033.33	2.03
7.	RG-111	1000	2370	2710	2540	2540	2.54
8.	Arati	1000	3480	3600	3460	3513.33	3.51
9.	Kaveri	1000	2030	2290	2190	2170	2.17
10.	RG-116	1000	3700	3680	3740	3706.67	3.70
11.	Rohini	1000	3480	3600	3500	3526.67	3.52
12.	RG-106	1000	3620	3480	3600	3566.67	3.56
13.	Vaishali	1000	1980	2210	2130	2106.67	2.10
14.	Hare-1	1000	3480	3360	3600	3480	3.48
15.	Krishna-51	1000	2260	1940	2410	2203.33	2.20
16.	BSS-1036	1000	2720	2870	2520	2703.33	2.70
17.	Harsha	1000	3680	3440	3480	3533.33	3.53
	SE \pm					78.39	
	CD @5%					225.309	

Table 4: Reaction of different germplasm lines of ridge gourd to root-knot nematode, *M. incognita* as evidenced by number of root-galls/egg masses/plant

Sr. No	Germplasm lines	No. of root gall/egg masses per plant			Mean number of galls/egg masses/plant
		R1	R2	R3	
1.	Punjab sadabahar	50	59	55	54.67
2.	RG-113	61	67	63	63.67
3.	Pusa nasdar	49	45	51	48.33
4.	Solapur local	56	63	51	56.67
5.	RG-109	68	73	64	68.33
6.	MHRG-7	45	41	53	45.67
7.	RG-111	81	74	87	80.67
8.	Arati	118	107	109	111.33
9.	Kaveri	51	57	62	56.67
10.	RG-116	158	165	161	161.33
11.	Rohini	127	105	111	114.33
12.	RG-106	121	138	130	129.67
13.	Vaishali	51	48	56	51.67
14.	Hare-1	102	108	113	107.67
15.	Krishna-51	67	57	60	61.33
16.	BSS-1036	93	89	90	90.67
17.	Harsha	129	115	109	117.67
	SE \pm				3.49
	CD at 5%				10.05

Table 5: Reaction of different germplasm lines of ridge gourd to root-knot nematode, *M. incognita* as evidenced by gall index/plant

Sr. No	Germplasm lines	Gall index per plant			Mean gall index	Reaction
		R1	R2	R3		
1.	Punjab sadabahar	4	4	4	4	S
2.	RG-113	4	4	4	4	S
3.	Pusa nasdar	4	4	4	4	S
4.	Solapur local	4	4	4	4	S
5.	RG-109	4	4	4	4	S
6.	MHRG-7	4	4	4	4	S
7.	RG-111	4	4	4	4	S
8.	Arati	5	5	5	5	HS
9.	Kaveri	4	4	4	4	S
10.	RG-116	5	5	5	5	HS
11.	Rohini	5	5	5	5	HS
12.	RG-106	5	5	5	5	HS
13.	Vaishali	4	4	4	4	S
14.	Hare-1	5	5	5	5	HS
15.	Krishna-51	4	4	4	4	S
16.	BSS-1036	4	4	4	4	S
17.	Harsha	5	5	5	5	HS
	SE ±				0.06	
	CD at 5%				0.17	

Conclusions

The experiment on screening of different germplasm lines of ridge gourd against root-knot nematode, *M. incognita* revealed that, none of seventeen germplasm lines tested was found to be resistant to root knot nematode. However, germplasm lines viz., Punjab sadabahar, RG-113, Pusa nasdar, Solapur local, RG-109, MHRG-7, RG-111, Kaveri, Vaishali, Krishna-51 and BSS-1036 were found to be susceptible to root-knot nematode. Remaining six germplasm lines were found to be highly susceptible to root-knot nematode.

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