International Journal of Agricultural Sciences ☞DOI:10.15740/HAS/IJAS/16.2/249-253
Volume 16 | Issue 2 | June, 2020 | 249-253 ■ ISSN : 0973-130X Visit us : *www.researchjournal.co.in*

RESEARCH PAPER

Evaluation of different rice genotypes for resistant against rice root-knot nematode, *Meloidogyne graminicola*

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Abstract : Screening of different rice genotypes were tested for their resistant reaction against rice root-knot nematode, *Meloidogyne graminicola*. In the present studies, 79 rice genotypes/lines (44 genotypes from OG series and 35 genotypes from AR series including Pusa 1121 and TN-1 as susceptible checks) were evaluated for resistant reaction against *M. graminicola* was carried out under screen house, Department of Nematology, CCS Haryana Agricultural University, Hisar, Haryana during *Kharif*, 2019-20. Seeds of each genotype were sown in the earthen pots (1 kg soil capacity) containing steam sterilized sandy loam soil. One week old seedlings of rice genotypes were inoculated with freshly hatched second stage juveniles of *M. graminicola* @ 2000 J_2/pot. Forty five days after inoculation, observations were recorded such as number of eggs and second stage juveniles. The result reveals that the genotypes showed great variation in reaction to *M. graminicola* from resistant to highly susceptible reaction. Out of 44 genotypes from OG series, 34 showed resistant reaction. However, two genotypes (OG-4 and OG-37) were found moderately resistant and remaining was categorized as susceptible reaction. Similarly, out of 35 genotypes from AR series, two genotypes (AR-08, AR-31) showed resistant reaction against *M. graminicola*. Four genotypes (AR-06, AR-20, AR-21 and AR-32) showed moderately resistant reaction and rests of the genotypes were categorized as susceptible reaction against *M. graminicola*. Most of the genotypes were found resistant/moderately resistant to *M. graminicola* which can be used for future breeding programmes to develop resistant reaction in these genotypes.

Key Words : *Meloidogyne graminicola*, Rice, Resistant, Screening, Genotypes

View Point Article : Kumar, Vinod, Kumar, Anil and Mann, S.S. (2020). Evaluation of different rice genotypes for resistant against rice root-knot nematode, *Meloidogyne graminicola*. *Internat. J. agric. Sci.*, **16** (2) : 249-253, **DOI:10.15740/HAS/IJAS/16.2/249-253.**

Article History : Received : 26.04.2020**; Revised :** 19.05.2020**; Accepted :** 23.05.2020

INTRODUCTION

Rice (*Oryza sativa* L.) is one of the world's most important staple food crops. It is consumed by more than half of the world's population and 90 per cent of it is being produced and consumed in Asia Rao *et al.* (2016) and share maximum in grain production. It is grown worldwide over an area 160.6 million hectares with total production of 492.2 million tonnes. India is the second largest producer of rice in the world and is the major cereal crop of the country. Rice crop is affected by several biotic and abiotic factors, of which plant parasitic nematodes (PPNs) constitute an important component Jain *et al.* (2012). The rice root-knot nematode was identified as one of the biotic factor most likely to

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contribute to the yield decline in aerobic rice fields Kreye *et al.* (2009); Pinili *et al.* (2009) and Van Buyten *et al.* (2013). *M. graminicola*, is one of the most predominant pest associated with rice under upland condition Bridge *et al.* (1990) and causing substantial yield losses Prot and Matias (1995) and Soriano *et al.* (2000). It is not only a serious problem in nurseries and upland rice but also found to be widespread in the deepwater and irrigated rice in many states of India Prasad (1985); MacGowan (1989) and Jairajpuri and Baqri (1991). This nematode is prevalent in eastern, north eastern and southern states of India Dabur and Jain (2005).

M. graminicola is a pest of international importance and it is reported to cause 17-30 per cent yield loss due to poorly filled kernels MacGowan and Langdon (1989) while in India, nematodes of rice alone cause 10.54 per cent yield loss which causes monetary losses of 779.30 million rupees Jain *et al.* (2007). Since, *M. graminicola* causes severe yield losses, efforts in the recent past have been initiated on the management of this nematode through host resistance, bio-agents and chemicals. Sufficient amount of work has been done on various aspects of pathogen and its management against root-knot nematode in rice. So, far more studies have not been carried out on aspects of availability of tolerant or resistant cultivars and an effective, eco-friendly management of root-knot nematode in rice. Keeping this in view, present investigation was undertaken to evaluate the different rice genotypes/lines for resistant against rice root-knot nematode, *Meloidogyne graminicola.*

MATERIAL AND METHODS

In the present studies, 79 rice genotypes/lines along with Pusa 1121 and TN-1 as susceptible checks were screened for resistant against rice root-knot nematode *M. graminicola* during 2019-20, in the Department of Nematology, C.C.S. HAU, Hisar, Haryana.

Preparation of pure culture of rice root-knot nematode, *M. graminicola:*

The inoculum of *M. graminicola* used for this experiment was propagated from the culture of *M. graminicola* maintained in screen house, Department of Nematology, C.C.S. HAU, Hisar on rice plants. Pure cultures were raised in screen house in earthen pots filled with steam sterilized sandy loam soil. One week old seedlings of rice were inoculated with freshly hatched second stage juveniles of *M. graminicola* @ 2000 J_2 per pot. Second stage juveniles of *M. graminicola* were obtained from a single egg mass and inoculated around the root of rice seedlings in pots. The culture was allowed to multiply for 2-3 generations and used for screening experiment in pots under screen house conditios. Freshly hatched second stage juveniles were used as inoculum in this experiment.

Collection of rice genotypes:

Seventy nine genotypes of rice (44 genotypes from OG series and 35 genotypes from AR series including Pusa 1121 and TN-1 as susceptible checks), obtained from Project Co-ordinator, AICRP on plant parasitic nematodes with integrated approach for their control, Division of Nematology, ICAR, New Delhi.

Seeds of each genotype were sown in the earthen pots (1 kg soil capacity) containing steam sterilized sandy loam soil. After germination, these were thinned to single plant in each pot with three replications. One week old seedlings of rice genotypes were inoculated with freshly hatched second stage juveniles of *M. graminicola* @ 2000 J_2 per pot by exposing the roots. Forty five days after inoculation, each plant was uprooted carefully from soil. The roots were retrieved carefully and kept in a basin of water to clear it from adhering soil particles and recorded the observations such as number of eggs and second stage juveniles. The genotypes were categorized (reproduction index) as resistant, moderately resistant, susceptible and highly susceptible for confirmation as per standard protocols (AICRP).

$$\text{Reproduction index} = \frac{\text{Number of eggs + } J_2 \text{ plant}^{-1} \text{ in test variety}}{\text{Number of eggs + } J_2 \text{ plant}^{-1} \text{ in standard variety (susceptible variety)}} \times 4$$

Categorization:

0-1.0 = Resistant (R)
1.1-2.0 = Moderately Resistant (MR)
2.1-3.0 = Susceptible (S)
3.1 and above = Highly susceptible (HS).

RESULTS AND DISCUSSION

Results are presented in Table 1 during 2019-20 for confirmation of resistant reaction against rice root-knot nematode, *M. graminicola*. The result revealed that the genotypes showed great variation in response or reaction to *M. graminicola* from resistant to highly susceptible. A total of 79 genotypes/lines were screened, 36 showed

Table 1: Reaction of rice genotypes for resistance against rice root-knot nematode, *Meloidogyne graminicola*

Sr. No.	Entry No./ genotypes	Reproduction index	Reaction
OG series			
1.	Pusa1121	2.8	S
2.	OG line 2	Did not germinate	
3.	OG line 3	2.1	S
4.	OG line 4	1.3	MR
5.	OG line 5	0	R
6.	OG line 6	0	R
7.	OG line 7	2.6	S
8.	OG line 8	2.4	S
9.	OG line 9	0	R
10.	OG line 10	0	R
11.	OG line 11	0	R
12.	OG line 12	0	R
13.	OG line 13	0	R
14.	OG line 14	0	R
15.	OG line 15	0	R
16.	OG line 16	0	R
17.	OG line 17	0	R
18.	OG line 18	0	R
19.	OG line 19	0	R
20.	OG line 20	0	R
21.	OG line 21	0	R
22.	OG line 22	0	R
23.	OG line 23	0	R
24.	OG line 24	0	R
25.	OG line 25	0	R
26.	OG line 26	0	R
27.	OG line 27	0	R
28.	OG line 28	0	R
29.	OG line 29	0	R
30.	OG line 30	0	R
31.	OG line 31	0	R
32.	OG line 32	0	R
33.	OG line 33	0	R
34.	OG line 34	0	R
35.	OG line 35	Did not germinate	
36.	OG line 36	0	R
37.	OG line 37	1.9	MR
38.	OG line 38	0	R
39.	OG line 39	0	R
40.	OG line 40	0	R
41.	OG line 41	0	R
42.	OG line 42	3.0	S
43.	OG line 43	0	R
44.	OG line 44	2.2	S
AR. Series			
1.	AR-01	Did not germinate	
2.	AR-02	2.1	S
3.	AR-03	2.9	S
4.	AR-04	2.6	S
5.	AR-05	Did not germinate	
6.	AR-06	1.3	MR
7.	AR-07	2.4	S
8.	AR-08	1.0	R
9.	AR-09	2.4	S
10.	AR-10	2.5	S
11.	AR-11	2.9	S
12.	AR-12	2.2	S
13.	AR-13	2.3	S
14.	AR-14	2.8	S
15.	AR-15	2.5	S
16.	AR-16	2.6	S
17.	AR-17	2.9	S
18.	AR-18	2.1	S
19.	AR-19	2.5	S
20.	AR-20	1.1	MR
21.	AR-21	1.9	MR
22.	AR-22	2.8	S
23.	AR-23	2.2	S
24.	AR-24	2.4	S
25.	AR-25	2.8	S
26.	AR-26	Did not germinate	
27.	AR-27	2.1	S
28.	AR-28	2.2	S
29.	AR-29	2.8	S
30.	AR-30	2.9	S
31.	AR-31	1.0	R
32.	AR-32	1.9	MR
33.	AR-33	2.2	S
34.	AR-34	3.0	S
35.	TN1	2.4	S

R- Resistant; MR- Moderately Resistant; S- Susceptible

Table 1 : Contd.……

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resistant reaction and six lines showed moderately resistant reaction against rice root-knot nematode. Out of 44 genotypes/lines from OG Series, 34 were found resistant reaction (OG line 5, 6, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 36, 38, 39, 40, 41 and 43). However, two lines (OG line 4 and 37) showed moderately resistant and remaining were found susceptible reaction against rice root-knot nematode. Similarly, out of 35 genotypes from AR series, two (AR-08, AR-31) were found resistant reaction. Four lines (AR-06, AR-20, AR-21 and AR-32) showed moderately resistant and rests of the lines were categorized as susceptible reaction against rice root-knot nematode. Yik and Birchfield (1979) showed that out of 26 rice cultivars, 21 cultivars were found resistance to the rice root-knot nematode. Green house evaluation of 12 Nepalese rice varieties showed that Masuli and Chaite-6 were found moderately resistant reaction against to *M. graminicola* Sharma-Poudyal *et al.* (2004). Evaluation of advanced backcross populations developed for water stress environment revealed that Teqing and the donarscvc Type 3, Zihui 100, Shwe Thwe Yin Hyv were resistant reaction against *M. graminicola* Prasad *et al.* (2006).

Simon (2009) evaluated the susceptibility of 53 rice genotypes to *M. graminicola* in pot and field experiments and observed that 13 cultivars were found highly resistant to this nematode. Das *et al.* (2011) reported that *Oryza glaberrima* accessions CG 14 and TOG 5674, traditional cultivars WAB 638-1 and IRAT 216 and aerobic rice genotype IR 81426-B-B-186-4 and IR81449B-B-51-4 were showed resistant reaction against *M. graminicola*. Rice lines Ranbir Basmati, Hasan Sarai and Purple cultures were rated as susceptible reaction against *M. graminicola* Shrivastava *et al.* (2011). Out of 135 rice cultivars, 32 cultivars were found to be highly resistant while, 45 cultivars were found resistant. However, 40 cultivars were evaluated to be moderately resistant and nine cultivars were found susceptible reaction against to *M. graminicola*. The remaining nine cultivars were learnt to be highly susceptible Ravindra *et al.* (2015).

Conclusion:

The findings of our study showed great variation in reaction to *M. graminicola* from resistant to susceptible. A total of 79 genotypes were screened, 36 showed resistant and six lines showed moderately resistant reaction against *M. graminicola*. These genotypes suffered less damage by the nematode as compared to susceptible genotypes. Resistant lines will be proved useful parents for root-knot nematode resistant breeding programme.

Acknowledgement:

The authors are highly obliged to the Project Co-ordinator, AICRP on plant parasitic nematodes with integrated approach for their control, Division of Nematology, ICAR, New Delhi for providing germplasm/ lines to carry out the research work.

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