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Reaction of rice cultivars to rice root-knot nematode *Meloidogyne graminicola*

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Abstract

The rice root knot nematode *Meloidogyne graminicola* is one of the important nematode problems in many rice-growing areas of the world. The development of nematode-resistant cultivars is the most cost-effective and sustainable method for nematode management in rice. The success of a breeding programme for resistance depends on the availability of diverse sources of resistance. The present study was conducted to screen fourteen rice cultivars for resistance to *M. graminicola* in search of strong resistant source. The rice cultivars were screened for resistance to *M. graminicola* by the germination paper screening method using the relative root-gall index (RRGI) and relative reproduction index (RRI) scores. Out of the fourteen rice cultivars tested, only two cultivars *viz*., Swarnadhan and Dhanrasi were found resistant to *M. graminicola*. These two rice cultivars can be studied further to use them as donors in resistance breeding against *M. graminicola*.

Keywords: Rice, *Meloidogyne graminicola*, resistance, screening

The rice root-knot nematode *Meloidogyne graminicola* is one of the important plant-parasitic nematodes infecting rice crop (Prasad *et al*., 2010; Ravindra *et al*., 2017). It is a pest of international importance to rice due to its presence in most of the rice-growing areas in the world (De Waele and Elsen, 2007; Dutta *et al*., 2012; Mantelin *et al*., 2017). It infects rice in almost all types of rice production systems, but the damage is more severe in rice nurseries and upland rice. *M. graminicola* infected rice plants show stunting and chlorosis due to the characteristic terminal swellings or hook-like galls on the roots, which ultimately results in severe reduction in growth and yield (Prasad *et al*., 2010; Pankaj *et al*., 2010). In India, *M. graminicola* is one of the major concerns in rice production in many states including Karnataka, West Bengal, Orissa, Uttar Pradesh, Himachal Pradesh, Assam (Jain *et al*., 2012). It is reported to cause 10-30% yield loss in different rice production systems (Jain *et al*., 2007).

In view of limited options for the management and poor awareness among the farmers about nematodes, the only effective management option for *M. graminicola* is the use of resistant cultivars. The development of nematode-resistant cultivars is the most cost-effective and sustainable method for nematode management for small as well as large-scale farmers in poor and developing countries (Pokharel *et al*., 2012). Several resistant to moderately resistant rice cultivars have been identified against this nematode, still there is a need for strong resistant source for breeding nematode resistant cultivars. Hence the present study was conducted to screen fourteen rice cultivars for resistance to *M. graminicola* in rice.

The rice cultivars tested in this experiment were reported to be resistant to multiple insect pests and diseases of rice (Padmavathi *et al*., 2013), but the information on the reaction of these cultivars to rice root-knot nematode *M. graminicola* is lacking. Hence these cultivars were selected for this study. The cultivars were screened for resistance to *M. graminicola* by the germination paper screening method (Somasekhar *et al*., 2019). Rice seeds were soaked in water for two days and sprouted seeds were transferred to the germination paper rolls. Ten seeds were placed in each germination paper roll. The germination paper rolls were placed in test tubes half filled with distilled water and incubated at 25-30 ^{o}C. Each seedling was inoculated with 50 second-stage infective juveniles (J_2) of *M. graminicola* 4-5 days after placing seeds in germination paper roll. Nematode susceptible cultivar TN 1 was used as a susceptible check and five replications

were maintained for each cultivar. Observations on root galls and total nematode population including eggs and juveniles were recorded three weeks after nematode inoculation. The experiment was repeated twice and the data from all the individual plants of a test entry from both the experiments were combined to compute the mean. The cultivars were categorized as resistant or susceptible based on the relative root-gall index (RRGI) and relative reproduction index (RRI) scores (Jena and Rao, 1976). RRGI/RRI score followed: 0 (Highly resistant), 0.1-1.0 (Resistant), 1.1-2.0 (Moderately susceptible), 2.1-3.0 (Susceptible) and >3.1 (Highly susceptible). The RRGI and RRI are computed as per the formula given below.

$$\text{Relative root-gall index} = \frac{\text{Number of galls in test entry x 4}}{\text{Number of galls in susceptible check}}$$

$$\text{Relative reproduction index} = \frac{\text{Total nematode population in test entry x 4}}{\text{Total nematode population in susceptible check}}$$

A large variation in the number of galls and total nematode population per root system was observed among the cultivars tested. The reaction of test entries was rated based on the relative root-gall index and relative reproduction index. Out of the fourteen rice cultivars tested, only two cultivars *viz*., Swarnadhan and Dhanrasi were found resistant to *M. graminicola* while the cultivars Vasumati, Suraksha, Nidhi, Mansarovar and DRRH2 were found moderately susceptible. All other cultivars were either susceptible or highly susceptible (Table 1). The galls on resistant cultivars Swarnadhan and Dhanrasi were very small and contained less numbers of eggs as compared to the galls in susceptible check TN 1. Also, the size of females dissected from the galls of resistant cultivars Swarnadhan and Dhanrasi were relatively small as compared to the females from the galls of TN 1. It is evident from the results that though the rice cultivars were reported to be resistant to multiple insect pests and diseases of rice, most of them were susceptible to the rice root-knot nematode *M. graminicola*. The resistant rice cultivars Swarnadhan and Dhanrasi can be studied further to use them as donors in resistance breeding against *M. graminicola*.

Table 1: The reaction of rice cultivars to rice root-knot nematode *Meloidogyne graminicola*

Sr. No.	Cultivars	RRGI	RRI	Reaction
1	Triguna	3.82	3.79	HS
2	Vasumati	1.58	1.40	MS
3	Shanthi	5.81	3.70	HS
4	Aghani	1.89	1.30	MS
5	Suraksha	1.53	1.10	MS
6	Akshaydhan	3.74	2.57	HS
7	Swarnadhan	0.89	0.30	R
8	Nidhi	1.14	1.10	MS
9	Tulsi	3.44	2.67	HS
10	Mansarovar	1.26	1.11	MS
11	Dhanrasi	0.95	0.20	R
12	Vardhan	2.65	1.12	S
13	Vikramarya	4.84	4.59	HS
14	DRRH2	1.40	1.10	MS
15	TN 1 (Susceptible check)	4	4	HS

RRGI: Relative root-gall index, RRI: Relative reproduction index, R: resistant, MS: moderately susceptible, S: Susceptible, HS: Highly susceptible.

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