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Original Research Article

Screening and Evaluation of Green Gram Varieties /Cultivars against Root-Knot Nematode, Meloidogyne Incognita

Ritu Kumari Pandey, Dhirendra Kumar Nayak

Department of Nematology, College of Agriculture, Orissa University of Agriculture and Technology, Bhubaneswar, 751003, Orissa.

Corresponding Author: Dhirendra Kumar Nayak

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ABSTRACT

Out of thirty-eight green gram varieties/cultivars screened against root-knot nematode, only thirty-four varieties have shown resistant reaction with 3-6 numbers of galls per plants, while four varieties/cultivars showed moderately resistant reaction with 10-11 numbers of galls per plants. Due to infection of root-knot nematode, the maximum average shoot length of green gram cultivars/varieties was 40.66 cm in variety 20 MH-175. The decrease in shoot length was more pronounced with 22.03 cm in 5 DGG-5 varieties, which was statistically different from other resistant varieties. The decrease is possibly due to improper uptake and transport of elements, nutrients and water resulted from nematode infection. The decrease in shoot weight (22.70 g) and dry root weight (0.3 g) of the green gram variety, 9 GM 11-02 and 15 IPM 2K 15-4 was significantly different from the rest varieties showing resistant and moderately resistant reaction to the test nematode. Possible reason for reduction of shoot weight and root weight in infected plant may be due to improper supply of nutrients resulting from nematode infection for which it is compensated to some extent in resistant varieties.

Key words: Green gram, *Meloidogyne incognita*, V. radiata (L.)

INTRODUCTION

Root knot nematodes (*Meloidogyne* spp.) are among the most prevalent economical crop pests worldwide (Sasser, 1989; Stirling et al., 1992; Oka et al., 2000) and they interfere with anchorage and absorption of crop plants. They are most destructive and devastating important crop pests. Root-knot nematode causes a quite different morphological and anatomical response in different plants and even in various parts of a particular plant, different species can causes different responses in the same plant (Krusberg, 1963). The morphological response of plants to nematode infection resulted in severe stunting, chlorosis, wilting and drooping of leaves, delay in flowering, fruit formation and yield, aggregation of nutrition deficiencies and retardation of growing point of shoot and root system. Though the nematicides are quite effective against nematodes but these are hazardous to health, soil and environment. Use of resistant cultivars is an economical and eco-friendly option for the management of nematode diseases under field conditions.

Green gram is commonly known as mung bean or moong [V. radiata (L.) Wilezek] is an important pulse crop next to chickpea and pigeon pea in India. Being one of the major pulse crop of the Fabaceae

family it is a rich source of dietary protein (22.9%), carbohydrate (62.8%), fat (1.2%), minerals (3%) and fibre (1%) and also it has considerable amount of calcium 105 mg, phosphorous 330 mg, Fe, ashes, etc. The major causes of low productivity are the incidence of insects and diseases including plant parasitic nematodes. Plant parasitic nematode, Meloidogyne *incognita* alters the metabolic processes of the host which are manifested in the form of cellular, physiological and biochemical changes occurring in the infected host. The root-knot nematodes cause measurable changes in the morphology and physiology of the host plants. (Williamson and Gleason, 2003). The infection caused by these nematode results in yellowing of leaves and poor plant growth. This nematode has a wide host range which reduces the effectiveness of crop rotation for its management. The nematode can also be managed by use of nematicides but due to high cost and unavailability makes them unsuitable for farmers in subsistence farming system. Therefore, an alternative source of ecologically sound and viable option to avoid the losses caused by the nematodes is the use of resistant cultivars / lines.

MATERIALS AND METHODS

In the present study, seeds of thirty-eight green gram genotypes were procured from MULLaRP (Mung bean, Urd bean, Lentil, Lathyrus, Rajmah & Pea) Project, Indian Institute of Pulses, Kanpur. Egg masses of *M. incognita* were collected from pure culture already maintained on green gram plants. Second stage juveniles used in these experiments were obtained from egg masses raised on infected green gram plants. The experiment was carried out in screen house of the Nematology Department, College of Agriculture, OUAT, Bhubaneswar, Orissa and treatments were arranged in Complete Randomized Block Design with three replications each. Earthen pots of 15cm dia. were filled with denematised, sterilized sandy soil, FYM and sand mixture in 2:1:1 ratio @1Kg/pot. Seeds of each genotype were sown in the earthen pots containing steam sterilized soil. After germination, these were thinned to single plants in each pot with three replications in each case. One week old seedlings of green gram genotypes were inoculated with freshly hatched larvae of root knot nematode (*M. incognita*) @ $1000J_2$/ pot by exposing the roots. Green gram plants were uprooted from the pots after 45 days of sowing i.e. 3o days after inoculation and screening of green gram germplasm for resistance and susceptibility against root knot nematode (*Meloidogyne incognita*) was done by adopting 1-5 scales as Highly Resistant (1= no gall/egg mass per plant), Resistant (2=1-10 galls/ egg mass per plant), Moderately resistant (3= 11-30 galls / egg mass per plant). Susceptible (4= 31-100 galls/ egg mass per plant) and Highly Susceptible (5 = more than 100 galls/egg masses per plant) as per Root-knot Index scale given by Gaur et al.2001

Evaluations of Resistant Green gram Varieties against Root-Knot Nematode, *Meloidogyne Incognita*

Seeds of green gram varieties of known resistance obtained from screening process were surface sterilized by treating with 0.1 % Hgcl2 solution for about four minutes followed by five risings with sterile water to remove the excess chemicals. For evaluation purpose inoculations and observations were followed as done before in screening process.

RESULTS AND DISCUSSION

Table 1: Root-knot Index Scale (Gaur et al.2001)

Root-knot Index Scale	Number of Galls/ egg mass per root	Reactions
1	0	HR
2	1-10	R
3	11-30	MR
4	31-100	S
5	>100	HS

Screening of green gram varieties / cultivars against root-knot nematodes

The Table 1 revealed that out of thirty-eight green gram varieties/cultivars screened against root-knot nematode, only thirty-four varieties have shown resistant

reaction with 3-6 number of galls per plants, while four varieties/cultivars showed moderately resistant reactions with 10-11 number of galls per plants.

Effect of nematode infections on plant growth parameters:

Plant height: Due to infection of root-knot nematode, the maximum average shoot length of green gram cultivars/varieties was 40.66 cm in 20 MH-175. The decrease in shoot length was more pronounced with 22.03cm in 5 DGG-5 varieties, which was statistically different from other resistant varieties. The decrease is possibly due to improper uptake and transport of elements, nutrients and water resulted from nematode infection (Table 3).

Shoot weight and root weight: The decrease in shoot weight (22.70 g) and dry root weight (0.3 g) of the green gram variety, 9 GM 11-02 and 15 IPM 2K 15-4 was significantly different from the rest varieties showing resistant and moderately resistant reactions to the test nematode. Possible reason for reduction of shoot weight and root weight in infected plant may be due to improper supply of nutrients resulting from nematode infection for which it is compensated to some extent in resistant varieties (Table 3).

Table 2. Reaction of green gram cultivars / lines against root knot nematode, *Meloidogyne incognita*

Sl. No.	Reactions based on Root-knot index	Cultivars / lines
1.	Resistant (1.1 to2.0)	15 IPM 2K 15-4, 9 GM 11-02, 1 AKM 12-02, 3 AKM 8802, 6 DGG 6, 14 IPM 2-14, 11 HUM-27, 35 SGC 20, 30 PUSA 1371, 28 PM 10-12, 33 RMG-1078, 22 MH-934, 10 HUM-1, 32 PUSA 1472, 21 MH-810, 27 PM 09-11, 12 IGKM 05-26-3, 19 KM-2342, 24 ML-233,13 IPM-2-3, 34 RMG-1030, 16 IPM 410-3, 2 AKM-4, 7 GGG 10-14, 17 IPM 9901-6, 26 NVL-641, 8GM 04-02, 23 ML-2056, 31 PUSA-1471, 37 TMB-45, 4 DGG-3, 20 MH-175, 36 TARM-1, 18 IPM 9901-8 (Thirty four)
2.	Moderately Resistant (2.1 to 3.0)	5 DGG-5, 0UM 11-5, 29 PUSA 0672, 25 NVL-516 (Four)

Table 3: Evaluation of green gram cultivars against root-knot nematode, *Meloidogyne incognita* (mean of three replications)

S.I. No.	Varieties	Fresh shoot wt.(g)	Fresh root wt.(g)	Shoot length(cm)	Root length(cm)	No. of galls	Reaction	No. of pods/plant	Dry shoot wt.(g)	Dry root wt.(g)	Final population *
1	15 IPM 2K 15-4	20.33	0.5	35.66	11.66	6	Resistant	11	3.06	0.3	3.24
2	9 GM 11-02	22.70	0.83	37.66	14.03	9	Resistant	11	5.1	0.5	3.28
3	1 AKM 12-02	9.13	0.3	27.46	14.16	4.66	Resistant	6.66	2.16	0.46	3.23
4	3 AKM 8802	17.16	0.63	29	13.06	4.66	Resistant	8	0.9	0.3	3.26
5	6 DGG 6	12.36	1.33	24	15.16	4.33	Resistant	5	3.3	0.6	3.03
6	14 IPM 2-14	19.80	1.4	28.16	11.16	7	Resistant	4	5.3	0.5	3.28
7	11 HUM-27	21.05	1.33	31.03	20.50	10.66	Resistant	6	4.23	0.7	3.22
8	5 DGG-5	15.20	1.66	22.03	12.66	9.33	ModeratelyResistant	11.66	1.5	0.4	3.26
9	OUM 11-5	13.13	0.36	25	9	5	Moderately Resistant	12	2.2	0.3	3.25
10	35 SGC 20	12.76	1.33	32.33	10.40	7	Resistant	12	3.3	0.8	3.27
11	30 PUSA 1371	5.56	0.4	28	11.20	3.33	Resistant	7	1.63	0.7	3.27
12	28 PM 10-12	9.03	2.33	30.16	15.33	8	Resistant	3.33	3.16	1.3	3.28
13	29 PUSA 0672	15.76	0.3	28.10	15.16	10.66	Moderately Resistant	11.33	4.16	0.43	3.27
14	25 NVL-516	12.06	0.5	31.86	13.70	11.66	Moderately Resistant	7	2.13	0.53	3.29
15	33 RMG-1078	16.60	0.7	34.80	11.83	4.66	Resistant	4.66	3.56	0.5	3.27
16	22 MH-934	6	0.66	28.33	12.86	3.33	Resistant	9.33	3.13	0.5	3.32
17	10 HUM-1	12.33	0.66	33.66	16	3.33	Resistant	4.33	3	0.9	3.28
18	32 PUSA 1472	12.66	0.73	26.66	13	5.33	Resistant	8.66	2.36	0.9	3.25
19	21MH-810	9	1.36	30.33	10	7.33	Resistant	10	2.8	0.5	3.30

Continued table no 3

20	27 PM 09-11	23.83	2.23	32	9	3.33	Resistant	8	3.03	1.16	3.29
21	12 IGKM 05-26-3	10.83	1.06	30.66	12.03	6	Resistant	9	3.03	0.53	3.32
22	19KM-2342	9.5	0.63	22.66	14.03	6	Resistant	8	4	0.5	3.34
23	24 ML-233	12.06	0.53	24.33	11.16	4.33	Resistant	6	1.73	0.9	3.39
24	13 IPM-2-3	12.66	0.6	23.66	12.10	7.33	Resistant	8	1.86	1.2	3.29
25	34 RMG-1030	16.16	0.8	30.33	12	2.66	Resistant	12.33	2.2	0.53	3.28
26	16 IPM 410-3	16.16	1.3	28	13.83	8	Resistant	10.33	3.6	0.7	3.27
27	2AKM-4	17.23	0.8	27.70	13.66	7.33	Resistant	8	3.3	0.83	3.23
28	7 GGG 10-14	17.10	1.3	29.73	11	4	Resistant	10.33	4.4	1.03	3.19
29	17 IPM 9901-6	12.16	0.56	25.03	16.83	2.66	Resistant	13.33	4.1	1.36	3.15
30	26 NVL - 641	15.23	0.53	27.56	11.16	3	Resistant	7.33	5.56	0.5	3.09
31	8GM 04-02	6.36	0.23	26.86	12.03	5	Resistant	4	2.06	0.36	3.11
32	23 ML-2056	22.36	0.6	32	22	3.33	Resistant	8.33	5	0.6	3.15
33	31 PUSA-1471	24.10	1.46	30	13.20	3.66	Resistant	13	3.06	0.93	3.13
34	37 TMB-45	26.80	1.26	32	14.36	8.66	Resistant	12.66	4.1	1.36	3.15
35	4 DGG-3	8.90	0.5	27.33	12.66	4.66	Resistant	4.33	2.23	0.53	3.09
36	20 MH-175	25.10	0.96	40.66	13.66	5.33	Resistant	15	4	0.66	3.08
37	36 TARM-1	13.86	0.46	29.33	13.06	7.33	Resistant	7	3.3	0.5	3.14
38	18 IPM 9901-8	11.10	0.36	29.66	12	4	Resistant	11.66	3.2	0.7	3.15
	SEM (±)	0.985	0.1	2.296	0.984	1.116		0.953	0.533	0.164	0.877
	CD(0.05)	2.774	0.281	6.467	2.771	3.143		2.684	1.501	0.461	2.47
	CV%	11.4	0.824	13.5	12.9	33		19	29.1	40.7	47.1

*log transformed value

CONCLUSIONS

Plant growth was seriously affected by nematode infection in terms of shoot length and shoot weight while root length increases due to gall formations .Shoot growth parameter like shoot length; fresh weight and dry weight of different varieties of green gram in general were reduced significantly due to poor translocation of water and nutrients upward for proper growth of the plants. Root knot nematode causes giant cells in the roots and this disrupts the root vascular system, reducing the uptake of water and nutrients and their transport from the roots to the shoots (Abad *et al*., 2003). A plant response to nematode parasitism causes a morphological and physiological change that affects photosynthetic process. The reduction in length and weight of shoots, root weight increase in infected plants, possibly due to the formation of giant cells in root systems. Basing on nematode population, root gall index and susceptibility, the effect of varietal difference on root gall numbers per root system was also observed to be significant.

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