Screening of mungbean germplasms against root-knot nematode, *Melodigyne javanica* to find out the source of resistance

Abstract

Root-knot nematodes (*Meloidogyne* spp.) have been widely recorded in mungbean growing areas.Screening for resistant genotypes has reduced the damage caused by the root-knot nematodes.An experiment was conducted to find out the Screening of mungbean germplasms against root-knot nematode, *Melodigyne javanica* to find out the source of resistance.Total forty-one cultivars screened in which three cultivars i.e., IPM 1603-3, MH 1142 (Ch.) and MH 1772 were found to be moderately resistant, twenty-eight cultivars recorded as susceptible and ten recorded highly susceptible ones..

Key words: Cultivars, Gall index,*Meloidogyne javanica*,Mung bean andScreening

1. INTRODUCTION

Root-knot nematode, *Meloidogyne javanica* is a major threat to mung bean (*Vigna radiata* L.) cultivation. Root-knot nematode is the major pathogen causes reduction in plant growth parameters and loss of grain yield.Pulses production is most vulnerable to the attacks of pests and diseases causing yield losses (Anonymous, 2014). Root-knot nematodes (*Meloidogyne* spp.) are one of the most destructive pests and causes severe economic losses (Kalele, *etal.*, 2010; Collange *etal.*, 2011).Root-knot nematodes belonging to genus Meloidogyne are serious menace to crop production around the globe (Ali *etal*., 2015). Mungbean root-knot nematode (*Meloidogynejavanica*) has emerged as a major threat throughout the world and it has occupied a place of 'National Pest' owing to its severity (Joshi *etal*., 2020). Buildup of inoculum of the nematode and repeated cultivation of same cultivars in the same land every year is the prime reason for yield losses by root-knot nematodes (Hussain *etal*., 2016). Hostplant resistance is effective management tool that increases yield in spite of nematode population densities that exceed the damage threshold (Sharma *etal*., 2006).There are several biotic and abiotic stresses including root-knot nematodes which are responsible for low productivity of mungbean (Ali and Bansa, 2007). Root-knot nematodes have a major impact on mungbean productivity , causing losses of 18-90%(Aliand Bansa 2007, Khan

etal., 2014).Root-knot nematodes parasitize plant root systems, directly absorption of water and essential nutrients. These are serious parasites which attack wide varieties of crop plants including pulses and are responsible for substantial economic losses (Williamson and Hussey 1996). During the infective stage, root- knot nematodes feed on the epidermal cells of root and penetrate through the newly formed tissues present above the meristematic zone (Dasgupta and Gaur, 1986). At the initial stage of the infestation by root-knot nematode in the plant tissue there is cell enlargement with rapid cell division in the pith and vascular bundle followed by transformation of cortex into gall (Taylor and Sasser, 1978).Consequently, with the increment of infestation, growth and development of infested plants become stunted along with yellowing of leaf (Ahmed *etal*., 2009).More than 80 species of *Meloidogyne* have been reported in different parts of the world. Out of them, two species *M. incognita* and *M. javanica* have been reported in pulse-based cropping systems(Khan *etal*., 2014; Suresh *etal*., 2017).

2. Material methods

The experiment was conducted in root-knot nematode infected sick field at Division of Nematology, Rajasthan Agricultural Research Institute, Durgapura, Jaipur. In sick field maintained the minimum inoculums level @ 2 larvae/g soil (2000 J_2/kg soil). Total forty-one germplasmof mung bean were sown in 2.5 m rows and each line was flanked with susceptible check line. Plants were uprooted 60 days after sowing and observations recorded on number of galls per plant. Mung bean cultivar categorized as highly resistant, resistant, moderately resistant, susceptible, and highly susceptible based on root-knot index on a 1 to 5 scale (with 1 = no galls or no egg mass and 5 = greater than 101 galls or egg mass per plant)Table (1). Reaction of entries was recorded on the basis of root-knot index (RKI) (1-5 scale) according to (Hartman and Sasser, 1985).

Table 1: Root-knot index for resistant varieties

S. No.	No.ofGalls/Plant	ReactionofVariety
1	NoGalls	HighlyResistant(HR)
2	1-10Galls	Resistant (R)
3	11-30Galls	ModerateResistant(MR)
4	31-100Galls	Susceptible(S)
5	101and AboveGalls	HighlySusceptible(HS)

3. Result and Discussion

In the present investigation, the resultrevealed that all the cultivar of mung bean showed varying degree of reaction against root-knot nematode, *M. javanica*. (Table-2and Fig.-1). A total forty-one (41) mung bean germplasm were screened (Table-2). The mung bean cultivars were categorized highly resistant, resistant, moderately resistant, susceptible and highly susceptible on the basis of root-knot index (1-5 scale) given by Hartman and Sasser, 1985. The data presented in table-2 and 3 showed that among the screened forty-one germplasm, only three varieties were found as moderately resistance *i.e.*, IPM 1603-3, MH 1142 (Ch.) and MH 1772, and having 11-30 galls per plant. However, twenty-eight germplasmof mung bean *i.e.*, AKM 12-28, AKM 8802 (Ch.), BM 2019-10, BM 4 (Ch.), GJM 1701, IPM 02-14 (Ch.), IPM 02-3 (Ch.), IPM 13-6, IPM 410-3 (Ch), IPM 512-1 (Ch), IPMD 1603-7, JLPM 702-1, LGG 610, MH 1142 (Ch), MH 2-15 (Ch.), MHBC-20-2, MI 750-1, MI 98-64, ML 2506, ML 818 (Ch), OBGG 104, OUM 11-5 (Ch), Pusa 0672 (Ch.), Pusa M 2171, SKNM 1904, SML 1839, VBN 4 (Ch), VCG 180-21 showed the susceptible reaction against root-knot nematode having (31-100) galls per plant. Whereas, ten cultivar of mung bean *i.e.*, COGG 912 (Ch.), PANT M4 (Ch.), PANT M6 (Ch.), PKV AKM 4 (Ch.), PM 1711, PM 1727, PUSA 1731 (Ch.), RMG 1166, SML 2015, Varsha (Ch.) were found the highly susceptible having (102-128) galls per plant against root knot nematode in mung bean. No cultivar was found highly resistant and resistant against root-knot nematode, *Meloidogyne javanica* in mung bean. .

The data are similar in accordance with Bora *et al.* (2004) who screened 282 varieties of green gram against *Meloidogyne incognita* and observed that all the screened varieties showed susceptible reaction or highly susceptible to *Meloidogyne incognita*. Hassan and Devi (2004) tested 72 chickpea, 34 pea germplasm for their resistance against root-knot nematode *(Meloidogyneincognita)* in culture plots. Amongst 72 chickpea varieties evaluated, 34 varieties showedhighlyresistant,25resistant,9moderatelyresistantandonlythreegenotypes *viz.* C-41-42, C-42-0, C-44-2 were found susceptible. Out of 34 varieties ofpea, 29 genotypes were found highly resistant, 4resistant, 1 genotype FP-21-02and found moderately resistant. Devi *et al.* (2014) screened twenty-eight germplasms of mung bean against root-knot nematode (*Meloidogyne incognita*). Out of twenty-eight genotypes, 24 were susceptible and 4 were highly susceptible to *Meloidogyne incognita*. No resistant or

moderately resistant genotypes recorded. Similarly, Panday and Nayak (2016) screened thirty - eight varieties of green gram against *Meloidogyne incognita*, in which thirty-four varieties found resistant reaction with 3-6 number of galls per plant, while four varieties showed moderately resistant reaction with 10-11 number of galls per plant. However, Kumar *et al.* (2020) screened 14 mung bean genotypes against *M. javanica*, noneof the germplasm was found resistant, however, four genotypes showed, moderatelyresistantreaction.

Devindrappa*etal.*(2020)evaluated24pigeonpeagenotypesagainst*M.javanica* and observed 5 genotypes *viz.*, DPPA 85-12, DPPA 85-8, DPPA 85-1,DPPA 85-13 and IPA 15-1 as moderately resistant reaction, 13 showed moderately susceptible, 3 susceptibleand 2 genotypes were found in thehighlysusceptiblereactions. The investigation clearly showed that different varieties showed different reactions to *Meloidegyne javanica*. This occurs due to genetic variation, initial inoculum level and other climatic or ecological conditions during the action and potential against the nematode.

Table:2 Reaction of mung bean germplasm against root-knot nematode

RKI Scal	Cultivar (41)	Number of germplasm	Galls / Egg masse / Plant (Range)	Reaction
1	NIL	0	0	Highly Resistant (HR)
2	NIL	0	0	Resistant (R)
3	IPM 1603-3, MH 1142 (Ch.), MH 1772	3	11-30	Moderately Resistant (MR)
4	AKM 12-28, AKM 8802 (Ch.), BM 2019-10, BM 4 (Ch. GJM 1701 IPM 02-14 (Ch.), IPM 02-3 (Ch.), IPM 13-6, IPI 410-3 (Ch), IPM 512-1 (Ch), IPMD 1603-7, JLPM 702- LGG 610, MH 1857, MH 2-15 (Ch.), MHBC-20-2, MI 75(1, MI 98-64, ML 2506, ML 818 (Ch), OBGG 104, OUM 11 5 (Ch), Pusa 0672 (Ch.), Pusa M 2171, SKNM 1904, SM 1839, VBN 4 (Ch), VCG 18-021	28	31-100	Susceptible (S)
5	COGG 912 (Ch.), PANT M4 (Ch.), PANT M6 (Ch.), PK AKM 4 (Ch.), PM 1711, PM 1723, PUSA 1731 (Ch.), RM 1166, SML 2015, Varsha (Ch.)	10	101-128	Highly Susceptible (HS)

Table:3 Reaction of mung bean germplasm against root-knot nematode

S. No.	Cultivar	Number of galls per plant	Root-knot index	Reaction

1.	AKM 12-28	57.2	4	S
2.	AKM 8802 (Ch.)	44.0	4	S
3.	BM 2019-10,	38.4	4	S
4.	BM 4 (Ch.)	54.6	4	S
5.	COGG 912 (Ch)	113.7	5	HS
6.	GJM 1701	43.8	4	S
7.	IPM 02-14 (Ch.)	34.7	4	S
8.	IPM 02-3 (Ch.)	48.3	4	S
9.	IPM 13-6	51.4	4	S
10.	IPM 1603-3	24.0	3	MR
11.	IPM 410-3 (Ch)	41.8	4	S
12.	IPM 512-1 (Ch)	47.4	4	S
13.	IPMD 1603-7	56.6	4	S
14.	JLPM 702-1	61.2	4	S
15.	LGG 610	55.0	4	S
16.	MH 1142 (Ch)	14.6	3	MR
17.	MH 1772	21.8	3	MR
18.	MH 1857	56.1	4	S
19.	MH 2-15 (Ch.)	50.5	4	S
20	MHBC-20-2	46.9	4	S
21.	MI 750-1	47.3	4	S
22.	MI 98-64	55.6	4	S
23	ML 2506	59.8	4	S
24.	ML 818 (Ch)	62.2	4	S
25.	OBGG 104	60.7	4	S
26.	OUM 11-5 (Ch)	63.2	4	S
27.	Pant M 4 (Ch)	107.3	5	HS
28.	Pant M 6 (Ch.)	115.4	5	HS
29.	PKV AKM 4 (Ch.)	109.7	5	HS
30.	PM 1711	118.3	5	HS
31.	PM 1723	123.4	5	HS
32.	Pusa 0672 (Ch.)	40.3	4	S
33.	Pusa 1371 (Ch)	121.2	5	HS
34.	Pusa M 2171	58.3	4	S
35.	RMG 1166	108.4	5	HS
36.	SKNM 1904	48.4	4	S
37.	SML 1839	57.3	5	HS
38.	SML 2015	105.7	5	HS
39.	Varsha (Ch)	113.8	5	HS
40.	VBN 4 (Ch)	60.2	4	S
41	VCG 18-021	59.3	4	S

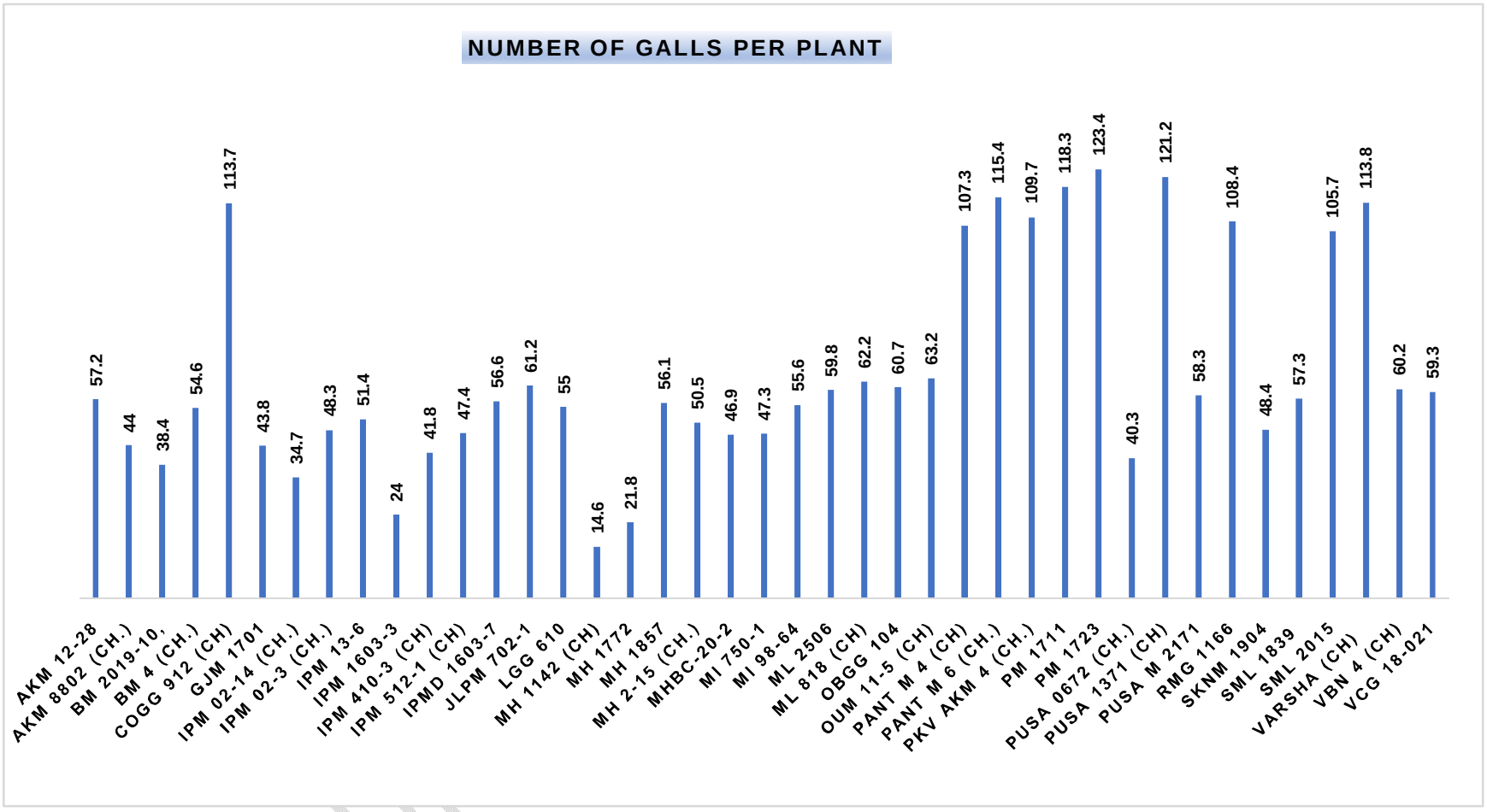

Fig:1. Reaction of mung bean germplasmagainst root-knot nematode

Conclusion

Root-knot nematode, *Meloidogyne javanica* is the major pathogen causes reduction in plant growth parameters and loss of grain yield.Screening for resistant genotypes has reduced the damage caused by the root-knot nematodes.Out of 41 varieties, three were recorded as moderately resistance, ten as highly susceptible and twenty-eight varieties recorded as susceptible.

Disclaimer (Artificial intelligence)

I hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

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