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Screening of bitter gourd germplasms against root-knot nematode, meloiodogyne incognita

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Abstract
An experiment was conducted in the net house of Department of Nematology, A. A. U. Jorhat, during the rabi season of 2020-2021 to evaluate the different germplasms of bitter-gourd (*Momordica charantia* L.) for resistance against root-knot nematode, Meloidogyne incognita. The pot experiment was carried out in a completely randomized design with five replications. Second stage juveniles of M. incognita at 1 J2 per cc soil were inoculated into the rhizosphere of 15 days old seedlings and the Root Knot Index for each germplasm was calculated after 45 days of inoculation. Among the screened germplasms, four germplasms were found to be moderately resistant, ten germplasms were found to be susceptible to root-knot nematode, M. incognita.

Keywords: Bitter gourd, root-knot nematode, Meloidogyne incognita, screening

1. Introduction
Bitter gourd (*Momordica charantia* Linn.) also known as karela, bitter melon, bitter apple, bitter squash, balsam pear and African cucumber is among one of the most important vegetable crops grown in India. It belongs to the family cucurbitaceae and is widely grown for its edible fruits in Asia, Africa, and the Caribbean. In India, it is mainly cultivated in Maharashtra, Gujarat, Uttar Pradesh, Haryana, Rajasthan, Punjab, Tamil Nadu, Andhra Pradesh, West Bengal, Assam Bihar and Odisha. Bitter gourd fruits are a good source of carbohydrates, proteins, minerals and have the highest nutritive value among cucurbits (Miniraj *et al*. 1993; Desai and Musmade 1998) [6, 2]. Bitter gourd varieties differ from each other in shape and bitterness of the fruit. The bitterness of bitter gourd is due to the cucurbitacin-like alkaloid momordicine and triterpene glycosides (momordicoside K and L) (Jefferey, 1980; Okabe *et al*.1982) [3, 7]. Bitter gourd is considered as a rich source of minerals like iron, potassium, magnesium and various vitamins such as vitamin A and C. Per 100 gram of bitter gourd fruit contains 13 mg sodium, potassium 602 mg, 7 g carbohydrates, 0.2 g fat, 3.6 g protein, 1.9 g fibre, 1 g sugar and energy34 KJ. Bitter gourd extracts possess antioxidant, antimicrobial, antiviral, antihepatoxic an antiulcerogenic properties while also having the ability to lower blood sugar (Welihinda *et al*. 1986; Raman and Lau, 1996) [13, 8]. The roots decoctions possess abortifacient properties, while the leaf and stem decoctions are used in treatment of dysentery, rheumatism and gout (Subratty *et al*. 2005) [11]. Likewise, the extracted juice from leaf, fruit and even whole plant are routinely used for treatment of wounds, infections, parasites, measles, hepatitis and fevers (Behera *et al*. 2008) [1]. The crop production is affected by various biotic and abiotic factors. The crop suffers from a number of pest and diseases caused by fungi, bacteria, virus and nematodes which leads to drastic reduction in overall growth of crop and yield. Among the various biotic factors, plant parasitic nematodes are found in close association with plant roots and act as a crucial factor in successful crop production both quantitatively and qualitatively. Many species of phytonematodes have been found associated with rhizosphere of bitter gourd plant and amongst these, root-knot nematode, Meloidogyne incognita is considered to be of great economic importance. Khanna and Kumar (2003) [4] reported 22.9- 42.8% losses in bitter gourd, M. charantia and an annual loss of Rs. 547.5 Million in cucurbits only due to root-knot nematode, M. incognita. Literature on screening of bitter gourd germplasms against root-knot nematode is very limited. Therefore, the present study aims at evaluation of bitter gourd germplasms against root- knot nematode, Meloidogyne incognita.

2. Materials and Methods

The pot experiment was carried out in the net house of Department of Nematology, A. A. U. Jorhat, during the rabi season of 2020-2021 to evaluate the 14 germplasms of bitter gourd along with one susceptible check 'Priya' for resistance against root-knot nematode. Seeds of bitter gourd germplasms were obtained from Germplasm Exchange and Policy Unit, ICAR- NBPGR, New Delhi. For each germplasm, three seeds were sown in 500g capacity pots filled with sterilized soil at a depth of 1 cm and then covered with a thin layer of soil. After this, pots were sprinkled with water. Each treatment was replicated five times and arranged in a completely randomized block design. Thinning of seedlings was done after one week of germination keeping only one healthy seedling in each pot for inoculation. The healthy seedlings were inoculated with freshly hatched second stage juvenile of M. incognita (obtained from pure culture of tomato maintained in the Department of Nematology, A.A.U.) by removing the top soil around the base of the seedling to a depth of 1 cm. After inoculation, the rhizosphere was covered again with soil. The rate of inoculation was 1 juvenile per gram of soil. The plants were watered regularly till the experiment was completed. Observations were taken 45 days after inoculation. Plants were uprooted carefully and washed under slow running tap water. The number of galls and egg masses per root system were counted and recorded. Root-knot index for each germplasm was determined on the basis of the root-knot index (1-5 scale) given by Sasser *et al*. (1984) which is shown below:

Scale	Particulars	Reaction
1	No gall, no eggmasses	Highly Resistant (HR)
2	1-10 galls with eggmasses	Resistant (R)
3	11-30 galls with eggmasses	Moderately Resistant (MR)
4	31-100 galls with eggmasses	Susceptible (S)
5	101 or more galls with eggmasses	Highly Susceptible (HS)

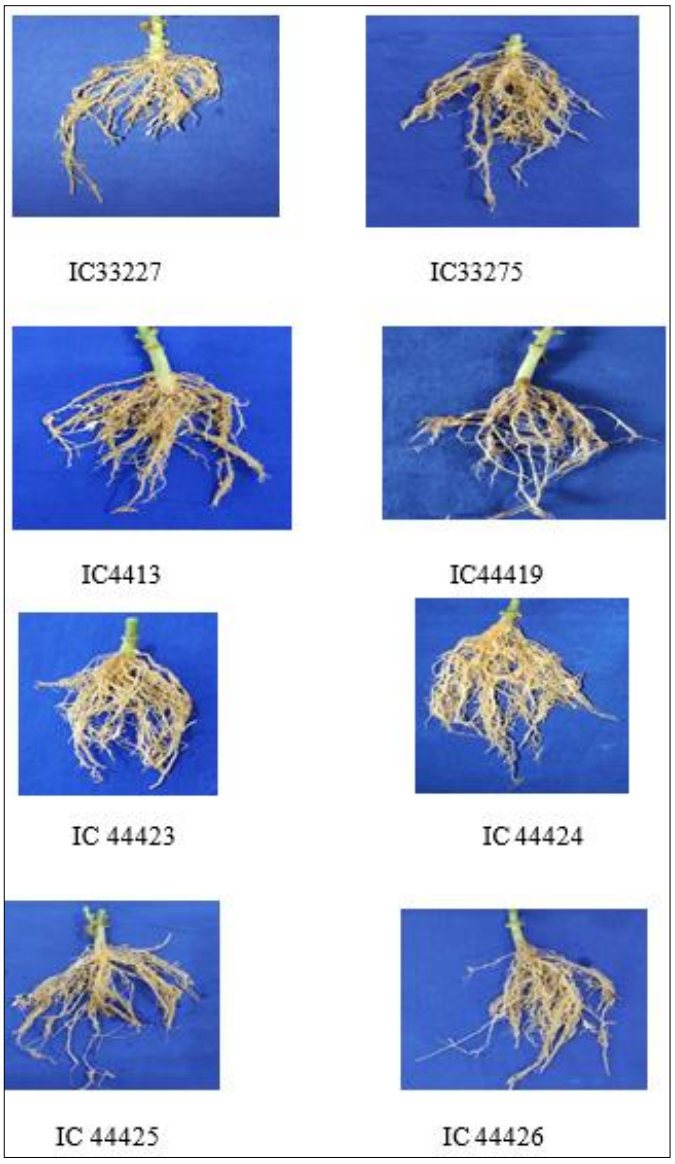
3. Results

The results obtained in the study of Screening of Bitter gourd germplasms against Root-knot nematode, Meloiodogyne incognita revealed that out of 14 germplasms four germplasms *viz*., 'IC 33275', 'IC 44426', 'IC 45346' and 'Pusa Hybrid' were found moderately resistant; ten germplasms *viz*., 'IC 33227', 'IC 44413', 'IC 44419', 'IC 44423', 'IC 44424', 'IC 44425', 'IC 44341', 'IC 50527', 'IC 85603' and 'Pusa Vishesh' were found to be susceptible and germplasm 'Priya' was found to be highly susceptible to M. incognita. The root-knot index and the reactions of the germplasms are presented in Table 1.

Table 1: Reaction of bitter gourd germplasms against Meloidogyne incognita (Mean of 5 plants)

Sl. No.	Germplasms	Root-Knot Index *(1-5) Scale	Reactions
1.	IC 33227	3.4	S
2.	IC 33275	2.5	MR
3.	IC 44413	3.2	S
4.	IC 44415	3.4	S
5.	IC 44417	3.2	S
6.	IC 44424	3.0	S
7.	IC 44425	3.6	S
8.	IC 44426	2.4	MR
9.	IC 44341	3.2	S
10.	IC 45346	2.2	MR
11.	IC 50527	3.2	S
12.	IC 85603	3.6	S
13.	Pusa Vishesh	3.4	S
14.	Pusa Hybrid	2.6	MR
15.	Priya (SC)	4.8	HS
S.Ed. (±)		0.31	
CD0.05		0.62	

*1 = No disease intensity 5 = Maximum disease intensity
R = Resistant
MR = Moderately resistant
S = Susceptible
HS = Highly susceptible
SC = Susceptible check



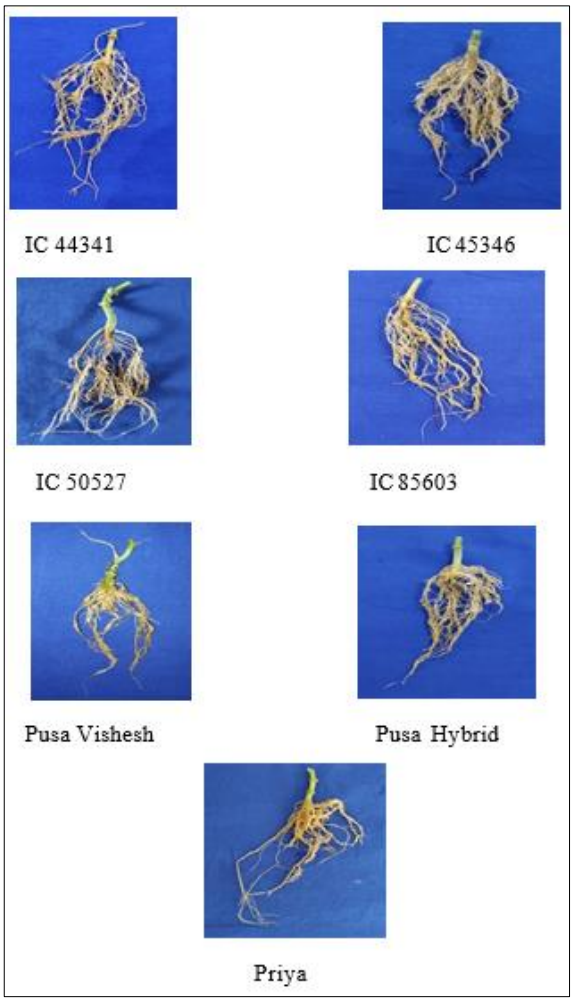


Plate 1: Screening of bitter gourd germplasms against Meloidogyne incognita

4. Result and Discussion

In the investigation of screening of bitter gourd germplasms against Meloidogyne incognita, out of fourteen germplasms, four germplasms *viz*., 'IC 33275', 'IC 44426', 'IC 45346' and 'Pusa Hybrid' were found to be moderately resistant and ten germplasms *viz*., 'IC 33227', 'IC 44413', 'IC 44419', 'IC 44423', 'IC 44424', 'IC 44425', 'IC 44341', 'IC 50527', 'IC 85603' and 'Pusa Vishesh' were found to be susceptible to Meloidogyne incognita. This finding is in agreement with Venaktesan (2009) [12] who screened some germplasms of bitter gourd against Meloidogyne incognita, who reported that 25 germplasms were moderately resistant and 21 germplasms were susceptible to Meloidogyne incognita. Mahapatra and Nayak (2019) [5] screened 17 bitter gourd varieties against Meloidogyne incognita in a green house experiment. Out of the seventeen varieties tested, only one variety was found resistant, four varieties were moderately resistant, five varieties were susceptible, and seven varieties were classified as susceptible / resistant to nematode infections based on the number of root galls and galls. Sharma *et al*. (2019) in an experiment evaluated thirty accessions of *Momordica charantia* and seven accessions of Momordica balsamina against rootknot nematode, Meloidogyne incognita. Results revealed that the seven accessions belonging to Momordica balsamina were resistant to the nematode and showed lesser number of root galls, low soil nematode population and reproduction factor. While only two accessions of *Momordica charantia* i.e., PAUBG-1 and PAUBG-13 showed moderate resistant reaction while the rest of the accessions were found to be susceptible or moderately susceptible to root-knot nematode infection.

5. Conclusion

The experiment on screening of bitter gourd (*Momordica charantia* L.) germplasms against root-knot nematode, Meloidogyne incognita was conducted in the net house of Department of Nematology A. A. U. Jorhat. 500 second stage juveniles (J2) of M. incognita were inoculated in the pots 15 days after germination and the experiment was terminated at 6 weeks after inoculation. Out of the fourteen screened germplasms, four germplasms were found to be moderately resistant and rest of the germplasms were found to be susceptible to Meloidogyne incognita.

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