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RESEARCH PAPER

Screening of vegetables crop genotype against root-knot nematode (*Meloidogyne incognita*) under polyhouse conditions

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Abstract : Root-knot nematode, *Meloidogyne incognita* is an economically important plant-parasitic nematode of vegetable crops grown under open as well as protected cultivation. Use of resistant cultivar is an important measure for managing root-knot nematode as compared to the other management strategies. Despite the potential importance of this nematode, sources of resistance to *M. incognita* are not yet available for breeding purposes. Present studies were conducted to evaluate the resistant reaction of crop genotype (cucumber japanes long green, tomato shu, cherry tomato P. cherry tomato-1, bitter gourd pusa aushadhi and capsicum yalo wonder) against *M. incognita* under polyhouse conditions (2018-20). Sixty days after sowing, observations were recorded on number of galls/plant and final nematode population. All the crop genotypes of vegetables were showed varying degree of response against *M. incognita*. Out of five crop genotypes of vegetables, four (cucumber japanes long green, tomato shu, cherry tomato P. cherry tomato-1 and bitter gourd Pusa aushadhi) were susceptible/highly susceptible while capsicum yalo wonder showed moderately resistant reaction against *M. incognita* in both the years (2018-2020) and this genotype can be used as a source of resistance.

Key Words : *Meloidogyne incognita*, Polyhouse, Screening, Tomato, Cucumber, Capsicum, Bitter gourd

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INTRODUCTION

India has wide variability of climate and soil which helps to produce a variety of horticultural crops and is considered as fruit and vegetable basket of the world. Protected agriculture allows growing crops under extended favourable climatic conditions in order to realize greater crop yield potential (than open field) by safeguarding the crop from meteorological adversities, diseases and pests (Maynard and O'Donnell, 2018). Presently, there are more than 90 countries in the world that has adopted indoor farming of different horticultural crops contributing the maximum share (Hickman, 2019). Unlike open field agriculture, soil-borne plant-parasitic nematodes (PPNs) proliferate heavily inside the protected structure due to continuous monoculture, maintenance of stable microclimate, recycling of nematode-infected growing medium and planting

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Table A : Root-knot index (RKI) on 1-5 scale

Sr. No.	No. of galls egg masses/plant	Root-knot index (RKI)	Reaction
1.	No galls	0-1.0	Highly resistant (HR)
2.	1-10 galls	1.1-2.0	Resistant (R)
3.	11-30 galls	2.1-3.0	Moderately resistant (MR)
4.	31-100 galls	3.1-4.0	Susceptible (S)
5.	101 and above galls	4.1-5.0	Highly susceptible (HS)

materials by unaware growers.

While critically pondering upon the important PPN genera and species causing major damages under protected cultivation system, the "devastating trio" can be distinguished as root-knot nematodes (*Meloidogyne* spp.), root lesion nematode (*Pratylenchus* spp.) and reniform nematode (*Rotylenchulus reniformis*). Among the PPNs, root-knot nematode (*Meloidogyne* spp.), are the most destructive and difficult to control in protected cultivation system (Sharma *et al.,*2007). Root-knot nematodes (RKNs) are obligate, sedentary endoparasites that parasitize over 3000 host plants globally (Moens *et al.,*2009). After invading the roots, they develop a permanent feeding site in the vascular tissues resulting in the characteristic galled or knotted appearance of the plant roots (Mitchum *et al.,* 2013). The losses are more severe under protected cultivation due to favourable microclimate and continuous availability of host (Sharma *et al.,* 2007). Overall, PPNs cause 21.3% crop losses amounting to Rs. 102,039.79 million (1.58 billion USD) annually; the losses in 19 horticultural crops were assessed at Rs. 50,224.98 million, while for 11 field crops it was estimated at Rs. 51,814.81 million (Kumar *et al.,* 2020).

Managing the population of these PPNs below damaging levels is important for reducing economic losses and sustaining productions. Several management strategies including use of chemicals and crop rotation have been used extensively over the years to minimize the losses caused by PPNs, but some of them stand out as inefficient and others can cause environmental damage. Therefore, an alternative source of ecologically sound and viable option to avoid the losses caused by the nematodes is the use of resistant cultivars/genotypes. The use of resistant cultivars is a widely accepted alternative method to combat *M. incognita* menace, due to its low cost, high efficiency and environmentally benign effect (Sujatha *et al.,* 2017). In the present investigation, five crop genotype (cucumber japanes long green, tomato shu, cherry tomato P. cherry tomato-1, bitter gourd pusa aushadhi and capsicum yalo wonder) were screened against *M. incognita* under polyhouse conditions.

MATERIAL AND METHODS

Five genotypes of different vegetable crops were received from P.C. (AICRP, Nematodes), New Delhi, and were screened against root-knot nematode, *M. incognita* under polyhouse conditions in village Bhuna (Fatehabad) during 2018-19. Initial nematode population in the soil was recorded to be 262 J_2/200 cc soil. In 2019-20, experiment was conducted in root-knot nematode infested farmer's polyhouse at village Dhand (Fatehabad). Initial nematode population in the soil was recorded to be 325 J_2/200 cc soil. Each treatment was replicated three times. Seeds of the above crop genotype were sown in the beds (root-knot nematode infested soil).

Sixty days after sowing, 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 galls/plant (RKI) and final nematode population. The genotypes were categorized (Table A) as highly resistant, resistant, moderately resistant, susceptible and highly susceptible as per standard protocols (AICRP). Initial nematode population and final nematode population from the field (polyhouse) were estimated by collecting the soil from the field and by extracting nematode from the soil using Cobb's decanting and sieving method (modified) followed by Baermann's funnel technique (Southey,1986).

RESULTS AND DISCUSSION

Results are presented in Table 1 during 2018-19. All the crop genotype of vegetables had supported development and multiplication of the nematode to a different extent and no resistant reaction was observed. All crop genotypes showed great variation in response or reaction to RKN from moderately resistant to highly susceptible reaction. Out of five genotype of different vegetables crops (cucumber japanes long green, tomato shu, cherry tomato P. cherry tomato-1 and bitter gourd pusa aushadhi) found were susceptible while capsicum yalo wonder showed moderately resistant reaction against *M. incognita*. With respect to the final nematode population in soil, minimum mean of 268 numbers of J2 were recorded from capsicum yalo wonder followed by cherry tomato P. cherry tomato-1, bitter gourd pusa aushadhi, tomato shu and cucumber japanes long green in 335, 420, 470 and 685, respectively.

During 2019-20, out of five genotypes of different vegetables crops screened, cucumber japanes long green, tomato shu showed highly susceptible reaction. It was observe that most of the germplasms showed varying degree of susceptibility to *M. incognita.* Cherry tomato P. cherry tomato-1 and bitter gourd Pusa aushadhi were found susceptible while capsicum yalo wonder was moderately resistant against *M. incognita* (Table 2). However, in case of soil, nematode population minimum mean of 235 numbers of J2 were recorded from capsicum yalo wonder followed by bitter gourd pusa aushadhi, cherry tomato P. cherry tomato-1, tomato Shu and cucumber Japanes long green in 385, 465 and 610, 985, respectively.

The occurrence of variation in susceptibility among forty tomato genotypes to *M. incognita* might be due to genetic differences (Brow *et al.,* 1997 and Jacquet *et al.,* 2005). The highly susceptible genotypes supported greatest number of juveniles penetrated and completed their development to maturity as shown by high gall index and maximum final nematode population present while in moderately resistant cultivar, limited numbers of juveniles were able to penetrate, develop to maturity and lay egg masses. The compatible reaction of moderately resistant, susceptible and highly susceptible crop genotypes to *M. incognita* infection indicated that they lack resistant genes so genotypes were unable to stop the penetration, development and reproduction.

Ito *et al.* (2014) evaluated 33 cucurbit accessions to the nematodes *M. incognita* and *M. javanica* and found that melon genotypes CNPH 01-930, CNPH 01-962, CNPH 01-963, 'Redondo Gaucho' and Wax Gourd (*Benincasa hispida*) were considered resistant reaction against *M. incognita* with reproduction factors less than 1; 'Redondo Amarelo' melon, 'Charleston Gray' watermelon, 'Coréia' progeny (*Citrullus lanatus*), and *Trichosanthes cucumerins*, were resistant against *M. javanica*. *Benincasa hispida* was resistant to both species. One tomato cultivar, Homerunking was proved to be resistant while eight cultivars such as Regendsummer, Regend, Sunmyung, Pinktop, Top3, Delice, Tasha and Lilyance were moderately resistant to the RKNs. Five cherry tomato cultivars (Tenten, Desert, Redstar, Veryking and Arigatto) showed moderate resistance and one cultivar (Redcherry) was resistant to RKNs (Kim *et al.,* 2010). Galatti *et al.* (2013) evaluated 16 cucurbit accessions for *M. incognita* and performed a graft compatibility study with a muskmelon cultivar and found that the genotypes loofah (*Luffa cylindrica*), pumpkin 'Goianinha' and pumpkin

Table 1 : Screening of crop genotypes against root-knot nematodes under polyhouse condition (2018-19)

Crop genotype	Nematode species	FNP/200 cc soil	Root-kt idex	Reaction
Cucumber (Japanes long green)	*M. incognita*	685	4.0	S
Tomato (Shu)	-do-	470	4.0	S
Cherry tomato (P. cherry tomato-1)	-do-	335	4.0	S
Bitter gourd (Pusa aushadhi)	-do-	420	4.0	S
Capsicum (Yalo wonder)	-do-	268	3.0	MR

MR- Moderately Resistant; S-Susceptible; FNP-Final nematode population Initial Nematode Population: 262 J_2/200 cc soil

Table 2 : Screening of crop genotypes against root-knot nematodes under polyhouse condition (2019-20)

Crop genotype	Nematode species	FNP/200 cc soil	Root-knot index	Reaction
Cucumber (Japanes long green)	*M. incognita*	985	5.0	HS
Tomato (Shu)	-do-	610	5.0	HS
Cherry tomato (P. cherry tomato-1)	-do-	465	4.0	S
Bitter gourd (Pusa aushadhi)	-do-	385	4.0	S
Capsicum (Yalo wonder)	-do-	235	3.0	MR

MR-Moderately Resistant; S-Susceptible, HS-Highly Susceptible; FNP-Final nematode population Initial Nematode Population: 325 J_2/200 cc soil

'Mini Paulista' (*Cucurbita moschata*), melon 'Redondo Amarelo' (*Cucumis melo*) and Charleston Gray watermelon (*Citrullus lanatus*) were resistant reaction against *M. incognita*. The melon *Cucumis metuliferus* known as 'Kino' was identified as genetic source of resistance against RKNs under greenhouse conditions (Pinheir, 2019).

Conclusion:

Conclusively present studies revealed that all the crop genotype were found susceptible/highly susceptible and only capsicum (yalo wonder) of them were found moderately resistant to *M. incognita* which can be used for future breeding programmes to develop resistant reaction in this genotype.

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