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Evaluation of some commercially grown polyhouse cultivars for their susceptibility/ resistance against *Meloidogyne incognita*

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Abstract
The present piece of scientific investigation entitled "Evaluation of some commercially grown polyhouse cultivars for their susceptibility/ resistance against *Meloidogyne incognita*" was conducted in Dr. YSP UHF, Nauni, Himachal Pradesh polyhouse to explore the possibilities of nematode management in highly susceptible cucumber crop by using environment friendly management tools. Observations regarding seedling status in terms of length at transplanting, fruit yield, nematode population and gall index in case of root knot nematode at termination were recorded. When selected cultivars viz. *Cucumis sativus* var. Maharaja, *Cucumis sativus* var. PCUC-15, *Cucumis sativus* var. Pusa Sanyog, *Cucumis sativus* var. Kheera Hybrid-1 and *Cucumis sativus* var. Kian screened against *M. incognita* were found to be highly susceptible; Kian and Kheera Hybrid 1 being more susceptible to *M incognita* as compared to other three test cultivars. However, variations in the yields of various cultivars seemed to be more due to their inherent yield characteristics and less due to variations in their susceptibility level.

Keywords: *Meloidogyne incognita*, polyhouse cultivars, cucumber, root gall index

Introduction
Cucumber (*Cucumis sativus* L.), a crop of Asiatic origin and indigenous to India, is a widely cultivated creeping vine of family Cucurbitaceae [4]. Whereas, among vegetable crops, it holds the prime fourth position after tomato, cabbage and onion, it is the second most widely grown and commercially cultivated cucurbit in the world after watermelon [11]. Besides, it is also a model system for sex determination studies and plant vascular biology [5]. In India, cucumber is grown extensively in all the tropical and sub-tropical regions which have conducive climate for its cultivation. In the year 2012, the crop occupied an area of 26,500 hectares in the country producing a yield of 1, 68,000 tonnes at the productivity of 6.34 tonnes /ha [3]. Intensive cropping and monoculture practiced by the growers in polyhouses invite heavy infestation of soil borne pathogens including nematodes under protected conditions. Besides, nematodes mainly *M. incogneta* are easily introduced into polyhouses through infested transplants and other growing medium. If not checked timely, these phytoparasitic nematodes are capable of causing total crop loss. Annual crop losses to the tune of 12 to 69.2 per cent in cucumber due to root knot nematodes have been assessed by various workers in India and elsewhere [7] [6]. Such huge losses necessitate the use of management practices against nematode pests in this crop. Looking into the hazards of chemical nematicides to the environment and human health, an urgent need to adopt alternative control and long term integrative approaches for their replacement is felt. For this screening of commercial cucumber cultivars for their susceptibility and resistance against *M. incognita* was done.

Material and Method
The experiment was conducted in the year 2016. Five commercial cultivars, commonly grown by the farmers of the region in polyhouses were selected for the purpose. Among the test cultivars, two viz., *Cucumis sativus* var. Pusa Sanyog, *Cucumis sativus* var. Kheera Hybrid-1 were monoecious and other three viz., *Cucumis sativus* var. Maharaja, *Cucumis sativus* var. PCUC-15 and *Cucumis sativus* var. Kian were parthenocarpic. Seeds of each variety were sown separately in polybags (15X10 cm) having nematode free soil from nematode free healthy solarised nursery. Seeds were allowed to grow for 30 days until the plants attained a suitable length for transplantation. Each cultivar was replicated ten times. The seedlings of each cultivar were transplanted separately in polyhouse soil infested with *M. incognita* population. Pre planting initial soil analysis revealed the population level of one juvenile of *M.*

incognita per gram of soil. Recommended plant to plant and row to row spacing as mentioned in experiment-1 were given. Standard cultural practices like staking, irrigation, weeding, hoeing etc were followed throughout the experiment. The experiment was terminated when the plants stopped yielding fruits and started wilting. Soil was taken from the composite sample and washed using Cobb's sieving and decanting technique followed by Schindler's modification for nematode extraction [2, 9]. Observations were recorded for Fruit yield per plant, Plant wise nematode population at final harvesting and Root Gall Indexing is done with help of 1-5 scale (1=No galls, 2=1-10 galls, 3=11-30 galls, 4=31-100galls and 5=100 galls and above).

Result and Discussion

1. Effect of *M. incognita* on fruit yield of various varieties of cucumber

the average initial population of *M. incognita* J_2s in polyhouse was 168 individuals/ 200 cc of soil. Among the tested cultivars, significantly more and highest quantum of fruits (1910.0g per vine) was produced in case of Kian. This was followed by significantly lower average yields of 1216.0 and 1280.0 g per vine attained in Maharaja and PCUC-15. Pusa Sanyog and Kheera Hybrid 1 producing 936.5 and 708.0 g per vine remained the poor yielders in presence of *M. incognita* infestation in the soil.

Table 1: Effect of *Meloidogyne incognita* on fruit yield of different varieties of cucumber

Varieties	*Fruit yield (g/vine)
	Average
Cucumis sativus var. Maharaja	1216.0(34.63)
Cucumis sativus var. PCUC-15	1218.0(34.59)
Cucumis sativus var. Pusa Sanyog	936.5(30.37)
Cucumis sativus var. Kheera Hybrid 1	708.0(26.12)
Cucumis sativus var. Kian	1910.0(43.63)
$CD_{0.05}$	4.04

*Average of ten replications
Figure in the parentheses are √n+1transformed values

2. Nematode population recorded in the soil surrounding roots of various cultivars at termination (per 200 cc of soil): The consolidated information regarding soil population of root knot juveniles in soil at termination as presented in Table 2 revealed highest J_2 count in cucumber cultivar Maharaja, wherein average of 341.8 J_2s per 200cc of soil were found harbouring the rhizosphere. The average nematode count of 303.2 in PCUC-15, was statistically at par with the number observed in Maharaja and Pusa Sanyog (284.9 individuals) but significantly higher than the populations of 244.8 J_2s recorded in the rhizosphere of Kheera Hybrid 1. Kian harboured 180 J_2s in its rhizosphere at the time of termination and this number was the lowest and significantly lower than populations recorded in all the cultivars. Also, this count was close to the average initial nematode population of 168 per 200 cc of soil.

Table 2: Final nematode population of *M. incognita* in various cucumber cultivars at harvest

Varieties	**M. incognita* J_2s (per 200cc soil)
	Average
Cucumis sativus var. Maharaja	341.8 (19.33)
Cucumis sativus var. PCUC-15	303.2 (18.27)
Cucumis sativus var. Pusa Sanyog	284.9 (17.74)
Cucumis sativus var. Kheera Hybrid 1	244.8 (16.48)
Cucumis sativus var. Kian	180.0 (14.04)
$CD_{0.05}$	2.35

*Average of ten replications
Figure in the parentheses are √n+1transformed values

3. Effect on root gall index

Data placed in Table. 3 showing mean root gall index in the range of 3.7 to 5.0. Kian, otherwise a high yielding parthenocarpic cultivar was found to be the most susceptible with all its roots highly distorted due to heavy galling at level of 5. Among other cultivars of cucumber, Kheera Hybrid-1 with an average gall index of 4.7, ranked equally susceptible to test nematode as Kian. The extensive galls produced on roots of Kheera Hybrid 1 and Kian virtually coalesced with each other and gave a distorted look to the roots. Roots of other varieties screened for root gall index viz., Maharaja, PCUC-15 and Pusa Sanyog had respective gall indices of 3.7, 3.8 and 3.8. These gall indices were significantly lower than those recorded in Kheera Hybrid 1 and Kian, both of which showed high nematode infestation and heavy galling. Thus, all the screened varieties were highly susceptible to *M. incognita* infestation, but with statistical variance in the level of susceptibility; Kian and Kheera Hybrid 1 being more susceptible than other three test cultivars.

Table 3: Root Gall Index in various test cultivars at harvest

Varieties	*#Root Gall Index (on 1-5 scale)
	Mean
Cucumis sativus var. Maharaja	3.7
Cucumis sativus var. PCUC-15	3.8
Cucumis sativus var. Pusa Sanyog	3.8
Cucumis sativus var. Kheera Hybrid 1	4.7
Cucumis sativus var. Kian	5.0
$CD_{0.05}$	0.62

*Average of ten replications
#Root Gall Index on 1-5 scale: 1=No galls, 2=1-10 galls, 3=11-30 galls, 4=31-100 galls and 5=100 galls and above

Similar findings were reported as the variation in fruit yield was perhaps due to the inherent genetic characteristics specific to the varieties. Earlier, Pusa Sanyog also has been categorized highly susceptible [1]. Though, various other cucumber cultivars viz. Babylon, Cobra, Falcon-560, Mehran,

Mirage, Marketmore, Long Green, Thiamin II, Dynasty, Green Wonder, Cucumber Certiolo, Pioneer-II, Summer Green, Royal Sluis and Pionsett have been earlier tried for their susceptibility/ resistance against *M. incognita*, these cultivars (except Pusa Sanyog) were evaluated for the first time. Of all the cultivars tested only one cultivar i.e. Long Green have been found to be resistant against *M. incognita* [8] and Hoe-707 and EC-173929 resistant and moderately resistant against *M. incognita* [10].

Conclusion

All the five cucumber cultivars viz. *Cucumis sativus* var. Maharaja, *Cucumis sativus* var. PCUC-15, *Cucumis sativus* var. Pusa Sanyog, *Cucumis sativus* var. Kheera Hybrid-1 and *Cucumis sativus* var. Kian were highly susceptible to *M. incognita* as inferred from observations of heavy galling and nematode densities in the rhizosphere of these cultivars. The variations in fruit yields recorded in the test cultivars were mainly due to their inherent genetic yield characteristics and to the lesser extent due to the level of susceptibility. However, cultivars Kian and Kheera Hybrid 1 were significantly more susceptible to *M. incognita* as compared to Maharaja, PCUC15 and Pusa Sanyog; the latter three having similar level of susceptibility.

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