International Journal of Agricultural Sciences
Volume **16** | Issue 2 | June, 2020 | 203-207 ■ ISSN : 0973-130X
DOI:10.15740/HAS/IJAS/16.2/203-207
Visit us : *www.researchjournal.co.in*

RESEARCH PAPER

Screening of okra (*Abelmoschus esculentus*) cultivars for resistant against root-knot nematode, *Meloidogyne incognita*

Vinod Kumar*, Anil Kumar, S.K. Dhankhar[1] **and** S.S. Mann
Department of Nematology, C.C.S. Haryana Agricultural University, Hisar (Haryana) India
(Email: vinodnagal09@gmail.com)

Abstract : The root-knot nematode (*Meloidogyne incognita*) is one of the major limiting factors affecting plant growth and yield causing an estimated $100 billion loss per year worldwide. Synthetic pesticides, though instantaneously effective, are usually prohibitively expensive, not readily available, may cause hazards to both man and livestock and inflict injury to the environment. Notable among the alternatives to nematicides, use of resistant cultivars which are inexpensive and eco-friendly is the only and effective option available for its control. In the present studies, seventy one okra (*Abelmoschus esculentus*) cultivars were evaluated for resistant against *M. incognita* under screen house conditions. One week old okra plants of test cultivars were inoculated with 1000 freshly hatched second stage juveniles of *M. incognita*. Results clearly revealed that all the cultivars showed varying degree of susceptibility against *M. incognita.* One cultivar (EC 306703) showed resistant and seven cultivars (EC 306697, EC 306700, EC 359891, EC 305718, IC 014018, BB-1, Hisar naveen and Hisar unnat) were rated as moderately resistant reaction against *M. incognita.* Rest of the cultivars exhibited either susceptible or highly susceptible reaction against *M. incognita*. No any single cultivar has been found as highly resistant. Cultivar, EC 306703 was rated as resistant and showed less damage by nematode as compared to susceptible cultivars and their planting could provide a useful tool to control root-knot nematode.

Key Words : *Meloidogyne incognita*, Okra, Resistant, Screening, Cultivars

View Point Article : Kumar, Vinod, Kumar, Anil, Dhankhar, S.K. and Mann, S.S. (2020). Screening of okra (*Abelmoschus esculentus*) cultivars for resistant against root-knot nematode, *Meloidogyne incognita*. *Internat. J. agric. Sci.*, **16** (2) : 203-207, **DOI:10.15740/HAS/IJAS/16.2/203-207.**

Article History : **Received :** 01.03.2020**; Revised :** 08.05.2020**; Accepted :** 14.05.2020

INTRODUCTION

Okra (*Abelmoschus esculentus*), is an important vegetable crop grown extensively under various agro-climatic zones of India. It is one of the warm season crops and commercially cultivated in the tropical and subtropical regions Rashid *et al.* (2012) with an extension to the Mediterranean climate Düzyaman and Vural (2003). Okra provides vitamin C (13.0-23.0 mg), calcium (58.2-58.3 mg), phosphorus (62.0-62.2 mg) and protein (13.6-16.3 %) per 100 g of tender fruits, in addition of crude oil (13.0-22.0 %) is present in the seed Adetuyi *et al.* (2011). Global production of okra is 9.62 million metric tons with 5.26 MT/ha productivity from an area of 1.83 million ha. Due to its nutritional, medicinal and economical importance, India stands first in okra production with 6.3 million MT from 0.52 million ha area accounting for 72 per cent of total world production with productivity of

*** Author for correspondence :**
[1]Department of Vegetable Science, C.C.S. Haryana Agricultural University, Hisar (Haryana) India

12 MT/ha FAOSTAT (2015). India is the leading producers of okra but per acre yield of this vegetable in the country is very low due to the attack of fungi, bacteria, viruses and plant parasitic nematodes (PPNs). Of all the pathogens, root-knot nematodes (*Meloidogyne* spp.) are among the most serious Mukhtar *et al*. (2013) sedentary endo-parasitic nematode worldwide. The host range of root-knot nematodes is extensive and more than two thousand plant species have been reported as hosts for this nematode Sasser (1980). Among these, *M. incognita* is the most common species and infects almost all cultivated plants, which makes it most damaging pathogen Abad *et al*. (2008). In addition, these parasites also interact with other disease causing organisms to produce disease complexes Begum *et al*. (2012) and break down resistance against other pathogens and reduce plant tolerance to environmental stress Taylor (1979).

The annual yield losses caused by *Meloidogyne* spp. have been estimated upto 16.9 per cent Bhatti and Jain (1977) and Sasser (1979). In India, losses in okra due to *M. incognita* have been reported, in monetary terms, as US $ 8.7 million Jain *et al.* (2007). The immense losses caused by root-knot nematodes (RKNs) can be minimized by using various control strategies. Although, chemical usage is a common and popular practice to manage PPNs, it can result in an unfavourable cost-benefit ratio and may cause pollution and possible health hazard problems and conventional nematicides may not be available. Therefore, search for better options has been emphasized. Use of resistant cultivars is an economical and eco-friendly management option that can constitute an important component of the integrated management of RKNs. Growing resistant cultivars of crops in crop rotations is economical for the farmers for reducing nematode populations gradually in the infested fields. Therefore, availability of resistant varieties is the first information needed for farmers and agricultural scientists. Unfortunately, no sufficient work has been done on okra cultivars for resistance to nematodes in Haryana (India). Therefore, the objective of the present work was to screen okra cultivars for resistance against root-knot nematode, *M. incognita* under screen house.

MATERIAL AND METHODS

The experiment was carried out under screen house, Department of Nematology, C.C.S. Haryana Agricultural University, Hisar, Haryana during *Kharif*, 2019-20.

Propagation of pure culture of root-knot nematode, *M. incognita*:

For inoculation, pure culture of *M. incognita* was maintained on tomato in the earthen pots (steam sterilized sandy soil) as well as in the field. Four week old healthy seedlings of tomato were transplanted in the earthen pots. Second stage juveniles (J_2) of *M. incognita* were obtained from a single egg mass and inoculated around the root of tomato seedlings in pots. The culture was allowed to multiply for 2-3 generations and used for screening experiment in pots under screen house conditions.

Collection of okra cultivars:

Fifty cultivars of okra, obtained from Project Co-ordinator, AICRP on plant parasitic nematodes with integrated approach for their control, Division of Nematology, ICAR, New Delhi and other twenty one commercial cultivars were obtained from Department of Vegetable Science, C.C.S. HAU, Hisar were evaluated for their reaction against *M. incognita.*

Seeds of the above variety were sown in sterilized sandy loam soil in the earthen pots (1 kg soil capacity). Thinning was done after germination so as to maintain only one healthy seedling in each pot. One week after sowing, the seedlings were inoculated with freshly hatched *M. incognita* @ 1000 j_2 per kg of soil. Each treatment was replicated three times. Sixty days after inoculation, each plant was uprooted carefully from soil. The roots were retrieved carefully and kept in a basin of

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)

Table 1 : Screening of okra cultivars against *M. incognita* under screen house condition

Sr. No.	Entries/cultivars	Average no. of galls	Root-knot index (RKI)	Reaction
1.	EC 305609	50.7	4	S
2.	EC 305615	52.7	4	S
3.	EC 305714	76.2	4	S
4.	EC 305718	15.7	3	MR
5.	EC 305731	48.2	4	S
6.	EC 305736	48.0	4	S
7.	EC 305741	67.0	4	S
8.	EC 305745	72.2	4	S
9.	EC 305749	88.0	4	S
10.	EC 305768	108.5	5	HS
11.	EC 305769	50.2	4	S
12.	EC 306696	40.5	4	S
13.	EC 306697	14.5	3	MR
14.	EC 306700	19.2	3	MR
15.	EC 306703	4.7	2	R
16.	EC 306713	55.7	4	S
17.	EC 306720	113.7	5	HS
18.	EC 359637	42.2	4	S
19.	EC 359939	70.2	4	S
20.	EC 359891	16.0	3	MR
21.	EC 359898	101.7	5	HS
22.	EC 359969	59.7	4	S
23.	EC 359954	65.0	4	S
24.	EC 359995	45.5	4	S
25.	EC 036001	41.5	4	S
26.	IC 001543	75.2	4	S
27.	IC 003664	114.2	5	HS
28.	IC 003769	58.7	4	S
29.	IC 004328	65.2	4	S
30.	IC 004378	78.0	4	S
31.	IC 007856	116.5	5	HS
32.	IC 007952	62.0	4	S
33.	IC 008991	123.5	5	HS
34.	IC 009856	69.7	4	S
35.	IC 010265	117.2	5	HS
36.	IC 011533	37.5	4	S
37.	IC 012933	111.5	5	HS
38.	IC 013356	46.2	4	S
39.	IC 013664	55.5	4	S
40.	IC 013917	52.2	4	S
41.	IC 013995	58.2	4	S
42.	IC 013999	84.0	4	S
43.	IC 014018	14.5	3	MR

Table 1: Contd…………..

Table 1: Contd………

44.	IC 014026	48.0	4	S
45.	IC 014600	57.2	4	S
46.	IC 015540	48.0	4	S
47.	IC 014096		Did not germinate	
48.	IC 016262		Did not germinate	
49.	IC 433641		Did not germinate	
50.	IC 433645		Did not germinate	
51.	Varsha uphar	71.2	4	S
52.	Hisar naveen	19.7	3	MR
53.	Hisar unnat	15.0	3	MR
54.	HB-13-76-2-43 Self	47.2	4	S
55.	HB-13-26-1-1 Self	49.0	4	S
56.	HB-13-26-1 Self	52.2	4	S
57.	HB-13-57-3 Self	103.5	5	HS
58.	HB-13-18-2 16/21 Self	68.7	4	S
59.	HB-13-65-1 16/26 Self	60.0	4	S
60.	BB-1	16.0	3	MR
61.	HB-13-58-1 Self	62.7	4	S
62.	105-2-2	57.5	4	S
63.	HB-13-61-2 Self	110.0	5	HS
64.	HB-13-64-2-1	106.7	5	HS
65.	HB-13-67-3-1-2	113.2	5	HS
66.	HB-13-64-3-2	100.5	5	HS
67.	HB-13-76-2-4-2	122.7	5	HS
68.	HB-13-59-1	45.0	4	S
69.	HB-13-73-1-3	57.7	4	S
70.	HB-13-59-1	64.2	4	S
71.	HB-13-76-2-4-1	74.5	4	S

R-Resistant; MR-Moderately resistant; S-Susceptible; HS-Highly susceptible

water to clear it from adhering soil particles and recorded the observations such as number of galls per plant. The genotypes were categorized (Table A) as highly resistant, resistant, moderately resistant, susceptible and highly susceptible as per standard protocols (AICRP).

RESULTS AND DISCUSSION

Seventy one okra cultivars were screened for their reaction against *M. incognita* under screen house condition and data is presented in Table 1. Okra cultivars did not have high levels of resistant to *M. incognita*. Results clearly revealed that out of seventy one okra cultivars screened, one cultivar (EC 306703) showed resistant reaction and seven cultivars (EC 306697, EC 306700, EC 359891, EC 305718, IC 014018, BB -1, Hisar naveen and Hisar unnat) were rated as moderately resistant reaction against *M. incognita*. Rest of the cultivars exhibited either susceptible or highly susceptible reaction against *M. incognita*. No any single cultivar has been found as highly resistant.

The findings of our study showed significant variation among the okra cultivars in response to *M. incognita*. The cultivars EC 306703, EC 306697, EC 306700, EC 359891, EC 305718, IC 014018, BB-1, Hisar naveen and Hisar unnat were found resistant/moderately resistant to the *M. incognita*. These cultivars suffered less damage by *M. incognita* as compared to susceptible or highly susceptible cultivars. Cultivation of resistance and moderately resistance cultivars will also help to minimize environmental pollution, preserve the agro-ecosystems and bio-diversity and keep management processes more economical. Furthermore, these cultivars could be used in breeding programmes to introduce new resistant cultivars to these plant parasitic nematodes. Singh *et al.* (1993) reported that KS-381, KS114 and KSL-380 varieties of okra were resistant and five cultivars showed moderately resistant and rests were found susceptible to *M. incognita*. Similarly, Rekha and Gowda (2000) recorded that okra varieties *viz.*, AROH-10, HOE-202, VLC-1, AROH-9, VB 9101, IIHR-91, and Arkaanamika were susceptible against *M. incognita*. Sheela *et al.* (2006) found 123 okra cultivars were moderately resistant with a gall index of 3.0 against root-knot nematode. Five lines *viz.*, IC-111472, IC-128372, IC-169482, IC-411698 and IC-433686 exhibited moderately resistant reaction against root-knot nematode Mohanta and Mohanty (2012).

Conclusion:

The findings of our study showed significant differences among okra cultivars in their response to *M. incognita.* The cultivars *viz.*, EC 306703, EC 306697, EC 306700, EC 359891, EC 305718, IC 014018, BB -1, Hisar naveen and Hisar unnat were found resistant/ moderately resistant reaction against root-knot nematode. These cultivars suffered less damage by the nematode as compared to susceptible/highly susceptible cultivars. Furthermore, these cultivars could be used in breeding programmes to introduce new resistant cultivars to these plant parasitic nematodes.

Acknowledgement:

The authors are highly obliged to the Project Coordinator, AICRP on plant parasitic nematodes with integrated approach for their control, Division of Nematology, ICAR, New Delhi and Department of Vegetable Science, CCS HAU, Hisar for providing germplasm/cultivars to carry out the research work.

REFERENCES

Abad, P., Gouzy, J. and Aury, J. M. (2008). Genome sequence of the metazoan plant-parasitic nematode, *Meloidogyine incognita*. *Nature Biotechnology*, **26** : 909-915.

Adetuyi, F.O.,Osagie, A.U. and Adekunle, A.T. (2011). Nutrient, anti-nutrient, mineral and bioavailability of okra [*Abelmoschus esculentus* (L.) Moench]. *American J. Food Nutrition*, **1** : 49-54.

Begum, N., Haque, M.I., Mukhtar, T., Naqvi, S.M. and Wang, J.F. (2012). Status of bacterial wilt caused by *Ralstonia solanacearum* in Pakistan. *Pakistan J. Phytopathol.*, **24**: 11-20.

Bhatti, D.S. and Jain, R.K. (1977). Estimation of losses in okra, tomato and eggplant yield due to *Meloidogyne incognita*. *Indian J. Nematology,* **7**: 37-41.

Düzyaman, E. and Vural, H. (2003). Evaluation of pod characteristics and nutritive value of okra genetic resources. *Acta Horticulturae*, **598** : 103-110.

Jain, R.K., Mathur, K.N. and Singh, R.V. (2007). Estimation of losses due to plant-parasitic nematodes on different crops in India. *Indian J.Nematology*, **37**: 219-221.

Mohanta, S. and Mohanty, K.C. (2012). Screening of okra germplasms/varieties for resistance against *Meloidogyne incognita*. *J.Plant Protec. & Environ.*, **9**: 66-68.

Mukhtar, T., Arshad, I., Kayani, M.Z., Hussain, M.A., Kayani, S.B., Rahoo, M. and Ashfaq, M. (2013). Estimation of damage to okra (*Abelmoschus esculentus*) by root-knot disease incited by *Meloidogyne incognita*. *Pakistan J. Botany*, **45** : 1023-1027.

Rashid, M.H., Yasmin, L., Kibria, M.G., Millik, A.K., Hossain, S.M. (2012). Screening of okra germplasm for resistance to yellow vein mosaic virus under field conditions. *Plant Pathology J.*, **1**: 61-62.

Rekha, A.R. and Gowda, D.N. (2000). Screening of okra germplasm and varieties for resistance against *Meloidogyne incognita*. *Indian J. Nematology,* **30**: 249.

Sasser, J.N. (1979). Economic importance of Meloidogyne in tropical countries. In: Lamberti, F., Taylor, C.E. (eds.), *Root-knot nematodes* (*Meloidogyne* spp.): *Systematics, biology and control*. Academic Press, New York, pp. 359-374.

Sasser, J.N. (1980). Root-knot nematode: A global menance to crop production. *Plant Disease,* **64**: 36-41.

Sheela, M.S., Jiji, R., Malu and Shaiju, S. (2006). Screening of okra varieties for resistance against *Meloidogyne incognita*. *Indian J. Nematology,* **36** : 292-293.

Singh, R.K., Singha, R.R. and Pandey, R.C. (1993). Screening of okra, *Abelmoschus esculentus* varieties/cultivars against root-knot nematode, *Meloidogyne incognita*. *Curr. Nematology,* **4** : 229-232.

Taylor, C.E. (1979). Meloidogyne inter relationships with microorganisms. In: Lamberti, F., Taylor, C.E. (eds.), *Root-knot nematodes* (*Meloidogyne* spp.). Academic Press, London, New York, pp. 375-398.

WEBLIOGRAPHY

FAOSTAT (2015). Available online at: *http://faostat.fao.org*.