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RESPONSE OF SOME TOMATO CULTIVARS AGAINST ROOT-KNOT NEMATODE, *Meloidogyne incognita* (KOFOID & WHITE) CHITWOOD

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ABSTRACT

Meloidogyne incognita (Kofoid & White) Chitwood was isolated as most predominant root-knot nematode from soil and the infected root samples of stunted tomato plants showed chlorosis. Root and shoot growth of five tomato verities was significantly reduced when inoculated with second stage infective larvae of *M. incognita* as compared to un-inoculated tomato varieties. *M. incognita* significantly reduced root length in tomato variety Anmol followed by Gola France and Sunehra as compared to un-inoculated tomato variety Roma Holland and Roma v.f. Root weight was also decreased in Sunehra followed by Roma Holland and Tomato Anmol than that of un-inoculated tomato variety Roma v.f., followed by Roma Holland. Shoot length was significantly increased in tomato variety Sunehra followed by Roma v.f. and Roma Holland and that was decreased in tomato Anmol as compared to un-inoculated tomato variety Roma Holland, Sunehra and Roma v.f. respectively. Shoot weight was significantly reduced in tomato variety Anmol inoculated with *M. incognita* as compared to Gola France, Roma v.f., and Sunehra than that of un-inoculated tomato varieties Roma v.f., Roma Holland and Anmol, respectively. The development of root galls and eggs formation were increased in all tomato varieties inoculated with *M. incognita.* Population of larvae and egg-laying females were also greater in all inoculated tomato varieties. Variation in multiplication of nematode in certain tomato was observed among varieties. The number of root-galls was significantly increased in tomato variety Roma v.f. followed by Roma Holland as compared to Gola France and Sunehra and that was decreased in tomato variety Anmol. The greater number of egg masses per root system was obtained in tomato variety Roma v.f. followed by Roma Holland and Gola France and minimum was recorded in Tomato Anmol, respectively. Maximum number of eggs per egg mass was found in tomato variety Roma v.f. followed by Roma Holland and Gola France as compared to Sunehra and Tomato Anmol. Number of larvae was significantly increased in tomato variety Roma v.f., Gola France followed by Roma Holland and that was decreased in Anmol. Population of egg-laying females of *M. incognita* was also increased in tomato variety Roma v.f. followed by Gola France and Roma Holland than that of tomato variety Sunehra and Tomato Anmol, respectively. However, the tomato varieties usually cultivated in Sindh are highly susceptible to root-knot nematode and thus provide substrate to build up the population of root-knot nematode in tomato field. These varieties should be replaced in order to reduce the population of root-knot nematode. The use of resistant varieties to manage the population of nematode is very cheep and an effective control of plant parasitic nematode but it require time and facilities to develop resistant varieties

Key words: Root-Knot, Nematode, Tomato and *Meloidogyne incognita* (Kofoid & White) Chitwood.

INTRODUCTION

Tomato (*Lycopersicon esculentum* L*,* Mill*)* is an important crop and used more frequently as source of daily diet vegetable. Tomato is cultivated on large scale in southern districts of Sindh and is rich in vitamins A, B and C (Khoso, 1994). Root-knot nematodes are the major pathogens of vegetable crops and responsible for heavy losses in the yield every year in heavily infected crops (Alam and Jairajpuri, 1990). Bafokuzara (1996) found that *Meloidogyne incognita* (Kofoid & White) Chitwood is responsible in deteriorating the quality of fruit and yield of tomato crop. Charchar *et al,* (2003) reported that tomato is one of the most susceptible vegetable crops and the nematode causing 30 to 40% yield losses in tropical regions. The use of resistant varieties is promising method of controlling plant parasitic nematodes and the resistance is often managed by one or more genes in tomato cultivars (Amati *et al,* 1985).

Several researchers have suggested the use of resistant varieties or cultivation of non-host crops against *Meloidogyne* spp., is cheap and an alternate method of managing population of root-knot nematodes in the vegetable crops as compared to nematicides. Mahajan (2002) evaluated 34 tomato cultivars in nurseries for resistance to *M. incognita* and recorded variation in root-knot indices of the nematode. Darban *et al,* (2003) rated seven tomato cultivars against *M. incognita* in pot experiment on the basis of root-knot development and

found resistance and susceptibility response in tomato cultivars.

It has been found that root-knot nematodes may enter susceptible and resistant tomato varieties in about equal number. Hence breaking of resistance in tomato cultivars to *M. incognita* may occur naturally or by selection of tomato plants with one or more resistant genes (Khan and Nirapma, 2000).

Keeping in view the very little work has been done on the testing of tomato varieties against *Meloidogyne* spp. and heavy yield losses in vegetables due to root-knot nematodes in Sindh, it was necessary to test all the available tomato varieties and to see their response against *M. incognita* causing tomato root-knot disease. Therefore, the present research was conducted on the interaction of varietal response to nematode, *M. incognita* on the collection, identification and preservation of inoculum of *Meloidogyne incognita* to be used for the entire research work and the pathogenicity test of *M. incognita* on different tomato varieties with infective larvae of *M. incognita.*

MATERIALS AND METHODS

Samples of soil and roots were collected from stunted tomato plants which were showing yellow colored leaves and other symptoms of the problems. The sampling was done at 20 cm deep with a needle nose shovel. Samples were kept in polythene bags and brought to the laboratory for isolation of root-knot nematodes.

Isolation of root-knot nematodes

i. Isolation and purification of the nematode was done from composite soil sample of 200 g. The mixture was passed through 300 mesh sieve and nematodes were isolated by a modified Baerman funnel method (Southey, 1986).

ii. Isolation was also done from 10-15 g infected tomato roots; knots were broken into very small pieces in a blender containing 150 ml distilled water for 30 seconds. The material was again passed from 300 mesh sieve. Both material were kept in beaker or cavity block and examined under the stereoscopic microscope.

Females were gently picked up and placed over a drop of lactophenol on a clean slide. Female posterior tail was cut with help of a sharp knife. Females were identified on their perineal pattern by using pictorial key of plant parasitic nematodes as described by Mai and Lyon (1975).

Pathogenicity test: Pathogenicity test of most frequently isolated *Meloidogyne incognita* was conducted on an 8-week old tomato seedlings of Roma v.f. variety. Tomato seedlings were inoculated with 500 second stage larvae (per pot).

Effect of *Meloidogyne incognita* on different tomato varieties: Seed of five tomato varieties, Anmol, Roma v.f., Gola France, Roma and Sunehra were raised for nursery in the Department of Plant Pathology.

Pot Experiment: After 2 months, seedling plants of five tomato varieties were transplanted in earthen pots containing 2 kg steam sterilized soil. After one week of adaptation, seedlings were inoculated with 500 second stage larvae of *M. incognita*, by soil drenching with water containing inoculum. Plants were watered whenever needed. Experiment was laid out in completely randomized design (CRD) with four replications of each variety. Un-inoculated plants were served as control with equal number of plants per pot.

After two months, plants were uprooted gently from pots and observations were taken. The measurement was performed on root length, root weight, shoot length, shoot weight, number of galls per plant, number of egg masses per root system, number of eggs per egg mass, number of larvae per plant and number of females per root system.

Root-knot index was determined using 0-5 scale as described by Taylor and Sesser (1978), where 0 = no galls, 1 = 1-25% root galled, 2=26-50%, 3=51-75%, 4=76-100% and 5=81-100% of root galled.

RESULTS

Isolation and identification of *M. incognita*: The isolated root-knot nematodes were identified on the basis of their female perineal pattern. The most predominant root-knot nematode from soil and infected tomato roots was *M. incognita*.

Response of different tomato varieties to *M. incognita*: 8-week old seedlings of five tomato varieties, Anmol, Roma v. f., Gola, Roma and Sunehra were inoculated with second stage larvae of *M. incognita* as described previously. Root length was significantly decreased in tomato variety Anmol (3.625 cm) followed by Gola France (6.175 cm) and Sunehra (6.250 cm) as compared to un-inoculated tomato variety Roma Holand (16.625 cm) followed by Roma v.f. (12.350). Results indicated in Table-1 showed that root weight was also decreased in Sunehra (0.125 g). There was no significant difference in root weight of tomato varieties Roma vf and Roma Holland. Gola France and Sunehra also did not show significant difference when inoculated with *M. incognita* as compared to un-inoculated tomato varieties.

Shoot length was increased in Sunehra (10.575 cm) followed by Roma v.f. (9.875 cm) and Roma Hold (9.425 cm), while that was decreased in Tomato Anmol (4.875 cm) as compared to un-inoculated tomato variety Roma Holand (14.375 cm) followed by Sunehra (13.950 cm) and Roma v.f. (13.550 cm) respectively (Table 2). There was no significant difference in shoot weight of tomato varieties Anmol, Gola France, Roma Holland and Sunehra inoculated with nematode as compared to

un-inoculated tomato varieties Roma v.f. (3.675 g) followed by Roma Holland (2.650 g) and Tomato Anmol (1.175 g) respectively (Table-1 & 2).

Table -1. Effect of *m. Incognita* on roots growth of different tomato varieties.

Varity name	Root length (cm)		Root Weight (g)	
	Inoculated	Un-inoculated	Inoculated	Un-inoculated
Anmol	3.62 c	6.92 cd	0.17 b	0.17 c
Roma v.f	9.80 a	12.35 b	0.40 a	0.65 a
Gola France	6.17 b	7.72 c	0.22 b	0.25 bc
Roma Holland	10.50 a	16.62 a	0.17 b	0.40 b
Sunehra	6.25 b	6.67 d	0.12 b	0.25 bc
LSD (P=0.05)	0.88	0.91	0.14	0.19

Means having different superscripts in a column differed significantly (P<0.05)

Table -2. Effect of *M. Incognita* on shoot growth of different tomato varieties.

Varity name	Shoot length (cm)		Shoot Weight (g)	
	Inoculated	Un-inoculated	Inoculated	Un-inoculated
Anmol	4.87 c	9.50 d	0.55 c	1.17 c
Roma v.f	9.87 b	13.55 b	1.75 b	3.67 a
Gola France	5.20 c	12.47 c	2.55 a	0.35 d
Roma Holland	9.42 b	14.37 a	1.52 b	2.65 b
Sunehra	10.57 a	13.95 ab	1.62 b	1.12 c
LSD (P=0.05)	0.69	0.71	0.25	0.19

Means having different superscripts in a column differed significantly (P<0.05)

The greatest number of galls per plants was obtained in tomato variety inoculated with *M.inocgnita* (70.00) followed by Roma Holland (34.25) as compared to Gola France (11.00) and Sunehra (9.00), while lowest number of galls was recorded in Tomato variety Anmol (Table.3). The maximum reduction on root-knot index was observed in Tomato Anmol, Roma v.f., and Gola France varieties as compared to Roma Holland and Sunehra tomato varieties (Table.3).

Maximum number of egg masses per root system was obtained in tomato variety Roma v.f. (1835.80) followed by Roma Holland (830.75) and Gola France (759.50), while minimum number of egg masses was recorded in Tomato Anmol (81.25) respectively (Table.3). Number of eggs per egg mass was significantly increased in Tomato variety Roma v.f (212.25) followed by Roma Holland (44.50) and Gola France (40.75) as compared to Sunehra (31.50) and Tomato Anmol (29.75) respectively (Table.3).

Number of larvae per plant was significantly increased in Tomato variety Roma v.f (1506.00) followed by Gola France (861.75), Roma Holland (603.25) and that was decreased in Tomato Anmol (57.50) followed by Gola France (188.25) and Roma Holland (93.00) as compared to Sunehra (69.50) and Tomato Anmol (9.00) respectively (Table.4).

Table -3. Effect of *M. Incognita* on development of galls and egg formation on different tomato varieties.

Varity name	No. of galls/plants	RKI	No. of egg masses per root system	No. of egg per root system
Anmol	4.50 d	1.0	81.25 e	29.75 e
Roma v.f	70.00 a	4.0	1835.80 a	212.25 a
Gola France	11.00 c	1.0	759.50 c	40.75 c
Roma Holland	34.25 b	2.0	830.75 d	44.50 b
Sunehra	9.00 c	1.0	387.75 d	31.50 d
LSD (P=0.05)	3.05		4.37	1.57

Means having different superscripts in a column differed significantly (P<0.05)

Table- 4. Responses of different tomato varieties to reproduction of *M. Incognita*.

Varity name	Number of larvae per root system	Number of female per root system
Anmol	57.50 d	9.00 e
Roma v.f	1506.00 a	259.75
Gola France	861.75 b	188.25 b
Roma Holland	603.25 c	93.00 c
Sunehra	367.25 d	69.00 d
LSD (P=0.05)	12.88	4.76

Means having different superscripts in a column differed significantly (P<0.05).

DISCUSSION

Tomato root knot nematode, *M. incognita* significantly reduced root length in tomato variety Anmol followed by Gola France and Sunehra as compared to un-inoculated tomato variety Roma Holland and Roma v.f.. Root weight was also decreased in Sunehra followed by Roma Holland and Tomato Anmol than that of un-inoculated tomato variety Roma v.f., followed by Roma Holland. Shoot length was significantly increased in tomato variety Sunehra followed by Roma v.f. and Roma Holland and that was decreased in tomato Anmol as compared to un-inoculated tomato variety Roma Holland, Sunehra and Roma v.f. respectively. Shoot weight was significantly reduced in tomato variety Anmol inoculated with *M. incognita* as compared to Gola France, Roma v.f., and Sunehra than that of un-inoculated tomato varieties Roma v.f., Roma Holland and Anmol, respectively. Root growth of five tomato verities was significantly reduced when inoculated with second stage infective larvae of *M. incognita* as compared to un-inoculated tomato varieties. Maximum reduction in shoot growth was also reduced in inoculated tomato varieties than that of un-inoculated tomato varieties.

Maqbool and Ghazala (1986) reported the growth of tomato seedlings that was significantly reduced when artificially inoculated with *Meloidogyne* spp. Darban (1994) observed that growth of tomato variety Roma was decreased when inoculated with different inoculum levels of *M. incognita.* Rao *et al,* (1998) found post-penetration of second stage larvae of *M. incognita* in tomato hybrid FM-2 and Pusa Puby before and after transplanting. The number of root-galls was significantly increased in tomato variety Roma v.f. followed by Roma Holland as compared to Gola France and Sunehra and that was decreased in tomato variety Anmol. The greater number of egg masses per root system was obtained in tomato variety Roma v.f. followed by Roma Holland and Gola France and minimum was recorded in Tomato Anmol, respectively. Maximum number of eggs per egg mass was found in tomato variety Roma v.f. followed by Roma Holland and Gola France as compared to Sunehra and Tomato Anmol. Number of larvae was significantly increased in tomato variety Roma v.f., Gola France followed by Roma Holland and that was decreased in Anmol. Population of egg-laying females of *M. incognita* was also increased in tomato variety Roma v.f. followed by Gola France and Roma Holland than that of tomato variety Sunehra and Tomato Anmol, respectively. The development of root galls and egg formation were increased in all tomato varieties inoculated with *M. incognita.* Population of larvae and egg-laying females were also greater in all inoculated tomato varieties. There was variation in multiplication of nematode in certain tomato varieties. Lawerence and Clark (1986) observed that number of females, root-galls and egg masses were increased on susceptible cultivar inoculated with *M. incognita.* Roberts and May (1986) studied the interaction of *M. incongita* and *M. javanica* and tomato cultivars on average RKI and number of eggs on infected plants. Roberts and Thomason (1986) found variability in root-knot indices of different isolates of *M. incognita.* Similar results have been reported by Darban *et al,* (2003) and Pathan *et al,* (2004) while artificially inoculating the different tomato varieties with *M. incognita* under pot and field conditions. Jayakumar *et al,* (2002) used dry leaves of different plants on development of *M. incognita.* Dabaj *et al,* (1996) tried different inoculum levels of *M. inocgnita* to see their effect on growth of five tomato and three eggplant varieties.

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