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# Screening of Fenugreek (*Trigonella foenum-Graecum*) Varieties against Root-knot Nematode *Meloidogyne incognita*

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**Abstract**

The screening of twenty *Trigonella foenum-graecum* varieties against to root-knot nematode *Meloidogyne incognita* was studied under pot condition. Two varieties, UM-72 and UM-178 showed resistant to *M. incognita,* one variety Rmt-361 show moderately resistant, two varieties UM-3 and Rmt-365 showed tolerant, seven varieties viz., UM-2, UM-7, UM-19, UM-86, UM-118, UM-135 and UM-354 showed susceptible and eight varieties viz., UM-12, UM-46, UM-85, UM-90, UM-97, UM-147, UM-185 and UM-202 showed highly susceptible to *Meloidogyne incognita.*

**Keywords:** Fenugreek varieties; *Meloidogyne incognita*; Resistant; Susceptible

## Introduction

Fenugreek (*Trigonella foenum -graecum L.*) is an annual herb in the family-Fabaceae and an important seed spice, native of South Eastern Europe and South Western Asia. Major fenugreek producing countries are Afghanistan, Pakistan, India, Iran, Nepal, Bangladesh, Argentina, Egypt, France, Spain, Turkey, and Morocco. In India, the major producing states are Rajasthan, Gujarat, Uttarakhand, Uttar Pradesh, Madhya Pradesh, Maharashtra, Haryana and Punjab. Rajasthan accounts for over 80% of India's output. The fenugreek is attacked by several fungi, bacteria, viruses and nematodes causing serious diseases resulting in reduced yields [1]. Root-knot nematode (*Meloidogyne* spp.) is one of the three most economically damaging genera of plant-parasitic nematodes on horticultural and field crops. Root-knot nematodes are distributed worldwide, and are obligate parasites of the roots of thousands of plant species, including monocotyledonous and dicotyledonous, herbaceous and woody plants. Four *Meloidogyne* species (*M. incognita, M. javanica, M. hapla* and *M. arenaria*) are worldwide with another seven being important on a local basis. In *Trigonella foenum–graecum* disease symptoms are characterized by the presence of galls or root knot nematodes on infected plants. These root-knots alter the uptake of water and nutrients and interfere with the translocation of minerals and photosynthesis in the host [2,3] resulting in poor yield, stunted growth, wilting and susceptibility to other pathogen. The most economical and effective ways to control plant disease caused by fungi, bacteria and plant parasitic nematodes is through growing resistant plant varieties which decreases yield losses, increase profit and result in more production of food and fibre. Unlike chemical methods, nematode management with resistant varieties requires no special equipment or extra capital investment by growers. The objective of this study was to screening fenugreek varieties for their reaction to *M. incognita.*

## Materials and Methods

### Test plant and pathogen

The root-knot nematode, *Meloidogyne incognita* (Kofoid and White) Chitwood was selected as test pathogen and *Trigonella foenum -graecum* L. was used as test plant.

### Preparation and sterilization of soil mixture

A mixture of soil and organic manure was prepared in the ratio 3:1. The clay pots were filled with this soil mixture at the rate of 1 kg per pot. A little amount of water was poured in each pot to just wet the soil before transferring to an autoclave for sterilization at 20 lb pressure for 20 minutes.

### Raising and maintenance of fenugreek seedlings

Surface sterilized seeds of each fenugreek varieties were sown at the rate of five seeds per pots. After their germination at three leaf stage thinning was done so as to maintain only one plant in each pot. Watering was done as and when required.

### Preparation of nematode inoculum

Large number of egg masses of *Meloidogyne incognita* from heavily infected brinjal roots on which pure culture of *M. incognita* multiplied was handpicked with the help of sterilized forceps. These egg masses, after being washed in distilled water, were placed on a sieve layered with tissue paper. The sieve was placed over a petridish containing water. A series of such assemblies were kept to obtain large number of second stage juvenile required for inoculations. After every 24 hours, the hatched out juvenile were collected along with water from the petridish in a beaker and fresh water added to the petridish. Volume of water in the nematode suspension was so adjusted that each ml contained about 100 nematodes. It was done either by adding more water or decanting excess amount of water, so that 10 ml of this suspension poured in each pot to provide required inoculum level (i.e. 1000 second stage juvenile (J2) of *M. incognita*/kg soil).

### Inoculation technique

Three week old seedling of twenty fenugreek varieties were inoculated with 1000 second stage juvenile (J2) of *Meloidogyne incognita.* Feeder root of seedling, just before inoculations, were exposed by carefully removing the top layer of soil and a required quantity of nematode suspension was poured uniformly all around the exposed roots using a sterilized pipette. Exposed roots were

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immediately covered by levelling the soil properly. Watering was done as and when required.

## Data collected

Data were collected from the following variables:

### i. Plant growth determination

Sixty days after inoculation of *M. incognita*. Plants were uprooted. Roots were washed thoroughly in slow running tap water. For measuring length, fresh weight and dry weight, the plants were cut with a short knife just above the base of root emergence. The length of root and shoot was recorded in centimetre from the cut end to the tip of first leaf and longest root respectively. For measuring dry weight of the plant, the weight was recorded in grams. Similarly the fresh weight of shoot and root of the plant was also recorded in grams. For interpretation of results, the reduction in plant growth was calculated in terms of percentage dry weight reduction. The number of galls per root system was also counted.

### ii. Nematode population estimation

For extraction of nematodes, the soil from each treatment was mixed thoroughly and a sub sample of 200 g soil was processed through sieves according to Cobb's sieving and gravity method followed by Baermann's funnel technique. Each suspension was collected in a beaker and volume made up to 100 ml. For proper distribution of nematodes, the suspension was bubbled with the help of pipette and 2 ml suspension of each sample was drawn and transferred to a counting dish. Mean of three such counting was calculated and the final population of nematodes/kg soil was determined. Reproduction factor (R) of the nematode was calculated by the formula

R= pf/pi where pf represented the final population and pi is the initial population of the nematode.

### iii. Basis of resistant rating

The degree of resistance and susceptibility of different fenugreek varieties against root-knot nematode was determine by using [4] Resistance Susceptibility index as given below.

Reproduction factor<1, 1-10 galls per root system, reduction in plant growth<5% =Resistant **(R).**

Reproduction factor 1-2, 11-20 galls per root system, reduction in plant growth<5%=moderately resistant **(MR).**

Reproduction factor 2.1-3.0, 21-30 galls per root system, reduction in plant growth 5-10% =Tolerant **(T).**

Reproduction factor 3.1-5.0, 31-100 galls per root system, reduction in plant growth 10-25% =Susceptible **(S).**

Reproduction factor>5, >100 galls per root system, reduction in plant growth>25% =Highly Susceptible **(HS).**

## Results and Discussion

The data presented in Table 1 reveal that different fenugreek varieties responded differently to the infection of *Meloidogyne incognita*. The results showed that out of the twenty fenugreek varieties eight varieties were highly susceptible, seven susceptible, two tolerant, one moderately

| Varieties | Length of plant (cm) | Fresh weight of plant (g) | Dry weight of plant (g) | Percentage reduction over control | Population of root-knot nematode | | | Rf=Pf/Pi | No. of galls/root system | *Response of the Varieties |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | No. of females/ root system | No. of juveniles/ kg soil | Total population | | | |
| **UM-2** | | | | | | | | | | |
| Control | 13 | 6.9 | 3.4 | - | - | - | - | | - | S |
| Inoculated | 9 | 5.8 | 2.6 | 23.52 | 208 | 4240 | 4448 | 4.4 | 68 | |
| **UM-7** | | | | | | | | | | |
| Control | 12.2 | 7.8 | 3.8 | - | - | - | - | | - | S |
| Inoculated | 6.9 | 6.3 | 2.9 | 23.68 | 188 | 3818 | 4006 | 4 | 54 | |
| **UM-3** | | | | | | | | | | |
| Control | 6.2 | 4.6 | 0.16 | - | - | - | - | | - | T |
| Inoculated | 5.9 | 4.2 | 0.15 | 6.25 | 57 | 2632 | 2689 | 2.6 | 24 | |
| **UM-12** | | | | | | | | | | |
| Control | 12.8 | 8.9 | 5.1 | - | - | - | - | | - | HS |
| Inoculated | 10.3 | 6.5 | 3.1 | 39.21 | 238 | 4932 | 5170 | 5.2 | 108 | |
| **UM-46** | | | | | | | | | | |
| Control | 6.9 | 5.9 | 3 | - | - | - | - | | - | HS |
| Inoculated | 4.8 | 4.3 | 2.2 | 26.66 | 229 | 7549 | 7778 | 7.8 | 116 | |
| **UM-19** | | | | | | | | | | |
| Control | 7.8 | 8.9 | 7.3 | - | - | - | - | | - | S |
| Inoculated | 6.3 | 7.1 | 5.8 | 20.54 | 167 | 3640 | 3807 | 3.8 | 46 | |
| **UM-72** | | | | | | | | | | |
| Control | 11.6 | 9.8 | 6.1 | - | - | - | - | | - | R |
| Inoculated | 10.1 | 9.1 | 5.8 | 4.91 | 14 | 845 | 859 | 0.8 | 8 | |
| **UM-85** | | | | | | | | | | |
| Control | 15.2 | 8.4 | 6.5 | - | - | - | - | | - | HS |
| inoculated | 12 | 6.3 | 4.7 | 27.69 | 366 | 10108 | 10474 | 10.5 | 131 | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **UM-86** | | | | | | | | | | |
| Control | 16.2 | 10.1 | 4.8 | - | - | - | - | | - | S |
| Inoculated | 13.4 | 8.6 | 3.7 | 22.91 | 226 | 4286 | 4512 | 4.5 | 88 | |
| **UM-90** | | | | | | | | | | |
| Control | 8.8 | 7.9 | 3.4 | - | - | - | - | | - | HS |
| Inoculated | 6.7 | 6.8 | 2.7 | 29.41 | 356 | 13088 | 13444 | 13.4 | 176 | |
| **UM-97** | | | | | | | | | | |
| Control | 7.8 | 8.1 | 0.7 | - | - | - | - | | - | HS |
| Inoculated | 6 | 6.8 | 0.52 | 25.41 | 268 | 11204 | 11472 | 11.5 | 122 | |
| **UM-118** | | | | | | | | | | |
| Control | 8.1 | 6.8 | 3.6 | - | - | - | - | | - | S |
| Inoculated | 6.2 | 5.9 | 2.8 | 22.22 | 212 | 4074 | 4286 | 4.3 | 68 | |
| **UM-135** | | | | | | | | | | |
| Control | 13.8 | 10.8 | 7.3 | - | - | - | - | | - | S |
| Inoculated | 11.5 | 9.1 | 6.1 | 16.43 | 196 | 4806 | 5002 | 5 | 48 | |
| **UM-147** | | | | | | | | | | |
| Control | 9.6 | 10.5 | 7.8 | - | - | - | - | | - | HS |
| Inoculated | 8.8 | 8.9 | 5 | 35.89 | 368 | 11240 | 11608 | 11.6 | 136 | |
| **UM-178** | | | | | | | | | | |
| Control | 5.2 | 4.6 | 4.3 | - | - | - | - | | - | R |
| Inoculated | 4.9 | 4.2 | 4.1 | 4.65 | 28 | 892 | 920 | 0.9 | 5 | |
| **UM-185** | | | | | | | | | | |
| Control | 4.8 | 3.8 | 0.9 | - | - | - | - | | - | HS |
| Inoculated | 3.5 | 2.9 | 0.53 | 41.11 | 201 | 5678 | 5879 | 5.9 | 110 | |
| **UM-202** | | | | | | | | | | |
| Control | 10.2 | 7.8 | 4.3 | - | - | - | - | | - | HS |
| Inoculated | 6.9 | 6.3 | 3.2 | 25.58 | 397 | 11340 | 11737 | 11.7 | 132 | |
| **UM-354** | | | | | | | | | | |
| Control | 5.1 | 3.8 | 2.8 | - | - | - | - | | - | S |
| Inoculated | 4.2 | 3.1 | 2.3 | 17.85 | 288 | 4480 | 4768 | 4.8 | 84 | |
| **Rmt-361** | | | | | | | | | | |
| Control | 5.8 | 6.3 | 0.84 | - | - | - | - | | - | MR |
| Inoculated | 5.2 | 5.8 | 0.8 | 4 | 58 | 1140 | 1198 | 1.3 | 16 | |
| **Rmt-365** | | | | | | | | | | |
| Control | 9.3 | 5.4 | 4.2 | - | - | - | - | | - | T |
| Inoculated | 8 | 4.8 | 3.8 | 9.52 | 74 | 2680 | 2754 | 2.7 | 26 | |

*R = Resistant, MR = Moderately Resistant, T = Tolerant, S = Susceptible, HS = Highly Susceptible

**Table 1:** Response of fenugreek varieties against *Meloidogyne incognita*.

resistant and two resistant. The varieties viz., UM-12, UM-46, UM-85, UM-90, UM-97, UM-147, UM-185 and UM-202 were found highly susceptible on the basis of percentage reduction in plant growth which was recorded as 39.21, 26.66, 27.69, 29.41, 25.41, 35.89, 41.11 and 25.58, respectively; nematode reproduction factor as 5.2, 7.8, 10.5, 13.4, 11.5, 11.6, 5.9 and 11.7, respectively and number of galls per root system as 108, 116, 131, 176, 122, 136, 110 and 132, respectively. The varieties viz., UM-2, UM-7, UM-19, UM-86, UM-118, UM-135 and UM-354 exhibited susceptible reaction when plant growth reduction as 23.52, 23.68, 20.54, 22.91, 22.22, 16.43 and 17.85, respectively; reproduction factor as 4.4, 4.0, 3.8, 4.5, 4.3, 5.0 and 4.8, respectively and number of galls per root system as 68, 54, 46, 88, 68, 48 and 84, respectively were collectively taken as the parameters for resistance rating in the corresponding varieties. The fenugreek varieties-UM-3 and Rmt-365 showed tolerant response to *M. incognita* on the basis of percentage reduction in plant growth as 6.25 and 9.52, respectively; reproduction factor as 2.6 and 2.7, respectively and number of galls per root system as 24 and 26, respectively. However, on the other hand, the fenugreek varieties Rmt-361 exhibited moderately resistant reaction (plant growth reduction as 4.0%, reproduction factor as 1.3 and number of galls per root system as 16. Moreover, only two varieties UM-72 and UM-178 showed resistant response to M. incognita when plant growth reduction 4.91 and 4.65%, respectively; reproduction factor as 0.8 and 0.9, respectively and number of galls per root system as 8 and 5, respectively were collectively considered as parameters of resistance rating. The different varieties of fenugreek have also been screened by the workers against *Meloidogyne incognita* and *Meloidogyne javanica* [5-8]. They also reported that different varieties responded differently to the infection of root-knot nematodes. Sharma et al. [5] reported that the fenugreek varieties-UM-34 and UM-35 showed resistant response to *Meloidogyne incognita,* whereas, vars. UM-5, UM-17, UM-32, UM-84, NLM, GF-1, Lam Sel-1 and Co.1 has moderately resistant reaction against *M. incognita*. Similarly, Das and Jena [6] reported the two resistant and four moderately resistant varieties of fenugreek against root-knot nematode (*M. incognita*). Malhotra and Vashishtha [7] reported fenugreek variety Rmt-305 as resistant to root-knot nematode, *M. incognita.* The resistant varieties of fenugreek the replacement of susceptible with resistant ones appears to be the most economic and feasible method of disease control.

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