RESISTANCE TO *MELOIDOGYNE INCOGNITA* IN GINGER AND TURMERIC GERMPLASMS

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Abstract: In order to locate resistance in ginger and turmeric for producing 'clean spices', 48 accessions of turmeric and 116 of ginger were screened against *Meloidogyne incognita*. Out of these, 12 turmeric and 35 ginger accessions showed resistance to the nematode in the preliminary study. Nine such 'resistant' accessions each in turmeric and ginger were further tested. Seven turmeric and six ginger accessions were found resistant to *M. incognita*. Among these, one ginger and two turmeric accessions were highly resistant to nematodes. This is the first report of root-knot nematode resistance in ginger.

Clean spices' free from pesticide residues are becoming increasingly popular throughout the world. Resistant varieties are the cheap, efficient and sustainable means to manage plant parasitic nematode, especially root-knot nematodes. Several turmeric lines are reported resistant to root-knot nematodes (Mani & Sri Hari, 1989). But none of the ginger lines screened so far are resistant to these nematodes (Charles & Kuriyan, 1982). This study was taken up to explore the rich germplasm of ginger and turmeric for locating resistant lines against root-knot nematodes.

MATERIALS AND METHODS

Germplasms used in this study included 48 turmeric and 116 ginger accessions obtained from the germplasm repository at Indian Institute of Spices Research, Calicut, India. The isolate of *Meloidogyne incognita* (Kofoid & White) Chitwood was collected from ginger and multiplied from single egg mass on a susceptible ginger cultivar.

Twenty five g seed materials of each of the above germplasm accessions were planted in different batches in black polythene bags (30 x 45 cm size) containing a 1 : 1 : 1: (v/v) sterilized mixture of jungle soil, farm yard manure and sand. Thirty days after germination, plants of uniform growth were inoculated @ 1000 juveniles of *M. incognita*/plant. The experiment was set up in a green house in a completely randomized design with five replications per treatment.

Galls or egg masses were counted after the preliminary study. Roots were carefully washed free of soil and stained in Phloxine B (Holbrok *et al.*, 1983). Following 60 days of nematode inoculation, gall or egg mass indices (GI) were counted using a 1-6 scale (Barker, 1985). Accessions with an egg mass or gall index of 2 in the preliminary study were short-listed for subsequent testing and the same procedure was followed in the second screening. In addition to root

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galling, the final nematode population was also estimated in the second study. For this, the entire root system was cut into small pieces, stained in acid fuchsin-acetic acid solution, macerated in a blender for 45 sec. and the nematode population was estimated (Byrd *et al.*, 1983). The resistance rating of each accession was done according to the scale of Taylor & Sasser (1978), based on nematode reproduction and GI. In this scale, I = immune (plant does not allow penetration of the nematode); HR = highly resistant (little or no reproduction of the nematode inside the roots); R = resistant (limited reproduction of the nematode); MR = moderately resistant (Pf equals or slightly higher than the Pi, galling scarce); S = susceptible (high reproduction of nematodes and heavy galling).

RESULTS AND DISCUSSION

Of the 48 turmeric and 116 ginger accessions tested, nine accessions showed promising results in the preliminary trial of screening. As the galling was not prominent in many accessions, eggmasses were also counted. The results of these accessions gave a true picture on the host status in the second trial of screening (Table 1). Two turmeric accessions (No. 71 and 90) and three ginger accessions (No. 28, 51 and 87) were designated as susceptible as the R > 2. These lines were not given the tolerant' status, as suggested in the modified scheme of Canto-Saenz (Sasser *et al.*, 1984), since their GI did not indicate the exact plant damage due to nematode attack. The above scheme is not ideal for plants like ginger and turmeric in which the galling is not so prominent always.

The rating-system employed in this study allowed grading of resistance which is not possible with other traditional schemes. Thus one highly resistant (No. 59), four resistant (Nφ. 4, 36, 85 and 171) and one moderately resistant (No. 90) accessions identified in ginger and two highly resistant (No. 142 & 198), four resistant (No. 3, 79, 84 & 182) in turmeric accessions. This is the first report of ginger lines exhibiting resistance to root-knot nematodes.

The highly resistant (No. 59) the exotic collection, Rio de Janeiro, is now completely acclimatized to Kerala and two resistant lines (No. 4 & 171) in ginger are collections from Kerala, the main area of cultivation of the crop. In case of turmeric also having the resistant lines, wherever origin is traceable, belongs to their most common area of domesticating i.e. Andhra Pradesh or Tamil Nadu. The study revealed that the regions of maximum variability is the place to look for sources of resistance as there will be always a coevolution of the host and the pathogen.

However, the exact nature of resistance in these accessions will be understood only through detailed studies on the plant-nematode interactions. In order to strictly define the host status of these lines, it is imperative to quantify the plant damage by studying the nematode-induced variation in growth and yield.

Table 1: *Host status of selected ginger and turmeric germplasm accessions against root-knot nematode, M. incognita* (Mean of five replications).

Acc. No.	Variety/Cultivar	Source	GI	SD	R	Host stauts	No. of tests
A. Ginger							
4	Unknown	Bison Valley,.Kerala	2.00	0.71	0.72	Resistant	2
28	Narasapatnam	Andhra Pradesh	2.00	1.00	3.67	Susceptible	2
36	PGS-13	Pottangi, Orissa	1.75	0.50	0.94	Resistant	2
51	PGS-37	Pottangi, Orissa	2.00	1.00	5.89	Susceptible	2
59	Rio-de Janeiro	Brazil	2.00	0.55	0.00	Highly Resistant	2
85	No. 506	N.A.	1.80	0.84	0.71	Resistant	2
87	No. 533	N.A.	1.40	0.55	4.00	Susceptible	2
90	No. 603	N.A.	1.80	0.84	1.87	Moderately Resistant	2
171	Panamaram-5	Panamaram, Kerala	1.20	0.84	0.67	Resistant	2
B. Turmeric							
3	C 11.320	Andhra Pradesh	2.00	1.00	0.36	Resistant	2
71	Unknown	N.A.	2.00	0.82	6.10	Susceptible	2
79	Unknown	N.A.	2.00	0.71	0.03	Resistant	2
84	Kattapana	Kattapana, Kerala	2.00	0.00	0.08	Resistant	3
90	Kong-Pong	N.A.	2.00	0.71	14.50	Susceptible	2
142	Cls No. 4	CPCRI, Kasaragod	2.00	0.00	0.00	Highly Resistant	3
179	Cls No. 15B	CPCRI, Kasaragod	2.00	1.00	1.58	Moderately Resistant	3
182	Cls No. 21	CPCRI, Kasaragod	2.00	1.00	0.18	Resistant	2
198	Erode	Erode, Tamil Nadu	2.00	0.45	0.00	Highly Resistant	2

GI = Gall index, SD = Standard deviation, R = Reproduction factor (R ={Pf/Pi; where Pf is the final population Pi = initial nematode population)

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