REACTION OF ROOT-KNOT NEMATODE-RESISTANT TOMATO CULTIVARS TO MELOIDOGYNE JAVANICA IN INDIA[1]

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Abstract

Tomato cultivars bearing the Mi gene for resistance to root-knot nematodes (Meloidogyne spp.) were field-tested in India for their reaction to Meloidogyne javanica. Cultivars Healani, Kalohi, Anahu, Hawaii 7526, Atkinson, Nematex, Y-207, and Y-240 lacked visible root galling. Two cultivars, VFN-8 and VFN-368, were heavily galled. The results suggest that one or more genes other than the Mi may directly or indirectly affect root-knot nematode resistance in tomato.

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In many areas of the world, root-knot nematodes (Meloidogyne spp.) are a major limiting factor in tomato (Lycopersicon esculentum) production; however, tomato cultivars resistant to several species of Meloidogyne have been developed.

Gilbert and McGuire (3) reported that resistance to M. incognita (Kofoid & White) Chitwood in tomato is dominant and conditioned by a single gene, referred to as the Mi gene. Barham and Winstead (1) later found that the Mi gene was incompletely dominant and also conferred resistance to M. incognita acrita Chitwood, M. arenaria (Neal) Chitwood, and M. javanica (Treub) Chitwood. Harrison (4), however, suggested that resistance could be dependent on a block of genes acting as a unit.

In this study, tomato cultivars bearing the Mi gene were tested in the field for their reaction to an Indian population of M. javanica. This population has caused severe galling on local tomato cultivars (5).

MATERIALS AND METHODS

Test plots were located on the G. B. Pant Agricultural University Farm in a field heavily infested with M. javanica. The field had never been planted to resistant tomatoes, only to local susceptible varieties of tomato, okra and eggplant. Tomato seedlings, grown in sterile sand for 7 weeks, were transplanted into rows 0.5 m apart. Following the method of Ross and Brim (7), we alternated a row of test cultivars with one of the susceptible local variety Pusa Ruby. Test cultivars were VFN-8, VFN-368, Healani, Kalohi, Anahu, Hawaii 7526, Atkinson, Nematex, Y-207, and Y-240. All possessed the Mi gene for resistance to M. javanica. Each treatment was replicated three times in a randomized complete block design. The experiment was surface-irrigated periodically, and soil temperatures at a depth of 15 cm were recorded each evening.

Sixty-five days after planting, five plants were removed from each row. The percentage of roots galled was estimated and tabulated on a 0 - 4 scale: 0 = no galls, 1 = 1-25% galled, 2 = 26-50%, 3 = 51-75%, 4 = 76-100%. Portions of the root system from each plant were stained with cotton blue in lactophenol and examined for the presence of egg-laying females.

RESULTS AND DISCUSSION

Eight tomato cultivars lacked visible root galling, although a few egg-laying females were present in the roots (Table 1). Cultivars VFN-8 and VFN-368, however, were heavily galled and supported high numbers of egg-bearing females, except in areas of the field where nematode populations were relatively low. Root-knot indices of the susceptible check ranged from 2 to 4.

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Table 1. Root gall indices of ten Mi-bearing tomato cultivars exposed to an Indian population of Meloidogyne javanica.

Cultivar	Root gall indices Replicates[a] 1	2	3	Cultivar	Root gall indices Replicates[a] 1	2	3
VFN-8	3	3	0	Hawaii 526	0	0	0
Check[b]	3	3	2	Check	4	4	4
VFN-368	4	0	4	Atkinson	0	0	0
Check	4	2	4	Check	4	4	2
Healani	0	0	0	Nematex	0	0	-[c]
Check	4	4	3	Check	4	2	-[c]
Kalohi	0	0	0	Y-207	0	0	0
Check	4	4	4	Check	4	4	3
Anahu	0	0	0	Y-240	0	0	0
Check	4	2	4	Check	3	3	3

[a]Each figure is the mean of five root systems scored on the basis of a 0-4 scale: 0 = no galls; 1 = 1-25% galled; 2 = 26-50%; 3 = 51-75%; 4 = 76-100%.
[b]Check variety was Pusa Ruby.
[c]Sufficient plants not available.

Table 2. Soil temperatures at a depth of 15 cm, G. B. Pant Agricultural University Farm, Pantnagar, India, March 22 - June 7, 1971.

Week	Temperature (°C) Mean	Range	Week	Temperature (°C) Mean	Range
1	31	29-32	6	37	35-39
2	32	31-33	7	36	34-38
3	34	33-36	8	33	28-38
4	32	24-36	9	34	29-37
5	30	25-32	10	33	27-38

The high degree of susceptibility in two of the tested cultivars indicates that the Mi gene alone does not effectively confer resistance in tomato to all populations of M. javanica. The VFN-8 cultivar also was highly susceptible to a greenhouse population of M. arenaria in the Netherlands[3]. Populations of Meloidogyne spp. capable of breaking resistance in tomato cultivars have been found in several other areas of the world (6, 8, 9), although apparently they evolved only after prolonged exposure to the nematodes.

Dropkin (2) demonstrated that resistance to M. javanica in the Mi-possessing variety Nematex broke down rapidly as temperatures increased above 28°C. In our study, however, Nematex remained gall-free even though soil temperatures at the 15-cm level were consistently above 28°C (Table 2).

These results suggest that one or more genes other than the Mi may directly or indirectly affect root-knot nematode resistance in tomato. They further emphasize the need for careful screening against local populations of root-knot nematodes and under local climatic conditions before purportedly resistant tomato cultivars are recommended for a particular area.

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OBSERVATIONS OF COLLETOTRICHUM GRAMINICOLA ON SWEET CORN IN INDIANA

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A severe epiphytotic of anthracnose was observed on 'Jubilee' sweet corn in Benton County, Indiana in mid-August 1972, which resulted in complete crop failure at three separate locations. More than 50% of the plants had lodged (Fig. 1), and stalks (Fig. 2) as well as ears and leaves were severely infected. The pathogen, Colletotrichum graminicola (Ces.) Wils., penetrated ear husks and was found sporulating on kernels.

Volunteer dent corn growing in one sweet corn field showed extensive leaf and ear infection. Stalks of these plants, however, showed mild infection. Dent corn in an adjacent field showed mild infection in rows bordering the infected sweet corn. Within 2 weeks the incidence of disease had increased to a moderate level of infection in border rows. Progression of the disease to interior rows had occurred, with ear sheaths showing the first evidence of infection. Trace amounts of anthracnose were found early in July on dent corn in Tippecanoe and Laporte counties, but the disease did not progress farther.

About 100 of 700 acres of Jubilee sweet corn planted for canning purposes were lost to anthracnose. This is an unusually heavy infection by C. graminicola on sweet corn. So far as we can determine, this is the first observation of severe infection of either dent corn or sweet corn in Indiana. Preliminary studies indicate that the organism is extremely pathogenic to three dent and four sweet corn hybrids at the seedling stage under greenhouse conditions.

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