

RESEARCH NOTES

Development of a Strain of the Sugarbeet Nematode as a Potential Pest of Tomato

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Tomato has been utilized for many years in the rotation with sugarbeet to control the sugarbeet nematode, *Heterodera schachtii*. Although tomato was assumed to be a nonhost for *H. schachtii*, Raski (5) reported a few females and cysts on roots of two yellow-fruited cultivars, and Golden and Shafer (2) reported white females and cysts on the red-fruited cultivar, Pearson XL. Since resistance-breaking biotypes of *Heterodera rostochiensis* were reported after cropping continuously to resistant potato varieties (1, 3, 4), similar investigations appeared desirable for the sugarbeet nematode. Our studies were undertaken to determine whether a strain or biotype of *H. schachtii* would develop on tomato to such an extent as to cause damage or at least maintain the nematode populations making tomato an unsuitable crop to rotate with sugarbeet.

MATERIALS AND METHODS

Varietal experiments. Initially, 16 commonly planted, multiple-harvest commercial cultivars of tomato (*Lycopersicon esculentum* Mill.) were selected, and seeds of each germinated in steamed sand. Cultivars were 'Fire Ball', 'J. Moran', 'Red Top', 'Penn Heart', 'San Marzano', 'Rutgers', 'Ace', 'Early Pak', 'Garden State', 'Improved Pearson', 'Earliana', 'Marralucie', 'Marglobe', 'Moscow' and 'Grand Pak'. After 14 days, one seedling of each variety was transplanted to each of three 12-cm clay pots of steamed sandy loam soil. Seedlings of sugarbeet and Brussels sprouts were transplanted to other pots of soil.

H. schachtii used were collected originally from a commercial sugarbeet field and maintained on sugarbeet in a greenhouse for about 5 years. Cysts obtained from this source were incubated, the second-stage larvae collected and approximately 300 added to each

pot. After 35 days, plant roots and soil from each pot were washed over a 100-mesh screen to recover any white females and cysts. White females developed on only four tomato cultivars, with an average of about 0.5 cyst/plant. Large numbers of cysts and white females were collected from the sugarbeet and Brussels sprouts plants. All cysts collected from tomato were placed back on 'Rutgers' tomato seedlings for possible increase of *H. schachtii*.

No further experiments were conducted for about 18 months, but during this time, nematodes previously recovered from tomato were maintained continuously on 'Rutgers' tomato. Cysts which developed during this period were removed carefully and various numbers placed on sugarbeet seedlings to see if a rapid increase of this population. After 45 days, cysts produced on sugarbeet plants were collected by washing roots and soil over a 100-mesh screen. Larvae hatched from these cysts were added to six replicated 'Rutgers' tomato seedlings. The number of cysts and white females produced on tomato was determined after 58, 115, 163 and 268 days. All cysts and females recovered were returned immediately to fresh tomato plants. In some cases, these plants were maintained in a greenhouse up to 5 months to determine rate of reproduction.

With the introduction of single-harvest, mechanically harvested tomato cultivars, an experiment was designed to check the susceptibility of three of these cultivars, VF-145, VF-11 and VFN-8, to the tomato "strain" or biotype of *H. schachtii* developed in these experiments. Seeds of these cultivars were germinated in steamed sand, and 12 seedlings of each transplanted to individual 600-ml plastic containers of steamed sand. The containers were placed in constant temperature water baths at 26.5 ± 2 C. Approximately 1000 larvae, obtained from cysts of the tomato strain of *H. schachtii* produced on sugarbeet, were added to each container. Sugarbeet seedlings served as inoculated controls. After 24, 35, 46, 50, 52 and 91 days, two tomato plants were

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washed free of soil and the number of white females and cysts determined.

Pathogenicity. During the various experiments described above, growth of tomato often was retarded for as much as 6 weeks after larvae were added. Later, growth appeared normal and eventually growth of control and infected plants was similar. The following experiment was designed to measure the effect of *H. schachtii* on growth of tomato seedlings.

Thirty-six 'Rutgers' tomato seedlings were transplanted to clay pots of steamed soil. Approximately 1000 larvae of the tomato strain of *H. schachtii* reared on tomato were added to each of 12 of these pots, and 1000 larvae from the original strain reared on sugarbeet were added to 12 other plants; only water was added to the remaining 12 pots. At intervals of 14, 28 and 42 days, plants were measured for height, and, after 42 days, the number of white females and cysts produced on each plant was determined.

In a second experiment, 15 'Improved Pearson' tomato seedlings were transplanted to pots of soil containing approximately 400 cysts of the original sugarbeet strain reared on sugarbeet. After 25 days, roots of five of the plants were washed clean of soil and stained with acid fuchsin in lactophenol, and the numbers of nematodes of all stages of development noted. After 54 days, the remaining 10 plants were removed and the number of white females determined.

RESULTS AND DISCUSSION

Continuous cropping to tomato resulted in the development on tomato of a strain of the sugarbeet nematode. In preliminary experiments with 16 cultivars of commercial tomato, cysts were produced on only four plants averaging less than one cyst/plant. Cysts from these four plants were cropped to tomato continuously for 18 months, and the larvae of offspring placed on 'Rutgers' tomato plants. After 263 days, an average of 1050 ± 460 cysts

developed. After 24-91 days on each of the single-harvest varieties, VF-145, VF-11 and VFN-8, an average of 5 ± 3 , 2 ± 1 and 9 ± 5 cysts developed, respectively, after exposure to 1000 larvae from cysts of the tomato strain produced on sugarbeet. An average of 22,500 cysts of the tomato strain developed on sugarbeet. These three varieties of tomato also have resistance to *Verticillium* sp. and *Fusarium* sp. One, VFN-8, also is resistant to *Meloidogyne incognita* and *M. javanica*.

In pathogenicity experiments, stained tomato roots from plants grown for 25 days in soil infested with the original sugarbeet strain showed penetration by an average of 14 larvae/root system. Completion of the life cycle appeared low since white females were found in only three of the 15 plants after 54 days. Tomato seedlings were 1.7-3.0 cm shorter during the growth period when inoculated with larvae of the tomato strain of *H. schachtii* than when inoculated with the sugarbeet strain or when uninoculated. This indicates the potential economic importance of this strain. It would appear that the use of tomato in rotation with sugarbeet should receive new attention.

LITERATURE CITED

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