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College of Agricultural, Consumer and Environmental Sciences

report on
PLANT DISEASE

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BRITTLE ROOT OF HORSERADISH

Brittle root, caused by the pathogen *Spiroplasma citri*, is considered to be the most serious disease of horseradish. Incidence of infected plants in the fields is usually limited to small patches (Figure 1). At unpredictable intervals, however, brittle root has occurred in epidemic proportions. Outbreaks in Illinois, the largest horseradish-producing state in the United State, were reported in 1936,1953, 1954, 1975, and 1979. Losses during these epidemics ranged from 25 to 80% of the entire crop, with serious reductions in the amount of planting stock available for the following season.

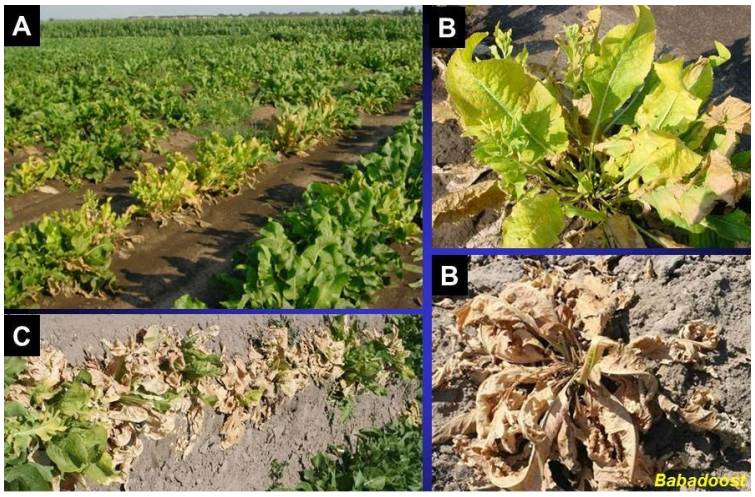

Figure 1. Brittle root of horseradish, caused by Spiroplasma citri. A and B, newly infected yellowing plants; C and D, dead plants caused by brittle root.

S. citri belongs to a specialized group of bacteria called Spiroplasmas, and restricted to the phloem, the tissue that transports the sugars made in the leaves to the rest of the plant. This pathogen is vectored by the beet leafhopper (*Circulifer tenellus*) (Figure 4). The beet leafhopper does not overwinter in Illinois, but in some seasons substantial number of these insect reaches the state. Disease outbreaks are most sever when migrations of the insets occur early in the season (May or June). *S. citri* infects numerous plant species in several families, but citrus and brassica species are most affected.

Figure 2. Sections of healthy root (left) and brittle root (right) of horseradish.

Symptoms

Foliar symptoms of brittle root of horseradish include yellowing of leaves, stunting of young leaves (Figure 1), and occasional leaf asymmetry with yellowing on the smaller side of the leaf. Leaf edges may curl and develop necrotic areas. Infected plants are stunted.

For further information contact ***Mohammad Babadoost****, Extension Specialist in Fruit and Vegetable Pathology, Department of Crop Sciences, University of Illinois at Urbana-Champaign. (Phone:* ***217-333-1523****; email:* ***babadoos@illinois.edu****).*

Root symptoms are more diagnostic than are foliar symptoms. In the early stages, there is s distinct discoloration, which may appear in cross section as a yellowish tan ring, just outside the root cambium in the phloem region (Figures 2 and 3). As the disease progresses, the ring turns dark brown or black. This ring is distinct from the xylem discoloration of roots infected with *Verticillium* and/or *Fusarium* species. Infected roots lose their flexibility and become so brittle that they snap easily when bent, hence the name "brittle root". Horseradish plants infected early to midseason with *S. citri* usually die few weeks after symptoms appear. Those infected late in the season may survive until harvest without developing diagnostic symptoms. Sets (propagative root stocks) from infected plants that are used the following season usually develop brittle root symptoms and die soon after foliar emergence.

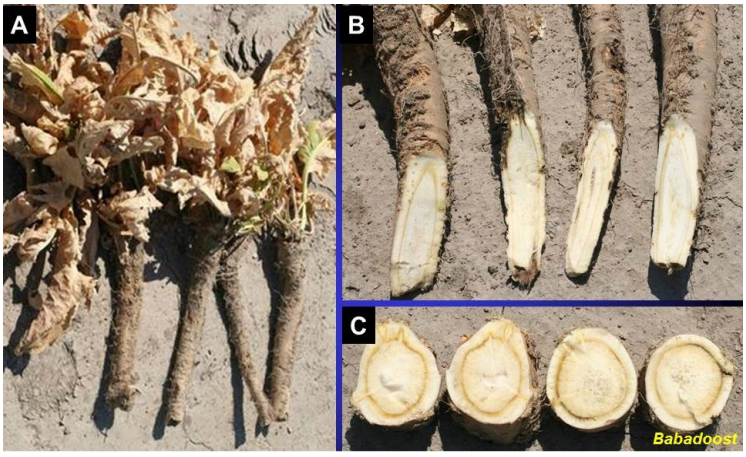

Figure 3. Brittle root of horseradish, caused by Spiroplasma citri. A, infected, dead plants; B and C, sections of infected roots.

Disease Cycle

Spiroplasma citri multiplies in the phloem and passes into other plant organs. The pathogen is spread from plant to plant primarily by leafhopper vectors. Beet leafhopper (*Circulifer tenulus*) is considered the primary vector of *S. citri*. It also can be transmitted by parasitic plants, such as dodder (*Cuscuta* spp.), but it is not transmissible through the application of infected sap (mechanical transmission) or through seeds.

The beet leafhopper is thought to play the major role in the initiation and spread of brittle root. This leafhopper readily transmits horseradish isolates of *S. citri* to and from horseradish an other susceptible plants. Little is know about the epidemiology of brittle root of horseradish. Most brittle root epidemics in Illinois have been associate with drought, but the disease develops in a small number of plants in Illinois each year, regardless of seasonal rainfall.

Figure 4. Beet leafhopper (Circulifer tenellus), the vector of the causal organism of brittle root of horseradish.

Disease Management

No horseradish cultivars resistant or tolerant to *S. citri* have been identified. Brittle root of horseradish can be managed by controlling the leafhopper vector. The application of an insecticide is advised when sweep net samples reveal the presence of beet leafhopper, especially if they appear before late July or August in Illinois. Insecticide application, however, may not act quickly enough to prevent the initial

wave of inoculations by infective adult leafhoppers entering a field. Nymph that subsequently acquire the spiroplasma by feeding on infected plants that developed within the field, however, cannot transmit the spiroplasma until completion of a latent period of several days to weeks. Consequently, insecticide spray may help to limit the secondary spread of *S. citri* from brittle root-infected to healthy plants. Horseradish growers should examine their fields in the spring and early summer for beet leafhoppers and diseased plants. Yellow sticky traps may be used for cumulative sampling of the leafhopper in the fields. Since beet leafhoppers thrive best in hot, dry, exposed field areas with little shade and low humidity, irrigation of fields may reduce drought stress on plants and make the field less hospitable for beet leafhopper reproduction and development. After a brittle root outbreak, growers should use extra care in selecting root cuttings for planting the following year to minimize carryover of brittle root-infected plants.