

Rhizoctonia Crown and Root Rot of Table beet

Pathogen

Rhizoctonia crown and root rot is caused by the fungus, *Rhizoctonia solani*. This fungus is split into 13 different sub-species called 'Anastomosis Groups (AG 1-13) based on host preferences. AG 2-2 IIIB and IV, AG 3, AG 4 and AG5 can infect table beets, among which AG 2-2 IIB and IV, and AG 4 are predominant groups in table beet growing areas in New York.

Host

The host range of *R. solani* is broad and can vary between different AGs. The *R. solani* AGs infecting table beets can also infect sugar beet, soybeans, common beans, turf grass, potatoes, corn, and other vegetables.

Significance

Rhizoctonia crown and root rot can reduce the appeal of produce for fresh market sale. Seedling death (damping off) can significantly reduce the plant population in the field leading to considerable yield loss. Severe disease in mature beets can also significantly reduce the yield and make roots unsuitable for processing. Rhizoctonia root rot can also reduce the storage life of the crop by causing post-harvest decay.

Symptoms

The pathogen can cause both pre- and post-emergence damping off. Post-emergence damping off begins with water soaking of the hypocotyl on the infected seedlings followed by dark brown to black sunken lesions. Lesions can expand to develop a constricted wire-like area on the stem, which becomes brittle and breaks off (Fig. 1).

Infection of mature roots begins with a small brown scarring on the outer surface which eventually develops into active brown to black lesions (Fig. 2 A) that extends inside and outside the root (Fig. 2 C). Cankers and cracks with gray fungal mycelia may also be observed (Fig. 2B). Affected roots may also be colonized by secondary bacteria and fungi.

Crown rot starts at the base of the petiole of the older leaves either through direct infection of the petiole in contact with the soil or upward movement of the pathogen from the infected roots. The infected area in the petiole becomes necrotic and leads to stunted foliage and wilting (Fig. 3). Foliar symptoms are more noticeable during the day in low moisture conditions. Severe disease leads to browning of the foliage and leaf death that give the plant a spider-like or rosette appearance (Fig. 4).



Figure 1. Damping off in sugar beet seedlings with wire stem symptom (right plant) caused by *Rhizoctonia solani*.

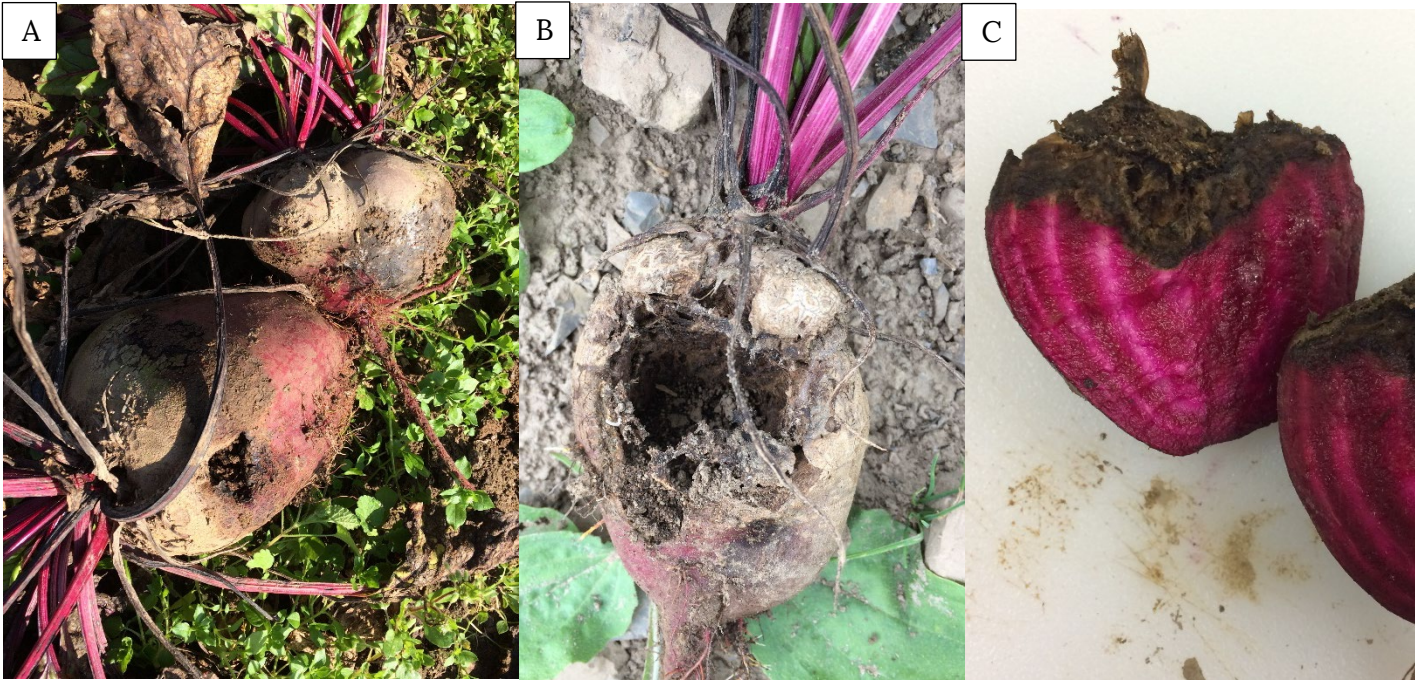


Figure 2. *Rhizoctonia* root rot in table beet. (A) Black lesions on the beet surface. (B) Interior cavity after affected tissue rots away. (C) Crown rot extending down into the root tissue. (Photo: courtesy of Eric Branch)



Figure 3. *Rhizoctonia* crown rot in table beets showing blackened areas of the petioles at the soil line. (Photo: courtesy of Eric Branch)



Figure 4. Rosette/Spider appearance of wilted sugar beet foliage due to severe infection by *Rhizoctonia solani*.

Disease Cycle

R. solani can survive in plant debris as saprophytic (living on dead or decayed organic matter) mycelia, or sclerotia. Sclerotia are the dark, hardened masses of fungal mycelia that can survive in the soil for more than 3 years. *R. solani* can infect the table beet plants across a broad range of temperatures (12–35 °C or 53.6–95 °F) and soil moisture (>25%) conditions, but warm temperatures (20–30 °C or 68–86 °F) and high soil moisture (>75%) are highly conducive for disease development. In late spring or early summer, when the soil begins to warm, the sclerotia germinate to develop hyphae which are guided to the plant by chemicals released from the roots (Fig. 5). Once attached to the host surface, *R. solani* can enter the host via wound, natural openings like stomata, or direct penetration of the host epidermis. Infection is followed by symptoms in the seed, seedling, crown and roots. *R. solani* does not produce asexual spores, therefore the disease has only one infection cycle within a season. Production of sexual spores that would be responsible for long-distance dispersal, are rare. This disease is therefore disseminated to new locations by infested soil and crop debris, irrigation water, soil erosion, and farm equipment.

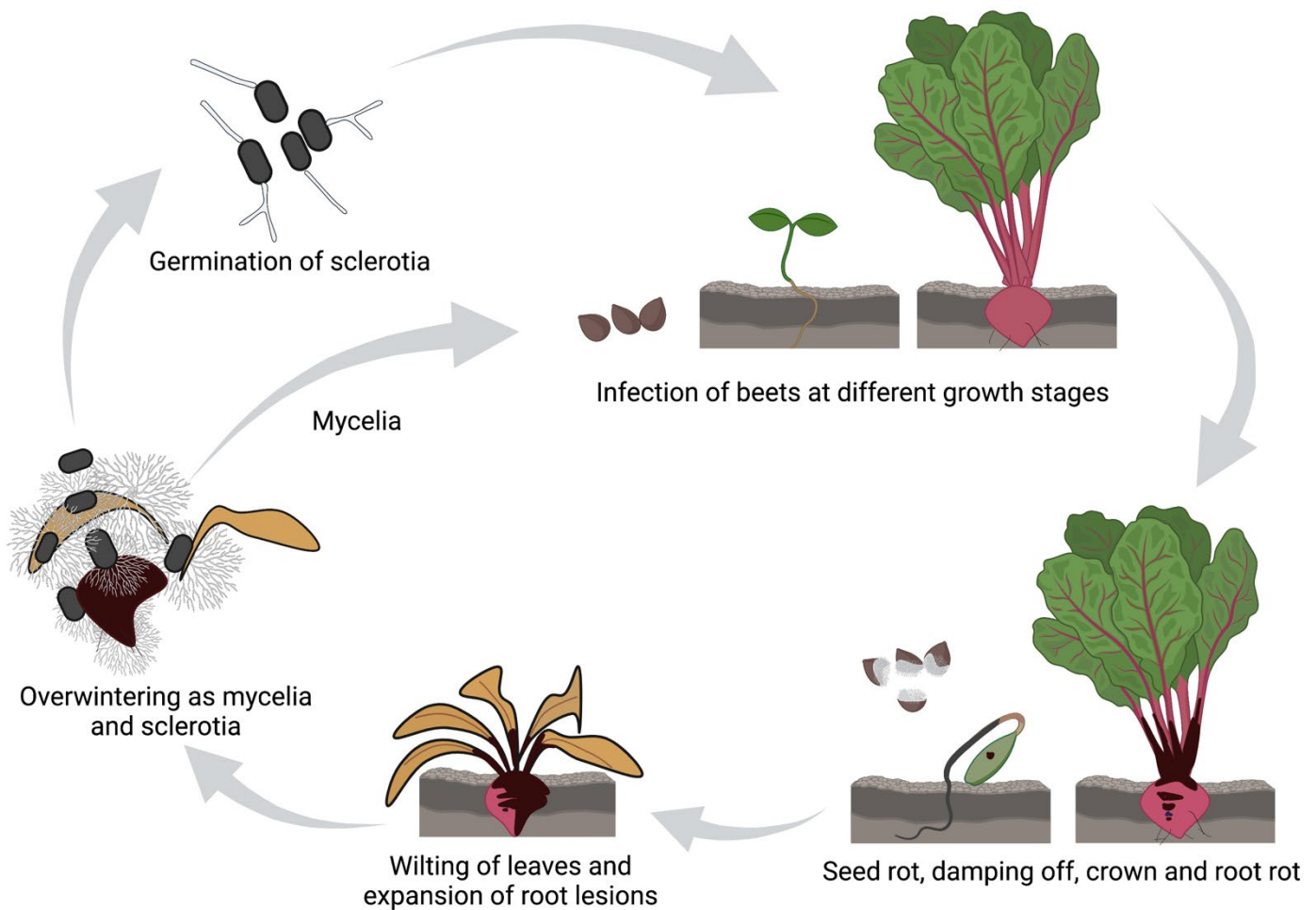


Figure 5. Disease cycle of *Rhizoctonia* crown and root rot of table beet (created with [BioRender.com](https://www.biorender.com)).

Management

Management of *Rhizoctonia* crown and root rot involves multiple tools to limit the survival of overwintering sclerotia and reduce mycelial growth and infection of seedlings and roots to minimize the carry-over of inoculum in soil between susceptible crops.

Cultural practices

- Crop rotation: Planting beets directly after snap beans or soybeans should be avoided. Corn, other legumes, and vegetable crops can also be alternative hosts. A 3-year rotation is the minimum and longer rotations are preferred, especially in consideration of the broad host range of *R. solani*.
- Deep tillage: Infested crop residues and sclerotia may be buried below the root zone to enhance degradation and hence reduce the carry-over of inoculum between seasons.
- Early and shallow planting: Early planting may avoid damping off due to warm and humid conditions that favor infection and disease.
- Drainage and soil structure: Poor soil aeration and drainage conditions promote fungal growth and may exacerbate infection and disease development.
- Soil movement: *Rhizoctonia* crown rot can be caused by infested soil thrown onto plants during hilling. Hill at a suitable speed to avoid soil being thrown into the crowns. Infested soil can be carried by equipment between fields. Consider cleaning equipment between fields.

Cultivar selection

- Certain table beet cultivars may provide a level of resistance to infection by *R. solani*, particularly in mature plants. Please refer to resistance information provided by seed companies.

Chemical controls

- Conventional Fungicides: In-furrow fungicide applications, such as azoxystrobin (Fungicide Resistant Action Committee (FRAC) 11), can provide acceptable early to mid-season protection. An additional post-emergent banded application may be made at the 4- to 8-leaf stage, but early applications have been shown to be most crucial for disease control. Resistance to azoxystrobin within NY populations of *R. solani* has not been detected.
- Organic Options: Alternatives to conventional fungicides for control of *R. solani* exist, but efficacy can vary. Again, early applications that can protect seedlings is best. Ongoing trials at Cornell AgriTech are currently seeking to identify the most effective organic products and application timings and doses.

Further information:

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