

Root Rot

Aggressiveness of Pathogen

	<i>Pythium</i> spp.	<i>Fusarium</i> spp.	<i>Rhizoctonia solani</i>
<p>Analogy of how these pathogens infect a canola root (compared to a thief breaking into a home)</p>	<p>Disease Analogy: <i>Pythium ultimum</i> unlocks and opens the door; only messes up the front room (mud room/entrance room)</p>	<p>Disease Analogy: <i>Fusarium</i> species (such as <i>F. culmorum</i>, <i>avenaceum</i> or <i>graminearum</i>) break through doors and windows; may destroy furniture</p>	<p>Disease Analogy: <i>Rhizoctonia solani</i> knocks the whole wall down; smashes all furniture and interior walls, collapsing the house</p>
<p>Disease Pathway</p>	<ul style="list-style-type: none"> Oospores germinate into zoospores, which swim, and infect quickly, start killing cells immediately and reproduce quickly 	<ul style="list-style-type: none"> Chlamydozoospores germinate into hyphae, but infection does not start immediately; buildup of infection tries to penetrate cell walls and tissues 	<ul style="list-style-type: none"> Mycelium grows, then infection penetrates and grows through cell walls and sends out cell wall degrading enzymes, cell macerations occurs within two days of infection
<p>Infection Sites</p>	<ul style="list-style-type: none"> Does not infect hypocotyl or above ground tissues. Only attacks seeds, damaged tissues and root tissues lacking suberin, such as root caps 	<ul style="list-style-type: none"> Infect root and hypocotyls; plants susceptible at all stages, but seedlings most susceptible; some species cause cellular damage to plant tissue in later infection processes 	<ul style="list-style-type: none"> Hyphae grow along plant tissue and adhere and macerate infected cells almost immediately; infect roots and hypocotyls at any stage, but more severely in seedlings
<p>Symptoms</p>	<ul style="list-style-type: none"> Seed rot, root pruning, damping off seedlings 	<ul style="list-style-type: none"> Cannot visually differentiate between <i>Pythium</i> and <i>Fusarium</i> spp. in field, as they have many similar symptoms; except, unlike <i>Pythium</i>, seed rot is not a symptom of <i>Fusarium</i> spp. 	<ul style="list-style-type: none"> Brown hypocotyl, pinched off and collapse at ground level Plant cells macerated by fungus may collapse over relatively large areas of tissue. Infection on the hypocotyl of a developing canola seedling, then wirestem disease may develop—collapsed and brown root tissue
<p>Preferred Conditions</p>	<ul style="list-style-type: none"> Likes saturated soil, cool and wet, most active when temperature is 5-15°C, if soil moisture drops below 75% water holding capacity infection potential drops significantly 	<ul style="list-style-type: none"> Favourable environmental conditions vary by species, but generally prefer warmer and dryer soils 	<ul style="list-style-type: none"> Does not like saturated soil but likes moisture; loose, cold, dry and well-worked (especially heavy soils and compacted) soils Overwinter as thick-walled, melanized mycelium
<p>Overwintering</p>	<ul style="list-style-type: none"> Overwinter as oospore, oospores can live for years in soil 	<ul style="list-style-type: none"> Overwinter as "thick-walled" before chlamydozoospores and/or mycelia 	<ul style="list-style-type: none"> Some can grow at soil temperatures as low as 2°C, but the preference is for (and damage tends to be more severe at) warmer temperatures (20°C or higher) and when soils are moist

Brown Girdling Root Rot

Brown girdling root rot is likely the combination of all three pathogens working together (but *Rhizoctonia solani* may be the predominant cause)



Varying degrees of root rot symptoms and severity from (left) healthy to (right) severe root rot.

Photo credit: Henry Klein-Gebbinck



Canola seedling with brown girdling root rot

Photo credit: Derwyn Hammond