

# Managing *Cylindrocarpon* on Ginseng

Dr. Mary K. Hausbeck, Distinguished Professor and Extension Specialist  
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*Cylindrocarpon destructans*, a soilborne fungus, causes disappearing root rot and, along with the fungi *Fusarium* spp. and *Rhizoctonia solani*, causes russetting of the root. It can also be part of the complex of fungi that cause damping-off of seedlings in one-year-old ginseng gardens, which can lead to a significant reduction in plant stands. *Cylindrocarpon* occurs in a wide range of soil types and is commonly found in soils of coniferous woodlands. This pathogen plays a significant role in declining gardens and replant problems. The disease affects all underground plant parts, causing near total destruction. Infections begin as small, gold to brown areas on the root surface which enlarge rapidly and deepen into a reddish-brown, spongy rot. The root exterior becomes

dark brown at infection sites. Lateral rootlets may be affected, producing a distorted taproot (stubbing), and the infection can advance into the crown and stem. Only fragments of the root tissues remain in advanced stages of the disease. Recent research suggests that the degree of rot from *Cylindrocarpon* infection is a factor of root age; older roots have more superficial rust-colored lesions while younger roots rot completely. This pathogen can be seed-disseminated.

Diseased plants may fail to emerge in the spring. Foliar symptoms include wilting that is often one-sided. Foliage can turn red to brown after repeated wilting, with aerial portions of the plant often dying. The disease appears in ginseng gardens as expanding circular patches of wilting or dead plants. Conidia (spores) form on the surface of rotted roots and can be spread on clothing or machinery or in infested soil. Dense plant populations may allow the pathogen to spread through direct contact of roots. *Cylindrocarpon* can survive in the absence of a susceptible host as thick-walled chlamyospores in soil or on infested plant residue, limiting the usefulness of crop rotation. *Cylindrocarpon* has a wide host range that includes many woody species prevalent in Midwest ginseng-growing areas.



Disappearing root rot on ginseng roots (top) and closeup of lesions (bottom).



Disappearing root rot in a ginseng bed. Note missing plants and red foliage of infected plants.

Cultural strategies recommended for Cylindrocarpon disappearing root rot management are summarized in the box below.

Cultural Management Strategies
<ul style="list-style-type: none"> <li>• Choose sites with good soil drainage.</li> <li>• Use treated seed produced in healthy gardens.</li> <li>• Work in diseased gardens at the end of the day.</li> <li>• Clean equipment used in a diseased garden with a power washer to remove soil and plant debris, then use a detergent.</li> <li>• Use disposable, plastic boots over footwear before entering a garden with <i>Cylindrocarpon</i>.</li> <li>• Clean hand tools with a disinfectant such as bleach (10% solution) and rinse.</li> </ul>

Fungicides, such as Fontelis, Captan, and Cannonball although somewhat effective against Cylindrocarpon, will not completely limit the spread of the pathogen. It is recommended to apply these fungicides in a preventive manner if you have struggled with Cylindrocarpon in the recent past.

See table below for list of especially effective products.

Product	A.I.	FRAC Group
<b>Rusty Root 'A' Team</b>		
Captan 80WDG	captan	M04
Cannonball WG	fludioxonil	12
Quadris 2.08SC	azoxystrobin	11
Topsin M WSB	thiophanate-methyl	1
Kenja 400SC	isofetamid	7
Fontelis SC	penthiopyrad	7
Miravis Prime	pydiflumetofen + fludioxonil	7/12
Luna Sensation	fluopyram + trifloxystrobin	7/11

Remember that the pesticide label is the legal document on pesticide use. Read the label and follow all instructions closely. The use of a pesticide in a manner not consistent with the label can lead to the injury of crops, humans, animals, and the environment, and can also lead to civil or criminal fines and/or condemnation of the crop. Pesticides are good management tools for the control of pests on crops, but only when they are used in a safe, effective and prudent manner according to the label.

Visit the IR-4 Project website (<http://www.ir4.rutgers.edu>) for updates on the registration of new products.