College of Agriculture, Food and Environment
Cooperative Extension Service

Plant Pathology Fact Sheet **PPFS-GEN-01**

Crown Gall

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Importance

Crown gall (Figure 1) can affect a wide range of crops, including woody ornamentals, tree fruits, and small fruits (Table 1). A few vegetable crops and herbaceous ornamentals are also susceptible, but these crops are only occasionally affected. Crown gall can cause losses in landscapes, nurseries, orchards, and vineyards.

Symptoms

Gall Formation

Crown gall is most readily identified by the lumpy, rough tumors that form on roots, lower stems, and lower branches (Figure 2). Systemic infections (in which the bacteria become distributed throughout plants) occasionally result in gall formation on upper branches of highly susceptible hosts (Figure 3). New galls first appear as white, fleshy callus growths (Figure 1), which later turn brown and become dry and corky (Figure 4). Galls vary in size from 1/2 inch to several inches in diameter.

On many hosts, tumors begin as spherical structures (Figure 2). Secondary galls can be more irregular in shape. In the case of grape, a series of very small galls may form underneath bark tissue (Figure 5). Galls may not initially be evident (Figure 6) until bark splits and peels as a result of gall enlargement and expansion.

Figure 1. Crown gall tumors, such as this one on euonymus, are initially white and fleshy in appearance.

Figure 2. Galls are rough and lumpy, most often forming on roots and lower stems. This gall has formed in the crown of a blackberry plant.

Figure 3. Crown gall may appear in upper branches of susceptible hosts when the pathogen becomes systemic, as in the case of this peach tree.

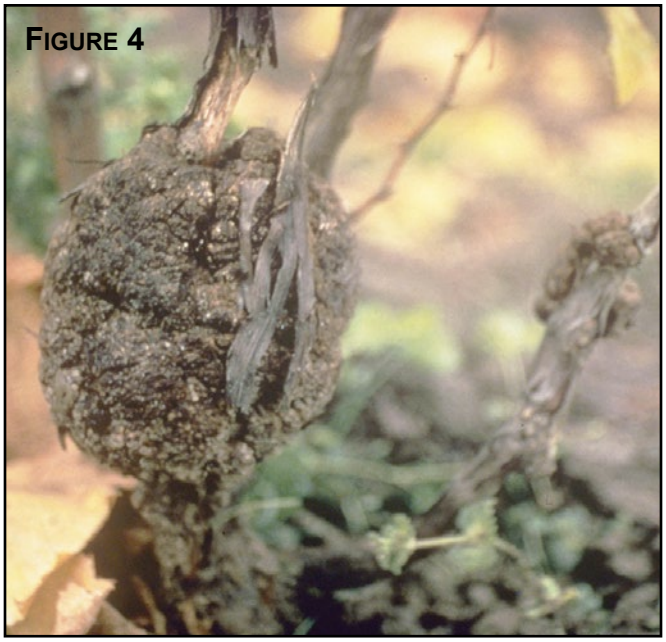

Figure 4. Galls turn brown and become dry and corky as they age. This gall formed on a grape vine.

Above-ground Symptoms

Gall formation, which girdles infected tissues, results in above-ground symptoms that can include stunting, yellowing, poor growth, and gradual dieback. In addition, infected plants become more sensitive to environmental stresses, especially winter injury. Severely infected plants may eventually die.

Cause & Disease Development

Crown gall is caused by several species of soil-borne bacteria in the genus *Rhizobium* (formerly *Agrobacterium*), such as *Rhizobium tumefaciens, R. vitis,* and *R. rubi*. These bacteria survive in soils where plants were previously infected, as well as roots of crops and weeds..

These pathogens can only infect susceptible plants through fresh wounds, such as those made during transplanting, cultivating, grafting, and pruning, as well as injuries resulting from insect or animal pest damage. Adverse environmental conditions, such as frost damage or intermittent freezing and thawing, which are common to Kentucky winter and spring seasons, can also create entry points for the bacteria. Bacteria may be spread to wound sites by splashing rain, via running water, or on tools. Contaminated nursery stock can introduce the pathogens into new locations.

Figure 5. A series of small galls may form on grape trunks and vines underneath the bark (A); close-up (B).

Figure 6. Before bark on grape vines splits and reveals the galls underneath, small/under-developed tumors may be difficult to see.

Disease Management

Site and Plant Selection

- Purchase only certified disease-free plants when possible.
- Avoid planting susceptible crops or cultivars on sites with a history of crown gall.
- Discard and destroy any planting material with visible galls or an unhealthy appearance.
- In landscapes, select woody ornamentals that are tolerant or less susceptible to crown gall (Table 2).

Table 1. Some plant genera commonly affected by crown gall in Kentucky

Ornamentals		Fruit	
Common Name	**Scientific Name**	**Common Name**	**Scientific Name**
Crabapple	*Malus*	Apple	*Malus*
Euonymus	*Euonymus*	Blueberry	*Vaccinium*
Forsythia	*Forsythia*	Brambles	*Rubus*
Lobelia	*Lobelia*	Cherry, Peach	*Prunus*
Poplar	*Populus*	Grape	*Vitis*
Rose	*Rosa*		
Russian olive	*Elaeagnus*		
Walnut	*Juglans*		
Willow	*Salix*		

Protect Against Wounding

- Minimize root and trunk injuries during planting.
- Adopt management practices that minimize wounding.
- Plant on northeast-facing sites to reduce incidences of freeze-thaw cycles.

Sanitation

- When crown gall is limited to branches, prune several inches below galls and destroy prunings. Disinfest tools between each cut in order to prevent transmission of bacteria from one cut to the next. Solutions of bleach (1 part bleach to 9 parts water) or commercial disinfectant are effective.
- Plant removal and destruction may be necessary when crown gall infections are extensive, especially on lower stems and roots.

Bactericide Options

Chemical treatments may only be practical for commercial growers or for homeowners with valuable plants.

- Various biological control protectants and eradicants are available for management of crown gall on a limited number of crops. Plant roots are dipped into the protectants prior to planting, while eradicants are "painted" on existing galls. Efficacy is limited and inconsistent.
- Contact a local county Extension office for current recommendations.

Additional Options for Vineyards

- Purchase certified disease-free plants. If possible, obtain Protocol 2010 material from the Foundation Plant Services (University of California-Davis) grape program.
- Plant tolerant or less susceptible grape cultivars. Refer to the table in *Commercial Fruit Pest Management Guide* (ID-232) that lists susceptibility ratings for various grape cultivars.
- Avoid cold-sensitive cultivars or planting into areas that are prone to freeze-thaw cycles. In some areas, growers bury or mulch young vines in autumn to reduce freeze injury.
- Mound soil around lower trunks in autumn to protect graft unions and young grapevines from winter injury. This also ensures the development of new scion shoots that may be needed for trunk renewal.
- Adopt the double or multiple trunk training system as a means for minimizing losses due to crown gall. If one trunk becomes girdled, it can be removed. The remaining trunk can be developed while the second trunk is renewed.
- Chemical and biological control options available for other crops are ineffective and/or inconsistent for management of crown gall on grape.

Table 2. Woody ornamentals reportedly tolerant or less susceptible to crown gall.

Common Name	Scientific Name
Boxwood	*Buxus*
Redbud	*Cercis*
Bald cypress	*Taxodium*
Barberry	*Berberis*
Beech	*Fagus*
Birch	*Betula*
Blackgum	*Nyssa*
Catalpa	*Catalpa*
Cedar	*Cedrus*
Elderberry	*Sambucus*
Ginkgo	*Ginkgo*
Golden raintree	*Koelreuteria*
Hemlock	*Tsuga*
Holly	*Ilex*
Hornbeam	*Carpinus*
Japanese cedar	*Cryptomeria*
Japanese pieris	*Pieris*
Japanese zelkova	*Zelkova*
Kentucky coffeetree	*Gymnocladus*
Larch	*Larix*
Linden, basswood	*Tilia*
Magnolia	*Magnolia*
Mahonia, grape holly	*Mahonia*
Mountain laurel	*Kalmia*
Pine	*Pinus*
Plum yew	*Cephalotaxus*
Pyracantha, firethorn	*Pyracantha*
Spruce	*Picea*
Sweetgum	*Liquidambar*
Tamarisk	*Tamarix*
Tulip poplar	*Liriodendron*

Additional Resources

- Commercial Fruit Pest Management Guide (ID-232) http://plantpathology.ca.uky.edu/files/id-232.pdf
- Disease and Insect Control Program for Homegrown Fruit in Kentucky including Organic Alternatives (ID-21) http://www.ca.uky.edu/agc/pubs/id/id21/id21.pdf
- Woody Plant Disease Management Guide for Nurseries and Landscapes (ID-88) http://www2.ca.uky.edu/agcomm/pubs/id/id88/id88.pdf
- Foundation Plant Sevices-Grapes: Grapevine Disease Testing Protocol 2010 http://fps.ucdavis.edu/fgr2010.cfm

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