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# Crown gall disease of nursery stock

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Crown gall is a bacterial disease that affects many species in more than 40 plant families. It occurs commonly on young nursery stock including willow, poplar and other shade trees, nut-bearing trees, pome fruits and stone fruits.

Several ornamental shrubs and vines are affected, particularly euonymus, honeysuckle, rose and wisteria. Certain perennial flowers such as asters, daisies and chrysanthemums may be damaged, as well as certain vegetables, with tomato a notable example. The brambles, like blackberry and raspberry, and grapes are also host species for this disease.

Losses from crown gall are often serious in ornamentals. In nurseries entire plantings may have to be destroyed.

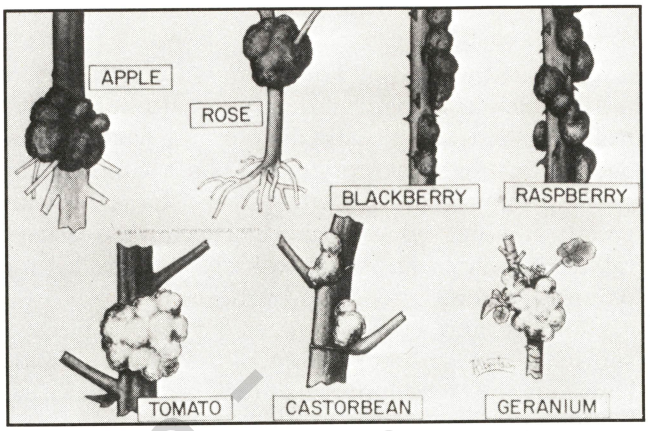
## Cause

Crown gall, caused by the bacterium *Agrobacterium tumefaciens,* is closely related to the bacteria that produce root nodules on legume plants. Another related bacterium causing hairy root in ornamentals and fruit is *Agrobacterium rhizogenes*. Some native soils may contain crown gall organisms. In most cases, they are obtained on infected plants.

## Symptoms

Galls occur at the soil line but also on the roots or above ground, especially at graft unions. Stem and twig galls occur occasionally on willow, poplar, euonymus and wisteria. They are usually rounded, with irregular rough surfaces ranging up to several inches in diameter. Internally, the galls show irregular structure, with tissue elements disarranged, at first firm and white, but later showing secondary decay.

Some gall-like growths may be mistaken for crown gall. Non-parasitic hard galls resembling crown gall are commonly knots of graft callus or wound overgrowth. Other related diseases include hairy root in which a large number of fine, weak roots replace the normal root system. Certain insects also stimulate gall formations.




Crown gall affects many species of commonly grown plants.

## Crown Gall Infection

Apparently the bacteria enter the plant tissues only through wounds usually caused by chewing insects or cultivation. In nurseries and home gardens, the hoe or other tillage equipment may be responsible. They may also be passed from diseased to healthy plants by contaminated grafting or pruning tools.

Once inside the root or crown tissue, the bacteria occur between the cells and stimulate the surrounding cells to divide rapidly, causing over-development. As the galls increase in size, some of the larger cells apparently are crushed by the pressure, and the bacteria move into other tissues.

Chewing insects may carry crown gall bacteria from one plant to another. Long distance movement is through nursery stock, with the bacteria carried either on the surface or within the tissue. Any practices that encourage insects or produce many injuries on the roots or crowns encourage infection.

Symptoms may not develop for several weeks after infection, depending on temperature, humidity and the growth of the host plant. The disease may not be apparent during nursery inspection. The period of greatest activity is during warm months of the year. In most cases, bacteria appear to survive more than two years in soil in the absence of susceptible plants. However, they may live for several years in decomposing galls buried in the soil. Crown gall is likely to be more serious on limed land than on more acid soil.

## Control

The zero tolerance on crown gall set by the state regulatory services for inter- and intra-state shipments necessitates control of the disease.

For nursery men, control of crown gall is a matter of using sanitary practices in propagating trees and shrubs. Select planting stock or propagation wood for freedom from crown gall.

Use extreme care in grafting to avoid transmission from diseased to healthy plants. Grafts should be well-fitted and carefully wrapped to protect them from injury until the union of stock and cion heals perfectly, with no wound where infection might occur.

Sterilize the grafting knife frequently with a disinfectant such as 70 percent denatured alcohol. Do not treat finished grafts with disinfectant chemicals as decay of the graft wrapping may be prevented and girdling may result. Crown gall and hairy root are greatly reduced when a budding technique is used rather than grafting. Avoid making deep mechanical wounds in young trees and bushes.

Remove and burn all infected plants. The Missouri State Department of Agriculture, Plant Industry Division, states, "All nursery stock bearing galls will be quarantined and must be destroyed."

Crops rotation is a satisfactory control measure, but increasing land costs and the unavailability of suitable land are increasing the need for alternative practices. Do not plant susceptible stock in infested soil until a non-susceptible crop has grown on it for at least two years. If nursery soil is infested, growing cowpeas, oats, corn, crotalaria or a grass crop prior to susceptible crops will reduce crown gall.

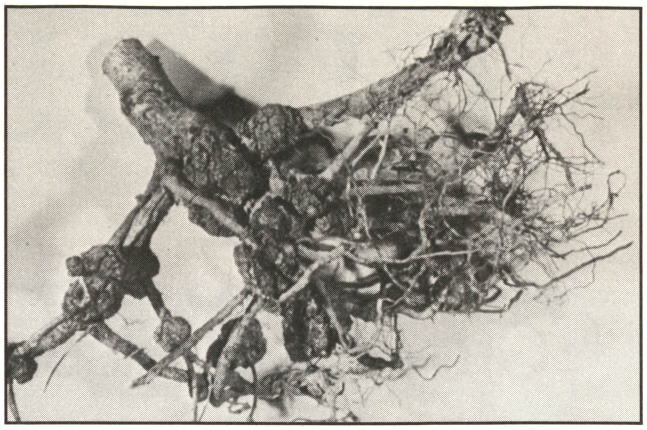
Soils known to have had crown gall can be disinfested by the application of heat or chemicals. Heat soils to 180°F. for 30 minutes, or treat with a soil fumigant (e.g. methyl bromide, ethylene dibromide, or other fumigants) following manufacturers' recommendations.

Chemical control of crown gall by dipping understocks in disinfectant solutions has reduced infections.

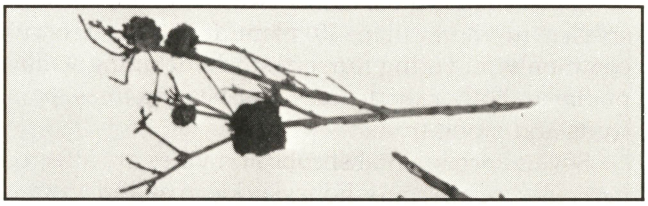
Formerly, solutions of mercuric chloride or Semesan Bel were used as effective disinfectants for dipping understocks. **The Environmental Protection Agency prohibits the use of most mercury-containing materials; hence, alternative methods will be necessary.**

Application of antibiotics and growth inhibitors to crown gall infections has met with some success. Terramycin (800 parts per million) used as a dip gave excellent protection of mazzard *(Prunis avium)* rootstocks in spring plantings.

A biological control method has recently been introduced. A bacterial species, *Agrobacterium radiobacter,* (strain 84) was discovered to be antagonistic to the crown gall bacterium, *Agrobacterium tumefaciens,* by research scientists at the University of California. It has since been made available for use as a preplant prevention treatment against crown gall infections on fruits, nuts, vines, and ornamentals that are susceptible to crown gall. Nursery stock should be dipped in a suspension of live bacteria in water (17 mm live cells per plate in 1 gallon of water). Successes with this control technique have been encouraging. It is commercially available under the trade name, Galltrol-A, from AgBioChem, Inc., distributed in nurseries in the Midwest by FMC Agricultural Group. Write AgBioChem, 3 Fleetwood Court, Orinda, Calif., for more information.



Crown gall bacteria cause infectious overgrowths in roots or graft unions near the soil line.



Crown gall on Euonymus may occur on stems and twigs as a result of pruning with infected shears.

Nurserymen may encounter more trouble on naturally alkaline soils or where lime has been added in recent years, as crown gall infections appear more often in alkaline than in acid soils. Give preference to varieties of ornamentals showing some resistance to crown gall in a given locality. However, varieties showing resistance in one locality may prove susceptible in another.

For home gardens, rigid exclusion of all suspected planting stock is the best control. Because crown gall is commonly spread by infected nursery stock, carefully select disease free stock.

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