

Plant Disease Diagnostic Clinic

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**Crown Gall:** *Agrobacterium* spp.

**Introduction**

Crown gall disease has an extremely broad host range and has been found in more than 600 plant species, mostly woody plants. Crown Gall has not been found on monocots. The bacterial disease causes significant damage, especially in fruit and nut trees.

*Agrobacterium* spp. are Gram-negative, rod-shaped bacteria. Tumorigenic *Agrobacterium* spp. carries a Ti plasmid. The Ti plasmid is transferred to a host plant cell during infection, and bacterial t-DNA is then delivered and integrated into a plant chromosome of the infected cell. Tumor formation is induced and infected host plant cells produce nutrients to support the bacterial growth.

*Agrobacterium tumefaciens* is the most common causal agent and causes Crown Gall in many species. It causes economically significant damage to cherries, apples, oranges, and a few other fruit and nut trees. Other *Agrobacterium* spp. may be more host-specific: *Agrobacterium vitis* causes Crown gall in grapes; *Agrobacterium rubi* infects blueberry and raspberry. Crown Gall is also a common problem on Euphorbia, Ficus, Roses, and occasionally on some other ornamental plants such as Chrysanthemum.

Tomato has been demonstrated to be susceptible to tumorigenic *Agrobacterium* spp. under laboratory conditions, but natural infections were not reported in commercial production fields until 2005 when Crown Gall was reported in organically grown tomatoes in the United Kingdom. *Agrobacterium radiobacter* biovar1 was confirmed as the causal agent. Crown gall may be an emerging disease of tomato that requires further monitoring.

**Symptoms and Signs**

On tomatoes, symptoms of Crown gall are distinctive. Galls are formed on the stem, root, or crown tissue of the infected plant. These galls are usually around 3-5cm, much smaller than most galls on woody plants, which may be 30cm or larger in size.

In addition to developing galls on stems, plants infected with the crown gall bacterium may suffer dieback where one or more galls has cut off water and nutrients that support stems and foliage. If the stem of a plant with a single stem is colonized and the gall tissue girdles the stem, the plant will die.



Figure 1: Galls developing on tomato seedlings after inoculation with a bacterial isolate (provided by S. Jensen, Cornell University).

**Disease Cycle**

The Crown gall bacteria are soil-borne pathogens. They can survive for 2-3 years in soil with or without susceptible host plants. Infection by *Agrobacterium* spp. requires free water and fresh wounds. The bacterium enters the plant through natural or pruning wounds, or through wounds on stem, crown, or root tissue caused by nematodes, insects, or cultivation equipment, etc. The first report of Crown Gall in tomatoes occurred on grafted tomato plants.

**Management Strategies**

In greenhouses or production nurseries, Crown Gall is spread mainly on grafting tools or equipment or transferring of contaminated soil, or infected seedlings. Therefore, proper sanitation methods include disinfection of tools and careful cleaning of machinery and the clothing of field laborers.

Exclusion and avoidance also play an important role in control of Crown Gall. Introduction of the pathogens by infected seedlings should be avoided. Frequent inspection of nursery plants is necessary. Once infected plant material is found, infected plants should be removed and destroyed. Since *Agrobacterium* spp. can persist in soil for 2-3 years, crop rotation with monocots for more than three years is suggested for contaminated sites

Pruning off infected branches is recommended to try to save valuable landscape plants, but tools must be cleaned with a sterilizing solution of 20% commercial bleach or 0.5 % potassium permanganate solution for sterilization between each cut. For most causes, however, the destruction of plant materials is the only control option.

Biological control with *Agrobacterium radiobacter* strains K84 and K1026 has been demonstrated to be effective against *A. tumefaciens* in cherries, but the effectiveness of biological control against Agrobacterium in tomatoes has not been studied. For some plant species like Chrysanthemum, cultivars resistant to Crown Gall may be available.



Figure 2: Galls developing on a potted Chrysanthemum (provided by S. Jensen, Cornell University).

**References:**

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