

Primefact

Crown gall in grapevines: emerging insights into crown gall-like symptoms in Australia

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Crown gall is a well-known plant disease characterised by tumour-like growths, historically linked to *Allorhizobium vitis* in grapevines. However, recent diagnostic work in NSW has uncovered a more complex picture, with multiple Rhizobiaceae species implicated in cane galls exhibiting crown gall-like symptoms. This Primefact summarises findings from 2022–2025 diagnostic submissions and pathogenicity testing, highlighting key implications for grapevine health and biosecurity.

Crown gall symptoms

Crown gall typically presents as tumour-like swellings on grapevine canes or at the base of the trunk. However, in the vine samples submitted for testing, the symptoms differed from classic crown gall, often originating internally and progressing to stem swelling, tissue rupture, and vascular damage.

Pathogen background

- Crown gall in grapevine has traditionally been attributed to *Allorhizobium vitis* (formerly *Agrobacterium tumefaciens* biovar 3), a member of the Rhizobiaceae family.
- All known crown gall pathogens belong to the Rhizobiaceae family, a group of bacteria capable of transferring tumour-inducing (Ti) plasmids into plant cells.
- Pathogenic Rhizobiaceae carry a Ti plasmid that integrates into the host plant's DNA, triggering hormonal imbalances and opine production, which leads to tumour formation.
- The disease can affect over 600 plant species in 93 plant families.
- While some Rhizobiaceae species are host-specific, many are generalists that can infect a broad range of plants.

Diagnostic investigation: 2022–2025

In 2022, NSW DPIRD received initial grapevine samples showing unusual gall-like symptoms (Figure 1 and Figure 2). Over the next 2 years, the number of submissions increased. Key findings include:

- 272 grapevine cane samples were assessed.
- PCR testing detected the pathogenic form of *A. vitis* in only one sample.
- Isolation and sequencing (rpoB gene) from 396 isolates revealed a diversity of Rhizobiaceae, including:
 - *Agrobacterium tumefaciens*
 - *Agrobacterium fabrum*
 - *Agrobacterium pusense*
 - *Agrobacterium radiobacter*
 - *Neorhizobium* spp.
 - *Agrobacterium* spp.
 - *Allorhizobium vitis*



Figure 1. Examples of submitted samples.

While multiple Rhizobiaceae strains were isolated from affected tissue, their presence does not confirm pathogenicity. Further testing is required to determine which strains are actively causing disease, as many might be non-pathogenic or opportunistic.



Figure 2. Examples of submitted samples.

Pathogenicity testing

Carrot disk assays and greenhouse trials on grapevine and sunflower plants were used to assess tumour formation. Results include:

- Several isolates of *Agrobacterium pusense* (Figure 3), *A. tumefaciens* (Figure 4), *A. radiobacter* (Figure 5), and *Neorhizobium* spp. (Figure 6) induced gall formation in pathogenicity assays, though the severity and consistency of symptoms varied between isolates.
- Isolates showed varied virulence; some caused only callus or no symptoms; others caused stem splitting and galling.
- *A. pusense*, *A. fabrum* (Figure 7) and certain *Agrobacterium* sp. (Figure 8; which require further identification) strains appeared particularly aggressive.



Figure 3. *Agrobacterium pusense*.



Figure 4. *Agrobacterium tumefaciens*.



Figure 5. *Agrobacterium radiobacter*.



Figure 6. *Neorhizobium* spp.



Figure 7. *Agrobacterium fabrum*.



Figure 8. *Agrobacterium* sp.

Key findings

- The pathogenic form of *Allorhizobium vitis* (Figure 9) was detected in only 1/272 samples.
- Four additional *Agrobacterium* species were confirmed to cause gall-like symptoms.
- The taxonomy of crown gall pathogens is evolving.
- Environmental factors might influence disease expression and plasmid activation.



Figure 9. *Allorhizobium vitis*.

Implications for industry

- Crown gall is emerging as a concern for grapevine health.
- Traditional diagnostics might miss non-*vitis* pathogens.
- A national reference collection was critical in avoiding unnecessary biosecurity responses.

Next steps

- Ongoing surveillance is essential.
- Further work is required to determine pathogenicity.
- Improved diagnostics and industry awareness will support management.

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