



Insights of Crown Gall Disease by *Agrobacterium tumefaciens*

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DESCRIPTION

Agrobacterium radiobacter (more commonly known as *Agrobacterium tumefaciens*) is the causative agent of crown gall disease (the formation of tumours) in over 140 species of eudicots. It is a rod-shaped, Gram-negative soil bacterium. Symptoms are caused by the insertion of a small segment of DNA (known as the T-DNA, for 'transfer DNA', not to be confused with tRNA that transfers amino acids during protein synthesis), from a plasmid into the plant cell, which is incorporated at a semi-random location into the plant genome. Plant genomes can be engineered by practice of *Agrobacterium* for the delivery of sequences hosted in T-DNA binary vectors.

Agrobacterium tumefaciens is an alphaproteobacterium of the family Rhizobiaceae, which includes the nitrogen-fixing legume symbionts. Unlike the nitrogen-fixing symbionts, tumor-producing *Agrobacterium* species are pathogenic and do not profit the plant. The wide variety of plants affected by *Agrobacterium* makes it of great distress to the agriculture industry.

Economically, *A. tumefaciens* is a serious pathogen of walnuts, grape vines, stone fruits, nut trees, sugar beets, horse radish, and rhubarb, and the persistent nature of the tumors or galls caused by the disease make it particularly harmful for perennial crops.

Agrobacterium tumefaciens grows optimally at 28°C. The doubling time can range from 2.5h-4h liable on the media, culture format, and level of aeration. At temperatures above 30°C, *A. tumefaciens* begins to experience heat shock which is expected to result in errors in cell division.

To be virulent, the bacterium contains tumour-inducing plasmid (Ti plasmid or pTi), of 200 kbp, which contains the T-DNA and all the genes necessary to transfer it to the plant cell. Many strains of *A. tumefaciens* do not contain a pTi.

Since the Ti plasmid is vital to cause disease, prepenetration events in the rhizosphere occur to promote bacterial conjugation - exchange of plasmids amongst bacteria. In the presence of opines, *A. tumefaciens* yields a diffusible conjugation signal called 30C8HSL or the *Agrobacterium* autoinducer. This activates the transcription factor TraR, positively regulating the transcription of genes obligatory for conjugation.

CONCLUSION

Agrobacterium tumefaciens infects the plant via its Ti plasmid. The Ti plasmid incorporates a segment of its DNA, known as T-DNA, into the chromosomal DNA of its host plant cells. *A. tumefaciens* has flagella that permit it to swim through the soil towards photoassimilates that accumulate in the rhizosphere around roots. Some strains may chemotactically move towards chemical exudates from plants, such as acetosyringone and sugars, which specify the presence of a wound in the plant through which the bacteria may enter. Phenolic compounds are accepted by the VirA protein, a transmembrane protein encoded in the *virA* gene on the Ti plasmid. Sugars are recognised by the *chvE* protein, a chromosomal gene-encoded protein positioned in the periplasmic space.

At least 25 *vir* genes on the Ti plasmid are necessary for tumor induction. In addition to their perception role, *virA* and *chvE* induce other of this protein can be found in other rhizobia.

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