

Website to brush up on bacterial diseases

Bacterial spot of pepper and tomato

www.apsnet.org/education/LessonsPlantPath/BacterialSpot/default.htm

Potato blackleg and soft rot

<http://www.apsnet.org/education/LessonsPlantPath/BlacklegPotato/default.htm>

Crown gall

<http://www.apsnet.org/education/LessonsPlantPath/CrownGall/default.htm>

Fire blight of apple and pear

<http://www.apsnet.org/education/LessonsPlantPath/FireBlight/default.htm>

Overwintering of bacterial pathogens

There are no specialized survival structures



Methods of overwintering:

In host or in seed or in clonal planting stock

Most common

On host as epiphyte

Pseudomonas spp. (bacterial canker of woody plants)

Free living in soil, water or debris

(generally rare)

Exceptions: crown gall pathogen, soft rot bacteria

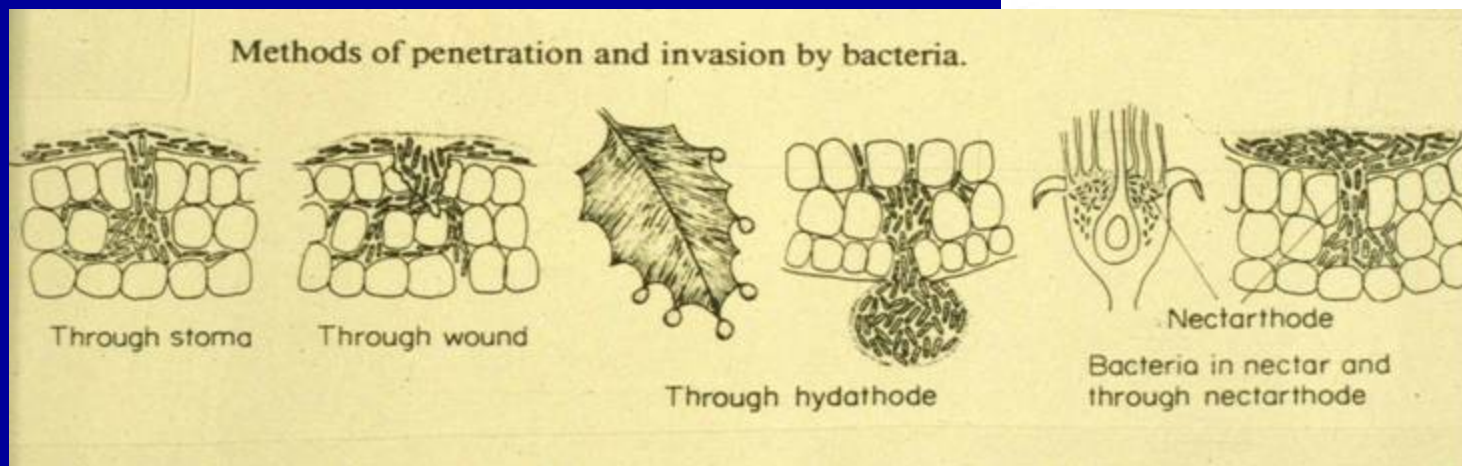
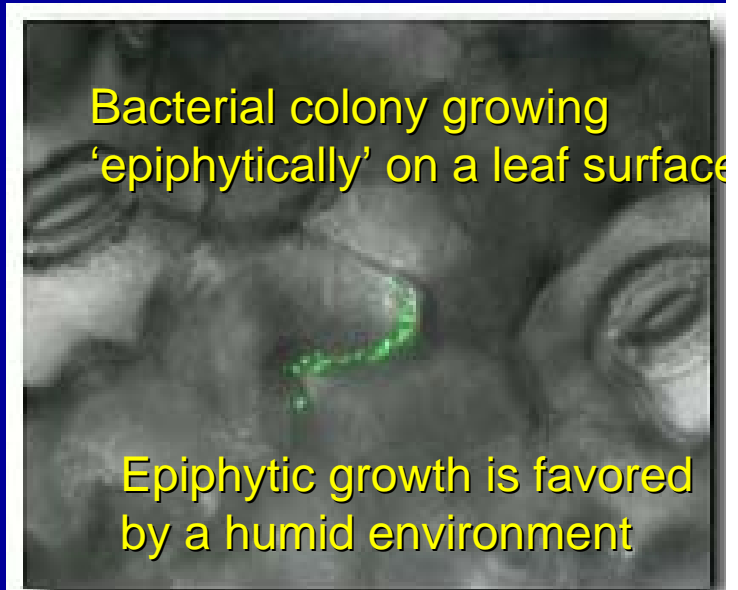
bacterial scab pathogens root & tuber crops

How bacteria cause disease

The typical life strategy of a bacterial plant pathogen is either facultative parasite or facultative saprophyte

Many survive grow and reproduce saprophytically (no disease) on plant surfaces. This growth is called 'epiphytic' (upon the plant).

Entry into plants is through wounds or natural openings:

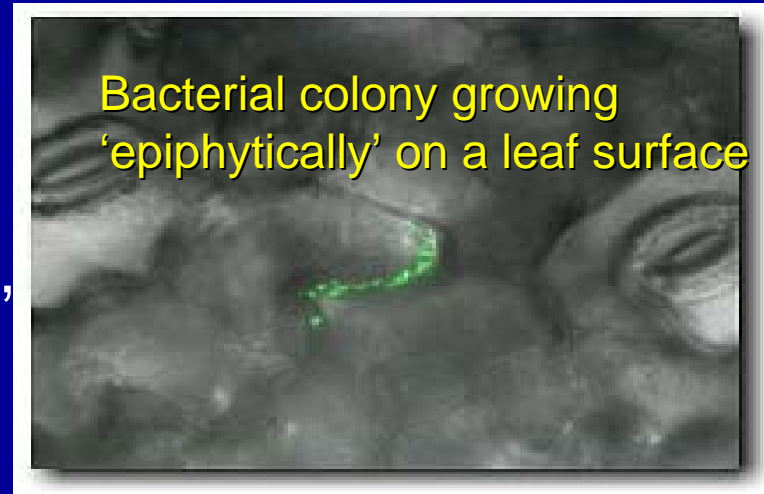


What does it mean to be an epiphyte?

- It is the ability of bacteria (and some fungi) to grow and reproduce saprophytically **on** plant surfaces

jargon: to live in the '*rhizosphere*' (on roots)
or in the '*phyllosphere*' (on a foliar surface)
or within a 'biofilm'

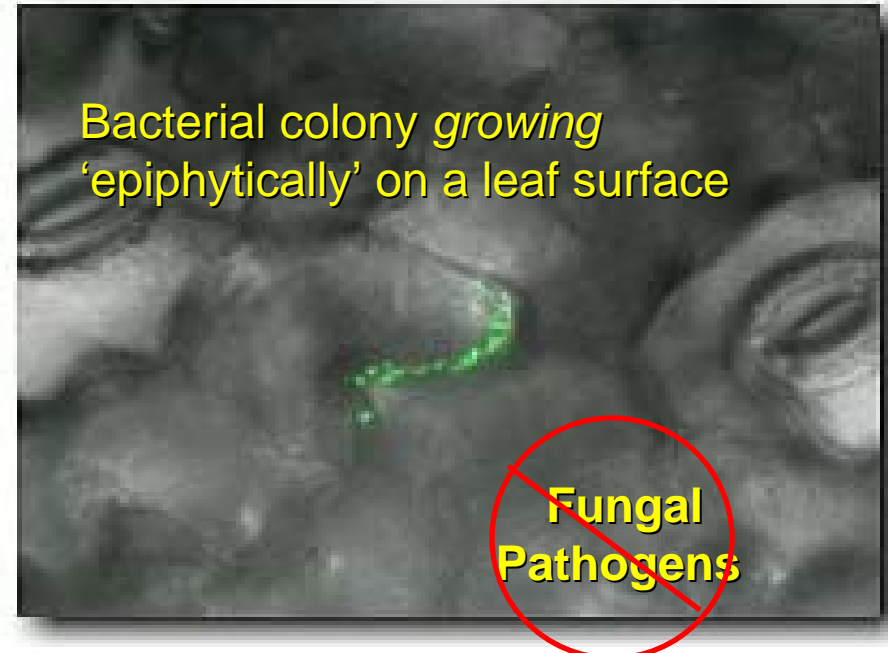
- Typically, with bacterial pathogens,
an epiphytic phase occurs
prior to infection



- Epiphytic growth is favored by a humid environment
- A bacterial epiphytic phase has been shown to influence a plant host's sensitivity to frost injury –
ice nucleation phenomenon
- Epiphytic (preinfection) phases of bacterial (and fungal) pathogens are frequently susceptible to biological control

Bacterial pathogens possess the ability to grow and reproduce on or in a plant without necessarily inciting disease

Bacterial colony growing 'epiphytically' on a leaf surface

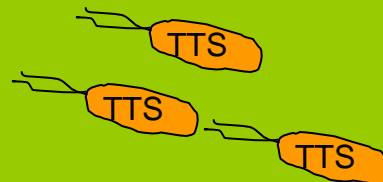


This growth is called:
'epiphytic' growth (upon the plant)
or 'endophytic' (within the plant).

Non-pathogenic bacterial epiphytes associate superficially



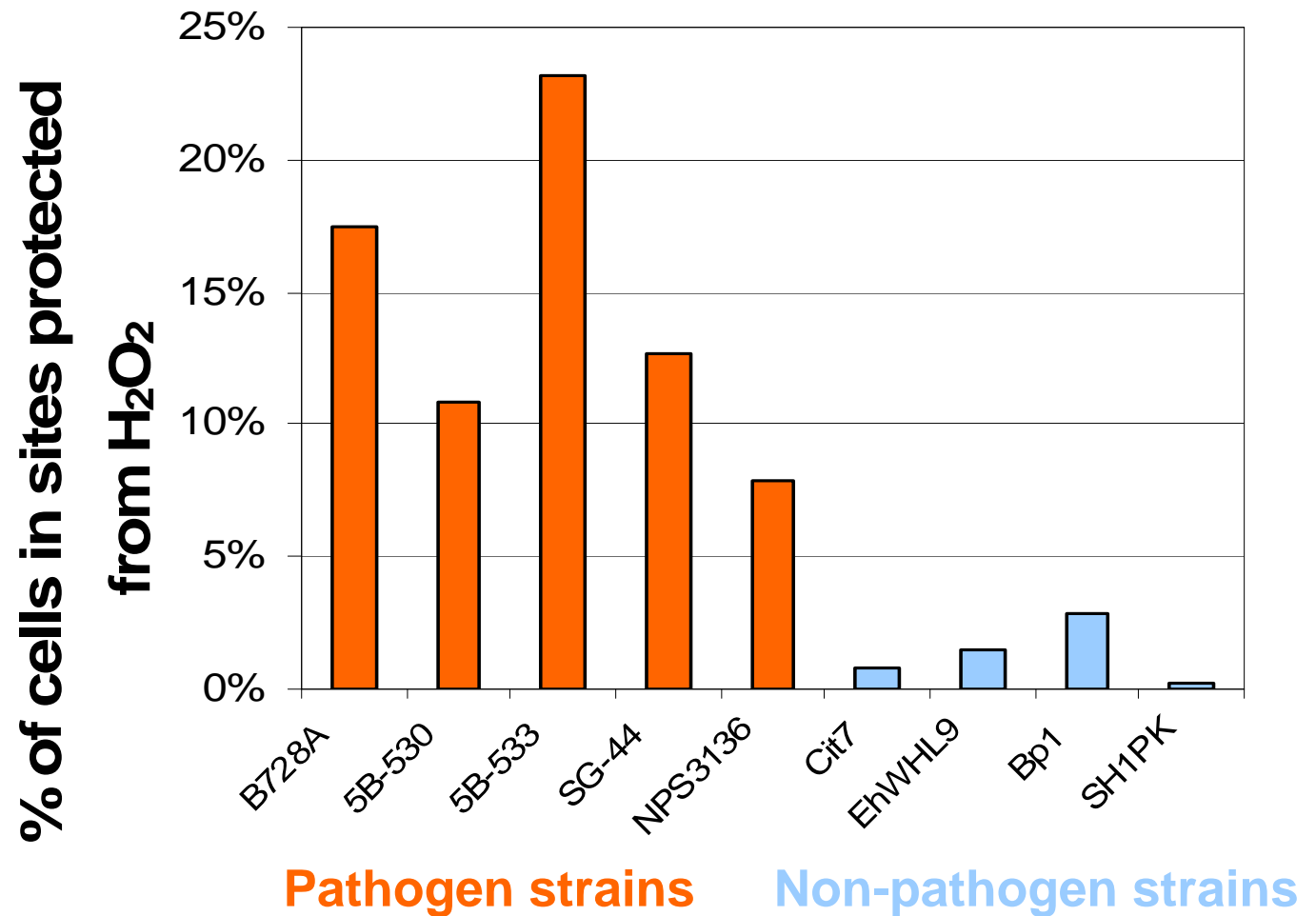
Pathogenic bacterial epiphytes associate intimately



Plant tissue

Effect of an H₂O₂ treatment on survival of epiphytic bacteria:

Wilson, Hirano, & Lindow 1999
AEM 65:1435-1443



Bottom line: Pathogens are specialized to associate intimately with their host

Biological control

Definition:

- reduction of the amount of inoculum or disease producing-activity of a pathogen by or through one or more organisms other than man Cook & Baker 1983

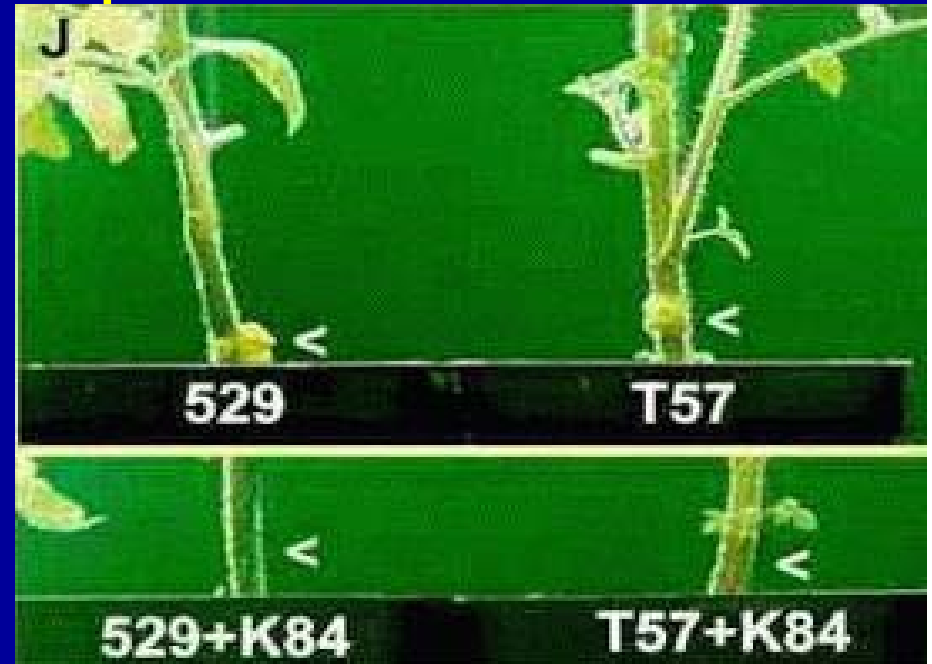
How is it accomplished?:

- Introduce saprophytic microorganism to plant environment
- Modify environment or cultural methods to favor specific saprophytic microorganisms that can accomplish biocontrol

Example 1: Biocontrol experiment from lab

Inoculated with
Agrobacterium tumefaciens
strains 529 or T57

Pretreated with
Agrobacterium radiobacter strain K84
followed by *A. tumefaciens*



Thus, in this example, the biocontrol agent (strain K84) protects the plant from infection by the pathogen.

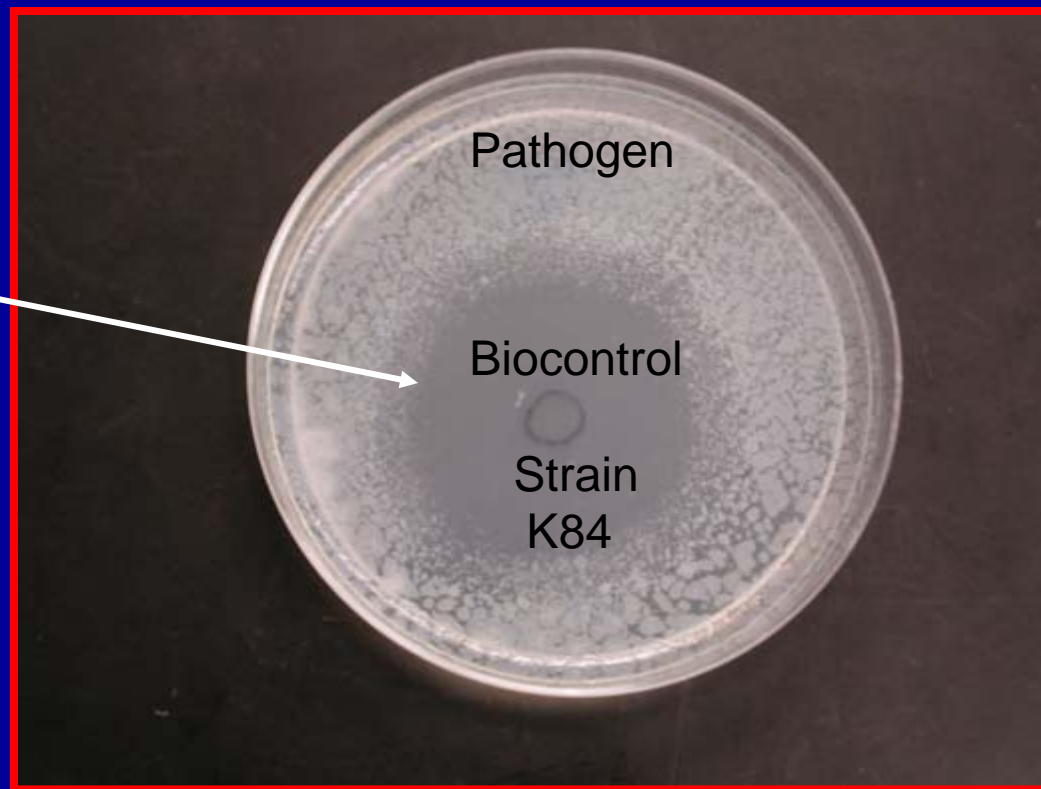
In the Oregon nursery industry, it is very common practice to dip the roots of plants in a suspension of K84 prior to planting.

Question: What is the mechanism of protection?

Important: The mechanism of suppression influences the *quality* of the biocontrol interaction

Mechanisms of biocontrol:

- Competition
- Antibiosis
- Parasitism



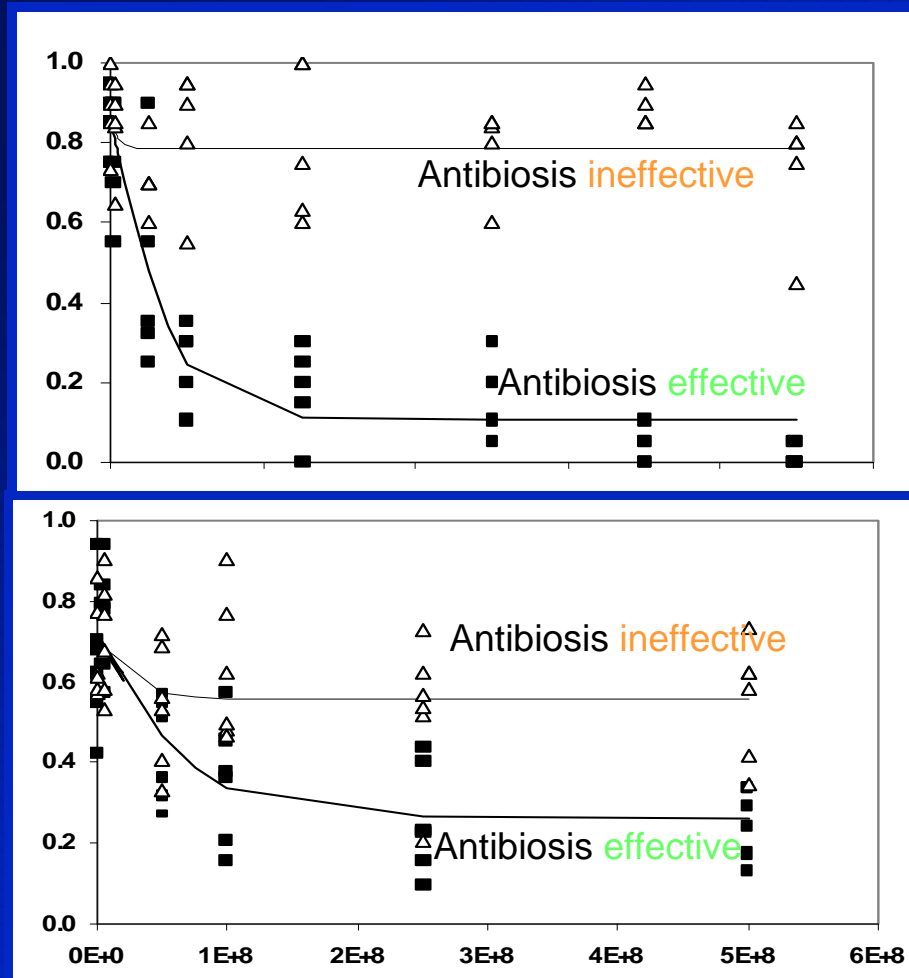
The importance of antibiosis to the effectiveness of K84

Control of Crown Gall of Tomato with *A. radiobacter* K84

Tomato

Disease incidence

Cherry



Antibiosis is ineffective either when K84 doesn't make its antibiotic or when the pathogen has become resistant to the antibiotic

Dose of biocontrol agent

Biological control

Works best when:

- The site of infection on plant supports growth of **competing** saprophytes (wounds, seeds, flowers, root surfaces)
- when the biocontrol agent possesses additional tools to suppress pathogen activity (**antibiosis**, **ability to induce SAR**)
- when disease is monocyclic and the pathogen is restricted to a short window of opportunity (wound healing, seed emergence, bloom period)

