ROLE OF INSECTS IN BACTERIAL DISEASES OF PLANTS

Vocabulary

* Nectarthodes



* An opening at the base of a flower from which nectar exudes

Hydathodes

- A water-excreting microscopic er plants
- * Lenticels
 - * Any of numerous pores in the stermer a movel plant and exchange of gases between the plant and the exterior





stomata, nectarthodes, hydathodes, and sometimes through lenticells, present in the infected area

- Such bacteria are then likely to stick on the legs and bodies of all sorts of insects
- Such as flies, aphids, ants, beetles, whiteflies, etc., that land on the plant and come in contact with the bacterial exudates
- Many of these insects are actually attracted by the sugars contained in the bacterial exudate and feed on it, thereby further smearing their body and mouthparts with the bacteria-containing exudate

- When such bacteria-smeared insects move to other parts of the plant or to other susceptible host plants, they carry on their body numerous bacteria
- If the insects happen to land on a fresh wound or on an open natural opening, and there is enough moisture on the plant surface
- * The bacteria may multiply, move into the plant, and begin a new infection. The same happens if the insects happen to create a fresh wound on the plant

- The type of insect transmission of bacteria is probably quite common and widespread among bacterial diseases of plants
- * But it is passive and haphazard
- Depending a great deal on the availability of wounds or moisture on the plant surface
- In any case, there are few data on how frequently such transmission occurs, and many conclusions about it are the result of conjecture

- Insects which, whether above or below ground, wound the host plant organs (roots, shoots, fruit, etc.) by feeding or by ovipositing in them
 - Increase the probability of transmission of plant pathogenic bacteria
- * This occurs because such insects place the bacteria, with their mouthparts or the ovipositor, in or around wounded plant cells, where they are surrounded by a suspension of nutrients (plant cell sap) in the absence of active host defenses and where they can multiply rapidly and subsequently infect adjacent healthy tissues.

- Numerous plant diseases in which bacteria are spread by insects passively as described above
- For example, the bacterial bean blights, fire blight of apple and pear, citrus canker, cotton boll rot, crown gal, bacterial spot and canker of stone fruits, etc.
- In several bacterial diseases, however, the causal bacterium has developed a special symbiotic relationship with one or a few specific types of insects and depends a great deal on these insects for its spread from infected to healthy host plants. Some of the better known are described briefly below.

Bacterium- Insect Associations Bacterial Soft Rots

- Bacterial soft rots cause tremendous losses worldwide
- * Particularly in the warmer climates and the tropics
- * Caused primarily by the bacterium Erwinia carotovora pv. carotovora
- * To some extent by Pseudomonas fluorescens and Ps. chrysanthemi
- * Occasionally, by species of *Bacillus* and *Clostridium*
- The last two genera of bacteria cause rotting of potatoes and of cut fleshy leaves in storage while *Pseudomonas fluorescens* and *Ps. chrysanthemi* cause soft rots of many fleshy fruits and fleshy vegetables

Bacterial Soft Rots Erwinia carotovora pv. carotovora





Erwinia carotovora

- * Causes the vast majority of soft rots on fleshy plant organs of any type
- * Leave, blossoms, fruit, stems, or roots
- * Especially in storage and under cover or in plastic bag
- * Affected fleshy fruits
 - * Strawberries, berries, cantaloupes, peaches, pears
- * Vegetables
 - * Tomatoes, potatoes, spinach, celery, onions, cabbage
- Ornamentals
 - * Cyclamen, iris, lily
- * Nearly all fleshy vegetables are subject to bacterial soft rots

The Procedure

- * The bacteria enter the plant organ through a wound
- * Sometimes in the field but more commonly during storage
- Multiply rapidly, secrete enzymes that separate the cells from each other and soften the plant cell walls, which causes the tissues to become soft and to rot.
- In many cases, these bacteria are accompanied in the rotting tissues by other saprophytic bacteria that further degrade the softened plant tissue and cause it to give off a foul odor.
- In all cases, rotting tissues become soft and watery, and slimy masses of bacteria ooze out from cracks in the tissues.

Bacterial Survival

- * The soft rotting bacteria survive
- In infected fleshy organs in storage and in the field, in plant debris, in infected roots and other plant parts of their hosts, in ponds and streams from where irrigation water is obtained, and to some extent in the soil and in the pupae of several insects

Seedcorn maggot, *Delia platura* (Meigen) (Diptera: Anthomyiidae)

- Play an important role in the dissemination and development of bacterial soft rot in potatoes
- * Both in storage and in the field.
- * The soft rot bacteria are usually introduced into a potato field on infected or contaminated seed pieces
- But they can also live in all stages of the insect, including the pupae, and there they may survive cold or dry weather conditions.

Seedcorn maggot, Delia platura

- The insect larvae become contaminated with the bacteria as they feed in, or crawl about on, infected seed pieces
- Carry the bacteria to healthy plants and there they deposit them into wounds they create
- Even when the plants or storage organs are resistant to soft rot bacteria and can normally stop the advance of the bacteria by developing a barrier of cork layers, the maggots destroy the cork layers as fast as they are formed and the soft rot continues to spread

Seedcorn maggot, Delia platura





Delia florilega (Zetterstedt), Drosophila busckii Coquillett (Diptera: Drosophilidae)





Other Insects and Soft Rots

- * Delia radicium (Linnaeus) and soft rot in the Brassicaceae;
- * The onion maggot, *Delia antiqua* (Meigen), the onion black fly, *Tritoxa flexa* (Weidman) (Diptera: Otitidae),
- * The seedcorn maggot, and the onion bulb fly, *Eumerus* strigatus (Fallen) (Diptera: Syrphidae)
- * The soft rot of onion; and the iris borer, Macronoctua onusta (Grote) (Lepidoptera: Noctuidae) and soft rot of iris.

- * The exact relationship between soft rot in each host and each specific insect is not clear
- * There is little doubt, however, that insect transmission of soft rot bacteria does occur, that insects help introduce the bacteria into wounds they open,
- Presence of insects in soft- rotting tissues inhibits the defense reaction of the plants against the bacteria
- * The insects also, by carrying the soft rot bacteria internally in their bodies, help the bacteria survive adverse environmental conditions
- On the other hand, the bacteria seem to help their insect vectors by preparing for them a more nutritive substrate through partial maceration of the host plant tissues