Insect transmission of xyleminhabiting bacteria

Ento-7110 Insects in Relation to Plant Diseases

Insect transmission of xylem- inhabiting bacteria

- Quite a few important bacterial diseases of plants, primarily trees, are caused by the fastidious bacterium *Xylella fastidiosa*.
- These bacteria inhabit the xylem of their **host plants** and are rather difficult to isolate and to grow on the usual culture media.



Xylem- inhabiting bacteria

 The diseases they cause differ from the vascular wilts caused by conventional bacteria in that instead of wilt they cause infected plants to decline, some of their twigs to die back, and in some cases the whole plant to die.



Insect Vectors

 The xylem-inhabiting fastidious bacteria are transmitted in nature only by xylem-feeding insects, such as sharpshooter leafhoppers (Cicadellidae) and spittlebugs (Cercopidae).





Xylella fastidiosa

- Xylella bacteria seem to be distributed in tropical and semitropical areas worldwide.
- Among the most important diseases caused by Xylella are **Pierce's disease** of grape and citrus variegated chlorosis.
- Other diseases caused by xylem-inhabiting bacteria include
 - Phony peach
 - Plum leaf scald
 - Almond leaf scorch
 - Bacterial leaf scorch of coffee
 - Oak leaf scorch
 - Leaf scorch diseases of oleander, pear, maple, mulberry, elm, sycamore, and miscellaneous ornamentals, as well as the alfalfa dwarf disease

- Pierce's disease is a devastating disease of European-type grapevines (*Vitis vinifera*).
- It is caused by the xyleminhabiting bacterium Xylella fastidiosa



Xylella fastidiosa

- The Pierce's disease bacterium moves and multiplies in the waterconducting (xylem) vessels of shoots and leaves, some of which become filled with bacteria and reduce the flow of water through them.
- Leaves beyond such blocked vessels become stressed from lack of sufficient water and develop yellowing and then drying or scorching along their margins.





- During the summer, the scorching continues to expand towards the center of the leaf, while some or the entire grape clusters begin to wilt and dry up.
- Scorched leaves fall off leaving their petioles still attached to the vine, while the vines mature unevenly and have patches of brown (mature) and green bark.

- In the following season(s), affected grapevines show **delayed growth** and stunting.
- The leaves and vines repeat the symptoms of the first year and both, the top of the plant as well as the root system, decline and die back.
- The bacterium apparently consists of various host specific **strains**. The strain that causes
- Pierce's disease of grape also causes alfalfa dwarf disease and almond leaf scorch.

- Apparently related but different strains of the bacterium cause citrus variegation chlorosis, the other related leaf scorch diseases of fruit and forest trees and of ornamental trees and shrubs.
- The identity and taxonomy, as well as the host range and vector preference of the possible strains of *Xylella fastidiosa*, are unknown

Transmission

- In all cases, the bacterium is transmitted from plant to plant through vegetative propagation, such as cuttings, budding, and grafting, and by one or more of several closely related insects.
- The known vectors of *Xylella fastidiosa* are **sharpshooter leafhoppers** (family Cicadellidae) or **spittlebugs** (family Cercopidae).
- It is possible that other or all sucking insects that feed on xylem sap, for example, the cicadas (family Cicadidae), are also vectors of Xylella fastidiosa

Transmission

- All vector insects **acquire the bacteria** when they feed on **infected plants.**
- Ingested bacteria seem to adhere to the walls of the foregut of the insect and when the insect moves to and feeds on the next healthy plant, the insect transmits the bacteria into the xylem vessels of that plant where they multiply and cause a new infection.
- Once a vector acquires bacteria from a diseased plant, it remains **infective indefinitely**. When, however, infective insects shed their external skeleton by molting, they loose the bacteria and must feed on a diseased plant again before they can transmit the bacteria to healthy plants.