D I S E A S E S

Presented by Jim Kissler

A diseased plant is one that does not produce or develop normally.

Causes of plant disease (2 groups)

--Parasitic - Results from invasion or infection by parasites or pathogens.

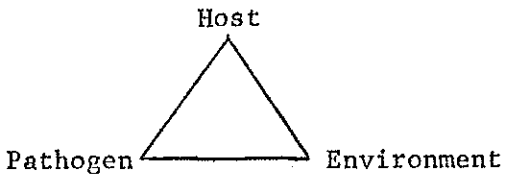
Examples: Fungi, bacteria, viruses, mycoplasmas, nematodes, algae, or parasitic plants (mistletoe).

--Non-parasitic - Conditions that result from unfavorable growing conditions.

Examples: Nutrient deficiencies, nutrient excesses, water deficiencies, water excess, frost, heat injury, pH, air pollution, phytotoxic pesticides.

Causal Dimension in Plant Disease

The 3 dimensions for a disease are: Pathogen - Host - Environment



You need all 3 dimensions if a disease is to occur.

Example: Dead arm disease
Host - Green grape leaves and shoots
Pathogen - Fungus Phomopsis viticola
Environment - Cool wet weather (spring or fall)

No dead arm disease infection will occur in July because the environment is unfavorable (hot and dry).

Parasitic Plant Disease

Fungi - Largest group of plant pathogens. Most fungi are not readily recognized because they are microscopic. Some visual ones are mushrooms, bread mold, yeasts, etc. Fungi are simple plants that lack chlorophyll. They obtain their food from other living organisms, from decaying non-living organic material. Beneficial fungi plus other micro-organisms break down organic matter into inorganic nutrients that the plant can use.

Life Cycle of a typical fungus can be somewhat compared to that of a higher plant:

--Begins life as a microscopic spore (seed of a higher plant).

--When moistened, the spore gives rise to miniature threads (hyphae), which grow and divide.

--Hyphae may enter the plant through wounds, natural openings, or even by forcing their way through the surface of a plant (like the root system).

--The fungus body, called the mycelium (stems of a higher plant), produces spores again (the flower and seed structures of a higher plant).

--Fungus spores then spread from the source, and the life cycle repeats.

--Fungi have different fruiting structures and spores that enable them to be identified by a plant pathologist (just as the plants have different flowers and seeds which make it possible to identify them).

Spread of fungus spores and disease build-up may be

--Air-borne

--Water-borne

--Seed-borne

--Carried by man, animals, insects, or equipment

--Some spores can lay dormant for long periods of time.

Fungus pathogens grouped--

In terms of behavior on the host plant

According to their spores and fruiting structure (most common grouping)

Major fungus groups and grape diseases associated with them are:

--Phycomycetes (so-called water molds). Grape diseases in this group:

Pythium - damping off
Phytophthora - collar rot
Peronospora - downy mildew (a common disease in Europe and eastern United States)

--Ascomycetes produce conidia spores.

Examples on grapes: Uncinula nectar - powdery mildew

--Basidiomycetes - Club-shaped cells which produce basidiospores

Examples on grapes: Armillaria or oak root fungus

--Fungi Imperfecti

Examples in grapes: Botrytis, Grey mold (Noble rot) - Phomopsis - Dead-arm disease

BACTERIAL DISEASES

Bacteria cause only a few major plant diseases. Bacteria are one-celled organisms that lack chlorophyll. They depend on external sources of living (or dead) organic matter for their food. Bacteria are small, requiring the organisms to be magnified several hundred times to be seen; they are smaller than fungi. Bacteria multiply by simple division of the cells: one cell divides into two. The rate of increase of bacteria occurs rapidly, with division occurring every few minutes.

Bacteria enter plants through wounds or natural openings on the plant surface. Inside the plant they rapidly multiply. Bacterial diseases spread on tools, equipment, or moving affected plants. Splashing rain, insects, and wind-blown dust can also aid spread.

Most bacteria are readily killed by exposure to dry air, sunlight, heat, chemicals, or even antibiotics produced by other organisms. However, they are the most difficult-to-control group of plant disease organisms.

Grape diseases caused by bacteria are: Agrobacterium tumefaciens (common name, crown gall); recently, Pierce's disease was found to be caused by a rod-shaped bacterium, spread by a special type leafhopper Draeculacephala minerva.

VIRUS DISEASES

Physical Properties of Virus

--Size - The smallest of all plant disease pathogens. Electron microscope is needed to see them. Electronic microscope magnifies by 150,000 to 300,000 times the true size.

--Shape - Varied shapes--long, straight, short rods, spherical.

Chemical Composition of virus consists of protein substances and nucleic acid.

Reaction to environmental conditions

--When juice is pressed from the diseased plant, the length of time they remain active varies according to the specific virus. Some become inactive immediately (these cannot be transmitted by juice inoculation); others remain active for a long period of time.

--Temperature - Some viruses can be inactivated by high temperatures. Heat therapy was used to produce virus-free grape planting stock. These are sold as certified plant stock. Procedure used at U.C. was to grow the vines in large potted containers in the greenhouse in which the temperature was maintained at 100° F for 100 to 200 days. This heat treatment killed the

virus diseases in the shoot tips. The tips of these vines then were cut and re-rooted under a hothouse spray mist. When the new plant was established it was then tested again for viruses. If found clean, the plant was accepted into the University foundation block. It was found that these heat-treated vines produced a vine that is more productive than even a virus-free vine that had not been heat treated. These vines usually are more vigorous. Today commercial nurserymen are reproducing these heat-treated vines using these mist spray propagation techniques by the thousands.

Life Process

--Viruses cannot carry out life processes of respiration, digestion, or other metabolic functions. They cannot grow or multiply outside the host plant. They do spread within the host and change the host into a virus substance. In other words, they can pass through a graft union.

Host Range

--Some viruses have wide host ranges such as weeds, grapes, ornamentals, agricultural crops; others have specific host ranges. Some hosts are symptomless carriers of virus.

Symptoms: Terms used to describe virus symptoms are

--Mosaic, which is a leaf pattern of yellow and green, or light green and dark green blotches.

--Vein clearing - Clearing or chlorosis of the tissue in or near the veins.

--Vein banding - A broad band of chlorotic tissue along the vein.

--Ring spot - Some localized spots on the infected leaf.

--Enation - Leaflike outgrowth on the lower surface of the leaf near the large veins.

--Necrosis - means death.

--Chlorosis - Yellowness of the normally green tissue due to partial failure of the chlorophyll to develop.

--Rugose - means rough.

Classification of Viruses

Viruses are generally classified as to the disease they cause. The name given the virus is descriptive of the disease; for example, in grapes: leaf roll, corky bark, fan leaf, yellow vein, vein banding, yellow mosaic, and leaf enation.

Spread of Viruses

Viruses can be spread by man (propagation, pruning, and handling); insects, mites, nematodes, fungi, seeds or pollen. Most grape viruses are spread by propagation--taking cuttings from diseased plants. The nematode, Xiphenema index, will spread vein banding (the entire fan leaf complex).

Identification of Viruses

Identifying grape viruses takes practice. You must know what the symptoms are and what they look like. An excellent text book of grape symptoms is "Virus Diseases of Small Fruits & Grapevines," published by the University of California Division of Agricultural Sciences.