

SYMPTOMATOLOGY IN PLANT PEST DIAGNOSIS

Symptoms are the detectable expressions of a disease, pest, or environmental factor exhibited by the susceptible plant which is subject to a given pathogen or causal agent. These symptoms, usually the result of complex physiological disturbances, commonly combine to form a definite symptom-complex or syndrome. Symptom-complexes may develop in different organs of a susceptible at different times. Symptoms may be either localized in a particular part of the plant, or **systemic**, that is, generalized in an organ or the plant. In addition, symptoms may be **primary** (direct and immediate changes in the tissues affected by a **pathogen** or other **causal agent**), or **secondary** (indirect and subsequent physiological effects on host tissue induced by action at a point distant from the initial infection). Usually, but not in all cases, localized symptoms are **primary** while generalized or systemic symptoms are **secondary**. Moreover, the sequence of symptom development frequently characterizes a particular disease. Symptomatology, the study of symptoms and associated signs that characterize a plant ailment, enables correct disease or pest diagnosis.

It is very important to be aware that because symptoms are “host reactions” to an irritation, many agents or even **abiotic** factors can cause a particular symptom. For example, wilting of the entire plant can be caused by bacteria, fungus, root rot, inadequate soil moisture, and other agents.

Signs are observable structure(s) of the agent which incites the disease or ailment. The commonest signs of disease agents are reproductive or vegetative parts of a pathogen such as fruiting structures, spore masses, mycelial mats, fans, rhizomorphs, etc. Signs are usually of greater diagnostic value than are symptoms because (1) different causal agents may incite similar symptoms, (2) our ability to distinguish between similar symptoms is limited, and (3) we are accustomed to think of a disease in terms of its immediate causal agent. Signs of insects or other pests include the insect itself (eggs, larvae, nymphs, resting structures, adults), parts of the insect (shed exoskeletons), excretions (wax, honeydew, scale, web, frass and droppings).

Both signs and symptoms are generally separated as to detectability into two categories: **macroscopic** or **morphologic** (distinguishable with the unaided eye) and **microscopic** or **histologic** (distinguishable with the aid of microscopes). For your purposes we will consider only macroscopic symptoms at this time. Following is a helpful flow chart of signs and symptoms:

- A. HYPERTROPHIC SYMPTOMS. Expressions of accelerated growth, differentiation or development.
 1. Those expressing an overdevelopment in size (hypertrophy) or number of cells (hyperplasia).
 - a. Callus
 - b. Curl, roll
 - c. Brooming (Witches' Broom)
 - d. Epinasty
 - e. Scab
 - f. Tumefaction (galls, burls, warts, knots, tubercles, blisters)
 2. Those expressing premature development of tissues or organs
 - a. Abscission or cast
 - b. Prolepsis
 3. Those expressing transformation of tissues or organs from one kind to another

- a. Heterotrophy
- b. Phyllody
- c. Russeting (Bark roughening and scaling)
- 4. Those expressing abnormal coloration
 - a. Anthocyanescence
 - b. Bronzing
 - c. Virescence or greening
- B. Atrophic Symptoms –Expressions of retarded or halted growth, differentiation or other development.
 - 1. Those expressing underdevelopment in size (hypertrophy) or number of cells (hypoplasia)
 - a. Dwarfing (Nanism and Stunting)
 - b. Rosetting
 - 2. Those expressing subnormal development other than in size
 - a. Abortion
 - b. Chlorosis (often used in place of yellowing)
 - c. Etiolation
 - d. Mosaic
 - e. Suppression (Blasting)
- C. **Necrotic Symptoms** – Expression of degeneration or death of cells and disintegration of tissues.
 - 1. Those expressing incipient protoplasmic degeneration preceding actual death
 - a. Water-soaking (hydrosis)
 - b. Mottle
 - c. Reddening
 - d. Silvering
 - e. Wilting
 - f. Yellowing
 - 2. Those expressing protoplasmic death and cellular disintegration
 - a. Bleeding
 - b. Blight
 - c. Canker
 - d. Damping-off
 - e. Dieback
 - f. Flagging
 - g. Girdling
 - h. Gummosis
 - i. Pitting
 - j. Mummy
 - k. Resinosis
 - l. Rot (decay), Heart rot, Dry rot, Soft rot
 - m. Scorch (Burn)
 - n. Shot-hole
 - o. Spot (on Leaf, fruit, or flower)
 - p. Staghead (Spike top)
 - q. Streak (stripe)
 - r. Lesion
 - s. Rot

GLOSSARY

Abortion—A halting in development of an organ after partial differentiation.

Abscission—Premature drop of or falling of leaves, flowers or fruit resulting from the premature formation of the abscission meristem.

Anthocyanescence – A reddish or purplish coloration of leaves resulting from abnormal of anthocyanin pigments.

Bark roughening – The formation of rough bark where smooth bark normally occurs.

Blasting – The failure to develop fruit.

Bleeding – Chronic sap-flow from wounds or other lesions.

Blight – The sudden drying and browning of whole leaves, shoots, or branches.

Bronzing – A coppery or bronze coloration of the leaves.

Burn – A synonym for scorch.

Callus – Overgrowths of tissue produced in response to injury or other irritation and which tend to cover a wound, canker, etc.

Canker – A sunken necrotic lesion beginning in the bark of branches, trunk, or roots and usually becoming deeper and wider by normal or accelerated secondary growth (callusing) of cambium, phellogen, and traumatic meristem. This deepening continues as the pathogen encroaches transversely into the cambium and wood as well as tangentially in the cambium region. A typically well-developed canker is a symptom-complex exhibiting necrotic, atrophic and hypertrophic symptoms.

Chlorosis – Diffused or patterned subnormal development of chlorophyll.

Curl (Roll) – Abnormal bending or curling of leaves or shoots due to localized overgrowth on one side or in certain tissues.

Damping-off – A symptom-complex characterized by rapid dying, browning, and rotting of germinating seedlings. Shoots may be killed before emergence, stems may be attacked in the root collar region with shoots falling over; roots may be destroyed; or cotyledons may be attacked.

Defoliation – Loss of leaves through abscission.

Dieback – The progressive drying, shriveling, and browning of twigs or branches from the tips inward toward the trunk.

Drop –The premature loss through abscission of fruit or twigs.

Dropsy – Extensive intumescence over large areas of tissue.

Dwarfing (Nanism) -- Subnormal size of a plant or some of its organs.

Epinasty – A leaf curl in which the leaves turn downward, due to a more rapid growth of cells on the upper side than on the lower side of the leaf stalk.

Etiolation – A symptom complex in which the major symptoms are dwarfing of foliage and inflorescence, spindly stem growth, and chlorosis.

Fasciation – Flattening or cohering of organs such as stems, flowers, and roots. The cause is unknown, but in some cases the condition may be propagated.

Fasciculation (Brooming) -- The clustering of organs such as branches about some common point on the plant. Generally arises from development of adventitious buds.

Flagging – A permanent condition of wilting.

Gall -- A pronounced tumefaction, often more or less spherical, and usually composed of unorganized cells.

Girdling – Tangential enlargement of a canker or lateral coalescence of cankers causing a branch or stem to be encircled and resulting in the complete stoppage of conduction.

Gummosis -- The formation of gums by diseased cells and tissues, and the extrusion of gum from wounds and other lesions.

Hairy root -- A type of fasciculation affecting the roots.

Heterotrophy -- The adventitious development of normal tissues or organs in unusual areas.

Honey dew -- The liquid excrement of aphids.

Hydrosis -- A water-soaked, translucent appearance of leaves, fruits, and green stems due to the extrusion of water from the cells into the intercellular spaces.

Hyperplasia -- An overdevelopment in the number of cells in a particular tissue or organ.

Hypertrophy -- An overdevelopment in the size of a plant or plant part, due generally to an abnormal increase in the size of the cells.

Interveinal chlorosis -- chlorosis of tissue between veins while veins remain green.

Intumescence -- Small epidermal swellings or eruptions resulting from hypertrophy of groups of epidermal or sub-epidermal cells due to high turgor pressure.

Knots -- A type of tumefaction,

Leaf retention -- The abnormally long retention of leaves usually resulting from a failure to develop the abscission meristem.

Lesion -- A localized area of diseased tissue.

Mosaic -- Variegated pattern of light and dark area with sharply defined borders.

Mottle -- Similar to mosaic but with diffused borders.

Mummy -- A dried shriveled fruit that is generally the result of a fungus disease.

Necrosis -- The death and disintegration of cells and tissues.

Needle cast -- The abscission of abnormal loss of needles from those species which possess them.

Oozes -- Viscid masses composed of living or dead pathogen structures and partially disintegrated susceptible tissues.

Phyllody -- development of leafy structures in place of normal flower parts.

Pitting -- Superficial depressions in the surface of succulent organs resulting in the death and shrinkage of subepidermal cells.

Prolepsis -- Premature development of a shoot from a bud.

Proliferation (Proliferation) -- Continued or extended development of a plant part after reaching a stage at which normal growth ceases.

Reddening -- The loss of normally developed green color from chlorophyllous tissue due to the destruction of the chlorophyll and/or degeneration of the chloroplasts which lead to a display of red pigments. Reddening may also result from the production of decomposition products accompanying death and deterioration.

Restoration -- A shortening of internodes through failure to elongate, which results in crowding of the foliage.

Rot (decay) -- The disintegration and decomposition of dead tissues.

Rosetting -- Abnormal clustering of leaves on a stem.

Russetting -- Rough or corky surfaces formed where they do not normally occur.

Sarcody -- The swelling of bark beyond girdling wounds or cankers and due to excessive accumulation of elaborated foods moving downward in the phloem and stopped at the lesion.

Scab -- A limited, more or less circular, raised and sometimes roughened lesion on fruits, tubers, leaves, and stems resulting from an overgrowth of epidermal, cortical, and peridermal tissues. This overgrowth is usually accompanied by rupturing and suberization (corking of cell walls).

Scaling -- The formation of scales or corky material where no scales normally occur.

Scorch -- A sudden drying and browning of large, indefinite areas on leaves and fruits. Also damage to bark resulting in drying and death.

Shot-hole -- Holes in leaves caused by the prompt falling out of the killed spots of tissue.

Silvering – A silvery sheen or gray luster of leaf or primary bark surfaces due to the development of unnatural air spaces beneath the epidermis.

Soft-rot -- A soft, watery decay or disintegration of plant tissue.

Spike-top – Death of the entire crown of the tree in a pattern that resembles a staghead.

Spot – Circular, areolate, or irregular discolored and killed areas on leaves, fruits, or green stems.

Staghead – Dieback or flagging of entire large branches in the crown, or of the entire top of the tree.

Streak – Elongated, narrow, superficial lesions which are first water-soaked then brown in foliage or green stems. In wood, there is discoloration in axial streak within the outer, conducting layer of sapwood resulting from deterioration of the wood structure or extraneous components.

Stripe – The streak symptom in monocots.

Stunting – A type of dwarfing in which the entire plant is subnormal in size.

Suppression – The complete prevention of organ development.

Tumefaction – Local swellings on any part of the plant, usually woody roots, stems, or branches and usually resulting from a stimulation of the plant meristem by the pathogen or agent.

Tumor – A malignant overgrowth of tissue or tissues.

Vein clearing – Whitish or translucent discoloration of leaf vein while the leaf remain normally green.

Virescence (greening) – The development of chlorophyll where not normally present.

Water-soaking – See hydrosis

Wilting -- A flaccid appearance of the leaves and shoots resulting from a temporary or permanent loss of turgor due to excess transpiration.

Witches' Broom – A type of fasciculation in which there is an abnormal bushlike development of many weak shoots or roots.

Yellowing – The loss of normally developed green color from chlorophyllous tissues due to the destruction of the chlorophyll and/or degeneration of the chloroplasts which leads to the display of yellow pigments.