A Guide to Identifying Plant Disease Symptoms

Michigan State University Extension Service

Christine Stephens, Anne Hartung, and Patrick Hart, Department of Botany and Plant Pathology; and Michael Mispagel, Department of Entomology

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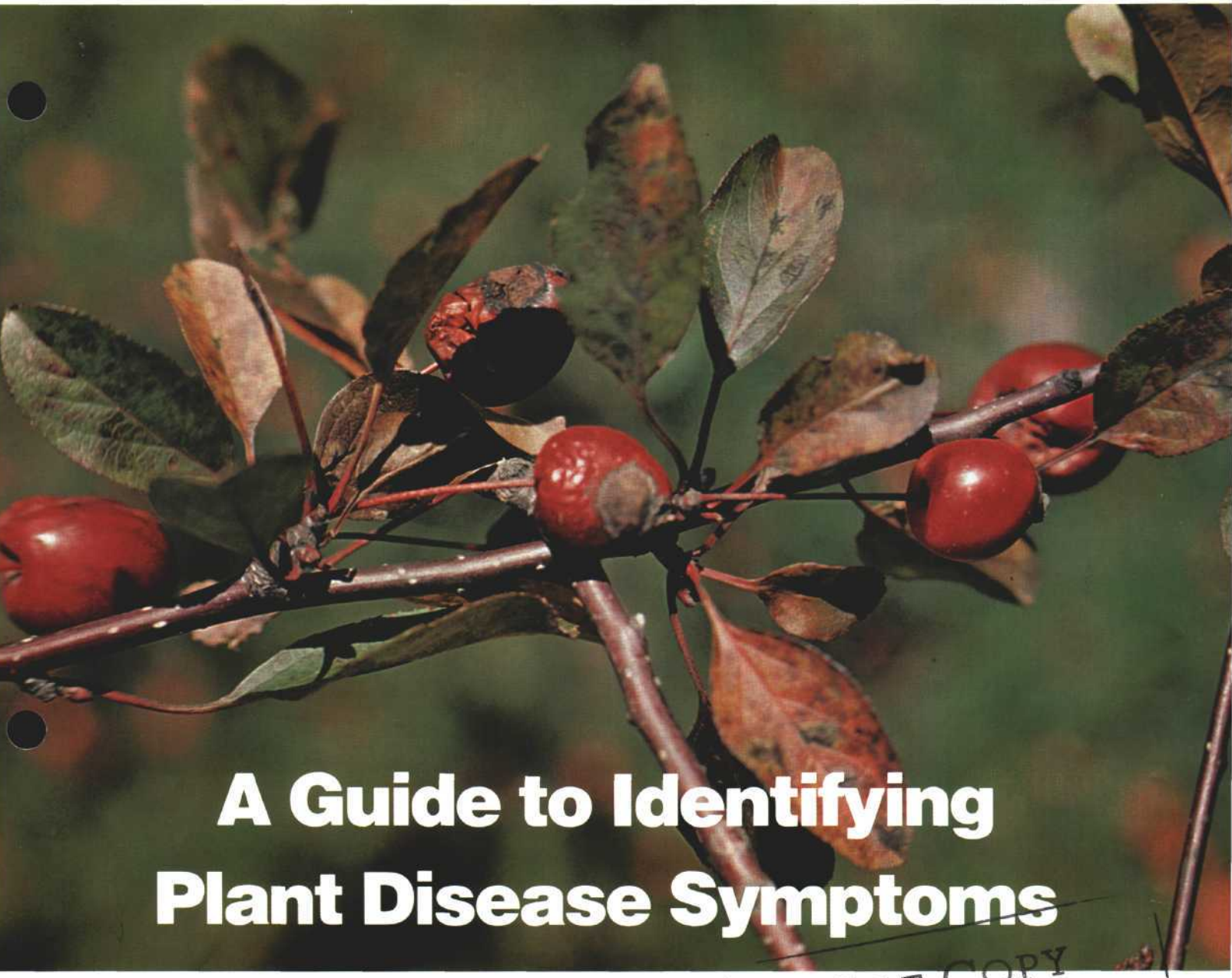


A Guide to Identifying Plant Disease Symptoms

By Christine Stephens,[1] Anne Hartung,[1] Patrick Hart,[1] and Michael Mispagel[2]
[1]Dept. of Botany and Plant Pathology; [2]Dept. of Entomology

Introduction

A plant disease is the result of a series of physiological changes followed by developmental or structural changes to the plant over time. A plant disease can be caused by a living organism, called a plant pathogen (bacteria, fungi and viruses) and also by non-biological stress (herbicide injury, mineral deficiencies or toxicities, excessive water and drought). Sometimes, both biological and nonbiological diseases are responsible for the plant disorder, or one may make the plant more susceptible to the other.

Plant diseases can often be diagnosed by certain signs and symptoms. A sign is the actual visible presence of the pathogen that caused the problem. Examples are rusts, powdery and downy mildews (see photos). A symptom is a plant expression or response to the changes within the plant brought about by the pathogen or stress. It is often difficult to determine the exact cause of a plant disorder because several disorders can cause the same symptom. For example, wilting of the aboveground parts of a plant may be caused by 1) root rotting organisms, 2) nematodes or 3) water stress. Plant leaves may turn yellow because of nitrogen deficiency in the soil, or because the roots are rotted and are no longer able to take up sufficient nutrients.

The following photographs illustrate symptoms and signs generally associated with common plant disorders. These symptoms also occur on other crop or ornamental plants and are not limited to those shown. Even though there are limitations to the use of symptoms for diagnosis, certain categories of symptoms provide definite clues to the cause of a plant disease. This guide should make it easier for you to discuss plant disorders with the

specialist. It should help you collect pertinent information and perhaps diagnose the problem yourself. It should be of use to county extension agents, teachers of vocational agriculture, instructors of plant science, personnel of state and local regulatory agencies and chemical companies, growers, personnel in charge of parks and recreational areas, gardeners, field scouts, private consultants and pest control operators.

Diagnosing Plant Problems

It is difficult to standardize diagnosis — diagnosis is often an art that is developed from a great deal of practice and experience. However, there are logical steps to follow. *Be sure to identify the plant affected* and, if possible, which variety. This allows the use of plant disease checklists and may reduce the number of possible diseases to a realistic level. *Note the distribution and location of diseased plants* in a field. The pattern of occurrence may help indicate cause. It is important to note *if one or many types of plants are affected.* If more than one type of plant is affected, it indicates that a parasitic disease is not involved and that weather conditions, chemical treatments or other causes are responsible for the symptoms. Observe what proportion of the whole plant population is involved. Diseases are generally progressive and it is unlikely that 100% of the host plants will be affected simultaneously. *Obtain a history of the problem* including such information as date first noticed, previous crops grown, previous weather conditions, cultural practices, chemical treatments and soil conditions. The problem often results from poor management or cultural practices.

It is necessary to know what a healthy plant looks like before deciding that it is diseased. Occasionally, normal plants are mistakenly assumed to be diseased because of some oddity in one of their parts. For example, variegation in tulip flowers can result from a viral disease or may be a genetic attribute of the cultivar. Note which plant parts are affected by examining roots, stem, leaves and fruity parts. Check for internal as well as external damage. Be sure to include several plants in your survey and collect what appears to be various stages of disease development. Try to determine which part of the plant was first affected.

Symptoms are not fixed or rigid, they change over time. A particular disease may initially cause brown lesions on the leaf surface. As time progresses, the area around the lesions may yellow and eventually the leaf may drop off the plant. Thus, one disease may cause 3 types of symptoms; leaf spotting, leaf yellowing, and leaf defoliation. Symptoms may also change over time due to 1) environmental factors that further damage the plant, 2) attack from insects and other organisms, 3) recovery of the plant, and many other reasons.

Collecting the Right Information

Accurate diagnosis depends on two factors:

i) the rapid receipt of a fresh and representative plant sample with the symptoms of concern; and
ii) the completion of the Diagnostic Submittal Form for each sample. This form is available at your local county extension office.

Answer all the questions on the form. Be sure to indicate all types of symptoms which are of concern. When the whole specimen can't be submitted (e.g., a tree) it is especially important to examine the entire plant thoroughly and include those observations on the form. Although obvious symptoms may be on the leaves, the primary problem could be elsewhere. Thus, it is helpful to note the conditions of the roots, presence of stem or trunk cankers, mechanical injury to the plant, etc. *Provide as much additional information as you can in the space provided or on a separate sheet.* For example:

a) Description of all disease symptoms *not included* in the material submitted.
b) Age of plant and length of disease condition.
c) Cultural practices — spraying information (dates, chemicals, amounts), fertilization.
d) Growing conditions — soil type, moisture, shading, when transplanted, etc.

You can never provide too much information, but too little information may hinder diagnosis or make it impossible.

Specimen Collection and Submission

The arrival of dead plant material or decomposed plant tissue is of little or no value in diagnosis because many nonpathogens will develop on the dead tissue and overrun or hide the real pathogen. Please collect the samples as described below.

a) LEAF — Collect early and late stages of infection. Press leaves between heavy paper or cardboard (magazines work well).

b) FLESHY PLANT PARTS — Do not send samples of a rot disease in an advanced stage of decay. Collect fresh specimens with early symptom development. Wrap individually in newspaper or dry paper toweling and pack in a crush-proof box. *Do not* add moisture to the samples.

c) CANKERS — Select recently produced cankers. Submit the whole cankered portion where possible; preferably with healthy wood above and/or below the canker. Wrap loosely in paper and ship in a crush-proof mailing tube or box.

d) WILT OR GENERAL DECLINE — Send the entire plants, with roots, if feasible; submit several plants, from healthy to severely infected. Dig, *do not* pull, plants from the soil so diseased roots will remain intact. If the whole plant cannot be sent, select samples from areas of active symptom development. Include the intact root system if root rot is suspected. If the whole plant is submitted, wrap the root ball tightly in plastic; send the entire plant in a crush-proof container. Diseased areas cut from the plant should be sent as for cankers (above).

e) TURF — Submit several 6-inch plugs of grass cut as deeply as roots will hold in soil. Plugs should show gradation from healthy to severely diseased. Collect and send plugs quickly. If mailed, pack plugs tightly with newspaper in a crush-proof box or plastic bag. *Do not* add moisture to the sample.

Always take samples to your local county extension office first. Extension agents are familiar with many plant diseases and may diagnose the problem immediately. If they cannot diagnose the problem, they will ship the material to the Plant and Pest Diagnostic Clinic at Michigan State University. Take samples early in the week to avoid a weekend layover in the Post Office. Keep samples refrigerated if there is a lapse of time between collection and submission.

NOTE: Diagnosis and recommended controls by the MSU Plant and Pest Diagnostic Clinic are based solely on the material and information submitted. The less representative the sample, and the less complete the information provided, the greater the chance for misdiagnosis. Also bear in mind that some samples may have to be cultured out in order to diagnose. This takes time! Following the steps outlined in this bulletin will result in a speedier and more accurate diagnosis.

TYPES OF SYMPTOMS

01. BLOTCH: Large and irregular-shaped spots or patches on leaves, stems and shoots. Algal leaf spot on magnolia.

04. CANKER: Necrotic (blackened), often sunken spot on a root, stem, branch, or twig of a plant. Usually sharply defined with the margins associated with callus tissue. Bacterial canker on cherry.

02. BRONZING: Copper or bronze color in leaves or needles. Air pollution injury on beans caused by ozone.

05. CHLOROSIS (yellowing): Yellowing of normally green tissues due to the destruction of the chlorophyll or the partial failure of the chlorophyll to develop. Iron chlorosis on shingle oak (right). Normal leaf on left.

03. CALLUS: Tissue overgrowth around a wound canker. Develops from actively dividing plant cells. Nectria canker on maple.

06. CRACKING: Splitting of tissue usually associated with drying cells. May result from different growth rates in adjoining tissue. Tomato crack.

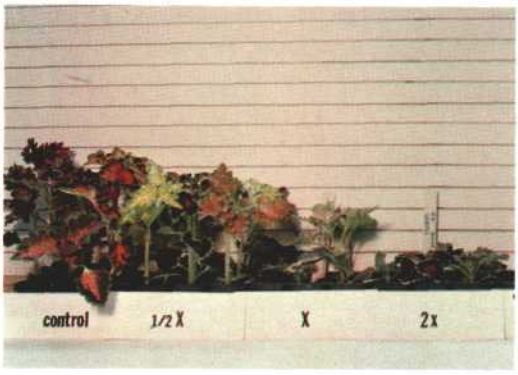
07. CUPPING: Up- or down-ward curling of the entire leaf margin forming a cup- or bowl-like shape. Gas injury to begonia.

10. DAMPING OFF (Post-emergence): Rapid rotting of the stems of seedlings at the soil line or the rotting of the root system after their vegetative growth above-ground is established. Damping off of impatiens.

08. CURLING: Abnormal bending of leaves from the unequal development of its two sides. Peach leaf curl.

11. DIEBACK: Progressive death of branches or shoots beginning at the tips and moving toward the main stem or trunk. Usually associated with woody plants. Fireblight on crabapple.

09. DAMPING OFF (Pre-emergence): A rapid rotting of the base of the stems or seedlings after germination but before the seedling breaks the soil surface. Damping off of impatiens.



12. DWARFING (stunting): Subnormal size of plant or some of its organs. Dwarfing from excess fungicide on coleus.

13. PROLIFERATION: Excessive development of secondary roots or stems around a main root or stem. Marked dwarfing may be associated with shortened internodes of stems. Fasciation of geranium.

16. HERBICIDE INJURY: Gross leaf distortion. 2, 4-D injury on grape.

14. GALL: A more or less spherical overgrowth or swelling of unorganized plant cells, usually the result of attack by insects, bacteria, fungi, or nematodes. Root crown gall on euonymous, stem crown gall in rose.

17. HYDROSIS (water soaking): A water-soaked appearance caused by the movement of water from cells into spaces between the cells; a common symptom during early stages of many bacterial diseases. *X. dieffenbachia* on dieffenbachia.

15. HALO: A spot on a leaf surrounded by a discolored (usually yellow) circle. Bean rust.

18. LEAF OR NEEDLE DROP: An untimely and uncommonly large loss of needles or leaves. Anthracnose on sycamore.

22. NECROSIS: Dead tissue or plant parts. Alternaria on cauliflower. Downy mildew on cabbage.

20. LODGING: Falling over of plants at the base, usually associated with root rots. Wind damage on wheat.

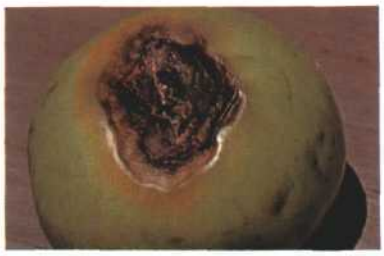
23. MARGINAL NECROSIS (scorch): Burning or dying and browning of leaf margins. Usually results from unfavorable environmental conditions. Scorch symptoms on maple.

21. MUMMIFICATION: Darkening, wrinkling, hardening of rotted fruit. Results from a rapid loss of moisture from the fruit. Brown rot of peach.

24. MOSAIC: Variegated patterns of shades of greens and yellows in normally green leaves. Also characterized by intermingled patches of normal and light green or yellowish color. A common symptom of many viruses. Rose Mosaic Virus.

25. POWDERY MILDEW: Whitish growth on plant surfaces, usually the leaf or stem. Cotton-like in appearance, initially occurs in spots. Powdery mildew on pansy.

26. REDDENING (purpling): Reddish or purplish discoloration of leaves or other organs which are normally green. May be a localized or general symptom. Aster yellows on carrot.



27. ROT: Disintegration, discoloration, and decomposition of plant tissue. A dry or hard rot if the decay is firm and dry; or a wet rot if soft, watery and foul smelling. Soft rot of lettuce and blossom end rot in tomato.

28. RUGOSITY: Wrinkling, ridging or puckering of normally flat leaves. Virus symptoms on soybean.

29. RUSSETTING: Brownish roughened areas on the skin of a fruit or tuber as a result of cork formation. Russett of Golden Delicious apple.

30. RUST: A disease giving a "rusty" appearance to a plant and characterized by dense masses of reddish-brown to orange spots on leaves and other plant parts. Orange rust on brambles.

31. SCAB: A roughened, crust-like diseased area on the surface of a plant organ. Potato scab, apple scab.

32. SMUT: A disease caused by smut fungi and characterized by masses of brown to black powdery spores. Loose smut in wheat, corn smut.

33. STREAK (stripe): Narrow, elongate areas on leaves characterized by yellowing or necrosis of the affected area. Wheat streak virus on wheat.

34. WILTING: Loss of freshness and rigidity, and drooping of plants due to insufficient water in the plant. Cucumber wilt.

COVER: Apple scab caused by *venturia inaequalis*. Photo credit: Sandy Perry, MSU.

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