A PRACTICAL GUIDE FOR DIAGNOSING ROOT ROT IN ORNAMENTALS

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Many root rot diseases caused by *Phytophthora* spp. or *Armillaria mellea* can be managed by implementing cultural practices that are adverse to the development of these pathogens. If the arborist develops a technique identifying the cause of the pathogen's invasion of the tree/shrub, chances are great that the elimination of these causes can slow down the tree's decline and prolong its life in the landscape. Most of the trees/shrubs planted in the California landscape are introduced, and they require careful cultural and irrigation practices. If these practices are changed, root rot disease can take advantage of nearly every stress that affects trees as "an opportunist takes advantage of the slightest change of circumstance in his favor, and *A. mellea*, does this very well" (1).

The material for this article was collected as a result of requests to diagnose various species of diseased woody ornamentals displaying a change in foliage appearance. A total of 86 trees/shrubs of 37 different species was examined. In cases where I was not absolutely certain about the identity of the causal fungus, infected tissues were submitted for culturing to the Department of Plant Pathology, University of California at Berkeley. In all instances the owner/manager of the property was interviewed.

The collection of data began in the fall of 1985 and continues in different landscape situations in San Francisco Bay Area counties. This area provides a fascinating study site because of its diversity. Several climatic zones and numerous microclimates in which several hundred plant species, ranging from subtropical to continental members, are planted as woody ornamentals.

A second characteristic of this area is its dry, almost rainless growing season, as well as periodic severe water shortages during which irrigation is reduced or terminated. In such situations plants respond with wilted foliage that is almost always associated with drought stress. However, infected trees with root rot-causing pathogens display similar symptoms, to which homeowners or inexperienced arborists respond mistakenly with excessive watering to reverse the wilt.

Following excessive irrigation, disease progress accelerates to the degree that a plant cannot be saved and rapid death of the plant follows. Even though the future course of a tree infected with root rot-causing organisms is difficult to predict, the specialist is always asked to predict the future health and liability of an infected tree in the landscape. An examination of the tree root-crown, water sprouts on the trunk and limbs, foliar symptoms, environmental factors, and recent nearby construction activity will provide enough clues for creating a case history and for preparing appropriate recommendations.

How to Create a Case History

Symptom expression varies in ornamentals infected with *Phytophthora* or *Armillaria* (2,3). In developing a helpful case history, observation of symptoms in the diseased plant is important. It is equally important to identify the conditions that have contributed to the disease's development (Table 1) in order to recommend appropriate or optimal treatment of the diseased tree. The initial procedure starts with a symptom analysis for which a diagnostic chart has been devised (Fig. 1).

This chart includes symptom expression described by Agrios (2) and Tattar (3) and is a practical method in which evidence is weighed rather than logical conclusions drawn, before any tissue is sent to a laboratory for culturing. After a dozen or more woody plants are diagnosed by this method, only a few samples will require laboratory culturing.

The second step in improving diagnostic accuracy is to investigate factors that may relate to

Table 1. Landscape changes implicated in root rot

ACTIONS	NO. OF CASES	SPECIES
Old (manual) irrigation was replaced with the new sprinkling system regulated by timer; Sprinkling heads position close to the trunk; Presence of water puddles or moist soil near the root crown	26	*Alnus rhombifolia, A. cordata, Camellia, Cedrus deodora, C. atlantica, Citrus sp., Cupressus macrocarpa, Ficus carica, Juniperus chinensis, Ligustrum japonicum, Persea americana, Pinus radiata, Prunus laurocerasus, Pyracantha fortuneana, Pyrus calleryana, Quercus agrifolia, Q. lobata, Rhododendron, Schinus molle, Taxus bacata*
New garden was installed around the tree, raised flower beds were built aroud the tree base	18	*Catalpa bignonioides, Cedrus deodora, C. atlantica, Citrus sp., Eucalyptus globulus, Fagus sylvatica, Ficus carica, Juniperus chinensis, Malus sp., Pinus radiata, Quercus agrifolia, Q. lobata, Rhododendron, Salix babylonica, Schinus molle, Taxus bacata*
New driveway, deck, stone wall, utility line, etc., were constructed	12	*Acer saccharum, Ailanthus altissima, Fagus sylvatica, Quercus agrifolia, Q. lobata, Q. palustris, Q. suber, Shinus molle*
Grade was raised - root crown was buried	6	*Acacia baileyana, A. melanoxylon, Eucalyptus viminalis, Quercus agrifolia, Q. douglasii, Q. lobata,*
Rhododendrons or azaleas, or camellias were planted under the canopy	4	*Prunus lauracerarus, Quercus agrifolia, Q. douglassi, Ficus carica*
Chemical weed control program under the tree drip line was initiated	3	*Acacia melanoxylon, Quercus agrifolia*
Soil poorly drained and compacted around the root zone	2	*Quercus agrifolia, Q. douglasii*
New lawn was installed or the old one was renovated	3	*Citrus sp., Quercus agrifolia, Q. lobata, Olea europaea*
Unexplained	12	*Acacia baileyana, Citrus sp., Fagus sylvatica, Jacaranda mimosifolia, Juniperus chinensis, Nyssa sylvatica, Quercus agrifolia, Q. douglasii, Q. lobata, Rhododendron, Shinus molle*

the onset of root rot due to stress or nonliving agents. This investigation requires cooperation and skillful communication with the homeowner or caretaker in three major areas: 1) depict what is atypical in the landscape, 2) search for hidden practices, and 3) avoid erroneous assumptions. Managers of the landscape are often replaced and even property ownership changes hands; both significantly affect maintenance changes. Tattar (3) expressed this issue best, "Shade trees are long-lived individuals in a rapidly changing environment. The amount of stress placed upon a tree is directly related to the rate of change of its microenvironment." Therefore, an entire array of questions should be asked or investigated to identify these agents. The problem is to match the symptomatic tree to the appropriate management practice by eliminating the harmful practice that triggered the disease. The survey in the San Francisco Bay Area assigned root rot development to eight commonly occurring environmental changes (Table 1).

It is not always easy to uncover pivotal clues unless the client is asked specific questions and an intense investigation is conducted. For example, the sprinkling system installed three years ago is history to the client, while for the arborist it might represent an important change in the microenvironment. Clients are preoccupied with the most recent symptoms and not with past events when the plant appeared normal. A helpful diagnostic aid to convince the client that the decline indeed might have begun in previous growing seasons is to check the annual shoot growth increments

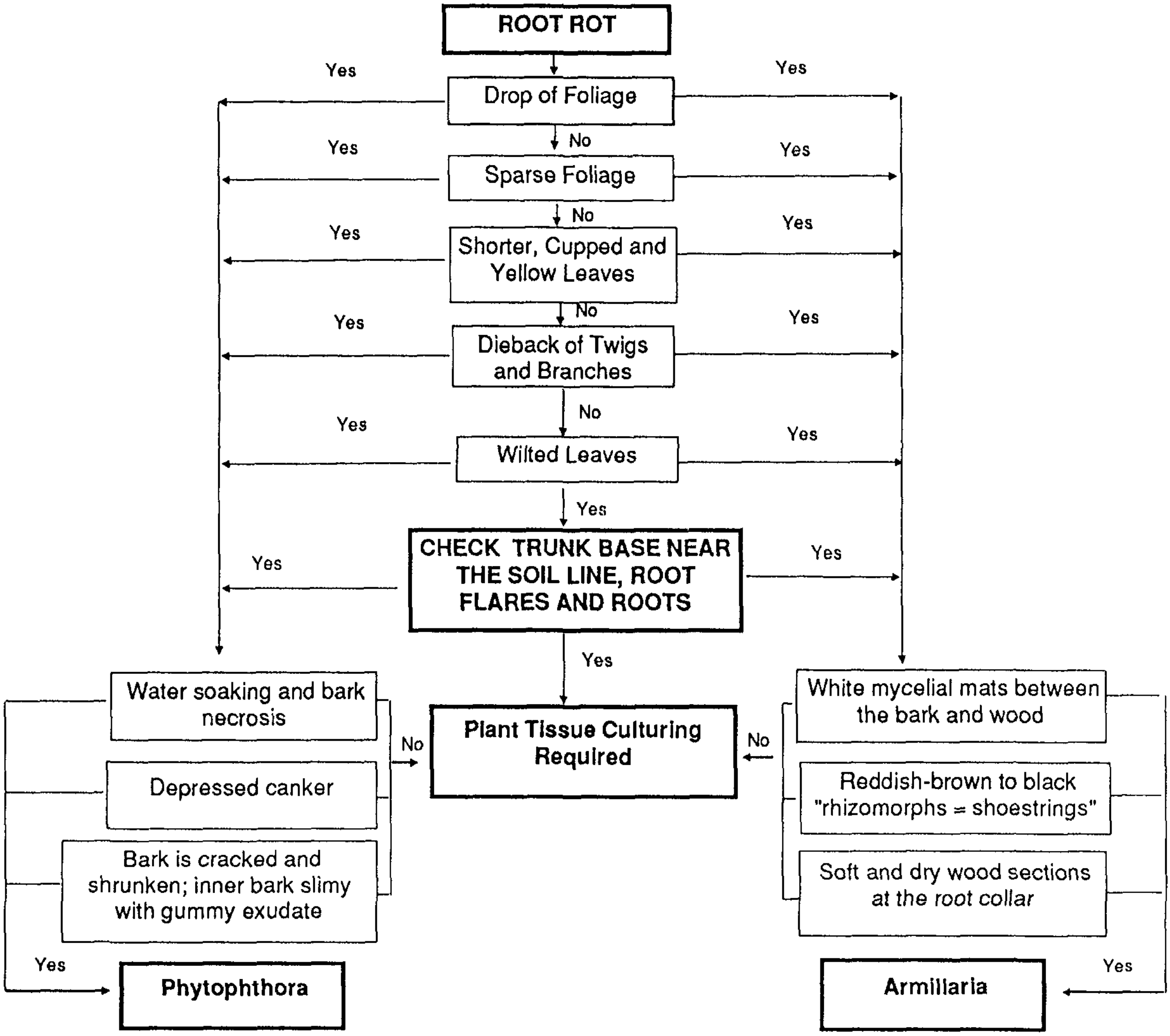

Figure 1. Chart for detecting root rot

(comparing distances between terminal bud scale scars) to find the year when poor growth began and then relate it to an event (change), e.g., drought, new construction, etc. Table 1 lists these changes with the corresponding frequency of cases and the plant species involved as recorded since 1985.

The diagnostic chart combined with Table 1 data can be applied by practitioners as an integrated system that serves as a diagnostic management adviser not only in the arid western states but also in a landscape with different climates. At the beginning of the investigative process, it might not seem easy to identify management practices or implicate recent weather conditions as a cause of the disease progression. While some plant problems can be related to sudden microenvironmental changes, most problems are influenced by conditions that occurred in prior years. The greatest difficulty experienced was with professional gardeners or landscape contractors who tended to deny engaging in any suspect practice such as weed control, overfertilization, raised grade and espe-

Fig. 2. Improperly irrigated Deodar cedar's trunk and root crown area created conditions conducive to the development of root rot.

cially overwatering. Tact and skill are needed in phrasing questions.

With practice, the arborist should be able to relate the onset of root rot to specific conditions, such as a sprinkler head throwing water on the tree trunk followed by water collection at the tree base (Fig. 2). If root rot is related to such a specific condition, the elimination of the sprinkler head or re-direction of water away from the tree trunk will result in tree improvement during the same growing season. Remission of foliar symptoms was observed in 18 trees and shrubs after the irrigation system was adjusted despite the presence of the causal organism.

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Literature Cited

1. Wargo, M.P. 1980. *Armillaria mellea: an opportunist.* J. Arboric. 6(10):276-278.
2. Agrios, G.P. 1988. Plant Pathology. New York: Academic Press. 688 pp.
3. Tattar, T. 1978. Diseases of Shade Trees. Academic Press, New York. 361 pp.

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