NATURE AND MANAGEMENT OF CANKER PATHOGENS INFECTING CUTTINGS

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Most fungi which cause canker diseases are weak pathogens and cannot infect undamaged tissue. They must have a wound for effective penetration of the plant. The wound at the base of a cutting or at a graft presents a fine infection court for these fungi, and not surprisingly, several canker diseases appear frequently under conditions of commercial propagation. General symptoms of canker diseases, when they occur on above-ground plant parts, are death of the cambium and overlying bark, and discoloration of the wood below from its usual greenish-white color to a black or brown. On small plants the cankers usually girdle rapidly and spread above and below the point of infection, resulting in death of branches beyond the canker even where no pathogen can be found. If the branch is not killed quickly, a depressed area develops which may or may not have a raised callus edge. The pathogens produce fruiting bodies within which spores are found in the bark over the canker. These fruiting bodies are the usual source of inoculum for reinfection and are of major importance in diagnosis.

When infection occurs on cutting wounds, the canker may be entirely below ground or may spread some distance above ground. The result is killing of the entire plant. In some cases the infected cutting is not killed quickly but may survive one or two years before succumbing. The symptoms of such infected cuttings superficially resemble *Pytophthora* root and collar rot diseases, but control measures for *Phytophtora* diseases are not appropriate for the canker diseases. Control of canker diseases in propagation involves use of pasteurized or pathogen-free rooting media and a fungicide dip for cuttings or scions.

The following is a discussion of three diseases this worker has observed causing appreciable losses in Southern California nurseries. Nursery blight of junipers, caused by *Phomopsis juniperovora*, is a very common disease on many juniper cultivars outside of California. Under local conditions, I have only seen the disease on *Juniperus virginiana*, the red cedar. On this plant the disease first causes yellowing and browning of the foliage of liners and plants in gallon containers, frequently with death of the entire plant. Cankers may be seen on the main stem. Typical fruiting bodies are inconspicuous pycnidia resembling bumps on the bark. Because the red cedars were grown for grafting root-

stocks, the disease became important by causing a shortage of stock plants. A persistant problem of low graft success was also undoubtedly due in part to infection of graft wounds by this pathogen. The problem was solved by replacing the red cedar with a much less susceptible but also less convenient species for rootstocks.

Phomopsis canker of gardenia, caused by *Phomopsis gardeniae*, results in a corky swelling at and above the soil line and a yellow-orange discoloration of the wood under the canker. Although the infection typically occurs at the base of the cutting under nursery conditions, some infected plants survive even into 5-gallon size before dying. Obviously many doomed plants are sold in apparently healthy condition.

Camellia canker, caused by *Glomerella cingulata*, results in great losses at some nurseries in certain cultivars; mortality of 50 percent or more in liners and young plants in gallon containers has been observed. When the plant is infected as a cutting, a reddish-brown discoloration extends under the bark from the base of the plant to varying distances above the ground. This phase of the disease is often confused with *Phytophthora* root rot caused by *P. cinnamomi* and others. It is necessary to distinguish the two diseases because different control measures are required for each. It is interesting to note that some nurseries have attempted and, not suprisingly, failed to control the canker disease using drenches of fungicides with activity only against the Phycomycetes, of which *Phytophthora* is a member. Most camellia cultivars grown in California seem to be resistant but some appear to be especially susceptible. These include Daikagura, Pink Parade, Leonard Messel, Jordan's Pride, Snow White, Pearl Maxwell, Kumasaka and Magnoliaflora. This list is not complete, and is based only on casual observations.

Jeff Dodson, a graduate student of Cal Poly, and this author have investigated some of the conditions necessary for infection of camellias by *G. cingulata*, hoping to learn how to better apply measures to control the disease. We looked at the above-ground phase, rather than the cutting phase since it is much easier to work with rooted plants than cuttings. Factors we looked at were: 1) the need for high humidity during infection, 2) the effect of temperature on infection, and 3) the length of time that wounds remained susceptible.

Young plants were wounded by removing a petiole and inoculated using a suspension of spores applied with a cotton swab. Eventually infected plants wilted above the point of inoculation and the leaves died.

Temperatures between 18° and 28°C (64° and 82°F) had no effect on disease incidence even though 23°C (73°F) is consid-

ered the optimum for the fungus. No difference was found in infection rate in plants incubated at less than 40% relative humidity, or in a saturated atmosphere in a plastic bag. Wounds made by breaking petioles become essentially non-susceptible after only 36 hours, again with no influence of temperature.

From these results it is concluded that relative humidity or available free water is not an important factor in infection of cut stems, and that any fungicide active against *G. cingulata* would provide sufficient protection for the brief period that wounds are susceptible to infection.

APPROACHES TO PLANT PROPAGATORS' INTEGRATED PEST MANAGEMENT

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Lately one only has to pick up the trade journals and find articles discussing integrated pest management (IPM) in the ornamentals industry. Scientists have many interpretations of IPM; it is described as a philosophy, discipline, system, or program. The researchers in agricultural endeavors welcome this as it elevates pest control to a more professional and technological level. The environmentalists look upon it as reducing or eliminating the use of pesticides. The legislators like it as everybody discusses and seems to like it and nobody is vigorously opposed to it. However, when everything has been said and outlined the growers are the people who must decide whether they want it or not. I would like to discuss some of these ideas as I see how and where they would fit into your industry. Every facet of the industry, beginning with the propagators to growers and even the retailers are actually using some of the principles of integrated pest management. First of all, let me give a definition of it by the National Research Council that you can understand. The Council stated, "It is a system of pest control that utilizes all suitable techniques in a compatible way to reduce pest populations and maintain them below the economic injury level."

Let me break this ". . . all suitable techniques in a compatible way to reduce pest populations and maintain them below the economic injury level" down to several categories: (1) Chemical Control, (2) Cultural Practices, (3) Preventive Measures, (4) Host-Plant Resistance, and (5) Biological Control.