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CYLINDROCLADIUM DISEASE OF AZALEAS STUDIED

A potentially serious disease of azaleas *(Rhododendron obtusum*), first described in the southeastern U.S. in 1955, lay quiescent until the mid-1960s when it suddenly appeared in epiphytotic proportions in many parts of the country. The cause of the disease was described as *Cylindrocladium scoparium*, a fungus previously known to attack primarily conifer seedlings. During the last several years, several species have been identified in the *Cylindrocladium* complex, and the number of ornamental plants reported to be affected by these fungi has increased at an alarming rate.

The Disease On Azalea

The rather sudden appearance of the *Cylindrocladium* wilt disease on azaleas during the mid-1960s coincided with the rapid expansion of the forcing azalea industry at that time. Many new cultivars of azaleas were released with horticulturally desirable characteristics, but unfortunately some of them were especially susceptible to *Cylindrocladium*. Many of these susceptible cultivars were propagated from cuttings in one area and shipped as liners to other areas of the country to be forced. During shipment and subsequent forcing, many of these liners suddenly began to defoliate and wilt (Figure 1). The wilt symptoms were essentially identical to those induced by *Phytophthora*, so diagnosis, and therefore control recommendations, were often not correct. Before long the industry was faced with a disease situation which had spread throughout the country, but nobody knew how it had happened or much about the cause.

Figure 1. Sudden wilt symptoms (center and right) on forcing azaleas caused by root and crown infections of *Cylindrocladium scoparium*.

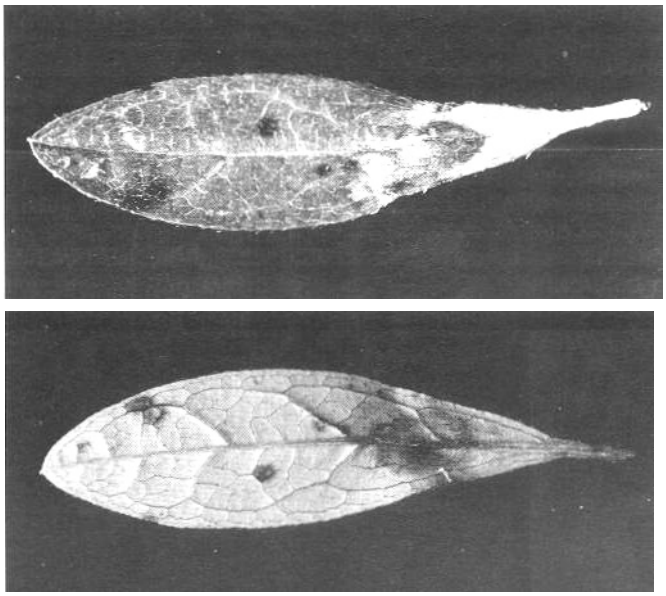

Figure 2. Leaf spot symptoms on forcing azalea caused by *Cylindrocladium scoparium*.

In analyzing the disease, several important clues surfaced. First, it appeared that liners shipped from the propagator were infected with *Cylindrocladium*, but showed no obvious symptoms. Secondly, the disease as it occurred in the southern, more humid areas, was a leaf spot (Figure 2) or blight, often in the cutting bed, but in other areas growers only observed sudden wilt or root rot symptoms. Though caused by the same organism, the two phases-aboveground and below-ground-seemed distinct, and unrelated. Lastly, there seemed to be a higher incidence of the wilt phase of the disease in plants subjected to certain stresses such as over-watering, over-fertilizing, high salts, etc. The result was that certain growers could force liners from a propagator without problems, while another would have serious losses.

Experimental

The objective of my research was to explain how the two phases of the *Cylindrocladium* disease-above-ground and below-ground-though often separated geographically, are linked, and how the dispersal of the disease probably occurred.

Azalea propagators probably have paid little or no attention to cuttings with minor blemishes or leaf spots. But we know that when cuttings are taken from stock plants with *Cylindrocladium* leaf spot, the pathogen is carried into the cutting propagation bed. That infected leaf becomes the link between the foliage disease and root disease, because *Cylindrocladium* can infect both leaves and roots. This characteristic makes *Cylindrocladium* different from many, if not most soilborne fungus pathogens. The situation is further complicated by the fact that only the lower leaves on a cutting are likely to be infected, so the infected leaves will probably be hidden when cuttings are stuck. Soon after the cuttings are stuck, the lower infected leaf will abscise and fall to the surface of the rooting medium. Our experiments were aimed at demonstrating that such leaves can provide the inoculum for root infections which result in the wilt phase of the disease some months later. *Cylindrocladium*-infected azalea leaves were placed on the surface of the rooting medium in flats under mist, the cuttings were rooted for two months, and then transplanted into 4-inch pots of sterile greenhouse mix. The fate of each cutting was recorded regarding its position relative to the inoculum leaves, the time until wilt symptoms occurred, and whether *Cylindrocladium* could be recovered by isolation either when the plant died or at the end of the experiment nine months after transplant (liner stage).

This study demonstrated that detached *Cylindrocladium*-infected azalea leaves on the rooting medium beneath the leaves of cuttings can provide sufficient inoculum to infect the cutting stem

and roots. Conidia of the fungus form on the infected leaves, and splash or wash into the rooting medium and infect the cutting stem or the new roots that develop. Many cuttings died before transplanting, especially those close to the inoculum. Those rooted cuttings farther away did not die until some months after transplanting. Of the surviving nine-month-old liner plants, most of which appeared healthy, 30-60 percent were found to be infected by culturing from the roots or stem. These plants had been on the periphery of the experimental infection center, but remained symptomless throughout the nine-month period.

Several possible factors can be postulated to explain why the infected plants remained symptomless. First, cuttings some distance from the inoculum source probably did not get as much conidial inoculum as those close to the source. Secondly, new roots form even more rapidly than the fungus kills roots. Finally, the cuttings and subsequent plants were under no moisture stress. The result was a plant with some portion of its roots infected, but the infection had not advanced into the crown and induced wilt symptoms. When these symptomless carrier plants were cultured, however, many showed dark streaks up the stem, a symptom which usually occurs prior to wilting.

Conclusions

These experiments demonstrated that azalea liners can be symptomless carriers of *Cylindrocladium*, and if so, they probably became infected during cutting propagation. The source of inoculum can be cuttings with leaves infected with the pathogen. Based on this information, propagators should 1) avoid cuttings with *Cylindrocladium* leaf spot either by spraying stock plants with protective fungicide or taking young cuttings from production plants, 2) remove dead cuttings or those showing defoliation and or red-veined leaves, 3) remove cuttings from the periphery of infection centers even though they show no wilt symptoms, and 4) remove the rooting medium from infection centers, and never re-use the medium without prior sterilization. These cultural practices can effectively reduce the incidence and severity of the *Cylindrocladium* wilt disease of azalea.

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