Although Alternaria diseases are quite common on many ornamentals, they have not received much attention in recent years. Other fungi that cause spots on ornamentals include Bipolaris, Corynespora, Drechslera, Helminthosporium, Stemphylium and Ulocladium. These fungi are closely related to Alternaria, and the diseases they cause can usually be controlled with the same fungicides and methods that control Alternaria leaf spot. The most common species of Alternaria found on ornamentals is *A. alternata*. This species has a very wide host range, including antirrhinum, asclepias, calathea, callistephus, chrysanthemum, clarkia, dahlia, ficus, hedera, helianthus, hibiscus, oenothera, pelargonium and petunia. In other situations, a single plant may be attacked by a number of different species of Alternaria. For example, helianthus (sunflower) is attacked by *A. alternata*, *A. helianthi*, *A. helianthinficiens* and *A. zinniae*. Finally, in many cases, the exact species of Alternaria responsible for a disease remains to be identified (see Figure 1, right).

Spores of *Alternaria spp.* are dark brown to black and appear in felt-like black masses on leaf and petal spots when conditions are ideal. Their size, and the fact that each spore has many cells, makes them a little longer-lived on the leaf surface than spores of fungi causing powdery or downy mildew or Botrytis blight. Their dark color actually protects them somewhat, like melanin protects us from the UV rays of the sun. They generally move by splashing water or by very strong winds. In a number of plants, such as zinnia, the infection originates in contaminated seed. Spread of Alternaria diseases from one type of flower to another can occur with some species (like *A. alternata*) so control measures must focus on all susceptible plants.

**SPECIFIC DISEASES**

*Alternaria* leaf spot of *Coreopsis spp.* is characterized by small spots, which are initially water-soaked. These spots turn reddish-brown, may reach ¼ inch in diameter and are roughly circular. Spots generally do not merge. This disease is most often found on landscape *Geranium spp.* or Martha Washington geraniums and rarely on zonal geraniums. On petunia, the disease is characterized by small spots that are initially water-soaked. These spots turn reddish-brown or black, may reach ¼ inch in diameter and are roughly circular. Their centers are frequently tan to white. Spots can merge and in severe infections readily cause blighting, especially in the landscape.

*Alternaria* leaf spot of impatiens is characterized by small spots that are initially water-soaked. These spots turn reddish-brown with tan centers, may reach ¼ inch in diameter and are round. Spots frequently merge to affect most parts of the leaf. In the early 1990s this disease was very common but is less so these days. I rarely see this disease outside landscape plantings in the Southeastern United States.

*Alternaria dianthi* and *A. dianthicola* each cause diseases on carnation and pelargonium (geranium). The former causes red spots on leaves and flowers in the landscape; this species only attacks amaranthus, nicotiana, passiflora and santolina. *A. dianthicola* also causes spots on lychnis and silene.

*Eustoma (Lisianthus)* is brown, may reach ¼ inch in diameter, and are roughly circular. Spots generally do not merge. This disease is most often found on landscape *Geranium spp.* or Martha Washington geraniums and rarely on zonal geraniums. On petunia, the disease is characterized by small spots that are initially water-soaked. These spots turn reddish-brown or black, may reach ¼ inch in diameter and are roughly circular. Their centers are frequently tan to white. Spots can merge and in severe infections readily cause blighting, especially in the landscape.

*Zinnia elegans* can be seed-borne and often in mixed infections with Xanthomonas (also seed-borne); often found on leaves and flowers in the landscape; this species also attacks sunflower.
rainbow pinks. They are typified by gray-brown leaf and petal spots with purple margins and black spore masses that form in spots. Disease spreads via contaminated plants and by water splashing from irrigation or rainfall. Free water is needed for 10 hours before infection can take place. Some cultivars of rainbow pink show a moderate level of resistance to this leaf spot (see Figure 2, right).

Alternaria leaf spot on alstroemeria is most common in cut flower production. Spots are relatively large, reaching 1/2-inch long, and are elliptical with white centers and black or purple margins. The ends of these spots can run along leaf veins in severe infections or on a particularly susceptible cultivar. The disease is difficult to control due to production practices that result in dense plantings up to 40 inches wide and 60 inches high. In such cases, early detection and/or preventative fungicides can help.

Alternaria leaf spot of Salvia spp. (usually found on blue salvia) is characterized by small water-soaked areas. These spots turn reddish-brown or black, may reach 1/8 inch in diameter and are roughly circular. Spots can merge and in severe infections readily cause leaf drop, especially in the landscape. This disease sometimes appears similar to Puccinia rust until leaf undersides are examined to reveal the dark brown rust spores of the later disease.

On vinca, small black leaf spots appear anywhere on the leaf, sometimes on petioles and stems and occasionally on flower petals. Spots range from pinpoint to about 1/4-inch wide. In severe infections, flowers become infected and die prematurely. This disease was first found in Florida but has been reported in other states (especially in the South). Vinca cultivars differ in resistance to Alternaria leaf spot. Highly susceptible cultivars were ‘Cooler Grape’, ‘Cooler Peppermint’, ‘Cooler Blush’, ‘Tropicana Pink’ and ‘Little Blanche’. ‘Tropicana Rose’, ‘Tropicana Bright Eye’, ‘Tropicana Blush’ and ‘Paraso’ had consistently lower levels of Alternaria leaf spot than the others. In many cases, these older cultivars have been supplanted by newer culti-
Alternaria leaf spot on scheffleras (Brassaia actinophylla) was very common when I worked at the University of Florida. The disease is caused by A. panax and is characterized by large (up to 2-inch) black spots on schefflera but also attacks aralia, dizygotheca, panax and polyscias. Resistant cultivars of schefflera have been developed.

**CONTROL METHODS**

Although impractical in the landscape, elimination of water on leaves can control Alternaria leaf spot. Always use pathogen-free plants when available. Early diagnosis of a problem is also critical, since choosing appropriate control measures depends upon an accurate diagnosis.

Cultivar resistance screening in certain crops, including marigold, impatiens, rainbow pink (Dianthus chinensis) and vinca, has received a lot of attention for a few Alternaria disease. In the past few years, Dr. Austin Hagan (Auburn University) has trialed many marigold cultivars for resistance to Alternaria leaf spot. Under their field conditions marigolds are very susceptible to Alternaria leaf spot. The researchers could find no French or African marigold cultivars with significant resistance to A. tagetica. In contrast, tests with either vinca cultivars or rainbow pinks did demonstrate a number of cultivars with significant resistant to Alternaria leaf spot (see Figures 2 and 3, page 40).

Many trials have been completed in the past few years on Alternaria leaf spots on ornamentals, including marigold, zinnia, impatiens, dusty miller and poinsettia (see Figure 4, left). Several studies on benomyl and the closely related thiophanate methyl compounds have shown that if they are used on Alternaria leaf and flower spots the disease can actually be made more severe. This class of fungicides does not control Alternaria (or any closely related fungus) and should not be used for this purpose. Phosphonates, like Aliette, are also ineffectve against this type of leaf spot disease. In the past couple of years, we have tested the ability of strobilurins as well as phosphonates to control a wide variety of Alternaria on verbena.
pests & diseases

Figure 5. Efficacy of some strobilurins and phosphonates in preventing Alternaria leaf spot on Zinnia elegans ‘Profusion Orange’ (Chase Research Gardens, Inc., 2005).

An earlier trial performed on impatiens tested a variety of products for Alternaria leaf spot control. In this case, plants were sprayed three times on a seven-day interval, with inoculation one day after the first application. As with the zinnia trial, phosphonates (Mimik-64 oz./100 gal. and Aliette-16 oz./100 gal.) were ineffective, while Daconil Ultrex (1.4 lb./100 gal.) and Chipco 26019 (16 oz./100 gal.) were 100 percent effective.

Figure 6, above, presents a summary of trials conducted throughout the United States on a wide range of ornamentals for control of Alternaria leaf spot. You can see that there are quite a few choices for prevention of Alternaria leaf spot on many ornamentals. You can probably use other factors such as REI, cost, plant safety and residue to choose the right fungicide for prevention of Alternaria leaf spot on your crops.

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