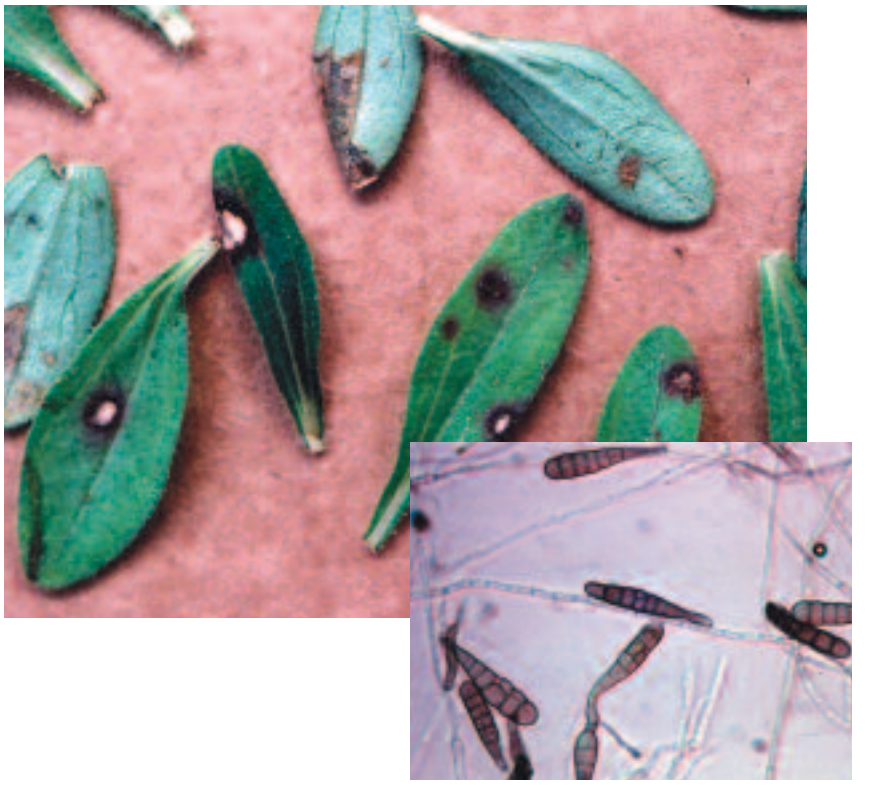
Advanced Treatment of Alternaria



Top: *Alternaria on zinnia.* ***Bottom:*** *Alternaria spores. (All photos courtesy of A.R. Chase)*

Learn about the latest research in controlling this disease.

By A. R. Chase

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. helianthis*, *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 ⅛ inch in diameter and are roughly circular. Spots generally do not merge, but mixed infections with other fungi, such as Rhizoctonia, are common.

Alternaria alternata (same as *A. tenuis*) causes a leaf spot on geraniums that is characterized by small, water-soaked lesions. These spots turn reddish-brown, may reach ¼ inch in diameter and are roughly circular with a yellow border. 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 ⅛ 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 ⅛ 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

Figure 1. Specific diseases of ornamentals caused by Alternaria spp.

Plant (common name)	Pathogen (species)	Comments (appearance and plant part attacked)
Brassaia (schefflera)	*A. panax*	Large (up to 2-inch) black spots on schefflera; also attacks aralia, dizygotheca, panax and polyscias.
Calendula	Unidentified	Reddish-purple leaf spots.
Catharanthus (vinca)	Unidentified	Flowers and leaves have spots; cultivars show varying levels of resistance; leaf drop occurs in severe infections.
Dianthus spp. (carnation/rainbow pinks)	*A. dianthicola*, *A. saponariae*	Can be confused with Helminthosporium and Heterosporium (fairy ring) leaf spots; cultivars show different reactions; *A. saponariae* also causes spots on lychnis and silene.
Euphorbia pulcherrima (poinsettia)	*A. euphorbiae*, *A. euphorbiicola*	Stem spots occur as well as leaf spots, which are small, chlorotic spots with dark margins; sometimes causes puckering.
Eustoma (Lisianthus)	Unidentified	Damping-off can occur.
Impatiens	Unidentified	Leaf spots appear similar to impatiens necrotic spot virus and Pseudomonas leaf spot; get this diagnosed.
Matthiola (stock)	*A. raphani*	Confused with Anthracnose; usually tan spots with felt-like black spore clusters.
Pelargonium (geranium)	*A. alternata*	Small, tan circular spots form on landscape plants.
Petunia	*A. alternata*, *A. solani*	Not very common; also found on amaranthus and ipomoea.
Platycodon (balloon flower)	Unidentified	Large, tan spots with yellow borders usually in landscapes.
Melampodium	Unidentified	Large, black spots.
Salvia (especially *S. farinacea*)	Unidentified	Leaf drop occurs in severe cases.
Senecio (dusty miller)	*A. cinerariae*	Large, black spots start on cotyledons; appears seed-borne and is less common in recent years.
Tagetes (marigold)	*A. tagetica*	Black spots with white centers and purple margins.
Viola (pansy/viola)	*A. tenuissima*	Small tan spots with red or purple margins that are easily confused with Anthracnose; this species also attacks amaranthus, nicotiana, passiflora and santolina.
Zinnia elegans	*A. zinniae*	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 ½-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 on alstroemeria.

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 ⅛ 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 ⅛-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-

Figure 2. Dianthus chinensis *(rainbow pink) cultivar severity of Alternaria leaf spot.*

Low Disease	Medium	Medium-high	High Disease
Bouquet series	'Ideal Cherry Picotee'	'Ideal Rose'	'Festival Carmine Rose'
Cinderella series	'Floral Lace Picotee'	'Floral Lace Crimson'	'Ideal Carmine'
'Ideal Salmon'	'Ideal White'	'Ideal Coral'	'Floral Lace Violet'
	'Corona Cherry Magic'	'Floral Lace Violet Picotee'	'Floral Lace Rose'
	'Ideal Pearl'	'Floral Lace True Rose'	'Ideal Raspberry'
	'Ideal Violet'	Valentine	'Ideal Fuschia'
	'Ideal Violet Picotee'	'Festival Cherry Picotee'	'Ideal Crimson'
	'Floral Lace Lilac'	'Ideal Pink'	'Ideal Cherry'
	'Floral Lace Purple'		'Floral Lace Cherry'
	'Ideal Blush'		

Holcomb, G. E. and A. Witcher. 2003. Reaction of rainbow pink cultivars to Alternaria leaf spot, 2003. Biological and Cultural Tests, *Vol. 19:0003.*

Figure 3. Catharanthus roseus *(vinca) cultivar severity of Alternaria leaf spot.*

Low Disease	Medium-low	Medium	Medium-high Disease
'Titan Polka Dot'	'Victory Carmine'	'Victory Blue'	'Victory Lavender'
'Victory Deep Pink'		'Victory Cranberry'	
'Titan Burgundy'		'Victory Pure White'	
'Titan Punch'		'Victory Grape'	
		'Victory Apricot'	
		'Victory Purple'	

Holcomb, G. E. and A. Witcher. 2004. Reaction of vinca (Madagascar periwinkle) cultivars to Alternaria leaf spot, 2004. Biological and Cultural Tests, *Vol. 20:0004.*

vars (see Figure 3, below). ➧

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.

Figure 4. Summary of fungicide efficacy trials on Alternaria diseases of ornamentals.

Product	Chemical class	Degree of control
Aliette	Phosphonate	None
BAS500 (Insignia)	Strobilurin	Excellent
Banner Maxx	Sterol inhibitor	Fair to very good
Camelot	Copper	Fair to very good
Chipco 26019	Dicarboximide	Very good to excellent
Cleary 3336	Benzimidazole	None to good
Compass 0	Strobilurin	Good to excellent
Cygnus	Strobilurin	Some
Daconil	Aromatic benzene	Very good to excellent
Decree	Hydroxyanilid	Fair
Dithane	Dithiocarbamate	Good to very good
Eagle (Systhane)	Sterol inhibitor	Poor to excellent
Endorse	Antibiotic	Good to excellent
Fosphite	Phosphonate	None
Heritage	Strobilurin	Good to excellent
Junction	Copper/Carbamate	Good
Kocide	Copper	Very good
Medallion	Phenylpyrrole	Excellent
Mimik	Phosphonate (experimental)	None
Phyton 27	Copper	Fair to excellent
PlantShield	Biological agent-fungus	None
Protect T&O	Carbamate	Good to very good
Rhapsody	Biological agent-bacterium	None to poor
Spectro	Aromatic benzene/benzimidazole	Very good to excellent
Strike	Sterol inhibitor	Very good
Terraguard	Sterol inhibitor	Good to excellent

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 ineffective 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.

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

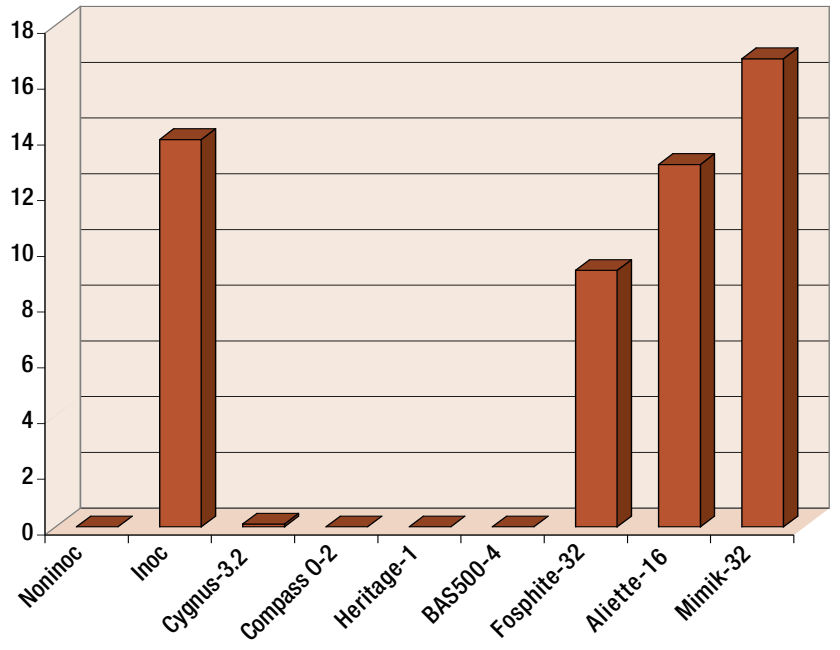
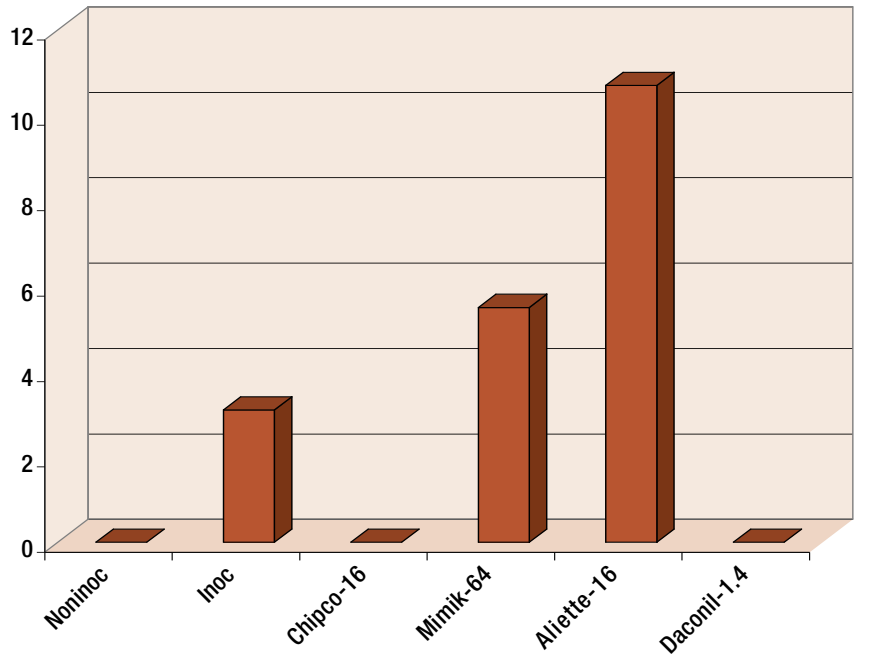


Figure 6. Efficacy of phosphonates and fungicide standards in preventing Alternaria leaf spot on Impatiens wallerana *'Super Elfin Violet'. Chase Research Gardens, Inc., 2004).*



diseases, including Alter-naria leaf spot on impatiens and zinnia. Figure 5, page 44, shows the response of zinnias to preventative applications of four ➧ strobilurins (Cygnus-3.2 oz./100 gal., Compass O-2 oz./100 gal., Heritage-1 oz./100 gal. and BAS500-4 oz./100 gal.) and three phosphonates (Fosphite-32 oz./100 gal., Aliette-16 oz./100 gal. and Mimik-32 oz./100 gal.). Plants were sprayed three times on a 10-day interval, with inoculation four days after the second application. All treatments were safe on these zinnias ('Profusion Orange'). As this trial clearly shows, strobilurins are very effective, while phosphonates are ineffective. Strobilurins can be very effective but occasionally not as good as the zinnia graph shows. Since we applied all products twice before inoculating this may be the key to effective use of strobilurins.

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. GPN

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