ALABAMA COOPERATIVE Extension SYSTEM

ANR-1214

ALABAMA A&M AND AUBURN UNIVERSITIES

Diseases of Pansies and Their Control

Leaf Spot Diseases

There are two common fungal leaf spot diseases that may damage pansies, *Viola x wittrockiana,* in the landscape or greenhouse. Anthracnose, caused by *Colletotrichum gloeosporioides,* and Cercospora leaf spot, caused by *Cercospora violae,* each causes severe damage to the overall appearance of pansy plantings and reduces the economic value of greenhouse crops. Both diseases require high relative humidity and moisture for their development and spread.

Anthracnose can be a problem in landscape and greenhouse plantings throughout the growing and production seasons, respectively. Symptoms first appear as pale white or cream-colored circular spots (one-eighth to one-fourth inch in diameter) on upper surfaces of leaves and occasionally on stems (Figure 1). Spots have thin dark brown or black borders. Often spotting is most severe on lower leaves where humidity is highest. When conditions are humid or wet, tiny black specks may appear on the surface of spots. These specks develop into spore masses of the fungus. Splashing rain or irrigation droplets falling onto spore masses disperse the spores to nearby healthy foliage. New spots typically appear on the previously healthy leaves and stems about 1 week after infection.

Figure 1. Anthracnose leaf spots on pansy

Figure 2. Cercospora leaf spot on pansy

Figure 3. Small white spots of powdery mildew in early stages of development on pansy leaves

Figure 4. Botrytis flower stem blight with fungal growth

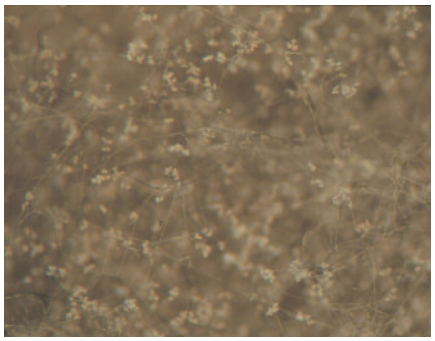

Figure 5. Botrytis at 10X magnification

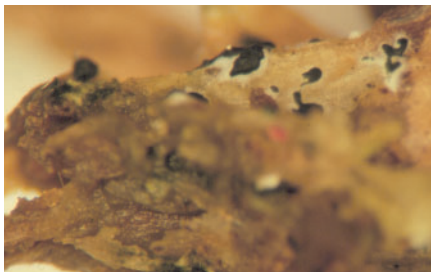

Figure 6. Myrothecium crown rot with black fruiting bodies and white spore masses at 10X magnification

Figure 7. Black roots typical of Thielaviopsis black root rot (Healthy plant on the right and diseased plant on the left)

Table 1. Anthracnose and Leaf Spot Diseases

Fungicides	Rates		Comments
	per gallon	per 100 gallons	
azoxystrobin			
Heritage 50W	—	1 to 4 oz.	Apply to foliage to runoff before symptoms are seen. Reapply as needed every 7 to 14 days. Shorten interval and increase rate when conditions favor disease development. Add a small amount of a spreader sticker or liquid detergent (¼ tsp. per gallon) to improve coverage of foliage with wettable powder (W) formulations.
chlorothalonil			
Daconil Weather Stik	—	1⅜ pt.	
Daconil Ultrex	—	1.4 lb.	
Daconil 2787 4F	2 t.	2 pt.	
mancozeb			
Fore 80W	1 T.	1.5 lb.	
thiophanate-methyl			
3336 50W	—	12 to 16 oz.	
3336 4.5F	—	10 to 20 fl. oz.	
Halt 50W	1 T.	—	
trifloxystrobin			
Compass 50W	—	2 to 4 oz.	

Cercospora leaf spot occurs most frequently in landscape plantings in early to midspring. Outbreaks of this disease also develop in early fall on greenhouse flat- and pot-grown pansies. Spots are approximately one-fourth inch in diameter, circular, and dark charcoal gray with a slightly raised feathery texture (Figure 2). Lower leaves are often severely spotted and usually fall from the plants. Spores of the fungus, which are produced when conditions are humid, are easily moved to nearby healthy foliage by wind currents and splashing water droplets. New leaf spots appear about 1 week after spore dispersal and infection begin.

Control of these leaf spot diseases involves (1) removal of severely spotted plants or leaves; (2) modification of watering practices so that foliage does not remain wet for prolonged periods; and (3) fungicide applications, which are needed in some situations. In landscapes or greenhouses, removal of infected plants is recommended. If diseased plants are not removed, they will serve as a reservoir of inoculum for future disease spread. If possible, fallen leaves should be removed from the area. In the late fall, the areas where disease is present should be thoroughly cleaned by removal of all pansy debris. When preparing to plant in the spring, bedding plant locations should be rotated so that the same type of plants are not installed into the same areas every year. Greenhouses should be thoroughly cleaned between crops. All pansy debris should be removed from the house. Benches, pots, tools, and floors should be thoroughly cleaned of debris. In landscapes, irrigation should be scheduled for the morning so that the foliage will dry quickly. Bedding plants should be located in landscape areas with well-drained soil. Greenhouses should follow similar practices regarding irrigation and drainage. Where large numbers of plants are involved, application of protective fungicide sprays is often recommended. Label directions should be followed carefully. See Table 1 for specific fungicides labeled for the control of these diseases.

Powdery Mildew

Powdery mildew may occur in March and April in landscape plantings of pansy. Fluctuating temperatures typical of spring and fall and high humidity are conditions favorable for disease development and spread. Although powdery mildew will not directly kill pansy, severe infections may reduce their vigor and ultimately speed up plant decline. Pansy cultivars differ considerably in their susceptibility to powdery mildew.

Small discrete, faint white patches that consist of numerous threadlike hyphae and spores of the causal fungus *Sphaerotheca macularis* appear on the petioles and leaves (Figure 3). These patches increase in size until the entire leaf surface is covered by the white threadlike growth of the causal fungus.

Typically, outbreaks of powdery mildew on pansy become noticeable shortly before the plants are replaced with summer annuals. As a result, protective fungicide treatments are rarely needed to protect plantings of pansy from powdery mildew. Plantings should be periodically inspected for disease symptoms. If the characteristic white colonies are seen and the plants are young, then begin fungicide applications. See Table 2 for a list of fungicides cleared for the control of powdery mildew on pansy. The fungicides used to control Cercospora leaf spot (Table 1) will also control powdery mildew.

The severity of powdery mildew varies considerably among cultivars of pansy. In field trials in Alabama, 'Bingo Clear Azure,' 'Imperial Silver Blue,'

Table 2. Powdery Mildew

Fungicides	Rates		Comments
	per gallon	per 100 gallons	
azoxystrobin			
Heritage 50W	—		Apply to foliage at first sign of disease. Reapply every 7 to 14 days as needed. Shorten interval and increase rate when conditions favor disease. Add a small amount of a spreader sticker or liquid detergent (¼ tsp. per gallon) to improve coverage of foliage with wettable powder (W) formulations.
thiophanate-methyl			
3336 50W	—	12-16 oz.	
3336 4.5F	—	10-20 fl. oz.	
Halt 50W	1 T.	—	
parafinnic oil			
Sun Spray Ultra Fine Oil	1% v/v	1 gal.	
trifloxystrobin			
Compass 50W	—	2-4 oz.	

'Crown Orange,' and 'Imperial Beaconfield' developed extensive powdery mildew of the foliage. Little if any damage was seen on most of the remaining pansy cultivars evaluated.

Botrytis Blight

Botrytis blight, caused by the fungus *Botrytis cinerea,* may be a problem in the landscape and in greenhouse production. Temperatures in the low 50s to upper 70s combined with prolonged periods of high humidity and frequent rain or overhead irrigation favor disease development. Flowers and flower stems are especially susceptible to attack by Botrytis.

Botrytis blight causes brown spots or blotches on flowers and flower stems (Figure 4). When the disease is severe and conditions are wet, leaves and major stems may become spotted, cankered, and blighted. In some situations, individual spots on leaves may have a slight zonate pattern. Severely damaged plants may collapse and die. When humidity is high, the fungus will form a dark to light gray webby growth on the surfaces of blighted leaves and flowers. If examined closely, the fungal growth may display a branchlike network with scattered, small light gray knots or clusters (Figure 5). Such knots or clusters are groups of spores that will be dispersed to nearby foliage by wind currents or splashing water.

Disease control involves (1) removing diseased plants; (2) reducing humidity and moisture; and (3) in certain cases, applying protective fungicide treatments. In a greenhouse, diseased plants should be removed. Production benches, pots, and tools should be thoroughly cleaned. For details on this clean-up process, see Extension publication ANR-753, "Identification and Control of Botrytis Blight on Floral Crops and Woody Ornamentals." Irrigation should be applied at midday so that foliage does not remain wet during night hours. Plants should be spaced and fans should be adjusted so that relative humidity is kept as low as possible. Heating cool air to temperatures of 75 degrees F or higher and venting warm moist air will help prevent continued development of the fungus, especially when these practices are applied during evening hours. Protective fungicides are recommended in many greenhouse situations when Botrytis blight has been detected. See Table 3 for fungicides labeled for Botrytis control on pansy, and follow all label directions.

Botrytis blight on pansy in the landscape is a problem only when the weather is cloudy, mild, or slightly cool with high humidity and abundant moisture. Botrytis does not readily spread under conditions of low humidity. When disease does occur, however, it is wise to remove the diseased plants and, if possible, increase plant spacing to improve air circulation. Planting pansies in low wet areas should be avoided. Watering should be done midday so that foliage will dry quickly. Applications of a protective fungicide are recommended only where large plantings are involved. See Table 3 for fungicides labeled for Botrytis control, and always follow label recommendations.

Myrothecium Crown Rot

The fungus *Myrothecium roridum* causes a crown (lower stem) rot and a petiole rot of pansy. This disease is typically a problem in greenhouses; however, Myrothecium crown rot has been observed occasionally in landscape plantings. Infection and damage occur under conditions of moderate temperatures and moderate soil moisture.

Symptoms begin as a brown soft rot of the crown and possibly the nearby leaf petioles (Figure 6). When crown rot is severe, a rapid wilt and collapse of the plant follow. Tiny white and black bodies (spore masses), just barely visible as specks, usually develop on the infected crowns (Figure 6). The white spore masses are easily spread by splashing or flowing water. When

Table 3. Botrytis Blight

Fungicides	Rates		Comments
	per gallon	per 100 gallons	
azoxystrobin			
Heritage 50W	—	4 to 8 oz.	Apply to foliage and flower buds when disease is observed. Reapply as needed every 7 to 14 days. Shorten interval and increase rate when conditions favor disease. Add a small amount of a spreader sticker or liquid detergent (¼ tsp. per gallon) to improve coverage with wettable powder (W) formulations.
chlorothalonil			
Daconil Weather Stik	—	1⅜ pt.	
Daconil Ultrex	—	1.4 lb.	
Daconil 2787 4F	2 t.	2 pt.	
fenhexamid			
Decree 50W	—	1.0 to 1.5 lb.	
iprodione			
Chipco 26019 50W	—	1 to 2 lb.	
mancozeb			
Fore 80W	1 T.	1.5 lb.	
thiophanate-methyl			
3336 50W	—	12 to 16 oz.	
3336 4.5F	—	10 to 20 fl. oz.	
Halt 50W	1 T.	—	
trifloxystrobin			
Compass 50W	—	2 to 4 oz.	

infected plants are pulled, the shoots frequently separate from the roots. Wounding from mechanical transplant machines has been shown to possibly increase disease susceptibility and incidence.

Disease control in a greenhouse situation requires disposal of all diseased plant material, associated cell packs or pots, and media. Trays, benches, and tools should be thoroughly cleaned and disinfected before reuse. In many greenhouse situations, it may be more practical, effective, and economical to replace plug flats and flats rather than cleaning these items. Irrigation should be applied so as to insure that plants do not remain wet for prolonged periods. Protective fungicide treatments are often recommended when the disease has been observed in the house or area. See Table 4.

In the landscape, disease control requires removal of the damaged plants and all plant debris. Also, pansies should not be grown in the diseased area for the next 1 to 2 years. Watering practices should be adjusted so that plants do not remain wet for prolonged periods. Low wet areas for plantings should be avoided. Fungicides are not generally recommended in landscape areas unless the plantings are extensive.

Black Root Rot

Black root rot is a disease caused by the soilborne fungus *Thielaviopsis basicola*. The disease has been observed in both landscape and greenhouse situations, but greenhouse problems are usually more common. Disease development is usually favored by alkaline soil or media (pH 6.5 to 8.0), cool to moderate soil temperatures (56 to 77 degrees F), and moderate to high levels of soil moisture.

Symptoms initially appear as black spots or bands on the normally white roots. Root tips are often infected and black in color when spores of the fungus are present. In some situations, infected roots become brown and cannot be distinguished from other root rot diseases by visual inspection. (Most root rot diseases require laboratory study for an exact diagnosis. See Extension publication ANR-450, "Plant Diagnostic Lab Services," for details on

Table 4. Myrothecium Leaf Blight and Collar Rot

Fungicides	Rates		Comments
	per gallon	per 100 gallons	
Chlorothalonil			Apply to leaves, leaf petioles, and root collar, as well as to soil around base of plant when symptoms are seen. Reapply as needed every 7 to 14 days. Shorten interval and increase rate when conditions favor disease. Add a small amount of a spreader sticker or liquid detergent (¼ tsp. per gallon) to improve coverage of foliage with wettable powder (W) formulations.
Daconil Weather Stik	—	1⅜ pt.	
Daconil Ultrex	—	1.4 lb.	
Daconil 2787 4F	2 t.	2 pt.	
Trifloxystrobin			
Compass 50W	—	2 to 4 oz.	

submitting plant samples for laboratory testing.) As the disease spreads throughout the root system, the plant becomes increasingly unthrifty, stunted, and sometimes yellowed, similar to a nitrogen deficiency. Wilt may or may not occur, depending on the plant and the extent of root damage. In many cases, stunting and yellowing of the foliage, beginning with the older foliage, are the only aboveground symptoms. The entire root system on severely infected plants may become black and rotted (Figure 7). Typically, these plants quickly wither and die. Black root rot usually is spread by movement of contaminated water, soil, or plants.

In greenhouses, control of black root rot involves removal of infected plants and associated media and pots. Benches, trays, and tools should be thoroughly washed and treated with a disinfectant labeled for greenhouse use. In many greenhouse situations, purchase of new plug flats and flats would be easier, more effective, and more economical than attempts to disinfect these items. This fungus may be introduced into greenhouses in peat-based potting media. Avoid situations of moisture or fertilization imbalances. Protectant fungicide drench treatments are frequently recommended to prevent disease development. See Table 5 for fungicides labeled for control of black root rot on pansy. Always follow label directions.

In the landscape, pansies with black root rot should be identified and removed quickly. Remove soil associated with roots along with the infected plants and plant debris. Soil pH levels should be checked and adjusted at or slightly below 6. Avoid planting pansies in the same area for a 1- to 2-year period. Planting pansies in areas of good soil drainage and providing them with appropriate fertilization will help keep them vigorous and less susceptible to black root rot.

Pythium Crown and Root Rot

Several species of the soilborne fungus *Pythium* are common crown and root rot disease agents of pansy and other greenhouse crops. Wet soil conditions for prolonged periods are required for this disease to develop. Plants previously stressed by drought or applications of excessive levels of fertilizer are more susceptible to infections by Pythium.

Pythium symptoms initially appear as water-soaked, sometimes sunken, lesions at the base of the stem near the soil line or on roots, especially young roots. Infected roots will be light brown in color, slightly darker than the normal root coloration (Figure 8). In some situations, the color of decayed stem or root tissues is hardly discernable from normal tissue color. Decay can be detected when there is lack of integrity or firmness of the tissues. An easy way to check for decay of small roots is to grasp the root between the thumb and forefinger and pull down gently. If the root is decayed, the outer cortex of the root will easily slip away from the central root cylinder. Aged root decay becomes darker brown in color, similar to other root rot diseases. As root deterioration progresses, foliage will begin to wilt and yellow, and plants will become stunted. Dieback can also develop. Water movement can disperse the fungus between infected and healthy plants.

Control of Pythium crown and root rot in greenhouses requires removal of infected plants and associated potting material and pots. Benches, trays, and tools should be washed and treated with a greenhouse disinfectant. For many greenhouse operations, it would be best to replace plug flats and flats rather than attempting to clean and disinfect these items. Watering practices and potting media should be adjusted to prevent prolonged periods of water-saturated media. Once Pythium is detected, protective fungicide drench treatments are often recommended. See Table 6 for fungicides labeled for control of Pythium on pansies.

Table 5. Thielaviopsis Black Root Rot

Fungicides	Rates		Comments
	per gallon	per 100 gallons	
Thiophanate-methyl			
3336 50W	—	12 to 16 oz.	Apply as a drench to the media or soil around base of plant before symptoms are seen. Reapply, as needed every 1 to 2 months. Shorten interval and increase rate when conditions favor disease.
3336 4.5F	—	16 to 20 fl. oz.	
Thiophanate-methyl + etridiazole			
Banrot 40W	—	4-8 oz.	
Triflumizole			
Terraguard 50W	—	2-4 oz.	

Phytophthora Aerial Blight, Crown Rot, and Root Rot

The soilborne fungus *Phytophthora nicotiana* (formerly *P. parasitica)* can cause foliar blight and crown and root rot of pansy. Wet conditions are necessary for this fungus to be active in causing disease. In the case of root rots, research has shown that drought or excessive applications of fertilizer will result in increased susceptibility to Phytophthora. Both aboveground and belowground phases of the disease may be present on landscape or greenhouse pansies, but foliar disease is more prevalent on landscape plants, while crown and root rot diseases are more common on pansies in greenhouse production.

Foliar blight or aerial blight often develops at temperatures of 75 to 85 degrees F when humidity levels are high and foliar moisture is abundant. Reports indicate that this disease develops rapidly at temperatures of 82 degrees F and higher. Leaves and stems on infected plants develop watersoaked spots that are light brown in color. Spots are irregular in shape and spread quickly to involve large areas of the plant. (Figure 9). When wet conditions occur, lesions girdle stems and foliage blight involves large portions of the plant. Drier conditions typically slow disease spread. Death of plants usually results from a combination of dieback from girdled stems and spread of foliar leaf blight. Splashing water droplets easily spread the disease. Spores may also be carried to other plants by water movement in the soil.

Control of aerial blight in the landscape involves removal of diseased plants and plant debris, reduced or adjusted irrigation practices, and planting in areas where soils drain well. Fungicide application is not usually recommended in landscapes unless the disease occurs on young plants in large plantings. Diseased plants should be removed as soon as possible after discovery. Care should be taken to remove whole plants, including roots as well as the associated soil. Removed plants should be placed in a bag at the location of removal to prevent contamination of other plants in the bed. If possible, soil drainage in the area should be improved. Irrigation practices should be modified to reduce the time that foliage remains wet. When appropriate, the length of irrigation periods should also be reduced so that soil does not become overly saturated for prolonged periods. See Table 6, if large plantings are involved and protective fungicide use is desired. Unfortunately, recent testing has shown that none of the fungicides currently available provide 100 percent disease control under conditions favorable for disease spread.

In a greenhouse situation, disease control requires removal of diseased plant material, taking care not to contaminate healthy plants with diseased plant parts or potting media. Benches, trays, pots, and tools must be washed thoroughly and treated with a greenhouse disinfectant before reuse. For many greenhouse situations, replacement of plug flats and flats is recommended rather than attempting to clean and disinfect these items. Irrigation schedules should be reviewed and adjusted to reduce the presence of excess water. Fungicide applications will give some protection against disease spread. See Table 6 for fungicides labeled for control of Phytophthora foliage blight in a greenhouse.

The crown and root rot phase of Phytophthora, which may be caused by *P. nicotiana* or other species, produces symptoms that resemble Pythium crown and root rot. In some situations, Phytophthora may cause a watersoaked rotting of tissues that has a darker brown discoloration and is easier to visually detect than with Pythium. Pulling on the outer cortex, as was described earlier for Pythium crown and root rot, can reveal tissue deterioration. Confirmation of Phytophthora or Pythium crown and root rot often requires laboratory testing. As root and crown rot progresses, foliage usually develops wilt and dieback. Stunting and yellowing may also result from crown and root rot caused by Phytophthora.

Control of Phytophthora crown and root rot in the landscape or greenhouse is the same as for Pythium. See Table 6 for fungicides labeled for control of Phytophthora crown and root rot. Pythium and Phytophthora are very similar fungi in many respects, and many fungicides that are labeled for Pythium are also labeled for Phytophthora.

Rhizoctonia Foliar Blight, Crown and Root Rot

The fungus *Rhizoctonia solani* causes foliar blight and crown and root rot diseases of pansy. This fungus is not as commonly seen as the fungi mentioned previously, but it does occasionally cause problems. High humidity and moisture favor the foliar phase of the disease; moderate soil moisture favors the crown or root rot phase. Foliar blight appears as brown, somewhat dried lesions on stems and as spreading brown lesions on leaves (Figure 10). Blight may involve large portions of the leaves and stems. Girdled stems result in complete plant collapse. When conditions are humid, a fine fungal webbing may develop and eventually cover portions of the blighted tissues.

Table 6. Pythium Root and/or Collar (Crown) Rot; Phytophthora Aerial Blight and/or Root/Collar Rot

Fungicides	Rates		Comments
	per gallon	per 100 gallons	
etridiazole			
Truban 30W	—	4 to 6 oz	Soil Drench: 100 gallons of fungicide mixture covers 800 square feet of bench or bed area. Irrigate immediately and repeat at 1- to 2-month intervals.
Truban 25E	—	3 to 4 fl. oz.	
fosetyl-Al			
Aliette T/O	—	1.25 to 4 lb.	Foliar Spray: Apply to wet foliage, using no more than 400 gallons of spray volume per acre treated. Repeat as needed at monthly intervals.
menfenoxan			
Subdue Maxx	—	0.13 to 0.25 fl. oz.	Drench at Seeding: 100 gallons of mixture covers 400 to 800 square feet of bench or bed area. Reapply after 1 to 2 months.
	—	0.5 to 2.0 fl. oz.	Drench at Transplanting: 100 gallons of mixture covers 400 to 800 square feet of bench or bed area. Reapply after 1 to 2 months.
Subdue GR	—	1.6 to 8 oz. per cu yd of mix	Dry Soil Mix: Mix thoroughly and irrigate with enough water to wet the root zone.
propamocarb			
Banol 66S	—	30 fl. oz.	Drench at Seeding and Transplanting: Apply 3 quarts of mixture to 10 square feet of bench or bed area.
thiophanate-methyl + etridiazole			
Banrot 40W	—	4 to 8 oz.	Soil Drench: 100 gallons of fungicide mixture covers 800 square feet of bench or bed area. Irrigate immediately and repeat at 1- to 2-month intervals.
Banrot 8G	—	8 oz. per cu. yd. of mix	Dry Soil Mix: Mix thoroughly. Reapply soil drench as needed.

Control of this disease in the landscape requires removal of infected plants. Care should be taken not to spread diseased plant material. If large plantings of pansies are involved, protective fungicide spray treatments may be appropriate. See Table 7 for available fungicides. Follow label directions.

Disease control in the greenhouse is much the same as that described for the landscape. Diseased areas, trays, and tools should be sanitized by treating them with a greenhouse disinfectant. In many situations, it is recommended to replace plug flats and flats rather than attempt to thoroughly disinfect these items. See Table 7 for labeled fungicides.

The crown and root rot phase of the disease develops as brown sunken lesions on lower stems (crowns) and roots. Decay is usually characterized as dry rot. As the disease progresses to girdle the crown and involve more root area, aboveground parts of the plant become stunted and yellowed, exhibit dieback, and eventually wilt and collapse. In some situations, girdled crowns may become brittle, and foliage may easily break off from the roots at the decayed crown (Figure 10). This type of deterioration at the crown may also be caused by other crown rot pathogens.

Disease control in the landscape and greenhouse requires practices of plant removal, disinfection, and tray replacement similar to methods described for the aerial phase of this disease. Excess nitrogen should not be applied because it favors disease development. Fungicides should be applied as protective drenches in greenhouse plantings or in large scale landscape plantings when the disease develops early in the season. See Table 7 for fungicides labeled for control of Rhizoctonia crown and root rot. Always follow label directions.

Table 7. Rhizoctonia Aerial Blight and Root and Collar Rot

Fungicides	Rates		Comments
	per gallon	per 100 gallons	
azoxystrobin			
Heritage 50W	—	1 to 4 oz	Heavy Spray/Drench at Transplanting: Apply enough water to wet foliage of target plant and media around base of plant. Reapply as needed. Use higher rate at shorter interval when conditions favor disease.
iprodione			
Chipco 26019 50W	—	1 to 2 lb.	Drench at Seeding or Transplanting: Apply 1 to 2 pints of fungicide suspension per square foot of bench or bed area. Reapply every 2 to 4 weeks as needed.
thiophanate-methyl			
3336 50W	—	12 to 16 oz.	Apply as a drench to the media or soil around base of plant before symptoms are seen. Reapply as needed every 1 to 2 months. Shorten interval and increase rate when conditions favor disease.
3336 4.5F	—	16 to 20 fl. oz.	
thiophanate-methyl + etridiazole			
Banrot 40W	—	4 to 8 oz.	
trifloxystrobin			
Compass 50W	—	2 to 4 oz.	
triflumizole			
Terraguard 50W	—	2 to 4 oz.	

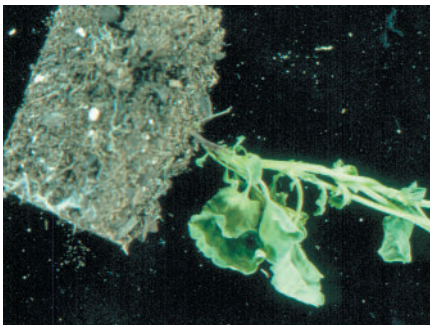

Figure 8. Pythium crown and root rot of pansy

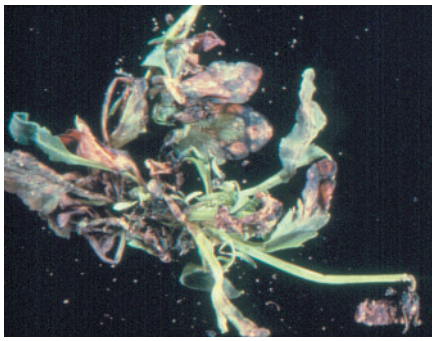

Figure 9. Phytophthora foliage blight on pansy

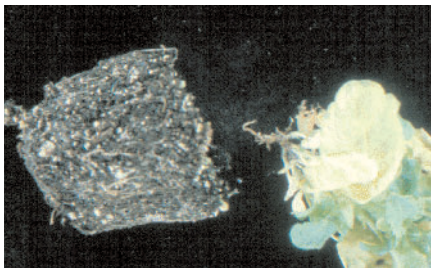

Figure 10. Rhizoctonia crown rot (as well as crown rots caused by other pathogens) may result in stem breakage.

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UPS, 6M41, **New Sept 2001,** ANR-1214

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ANR-1214