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BOTRYTIS BLIGHT OR GRAY MOLD OF ORNAMENTAL PLANTS

Botrytis blight or gray mold, one of the most common and destructive diseases of greenhouse-grown crops, is estimated to cause a greater economic loss of ornamentals and vegetables than any other disease. Botrytis blight frequently occurs on the same hosts in out-of-door plantings, especially during or following cool, damp, cloudy weather. It also causes damage on many fruits and vegetables and can be a serious problem during both short- and long-term cold storage and subsequent shipment of most types of horticultural commodities.

Figure 1. Botrytis petal blight of petunia showing lesions or spots (Dr. R.K. Jones).

The causal fungus can invade and damage many plant parts including flowers, pedicels, stems, leaves, buds, fruits, bulbs, corms, tubers, and roots. With some exceptions, however, Botrytis blight mainly attacks tender tissues (flower petals, buds, or seedlings), weakened or injured tissues (such as stubs or bases left on stock plants after cuttings), and aging and dead tissues. Actively growing tissues, other than flower petals, are seldom invaded. Blight is the most common symptom, however, fruit, vegetable, tuber, stem, corm, and bulb rot and leaf spot or blotch are also symptoms of Botrytis infection.

There are some 50 species of *Botrytis*, accounting in part for the wide range of plants and plant parts affected. *Botrytis cinerea* has by far the largest host range of any species of *Botrytis*, and the following discussion will deal almost entirely with Botrytis blight of ornamentals caused by *cinerea*. Table 1 is a partial list of some of the ornamental plants affected by *Botrytis cinerea*. It should be remembered that most ornamental plants, even if not officially recorded as hosts, are probably susceptible to one or more species of *Botrytis* under the right circumstances.

Symptoms

Botrytis cinerea causes blossom blight, bud rot, stem canker, stem and crown rot, cutting rot, leaf blight, and damping-off or seedling blight. Botrytis infection first appears as a water-soaking and browning regardless of the tissue affected. A conspicuous, tan to gray fuzzy mold (composed of many thousands of spores borne in grapelike clusters) develops on rotted tissue under humid conditions. Flag to roundish, black resting bodies (sclerotia) of the fungus can appear on infected and sporulating tissue as the plant or plant part dies.

For further information concerning diseases of ornamentals, contact Nancy R. Pataky, Extension Specialist and Director of the Plant Disease Clinic, Department of Crop Sciences, University of Illinois at Urbana-Champaign.

Blossom or Flower Blights and Bud Rots

Blossom blight and bud blight of such ornamentals as asters, azalea, begonia, carnation, chrysanthemum, cyclamen, dahlia, geranium, marigold, peony, petunia, roses, and snapdragon very often precede and lead to stem rot. The fungus becomes established in flower petals and sometimes appears as irregular, enlarged, tannish, water-soaked flecks or spots (Figure 1). Flowers are particularly susceptible as they begin to age. Infected petals wither and turn tannish brown (Figure 2). The mycelium of Botrytis may continue to grow and invade the rest of the inflorescence, and, if moist conditions persist, spore production can occur (Figure 3). The petals of badly infected flowers often become matted and stick together. The fungus may invade the pedicel, which rots and leads to bud and flower collapse (Figure 4).

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Figures 2-7. Botrytis blight of (2) chrysanthemum blooms, (3) geranium, and (4) cyclamen. Spore production of the fungus; 3, florets have matted; 4, rot progressed into pedicel, flower collapsed; (5) bud blast of peony; (6) stem rot of geranium, and (7) leaf blight of geranium. Figure 6 - cut stub in foreground; spore production (gray mold) on stem. Figure 7 - lesions from infected petals on healthy leaves. Hydathode infections of leaf margin on right (Nat. Hist. Survey and Dr. C.H. Hadden).

Flowers can also become infected while still in the bud. Blight or blast is very common on leaf and flower buds of peony and rose, causing them to turn brown or black. Blossom blight can also be a serious problem during shipment of potted plants and cut flowers, such as carnations, chrysanthemums, geraniums, and snapdragons, with bud blight causing problems during cold storage of plants like hydrangeas.

Stem Canker, Stem and Crown Rot, Wilt, and Cutting Rot

Black or caramel-colored, sunken and elongated lesions, with a definite outline, frequently appear on succulent stems or stalks of such ornamentals as begonia, geranium, exacum, peony, rose, and snapdragon. Infection also may spread through the stem causing it to be weakened, girdled, and collapsed at the point of infection followed by wilting of the foliage above the lesion. Lesions on rose canes tend to be black, whereas on geraniums they are a light caramel to brown; on exacum, girdling stem lesions are tannish brown and somewhat dry. Blossom, leaf, or petiole infections may progress into the stem. Black, roundish sclerotia frequently form on infected stems. Infection of cutting stubs (Figure 6) of geraniums and roses is common. Geranium cuttings infected with *Botrytis* often fail to root.

Leaf Spot or Blight

The leaf spot phase of Botrytis blight often appears when infected flower petals or other plant parts fall on the leaves and the pathogen invades healthy tissue. The resulting lesion often assumes the outline of the fallen, infected tissue. If the leaves are wet or high humidity conditions prevail, the spots enlarge, merge, become irregular, brown, and water-soaked (Figure 7). If high humidity continues, the lesions become covered with coarse, tan to gray masses of *Botrytis* spores. Lesions commonly develop at the leaf margins as a result of entry through a guttation droplet, resulting in a V-shaped blotch.

Damping-off or Bed Rot

Botrytis cinerea is a common cause of damping-off of ornamental seedlings such as calceolaria, cineraria, cyclamen, exacum, and snapdragon both in the greenhouse and outdoors. Damping-off is prevalent when the humidity is high or when the soil or seed is contaminated with the fungus. Infected plants wilt or collapse at or near the soil line from a soft, tan to brown, water-soaked rot.

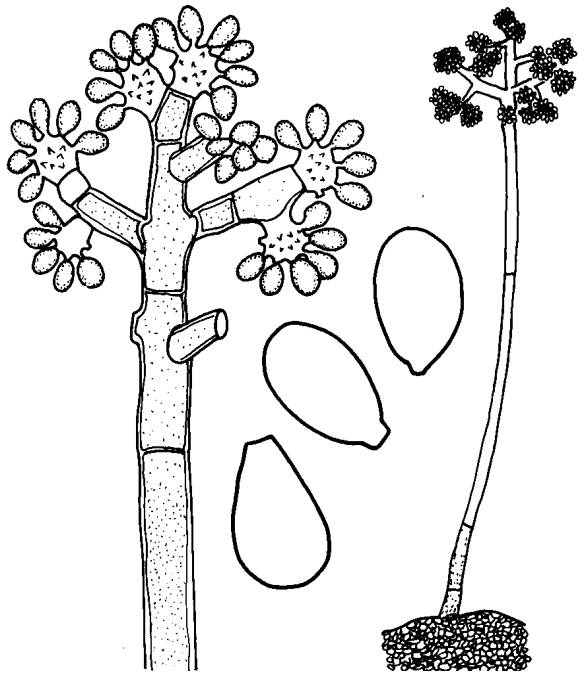

Figure 8. Condidiophores (left and right) and conidia (center) of Botrytis cinerea as you would see them under a high-power microscope.

Disease Cycle

Botrytis cinerea persists in the greenhouse year around as (1) mycelium, conidia, or sclerotia on living or dead plants, and as (2) sclerotia or conidia in infested soil. Outdoors, the fungus overseasons on decayed plant material or in infested soil. In rare cases, a seed lot may be contaminated with sclerotia of the same size as the seed or with bits of plant debris that may carry sclerotia or mycelium. Sclerotia are the main structures for field survival, although conidia may overseason in the field and can survive a temperature range of 39° to 131°F (4°to 54°C). The overwintering stage can be spread by anything that moves soil or plant debris and transports sclerotia, mycelium, or conidia.

Upon germination, the sclerotia generally give rise directly to conidia and occasionally to infection hyphae. In some cases, sclerotia of *B. cinerea* germinate by producing apothecia and ascospores although this type

of germination is very rare and has been reported to occur from *Botrytis* isolates on grapes. Greenhouse and field infections commonly result from dispersal of the conidia, which are borne in grapelike clusters (Figure 8).

Conidia produced on germinating sclerotia, on infected plants, or on infected plant debris are dispersed in large numbers by air currents to new plants. Infection occurs following initial penetration of plant tissue. The optimum temperature for germination of the conidia of *B. cinerea* is 72° to 77°F (22° to 25°C) with free moisture or high relative humidity (90 to 100 percent) also necessary for spore germination. Germinating conidia seldom penetrate actively growing tissue directly since they need an outside nutrient source. Penetration of green tissue is common through wounds, such as cutting stubs, and tip-burned leaves. Aging flower petals and dying leaves are very susceptible to conidial infection.

Another source of inoculum, with an even higher inoculum potential than conidia, is when diseased flower petals or pieces of Botrytis-infected debris come into contact with healthy tissues. The infected tissue provides a food base, allowing the mycelia of *Botrytis* to penetrate the underlying green tissue directly upon contact.

Botrytis is often considered a cool weather pathogen with best growth, sporulation, spore release, germination, and establishment of infection occurring at an optimum of 66° to 74°F (18° to 23°C), however, it is also active at low temperatures and can cause considerable loss of plant material maintained at 32° to 50°F (0° to 10°C). Once infection occurs, the fungus can grow over a range of 32° to 96°F (0° to 35°C).

Control

1. **Avoid splashing water on the foliage when watering.** Free moisture is needed for spore germination and infection. Surface irrigation and watering in the morning is recommended.

2. **Strict sanitation is of the utmost importance** and cannot be overemphasized. The fungus readily attacks aging or dead tissue and then produces tremendous quantities of airborne spores. All old blossoms and dead leaves should be removed, and all fallen leaves and plant debris on or under greenhouse benches and in plant beds should be carefully collected and burned or hauled away with the trash. Ideally, all diseased plants and plant parts should be removed and destroyed.

3. **Provide maximum air circulation in the greenhouse and in plant beds**. Maintain the humidity below 85 to 90 percent by (a) forced circulation in each section or the entire greenhouse, or (b) an increased amount of heat. To avoid condensation on the foliage, supply heat at night to maintain the indoor temperature higher than the outside. Night heating may be needed from September through mid-June.

4. **Properly space plants to allow for maximum air circulation.** Growth regulators on some plants, such as geranium, tend to produce a more compact plant. Proper bench spacing is thus essential. In outdoor plantings, plant in well drained soils. Avoid shady or low spots with poor air movement. Keep down weeds.

5. **Avoid over-fertilization (especially with nitrogen) and wet mulches.**

6. **Avoid unnecessarily wounding plants.** Wounds are possible entry sites for *Botrytis* spores.

7. **Steam all soil used for pots and plant beds** at 180° (82°C) for 30 minutes or 160°F (71°C) for one hour at the coolest spot.

8. **Place cut flowers or cuttings in storage immediately after harvest.** Only blemish-free, nonsenescent flowers or plant material should be stored. The storage area should be clean, cool, and dry without free moisture on the walls, ceiling, or floor and with a humidity of 90 to 95 percent to prevent shrinking or shriveling of plant material. The temperature should be as close to freezing as possible.

9. **Routine fungicide control programs are highly recommended** for greenhouse production of all ornamentals, especially crops such as geraniums and chrysanthemums, where cuttings are routinely taken and cutting stubs remain on the plant. There are a number of fungicides that give excellent control of *Botrytis* when properly applied. Applications are needed at intervals of 5 to 7 days in rainy, overcast weather and every 7 to 10 days in warm, dry weather. Usually 1/2 to 1/3 the normal rate of fungicide is applied to open flowers—or injury may result. Current fungicide recommendations are given in Illinois Homeowner's Guide to Pest Management. This publication is updated annually. Check container labels for specific directions, precautions, and crop registrations.

Table 1. A partial list of ornamental plants susceptible to Botrytis Blight caused by *Botrytis Cinerea* or a closely related species

African violet	coreopsis	honeysuckle	pothos
ageratum	cranesbill	hound's-tongue	primrose
alexanders	cryptamthus	hyacinth	Pyracantha
allium	cuphea	hydrangea	pyrethrum
aluminum-plant	currant, alpine	impatiens	pyrola
amaryllis	currant, white-flowered	Indian paint brush	rhododendron
amazon lily	cyclamen	iris	rhoea
anemone	cytisus	kalanchoe	rose
angelica	dahlia	kenilworth ivy	rose-of-Sharon
arabis	daisies	larkspur	rubber plant
arborvitae	daylily	lilac	ruellia
aster	delphinium	lilies	saffron
azalea	devil's-club	lily-of-the-valley	saxifrage
baby's-breath	dogwood	lithospermium	sedum
bee balm	dracaena	live forever	senecio
begonia	Dutchman's-pipe	lobelia	snapdragon
bellflower	epilobium	lupine	snowball
bleeding heart	erigeron	magnolia	snowdrop
butter-and-eggs	erythronium	Maltese cross	spiderwort
buttercup	euonymus	marigold	statice
caladium	eupatorium	mertensia	stephanotis
calathea	evening-primrose	mock-orange	stock
calceolaria	exacum	monkey-flower	stokesia
calendula	ferns	narcissus	strawberry-begonia
California poppy	firecracker-flower	nasturtium	sumac
calla	flamingo-lily	old-man	sunflower
calla-lily	flax, flowering	orchids	sunrose
calthus	forget-me-not	oysterplant	sweet pea
camassia	foxglove	oxalis	thyme
camellia	fuchsia	palms	tobacco, flowering
candytuft	gardenia	pansy	toadflax
Cape marigold	gentian	parthenium	tradescantia
carnation	geranium, florist's	passion flower	Transvaal daisy
century-plant	gerbera	penstemon	trout-lily
China aster	gladiolus	peony	tuberose
Christmas-rose	globe-amaranth	peperomia	tulip
chrysanthemum	gloxinia	pepper, Christmas	verbena
cineraria	gold-moss	periwinkle	viburnum
clarkia	gynura	philodendron	vinca
clematis	gypsophila	phlox	violet
climbing beauty	heather	pinks	wallflower
colchicum	heliotrope	plantain lily	wormwood
coleus	heuchera	poinsettia	zinnia
columbine	hibiscus	poppy	