



TULIP FIRE OR BOTRYTIS BLIGHT

Tulip fire or Botrytis blight is caused by the fungus *Botrytis tulipae*. It attacks all parts of the plant and is by far the most common and serious disease wherever this popular flower is grown. Once a tulip bed is infested, fire or Botrytis blight generally becomes more serious in succeeding crops. The disease commonly follows frost or hail injury. If not controlled, tulip fire can cause an almost complete loss of flowers and greatly reduce the yields of bulbs during cool, wet spring weather. Attacks are confined to the tulip (*Tulipa gesneriana*), other *Tulipa* species, and hybrid tulips. All commercially grown tulip cultivars and species are susceptible to some degree.

Symptoms

The first evidence of disease in the spring is usually the appearance of scattered stunted shoots, called primary infectors or “fireheads”, that emerge with their leaves twisted, tightly rolled, and blighted (Figure 1). The weakened shoot often collapses and dies. In damp, overcast weather a dense grayish mold develops on these primary infectors. The mold is largely composed of tremendous numbers of microscopic spores (conidia) of



Figure 1. Tulip fire - a primary infector or “firehead”. Note distorted, twisting leaves.



Figure 2. Older, enlarging *Botrytis* lesions on mature tulip leaf. Note gray mold (courtesy G.W. Simone).

Botrytis. If the blighted leaves and shoots do manage to unfold, they are “ragged” and partly withered with a fuzzy grayish mold forming on diseased parts in moist weather (Figure 2).

Minute spots soon appear on the leaves of other nearby tulip plants (Figure 3). These spots are oval to round and turn yellow to gray-brown, each with a dark, water-soaked border. Similar, more elongated spots appear on the stems. In wet weather some leaf lesions enlarge rapidly and merge, turn whitish gray with a brownish tinge, and cover a large part or all of a leaf (Figure 4). In

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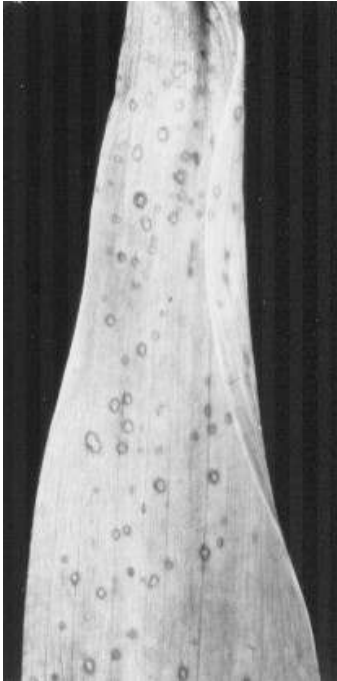


Figure 3. *Botrytis* blight or fire of tulip (British Ministry of Agriculture photo).

dry weather, invaded leaf tissue becomes brittle and is often split and torn by the wind. Leaf infections may spread into the stem where gray to brown, depressed, and often zonate spots are formed. Weakened stems often collapse and die.

Flower buds are spotted. Badly blighted ones fail to open and become covered with the dense gray mold of *Botrytis*. Small, whitish, somewhat blistered spots develop on colored tulip flowers, with light yellow to tan lesions forming on white petals within 10 hours after infection (Figure 5). If the weather continues to be damp, the lesions soon enlarge, turn a deeper brown, and merge. Within a few days, a flower may become completely blighted. During or following wet weather, blighted flowers are covered with the typical gray mold.

Shiny, black bodies (sclerotia) the size of a pin head of *Botrytis tulipae* develop on or under the outer husk which may be discolored and split. Dark yellow to brown, round, slightly sunken “scabby” spots commonly form in the outermost flesh bulb scale. The lesions are usually on the side of the bulbs, but may occur at the nose or base of the bulb. The minute black sclerotia may form in the larger scab-like bulb lesions (Figure 6), in tulip leaves and flower parts rotting on the soil surface, and on flower stems. Infected stems and/or bulbs may cause leaves to turn reddish to purple

without any spotting.

If damp, the *Botrytis* fungus may penetrate deeply into the bulb and rot it completely. Under drier conditions, the bulb lesions become more or less dormant and the bulb survives until planting time. When planted, such infected bulbs may rot without growing a shoot, produce a stunted blighted plant (Figures 1 and 2), or give rise to a healthy plant.

Disease Cycle

The most common source of infection each spring is the stunted and blighted tulip plants (primary infectors) that have grown from diseased bulbs accidentally planted with the crop. Other sources of infection arise from sclerotia of *Botrytis tulipae* germinating in the soil, decaying tulip stems, and other plant parts. If tulips are planted in contaminated soil within two years, there is considerable risk that they will become infected.

Plants that emerge after being infected in the soil are usually less seriously affected than those arising from infected bulbs, but they also serve as primary infectors. When an infected bulb produces a healthy shoot, normal development of daughter bulbs occurs, and the *Botrytis* fungus can spread to these from the mother bulb. By late spring, the outermost scale of the daughter bulbs is white and fleshy, later turning brown and dry. If the fungus penetrates beneath the outer scale at this stage, bulb lesions may form and remain hidden, unless the brown husks are removed. Daughter bulbs thus infected often escape detection and are replanted in the fall. The *Botrytis* fungus can survive in lesions on the outermost white bulb scale and can resume growth when the bulb is planted. The fungus persists longer under cool and moist conditions, than when they are stored where it is warm and dry.



Figure 4. Older, enlarged *Botrytis* lesions on mature tulip leaf (courtesy, Dr. C.U. Gould, Washington State Univ.).

The tremendous number of microscopic spores (conidia) formed on primary infectors are spread by air currents and splashing raindrops. The spores can germinate and infect at temperatures not much above freezing. Spore production, germination, infection, and the resulting mycelial growth in the infected plant are all more rapid when the temperatures are higher – provided that the humidity is above 95 percent. These conditions are quite common in mid to late spring when sharp temperature drops at night result in heavy dews and when a film of water is present on aboveground plant parts. Retarding air movement (i.e., crowded plantings, excessive weeds, or poor locations) favors infection.



Figure 5. *Botrytis* spots on tulip flower petals.

How far the conidia of *Botrytis tulipae* can be carried by the wind and still remain capable of causing infection is not known. It is certain that the spread from one flower bed to neighboring beds is common. Spores have also been shown to survive for up to six weeks on the surface of moist soil at 50°F (10°C). The fungus is active over a fairly wide temperature range with sporulation occurring between 41° and 81°F (5-27°C).

Control

1. Purchase only the largest, blemish- and disease-free bulbs available. Buy from a reputable nursery or garden supply store.
2. Plant tulips in the same location no oftener than every third year. The spot should be sunny where air circulation and soil drainage are good. Remove the outer brown husks, and discard all spotted, damaged, or moldy bulbs. Avoid a wet mulch, overwatering and high rates of nitrogen fertilizer. Fertilize based on a soil test. Keep tulip beds weeded to increase circulation.
3. Dig the bulbs in dry weather and not later than three weeks after the petals have fallen. Remove the stems and handle the bulbs with care. Infection occurs more easily on bruised and cut bulbs than on undamaged bulbs.
4. Dry and clean the bulbs promptly after digging and before storing in thin layers in a dry, well-ventilated location. Commercial concerns usually store their bulbs after receiving them in early autumn at 77° to 81°F (25-27°C) until November 1, and thereafter at 63°F (17°C).
5. Examine all bulbs carefully before storage and again before planting. Discard all diseased, bruised, and cut ones.



Figure 6. Infected tulip bulb with scab-like spots and black sclerotia on outer white scales (courtesy, Dr. C.J. Gould, Washington State Univ).

6. When tulips come up in late winter or early spring, carefully remove all infected plants and plant parts as soon as they are noticed. Place in a paper bag or other covered container, and burn them. If possible, these important sanitary measures should be done in dry weather when the fungus is not producing spores.
7. Collect and destroy all leaves, blossoms, and stems as soon as blooming is over. Entire tops should be cut off an inch or so below the soil surface, removed, and burned.
8. Fungicide sprays are effective as a preventive measure, starting when the leaves emerge from the soil. Spray several times at 5- to 10-day intervals and continue until the bloom stage. If the weather is rainy, spray every five days; if conditions are dry, every 10 days. The addition of a half teaspoonful of liquid household detergent or a commercial spreader-sticker (surfactant) to each gallon of spray helps to ensure that the foliage will be wetted and that good coverage will be obtained. Fungicide recommendations are given in the Illinois Pest Control Handbook which is revised each year, and available at all Illinois Extension offices. Dipping bulbs in a fungicide has given very good control of fireheads, as has a soil drench at planting time and again just before emergence.
9. When forcing tulips indoors, observe these precautions: water in the morning rather than in the afternoon; keep water off the foliage; hold the humidity below 90 percent; and avoid forcing the tulips at too high a temperature. The temperature should be kept as uniform as possible to avoid condensation (dew) at night. Provide for good air circulation. Promptly remove and destroy all diseased plants and fading flower heads. Disinfect flats in a fungicide solution and dry before separating. Do not plant susceptible cultivars close together. Dip bulbs in a recommended fungicide. Either use fresh soil or pasteurize reused soil. Do not place flats in wet locations during rooting of the bulbs.