



BLACK SPOT OF ROSE

Black spot, caused by the fungus *Diplocarpon rosae* (imperfect stage *Marssonina [Actinonema] rosae*), is probably the most serious and damaging disease of outdoor roses (*Rosa* species). The disease is found worldwide where roses are grown, except for the driest regions. Losses from black spot occur through: (1) reductions in flower quality and quantity; (2) chlorosis, often followed by premature defoliation; (3) a slow growth of cuttings and failures in grafting or budding; and (4) an overall stunting and weakening of the plant, followed by an increased susceptibility to other diseases, winter injury, drought, and damage from insects and mites. Adequate spray programs give good control, but must be continued at 5- to 10-day intervals from the first flush of growth in the spring until the leaves drop in the fall.

Symptoms

Tiny, dark lesions develop—generally on the upper surface of the leaves. These lesions slowly enlarge over several weeks into circular black spots with irregular fringed margins up to about ½ inch (13 mm) in diameter (Figure 1). Small, purplish red-to-black lesions may also form on the first-year stems, petioles, stipules, peduncles, fruit, sepals, and petals. The slightly raised, irregular blotches on the canes are first purplish-red (Figure 2), later becoming blackened and blistered. These blotches are a major source of primary infection in the spring. Chlorosis often develops about each leaf spot, later involving the entire leaflet. Severely infected leaves of the more susceptible rose cultivars usually fall prematurely due to ethylene production by the black spot fungus.



Figure 1. Black spot of rose. If the disease is left unchecked, an infected plant may lose most of its leaves.

Disease Cycle

The black spot fungus overwinters in fallen leaves and in lesions on infected canes. White, slimy masses of microscopic spores (conidia) produced in diseased tissue are splashed by water or wind-blown rain from fallen leaves and cane lesions to the opening leaves in the spring. If the foliage remains wet for 7 hours or if the atmospheric humidity is 95 percent or greater, the conidia produce one or more germ tubes that penetrate the leaf tissue.

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Figure 2. Closeup of black spot lesions on a rose cane (L) and *Coniothyrium canker* (R). *Coniothyrium* looks serious, but generally does not develop on well-matured canes (courtesy Dr. E. Lyle).

Radiating, branching, fungal mycelia develop **below** the leaf cuticle, producing a black coloration (Figure 3). Depending on the stage of leaf development, resistance of the rose cultivar, temperature, relative humidity, and inoculum density, characteristic black spots are visible within 3 to 16 days. Lesion development is enhanced by the leaves expanding in size (6 to 14 days old), temperatures above 75°F (24°C), high relative humidity, and wet foliage. No infection occurs if the foliage remains dry or if the humidity is below 95 percent.

From 5 to 14 days after the lesions first become visible, conidia are produced in subcuticular acervuli that appear as dark specks within the black spot lesions (Figure 4). Several hundred acervuli may be produced over several weeks in one large black spot. Each acervulus is capable of producing 4,000 or more 2-celled hyaline conidia. The acervuli irregularly rupture the cuticle, releasing the conidia in white slimy masses. The sticky conidia are disseminated primarily by splashing water and wind-borne rain, but are also carried to some extent on hands, clothing, tools, and by insects and mites to other leaves where secondary infections may develop.

A rose leaflet with two black spots 2/5 inch (10 mm) in diameter can produce over 2.5 million spores in 30 days. The conidia must be wetted for at least 5 minutes before they can germinate. Such spores may be dried and still remain viable for 2 to 4 weeks.

Conidial germination is optimum at 64° to 78°F (18° to 26°C). The minimum is 32° to 37°F (0° to 3°C) and the maximum, 86° to 91°F (30° to 33°C). Germination starts within 36 hours at temperatures below 43° F (6°C), 24 hours at 48° to 54°F (9° to 12°C), and 9 hours at 64°F (18°C).

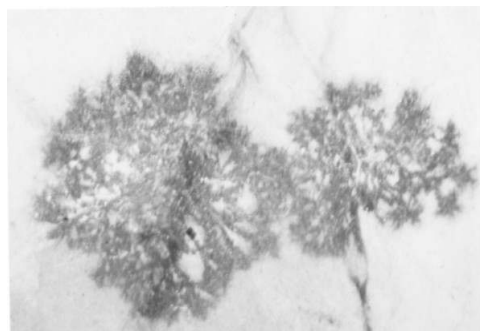


Figure 3. Radiating hyphae of the black spot fungus under the leaf cuticle (courtesy Dr. E. Lyle)

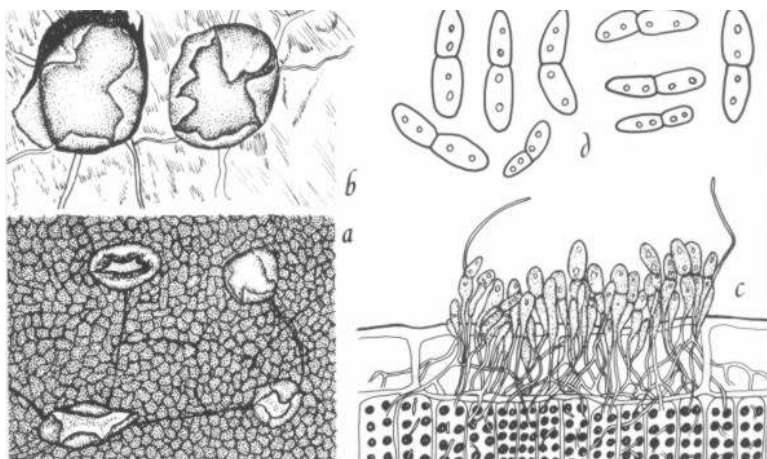


Figure 4. The imperfect stage of the black spot fungus (*Marssonina [Actinonema] rosae*) as seen under a microscope; a and b) ruptured acervuli; c) cross-section of an acervulus; d) conidia.

Disease development is optimum at 68° to 80°F (20° to 27°C), dropping rapidly from 64° to 43°F (18° to 6°C) and from 86° to 91° F (30° to 33°C). No infections develop if the leaflet surfaces are dried within 7 hours after conidia start to germinate at 59° to 75°F (15° to 24°C), or after 13 hours at 50° to 53°F (10° to 12°C). During periods of prolonged wet and warm weather, black spot may become quite severe. Large numbers of secondary infections are produced by the conidia.

Following defoliation in the autumn, the hyphae go deeper into the dead leaf tissue

and form black specks (pycnidia) under the old acervuli. The pycnidia rupture in the spring, exposing the white slimy masses of conidia and completing the disease cycle. The sexual stage (*Diplocarpon rosae*) is extremely rare and plays no part in the disease cycle.

Control

1. **Purchase only top-quality, disease-free plants of resistant cultivars from a reputable nursery.** Roses with a high ARS number, especially those with thick waxy leaves, usually have fair to good resistance to black spot and other common rose diseases. Resistance to black spot has been bred into many modern cultivars by cross breeding with *Rosa wichuraiana*, *R. multiflora*, *R. cinnamomea*, and *R. pendulina*—all highly resistant or immune. Other species that have good to excellent resistance to black spot include *Rosa arvensis*, *R. canina*, *R. kordesii*, and *R. moschata*. Climbing and tree roses are not injured as often as the bush types.

The relative resistance of a rose cultivar may vary from one location to another, depending on which physiologic race or races of the fungus are dominant in the area. Cultivars resistant to black spot are penetrated by the fungus more slowly and the disease cycle takes longer to complete than with susceptible cultivars.

2. **Carefully collect and compost or burn all fallen leaves in the autumn and again before the new growth commences in the spring.** Where feasible, removing infected leaves, especially during early to mid-season, will further reduce the spread of black spot.
3. **Prune canes in the fall and early spring, according to type and cultivar. All dead wood and infected canes should be removed and burned.** Drastic pruning to within 1 to 2 inches of the bud union greatly reduces the carryover of the black spot fungus.
4. **Maintain plants in high vigor.**
 - a. **Proper planting.** Use well-prepared and well-drained soil, high in organic-matter content, where roses will obtain all-day sun (or a minimum of 6 hours of sunlight daily). If possible, avoid planting near large shrubs or trees that will compete with roses for moisture, light, and soil nutrients.
 - b. **Space plants for good air circulation at the suggested distance for the cultivar, type of rose, and effect desired.**
 - c. **Do not handle or work among plants when the foliage is wet.**
 - d. **Fertilize based on a soil test.** Avoid excessive applications of high-nitrogen fertilizers. Newly planted roses should not be fertilized until they are well established and growing steadily. The soil reaction (pH) should be between 5.5 and 6.5.
 - e. **Water thoroughly at weekly intervals during periods of drought.** The soil should be moist 8 to 12 inches deep. Avoid overhead irrigations and syringing the foliage when watering, especially in late afternoon or evening. Use a soil soaker hose or some method that will not wet the foliage.

- f. **Protect plants for winter following local recommendations.** Winter safeguards provide insulation against extremely low temperatures and alternate periods of freezing and thawing, and protection against damage by wind or heavy snow and ice.
 - g. **Whenever possible, destroy nearby wild or uncared for roses.** These plants commonly serve as a source of infection for garden roses.
5. **Thoroughly spray all above ground parts of each rose plant, including both leaf surfaces, with a suggested fungicide. Start as the buds break open in the spring and continue into September or early October.** Few or no fungicide applications are needed on resistant climbers and ramblers. If hybrid tea roses, hybrid perpetuals, and other roses are selected with special reference to partial resistance to black spot, control with fungicides is easier and fewer fungicide applications are required. Grouping the more susceptible rose cultivars facilitates spraying. Carefully follow all label directions and precautions as printed on the container label.

The fungicide must be present on the leaves, canes, and other susceptible parts prior to rainfall. Spraying is more efficient than dusting. Sprays are required at 7- to 10-day intervals to keep the young, susceptible growth adequately covered. If the period is unusually rainy, the spray interval should be shortened to 5 or 7 days; if dry, lengthened up to 10 days. If possible, sprays should be applied before it rains to provide maximum protection of the foliage from spores that are distributed by splashing water or wind-blown rain.

The fungicides suggested for controlling black spot are given in Illinois Homeowner's Guide to Pest Management, Circular 1354, available at your nearest Extension office or Ag Services, P345 1917 S. Wright St., Champaign, IL 61820. When possible, apply combinations of one or more fungicides, insecticides, and a miticide to control a wide variety of diseases and animal pests. Many spray mixes are available for roses. Check the label to be sure it contains one or more of the fungicides listed Circular 1354, listed above. In general, 1 gallon of spray mix will cover 10 to 20 rose bushes. Spray to the point of run-off (plants begin to drip). On a nursery-size scale, 200 gallons of spray are needed for an acre.

Waxy rose foliage is hard-to-wet with a spray. The spray will be more effective with the addition of a small amount of household detergent (about ½ teaspoonful per gallon) or a commercial spreader-sticker (Surfactant) to the spray mix, following the manufacturer's directions printed on the container. Commercially available surfactants include DuPont Spreader-Sticker, Bio-Film Spreader-Sticker, Chevron Spray Sticker, Citowett Plus, Filmfast Spreader-Sticker, Miller Nu-Film-P and -17, De-Pester Spreader-Activator, Triton B-1956, Plyac NonIonic Spreader-Sticker, Multi-Film L, and Colloidal Products Spray Modifier spreader sticker.