

ROSE DISEASES AND THEIR CONTROL

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Black Spot

Black spot of roses is caused by the fungus *Diplocarpon rosae* (imperfect state *Marsonina rosae*). This disease appears every year throughout the US and is the most continually damaging disease of roses. Many agree it is the most serious disease of rose worldwide.

SYMPTOMS

The symptoms are circular black spots with indistinct or jagged margins that are frequently surrounded by a yellow halo. Infected leaves turn bright yellow and fall prematurely when the attack is severe and allowed to continue, repeated defoliation occurs, greatly weakening the plant. The disease has been shown to decrease flower production on many cultivars. This has been correlated to increased susceptibility to winter kill. Spores of the fungus are spread to immature leaves by splashing rain or irrigation water. Spore germination and infection takes place only when water remains on the leaves for periods of 6 hours or longer and typical leaf spots develop within 5 to 10 days.

CULTURAL CONTROL

Cultural methods are critical if a successful control program for black spot is to be achieved. Elimination of overhead irrigation by switching to methods that deliver water to the soil around plants is especially important. If this cannot be achieved then irrigation must occur at a time of day that allows rapid leaf drying. Sanitation is also recommended to reduce the availability of spores in the spring. Remove all infected leaves that have dropped during the previous season in the fall and discard them - do not use as mulch. When canes of severely infected roses are weakened they should be removed as well. It is critical that cultural management for roses affected by black spot be proper. The stresses the rose sustains from all sources will be additive and poor fertilization; pruning or planting practices will simply weaken the rose further.

There are large differences in susceptibility of different rose cultivars to the black spot fungus. Since the list of commercial rose cultivars is extensive and changes annually, it is not possible to record results here. Trial and error responses for cultivars in your area may be the best way to determine which cultivars are resistant to the black spot fungus. Alternatively, your cooperative extension service may have a list published for resistant roses.

CHEMICAL CONTROL

Controlling black spot with fungicides is successful if they are applied consistently before symptoms develop. This usually means starting fungicide sprays at bud break and continuing until the end of the season. Weekly applications may be needed during the summer months when rainfall is prevalent and temperatures are ideal for black spot development. Timing fungicide applications to rainfall events of 0.25 inches has provided effective black spot control experimentally. For the past 30

years, one of the most effective products for black spot control has been chlorothalonil (Daconil 2787 and Daconil Ultrex). Other products that have shown high levels of efficacy are in the triazole chemical group including cyproconazole (Sentinel), tebuconazole (Lynx), fenarimol (Rubigan), myclobutanil (Systhane) and propiconazole (Banner Maxx). Although these products are related chemically, research has shown large differences in their efficacy. Generally the best results have been obtained with cyproconazole and tebuconazole. Efficacy of tebuconazole drenches has been variable although spray applications are excellent for black spot control.

Some control has also been reported for fungicides in the strobilurin group (azoxystrobin (Heritage), kresoxim-methyl (Cygnus) and trifloxystrobin (Compass)). Perhaps the best program will involve rotations of products between the three chemical groups. Some of the triazoles are labeled for application to roses while others are still in the experimental phases. Check fungicide labels for legal uses in your state or call your county extension service.

Botrytis Blight

One of the most common diseases affecting rose flowers is Botrytis blight. The fungus *Botrytis cinerea* is present in most environments from the garden to cut flower production to storage. The disease in the garden affects flowers at all stages. It is especially common during the early spring when the weather is rainy and cool and cloud cover is present. If you are in a mild climate where the roses continue to flower during the winter, you may experience Botrytis blight all year. Unfortunately, most flowering plants are hosts of Botrytis and controlling the disease on roses may be only partially effective if other plants in the garden are under attack. In cut flower production the disease can also be a year round problem if conditions in the ranges are humid and temperatures are between 60 and 72F. Finally, storage rots caused by *Botrytis cinerea* are common on both cut flowers and bare-rooted plants.

SYMPTOMS

Botrytis flower blight starts as tiny water-soaked, translucent spots that may appear as flecks, blisters or sunken areas. They rapidly turn tan and may have a dark margin. Under ideal conditions the fungus will start to sporulate producing masses of gray-brown powdery spores. These conidia are easily dislodged by handling and air movement and cause new infections when the environment remains ideal for germination and infection. In a similar manner, bare-root roses in storage may be severely affected by this fungus. Younger, more succulent plants are most susceptible.

CULTURAL CONTROL

Control of Botrytis blight depends somewhat on your environment. Always remove senescent flowers and canes showing dieback since these are easily colonized by Botrytis and will act as a source of infection. In a greenhouse, environmental management is very effective. In this case, the relative humidity can be reduced through venting and heating at sunset to reduce the formation of dew on roses overnight. In addition, horizontal air movement to reduce relative humidity around plants has been effective on other ornamental crops. Since handling the crop in any way (including irrigation, harvesting and fertilizing) will result in spreading spores, you should time fungicide sprays to immediately follow these activities. Use of supplemental calcium applications has been shown to

decrease development of Botrytis blight in both cut flower production and post-harvest storage.

CHEMICAL CONTROL

Fungicides for control of Botrytis blight are many and represent a wide range of chemical groups. Some of the most effective include chlorothalonil (Daconil Ultrex), iprodione (Chipco 26019), vinclozolin (Curalan), and fenhexamid (Decree). These products represent three chemical groups with iprodione and vinclozolin in the same group. Fludioxinil (Medallion) has also been shown very effective for Botrytis control and it is in a fourth group. Resistance to fungicides is relatively easy to develop for Botrytis. Many populations of this fungus throughout the East and Midwest have been documented to be resistant to the benzimidazoles (thiophanate methyl) as well as the dicarboximides (iprodione and vinclozolin). It is highly recommended that fungicides be rotated between groups to manage resistance development. In general, fungicides should be applied prior to symptom development but certain products do show some ability to reduce Botrytis blight after symptoms are present. For example, fenhexamid will reduce sporulation on active infections.

Crown Gall

This bacterial disease used to be very common on roses but due to a rigorous inspection and eradication program is no longer common. The disease is caused by *Agrobacterium tumefaciens* that attacks a multitude of other woody and herbaceous plants. Weakened or dying bushes are sometimes found to have a large gall near the crown. The bacteria live in the soil where they may survive for at least 3 years in the absence of plants. The bacteria spread by water movement and enter the rose through injuries made in grafting or cultivating or by rodents or insects.

SYMPTOMS

Galls start as pale green or white but turn brown and become corky with age. Galls may form between 1 week and many months after infection occurs and can range from 1/4 to over 1 inch in diameter on stems and roots. Plants with crown gall may be stunted and have weakened stems and foliage.

CONTROL

There are no immune rootstocks and Manetti has been found to be especially susceptible. Only crown gall free plants should be used, and avoid wounding as much as possible. Using sterilized tools between plants can be critical in reducing spread of the bacterium by contaminated knives. Various materials have been effective in cleaning knives including alcohol, bleach and quaternary ammonium. Dips of canes in quaternary ammonium solutions or bleach have been effective in combination with a rigorous roguing of all symptomatic plants. Roses infected with crown gall should be removed. The surrounding soil should also be removed and possibly treated with a soil fumigant. There are no effective bactericides for treatment of crown gall under field conditions.

Cylindrocladium Cutting Rot

Cutting rot of miniature roses is caused by *Cylindrocladium* spp. including *C. scoparium*. The disease occurs commonly in production of potted miniature roses but has not been a problem on other roses.

SYMPTOMS

Symptoms are a general yellowing and loss of lower leaves, wilting and basal stem rot of the cutting. They may appear within a few days of sticking. The cutting base turns water-soaked and sunken and eventually dark brown. Sporulation of the fungus on the stem surface can occur on cuttings produced under intermittent mist. These spores are sometimes easy to see with a 10X magnification and are white, and sparkle under high light.

CONTROL

Cylindrocladium spores are easily spread by water and in most cases the infection occurs when cuttings are dipped to control the disease. Even a few infected cuttings in a dip tank will allow all cuttings to become inoculated. It is highly preferable to apply a fungicide to either the stock plants the day before taking cuttings, or as a post-sticking drench. The best control of *Cylindrocladium* cutting rots has been found with fludioxinil (Medallion). If rooting appears to be affected by a drench, then spraying the stock plants the day before should be used.

Dieback

Dieback of roses can be caused by many different fungi although the most common appears to be *Leptosphaeria coniothyrium* (*Coniothyrium* spp. are the imperfect stages). Frequently, more than one fungus is involved in a dieback disease on roses. Other fungi isolated from dieback tissue include *Botryodiplodia theobromae*, *Diplodia* and *Botryosphaeria* spp.. Dieback of canes or shoots occurs from tips, wounds created by removing buds or thorns and other mechanical injuries anywhere on the canes. The pathogens enter stems through these wounds or attack plants that have been weakened by some other cause such as sunburn or freeze damage. Dieback is often more prevalent on plants that have been defoliated by black spot and is generally favored by wet weather which allows spores to infect wounds before they heal. Plants that have been growing in poorly drained areas or suffering from poor nutrition may be more susceptible to dieback.

SYMPTOMS

Spots start as small yellow or reddish discoloration around wounds that turn tan with a dark-brown border. Cracks can form in these areas due to drying and sometimes the wounds girdle the stems killing them. The spores producing fruiting bodies (pycnidia) are black and appear in the dead tissues.

CULTURAL CONTROL

Manetti rootstock is somewhat resistant to common dieback but little research has been reported on any of the fungi responsible for dieback on roses. Control depends upon using clean

pruning knives between cuts when plants are being pruned. Always cut flowers to limit the length of stem remaining on the plants since this tissue is most likely to become infected with dieback organisms. When removing stems with dieback symptoms, cut at least 3 inches below the rotted area. Be sure to remove crop debris from the growing area and destroy it to reduce the inoculum available for new infections.

CHEMICAL CONTROL

Fungicide applications after pruning may be helpful but little information is available regarding which products may be most effective. One study reported that control of some dieback fungi was achieved up to three weeks after infection had occurred. In this case both benomyl and chlorothalonil were effective for some fungi but not all those involved in the dieback complex. Most notably, control of *Coniothyrium* sp. (the cause of common dieback) was not successful. Since a variety of fungi are responsible for dieback use of broad-spectrum products is recommended. Be sure to read labels for legal uses on roses in your state.

Downy Mildew

During the past ten years downy mildew of roses has become a periodic, serious problem. The disease has been known on roses for nearly 140 years but has not been studied much since it does not appear annually. The cause of downy mildew on roses is *Peronospora sparsa*, which also attacks certain cane berries such as raspberry. Downy mildew occurs on all types of roses including cut flowers, garden roses, potted miniature roses and carpet type roses used as ground covers.

SYMPTOMS

Symptoms start as yellowish to brown blotches on upper surface of the leaves. The blotches may frequently occur along the leaf margins. Under moist, cool conditions leaves may turn yellow and drop. A white, downy fungus growth may occur on the lower surface of the leaves. The development of these structures is not abundant on roses, unlike similar downy mildew diseases on other crops. Under drier conditions, leaf spots appear as brown burned areas. Infected leaves frequently show a crinkled appearance. Reddish streaks may occur on flower stems and canes and flowers may be infected as well. Unfortunately, symptoms of downy mildew on roses are easily confused with phytotoxicity or other leaf spotting fungi. Accurate diagnosis is further compounded since the disease may not appear for years only to cause severe problems when the environmental conditions and a source of infection coincide. Latent (non-symptomatic) infections of canes are thought to occur at times.

CULTURAL CONTROL

Downy mildew occurs during the winter months or anytime when temperatures are low (60-70 F) and moisture is high (RH of 85%) due to overcast skies. The disease can continue well into the spring if these conditions persist. When temperatures reach 80F or higher spores and superficial hyphae on the leaf surface dry out and the disease slows down and stops. In a greenhouse, raising the temperature and lowering the relative humidity by heating and venting may be effective means of managing downy mildew.

CHEMICAL CONTROL

Fungicide sprays can be very effective for downy mildew control but must be applied prior to symptom appearance. Effective products include fosetyl aluminum (Aliette), mancozeb (Dithane and Protect), and the strobilurins (azoxystrobin - Heritage and trifloxystrobin -Compass). Unfortunately, one of the most effective products, metalaxyl (Subdue) is no longer available for this use and its replacement, mefenoxam (Subdue Maxx) is not labeled for application to foliage. Resistance management for downy mildew is critical and must be based on strict rotation of fungicide groups. Read all label directions carefully. The labels on the strobilurins state specific requirements for rotation of the product to maintain their efficacy.

Powdery Mildew

Powdery mildew is a fungal disease occurring primarily during the spring and fall and is not usually a problem during the mid-summer months. Dry warm days followed by cool, humid nights are ideal for development of powdery mildew on roses. The disease is caused by *Sphaerotheca pannosa* var. *rosae* and is inhibited by frequent rains and temperatures above 80F. Under the cool, moist conditions common to the Pacific coast states the disease may occur year round.

SYMPTOMS

Powdery mildew is characterized by white powdery growth, masses of spores on young leaves, shoots and buds and sometimes-open flowers. Foliage may be distorted, and shoots stunted or swollen. Spores of powdery mildew are usually not spread by splashing water, but are wind-borne spreading through natural air movement as well as fans. Disease may be apparent within 1 week of infection and immature leaves are very susceptible. The rose powdery mildew fungus occurs only on roses.

CULTURAL CONTROL

Both temperature and relative humidity are critical factors in development of powdery mildew on roses. In a greenhouse, control can be partially achieved with heating and venting to avoid optimal temperature (70F) and relative humidities (near 100%). Older studies with a technique called syringing demonstrated that washing the foliage of greenhouse vegetable with water kept some spores from germinating (free water on leaves inhibits germination) and washed other spores from leaves into the soil. Unfortunately, this technique increases severity of other rose leaf diseases including black spot.

Some researchers have found large differences in susceptibility of rose cultivars to powdery mildew. Since the list of rose cultivars in commercial production as well as garden use is long and changes annually, you should check with local authorities for a listing of rose cultivars in your areas that are known to be resistant to powdery mildew.

CHEMICAL CONTROL

Scouting your crops routinely and frequently is the best way to make sure that a powdery mildew problem does not become serious. The timing of scouting will depend upon the specific crop but be sure to check under leaves and at flower bases since powdery mildew colonies usually start in these areas. Make sure that you scout the crop at a time of day with good light since the structures may be difficult to see in their early stages.

There are many fungicides registered for control of powdery mildew on roses. In 1998 we lost use of triforine which was especially effective for control of powdery mildew as well as rust and black spot. Some of the most effective products are found in the sterol inhibitors (triazoles and imidazoles) including propiconazole (Banner Maxx), myclobutanil (Systhane), triflumizole (Terraguard) and triadimefon (Strike). Others are found in the strobilurin group including azoxystrobin (Heritage), kresoxim methyl (Cygnus) and trifloxystrobin (Compass). Table 1 summarizes trials on rose powdery mildew control over the past 2-3 years. The products listed fall into 7 distinct chemical groups and rotation between groups is highly recommended. Care should be taken to test all new products for safety on your rose cultivars. Some of the "environmentally friendly" products are not always safe for our ornamental crops.

Table 1. Control of powdery mildew on rose and mini-rose.

Fungicide	Group	Rate/100 gal	Interval	Result
Camelot	copper	3 or 5 pints	14 days	very good
eKsPunge**	bicarbonate	8.3 oz	7 days	very good to excellent
FirstStep	bicarbonate	2 or 5 lb	7 days	excellent
Heritage 50W	strobilurin	1, 2 or 4 oz	14 days	some to very good
Junction	copper/carbamate	1.5 or 3 lbs	14 days	good
Kaligreen	bicarbonate	1.5 lb	14 days	very good to excellent
Phyton 27	copper	25 oz	14 days	excellent
Pipron*	piperalin	8 oz	7 days	excellent
Systhane 2E	triazole	3 oz	14 days	excellent
Terraguard 50W	imidazole	4oz	7 or 14 days	very good to excellent
Triact 70EC	plant extract	1%	14 days	excellent
3336 50W*	benzimidazole	1 lb	7 days	excellent

* plus 2 oz/100 gal Latron B 1956

** plus 16 oz

Rose Mosaic

A variety of viruses are responsible for rose mosaic including Apple Mosaic Virus (ApMV), Arabis Mosaic Virus (AMV) and Prunus Necrotic Ringspot Virus (PNRSV). The expression of symptoms varies a great deal with the season. Mosaic symptoms include bright yellow patterns on green leaves that appear as mottles, wavy lines, or oak-leaf patterns.

CONTROL

The viruses are spread by use of infected stock materials. Although once thought to be spread by pruning instruments and insects, research has shown that ApMV and PNRSV do not spread by these means. For this reason an infected plant in a garden is not a menace to surrounding plants. Mosaic infected plants should not be bought or used for propagation. Severely infected plants, which are stunted by the disease, should be dug and destroyed. Research has shown that plants infected by ApMV and PNRSV produce fewer flowers on shorter stems in the spring flush. One study conducted in a commercial rose range showed that over the period of a year, those roses infected with viruses yielded 14% fewer salable flowers compared to a similar group that was heat-treated and tested virus-free. In 4-year Florida study on garden roses, the majority of plants infected by ApMV died. The only control for viruses is prevention.

Rose Rust

Rose rust is one of the most easily recognized diseases of garden flowers because of the bright yellow or orange pustules, which occur on the undersurface of the leaves. The spots appear light yellow when viewed from the upper surface. Long, narrow, orange spots may be found on young canes and sepals as well as leaves. The pathogen is usually *Phragmidium mucronatum*, although other species of *Phragmidium* also occur.

CUTLURAL CONTROL

Rust spores are airborne and spread through air movement (wind or fan). The disease is most severe at temperatures between 65 and 70F. The spores need 2-4 hours of standing water on leaves before they can germinate so anything that shortens the time leaves are wet will help control rust severity. Rust is not usually a problem for miniature rose producers but may occur on certain cultivars of cut roses. The most common roses affected by rust are found in the garden where the disease can be slight to severe depending upon the weather and rose cultivar. Little information is available on cultural management of rust but spacing plants to allow more rapid drying of leaves and irrigating in a manner that keeps the foliage dry should help manage rust severity. Use resistant cultivars when known and remove and destroy crop debris each season..

CHEMICAL CONTROL

Fungicides with some efficacy against rose rust include both triazole (fenarimol [Rubigan] and myclobutanil [Systhane]) fungicides and strobilurins (kresoxim-methyl [Cygnus]). Excellent control has been reported with another triazole - tebuconazole (Lynx). Rotation between the two groups is recommended. As commercial production of roses as cut flowers continues to diminish, rust will become a problem common only in the garden.