



VIRUS AND VIRUS-LIKE DISEASES OF ROSES

Virus and viruslike diseases of roses have become as common as any of the other rose diseases. All species and varieties of roses are susceptible to one or more virus diseases. However, infection often goes undetected because virus and virus-like symptoms can be mild and easily overlooked. Some cause serious disease damage; others only retard normal growth.

Plant pathologists in California have estimated that a 14 percent loss in salable blooms occurs because of virus-infected greenhouse roses. Similar losses occur in roses grown outdoors.

In most virus and viruslike diseases of roses, the infective agent appears to be spread only by budding and grafting practices and not by contact between plants, by the feeding of insects and mites, or by seed.

Most roses are propagated by budding a variety onto a special rootstock such as *Rosa multiflora*, *R. manetti*, *R. odorata*, or “Dr. Huey.” Some nurseries maintain rootstock beds; others maintain budded nursery rows from which rootstock cuttings are taken. When virus-free rootstocks are budded with an infected variety, the rootstock becomes infected and retains the virus or other agent. Similarly, when a virus-free variety is budded onto an infected rootstock, the variety becomes infected.

Virus infections are systemic, and they spread throughout the plant via the phloem (food-conducting) system. Therefore, once a plant becomes infected, the virus moves into all its parts—leaves, stems, flowers, fruits, and roots. Studies show, however, that the concentration of the virus varies and that the virus is usually not uniformly distributed within the plant.

In general, symptoms of virus and viruslike infections that are visible on the leaf may include overall chlorosis (yellowing) or chlorotic mottling; yellowing, or clearing of the veins; green or brown banding of veins (a dark green or brown color that parallels the veins); yellowish green to bright yellow spots and blotches; and various fine lines, some resembling an “oakleaf” pattern and others appearing as erratic, wavy “watermarks,” or as definite rings (Figure 1). The leaves may also be misshapen, puckered, recurved, cupped, twisted, brittle, and smaller than normal. In some cases, the leaves are cast prematurely.



Figure 1. Foliar symptoms of rose mosaic, including line patterns, ring spots, and mottles.

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Canes often have shorter than normal internodes, resulting in stunting or severe dwarfing of the plant, or a “balling” (rosette growth) of the new terminal growth. In some cases, there is severe cane dieback. Only one or a few canes of a plant may exhibit symptoms, or the entire plant may be affected.

With some of these diseases, only the new leaves and canes develop symptoms; with others, it is the mature, older leaves and canes that are visibly affected.

Usually, the higher temperatures and drier conditions of summer inhibit virus or viruslike activity in the plant. As a result, rose plants that had symptoms of infection in the spring commonly resume normal or near-normal growth in summer. With a return of cooler temperatures in autumn, symptoms often reappear, depending on the variety of rose, the strain of the virus or other agent, and environmental conditions. Although rose plants may seemingly tolerate infection, with symptoms appearing and then disappearing during the year, the agent does exert an overall debilitating effect and may eventually kill the plant. Aside from the acute symptoms that develop on leaves and stems, the plant suffers a chronic decline in vigor that, in cooler climates, increases the chances of winter-kill. Infected plants also show a decline in flower production and quality. Flower petals may show mottling, distortion, and line markings.

The earliest recognized viral disease of roses is common mosaic. Yellow mosaic has since been described. At present, the mosaics are the only rose diseases proven to be caused by a virus. The other agents have not been sufficiently characterized to provide positive proof that the diseases are incited by a virus. The causal viruses and viruslike agents comprise one or more complexes of virus strains that infect other members of the rose family as well as other plant families.

Although certain symptoms may be described for a certain type of virus or viruslike infection, it should be noted that infected plants may show no symptoms, that any one disease may exhibit a broad range of symptoms (as, for example, common rose mosaic does), and that different viruses or virus like agents can produce near-identical symptoms in certain rose varieties, but not in others.

Because the treatment for all virus and viruslike diseases of roses is primarily the same at present, it is not absolutely necessary to identify the precise virus or virus like disease before you begin treatment.

COMMON ROSE MOSAIC

This very common disease of all types of cultivated roses and other rose species is prevalent throughout the world. It is caused by one or more viruses.

Depending on the rose variety, the strain of virus, and environmental conditions, symptoms range from a general yellow chlorosis to vein clearing or banding, to distinct, erratic, wavy rings and lines, forming intricate patterns that resemble “watermarks” or outlines described as “oakleaf.” Little or no puckering or distortion of the blade is found in leaves with line markings. The pale green to bright yellow (chlorotic) blotches in the leaves are somewhat angular or fringed because of the clearing of the small veins. These areas are more numerous near the midvein and appear to feather away from it. They also commonly occur in greater numbers near the base of the leaflet. The leaf blade is commonly puckered and somewhat distorted around the chlorotic areas.

Affected plants range from slightly stunted to severely dwarfed. Because they are less vigorous, they may suffer greater winter injury in colder climates than healthy plants. The virus is transmitted by bud-

grafting. Transmission fails if the virus-affected bud does not unite with the rootstock plant. The causal agent is considered by many to be one or more strains of the *Prunus* ringspot virus, although some rose mosaics may be caused by different viruses.

YELLOW MOSAIC

Symptoms of this disease are essentially the same as those for mosaic except that the chlorotic areas are generally a brighter and lighter yellow. They are often more extensive and conspicuous (Figure 2). In most rose varieties, yellow mosaic tends to pucker the leaf less than common rose mosaic. The causal virus is probably one of the strains within the *Prunus* ringspot virus complex. Transmission is by bud-grafting.



Figure 2. Portion of a plant with yellow mosaic symptoms.

ROSE RING PATTERN

This disease is often confused with or obscured by common rose mosaic because of their similar symptoms. Rose ring pattern is considered a distinct component of the rose mosaic complex.

Symptoms are first expressed on the older leaves in the spring. Leaves always develop a network of fine lines that form rings and other patterns. Chlorotic flecks or larger spots occur with or without the fine line patterns. Color-break patterns may form in the petals. Symptoms can be mild and easily overlooked (Figure 3).

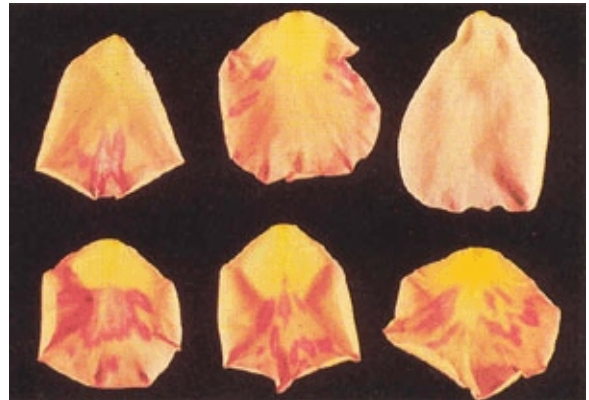


Figure 3. Rose Ring Pattern showing color-break patterns in petals.

Infected leaves are severely stunted, deformed, roughened, and mottled on the multiflora variety 'Burr', a useful indicator plant. Ring and line patterns are less obvious in summer, but the intense ring patterns reappear when temperatures fall in autumn. The causal agent is considered to be a distinct virus outside the ringspot and rose mosaic complex, but its present identity is unknown. Transmission is by bud-grafting.

ROSE STREAK

Symptoms are expressed in the leaves and canes as they approach maturity in autumn. Brownish green rings, brown vein banding, and mottling are visible in fully expanded leaves. Brownish or greenish, often water-soaked ring patterns develop on the canes and sometimes on fruit. Certain hybrid tea roses (e.g., 'Madame Butterfly') develop dark necrotic lesions that may girdle the canes where buds from plants affected by rose streak are inserted; secondary black lesions may appear on young lateral branches below the inserted buds.

ROSE LEAF CURL (Rose Wilt or Dieback)

The symptoms of rose leaf curl closely resemble those of rose wilt or dieback, a disease that occurs mainly in Australia, New Zealand, Africa, and Europe. In the United States, the infectious agent of rose leaf curl

occurs in many ‘antique’ roses in community rose gardens. The disease is widely distributed in the United States, but when it is seen in hybrid tea roses in public gardens, “antique” roses are usually nearby.

Symptoms include a downward curling (epinasty) of the emerging leaves in the spring. Leaf casting and shoot dieback follow and are accompanied by loss of plant vigor. The young leaves are generally smaller than normal and pale greenish yellow. In addition, there is localized clearing or flecking of secondary veins (Figure 4). The clearing is often associated with a diffuse chlorosis that may be transitory or that may progress until the veins become necrotic. The leaves eventually become quite brittle and are easily knocked off.

After leaf fall, the canes die back from the tips and plants lose vigor. Individual canes or the entire plant may be affected. Disease severity may fluctuate from year to year. Some plants, although apparently near death, have shown marked improvement, but many remain in a general state of debilitation. Subsequently, the lateral buds may produce new growth that may also become affected. Both hybrid tea roses and some “antique” roses “run out” from the disease. The effects are accentuated by severe winters.

Infected plants may have near normal growth in summer, but by late fall they again show conspicuous symptoms. The young leaves curl downward, and corky cracks form in the leaf rachis and main veins on both leaf surfaces. The bark of mature canes may split or show longitudinal cracks bordered by rough, corky bark. The inner bark of some canes may develop brown flecks, streaks, and patches beginning in early summer (Figure 5). This inner bark necrosis and pitting in the wood can occur without external symptoms, at least in the early stages. The causal agent (or agents) has not been identified.

ROSE SPRING DWARF

This disease occurs in commercial nurseries, landscape plantings, and public gardens. Symptoms appear in the spring when the emerging leaves show a downward curling and twisting on dwarfed shoots. The condition is so severe that the shoot tip becomes severely rosetted. The small, distorted leaflets show conspicuous and extensive vein-clearing, which gives rise to a netted appearance (Figure 6). Unlike rose leaf curl, the leaves do not become brittle and drop off.

Shoot elongation may be delayed for as long as two months as a result of the severe balling of the terminal growth. As shoots begin to elongate, the symptoms become less obvious. Leaflets produced in summer and autumn are essentially symptomless. Symptoms may, however, reappear if the canes are defoliated and lateral buds produce new growth. During summer and autumn, a marginal chlorosis of the terminal



Figure 4. Rose leaf curl. Note leaf epinasty and shoot necrosis.

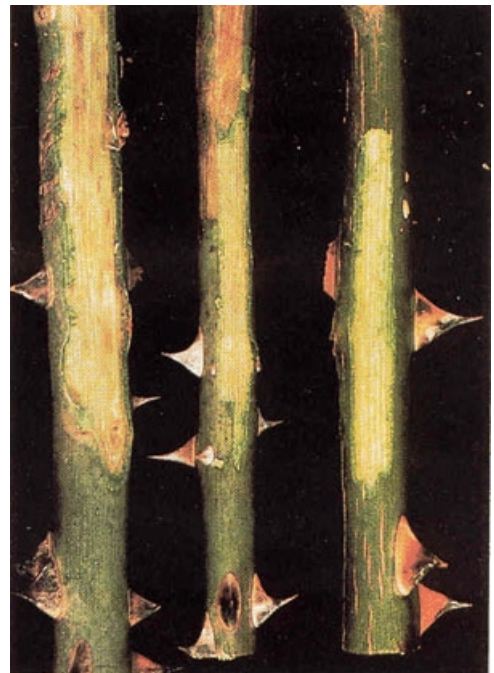


Figure 5. Stem pitting in cane.

leaflets may extend to the midrib. The chlorosis is evident on certain rootstocks such as multiflora 'Burr', *Rosa odorata*, and 'Multiflore de la Grifferaie'. Young shoots may show a zig-zag type of growth. In autumn the terminal leaflets may roll longitudinally upward and also turn prematurely red. Mature canes are brittle, but no dieback occurs as in rose leaf curl, nor is there necrosis of the leaf rachis or stem bark as in rose leaf curl.

The causal agent (or agents) is unknown. Transmission is by bud-grafting. No natural spread has been observed. Heat treatment will not "cure" this disease.

Control

Because rose viruses or viruslike agents are not seedborne and are spread almost exclusively during budding and grafting operations, control of these diseases rests primarily with the nursery and commercial rose grower.

1. The nursery has a responsibility to provide healthy rootstocks that originate from seed or cuttings taken from indexed, mother-block plants free of graft-perpetuated diseases.
2. The commercial grower has a responsibility to provide disease-free budwood or cuttings taken only from properly indexed, virus-free mother plants.
3. Identification of rose viruses and viruslike agents can be confirmed only through (a) several serological techniques performed by trained virologists in a well-equipped laboratory and (b) budding onto such indicator plants as virus-free 'Shirofugen' flowering cherry (common and yellow mosaics), *Rosa multiflora* 'Burr' (rose ring pattern and rose spring dwarf), and rose cultivars that include 'Queen Elizabeth' and 'Madame Butterfly' (rose leaf curl).
4. All rose plants showing virus and viruslike symptoms should be tagged by the propagator or commercial grower as soon as symptoms appear. Infected mother plants should be destroyed and not used for propagating. Routine inspection and tagging should be done periodically throughout the growing season because of the seasonal and sporadic appearance of symptoms. If these procedures are followed carefully, the cuttings, budsticks, and rootstocks should be free of viruses and viruslike agents. Freedom from disease cannot be guaranteed, however, since many of these agents are latent, or their symptoms are masked over much of the year.
5. Roses infected with mosaic have been cured by keeping the affected plants at a constant temperature of 94°F (34°C) for four weeks plus two additional weeks at (96°F (36°C)). The rose ring pattern agent can be destroyed in rose plants by keeping them at 100°F (38°C) for three to four weeks, followed by propagation of the lateral buds onto clean rootstocks. Such treatments produce rose plants free of this disease. Heat treatment will not destroy all rose viruses and viruslike agents, including rose spring dwarf and rose leaf curl (wilt or dieback). Finally, heat treatment procedures are practical only for a few large propagators who have the proper facilities.

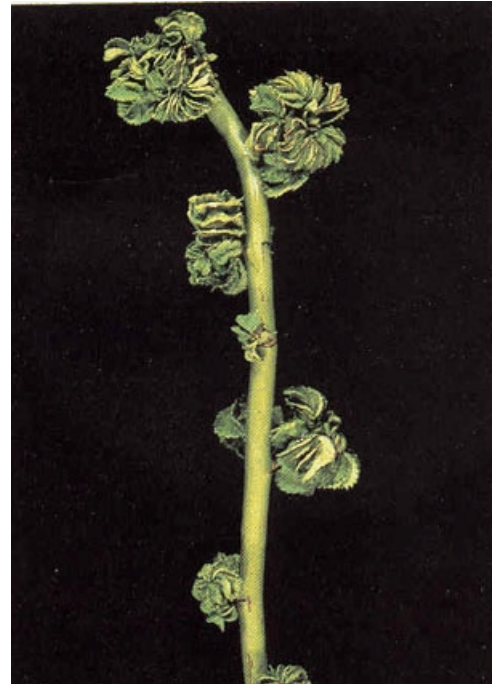


Figure 6. Leaf balling symptoms on *Rosa multiflora* 'Burr'.