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Rose Rosette Demystified

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What do we know?

Rose rosette disease, a lethal rose disease with no known cure, became a common disease in North Texas in the late 1990s. As of April 2019, it had been found within 300 miles of the El Paso County line, as well as in Midland and Odessa (Stalker, 2020). Many people who grow and enjoy roses, as well as landscapers who take care of them, are concerned about how to protect their plants and are confused by all the information available from various sources on the Internet, in publications, and from the media. So, what is known about this disease?

The following review of information from peer-reviewed (i.e., evaluated by experts in the field) articles in scientific journals summarizes what is known so far. The disease has been around for more than 70 years. As early as the 1940s, symptoms of witches' broom (growth of a tight, brush-like cluster of plant shoots) (Fig. 1) were described on roses in Manitoba, Canada (Conners, 1941). In the United States, rose plants in Wyoming with similar symptoms were described in 1942 (Thomas & Scott, 1953), and the disease was subsequently found in other states. In 1990, George Philley reported the disease in East Texas. It appeared in the Dallas-Fort Worth area in the mid-1990s and later expanded into West Texas. Symptoms associated with rose rosette disease include:

- Witches' broom (Fig. 2)
- Malformed flowers and leaves
- Excessive leaf growth and thorniness
- Extreme red discoloration of plant tissue (Fig. 3)
- Lateral shoot elongation (i.e., abnormal lengthening of side branches/twigs)
- Enlarged/thickened stems

However, symptoms vary on different rose types and cultivars. For example, red shoots do not occur in some ornamental rose varieties, and multiflora roses do not exhibit excessive thorns.

Figure 1. Witches' broom—the cluster and bunching of abnormal plant shoots.

Figure 2. Witches' broom effect on a flower cluster. Distorted flowers and increased, atypical reddish color on the buds.

Figure 3. Malformed shoots, smaller leaves, and increased red discoloration.

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What causes rose rosette?

Researchers have suspected that mite damage, phytoplasma, or a virus causes rose rosette disease.

Eriophyid mites

Transmission experiments using eriophyid mites collected from asymptomatic roses did not result in appreciable rose rosette symptoms (Armine et al., 1988), making it unlikely that the eriophyid mite's feeding causes the damage all by itself.

Phytoplasma

Phytoplasma, a specialized group of bacteria that infect plants, has long been considered a major candidate for the cause of the disease. Research articles from Poland (Kaminska et al., 2005), India (Chaturvedi et al., 2009), and China (Gao et al., 2008) demonstrated the presence of a phytoplasma from the aster yellows family causing rose rosette-like symptoms. However, there are no reports of phytoplasmas in symptomatic roses in the United States. In an experiment where symptomatic plants were treated with antibiotics, rose rosette symptoms persisted (Epstein & Hill, 1995). Antibiotics should have killed or suppressed the phytoplasma.

Virus

In 2011, a research group from the University of Arkansas detected a new virus, an Emaravirus (negative-strand RNA virus), in symptomatic roses. The virus occurred in 84 out of 84 symptomatic plants (Laney et al., 2011). This study also resulted in a genetic test to detect the virus. However, the procedure can be tedious. Several diagnostic clinics, including the Texas Plant Disease Diagnostic Lab, are testing a modified, easier-to-use detection method. The Oklahoma Plant Disease and Insect Lab and the Texas Plant Disease Diagnostic Lab are two National Plant Diagnostic Network-affiliated labs that can test for the rose rosette virus using PCR methods.

What is so bad about a virus?

There is no effective way to treat a virus on an infected plant because the virus may be systemic (i.e., spread throughout the plant) and not a localized infection. When symptoms occur on only part of the plant, the disease may be localized, or it may be systemic but asymptomatic on other parts of the plant. Pruning the infected part may eliminate the pathogen if the infection is localized, but, if systemic, the infection will persist. Mites carrying the virus can continue feeding on all parts of the rose and carry the virus to uninfected rose tissues.

What do studies show about how rose rosette disease is transmitted?

Grafting experiments

Grafting experiments on many different roses did not always result in transferring the rose rosette symptoms. Species and plant tissue age may have some influence, and disease transmission was more efficient on rapidly growing tissue (Armine et al., 1988; Epstein & Hill, 1995; Thomas & Scott, 1953).

Eriophyid mite (*Phyllocoptes fructiphilus*)

To test the mites' ability to transmit the disease, researchers took mites from infected, symptomatic plants and introduced them onto healthy plants. Although the disease was not always transmitted, the results suggest that the eriophyid mites can effectively transmit the disease for about 10 days. Experiments using eriophyid mites harvested from healthy plants and transferred to healthy plants did not result in rose rosette symptoms, suggesting that mite damage alone does not cause the symptoms (Allington et al., 1968, Armine et al., 1988).

Mechanical transmission experiments

To find out whether pruning practices might transmit the disease, leaf sap and juice, made by grinding infected plant parts, were rubbed on the leaves of healthy plants. This did not result in rose rosette symptoms (Allington et al., 1968).

Other experiments using contaminated razor blades to wound healthy plants also did not result in rose rosette symptoms. Stab inoculation, using a contaminated needle to wound healthy plants, resulted in rose rosette symptoms in two out of 120 tries (Epstein & Hill, 1995), showing that mechanical transmission is possible but highly unlikely.

How does the mite spread?

If plant parts are touching, it is possible that the mites could walk from one plant to the next. Movement for longer distances is thought to occur passively by wind (Epstein et al., 1997[; Keifer, 1975) or by piggybacking on other insects (Shvanderov, 1975).

Do we know conclusively that the eriophyid mite is transmitting the rose rosette virus?

No published study clearly demonstrates that the eriophyid mite (*Phyllocoptes fructiphilus*) actually carries the rose rosette virus. Evidence from mite transmission studies suggests that the eriophyid mites are carrying and transmitting some disease-causing agent from the diseased plant.

Can the virus move through root grafts?

The more apt question is whether adjacent roses will graft their roots together. Many have said that this is unlikely, but Golino (2005) demonstrated possible root grafting by using an herbicide on a plant and observing the mortality of the adjacent roses. An experiment where researchers grafted pieces of roots from an infected plant onto a healthy rose resulted in rose rosette symptoms on the new plant, suggesting that root tissue can harbor the virus (Armine et al., 1988).

If the virus is systemic and can get into the roots, it may be able to move to adjacent plants or new plants through the root graft. This theory has not been scientifically confirmed.

Why can't I leave it alone and see if it recovers?

Sometimes rose rosette disease does not kill the rose but stunts it. Although it may recover on its own, it is highly unlikely, and the infected rose can serve as a virus reservoir. Theoretically, eriophyid mites can transmit the virus from a diseased plant to other roses.

How is this disease currently identified and/or confirmed?

The following methods are used to diagnose rose rosette disease:

- Field identification based on symptoms. (The reliability of symptoms is an issue since herbicide damage, insect damage, and nonbiological environmental conditions—such as wind, temperature, and sun—can mimic rose rosette symptoms.)
- Detection of eriophyid mites along with disease symptoms
- Electron microscopy to identify virus-like particles and soluble, membrane-bound particles (Ahn et al., 1996; Rohozinski et al., 2001; Silvestro & Chapman, 2004)
- PCR analysis using molecular methods to detect the virus. (See more below.)

Are my roses "clean" if the genetic detection test is negative?

Not necessarily. The genetic test detects the presence of the virus on the sample. Typically, even though symptomatic plant tissue is usually used for the test, only a small portion of the plant is sampled. The sample does not show the extent to which the virus is distributed throughout the plant. The sample may contain no viruses or viruses below the detection limit of the test.

If infection is suspected, additional sampling and continued monitoring for symptoms and mites is advised.

What is the best way to deal with rose rosette disease?

Based on the current information about the disease and its presumed vector, the best management practices are:

- Remove confirmed and/or symptomatic plants quickly.
- Treat nearby plants with miticide to reduce the probability of disease transmission by eriophyid mites, but this will not stop the virus if it is already in the plant.
- Monitor symptoms weekly and act quickly when and if symptoms occur.
- If desiring to replant with roses, remove all diseased plant roots from the soil before replanting in the same area. This is a prudent precaution even though it is unlikely the virus spreads this way.

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