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Apple, crabapple, hawthorn, and juniper disorder: Cedar-rust complex

G.L. WORF and M.F. HEIMANN

Cedar-rust complex is caused by a fungus that requires two hosts—juniper plus apple, crabapple, hawthorn, or quince—to complete its life cycle. This disease is found anywhere that junipers (also known as red cedars) grow and can cause considerable damage when both hosts are grown near each other.

Symptoms and effects

Deciduous hosts

Cedar-apple rust symptoms occur primarily on leaves, although they may appear on twigs and fruit. Small, pale yellow spots appear on the leaves' upper surface in May. These gradually enlarge and turn orange, exuding rust-colored droplets from the center when the diameter of the spots reach ⅛ inch. Later, black dots appear on the surface of the spots. At this stage, the spots also are evident on the leaves' undersurface, but remain yellow rather than orange. The lesions vary in size depending on the variety of tree and the number of spots present on a single leaf. The affected leaf tissue swells but rarely dies. Bulges appear on the underside of the spots. The bulges later develop cylindrical tubes that are open on the undersurface and contain light-brown spores. In July and August, the infected leaves may drop. Defoliation is more severe during dry summers.

On twigs, the cedar-apple rust first appears on the current season's growth as a swollen section—usually not more than 1 inch in length. The swelling eventually develops the characteristic cylindrical fruiting bodies.

On fruit, cedar-apple rust causes orange spots similar to those found on leaves, but the spots are usually much larger. The lesions are usually found near the bottom of the fruit. The normal light-green coloring of young fruit becomes darker around the border of the affected area. The cylindrical fruiting bodies that are found on leaves and twigs rarely appear on the fruit, but when present they are usually in a circle outside the dark centers of the spots.

Rust disease on hawthorn produces conspicuous orange spots on the upper surface of leaves and cylindrical tubes or rough areas on the undersides.

Rust galls on juniper twigs before warm spring rains cause them to expand to produce spore horns. Cedar-apple galls (a) are usually rounder, larger, and produce lighter colored, more cylindrical spore horns than cedar-hawthorn galls (b). Spore horns on the latter are more angular and usually dark red.

Quince rust is much more likely to attack fruit than cedar-apple rust and, on the fruit of hawthorn and some ornamental crabapples, the cylindrical fruiting structures can be very conspicuous. The apple skin becomes raised and rough and often the whole fruit is misshapen as a result of this disease. While the flesh under the spot is still alive, it is somewhat corky.

Fruit infection reduces the quality of the fruit for home use; leaf loss reduces the size and quality of the current season's growth; and infection over several years weakens the tree reducing yields or resulting in no fruit set.

Disease severity increases as the number of red cedars grown near susceptible deciduous hosts increases. Weather also influences severity. During extended periods of wet weather, infection can occur anywhere on deciduous hosts when temperatures range from slightly above freezing to 90°F. However, this disease is more likely to occur between 50° and 75°F. At these temperatures, just 4–6 hours of leaf wetness can cause severe infection on leaves that are less than 8 days old.

Junipers

On juniper, the cedar rust fungus produces galls or swellings that usually are conspicuous in the spring when the spores are being released. Their characteristic appearance makes rust galls easy to identify in the field. Galls of the cedar-apple rust are most common and conspicuous. They are typically found within or attached to juniper needles, brown to dull red in color, globular in shape, and may vary from pea-sized to an inch or more in diameter. When "spore horns" are produced in the spring, they are red-orange and circular.

Cedar-hawthorn rust galls are generally smaller than cedar-apple rust galls, not quite as symmetrical, and produce darker-colored spore masses that are more rectangular at the bases where they emerge from the gall. They are typically biennial, as are cedar-apple rust galls, although cedar-hawthorn rust galls may survive for additional years.

A year after galls first appear, following rainy periods in May, a gelatinous spore horn ¼–½ inch long and about ⅛ inch in diameter pushes out from the center of each depression in the gall. As the spore horns dry, they become thin, wrinkled threads. When re-moistened, they swell again and grow. The number of individual spore horns per gall can vary from one to more than 100; and each releases many spores during dry, windy weather that follows. Spore production lasts for a few weeks in the spring after which the spore horns dry and turn black, remaining on the tree but no longer functional.

Quince rust produces small, spindle-shaped swellings within the stems of the junipers. These swellings are much less conspicuous than the cedar-apple and cedar-hawthorn rust galls and are often overlooked, except in spring when the red-orange spore masses emerge. Quince rust galls last many years, producing spores each spring.

Quince rust infection on a crabapple fruit is typical of symptoms on fruits of other susceptible trees.

Cause

Cedar rust—commonly called cedar-apple rust—is caused by several species of the fungal genus *Gymnosporangium*, each of which attacks certain species of juniper and one or more members of *Malus, Crataegus,* and closely related genera. *G. juniperi-virginiani* causes cedar-apple rust, *G. globosum* causes cedar-hawthorn rust, and *G. clavipes* causes cedar-quince rust.

Control

Cultural

Cultural control of cedar-apple rust is possible through selection of resistant cultivars. Table 1 lists apple cultivars with resistance to cedar-apple rust. There are also some resistant red cedar cultivars; check with your nursery. Removing the alternate host—red cedar—offers only limited control as rust spores can be carried miles.

Chemical

If necessary, apply fungicides before or immediately following the first warm spring rains. At this time, rust galls on junipers release large amounts of spores—when apple and ornamental crabapple are most susceptible to rust infection.

Table 1. Apple cultivars with resistance to cedar-apple rust

Very resistant	Resistant
Delicious	Early McIntosh
Jerseymac	Empire
Liberty	Gravenstein
McIntosh	Jonafree
Milton	Jonamac
Mollies Delicious	Macfree
Nova Easygro	Macoun
Priscilla	Paulared
Redfree	Spartan
William's Pride	Starkspur Earliblaze
	Viking

This is a rust gall on red cedar in spring. The fully expanded, orange spore horns release spores which infect nearby apple and related trees.

Apples. Spray three times during flowering: when flower buds show color but are not yet open ("pink"), when half of the flowers are open, and at petal-fall. Treat 7–10 days after petal-fall and again 10–14 days later. The timing is the same as for scab control, so you can add this fungicide to scab sprays if you are controlling that disease as well.

Several fungicides are registered for rust control on apples. These include ferbam, mancozeb (Dithane M-45, Manzate 200), maneb plus zinc (Manzate D, Dithane M-22 special), metiram (Polyram), thiram, triforine (Funginex), and zineb. General-purpose fruit sprays should also control rust if they contain one of these chemicals—check the label, many do not. Carefully follow label directions for application rates.

Crabapple and hawthorn. The spray schedule is the same as for apple, although the fungicides differ. Sulfur, chlorothalonil (Daconil), mancozeb (Fore), Zyban, Duosan, and Bayleton are registered for crabapple; most of these also are registered for hawthorn, but check the label for current status. Again, carefully follow label directions for dosage.

References to products in this publication are for your convenience and are not an endorsement of one product over other similar products. You are responsible for using chemicals according to the manufacturer's current label directions. Follow directions exactly to protect the environment and people from chemical exposure.

Authors: G.L. Worf is professor emeritus of plant pathology and M.F. Heimann, O.S.F., is distinguished outreach specialist, College of Agricultural and Life Sciences, University of Wisconsin-Madison and University of Wisconsin-Extension, Cooperative Extension.
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