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COMMON DISEASES OF CRABAPPLE

There are several diseases that commonly occur on ornamental crabapples in landscapes throughout the state every year. These fungal diseases are scab and two Gymnosporangium rusts (cedar-apple rust and cedar-hawthorn rust). A bacterial disease called fire blight is considered to be an occasional problem. However, when this disease occurs, it can be very damaging. The occurrence and severity of these diseases are influenced by many factors, including the level of infection and amount of overwintering inoculum from the previous year, the weather at the time of leaf emergence, cultural practices, and the species or cultivar of crabapple that is planted.

I. SCAB:

Causal Agent: *Venturia inaequalis* (fungus)

Symptoms and Disease Development:

Scab, sometimes referred to as "apple scab," is the most noteworthy and common disease of crabapple in Connecticut. It is usually most severe after cool, wet spring weather. Leaf symptoms are first visible in May or early June and appear as pale green blotches. These develop into circular, olive-black, velvety lesions with feathery margins that are diagnostic for this disease (Figure 1). These lesions are often found along the mid-vein (Figure 2) where the leaf surfaces stay wet for longer periods of time. Infected leaves usually turn yellow or chlorotic, even when they only have a few spots. As the

Figure 1. Olive-black, velvety scab lesions with feathery margins.

Figure 2. Scab lesions concentrated along the midvein of a leaf.

leaves yellow, they often drop prematurely. Heavy leaf infections can result in significant defoliation of highly susceptible crabapples by July. When the trees are otherwise healthy and vigorous, premature defoliation is more of a cosmetic or aesthetic problem, which rarely has long-term health implications.

Symptoms also develop on fruit and young fruit stems. Lesions on fruit appear similar to those on the leaves but they become corky and crack as the fruit enlarge. Infections on young fruit can cause fruit deformity as the fruit expands.

The fungus overwinters on dead, fallen leaves. These leaves serve as a critical source of primary inoculum (fungal spores responsible for primary infections) available to infect newly emerging leaves and young fruit during periods of rain or overhead irrigation in spring. If scab symptoms develop on leaves or fruit by late spring from these primary infections, a secondary cycle of infection is initiated. This secondary or summer cycle is caused by a second type of spore (different from those responsible for spring infections). These spores initiate new infections after they land on leaves and developing fruit during periods of wind-driven rain or irrigation during the summer. Summer infections of scab can result in dramatic increases in both the severity and prevalence of disease on individual trees.

Management of Scab:

Cultural Practices—it is helpful to keep trees vigorous by following sound cultural practices, controlling insect infestations, and watering during periods of drought. Pruning crabapples in late winter to "open" the canopy of the tree helps to reduce disease by increasing air circulation, which results in faster drying of the tissues. It also allows for better penetration of spray materials if they are part of the management program.

Sanitation—a good sanitation program in which diseased leaves and fruit are removed from the vicinity of the tree will also help to eliminate sources of primary inoculum in the spring.

Resistance—Scab is most effectively managed by planting resistant varieties. A partial list of resistant crabapples that are hardy in Connecticut includes Adams, Baskatong, Brandywine, Callaway, David, Dolgo, Donald Wyman, *Malus floribunda*, Henry Kohankie, Henningi, Jewelberry, Ormiston Roy, Professor Sprenger, *Malus seiboldi* var. *zumi* cultivars Calocarpa, Silver Moon, Sugartyme, *Malus tschonoski*, Weeping Candy Apple, White Angel, and White Cascade.

Fungicides—when heavy defoliation is frequent, fungicide sprays are often helpful. Among the fungicides registered for use in Connecticut are chlorothalonil, copper sulphate pentahydrate; mancozeb, myclobutanil, propiconazole, and thiophanate-methyl. For organic management, acceptable formulations of copper, neem oil, potassium bicarbonate, and sulfur can be used to reduce infections. Applications can be made at budbreak and repeated at label intervals until mid-June. More frequent and prolonged sprays may be necessary in wet weather.

II. GYMNOSPORANGIUM RUSTS

There are over 40 species of Gymnosporangium rusts in North America but two species are significant on crabapple throughout Connecticut and New England. These are cedar-apple rust and cedar-hawthorn rust. These fungi are closely related and are heteroecious, meaning that they require two different hosts to complete their life cycles. The primary hosts are members of the Rose family (Rosaceae), crabapples in this case. The alternate hosts

are evergreens in the genus *Juniperus*, which includes the native Eastern red cedar (*J. virginiana*) as well as many ornamental junipers (e.g., Chinese, low, and creeping junipers). These diseases are most problematic when both hosts grow in close proximity. Refer to the fact sheet "Gymnosporangium Rusts" by S. M. Douglas for more detailed information and photos of these diseases.

A. CEDAR-APPLE RUST

Causal Agent: *Gymnosporangium juniperi-virginianae* (fungus)

Symptoms and Disease Development:

Infections result in brilliant yellow-orange spots or lesions on crabapple leaves and occasional lesions on the calyx end of the fruit. Symptoms first appear in early June as greenish-yellow spots that gradually increase in size. They eventually develop into brightly colored spots—the color varying from yellowish-orange to red, depending on the variety (Figures 3 and 4). Fungal fruiting structures called aecia develop within the lesions and are visible on the undersurfaces of the leaves. These are typically short, cup-like protrusions (~$^1/_8$ inch long) (Figure 5). Spores are produced in these structures during the summer that can only infect juniper. They are carried by wind to junipers where they initiate new infections.

Heavy foliar infections of crabapple can result in leaf yellowing and substantial premature defoliation.

On juniper hosts, infections result in brown to reddish-brown galls, ¼-2 inches in diameter (Figure 6). These galls are generally inconspicuous during the winter. However, during rainy periods in the spring, distinctive bright orange, gelatinous spore-horns protrude from the surface of these galls (Figure 7). The spores are blown by the wind to crabapple trees where they infect and produce characteristic lesions on newly developing crabapple leaves.

Figure 3. Symptoms of cedar-apple rust on red-pigmented crabapple (upper leaf surface).

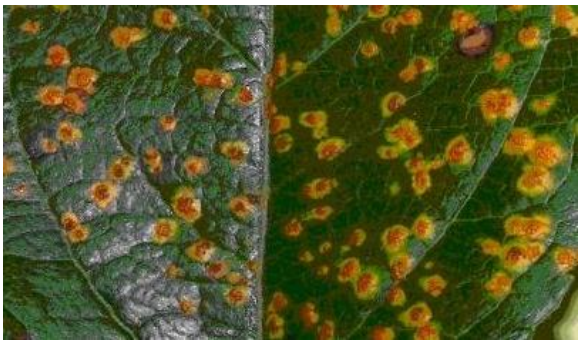

Figure 4. Characteristic yellow-orange lesions on the upper surface of a crabapple leaf.

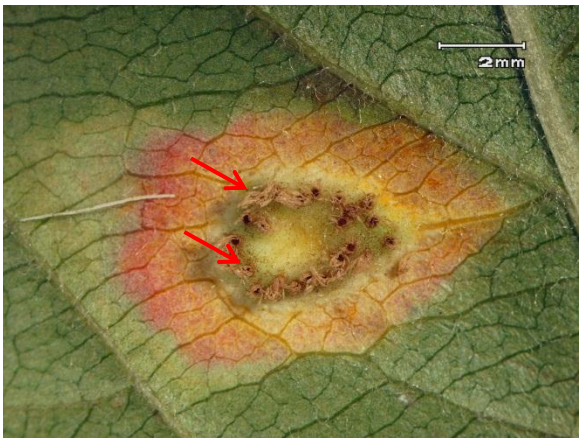

Figure 5. Aecia (arrows) are cup-like protrusions visible in the rust lesion on the lower leaf surface.

Figure 6. Dormant cedar-apple rust gall overwintering on Eastern red cedar.

Figure 7. Spectacular, gelatinous telial horns develop from galls after rain.

Figure 8. Brightly colored cedar-hawthorn rust lesions on crabapple.

Figure 9. Long, finger-like aecia protrude from the lower surface of a cedar-hawthorn rust lesion.

B. CEDAR-HAWTHORN RUST-
Causal Agent: *Gymnosporangium globosum* (fungus)
Symptoms and Disease Development:
Symptoms usually develop on leaves but cedar-hawthorn infections can also result in symptoms on fruit, petioles, and twigs. On leaves, characteristically brightly colored lesions develop in June and July (Figure 8). Cedar-hawthorn rust can be distinguished from cedar-apple rust by several attributes of the fungal fruiting structures (aecia) on the undersurface of the leaves of crabapple. For example, the aecia of cedar-hawthorn rust are substantially longer than those of cedar-apple rust and appear as finger-like projections (Figure 9). Heavy foliar infections can result in yellowing and premature defoliation.

Symptoms of cedar-hawthorn rust on Eastern red cedar and other junipers are usually inconspicuous, especially during winter. They are small, brown galls from $^{1}/_{8}$-$^{9}/_{16}$ inch in diameter (Figure 10), and can appear flattened on the side attached to the twig. These galls are much smaller than those associated with cedar-apple rust. In spring, brightly colored telial horns protrude from the galls, but they are typically much smaller and less spectacular than those produced in cedar-apple rust (Figure 11).

Figure 10. Dormant cedar-hawthorn gall (arrow) on juniper.

Figure 11. Telial horns protruding from cedar-hawthorn galls in spring.

Management of Gymnosporangium Rusts:

Cultural Practices—these include removal of either host within ½-1 mile from the other, although in most cases this is not a feasible option. Crabapple trees should also be kept as vigorous as possible by following sound cultural practices to maintain tree vigor, controlling insect infestations, and watering during periods of drought.

Sanitation—Galls can also be pruned and removed from juniper branches during dormancy, although this is usually not practical.

Resistance—Selection and planting of resistant varieties is the most important and effective method of managing rust diseases. Examples of rust-resistant crabapple varieties include Adams, Dolgo, Donald Wyman, Firecracker, Ellwangerina, Henry Kohankie, Ormiston Roy, and Prairifire.

Fungicides—in situations where rust diseases rarely occur or very limited infections occur, no control is usually necessary. However, where disease is frequent and severe, fungicide sprays can be applied to the crabapple hosts. Among the fungicides registered for use in Connecticut are chlorothalonil, mancozeb, triadimefon, myclobutanil, propiconazole, and thiophanate-methyl. For organic management, acceptable formulations of sulfur can be used to reduce infections. Applications can be made at budbreak and repeated at label intervals as necessary. More frequent sprays may be necessary in wet weather. Fungicide control for juniper hosts is usually not practical since it usually requires a season-long spray program.

III. FIRE BLIGHT-

Causal Agent: *Erwinia amylovora* (bacterium)

Symptoms and Disease Development:

Fire blight is the most devastating disease of crabapple in the landscape. Fortunately, this disease is only an occasional problem and when it does occur, it is often isolated to specific geographical locations. However, when infection does occur, the disease can develop quite rapidly and can destroy individual trees in a single season.

Infected blossoms and leaves suddenly wilt and turn dark brown to black, shrivel, and die, but usually remain attached to the plant (Figure 12). Leaves show a blackening of the petiole and adjacent tissue can be seen before the whole leaf dies. Infected fruit appear leathery and often ooze with bacteria. Cankers on limbs are characteristically shrunken and dark brown to purplish in color. Dark streaking in the wood often extends several inches beyond any surface discoloration. A diagnostic symptom of fire

blight is the bending of the "blighted" terminal, which resembles a shepherd's crook.

Figure 12. Blackened leaves remain attached to infected shoots.

The bacteria survive the winter in old cankers on infected crabapples and other plant hosts and in healthy buds. As weather becomes favorable for growth in spring, the bacteria begin to rapidly multiply and can be seen oozing out of tissues. This creamy bacterial ooze is attractive to insects, which pick up the bacteria and carry them to open flower buds where infection occurs. Infections can also occur through natural openings in leaves (stomata), branches (lenticels), pruning wounds, insect feeding and ovipositing, and hail. The bacteria are also carried by wind and rain to open blossoms. Infected tissues are characterized by their blackened, "burned" appearance, hence the name "fire blight."

Management of Fire Blight:

Cultural Practices—the effects of this disease can also be minimized by maintaining overall tree health following proper cultural practices that avoid excessive vigor. It is especially important to avoid heavy applications of nitrogen in spring.

Sanitation—this is a **very** important aspect of control. Any cankered or infected branches or twigs should be cut back to healthy wood during the dormant season. All pruning cuts should be made at least 8-12 inches below visible symptoms. All tools should be disinfested with 10% household bleach (1 part bleach: 9 parts water) or 70% alcohol. Prunings should be removed from the vicinity of the tree.

Resistance—the most effective method for managing this disease is to select and plant crabapple varieties that are resistant to fire blight. These include: Adams, Adirondack, Autumn Glory, Camelot, David, Lancelot, Indian Summer, Jewelberry, Liset, Profusion, Prairifire, Tina, and White Angel.

Chemical Control—this is generally not suggested for landscape crabapples. However, dormant copper sprays applied to the bark in early spring before budbreak have been shown to reduce the growth of bacteria on bark surfaces.

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