CHEMICAL CONTROL OF CEDAR-APPLE AND CEDAR-HAWTHORN RUSTS

by Dan Neely

Flowering crabapples and ornamental hawthorns are popular small trees for use in landscape plantings. They have excellent displays of flowers, attractive dark green foliage, and outstanding, often persistent, displays of colored fruits. However, many species and cultivars of crabapples (*Malus*) and hawthorns (*Crataegus*) are susceptible to one or more diseases. The four most common diseases are scab, fire blight, rust, and powdery mildew. These reduce the aesthetic value by spotting the leaves and/or fruit and reduce the vigor of the plants through repeated infections and premature defoliation.

The best measure to avoid these disease problems is the use of resistant plant cultivars. Screening trials and evaluations for disease resistance have been conducted over the last 20 years. Nichols (2) and Smith (3) recently published descriptions of their favorite flowering crabapples giving size; flower, foliage, and fruit characteristics; and disease resistance ratings. All crabapples and hawthorns for current or future landscape planting should be selected from lists of disease-resistant cultivars.

Unfortunately, many of the crabapples and hawthorns already in the landscape are not resistant cultivars. For disease control, fungicides and bactericides are frequently recommended. Maneb, mancozeb, chlorothalonil, zineb, and ferbam fungicides have been used for several years. These are protectant fungicides which remain on the leaf surface and inhibit fungal activity upon contact, thereby reducing leaf infection. Since they remain where they are applied, additional applications are required to protect new growth.

Landscape maintenance personnel now have available a new type of fungicide that controls diseases more efficiently and economically: the systemic fungicide. Systemics are absorbed into leaf and green stem tissue and move within the plant, even to unsprayed plant parts. They reduce leaf infection from without and within. The first systemic fungicide to be registered (1971), and to gain widespread use in North America, was Benlate (benomyl). In 1980 a second group of systemic fungicides was registered for use on certain agronomic crops. Three of these were included in 1980-1982 screening trials to control rust diseases. Those tested were Baycor (bitertanol) and Bayleton (triadimefon) from Mobay Chemical Corporation, Kansas City, MO, and Vangard from CIBA-GEIGY Corporation, Greensboro, NC.

Rust on crabapple (caused by the fungus *Gymnosporangium juniperi-virginianae*) or on hawthorn (caused by *G. globosum*) is usually a problem only in areas where native red cedar (*Juniperus virginiana*) or plantings of other susceptible junipers (1) are growing within one mile of susceptible crabapples or hawthorns. Yellow-orange spots appear on the leaf blades of the deciduous host, and the upper surface of the lesion becomes covered with minute black dots. Later, cup-like structures form on the lower surface. Spores produced on the crabapples or hawthorns infect junipers, producing galls on the young shoots. When mature, horns form on these galls which gelatinize during damp spring weather and produce spores that infect the crabapples or hawthorns.

In the Illinois Natural History Survey arboretum where susceptible juniper (*Juniperus virginiana*), crabapple (*Malus ioensis*), and hawthorn (*Crataegus mollis*) are growing within 100 feet of each other, disease damage is present every year. The *Malus* and *Crataegus* plants are pruned severely each spring prior to bud break to maintain distinct, low, small crowns. The fungicides were applied with a 3-gallon knapsack air compression sprayer. The fungicides tested and the dates of application are shown in Table 1. Each plant was observed weekly following the first application for evidence of chemical toxicity. Efficacy data were obtained by indexing disease severity on four ter-

Table 1. Control of crabapple rust and hawthorn rust with various fungicide treatments in the Illinois Natural History Survey arboretum, Urbana, Illinois.

	*Leaf lesion index**					
	Crabapple rust			*Hawthorn rust*		
Treatment and rate/100 gal	*1980*	*1981*	*1982*	*1980*	*1981*	*1982*
Baycor 25W, 16 oz	0.0	1.8	—**	0.0	0.0	—
Bayleton 25W, 4 oz	—	1.6	0.0	—	0.0	0.0
Vangard 10W, 12 oz	0.5	1.7	—	0.0	0.0	—
Daconil 2787 500F, 2 pts	2.2	—	—	—	1.3	—
Manzate 200 80W, 24 oz	2.5	—	—	1.8	—	—
Difolatan 4F, 3 pts	—	—	3.1	—	—	3.0
Captan 50W, 2 lbs	—	—	3.3	—	—	—
Untreated check	3.0	3.7	4.1	3.1	2.7	4.1

*Leaf lesion index: 0=none, 1=rare, 2=light, 3=moderate, 4=heavy, 5=severe. Application dates: May 2, 15, and 27, 1980; April 27 and May 12, 1981; and May 11 and 24, 1982: three trees per treatment.
**No observation.

minal shoots of each treated and untreated plant in late June or early July.

The severity of rust on the leaves of crabapple and hawthorn varies annually, depending largely on rainfall, humidity, and temperature. The weather in May, when most of the leaf infection occurs in central Illinois, was warm and dry in 1980, cool and wet in 1981 (even through mid-June), and warm and wet in 1982. Rust infections were moderate in 1980, moderate to moderately heavy in 1981, and heavy in 1982 on the unsprayed trees.

Bayleton, Baycor, and Vangard gave almost perfect control of crabapple rust and hawthorn rust. The crabapple rust lesions evident in 1981 were late-season (June) infections on leaves that had never been sprayed. The four other fungicides used in those years, Daconil 2787, Manzate 200, Difolatan, and Captan, gave some control but were not nearly as effective as the first three (Table 1).

The mode of action of Bayleton, Baycor, and Vangard is different from that of protectant fungicides. They are sterol-inhibiting fungicides, and since sterols contribute significantly to the structure and function of fungal membranes, any disruption in the development of cellular membranes can have a profound effect on the pathogenicity of the fungus.

Bayleton is the only sterol-inhibiting fungicide currently registered and labeled for use on ornamental crabapples and hawthorns. It has a high degree of systemic activity and is particularly effective against rust and powdery mildew fungi. It can be a protective fungicide by preventing completion of the infection process. It also acts curatively by preventing symptoms after infection has taken place and by eradicating the causal fungus after disease symptoms have appeared. This prolonged activity greatly lengthens the period for effective application.

The systemic capability of Bayleton allows control of rust diseases with fewer sprays. Whereas previously used fungicides required three or more applications per season, Bayleton effectively controls with two sprays (the first in Illinois immediately following the first ½-inch (1.2-cm) rain in May, the second 14-20 days later); even a single spray will substantially reduce lesion number. This is an important consideration both in the economics of spray application and in the reduced chemical contamination of the environment. Bayleton is compatible with other fungicides, insecticides, and herbicides. Since Bayleton is only moderately

effective against scab (caused by the fungus *Venturia inaequalis*), a second fungicide, such as Benlate, may have to be added to the tank mix when both rust and scab diseases require control.

Bayleton is not inexpensive, but it is applied at a rate much lower than that arborists are accustomed to using and is effective with fewer applications. Bayleton is available from wholesale establishments that distribute lawn chemicals (or contact Mobay Chemical Corporation, Ag. Chemicals Division, Box 4913, Kansas City, MO 64120).

Literature Cited

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ABSTRACT

Shank, B.F. 1982. **Shigo and his saw shed new light on tree health.** Weeds, Trees & Turf 21(6): 28, 30, 34.

Alex Shigo, chief scientist at the USDA Northeastern Forest Experiment Station in New Hampshire, is well known to the tree care community. In 1950, he began to dissect hundreds of trees with a chain saw to pin down the actual response of trees to injury and maintenance practices. His string of discoveries has not stopped. There are many people causing unnecessary damage to trees during pruning by cutting into the collar of the branch. Many still use tree wound paint even though it serves no purpose to the tree. During cavity repair, excessive cleaning may reinjure the tree rather than help it. Injecting materials into the tree may do more harm than good, especially if holes are drilled along the same line year after year. These are just a few of the conclusions made by Shigo while working for the Forest Service. The biggest breakthrough, however, may be just around the corner. Shigo is focusing on the energy needed for a tree to protect itself and the level of stored energy in healthy versus unhealthy trees. If the energy problem can be solved, then perhaps the tree will depend more on itself for maintenance. His work on energy reserves in trees developed out of the Dutch elm disease research he is doing. When potassium iodide was applied to cores or slices of various trees, healthy trees showed good starch reserves while dying trees showed little if any reserves. The thought follows if starch reserves can be restored, the tree's defensive reactions will improve and it will survive.