Figure 2.

Figure 3.

Figure 1. Colorized scanning electron micrograph of the rose mite (*Phyllocoptes fructiphilus*), a rose rosette virus vector. Scale bar = 20 µm (0.02 mm), image courtesy of Gary Bauchan and Ron Ochoa, colorized by Chris Pooley, USDA-ARS, Beltsville.

Meet (and Beat) Rose Rosette

John Hammond, Ph.D. and Ramon Jordan, Ph.D.

U.S. NATIONAL ARBORETUM SCIENTISTS John Hammond and Ramon Jordan are participants in a Specialty Crops Research Initiative grant to tackle the problem of rose rosette disease (RRD). RRD threatens the $400 million rose industry, rose collections, and roses in private gardens across the US. Drs. Hammond and Jordan are tasked with developing reliable and fast serological (antibody-based) tests for detecting and identifying the rose rosette virus that causes RRD. They collaborate with other plant pathologists, entomologists, rose breeders, and extension personnel at five universities as well as the US Department of Agriculture Electron and Confocal Microscopy Unit in Beltsville in a multidisciplinary approach to understanding and combating RRD, including selection and breeding of RRD-resistant roses.

RRD has emerged as a significant threat to the health and ultimate survival of many types of roses; infected plants may die within one or two years. RRD is caused by infection with the recently discovered rose rosette virus, although RRD has been known since the 1940s as a disease of wild multiflora roses. RRD was long thought to be confined to multiflora roses, a noxious weed in many states, and was considered a potential biocontrol for multiflora roses. But more recently, RRD has been found to affect cultivated roses, starting with landscape roses and then many other rose types, meaning that use of RRD for biocontrol may endanger cultivated roses.

Rose rosette virus is transmitted by eriophyid mites (*Phyllocoptes fructiphilus*), which are spread by wind currents. The mites stand erect on exposed leaves, and then release their grip to be lifted and spread around by a suitable breeze. The mites require magnification to be visible—an adult is about 0.02 millimeters long (Figure 1). The best approaches to control RRD in cultivated roses are to start with healthy plants, to root out RRD-affected plants as soon as possible, and to minimize mite populations to avoid transmission.

To remove infected plants, it is first necessary to recognize the symptoms of RRD, which may differ between rose species and cultivars (some symptoms mimic herbicide damage), making visual diagnosis difficult. Characteristic symptoms include increased growth of vegetative shoots, followed by proliferation of small branches with densely-packed, often distorted, small leaves (a witches' broom appearance; Figures 2 and 3). Leaves and stems may have abnormal pigmentation, and stems may also be swollen and produce an excessive number of thorns which may be either green or red. Flowers may be abnormal in appearance and color; some petals may be replaced by leaf-like structures. Removal of symptomatic canes by pruning may delay the spread of the virus but is unlikely to save the plant, which may serve as a source for mite transmission to other plants.

Removal of affected plants at first identification is recommended, preferably by bagging the plant (to prevent mites from migrating) and cutting it at ground level; the root system should be dug out, and both roots and shoots should be burned or bagged for disposal. The mites can overwinter under bark, in dormant vegetative buds, and in spent flower buds remaining on the plant. Hard winter pruning (cutting back by about two thirds) followed by removal of all prunings and treatment with horticultural oil, should remove most of the mites from healthy plants or kill them. Application of horticultural oil, insecticidal soap, or miticides to control eriophyid mites during active growing may also help, but may also affect beneficial insects that prey on eriophyid mites.

Currently, definitive diagnosis of rose rosette virus is by nucleic acid–based laboratory tests such as polymerase chain reaction assays, which require specialized equipment and are not available to most rose producers or growers. Arboretum scientists are working to develop serological tests that can be implemented by rose producers or even home gardeners, with the end goal of developing a dipstick test similar to a home pregnancy test. To date, new antibodies for detection of rose rosette virus have been developed and are being evaluated for specificity and sensitivity in various test formats. Arboretum scientists are also working with other Agricultural Research Service scientists and with rose breeders to examine interactions between the mites and different rose types to identify characteristics of roses with resistance to either rose rosette virus or the mite vectors, characteristics the breeders can use to select new varieties.

Previous page, top left: Figure 2. Rose rosette-affected landscape rose showing proliferation of branches with small, densely packed leaves and abnormal leaf coloration and distortion. An unaffected plant in the background shows normal leaf size and color, photo courtesy of John Hammond; **Top right:** Figure 3. Severely RRD-affected shoots at lower left contrast with relatively normal growth and flowering of adjacent plants, photo courtesy of John Hammond; **Bottom:** Dr. Hammond looking at a rose with RRD, photo courtesy of Sue Bentz.

DR. JOHN HAMMOND *is Research Plant Pathologist in the Arboretum's Floral and Nursery Plants Research Unit, where he has been studying rose rosette disease for several years.* **DR. RAMON JORDAN** *is Associate Director of the Floral and Nursery Plants Research Unit.*