Our Dahlia Viruses Are Evolving!

By Ron Miner

In hindsight, it is no great shock that the dahlia viruses we've been monitoring over the last seven years are evolving. Just think of the multitude of Covid-19 variations we've heard about over the last couple years! Professor Pappu and his team of researchers at WSU have studied several populations of the Dahlia Mosaic Virus (DMV) and Dahlia Common Mosaic Virus (DCMV) in great detail. That new knowledge has allowed them to develop new tests that are able to reliably detect DMV and DCMV again. They now know, too, that the two viruses can be considered to be variants of the same virus, DMV.

The team will provide a more detailed summary of that important work as soon as the testing load provides enough time and opportunity to write it up. The practical consequence of that development work is a delay in the evaluation of samples collected this summer for DMV. We will not know the DMV results on this summer's samples until nearer the end of the year.

On the other hand, existing tests for Tobacco Streak Virus (TSV), Tomato Spotted Wilt Virus (TSWV), Impatiens Necrotic Spot Virus (INSV), and Cucumber Mosaic Virus (CMV) have proven reliable in continuing to identify the presence or absence of those viruses in our leaf samples.

Common Traits of TSV, TSWV, INSV, and CMV

These four viruses are fundamentally different from DMV. The four are RNA-viruses while DMV is a DNA-virus. The differences are important to the scientists studying them, but not so much to the gardening public. Suffice it to say that one important difference is the tendency for the DNA viruses to routinely evolve to a more effective structure (think Coronavirus). Since we have had reliable tests for the four RNA viruses, we've learned a lot about their behavior. The most important behavior, at least for our dahlia exhibitors, is that the presence of any of the viruses in a plant frequently leads to yellowing of the veins and/or mottling of the foliage on those plants. The appearance of those virus characteristics in the foliage is sometimes very subtle and sometimes very obvious. The foliar appearance of a plant with virus is different from a plant with nutritional deficiencies. See Linda Taylor's article in the October 2022 *Bulletin* and the YouTube video out of NC State (TinyURL.com/DahliaVirus-Video).

This characteristic behavior of the foliage on plants with virus is what led to the recommendation "If in doubt, throw it out." The most insidious behavior is that the host plant, with the help of thrips or aphids, can infect its neighbors with virus. Worse yet, if you cut a bloom, for example, on a virused plant and move directly on to cut a bloom on the next plant, you will transfer the virus to the second plant. Cutting tools must be disinfected between plants to avoid that transfer. The most common practices for disinfecting tools are a quick dip in a 10% bleach solution or a quick dip in a solution of 5 tsp of Dawn dishwashing soap in 4 cups of water. "Clean Between" will avoid spreading virus to other plants.

Top: Veinal chlorosis caused by virus infection.

Bottom: Yellowing of foliage caused by magnesium deficiency.

Photos by Kristine Albrecht
Photos courtesy Dahlia Virus Research Team & Dr. Hanu Pappu

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Another common characteristic is that these viruses sometimes leave the plants completely without symptoms. Thus, you can't decide on whether to disinfect on the basis of the appearance of the foliage. It may appear to be entirely clean but still have virus. Good plant husbandry can minimize the appearance of virus; stress will tend to maximize the appearance.

The good news is that seedlings taken from parents with the RNA virus will not have virus.

Different Behaviors of the Different Viruses

Perhaps the most interesting differences in behavior we've observed is the tendency of the various viruses to persist through digging, dividing, and storing for a winter. Tobacco Streak Virus (TSV) is the most persistent. It will almost always carry over in stock from one season to the next. Tomato Spotted Wilt Virus (TSWV) usually, but not always, persist through the off season. Impatiens Necrotic Spot Virus (INSV) almost always disappears from one season to the next. We have seen so little CMV over the years that we know almost nothing about its behavior. All the observations need to be considered anecdotal; they are based on hundreds of samples but from a very limited number of gardens.

Once the DMV results are available, the individual Clean Stock project managers will have a framework in which to determine how best to utilize the stock accumulated in the project. For example, while only the stock free of any virus can be promoted as "Virus Free," it may also be worthwhile to save the INSV stock for observation and testing next season. Plants that were positive for TSV, TSWV, CMV, or DMV should be destroyed.

Preliminary Summary of the RNA Virus Test Results

Many of the initial results on the tests for the RNA viruses were available and had been distributed to the project managers when the new tests became available for DMV. At that point, the WSU team switched to working on the DMV tests. Hopefully by the time this Bulletin is released, both the DMV and those additional RNA test results will have been determined and distributed. In the meantime, the results from the (preliminary and incomplete!) vendor tests and the ADS clubs are summarized in the figures attached. The charts present the lowest, highest, and the average percentages of the different viruses among the samples provided. Note that, on average, over half of the samples from the vendors had one virus or another. In one case, the supplier had over ¾of his product with virus. The second chart presents the same data for the samples submitted by ADS-associated clubs. The results are very similar. Among the clubs tested to this point, the Elkhart Dahlia Society had the lowest overall level of virus in their samples. Even in the worst case, however, the results provide each club with the opportunity to propagate and sell known clean stock in their spring sales.

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Ron Miner and Professor Hanu Pappu with the support of the ADS Virus Team: Brad Freeman, Nick Weber, Jerry Moreno, and Linda Taylor.

Figure 1: RNA Virus Results in Club Samples

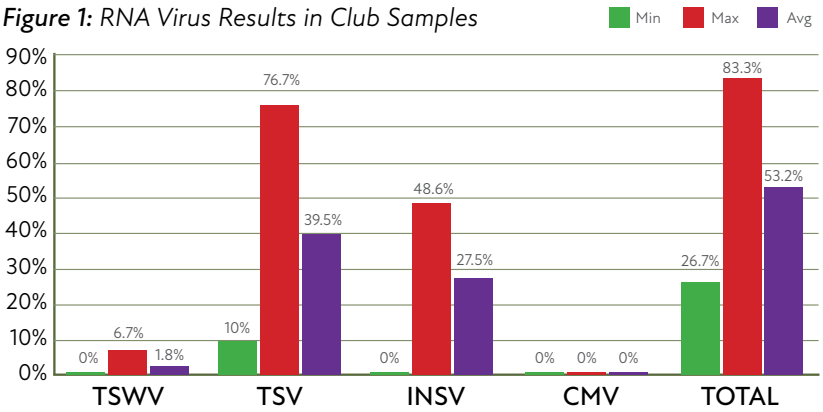

Figure 2: RNA Virus Results in Vendor Samples

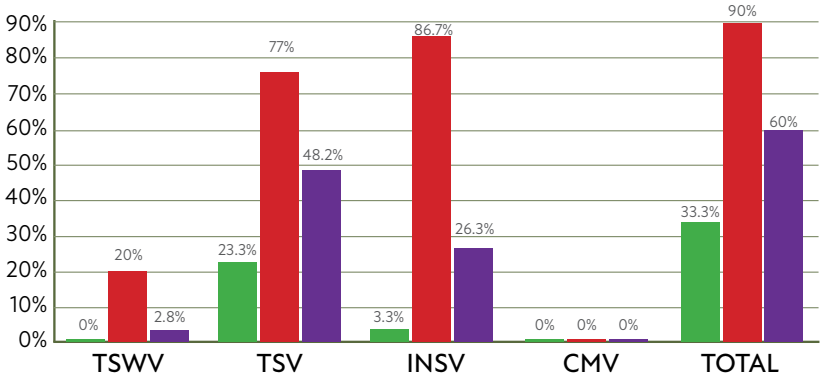

Photo by Ron Miner