

Virus Analyses in Dahlias - 2017

Introduction

The year of 2017 was a watershed year for virus research on dahlias at Washington State University (WSU). Another major donation by the Sheetz-Chuey Foundation created the Carl F. and James J. Chuey Endowed Chair for Dahlia Research and Development. Professor Hanu Pappu is the first to hold that Chair at the University. The funds donated will also make it possible for the University to staff a Dahlia Resource Center. The key function for the Center will be to translate the technological developments at the University to practical applications in our dahlia gardens.

2017 marks the 3rd year in which samples of foliage from plants in ADS-member gardens were evaluated for virus. In 2015, a pilot program was initiated to look at the extent of the presence of virus in home gardens in NE Ohio. Testing in 2016 was opened up to dahlia gardens across the US. (Unfortunately, border issues continue to be a problem for getting samples from our Canadian friends.) Summaries of the results of those tests have been presented in the June 2016 and March 2017 ADS Bulletins and more details of the work are available on the website.

One-thousand-six-hundred-sixty-five samples were analyzed from plants last season. They came from 27 different gardens around the country. The emphasis for testing in 2017 was on samples that came from plants found not to have virus in 2016. Seven-hundred-six of the samples received fell in that category. It was anticipated that the results on those G1 (first generation tubers from plants where no virus was detected) plants would be better than previously untested plants. The very large response to our request for G1 samples combined with difficulties encountered in getting the critical reagents to do the testing led the WSU lab to fall way behind schedule in completing the tests. We apologize for that inconvenience.

Results

A few samples were also submitted from plants that tested positive for virus in 2016. We can therefore consider three different kinds of 2017 tests: 1) those from samples grown from tubers that were found to have no virus in 2016 (the G1 samples); 2) samples grown from tubers that were not tested in 2016; and 3) samples grown from tubers that tested positive for virus in 2016. We were, frankly, disappointed to have 38.1% of the G1 plants test positive for virus. We had hoped for a lower number. Among the previously untested plants, 52.8% tested positive for virus. Among the smaller set of samples (29 plants) that were positive for virus in 2016, 100% of the samples were positive for virus in 2017.

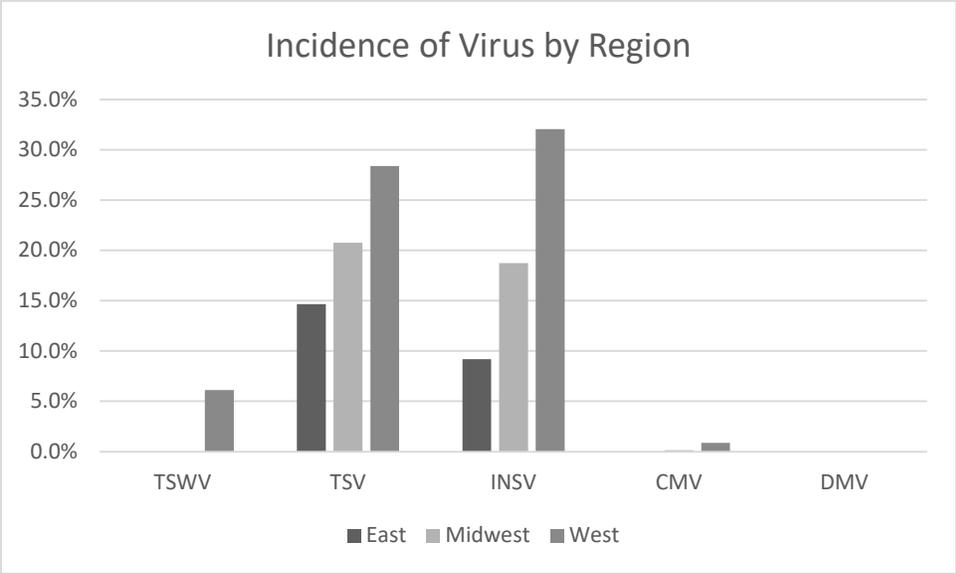
We solicited inputs from the sample suppliers on the quality of the foliage on the plants being tested. The criteria for the rating was as follows: A for uniformly dark green foliage; B for subtle signs of yellowing along the veins in the leaves; C for some yellowing of the leaves away from the veins; D for yellow or brown spots or pattern on the leaves; and F for clear signs of virus like those in the brochure distributed with the 2015 June Bulletin (and available on the website). The following table presents the virus results on the G1 samples only, for each of the viruses tested. The abbreviations are TSWV for Tomato Spotted Wilt Virus, TSV for Tobacco Streak Virus, INSV for Impatiens Necrotic Spot Virus, CMV for Cucumber Mosaic Virus, and DMV for Dahlia Mosaic and Dahlia Common Mosaic Virus.

G1 Only	TSWV	TSV	INSV	CMV	DMV	TOTAL
A	0.6%	16.7%	17.5%	0.3%	0.0%	35.1%
B	1.0%	16.5%	18.0%	0.0%	0.0%	35.4%
C	0.0%	29.7%	12.5%	0.0%	0.0%	42.2%
D & F	12.0%	64.0%	16.0%	0.0%	0.0%	92.0%

Perhaps the most obvious observation in the table is that the incidence of virus is dramatically higher in samples taken from plants with D or F rating; that is, those with clear yellowing of leaves, like that described earlier in the brochure distributed with the June 1015, ADS Bulletin. In looking at the individual viruses, the incidence of TSWV and TSV increases significantly with decreasing quality of the foliage. On the other hand, the incidence of INSV is not particularly affected by the quality of the foliage. That is, the presence of INSV does not seem to greatly affect the foliage of the plant. It is also clear that little or no CMV or DMV was detected this year.

Discussion

While we were disappointed to have over one-third of even the best looking of our G1 samples test positive for virus, it remains clear that G1 plants are less likely to be positive than untested plants. It is also clear that plants with poor foliage are very likely to be positive for virus. Plants that are positive for virus will produce tubers and plants the following year that will almost certainly be positive for virus. This “bottom line” is entirely consistent with Professor Pappu’s early counsel to discard plants with clear signs of virus.



The samples analyzed were concentrated in three areas across the country: the Virginia and Maryland area on the east coast, Ohio in the Midwest, and Washington and Oregon on the west coast. Gardens on the east coast showed less virus than those on the west coast, and midwestern gardens fell between the two. More time and effort are required to understand these results.

There have been dramatic changes in the relative incidence of the various viruses over the three years we’ve analyzed for them. Further time and effort are also required to understand those results.

The results from the state of the foliage and virus status confirmed what has long been known about virus infections. While symptoms are a good indication of the virus status of a plant, some viruses produce more characteristic symptoms of diagnostic value than others. Moreover, symptom expression is influenced by many factors including time of infection and weather conditions such as temperature.

It is interesting to note the absence of DMV and DCMV. These viruses tend to be less persistent compared to other dahlia-infecting viruses and sometimes the virus levels can be too low for detection. Environmental conditions have a significant effect on the virus levels in a plant. Also, this is inherent to a given virus-host combination, as some viruses tend to reach relatively high levels (INSV and TSWV are good examples) compared to others. Also, younger foliage of an otherwise infected plant may be free of virus - these plants were considered to have a 'recovery' phenotype. What conditions would influence this outcome are not fully understood.

The relatively high number of infections in the G1 plants gave us some important insights. These infections are likely to be 'current season infections' as opposed to diseased plants resulting from the tubers. 'Current season infections' are plants that got infected during the growing season. This was very likely due to insect mediated spread as these viruses are spread by thrips, besides being transmitted through propagating material (cuttings and tubers). This is common in vegetatively propagated crops such as potato. Potato viruses can be spread from season to season through infected potato tubers and additionally, during the growing season, virus-free plants could be get infected by aphid-transmitted viruses. Current season infections could be reduced through managing the insects that spread these viruses. An accompanying article in this issue talks about thrips and their role in virus spread in dahlias.

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