

Virus in Dahlias

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You are reading this publication because you enjoy dahlias. Dahlias come in a variety of forms, colors and sizes to please most gardeners. With any horticulture activity, such as raising dahlias, come the challenges from the weather, insects and diseases which affect the health of the plants in your garden. This includes a number of viruses that have been indentified in dahlias which can diminish the vigor of individual plants.

Viruses in dahlias have been written about for some time now. In a book published in 1925 titled "Little Book of Modern Dahlia Culture" the author W.H. Waite talks about "mosaic" disease in dahlias. The authors states the dahlia plants afflicted by this disease are stunted. The 1946 publication by the Portland Dahlia Society titled "Practical Dahlia Culture" talks about mosaic, spotted wilt and ring spot viruses. The viruses were indentified based on the light green or yellowing pattern on the leaves. It is also noted that plants afflicted with the mosaic virus can be stunted with malformed leaves. Keith Hammett in his 1980 book title "The World of Dahlias" states that the three most common viruses in dahlias are cucumber mosaic, tomato spotted wilt and dahlia mosaic. The book includes photographs of the damage done to plants infected with a virus and includes advice on dealing with virus in dahlias.

In the early 1990's Evie Gulkison, a member of the Evergreen State Dahlia Society in Olympia, Washington, initiated an effort to begin research on the viruses that inflict dahlias. By 1994 the American Dahlia Society joined the effort which resulted in the Samuel Smith Endowed Professorship at Washington State University (WSU) in Pullman, Washington. In 2002 Dr. Hanu Pappu was appointed to the position at WSU and is still leading the research efforts there.

Dr. Pappu and his graduate students at WSU have indentified six viruses that commonly affect dahlias. They included:

- CMV - Cucumber Mosaic Virus
- INSV - Impatiens Necrotic Spot Virus
- TSWV - Tomato Spotted Wilt Virus
- TSV - Tobacco Streak Virus
- DMV - Dahlia Mosaic Virus
- DCMV - Dahlia Common Mosaic Virus

You will notice only two of the viruses have "dahlia" in their name. Viruses can infect a number of plants species but they are named based on the plant they were first identified in and the type of damage they cause. Some of these viruses have a broad host range. For example, Tomato spotted wilt virus can infect more than 1,000 different plant species that includes field and horticultural crops as well many weeds.

In 2014 the Scheetz-Chuey Charitable Foundation made a sizeable contribution to the dahlia virus research at WSU. As a result of this contribution a dahlia virus testing program was developed at WSU. Initial testing was done on a limited scale in 2015 and this was expanded further in 2016. Leaf samples can be sent to the WSU Clean Dahlia Center and they are tested for the presence of the six viruses listed above. The testing is open to anyone with the desire of getting a large data set from the across the United States. The data set will be analyzed to see:

- Is there is a correlation between the appearance of symptoms and presence of a viruses
- Are some viruses more prevalent in one region over another
- Are there cultivars that appear to be resistant to viruses

This is an on-going effort and more questions will be added to the list. The results of the analysis of the 2016 data should be ready in 2017.

In early October, 2016 my wife Rosemary and I visited Dr. Pappu at WSU to see the testing process first hand. WSU is a land-grant university so one of its primary missions is to provide agricultural based education and research. The depth and breadth of the research that is currently being done at WSU is impressive. There is a lot of research being conducted on major food crops such as apples, grapes, potatoes, nursery and floriculture, and wheat. While the dahlia virus research project may be small in comparison to some of the other research efforts, we saw first-hand that it is well supported by the administration at the university.

Dr. Pappu's laboratory is in a new state of the art building across the street from the WSU football stadium. Dr. Pappu said this is "prime real estate" on campus. At the laboratory we were given a demonstration of the dahlia virus testing process. Every virus has a one or more proteins which are associated with it. The key to dahlia virus testing is to determine if the proteins associated with a specific virus are present in a subject leaf sample. The process begins by freezing and crushing the sample dahlia leaf to break the walls of the plant cells and release the cellular components from within the cells. Proteins are "extracted" from the macerated leaf material using an ELISA tray. The ELISA tray is rectangular in shape with a series of wells in which the macerated leaf material is placed. Each leaf sample is tested for the six viruses and two wells on the ELISA tray are filled to test for each virus. After the wells are filled, the ELISA tray is taken through a series of steps.

Reagents are used to detect if the proteins associated with a specific virus are present. It takes several months to develop the reagents but enough is produced to do numerous tests. For dahlia mosaic virus and dahlia common mosaic virus there is a common reagent which is used to test for presence of both viruses. Once the proteins are extracted, virus-specific antibodies (there had to be produced separately) for each virus are added to duplicate wells of the ELISA tray. After a series of steps where the wells are washed with a buffer solution followed by additional of a different type of antibodies and incubated for various times that range from 2 hours to overnight.. reagents. If the proteins associated with a specific virus are present in a sample the reagent turns a yellow color. If the sample did not have the virus, the sample well remains colorless. To complete the testing process the ELISA tray is placed in a ELISA plate reader which measures the intensity of the color present, an indicator of the relative level of the virus in a sample. After that results of the testing are sent back to the contributor of the samples.

Rosemary and I spent an entire day with Dr. Pappu and we thank him for an informative and enlightening experience. To some it may be disconcerting that virus research efforts over the last fifteen plus years has not resulted in a "cure" for the many viruses that infect our dahlias. However we must remember that viruses are complex and science has not discovered a cure for the common cold which infects human beings. In the last ten years, significant progress has been made in our understanding of the identity and the nature of the viruses that infect dahlia, rapid and sensitive virus detection methods were developed that made the virus testing possible. The virus research that is being done at WSU and the upcoming mapping of the dahlia genome at Stanford University will further the efforts of scientists and researchers looking at plant viruses including those that infect dahlias. It is just going to take time to the basic research needed to answer the myriad of questions about the viruses

that infect plants including dahlias. At this time the best advice is to follow the simple rule “when in doubt, throw it out”. Gardeners need to rogue out the dahlia plants that are clearly unhealthy and to propagate from clean stock, as much possible. Until then enjoy the beauty of our favorite flower the dahlia.