

Viruses Affecting Hibiscus in Hawai'i

Their Detection and Management

At A Glance: Since 2012, seven viruses have been reported in hibiscus in Hawai'i. We review the current understanding of the viruses that affect native and non-native hibiscus in Hawai'i, the current research, and known management tools for hibiscus virus diseases.



Hibiscus latent Fort Pierce virus (HLFPV), Hibiscus latent Hawai'i virus (HLHV), Hibiscus Betacarmovirus (HBCV), and Hibiscus Soymovirus (HSV). Table 1 and Figures 1-3 illustrate the symptoms of hibiscus infected with these different viruses. Notably, Figure 3 shows the symptoms of four viruses (HLFPV, HLHV, HBCV, and HSV) in hibiscus leaves. It is unclear if one or several of these viruses cause the disease symptoms described in the introduction.

The complete genome sequences of these viruses are available, and RT-PCR assays based on the sequences have been established.

Introduction

Hibiscus (*Hibiscus* spp.) are important flowering plants in Hawai'i, exemplified by the fact that *Hibiscus brackenridgei* is Hawai'i's state flower. There are currently seven accepted indigenous hibiscus species in Hawai'i, and five are known to be endemic. Native and non-native hibiscus are commonly used in landscapes and are sold as nursery crops throughout the state.

Since 2012, seven viruses have been reported in hibiscus in Hawai'i. These viruses can cause chlorotic spots, ringspots, and mosaic patterns, and lesions on leaves that reduce photosynthetic ability and leaf health. Some of the viruses can also lead to premature leaf senescence and leaf drop. Virus infection has not been linked to full decline and plant mortality. The full effect of virus infection on hibiscus health is not fully understood and is an area for further research. The objective of this publication is to review the current understanding of the viruses that affect native and non-native hibiscus in Hawai'i, the current research, and known management tools for hibiscus virus diseases.

Hibiscus Viruses in Hawai'i

The presence of seven viruses has been detected on hibiscus plants in Hawai'i. These viruses are Hibiscus green spot virus 2 (HGSV2), Citrus leprosis virus cytoplasmic type 2 (CiLV-C2), Hibiscus yellow spot virus (HYBV),

HGSV2 has been found to infect citrus in addition to hibiscus, causing symptoms of leprosis on the leaves and bark. Leprosis symptoms include expanding yellow and brown spots on leaves and necrotic spots on stems. CiLV-C2 was originally found in citrus, but no infections have been detected in Hawai'i. However, CiLV-C2 has been found on Passionfruit, causing chlorotic spots

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Xupeng Wang

John Hu

Michael Melzer

Department of Plant and Environmental
Protection Sciences

Russell Galanti

Alberto Ricordi

Department of Tropical Plant and Soil Sciences
rgalanti@hawaii.edu, 808 746-0910

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Figure 1. Foliar symptoms of hibiscus infected with citrus leprosis virus cytoplasmic type 2 (CiLV-C2).

on young leaves and green spots in senescing leaves. A mite (*Brevipalpus* spp.) is associated with CiLV-C2H transmission in passionfruit, which is the only virus whose transmission vector has been identified among the viruses that infect hibiscus in Hawai'i.

The mite's ability to transmit the virus from

passionfruit to hibiscus is a possibility. Yet, without relevant experiments or direct evidence, this claim lacks substantiation. Another mite-transmitted cilevirus found in passionfruit could also potentially infect hibiscus (Costa-Rodrigues et al. 2022). The transmission vectors of the other viruses are currently unknown or not yet characterized.

Further research is needed to establish the correlation between the four newly identified viruses (HLFPV, HLHV, HBCV, and HSV) and symptoms. Larger virus surveys and testing are required to clarify the relationship between mixed viral infections and symptoms in hibiscus plants.

Management

Virus infections in hibiscus can be managed by using a combination of the approaches listed below:

Starting new plants

Start new plants using pathogen-free cuttings. Exclude plants with known symptoms from your property through quarantine. The current recommendation does not include destruction of infected plants, because the full effects of virus infection are not known and the viruses are not linked to full decline symptoms or plant mortality.

Sterilizing Pruning Equipment

Some of the viruses known to infect hibiscus may be transmittable mechanically through pruning equipment. Disinfecting tools that may come in contact and damage hibiscus plants will reduce the spread of viruses. This can include pruning tools used to prune any plant part, and even digging tools that may cut through or damage roots. There are several options for disinfecting tools. Soak tools in a 10% bleach solution, 20% non-fat dry milk powder solution, 2% sodium hydroxide, or 20% trisodium phosphate solution for 1 minute or longer. The longer the soak time, the closer to complete disinfestation. These solutions have been tested for control of Hibiscus latent Fort Pierce virus, but have not been tested for control of all the listed viruses in this publication.

Heat can also be used to kill plant viruses. Using a flame to sterilize metal tools above 150° F for at least 10 seconds is one of the most common methods, but often 30 or more seconds is required for complete control of plant pathogens.

Fertilizer

Fertilizer has been shown to affect the severity of mites on ornamental plants. High levels of nitrogen in the plant can increase mite growth and reproduction rates. Therefore, the use of slow-release fertilizer at appropriate rates is recommended. Observe the effects of your fertilizer

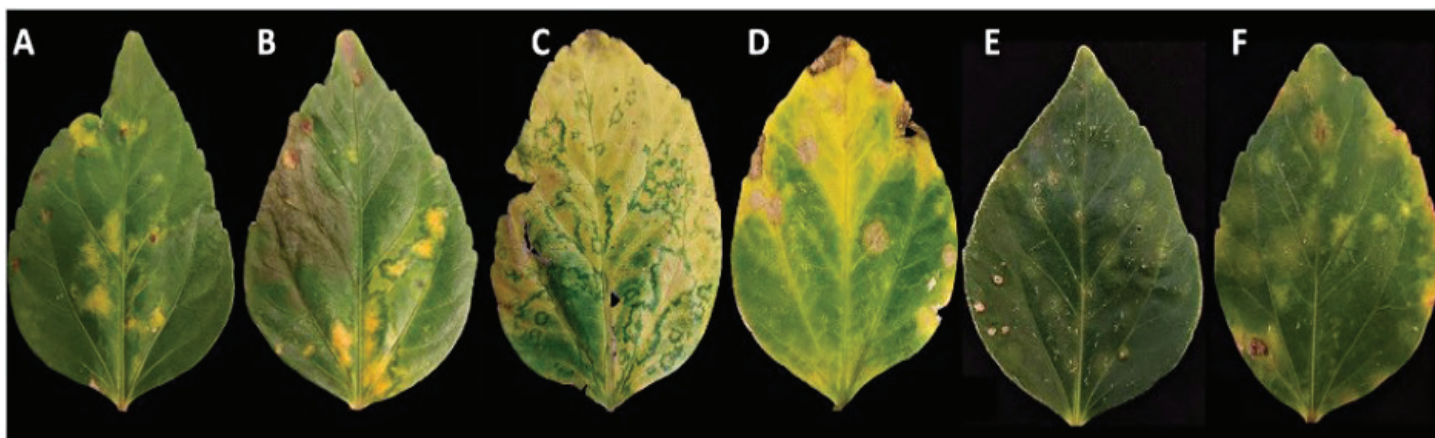


Figure 2. Foliar symptoms of hibiscus infected with hibiscus yellow spot virus (HYBV).



Figure 3. Foliar symptoms of hibiscus infected with Hibiscus latent Fort Pierce virus (HLFPV), Hibiscus latent Hawai'i virus (HLHV, genus Tobamovirus), Hibiscus Betacarmovirus (HBCV, genus Betacarmovirus), and Hibiscus Soymovirus (HSV, genus Soymovirus).

practices on the mite population and modify your practices accordingly to reduce mite population and damage. Some insecticides are also reported to increase nitrogen levels in the plant.

Alternate hosts

Brevipalpus is currently the only known vector associated with transmitting one of the viruses, CiLV-C2H. Mite populations should be controlled in host plants surrounding hibiscus plants or nurseries. The U.S. Department of Agriculture reported there may be as many as 1,000 hosts of Flat mites (*Brevipalpus* spp.).

Sanitation

Sanitation is the cleaning or tools and periodic removal of diseased plant organs, such as leaves, from the vicinity of healthy leaves. Routinely prune and destroy branches with heavily diseased leaves. Pick up and destroy fallen leaves. Remove and destroy diseased cuttings from nurseries or young transplants.

Miticides

Brevipalpus phoenicis has at least four natural predators. Unfortunately, these predators generally fail to provide economic control. Predation becomes noticeable only after *Brevipalpus phoenicis* achieves a very high population density and severe plant damage has already occurred.

As a result, other management agents, such as pesticides, are necessary for economic control (Haramoto, 1969). In the early 20th century, sulfur was used to control spider mites in Florida, but the use of sulfur in today's management programs should be minimized, given its toxic effects on beneficial arthropods (Childers et al. 2005).

It is important to repeat treatments for mite control in order to interrupt reproduction and reduce the mite population. Female false spider mites lay eggs that take 20 to 21 days to hatch at room temperature. Larvae hatch from the eggs and feed for about two weeks before molting into protonymphs. Because mites live on the underside of the leaves, it is important to use translaminar products and ensure that the underside of leaves are sprayed when applying miticides for flat mite control.

Overview

There are currently seven viruses that are identified as pathogens in hibiscus in Hawai'i.

There are gaps in the understanding of the full symptoms of the viral pathogens and their effect on hibiscus. There are several management strategies to reduce the spread of viruses, including sanitation and control of mite vectors. Maintaining healthy plants can also help reduce the effects of virus. Continued research is required to develop better understanding of the viruses, their vectors, and their effects on hibiscus.

References

- Childers, C.C., McCoy, C.W., Nigg, H.N., Stansly, P.A., Rogers, M.E.. 2013. 2014 Florida Citrus Pest Management Guide: Rust Mites, Spider Mites, and Other Phytophagous Mites. ENY-603. Gainesville: University of Florida Institute of Food and Agricultural Sciences. <https://edis.ifas.ufl.edu/cg002>
- Denmark, H A. & Fasulo T.R. 2021. Red and Black Flat Mite, A False Spider Mite, *Brevipalpus phoenicis* (Geijskes) (Arachnida: Acari: Tenuipalpidae). IFAS Extension Publication EENY-381. <https://edis.ifas.ufl.edu/publication/IN685>.
- Haramoto, F.H. 1969. Biology and control of *Brevipalpus phoenicis* (Geijskes) (Acarina: Tenuipalpidae). Hawai'i Agricultural Experiment Station Technical Bulletin No. 68: 1–63.

Table 1. Viruses detected on hibiscus in Hawai'i.

No.	Virus Name	Abbr.	Genus	Family	Foliar symptoms	References
1	hibiscus green spot virus 2	HGSV2	<i>Higrevirus</i>	<i>Kitaviridae</i>	green or brownish spot or ringspots	Melzer et al. 2012
2	citrus leprosis virus cytoplasmic type 2	CLV-C2	<i>Cilevirus</i>	<i>Kitaviridae</i>	green ringspot	Melzer et al. 2013
3	hibiscus yellow spot virus	HYBV	<i>Cilevirus</i>	<i>Kitaviridae</i>	yellow chlorotic blotches with a green perimeter	Olmedo-Velarde et al. 2021
4	hibiscus latent Fort Pierce virus	HLFPV	<i>Tobamovirus</i>	<i>Virgaviridae</i>	mosaic, ringspot, and chlorotic spots	Wang et al. 2023 (a)
5	hibiscus latent Hawaii virus	HLHV	<i>Tobamovirus</i>	<i>Virgaviridae</i>	mosaic, ringspot, and chlorotic spots	Wang et al. 2023 (a)
6	hibiscus betacarmovirus	HBCV	<i>Betacarmovirus</i>	<i>Tombusviridae</i>	mosaic, ringspot, and chlorotic spots	Wang et al. 2023 (b)
7	hibiscus soymovirus	HSV	<i>Soymovirus</i>	<i>Caulimoviridae</i>	mosaic, ringspot, and chlorotic spots	Wang et al. 2023 (b)

da Costa-Rodrigues, M., Rossetto Pereira, L., Ramos-González, P. L., Chabi-Jesus, C., Tassi, A. D., Leão, I. G., ... & Freitas-Astúa, J. (2022). First report of Passion fruit green spot virus infecting hibiscus plants. *New Disease Reports*, 45(2), e12080.

Melzer, M.J., Sether, D.M., Borth, W.B., Hu, J.S. 2012. Characterization of a virus infecting Citrus volkameriana with citrus leprosis-like symptoms. *Phytopathology*, 102(1), 122-127.

Melzer, M.J., Simbajon, N., Carillo, J., Borth, W.B., Freitas-Astúa, J., Kitajima, E.W., ... & Hu, J.S. 2013. A cilevirus infects ornamental hibiscus in Hawai'i. *Archives of virology*, 158, 2421-2424.

Mersino, E. 2002. Mites on Ornamentals. CTAHR Extension Publication MP-2. <https://www.ctahr.Hawaii.edu/oc/freepubs/pdf/mp-2.pdf>

Nelson, S. 2011. Bacterial Leaf Spot of Hibiscus in Hawai'i. CTAHR Extension Publication PD-72. <https://www.ctahr.Hawaii.edu/oc/freepubs/pdf/PD-72.pdf>

Ochoa, R., Kane, E., & Erbe, A. 2004. Targeting a threat to U.S. citrus mite-borne disease already has foothold in South America. *USDA-Agricultural Research Magazine*, March 2004 - Vol. 52, No. 3. <http://www.ars.usda.gov/is/AR/archive/mar04/citrus0304.htm>

Olmedo-Velarde, A., Hu, J., & Melzer, M.J. 2021. A virus infecting Hibiscus rosa-sinensis represents an evolutionary link between cileviruses and higreviruses. *Frontiers in microbiology*, 12, 660237.

Olmedo-Velarde, A., Roy, A., Larrea-Sarmiento, A., Wang, X., Padmanabhan, C., Nunziata, S., ... & Melzer, M.J. 2022. First Report of the Hibiscus Strain of Citrus Leprosis Virus C2 Infecting Passionfruit (*Passiflora edulis*). *Plant Disease*, 106(9), 2539.

Wang, X., Larrea-Sarmiento, A. E., Olmedo-Velarde, A., Kong, A., Borth, W., Suzuki, J. Y., ... & Hu, J. 2023. First Detection and Genome Characterization of a New RNA Virus, Hibiscus Betacarmovirus, and a New DNA Virus, Hibiscus Soymovirus, Naturally Infecting Hibiscus spp. in Hawai'i. *Viruses*, 15(1), 90.

Wang, X., Larrea-Sarmiento, A., Olmedo-Velarde, A., Kong, A., Borth, W., Suzuki, J. Y., ... & Hu, J. 2023. First detection and complete genome sequence of a new tobamovirus naturally infecting Hibiscus rosa-sinensis in Hawai'i. *Archives of Virology*, 168(2), 40.

WSU CAHNRS and WSU Extension. 2023. Rose: Spider mites. HortSense. Retrieved June 20, 2023, from <https://hortsense.cahnrs.wsu.edu/fact-sheet/rose-spider-mites>