



## Taro Vein Chlorosis

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**T**aro vein chlorosis is a disease of taro caused by *Taro vein chlorosis virus* (TaVVCV). This disease is present in Fiji, the Federated States of Micronesia, New Caledonia, Palau, Papua New Guinea, Solomon Islands, Tuvalu, and Vanuatu (Davis and Ruabete 2010, Harding 2008, Revill et al. 2005) and was most recently found in Hawai'i (Long et al. 2013). In a recent survey, TaVVCV was discovered on the islands of Kaua'i, O'ahu, Moloka'i, Maui, and Hawai'i. It is not known how long TaVVCV has been present in Hawai'i. Taro has deep cultural significance and is an economically valuable commodity in Hawai'i, and effective management of viral diseases such as taro vein chlorosis is essential for the continued production of this important staple crop in the state.

This publication describes and illustrates the symptoms of TaVVCV and suggests practices to manage the disease.

### Host Species

At present, TaVVCV has been reported to infect only taro (*Colocasia esculenta*), although other species may host the virus. The development of reliable diagnostic assays is needed to further determine the host range of this virus.



**Veinal chlorosis on the leaf lamina and petiole of a purple-stemmed taro hybrid.**

### Disease Symptoms

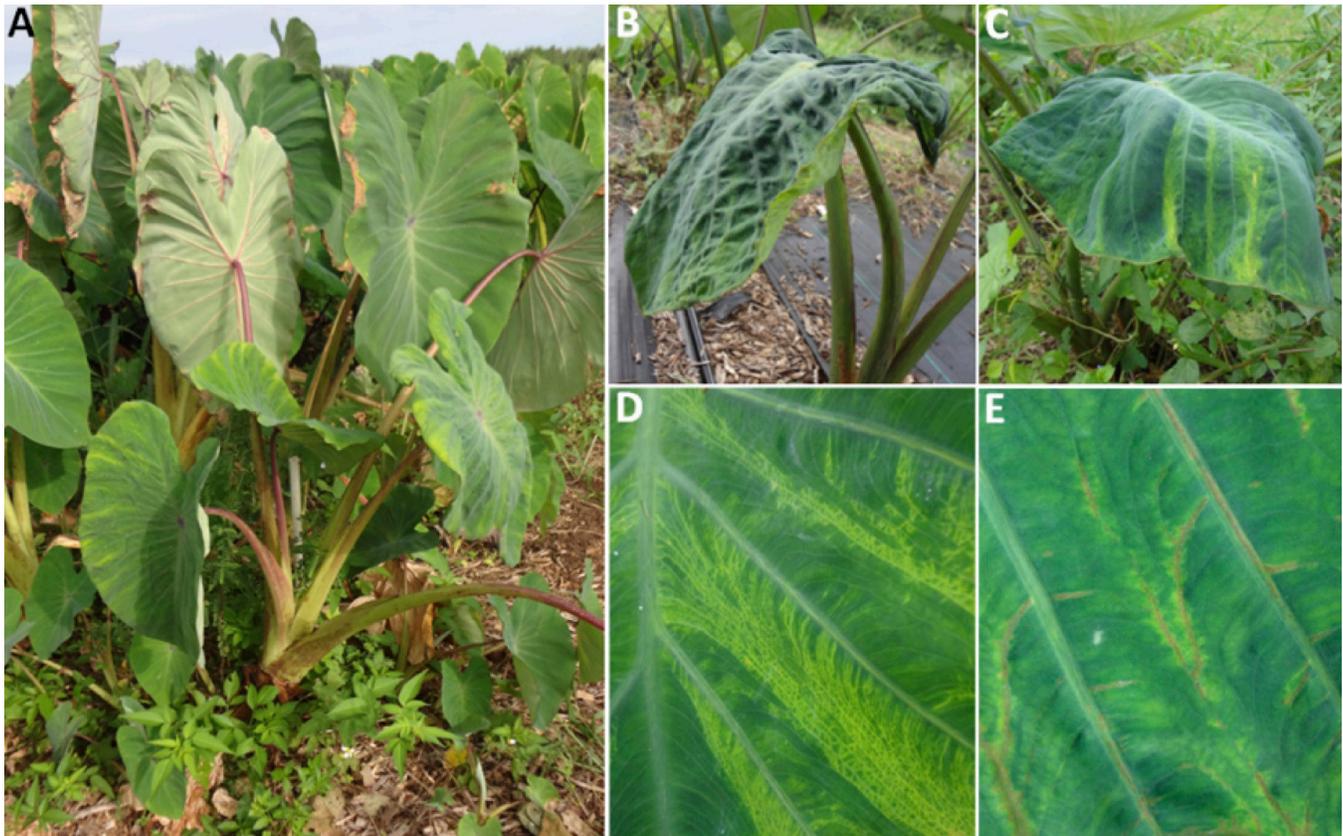
Initial symptoms of TaVVCV infection are the distinctive chlorosis or yellowing of leaf veins. As the disease progresses, chlorotic areas coalesce, forming a reticulated pattern across the leaf. Necrosis of the leaf veins may also develop, especially along the leaf edges. Foliar symptoms of taro vein chlorosis can be mistaken for dasheen mosaic, another common taro disease caused by *Dasheen mosaic virus* (DsMV). DsMV causes yellow, white, or pale green chlorosis between the veins in feathered or patchy patterns. Symptoms of dasheen mosaic are usually restricted to localized areas of

leaves, whereas symptoms of taro vein chlorosis often manifest throughout an entire leaf. Plants may become co-infected with TaVVCV and DsMV and display symptoms of both diseases concurrently. As such, accurate diagnosis requires laboratory testing. Growers can submit suspect leaf samples to the Agricultural Diagnostic Service Center at the University of Hawai'i at Manoa for analysis.

Other symptoms of taro vein chlorosis include chlorotic streaks on the petioles of certain taro varieties, particularly those having dark foliar pigmentation. Plants with taro vein chlorosis are often stunted, and affected leaves display a distinctive downward curvature. This



Mild, moderate, and severe foliar symptoms of taro vein chlorosis caused by *Taro vein chlorosis virus* (TaVCV, upper panel) compared with dasheen mosaic caused by *Dasheen mosaic virus* (DsMV, lower panel). These two diseases are often confused in the field.



Plants with taro vein chlorosis are often stunted (A, foreground plant), and the leaves have a distinctive downward bend (B, C). Close-ups show veinal chlorosis (D) and necrosis (E) in symptomatic leaves.

downward bend also occurs in taro plants infected with *Colocasia bobone disease virus* (CBDV) and is associated with *alomae-bobone*, a disease symptom caused by this group of viral pathogens when they infect taro.

The number of leaves expressing symptoms on a plant varies, and, as with dasheen mosaic, new growth may emerge asymptotically. Such plants still harbor the virus and may develop symptoms thereafter, so huli from asymptomatic plants are not guaranteed to be TaVCCV-free.

### Pathogen Dissemination

Humans are responsible for long-distance movement of TaVCCV by transporting and sharing infected planting material. Research is currently underway to identify an insect vector. It is unknown whether TaVCCV can be transmitted mechanically through the use of infected tools.

### Disease Management

The best approach to managing diseases such as taro vein chlorosis is to use virus-free planting material where the virus is absent, or resistant varieties where the virus is present. Unfortunately, there are currently no virus-free sources of Hawaiian taro varieties, and it is unclear whether resistance to this virus is present in taro germplasm. Roguing infected taro plants is the best practice to manage the spread of TaVCCV where disease incidence levels are low. Removing and destroying visibly diseased plants will lessen the distribution of the virus by reducing the number of infected huli used for planting material. Roguing will also help decrease the amount of infected feeding material available to potential insect vectors. Even though it is unknown if TaVCCV is mechanically transmitted, it is always good practice to frequently sanitize tools to prevent the spread of other taro pathogens that are mechanically transmissible.

When TaVCV is common in an area and replanting with virus-free huli is not an option, plants should be well maintained to prevent any stresses that may result in a recurrence of symptoms. Adequate water, fertilizer, and pest control will help to minimize the damage caused by TaVCV.

### Development of Virus-Free Taro

The occurrence of TaVCV in Hawai'i, combined with the already-present DsMV and perhaps additional uncharacterized pathogens, has prompted attempts to develop virus-free taro plants for both local and international distribution (Hu et al. 1995, Nelson 2008, Melzer et al. 2013). The goal of this ongoing project is to employ tissue-culture techniques to eliminate targeted viruses from commercial and heirloom taro varieties to ensure that growers have access to the best planting materials when starting a new farm or replanting existing acreage.

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