

Dasheen Mosaic Disease of Araceous Foliage Plants

G. W. Simone and F. W. Zettler, Professor Retired, Extension Plant Pathologist and Professor Plant Pathology Department, University of Florida, Gainesville, Florida 32611

Florida Cooperative Extension Service/ Institute of Food and Agricultural Sciences/ University of Florida/ Christine Waddill, Dean

The most significant viral disease affecting foliage ornamentals in the nursery is dasheen mosaic virus (DMV). Only plants in the Araceae (aroid) family are known to sustain damage from this pathogen. Much of the importance of this disease is due to the significance of the Araceae within the product mix of foliage ornamentals grown nationwide. As of the last available industry statistics, species in the Araceae accounted for nearly 25% of U.S. production of foliage ornamentals (4). The Araceae contains more than 100 genera and 1,500 species of plants, including such important foliage ornamentals as *Aglaonema*, *Caladium*, *Dieffenbachia*, *Epipremnum*, *Philodendron*, *Spathiphyllum*, and *Syngonium*. In addition to these foliage plants, the Araceae contains the genera *Cryptocoryne* (commercially grown aquarium plant), *Zantedeschia* (calla lily), and two high-carbohydrate tropical food crops known as dasheen or taro (*Colocasia*) and malanga (*Xanthosoma*).

Symptoms

Plant symptoms can be induced by either an invading pathogen or an adverse environmental or cultural factor. Symptoms induced by DMV are distinct from those typically produced by other types of pathogens infecting aroids; they include leaf mosaic where the normal leaf coloration is altered by uneven light

and dark patterns. Clearly defined ring spots on the leaves as well as some degree of leaf distortion also occur on some hosts. A general decline in plant vigor manifested by plant stunting may also occur and is more difficult to assess.

Obvious symptoms in *Philodendron* spp. are leaf mosaic, chlorotic streaking along veins on leaves (Figure 1), and leaf distortion. These symptoms are not consistent within infected plants but may vary, with apparently healthy foliage produced although virus infection is still present. Reduced vigor and plant stunting symptoms are often expressed by DMV - infected plants. Work in Florida (5) with *Philodendron scandens oxycardium* compared several criteria of vigor between healthy and DMV infected plants. For the growth characteristics of leaf number, leaf area, and vine length, the diseased plants sustained losses of 38.6%, 31.6%, and 65.6%, respectively. Although virus-induced foliar variegation may on occasion look attractive, there will always be a loss of vigor and the added risk of virus spread to other plants.

More economic loss due to DMV infection has occurred on *Dieffenbachia* spp. than other species in the Araceae. General symptoms of DMV on *Dieffenbachia* spp. include leaf mosaic (Figure 2), ringspots (Figure 3), distortion, and stunting. Work by Chase and Zettler (1) demonstrated that symptom severity varied in

Florida with time of year. The most severe symptoms developed between July and September and between November and January. Species and cultivars of *Dieffenbachia* also differed in severity of symptom expression (1). Of eight species and/or cultivars tested, disease reactions to DMV fit into categories based upon initial (acute) symptom development and long term (chronic) symptom development (see Table 1). Two varieties had severe initial symptoms that progressed to plant death, thus eliminating infected plants from production. The majority of varieties examined had severe early symptoms but either mild or no symptoms in subsequent growth; thus, marketability was not greatly affected. Both *D. maculata* "Perfection" and "Lemon" expressed moderate initial reactions to disease but these worsened at certain times during a production cycle point that seriously impaired marketability. For these two varieties, avoiding DMV infections is based on acquisition and maintenance of virus-free, tissue-cultured stock to support their production.

As with *Philodendron oxycardium*, DMV-infected *Dieffenbachia* sustained considerable loss in plant vigor. Using a virus-free, tissue-cultured *D. maculata* "Perfection 137B" line, researchers compared healthy and virus-infected plants under the same growing conditions (2). Virus-free plants out-yielded infected plants by producing 25.3 cuttings per plant compared to 9.1 cuttings for diseased stock. These same plants were subjected to a visual rating for disease symptoms on a scale of 1 to 4 where a rating of 1 indicated no symptoms and complete salability while a rating of 4 indicated severe symptoms and an unsalable condition. Virus-free stock rated 1.01; infected stock rated 3.27. The superiority of virus-free stock has also been demonstrated for *Caladium hortulanum* (Figure 4), in terms of leaf area, tuber weight and numbers of tubers produced when compared with infected stock (3).

The Pathogen

Viral pathogens like DMV are relatively small and simple compared to fungal and bacterial pathogens. Individual DMV particles are observable only by electron microscopy. In fact, it would take 600 or more particles laid end-to-end to span the width of one pencil point. In addition to their small size, DMV particles are simple entities, consisting only of a strand of nucleic acid surrounded by a protein coat that functions as an obligate parasite in the plant host. The virus is totally dependent upon the physiological machinery of the plant cell to duplicate and spread within the plant.

Disease Spread

Unlike fungal and bacterial pathogens, viruses have a significant dependence on other organisms (vectors) to facilitate their movement in the environment from plant to plant. In the case of DMV, winged aphids have been demonstrated to transmit this virus in a non-persistent manner to susceptible plants. Several aphid species have been shown to be effective vectors of DMV including the green peach aphid (*Myzus persicae*), the cotton-melon aphid (*Aphis gossypii*), and the cowpea aphid (*Aphis craccivora*). These aphids will probe infected plants with their feeding spears or stylets. In less than 1 minute, these aphids pick up virus particles on the ends of their stylets, after which they can fly to another suitable host plant and transmit the DMV particles.

The activity of the grower is also important in the spread of DMV. Most Araceous foliage species are vegetatively propagated for two very good reasons. Many ornamental aroid species do not flower and set seed readily under nursery production conditions. When they do, the seedlings do not breed true to parental types. Although seed production is an effective means to eliminate DMV from a plant type (the virus is not seedborne), seedling progeny are variable and seldom meet the horticultural stan-

dard of the foliage industry. Hence, the use of tip or eye cuttings, cane cuttings, or tuber divisions to rapidly and economically propagate desired aroid foliage plants is preferred over seed propagation. Although vegetative propagation does meet the market demands for plant production, it also can effectively increase incidence of such systemic plant pathogens as DMV. Infected stock plants usually give rise to infected propagules and, in the process of propagation itself, infected plant sap on a propagation knife could transmit DMV to a previously healthy plant during the cutting operation.

Host Range and Distribution

Dasheen mosaic was first documented by researchers in Florida (7) in 1970. Samples of *Aglaonema*, *Caladium*, *Colocasia*, *Dieffenbachia*, and *Xanthosoma* were found to be naturally infected with a flexuous rod-shaped virus. Subsequent investigations (6) have expanded the susceptible host range for DMV to include 13 genera in the Araceae family (see Table 2). DMV world wide is known to occur on the five major continents (6). A few economically important foliage plants in the Araceae have not been demonstrated to be susceptible to DW at this time. These include *Epipremnum aureum* (Golden Pothos), *Scindapsus pictus* (Satin Pothos), and *Syngonium* spp. (Arrowhead-Vine).

Diagnosis

Plant symptoms are the critical first step in viral disease determination; however, the variability in symptom expression of infected plants may make additional techniques necessary for accurate determinations of DMV in stock or production areas. Direct examination of infected plant sap by electron microscopy will reveal viral particles that can confirm the presence of this virus. Two more available techniques include serology and plant virus inclusion-body staining. Diagnostic facilities differ as to which techniques they employ but the

mentioned techniques are rapid and available in many laboratories.

Control

An integrated effort should be used to develop a control program for DMV. The rapid transmission of the virus by aphid vectors makes use of conventional insecticides ineffective in situations where aphids are already present. In addition, there are no effective preventative or eradicated pesticides to deal with viral diseases at this time. Only rigid cultural controls will allow satisfactory control of DMV problems on particular aroids.

Table 1. Varietal Reaction of *Dieffenbachia* spp. to Dasheen Mosaic Virus¹.

Moderate Acute Severe Chronic	Severe Acute Mild Chronic	Severe Acute Death
(<i>D. maculata</i>) "Perfection"	(<i>D. maculata</i>) "Rudolph Roehrs"	(<i>D. x memoria- corsii</i>)
	(<i>D. amoena</i>) "Tropic Snow"	

¹Research reported by Chase, A.R. and F.W. Zettler 1982. PLant Disease 66:891-893.

The following control observations are made in an effort to limit introduction and spread of DMV in the nursery.

1. Control Araceous and other weed species either within or outside production areas that can serve as a virus and/or aphid vector reservoir.
2. Maintain adequate insect control especially in greenhouses, to avoid buildups of potential aphid vectors of DMV.
3. Aroids propagated extensively by seed (e.g. *Philodendron selloum* and some *Spathiphyllum*

spp.) can be expected to have few DMV problems since the virus is not seedborne.

4. The majority of aroids propagated vegetatively must begin with the highest quality, pathogen-free stock that can be obtained. A number of tissue-culture companies can be contacted for direct purchase of pathogen-free plants or for contracted production of special material.

5. DMV-free stock blocks should be isolated from production areas and must be inspected routinely for DMV symptoms throughout the year, since symptom expression varies with the time of year and species affected.

6. Replace all plants exhibiting virus symptoms and replace with DMV-free stock whenever possible. DMV is systemic and cannot be cured. **Some cultivars** (*Dieffenbachia amoena* and Chinese evergreen), although diseased, are still commercially valuable.

7. Choose a procedure for propagation that prevents introduction and spread of DMV and other pathogens in the stock block:

a) Limit use of propagation tools to one cultivar or stock block at a time.

b) Propagation tools should be changed or disinfested prior to reuse with other stock blocks as insurance against virus spread.

8. Remove accumulated plant sap or pieces of plant tissue that become lodged within or on scissor or anvil-type shears prior to dipping.

9. Dip tools in a saturated solution of trisodium phosphate (TSP) for at least 15 to 20 seconds. Rinse tools in water after dipping in TSP. Discard the solution as soon as it begins to discolor.

10. Stock blocks produced from tissue-cultured plants are initially pathogen-free but are not

pathogen protected. The practical life span of a stock block depends on the level of sanitation maintained by the individual grower.

Literature Cited

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6. Zettler, F. W., M. M. Abo El-Nil, and R. D. Hartman. 1978. Plant Virus Description No. 191. Commonwealth Mycological Institute, Ferry Lane, Kew, Surrey, England. 4 pp.

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Table 2. Genera in the Araceae Susceptible to Dasheen Mosaic Virus.

Genus	Common Name	Economic Importance
<i>Aglanomea</i>	Chinese evergreen	Foliage ornamental
<i>Alocasia</i>	Elephant's-ear plant	Foliage ornamental, food crop
<i>Amorphophallus</i>	Devil's tongue	Foliage ornamental, food crop
<i>Anthurium</i>	Flamingo lily	Flowering ornamental
<i>Arisaema</i>	Dragon root, Jack-in-the-Pulpit	Wild flower
<i>Caladium</i>	Caladium	Foliage ornamental
<i>Colocasia</i>	Dasheen, taro	Food crop, foliage ornamental
<i>Cryptocoryne</i>	Crypts	Aquarium plant
<i>Cyrtospermia</i>		Food crop
<i>Dieffenbachia</i>	Dumb cane	Foliage ornamental
<i>Philodendron</i>	Philodendron	Foliage ornamental
<i>Spathiphyllum</i>	Peace lily	Foliage ornamental
<i>Xanthosoma</i>	Malanga, cocoyam	Food crop, foliage ornamental
<i>Zantedeschia</i>	Calla lily	Flowering ornamental



Figure 1. Chlorotic streaking along leaf veins of *Philodendron scandens oxycardium* caused by DMV.



Figure 2. Leaf mosaic and distortion symptoms on *Dieffenbachia* "Exotica" cultivar caused by DMV. (Contrast with healthy leaf on left.)



Figure 3. Ringspot symptoms in *Dieffenbachia maculata* "Rudolph Roehrs".

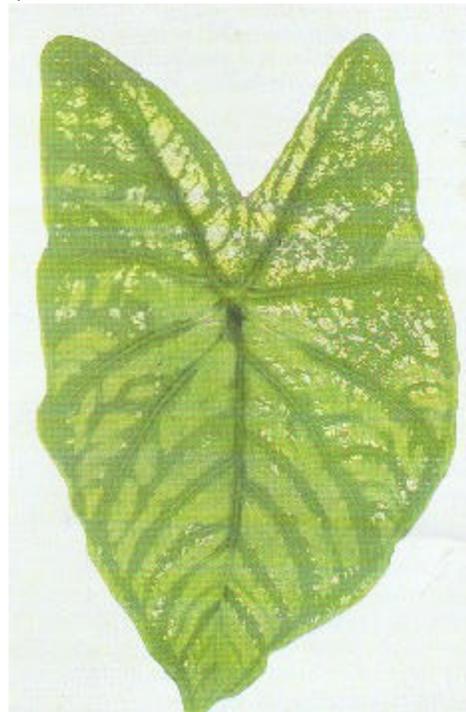


Figure 4. Natural variegation (upperleaf) and DMV symptoms (lower leaf) in *Caladium hortulanum* "Candidum".