

Pepper Mild Mottle Virus¹

Elizabeth M. Lamb, Scott Adkins, Kenneth D. Shuler, and Pamela D. Roberts²

Pepper mild mottle virus (PMMoV) occurs worldwide in field-grown bell, hot and ornamental pepper species. It has also been found in greenhouse pepper cultivars in Canada and Spain where greenhouse production practices are ideal for rapid spread of the disease. PMMoV has only recently been identified in commercial bell pepper fields in Florida, initially in Southwest Florida in January 2000 and then in Southeast Florida in December 2000. Disease incidence (the percentage of plants infected) of up to 30% was estimated in the Florida outbreaks. Because foliar symptoms can be mild, infected plants may not be noticed until the fruit symptoms are evident; resulting in spread to neighboring plants and higher yield losses.

Causal Agent and Symptoms

PMMoV is in the tobacco mosaic virus (TMV or tobamovirus) family. It is spread by mechanical transmission and by infected seed but cannot be transmitted by insects. The virus is identified by the symptoms it causes on indicator host plants, serological methods such as ELISA and the morphology of inclusion bodies induced by the virus

in host plant cells. A reputable laboratory should be used to ensure accurate identification of the virus.

Symptoms caused by PMMoV on pepper plants may vary between cultivars. Infected leaves are frequently puckered and mottled yellow or light green (Figure 1). Leaf symptoms are more evident on younger leaves.

Equation 1.
NPV = Present value (PV) of revenues - PV of costs

$$PV = \sum_t \frac{\$t}{(1 + i)^t}$$

Figure 1. Leaf mottling on pepper plants caused by PMMoV

Plants can be stunted, especially when the infection occurs early in the plants development (Figure 2).

Although infected fruit can be reduced in size and show variations in color (mottling and color changes at maturity), the most obvious symptom is the distorted or lumpy appearance of the fruit (Figure

1. This document is HS-808, one of a series of the Horticultural Sciences Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Original publication date July 2001. Reviewed May 2008. Visit the EDIS Web Site at <http://edis.ifas.ufl.edu>.
2. Elizabeth M. Lamb, Assistant Professor, Horticultural Sciences Department, Indian River Research and Education Center, Institute of Food and Agricultural Sciences, University of Florida, Fort Pierce, FL 34945
Scott Adkins, Research Plant Pathologist, USDA-ARS/United States Horticultural Research Laboratory, Fort Pierce, FL 34945
Kenneth D. Shuler, Vegetable Extension Agent IV, Palm Beach County Cooperative Extension Service, West Palm Beach, FL 33415
Pamela D. Roberts, Assistant Professor, Plant Pathology Department, Southwest Florida Research and Education Center, Institute of Food and Agricultural Sciences, University of Florida, Immokalee, FL 34142

The Institute of Food and Agricultural Sciences (IFAS) is an Equal Opportunity Institution authorized to provide research, educational information and other services only to individuals and institutions that function with non-discrimination with respect to race, creed, color, religion, age, disability, sex, sexual orientation, marital status, national origin, political opinions or affiliations. U.S. Department of Agriculture, Cooperative Extension Service, University of Florida, IFAS, Florida A. & M. University Cooperative Extension Program, and Boards of County Commissioners Cooperating. Larry Arrington, Dean



Figure 2. Stunting of young plant caused by PMMoV

3). Older fruit may develop brown streaks or blotches.



Figure 3. Virus symptoms on green pepper fruit (uninfected fruit bottom left)

Most cultivars and species of pepper (genus *Capsicum*) are susceptible to PMMoV. However, this virus does not affect tomato, eggplant or tobacco, which are in the same family (*Solanaceae*).

Control

Avoidance is the best means of control. Only seed that has been tested and determined to be free of the virus should be planted. Infected seed can be treated with heat, acid, or trisodium phosphate, but virus both on the seed surface and inside the seed must be removed to ensure freedom from disease. Seed treatments can reduce the seed germination percentage even if done accurately. Although the gene for resistance has been identified, there are very few resistant field cultivars available in the US.

The virus enters the plant through microscopic abrasions or wounds. There are no chemical or biological control methods that can be used to control the disease once the plant is infected. Like other members of this family of viruses, the virus is very stable and can be present on skin, clothing, tools and equipment so infected plants should be handled as little as possible and infected fields should be worked

(staked, tied, harvested, sprayed, etc.) last to avoid spreading the virus to uninfected areas. Infected plants should only be removed if elimination can be done without contact with healthy plants. A symptomless plant on either side of those removed should also be rogued, as it is likely that they are also infected. Some viruses can be spread through smoke so diseased plants should be disposed of by composting or burying them away from fields where peppers will be grown rather than by burning them.

Viruses in the tobacco mosaic virus family are notoriously easy to spread and difficult to eliminate. To reduce spread of the disease, anyone working with the plants should wash their hands with 70% alcohol or strong soap, also cleaning under the nails. Clothing should be washed as frequently as possible. Equipment should be washed and then cleaned with 3% trisodium phosphate and not rinsed. Stakes from infected areas of the field should be discarded or soaked in 3% trisodium phosphate before being reused. Household bleach can also be used to clean equipment or stakes.

Diseased plant material will remain infectious until completely broken down. Tillage, increased irrigation, and high temperatures encourage the breakdown of plant material in the soil. Any infected plant material in the soil can serve as a source of inoculum for subsequent crops so crop rotation should be practiced, if possible. Volunteer peppers and weeds, particularly those in the *Solanaceae* family (such as nightshades), should be removed to reduce possible sources of infections.

Accurate identification is important to avoid yield loss. Other pepper viruses can have similar symptoms but may be spread and controlled through different means. For example, pepper mottle virus, which has somewhat similar symptoms and is also found in Florida, is transmitted by aphids and not by mechanical means. Check with a laboratory that does virus testing, or with your local Cooperative Extension office for identification.