

Bean Common Mosaic Virus

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Bean common mosaic virus (BCMV) was one of the earliest reported virus diseases of plants in the world. Field infections as high as 100% have been reported, and yield losses have ranged from 6 to 98%, depending upon cultivar, environment, and time of infection. Twenty-eight host plants other than the dry bean (*Phaseolus vulgaris*) are known to be susceptible, but none of these are important alternate hosts in Michigan. BCMV is transmitted in seed and pollen, by insect vectors (mainly aphids) and by mechanical means, such as machinery. Infected seeds and plants of susceptible cultivars serve as sources of initial BCMV inoculum. Plants grown from infected seed are almost always stunted and unproductive. Plants infected later in the season by aphids or mechanical transmission usually have little loss in yield, but a high percentage of the seed harvested from such plants may be infected and should not be used for planting stock.

SYMPTOMS

Two basic symptom types are produced by BCMV – typical leaf mosaic (mottling, Fig. 1), and a systemic necrosis (Figs. 2 and 3), which may include black root and local lesions. Development of a symptom type depends upon the cultivar, time of infection, strain of BCMV, and environmental conditions. Typical mosaic symptoms develop only in infected susceptible varieties, and are characterized by alternating patterns of light and dark shades of green on the leaves. Other symptoms seen on susceptible hosts include mottling, curling, and malformation of leaves, as well as stunting of plants. Infected leaves may appear narrower and longer than healthy leaves, and leaf tips curl downward and deform the leaf (Fig. 4).

Plants infected early in the growing season or



Fig. 1. Leaf puckering and mosaic symptoms (alternating areas of light and dark green) characteristic of the susceptible reaction to BCMV.



Fig. 2. The hypersensitive reaction to BCMV observed on the upper leaf surface.

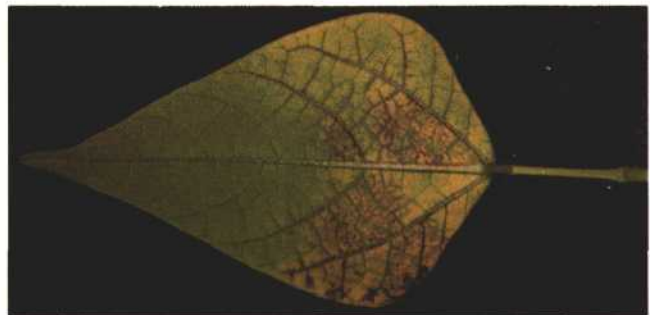


Fig. 3. The hypersensitive reaction to BCMV observed on the lower surface of the leaf.

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Fig. 4. Typical leaf distortion in susceptible bean plants infected with BCMV. Note the elongated and rolled up leaves.

grown from infected seed may have fewer pods and fewer seeds per pod than healthy plants. Plants infected through secondary means later in the season usually produce near normal yields, but a high percentage of the seed may be infected.

Black root occurs in cultivars possessing the hypersensitive I gene for resistance to the mosaic virus. However, not all strains of BCMV can cause black root in such resistant cultivars. Symptoms (systemic necrosis) appear as leaf lesions, or as wilting of the plant top and young trifoliolate leaves which turn dull green and then gray. Eventually, the entire plant wilts and dies. A reddish-brown discoloration of vascular tissue usually develops in stems, roots and pods. Such discoloration can easily be seen by cutting through these tissues with a knife. The rapid wilt and death of the plants, called a hypersensitive reaction, prevents the plants from serving as sources of infection for healthy plants; however, when large numbers of plants are affected by black root, yield losses are substantial (Fig. 5).

CONTROL

Resistant cultivars should be grown whenever possible. Even though the resistance associated with the black root syndrome can result in severe yield losses, this type of resistance is generally adequate against most strains of BCMV. The genes that control resistance to systemic necrosis can result in the black root reaction, a systemic mosaic reaction to some strains, or no reaction at all to other strains of BCMV.

The use of clean, virus-free seed is a necessity. Plants developing from infected seed are generally stunted and may not produce seed. A high percentage of infected seeds will result in high numbers of infected plants and substantially reduced yields. Even a low percentage of infected seed (1-5%) can result in the introduction and buildup of new strains of BCMV in Michigan that could induce the black root reaction in resistant cultivars. Further, even a low percentage of infected plants can result in rapid and widespread disease development if aphid vectors are abundant



Fig. 5. The hypersensitive reaction to BCMV in beans is also called black root. Entire plantings of beans may die.

and are active. The safest procedure is to use seed with no detectable seed-borne BCMV.

Attempts to control the common mosaic virus diseases by controlling aphid populations with insecticides have not been successful. Crop rotation, early planting, and deep plowing of infected fields are not effective in controlling BCMV, but are recommended practices for other diseases of dry beans.

Table 1. Reactions of commercial dry bean varieties to the type strain of bean common mosaic virus (BCMV) and its New York 15 variant.

Class and Variety	REACTION TO	
	Type Strain	New York 15 Variant
Navy (pea)		
Aurora ¹	R	R
Fleetwood ¹	R	R
Gratiot ¹	R	R
Kentwood	R	S
Sanilac	R	S
Seafarer ¹	R	R
Tuscola ¹	R	R
Black		
Black Beauty	R	R
Black Turtle Soup ¹	S	S
Midnight	R	R
T-39	R	R
Light Red Kidney (LRK)		
Cal. LRK	S	S
Manitou	S	S
Mecosta	R	R
Redkloud	S	R
Sacramento	S	S
Dark Red Kidney (DRK)		
Cal. DRK	S	S
Charlevoix	S	S
Montcalm	R	R
Royal Red	R	R
Pinto		
UI-111	R	R
UI-114	R	R
Olathe	R	R
Ouray	R	R

¹Varieties which have exhibited the hypersensitive reaction under field conditions in Michigan.

R = Resistant S = Susceptible