

CUCUMBER MOSAIC

Cucurbit mosaic, caused by *Cucumber mosaic virus* (CMV), is one of the most common virus diseases of cucurbits. CMV can be found wherever cucurbits are grown. However, it is more prevalent in temperate regions. The virus was first described from the United States (US) in the early 1900s, where it caused substantial losses to cucumber production in the Midwest.

The host-range of CMV is wide and includes over 1,200 species, including both dicots and monocots. CMV infects crops, ornamental, and weed species. Economically important hosts include many vegetables (carrot, celery, cucurbits, legumes, lettuce, onion, pepper, spinach, tomato, and others), ornamentals (anemone, aster, delphinium, geranium, lilies, periwinkle, petunia, primula, viola, zinnia, and others), and woody and semiwoody plants (banana, passion fruit, privet, tree tomato, and others).

Symptoms

Cucurbits differ in their susceptibility to CMV. The virus is particularly damaging in cucumber, pumpkin, summer squash, and melon. Watermelon is usually resistant to CMV, but occasionally is affected by a specific strain of the virus.

Infected plants are usually stunted with reduced leaf and internode size and show deformation and mosaic. Infected plants show downward leaf curling and yellow spots on newly emerging leaves. Leaves of pumpkin, squash, and zucchini plants infected with CMV may show a particular strong yellow mosaic, sometimes in a star shape, as well as leaf deformation. Flowers of affected plants may have prominent abnormalities, including petals with a green coloration. Fruit-set can be substantially reduced, and infected fruits are smaller than normal, deformed, often distorted, and have yellow green mosaic (Figure 1). Melon fruits may show a mild mottling; cucumber fruits are mottled and bumpy; and squash and zucchini fruits exhibit mottling or green dots.



Figure 1. Cucumber mosaic (CMV) on cucumber fruit.

It is not possible to identify CMV on the basis of symptoms alone because of their similarities with symptoms induced by other viruses. CMV can be detected by serological methods, including ELISA and lateral flow devices (immunostrips). Lateral flow devices provide a rapid

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method for detection of the CMV infection in the field. CMV also can be readily detected by RT-PCR and sequencing, and numerous primers have been developed for amplification of different portions of the CMV genome.

Disease Cycle

The primary inoculum sources for CMV infection in cucurbits are nearby infected weeds, ornamentals, or crop plants. In nature, CMV is transmitted in a nonpersistent (stylet-borne) manner by more than 80 aphid species. The virus can be acquired and transmitted in 5-10 seconds and is retained in the insect for only a short period (about 1-2 h). The virus is also readily transmitted mechanically (via sap), but it is not thought to be transmitted plant-to-plant contact. Seed transmission of CMV in cucurbits has not been reported.

Following the development of infection (after about 7-14 days), CMV infected cucurbit plants serve as secondary inoculum sources for acquisition and transmission by either resident or migratory aphids. In temperate regions with a winter season, CMV overseasons in perennial reservoir hosts, whereas in tropical and subtropical regions, the virus is maintained year round in reservoirs and overlapping susceptible crops.

Disease Management

Management of CMV is a challenging task because it has a broad host range and its efficient transmission by aphid species. The most effective management involves an integrated pest management strategy before, during, and after the growing season. Practicing the following recommendations can help to minimize infection of plants with CMV.

- New cucurbit fields should not be adjacent to or near established fields with CMV-infected plants. Similarly, new fields should not be planted downwind of established fields with CMV-infected plants.
- If transplants are used, plant virus- and aphid-free plants.
- Plant resistant cultivars to CMV. Different levels of resistance to CMV exist in cucumber, melon, and squash. Most cucumber cultivars are highly resistant to CMV.
- Since the greatest losses occur when plants are infected in early development (before flowering), efforts should be made to delay CMV infection during early season by controlling weeds, rogueing diseased plants early in the season, and preventing aphids from landing on plants (i.e., by using reflective mulches).
- Applications of mineral oils and insecticides can slow the spread of viruses in cucurbit fields. The application of chemicals may be combined with a program of rogueing infected plants early in the growing season. Application of systemic insecticides are more effective than contact insecticides for management of virus diseases.
- After the crop is harvested, old plants should be removed and destroyed to prevent old plants serving as sources of inoculum for other plants.