

# Viruses cause heavy melon losses in desert valleys

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## Complex of three viruses found in many desert valley fields

The desert valleys in southern California's Imperial and Riverside counties produce approximately 25 percent of the melons in the state, including cantaloupes, mixed melons, and watermelons. Cantaloupes represent the largest acreage. In the spring of 1984, a severe mosaic disease of viral origin affected many acres of these melons. A similar disease had occurred in 1982 and 1983 but was less widespread. Symptoms included severe mosaic and blistering on melon foliage and fruit, along with stunting and yellowing of entire plants. Fruit cracking was also observed in seriously affected fields. Some fields were a complete loss.

### Viruses involved

The virus complex affecting cucurbits in the desert valleys has undergone significant change in the last seven to eight years. In 1976, the whitefly, *Bemisia tabaci*, introduced a new virus, squash leaf curl, affecting summer and winter squashes in the Imperial Valley. Five years later, lettuce infectious yellows virus was recognized as another major whitefly-transmitted virus in fall squash and melon production.

Aphid-borne viruses have been a problem for spring melon producers since these crops were first grown in the desert valleys. The severity of these diseases in the spring of 1984, however, indicated that some change in the virus complex may have occurred. Tests showed that three aphid-borne cucurbit viruses were present—watermelon mosaic virus-2 (WMV-2), watermelon mosaic virus-1 (WMV-1), and zucchini yellow mosaic virus (ZYMV). WMV-2 is common in most

fields every spring. WMV-1, although less common, had been previously reported in southern California desert valley melon fields but was not detected in samples tested in the previous four years. ZYMV, a new virus first found in Italy and France in 1981, has since been reported in many other parts of Europe and several states throughout the United States. This virus is carried by the same aphid (*Myzus persicae*) as WMV-1 and WMV-2 but has a different host range.

The viruses are sufficiently distinctive to be reliably diagnosed by virus-specific antisera in a variety of serological tests, including the enzyme-linked immunosorbent assay (ELISA), which was used in this study. All three are members of the same group of plant viruses, the potyvirus group.

ZYMV produces much more severe symptoms on the fruit and foliage of melons than does either WMV-1 or WMV-2. This virus was first reported in Imperial Valley cantaloupe fields in 1982 and possibly was present in 1981. Initially, ZYMV-Ca (California strain) was called "watermelon mosaic virus - Niland" to designate it as a new virus isolated from

the Niland area of the Imperial Valley. Although it is considered new, its dramatic increase from 2 percent of the samples tested in 1982 and 10 percent in 1983 to 40 percent in the spring of 1984 suggests it may have been present but undetected for some time. This virus would have been difficult to overlook, however, since it has such severe effects on infected plants. Not only did the incidence of ZYMV-Ca increase, but WMV-1, which had not been reported in the Imperial Valley in the previous five years, was present in 40 percent of the samples tested in 1984.

### Virus distribution

Foliage samples were collected from squash, cantaloupe, watermelon, and mixed melon plantings throughout the Imperial Valley in the spring of 1984. Laboratory tests indicated that WMV-2 was generally distributed in the valley and was present in all four cucurbit species tested. WMV-1 infection was also found in all the cucurbit species tested but was much more limited in distribution. All but one confirmed instance of WMV-1 infection were found in fields within 2 miles of the desert. WMV-1 was also more

Symptom reactions of plants to zucchini yellow mosaic virus-Ca (ZYMV-Ca), watermelon mosaic virus-1 (WMV-1), and WMV-2 on selected hosts after mechanical inoculations

Virus	<i>Luffa acutangula</i> *	<i>Phaseolus vulgaris</i> 'Black Turtle 2'	<i>Chenopodium amaranticolor</i>	<i>Cucumis melo</i> 'Topmark'	<i>Cucurbita pepo</i> 'Early Prolific'
ZYMV-Ca	SM†	NR‡	LL§	SM	SM
WMV-1	SM	NR	NR	SM	SM
WMV-2	NR	SM	LL	SM	SM

\* Plants chosen were those normally used to distinguish between WMV-1 and WMV-2.

† SM = systemic mosaic and ELISA-positive.

‡ NR = no local or systemic reaction and ELISA-negative.

§ LL = local lesion and ELISA-positive.



Of the three mosaic viruses affecting the spring melon crop in southern California desert valleys, zucchini yellow mosaic virus (ZYMV-Ca) is the newest and most damaging. The combined infection of this virus and two forms of watermelon virus cause severe yellowing and stunting of vines and abortion of blossoms. Fruit that sets becomes misshapen and often cracked, as with the Honeydew (left above) and Crenshaw (above, right).

prevalent in early-planted melon and squash fields, and in melons adjacent to squash plantings.

ZYMV-Ca was most severe in the Niland melon-growing area, where all fields sampled were positive for the virus. Several other fields were positive for ZYMV-Ca, but there was no apparent pattern that could be correlated with planting date, nearby crops, or prevailing wind direction.

### Discussion

WMV-2 can be found in spring cucurbit plantings in the desert almost every year. Damage from this virus depends on aphid populations, which in turn depend on climatic conditions. Melons infected early can be severely damaged. If WMV-2 infections occur when plants are well developed, however, incidence may still be high but damage is minor and near-normal melon production can be expected.

WMV-1 has been previously reported from the Imperial Valley, but occurs sporadically. When this virus is present in combination with WMV-2, the mixed infection causes a severe mosaic and stunting of the vine. Fruit is small and poorly formed, often shows mosaic, and has a low sugar content, which gives the melon a flat taste. As a result, a reduced harvest of inferior quality melons is produced.

Of the three mosaic viruses that have affected the spring melon crop in the desert valleys, ZYMV-Ca is the newest and most damaging. All fields infected with ZYMV-Ca were also infected with WMV-2 and, in some instances, WMV-1. The combined infection resulted in severe chlorosis and stunting of the vines and abortion of blossoms. Fruit that did set became

misshapen and often cracked, causing a total loss of production. As a result of the multiple virus infections, overall yields of melons in the desert valleys during the spring of 1984 were decreased by 40 to 50 percent. Yield losses ranged from 25 to 100 percent, depending on the melon variety and location of the field. During the fall melon seasons of 1982 and 1983, similar losses occurred in several fields in the Niland area. Plant tissues assayed from these fields were positive for the presence of ZYMV-Ca.

The occurrence of WMV-1 and ZYMV-Ca poses serious problems for desert melon production. If these two viruses recur annually, profitable production of spring melons in the desert valleys will be seriously affected.

Research is needed on the off-season hosts of these viruses. Several crop and weed hosts are known, but observations indicate that some desert vegetation may also harbor these viruses. Also, the vector complex should be reexamined. The aphid *Myzus persicae* is a known vector, but its populations are very low during the fall melon season. Since ZYMV-Ca still causes problems in some fields at that time of year, other aphids may also be vectors in the fall. In addition, research to develop virus-resistant melons or to find means of virus suppression in the melon crop is urgently needed.



Along with ZYMV, watermelon mosaic virus 1 and 2 have been found to be common in Imperial and Riverside County melon fields.



Lettuce infectious yellows virus was identified as a whitefly-transmitted virus in fall squash and melons in 1981.

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