

than most varieties. They are good for cooking.

The variety, Gold Nugget is said to be a synonym of Thales. However, the Gold Nugget at the Sub-Tropical Experiment Station is different from both Tanaka and Thales. The tree is much more upright and the fruit is larger, rounder and later in ripening. The fruit is tart when fully colored, and the tree is a shy bearer. This variety cannot be recommended for South Florida conditions.

The Oliver variety which was described by Mrs. Krome in 1936 remains one of our choicest varieties. It bears heavily and the fruit is good to eat out of hand or cooked. Although

many people like the flavor of other varieties better, the Oliver is propagated at present more than any other variety in Dade County. It has an orange colored flesh and ripens in mid-season.

Among new varieties at the Sub-Tropical Experiment Station, Fletcher and Red Royal may show some promise. Both varieties have very deep orange flesh though it is not a true red. These will need further evaluation before they can be compared with other varieties. A so-called seedless variety has also been obtained but it has not yet produced a crop.

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## SPECIES OF FICUS SUSCEPTIBLE TO THE FIG MOSAIC VIRUS

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In April, 1958, several hundred fig plants, *Ficus carica* L., from Italy, grown under post entry permit, and several hundred fig plants from California were found in Florida, and all were infected with the fig mosaic virus. The disease was successfully transmitted from affected to healthy fig plants by budding. Studies were initiated to determine possible susceptibility of other moraceous plants growing in Florida to this virus disease.

Condit and Horne (1) first reported fig mosaic from California in 1933, and later from Texas in 1941 (2). Pittman, in 1935, (5) recorded the presence of this disease in England, Puerto Rico, Kwangtung and Nanking, China, and New South Wales, Australia, and Ti and Procter (4) in New Zealand in 1944. It was reported from Georgia by Garren (3) in 1947.

Condit and Horne (1) first described the viral disease on *Ficus carica* and reported that it occurred on practically all varieties of fig wherever grown in California. They named *Ficus altissima*, *F. krishna* and *F. tsida* as specific hosts. (2). Li and Procter (4) suspected *F. retusa*, *F. repens*, *F. australis* and *F. macrophylla* of showing symptoms of the disease, but transmission from diseased to healthy plants of these varieties was not demonstrated.

Since 1958, virus-free plants in the family

*Moraceae*, including those in the genus *Ficus* and additional ones from other genera, have been inoculated with buds infected with fig mosaic. One plant in the genus *Cudrania* and seven species of *Ficus* have been found to be susceptible to this virus. The degree of mottling ranged from slight to severe, depending upon the response by the individual plants. The following species have been found susceptible: *Ficus lucescens*, (*F. wightiana*), *F. jacquinifolia*, *F. rubiginosa* (*F. australis*), *F. retusa*, (*F. nitida*), *F. mallatocarpa*, *F. glomerata*, an unidentified species of *Ficus*, and *Cudrania tricuspidata*.

All the species listed above are new hosts for this virus, with the possible exception of *F. rubiginosa* (*F. australis*), although it was reported from New Zealand as a suspected host by Ti and Procter in 1944. (4). *Cudrania tricuspidata* also is a new host, and is the first plant outside of the genus *Ficus* found to be susceptible to this disease.

Eleven other moraceous plants have been inoculated by budding from virus-infected plants. To date, none of them have shown any symptoms suggestive of this disease. Currently, they are under test to see if they are symptomless carriers of the virus. Those inoculated plants which show no symptoms after from six to fifteen months are as follows: *Morus rubra*, *Humulus americanus*, *Ficus lyrata* (*F. pandurata*), *F. religiosa*, *F. elastica*, *F. aurea*, *F. quercifolia*, *F. calophylloides*, *F. kiristingii*, *F. radulina* and *F. vogelii*.

## SYMPTOMS

Condit and Horne (1) described the symptoms of mosaic virus in fig, *Ficus carica*, as follows: "Fig mosaic manifests itself both on the leaves and on the fruit. On the leaves the mosaic spots are sharply delineated, the light

green color of the affected areas contrasting sharply with the normal green color of the foliage. The borders of mosaic spots are, however, usually indefinite, their light color blending gradually with the dark green of healthy tissue. In some leaves, the spots are more or

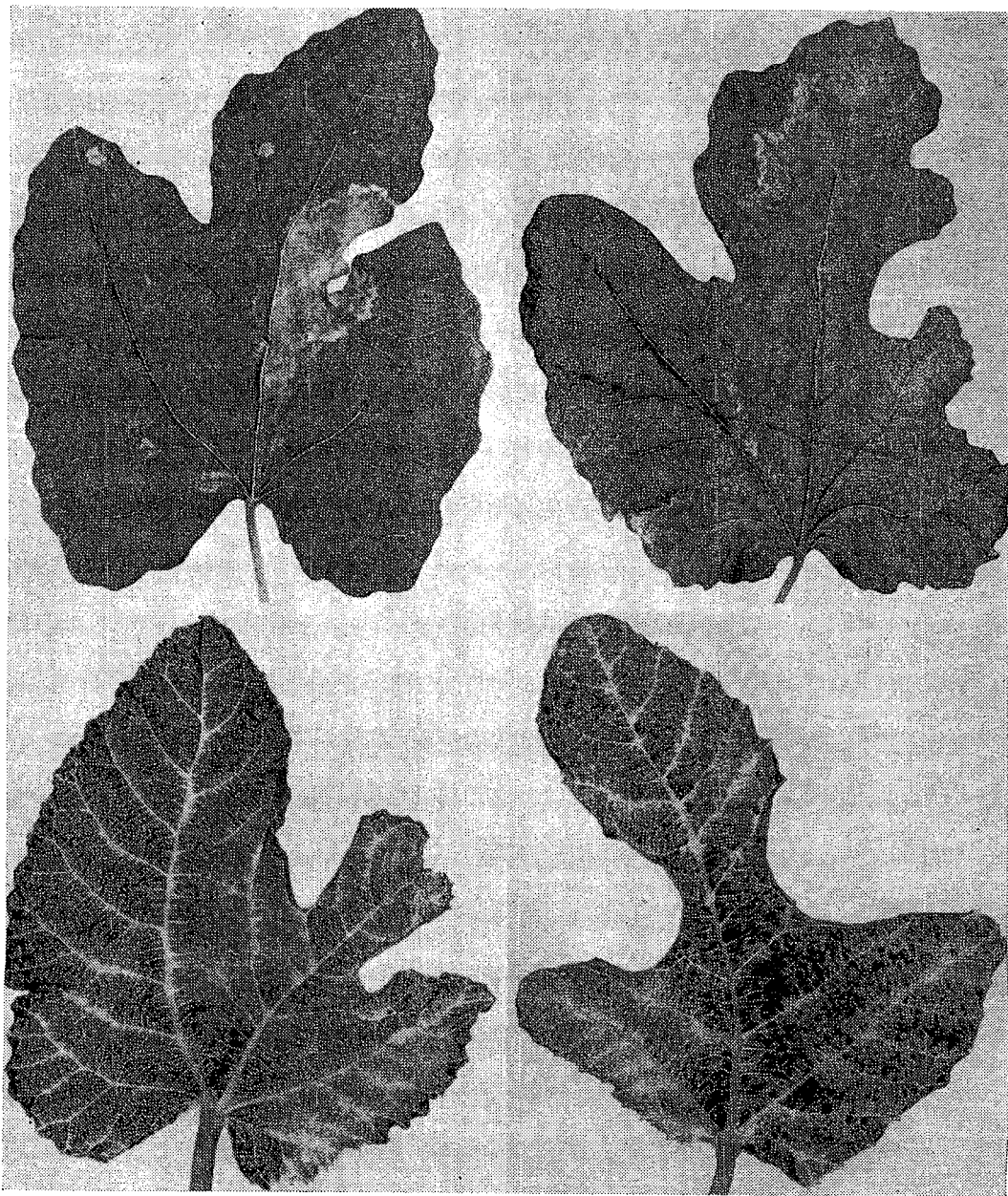


Fig. 1. Symptoms of fig mosaic on *Ficus carica*. (State Plant Board Photograph by Jerry Messac.)

less uniform size, small and densely scattered over the surface. In other cases, they are of various sizes, of indefinite outline, and appearing as irregular patches of light green, diffused widely throughout the blade of the leaf with no relation whatever to the position of the leaf veins. Mosaic spots often are bordered by a rust-colored band, evidently caused by the death of epidermal or subepidermal cells. Seldom does the mosaic bring about an actual necrosis or dying out of whole areas of leaf tissue.

"One manifestation of fig mosaic, which appears to be systemic, is the malformation of leaves. In some cases, certain twigs bear none but malformed leaves. In other cases, both malformed and normal leaves are found on the same twig. Malformed leaves show an infinite variety of shapes and sizes.

"The appearance of mosaic spots on the fruit is very similar to that on the leaves. The premature dropping of figs appears at times to be due to the presence of these mosaic spots on the surface of the fruit and on adjacent leaves."

Leaf symptoms on infected fig plants growing in Florida correspond to those described by Condit and Horne (1). The premature dropping of figs, however, has not been observed on the limited number of plants under observation, although a yellow streaking and spotting has been noted on a small percentage of fruit. This symptom has been noted throughout the whole growing season, but is more pronounced or evident in the spring of the year. Occasionally, all or almost all the leaves show at least some of the mosaic pattern, but usually it is limited to leaves on one or several limbs. Often, small twigs occurring on the main trunk and near the ground level will show symptoms while the balance of the tree will be symptomless. See Figure 1 for symptoms on *Ficus carica*.

The response to the virus by the eight new host plants listed above are so varied that a description of the symptoms of each seems desirable.

#### SYMPTOMS ON *Ficus lucescens* (*F. wightiana*)

Plants of *Ficus lucescens* were donated by Dr. Murray Gaskins of the United States Plant Introduction Garden, Miami, Florida, where they are listed as PI 249537.

This species gives the most pronounced response of any of the plants tested. It is superior to *F. carica* in symptom-expression and is now used as an indicator plant for the fig mosaic virus. Leaf symptoms may be described as the same as those on *F. carica*, but more accentuated. The leaves of this plant are normally a deeper green than those of the common fig. There is, therefore, a greater contrast between the yellow or yellow-green mosaic pattern and the dark green background. Mosaic-infected leaves are generally smaller to much smaller than normal ones, and there may be extreme twisting, puckering and distortion. What appears to be a shock reaction results after a plant is inoculated. Leaves are twisted and distorted, and may be reduced in size as much as 90% of that of a normal leaf. Eventually, or within six to ten months, new leaves become larger until they approach the size of normal leaves. At this time, they still continue to show the typical mosaic symptoms characteristic of this species. The earliest symptoms show on the second flush of growth, which is usually from four to six weeks after inoculation. Figure 2C shows symptoms on *F. lucescens*.

#### SYMPTOMS ON AN UNIDENTIFIED SPECIES OF *Ficus*

A mosaic pattern appears on leaves within six weeks after inoculation. This pattern is distinct and loses little intensity, even after twelve months. All or part of a leaf may show symptoms, but not all leaves on a given plant, or even on a given twig, show symptoms. The leaves that do show symptoms are reduced to about three-fourths the size of a normal leaf, and may be slightly deformed. Often, the mosaic pattern extends from one or both sides of the midrib and may cover the entire leaf, or only a part of it. When only a part of the leaf is involved, it is not uncommon to find small circular to irregular yellow blotches scattered at or near the leaf margin. The mosaic patterns and blotches may have narrow rust-colored borders, similar to those described on fig by Condit and Horne (1). See Figure 2A for symptoms on *Ficus* sp.

#### SYMPTOMS ON *Ficus rubiginosa*

First symptoms appear six to eight weeks after inoculation as a typical mosaic pattern with leaf distortion and reduced leaf size, as noted on *F. lucescens*. Some of the leaves are

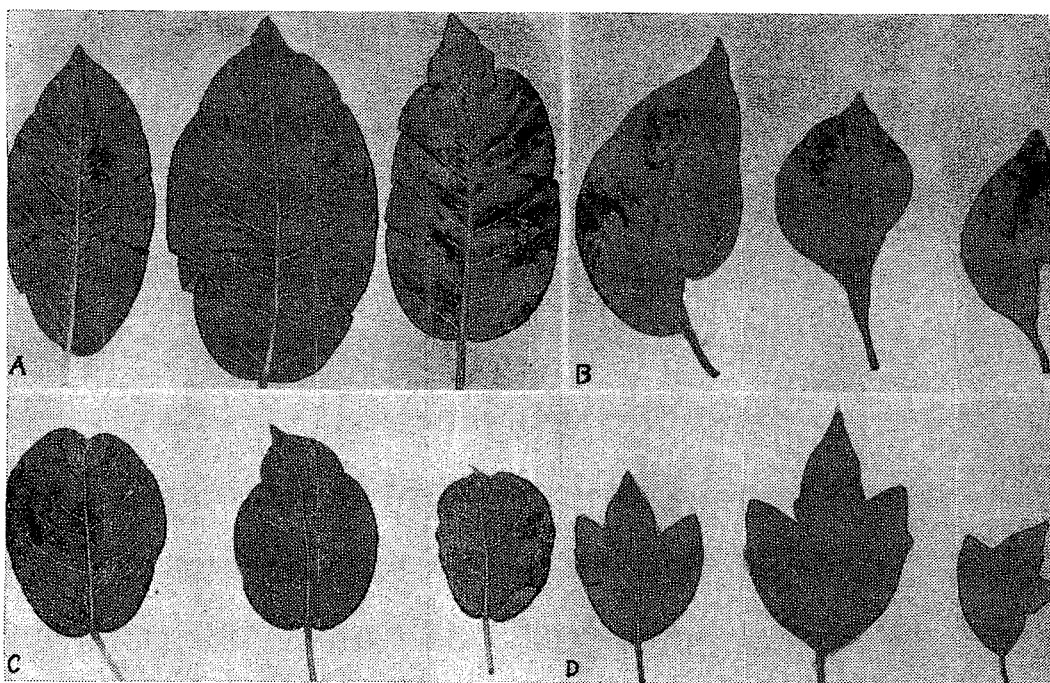


Fig. 2. Symptoms of fig mosaic on various hosts. A. on *Ficus* sp.; B. on *Ficus retusa* (*F. nitida*); C. on *Ficus lucens*; and D. on *Cudrania tricuspidata*. (State Plant Board Photographs by Jerry Messec.)

only one-tenth normal size and extremely distorted. Infected plants become stunted, new growth lacks vigor, and almost all leaves show some marks of the virus, either as a mosaic pattern or as distortion, or both.

This species also was donated by the United States Plant Introduction Center at Miami, and is listed as PI 90711.

#### SYMPTOMS ON *Ficus retusa* (*F. nitida*)

This is one of the most common species of *Ficus* in Central and Southern Florida. Symptoms are not as striking as on the above mentioned plants. Nevertheless, the mosaic pattern and the slightly smaller and distorted leaves are conspicuous, though less pronounced as in some other species. Infected plants of this species tend to have a lighter green than normal appearance, which tends to give less contrast with the yellow-green mosaic pattern. Generally, the leaves showing symptoms are slightly smaller than those not showing symptoms. Some dwarfing has been noted, especially on branches where a considerable number of leaves show infection. However, branches are quite vigorous when none, or only a very

few of the leaves show symptoms. Figure 2B shows symptoms on *Ficus retusa*.

#### SYMPTOMS ON *Ficus jacquiniifolia*

Symptoms on this species are less conspicuous than any so far described. The whole leaf is not involved as in other species, but scattered areas of mosaic patches may be seen anywhere along the leaf. The virus causes a slight reduction in the size of the leaf, but very little distortion. The over-all symptoms are obscure, and with only a casual observation, an infected plant may easily be overlooked. First symptoms show up in six weeks after inoculation, as with other species tested.

#### SYMPTOMS ON

#### *Ficus mallatocarpa* and *F. glomerata*

Four seedlings of *F. mallatocarpa* were secured from the U. S. Plant Introduction Gardens and are listed by them as PI 244611.

The symptoms of infection expressed in these two species are described together since their responses to the virus are practically identical. The plants seem to be symptomless, but in some cases one twig, or only one leaf on an entire plant may show symptoms which,

when noted, are expressed as a mosaic mottling of the entire leaf or as a leaf only half the normal size. Some inoculated plants may show no symptoms. Yet, when buds are taken from these symptomless plants and placed on healthy *F. carica* or *F. lucescens* plants, the typical fig mosaic symptoms appear.

#### SYMPTOMS ON *Cudrania tricuspidata*

*Cudrania tricuspidata* was the only moraceus plant outside the genus *Ficus* which proved susceptible to this virus. The first symptoms showed within six weeks after inoculation as yellow blotches, often but not always associated with the midrib or main veins. The outer periphery of the blotches became yellow-green and finally blended into the normal green of the leaf. Although there was no noticeable reduction in leaf size, some distortion did occur, especially if the blotches were confined to one side of the leaf. Symptoms of infection decreased as new growth progressed, until only a scattered leaf was noticeably affected. When older plants were cut back, the new growth that followed devel-

oped clearly visible symptoms. These symptoms again became weaker in the succeeding flushes of growth. Figure 2D shows typical symptoms on *Cudrania tricuspidata*.

Studies of other moraceus plants, particularly those grown in Florida, are being continued-

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## PROGRESS IN THE DEVELOPMENT OF GRAPE VARIETIES FOR FLORIDA

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Cultivated grapes were introduced into Florida at various times since the earliest days of colonization (1). Spanish, French, and English settlers endeavored to establish *Vitis vinifera* L. varieties so that they might duplicate the wines of their homeland. With the possible exception of the Key Grape on the Florida Keys, all plantings of pure *V. vinifera* grapes in Florida followed the same general pattern of decline and failure.

At the close of the Civil War settlers attempted to establish in Florida the *Vitis labrusca* L. varieties of northeastern America. These vineyards at various locations thrived briefly. Between 1885 and 1895 several hun-

dred acres of Concord, Ives, Worden, and Niagara were grown in the vicinity of Orlando. The ultimate failure of these grape plantings influenced the United States Department of Agriculture to establish an experiment in 1899 at Earlton, Florida, designed to ascertain why standard cultivated varieties of grapes sickened and died at a relatively early age. Baron von Luttichau conducted the work and within a few years reported that attacks of various fungi were responsible. In the meantime interest in commercial viticulture in Florida disappeared almost entirely.

About 1920 the Texas "Post-Oak" hybrid grapes (2) developed by Colonel T. V. Munson from *Vitis lincedumii* Buckley were introduced and quickly aroused interest in the possibilities of commercial grape culture, particularly in the central ridge area. Over a period of about five years some 5000 acres were planted to the Munson hybrids. Superior among these were Extra, Carman, R. W. Munson, Bailey, and Armalaga. About 1923 the variety Florida Beacon, which later was found