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Eruptive Gummosis, a New Virus Disease of Citrus

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IN MARSH GRAPEFRUIT (*Citrus paradisi* Macf.) orchards near Concordia, Argentina, trees are commonly observed bearing one to several fruits on the same branch and having the symptoms shown in Figure 1.

Symptoms

FRUIT.—The fruit symptoms consist primarily of localized, gum impregnated spots in the albedo. When superficial gum deposition is accompanied by necrosis of the cuticle and the oil glands, these small necrotic spots (5 to 8 mm) frequently coalesce to form larger lesions which then resemble those caused by anthracnose (*Colletotrichum* sp.). As a matter



FIGURE 1. Sunken discolored areas in the rind of an inoculated Duncan grapefruit. Some areas show a circular arrangement.

of fact, *Colletotrichum* can often be isolated from the lesions. In other cases, the cuticle remains intact and the lesions are visible as sunken areas on the rind. Frequently, the spots are disposed in a circular pattern (Fig. 1). At times the fruits appear completely normal, and the symptoms are visible only when the fruit is cut. Such lesions are sterile. Affected fruits often fall prematurely.

TREE.—After removing the bark of a branch bearing five affected

fruits, lines of gum deposits somewhat similar to the stem pitting of triszeta were observed. The lines were dark brown in color, and the cambial surface showed a generally brownish discoloration. These gum deposits were not observed on other trees with affected fruits.

Materials and Methods

Bark tissue from a 5-year-old Marsh tree bearing affected fruits and having discolored cambium was used for inoculum in all of the experiments. The following test plants were inoculated. a) A 16-year-old Marsh grapefruit and a 12-year-old Duncan grapefruit, both on trifoliolate rootstock. Each plant was inoculated in 3 small branches bearing fruit of approximately 1 cm in diameter. Leaves of the producing Duncan tree were analyzed for boron. b) Three 18-month-old Marsh seedlings in pots in the greenhouse and one 3-year-old seedling in the field. c) One-year-old seedlings of the following varieties: California, Improved, Duncan, Ruby, McCarty, and Marsh grapefruit, sweet orange, Meteor shaddock (*C. grandis* Osb.), Perrine lemon, and Orlando tangelo (*C. paradisi* Macf. x *C. reticulata* Blanco). Five plants of each variety were inoculated and 3 of each were left as controls.

Results

The two bearing trees, Marsh and Duncan, reacted differently to inoculation. Gum erupted generally over the trunk, the main and even secondary branches of the Marsh tree, but no symptoms occurred on the fruit. On the Duncan tree, clusters of fruit on the three inoculated branches developed fruit symptoms, and when the bark was removed from these branches, a line of pitting and gum deposition was visible from the point of inoculation along one side of the branch to the corresponding sector of the affected fruit. The following year fruit symptoms occurred on other branches and more fruit fell from the inoculated plant than from the control.

General eruption of gum occurred in all inoculated Marsh grapefruit seedlings. By raising the bark around the point of inoculation one month after inoculation, gum deposition could be seen. In three to five months' time, gum was exuding at various points on the stem and branches (Fig. 2). By raising the bark of the stem, wide, longitudinally delimited sectors of abundant gum deposition could be observed (Fig. 3). The inoculated plants showed small, chlorotic leaves and necrotic shoots, possibly as a result of the gum eruption. As can be seen in Table 1, gum deposition occurred in the cambium of all of the varieties tested. The grape-



FIGURE 2. Gum exudation on a Marsh grapefruit seedling, three to five months after inoculation.

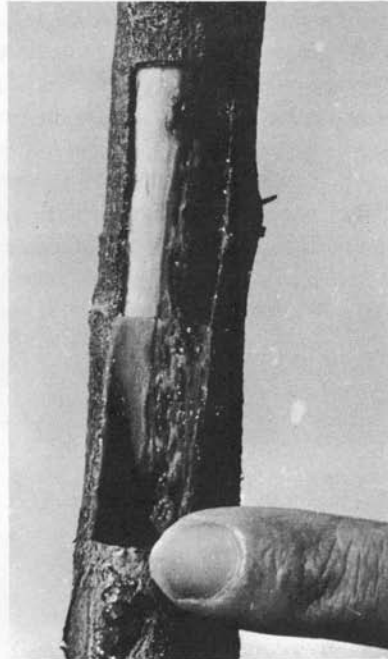


FIGURE 3. Wide, longitudinally delimited sectors of gum deposition shown by seedling in Figure 2, after peeling the bark.

fruit varieties developed symptoms of eruptive gummosis to various degrees. Perrine lemon also showed yellowing of the leaves and isolated cracks with gum exudation.

The symptoms on the fruits of Marsh grapefruit were similar to those caused by boron deficiency, although the boron content of the affected Duncan grapefruit was higher than normal (227 ppm). However, the symptoms appeared only on fruits of inoculated branches. Comparative inoculations with eruptive gummosis, psorosis plus exocortis, xyloporosis plus exocortis, all accompanied by endemic tristeza, and with tristeza alone were made using five plants in each case. However, symptoms appeared only on those plants inoculated with eruptive gummosis.

Discussion and Conclusions

The symptoms observed on fruit resemble in part those described by Ruggieri (1) for impietratura, but hardness of the fruit was observed in

only a few cases. Inoculations on sweet orange were negative, and up to the present time only grapefruit varieties have shown fruit symptoms. Nevertheless, the possibility remains that this is the same disease with some variation due to difference in virus strains or environmental factors. The fruit symptoms have appeared only on the producing Duncan grapefruit tree. Attempts to produce them on Marsh trees failed.

On the other hand, inoculations of 1- to 3-year-old trees and one 16-year-old producing tree of Marsh grapefruit produced eruptive gummosis in all cases. The symptoms obtained, the relatively short period of incubation on young Marsh trees, and the varieties affected are not similar

TABLE 1. REACTION OF VARIOUS SPECIES AND VARIETIES TO INOCULATION WITH ERUPTIVE GUMMOSIS

| Variety | Gum deposition | Gum eruption |
|-----------------------|----------------|--------------|
| California grapefruit | + + | + |
| Sweet orange | + + | - |
| Improved grapefruit | + + | - |
| Meteor shaddock | + + | - |
| Orlando tangelo | + + + | - |
| Duncan grapefruit | + + | - |
| Ruby grapefruit | + + | - |
| McCarty grapefruit | + + | - |
| Marsh grapefruit | + + + | + + + |
| Perrine lemon | + + | + + |

- none; + mild; + + moderate; + + + severe.

to any known virus disease of citrus. This is confirmed by the results of comparative inoculations with this virus alone, with psorosis plus exocortis, with xyloporosis plus exocortis, and with tristeza alone. At present, Marsh grapefruit seems to be the best indicator for this virus, since the behavior of Perrine lemon is still uncertain.

Whether the eruptive gummosis and the fruit symptoms are caused by the same virus or by two different viruses remains to be determined.

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