Investigations on Citrus Cristacortis in Sardinia

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THE OCCURRENCE of a stem-pitting disease on several citrus species and varieties in Sardinia was first reported by Marras (1) in 1966. This disorder is symptomatologically identical with the disease of sour orange (*Citrus aurantium* L.) and sweet orange [*C. sinensis* (L.) Osb.] reported by Vogel and Bové (2) in Corsica. A description of the symptoms of this disorder is not presented because they differ in no way in Sardinia from those described by Vogel and Bové. Vogel and Bové (3) have given the name cristacortis to this disease. We follow this terminology, although the paper as originally presented used the name "stem pitting."

Methods

Distribution of infected trees and the severity of symptoms in different species and varieties of citrus was studied in 22 citrus-growing areas of Sardinia. Over 3,600 trees of sweet orange, mandarin orange (*C. reticulata* Blanco), lemon [*C. limon* (L.) Burm. f.], grapefruit (*C. paradisi* Macf.), and shaddock (*C. grandis* Osb.) were examined, and the severity of symptoms was rated on a scale of 0 to 4 (Table 1).

Vogel and Bové (2) reported that the form of stem pitting found in Corsica is not caused by any known citrus virus or strain of virus. To determine whether this disease is caused by a virus at all, transmission trials by chip budding from affected Tarocco orange to five 2-year-old sour orange seedlings were undertaken in the spring of 1964. Also, the relation between the stem pitting of Corsica and of Sardinia was investigated by chip budding from affected Tarocco orange and Avana mandarin trees to indicator varieties used by Vogel and Bové (Hamlin sweet orange for psorosis, sweet lime [*C. aurantifolia* (Christm.) Swing.] and Orlando tangelo [*C. reticulata* Blanco x *C. paradisi* Macf.] for cachexia-xyloporosis, and Mexican lime [*C. aurantifolia* (Christm.) Swing.] for tristeza). The latter inoculations were made in the autumn of 1965 as follows: of 10 plants of each indicator variety, 5 were inoculated from Tarocco orange and 5 from Avana mandarin trees.

Results

DISTRIBUTION.—Cristacortis disease was found in all of the 22 citrus-growing areas investigated in Sardinia. The percentage of affected trees was higher in young orchards than in old ones and sometimes ranged

above 80 per cent in young orchards of Tarocco orange and Avana mandarin. In all trees examined, of all ages, incidence within varieties ranged from 9 per cent in Clementine mandarin to 65 per cent in Tarocco sweet orange (Table 1). Also, all affected trees on sour orange and trifoliate orange [*Poncirus trifoliata* (L.) Raf.] exhibited pitting symptoms on the rootstocks. Incidence of the disease was not rated in these latter species because they occurred exclusively as rootstocks.

TABLE 1. INCIDENCE OF STEM PITTING ON SOME CITRUS SPECIES AND VARIETIES IN SARDINIA AND THEIR SUSCEPTIBILITY TO THE DISEASE

Species and varieties	Number of trees examined	Number of trees affected	Per cent	Severity of symptoms (degree of susceptibility)
Sweet orange				
Belladonna	146	32	21.91	+
Biondo comune	339	41	12.09	+
Brasiliano	80	8	10.00	+
Moro	250	130	52.00	+++
Ovale calabrese	182	74	40.65	++
Portogallo	52	5	9.61	+
Sanguinello	228	52	22.80	++
Tarocco	592	384	64.86	+++
Thomson navel	34	4	11.76	+
Vaniglia	274	104	37.95	+
Washington navel	204	22	10.78	+
Mandarin				
Avana	700	267	38.14	++++
Clementine	241	22	9.12	+
Lemon				
S. Teresa	260	39	15.00	+
Grapefruit (undetermined)	23	4	17.39	+
Shaddock (undetermined)	6	1	16.66	+
Sour orange (undetermined)				+++
Trifoliate orange				+++

Degree of susceptibility: ++++, high; +++, average high; ++, average low; +, low.

SEVERITY OF SYMPTOMS.—The severity of symptoms among the 18 varieties examined was not related to the incidence of symptoms. Symptoms were most severe in those varieties (Tarocco and Moro sweet orange and Avana mandarin) wherein the symptoms were most common, but incidence of the disease was high also in Vaniglia sweet orange which rated low in susceptibility. The symptoms in both sour orange and trifoliate orange rootstocks were of average severity.

TRANSMISSION TRIALS.—By the summer of 1966 all sour orange seedlings inoculated in 1964 exhibited pitting symptoms typical of the dis-

ease. Of the 5 Hamlin orange seedlings inoculated from Tarocco orange trees in the psorosis test, 3 showed leaf symptoms by the spring of 1966. The other 5 Hamlin seedlings inoculated from Avana mandarin trees and all sweet lime, Orlando tangelo, and Mexican lime plants showed no symptoms by that date, a period of approximately 10 months.

Conclusions

According to the results of our survey, the disease described by Vogel and Bové (2), and later named by them cristacortis, is present in all citrus-growing areas of Sardinia. The highest incidence and also the most pronounced symptoms were found in Tarocco and Moro sweet orange and Avana mandarin. Our preliminary attempt to transmit the disease to sour orange seedlings by budding was successful and confirms Vogel and Bové's report (2) that the disorder is caused by a virus. Because our index tests are not yet complete, we cannot at this date confirm Vogel and Bové's (2) opinion that cristacortis is caused by a hitherto unrecognized virus. However, our early results indicate that the cause of cristacortis is distinct from that of psorosis virus, and the occurrence of symptoms on trifoliate orange rootstocks suggests that it is distinct from tristeza and cachexia-xyloporosis.

Literature Cited

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