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# Phytopathological Status of Bergamot in Italy

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**ABSTRACT.** The bergamot culture in Italy is localized along the coast of Reggio Calabria province and totals about 2500 ha. In surveys begun in 1974, gummosis and exocortis diseases were found widespread with a minor incidence of xyloporosis and impietratura. Culture of nucelii and of the undeveloped ovules did not give suitable results, whereas two trees of Castagnaro cultivar that are virus-free and already bearing were obtained by shoot-tip grafting.

*Index words.* concave gum, exocortis, sanitary selection, shoot-tip grafting.

The bergamot is grown in Italy exclusively along the coast of Reggio Calabria province from Punta Pezza to Punta Stilo (Fig. 1). Total acreage is about 2,500 ha.

The origin of the bergamot is unknown. According to Chapot (1) it is a natural hybrid between sour orange and an acid lime but according to another more credible hypothesis the bergamot originated in Calabria as a natural cross of lemon and sour orange. It has been grown commercially since the 17th century.

The two major areas of culture are the "Tyrrhenian" and the "Jonian" zones which each have

some distinctive characters. The former, about 35 km wide, is located in the Reggio Calabria district along the coast, whereas the second is more than 100 km wide and borders the Monasterace district on the north. The quality and quantity of the essential oil also differs between the two areas.

There are three main varieties of bergamot, the Castagnaro, the Fantastico and the Femminello which are generally mixed in the same grove. The Femminello is progressively being replaced by the other cultivars because it produces less essential oil of inferior quality (6).

Investigations were started in 1974 to identify the presence of fungal, bacterial, virus and virus-like diseases. The possibility of developing some effective practical control measures was suggested (8).

## VIRUS DISEASES DETECTED

During the various surveys conducted symptoms of crista-cortis, bergamot gummosis, oak-leaf (concave gum type) and impietratura were detected.

Gummosis was widespread on all three cultivars. Trees 7-8 years-old, begin to show progressive decline, stunting, reduced yield, and yellowing of the leaves. At this stage the bergamot portion of the trunk near the bud union shows some bumpy areas which crack and ooze gum. At a more advanced



Fig. 2. Bergamot branches showing symptoms of gummosis.

stage, the cracking extends to the primary branches and the bark lesions expand with further gum emission at certain seasons (Fig. 2). When cut transversely branches show wood impregnated with rings of a gummy substance interspersed with apparently healthy rings of wood.

The sour orange rootstocks do not show gumming or other symptoms. Observations made with the light microscope (2, 3) and with scanning electron microscopy (10) provided further information on this disorder whose symptomatology is similar to that observed on the Brasiliano cultivar of sweet orange (8). Schizolysogenous cavities and gum formation have been observed on branches 35 mm in diameter (10).

**SANITARY SELECTION**

Because these problems are principal limiting factors for pro-

duction, a phytosanitary selection program was started to find virus-free trees of the three named cultivars (9). The first stage was field selection where trees with apparent symptoms of viruses were rejected. The symptomless trees selected were indexed but none were completely virus-free.

A program to obtain virus-free materials was started, by tissue culturing nucelli and undeveloped ovules and by shoot-tip-grafting from trees which showed only gummosis, oak-leaf and exocortis symptoms. A number of plants were obtained from the nucelli extracted from the seeds within 100 days from anthesis and cultured *in vitro* on Murashige and Skoog medium. These were transferred to plastic pots and raised in a greenhouse. These plants were not true-to-type (7) and therefore were not suitable.

The ovules of fruits obtained



Fig. 1. The area of bergamot culture.

more than 100 days from anthesis or undeveloped ovules of ripe fruits did not proliferate in tissue culture; behavior similar to that observed in other monoembryonic varieties.

The shoot-tip-grafts were made in 1977 by taking the shoots from selected, greenhouse propagated young trees of the Castagnaro and Fantastico cultivars. The rootstock used was Troyer citrange grown by

the usual technique (4, 5). The plants obtained in this way, were transplanted in soil in plastic pots and indexed for viruses. Two plants of the Castagnaro cultivar, have begun fruiting and indexed free of oak-leaf symptoms and exocortis. They have been propagated on sour orange rootstock in 1979 and until now do not show symptoms of gummosis.

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