

The Use for Ornamental Purposes of an Ancient *Citrus* Genotype

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Abstract

Interest in *Citrus* species suited for ornamental and landscape purposes is rapidly increasing. Yet, the development of a successful *Citrus* ornamental industry would be greatly enhanced if it were possible to diffuse genotypes showing peculiar and original features. In a effort to collect and maintain *Citrus* germplasm through the recovery of varieties neglected for fresh and juice industrial market, we have focused our attention on an old *Citrus* genotype exhibiting a number of valuable and attractive qualities for ornamental purposes. The accession here described exhibits, a combination of stable high yield, vigorous tree growth, dark green and attractive foliage, strong attachment and long persistency of fruits on the tree which are particularly handsome of original ribbed shape.

Already represented in some Renaissance paintings for their fascinating fruit shape, probably deriving from a chimeric mutation, the accession has been, characterized following the *Citrus* standardized descriptors produced by The International Plant Genetic Resources Institute (IPGRI). Such a characterization was carried out paying special emphasis to those traits of ornamental interest. In order to ensure the production of virus-free plant material, protocols for *Citrus* virus and viroids control and elimination, through micro-grafting and somatic embryo-genesis from styles culture, have been successfully established.

INTRODUCTION

The genetic diversity found within *Citrus* spp. and related genera is extremely broad. However, during the last 20-30 years, the loss of genetic diversity in several members of the Rutaceae family has reached dramatic levels (Grosser and Gmitter, 1990). In several countries, efforts to collect and maintain germplasm in gene banks are in progress, in order to preserve important traits (s.a. tolerance to biotic and abiotic stresses, horticultural characteristics, etc.) that can be found among *Citrus* and related genera. The accession described herein has been found in the framework of a *Citrus* gene pool conservation program, based on the recovery, preservation and exploitation of genotypes of unknown potentials or varieties for fresh and industrial market so far neglected by scientists.

The carpological oddities here described have been already described and accurately represented during the Renaissance period, when naturalists and botanists reported about “variegated citrons, showing the flavedo veined by longitudinal stripes with various colours and width” or other “marvels” (“meraviglie”). The beauty of these fruits, especially “the strange and prodigious biological manifestations” classified as “Bizzarrie”, was reproduced in the famous paintings by Bartolomeo del Bimbo (1644). The thoroughness of these paintings is so accurate that it is possible to identify clearly the accession herewith described.

The tree has been detected in a small private *Citrus* collection situated near Palermo (Sicily), southern Italy. The place of origin is unknown, although a similar genotype is being maintained also at the Botanical Garden of Naples (Italy), classified as “*Citrus aurantium canaliculata*”.

MATERIALS AND METHODS

The characterization and evaluation of the tree was carried out following the criteria established by IPGRI (IBPGR 1988).

RESULTS AND DISCUSSION

The plant, grafted onto sour orange, is 35 years old. The shape of the tree is typically spheroid with an upright habit and a height of 3.20 m. The tree is vigorous and the canopy volume (calculated using the prolate sphere equation) is 15.1 m³. The density of branches is quite dense. The scion trunk surface looks smooth and the scion trunk diameter -observed 10 cm from bud union- is 59 cm. The color of the shoot tip is green. The vegetative life cycle is evergreen. The leaf is simple, showing a dark green color in the upper surface. The tree has vigorous foliage, the leaf form is brevi-petiolate, with narrow and obovate petiole wings. The leaf shape is mainly elliptic, however, several ovate leaves are also present. Leaves average 108 mm in length and 57 mm in width (500 mature leaves examined). The leaf margin is entire. The plant is spineless.

Flower: Blooming is, normally, very prolific. Flower are mostly arranged in apical inflorescences, however, several solitary and axillary flower buds are present. Up to 10-12 flower buds may occur in an inflorescence. Flower buds are white, the length of pedicel is 8 mm on average, while the length of the mature flower bud is 24 mm (including pedicel). The color of open flowers is white, the length of petals is 16 mm and their width 5.5 mm. The average number of stamen is 28. The length of anthers is 3.5 mm.

Fruit: The peculiarity of this genotype is mainly contained in the external appearance of the fruit. The fruit shape is oblate, the base is truncate, as well as the apex. The fruits are often crowded, up to 8 in a dense cluster (Fig. 1). The exocarp color at maturity is bright orange. The surface of exocarp is covered by longitudinal grooves and ridges. Grooves and ridges are very evident since the beginning of the fruit development. Rind color has been observed to change from green to bright orange between 10 and 30 December over several years. The width of exocarp at the equatorial section area is 2 mm. The adherence of the exocarp to the mesocarp is moderate. The nature of oil glands is conspicuous. The thickness of the mesocarp ranges from 5 to 8 mm and its color is yellow. The number of segments per fruit is 8, the adherence of segments is moderate and the skin around segments is delicate. Fruit axis is semi-hollow, the axis cross section is round and the diameter of fruit axis is 8 mm. The pulp is uniformly orange, the texture is tender, the size of vesicles is small and the shape thin. The juice content in the endocarp is low and the color is orange. The fruit is sour and bitter. Total soluble solids are 10.2 % and the acidity is 2.2. Fruit weight averaged 125 g (range 105-160) over two sampling dates per year (February and May). Fruit length is 52.5 mm (range 46.3-56.2), while fruit width is 65.8 mm (range 56.1-69.8). An average of 12 seeds per fruit was observed.

The attachment of the fruits to the tree is very strong and bright orange fruits persist until July. In the period April-July it is, therefore, possible to admire fruits at different stages of development showing different colors, which is a very useful trait for gardening purposes. Yield has not been recorded, but crop estimates over 3 years of observations indicate that production is abundant and uniformly distributed all over the plant. To date, no alternate bearing has been observed, though the tree has never been pruned in the last 3 years.

Overall, we consider that this worthy fruit cultivar has close resemblances in vegetative and flowering characteristics with the sour orange. Most distinctive differences may be observed in the external appearance of the fruits and in their smaller size. Analysis of leaf isozyme banding patterns was performed using crude extracts of this genotype and compared with those from sour oranges. Phosphoglucose isomerase (PGI) and phosphoglucose mutase (PGM) banding patterns appeared identical. DNA analysis is hence recommended to obtain a better understanding of the genetic origin of this accession.

In order to ensure production of virus-free bud-wood sources, we established

protocols for *Citrus* virus and viroids control and elimination have been used, through micro-grafting and somatic embryo-genesis from style culture (D'Onghia et al., 2000).

CONCLUSIONS

Production of *Citrus* plant for ornamental purposes has become more important than traditional *Citrus* in Southern Italian nurseries. Italy is the chief supplier for the European ornamental *Citrus* market. Currently, kumquats (genus *Fortunella*, spp. *japonica*, *margarita*, *obovata*, *hindsii* and *crassifolia*), calamondin (*Citrus madurensis* Loureiro) and *Citrus myrtifolia* Raf. are the ornamental *Citrus* genotypes grown in the nurseries. Indeed, there is a need to diversify production through selection of new varieties showing interesting, original and attractive features. The genotype here described offers a useful combination of attractive tree appearance, constant high crop production, vigorous growth, dark green foliage, absence of spines, strong attachment and long persistency on the tree of the fruits exhibiting unusual, originally ribbed shape and bright orange colour. No other ornamental *Citrus* cultivars combines all these attributes into one genotype.

Additional evaluation is necessary in order to know the vegetative performance during the juvenile phase (presence/absence of spinescence, canopy growth index, age of first crop production, etc.) as well as the degree of tolerance of the mature plant to biotic and abiotic stresses. Although, the suitability for its use as potted plant need to be evaluated, the preliminary data presented here already provide a strong indication for the possible use of this genotype in gardening and landscaping purposes.

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Figures



Fig. 1. Example of fruit cluster and foliage.