About the Biological Behaviour of Cultivar 'Coratina'

S. Camposeo, G. Ferrara, M. Palasciano and A. Godini
Dipartimento di Scienze delle Produzioni Vegetali
Università degli Studi di Bari
Italy

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Abstract

The horticultural interest of self-compatible fruit tree cultivars depends on their ability to reach the optimal fruit set by self-pollination, thus making superfluous cross-pollination and related problems. In Apulia region (southern Italy) the olive cultivation is spread on about 370,000 hectares. 'Coratina' is the most popular olive cultivar in the central part of the region, where actually it is grown in solid blocks on 60,000 hectares and characterized by high and constant productivity. 'Coratina' is generally considered to be a self-compatible olive cultivar, but its biological behaviour is a vexed question in the scientific literature.

In order to ascertain the real biological behaviour of 'Coratina', a 3-year study was carried out on 10 representative monovarietal olive groves scattered on the area of main diffusion. Data concerning fruit set following open-pollination and unassisted self-pollination have been gathered. Among years and sites, an optimal fruit set (3.5%) was obtained from open-pollinated branches and a scarce fruit set (0.02%) from self-pollinated ones. These results assert the self-incompatibility of 'Coratina' and show its capacity to provide optimal production levels thanks to the abundant and natural sources of flying compatible pollen from neighbouring districts where different cultivars are spread.

INTRODUCTION

The horticultural interest of any self-compatible fruit tree cultivar depends on its ability to reach the optimal fruit set by self-pollination, so making superfluous cross-pollination and related problems.

In Apulia region (southern Italy) the olive cultivation is spread on about 370,000 ha. 'Coratina' is the most popular olive cultivar in the central part of the region (Fig. 1), where actually it is grown as a solid block of about 10 million trees on a surface of 60,000 hectares, rarely associated with 'Ogliarola barese' at very low percentage (<1‰) (Godini, 2002; Lombardo, 2003). 'Coratina' is marked by high and constant productivity in monovarietal groves, so that it is generally considered to be a self-compatible cultivar (Godini, 2006). Nevertheless its biological behaviour is a vexed question in the scientific literature: self-compatible according to UNSEA (1949) and Del Gaudio (1952); partially self-incompatible according to Carrante et al. (1949), Morettini et al. (1972) and Lombardo (2004); self-incompatible according to Pastore (1957). These conflicting results are probably due to the incorrect methodology used to investigate monofactorial gametophytic sterility: low and unequal number of flowers among different pollination methods (Godini et al., 1991), time of fruit set determining (Rallo et al., 1990), type of bag used (Rio and Caballero, 1999).

To try to ascertain the real biological behaviour of 'Coratina', numerous and representative monovarietal groves scattered in the area of its main diffusion have been chosen and data concerning fruit set have been gathered.

MATERIALS AND METHODS

The study was carried out for three years (2004-2006) in different 'Coratina' monovarietal olive groves, spread in the central part of the Apulia region. Each year the data were collected from five olive groves. The experimental groves were representative of all local oliveculture typologies, both for pedoclimatic and cultural aspects.

In each grove a total of 30 fruiting branches (10 branches × 3 trees) were labelled and divided into 2 groups of 15 branches, each branch bearing 77 inflorescences as average. Annually, the number of flowers used for the two pollination methods was determined by multiplying the number of inflorescences by the average number of flowers per inflorescence, measured on a sample of 300 inflorescences per grove. The average number of flowers per inflorescences was 18.5, in accordance with what is reported in literature (Lombardo et al., 2004). On the whole, in each grove 1,160 inflorescences and about 21,300 flowers were assigned to each pollination method.

The flowers of the first group were isolated with non-woven bags prior to anthesis and were left to unassisted self-pollination by wind buffeting of branches throughout the blooming time (Fig. 2). The flowers of the second group were left to open-pollination by wind. The non-woven tissue was used because rain and wind resistant, permeable to air but impermeable to olive pollen with uninfluential effect on the internal microclimatic conditions, as demonstrated by Rio and Caballero (1999) using similar bags. The bags were removed two weeks after complete petals drop (second half of June) in order to avoid any risk by pollen pollution. The reported fruit set values are those observed at the beginning of veraison, i.e., at the beginning of October. The data obtained were submitted to the ANOVA and to the SNK test.

RESULTS AND DISCUSSION

For each experimental grove and for each year, fruit set from the two pollination methods are reported in Table 1. Fruit set near to zero (0.02% as three-year average) from self-pollination indicates the self-incompatibility of ‘Coratina’. Fruit set from open-pollination averaged 3.53%, that is the optimal set for olive (Pastore, 1967; Baldini, 1986) and about three times higher than the minimum threshold value (1.0%) for a good crop (Griggs et al., 1975). Any temperature limitation due to the bags could be invoked to explain the very low fruit set values by self-pollination. As a consequence, it must be supposed that the self-incompatible flowers of ‘Coratina’ were effectively cross-pollinated by flying pollen of other cultivars grown in districts outside the true ‘Coratina’ area, such as ‘Ogliarola barese’ and ‘Cima di Mola’ at South-East, ‘Peranzana’ and ‘Bella di Cerignola’ at North-West (Godini, 2006). Actually, it has been demonstrated that the pollen of olive can be transferred efficaciously by wind even at distances further than 27 km (Fornaciari et al., 2002). Moreover, the prevalent wind directions in the area at blooming time of olive are exactly South-East to North-West and viceversa (pluriannual UCEA and CHIEAM agrometeorolgical data).

This three-year study demonstrated undoubtedly that ‘Coratina’ is self-incompatible; moreover, although grown in a unique and large solid block, ‘Coratina’ did not show fruit set problems face open-pollination. Therefore, the study demonstrated that in the case of very large and contiguous monovarietal areas with self- incompatible cultivars (southern Italy, Spain, Portugal, North Africa) the introduction of pollinizers to make more effective cross-pollination is of limited importance, since the availability of large amount of pollen transferred by wind from neighbouring districts may assure naturally optimal sets. The association of compatible cultivars for cross-pollination keeps all its importance in the case of new, small and isolated olive districts, such as hilly districts of northern Italy, sub-desert regions of Israel and/or Australia (Farinelli et al., 2006; Lavee and Datt, 1978; Wu et al., 2002). Finally, the effects of climatic conditions on self- and cross-pollination and so the different degree of self- and cross-incompatibility hypothesised by some authors (Baldini, 1986; Lavee et al., 2002; Farinelli et al., 2006) could be checked under more correct experimental methodology, as suggested by other authors (Rio and Caballero, 1999).

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Tables

Table 1. Fruit set from self- and open-pollination, for each experimental grove and year (2004-2006).

Year/grove	Fruit set (%)	
	Self-pollination	Open pollination
	2004	
Andria 1	0.02	3.00
Bisceglie	0.01	4.16
Corato 1	0.04	2.62
Ruvo 1	0.04	2.96
Ruvo 2	0.01	2.71
Mean	0.02	3.09
	**[1]	
	2005	
Andria 1	0.03	3.98
Andria 2	0.02	4.02
Corato 2	0.02	4.04
Ruvo 2	0.03	3.34
Trani	0.04	3.37
Mean	0.03	3.75
	**	
	2006	
Andria 1	0.01	4.50
Andria 3	0.04	2.38
Corato 2	0.03	5.60
Ruvo 1	0.03	4.09
Ruvo 3	0.01	2.29
Mean	0.02	3.77
	**	
Mean 2004-2006	0.02	3.53

[1] **=significantly different means at $p \leq 0.01$ (SNK test).

Figures

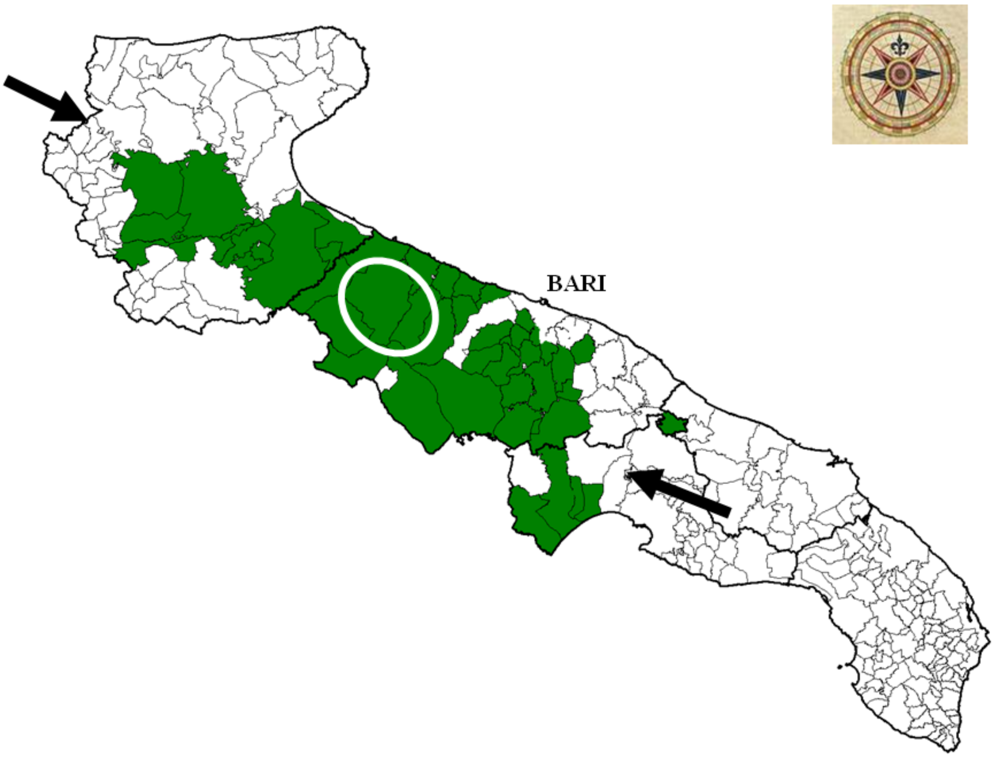

Fig. 1. ‘Coratina’ district in the Apulia region (INEA, 1997), location of the experimental olive groves and prevalent wind directions during blooming.

Fig. 2. Fruiting branch isolated with non-wowen bag.