Compatibility Relationships within and between Olive (*Olea europaea* L.) Cultivars

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Introduction

The olive (*Olea europaea* L.) is one of the most important fruit species in the Adriatic part of Croatia. Growing region spreads from Oštro cape in the south to the river Mirna valley in the north of the country. In the old olive groves autochthonous cultivars are planted. Those orchards are mainly monovarietal and record low yield. 'Oblica' is the most widely planted autochthonous cultivar and accounts 80% of total production (Perica and Kovačević, 1994). Other valuable autochthonous cultivars are 'Drobnica', 'Lastovka', 'Levantinka' and 'Istarska bjelica'. In newly planted olive groves beside mentioned cultivars introduced ones are presented ('Frantoio', 'Leccino', 'Pendolino' etc.). Olive is a wind-pollinated species. The level of self-compatibility varies in different cultivars (Androulakis and Loupassaki, 1990). Thus, the orchard productivity depends upon combination of planted cultivars. Self-incompatibility often leads to the reduction of fruit set. The problem of self-incompatibility is mostly expressed in isolated old olive groves where single cultivar is planted. Simultaneous flowering period enables cross-pollination, fertilization and fruit set of different cultivars if compatibility between recipient and polleniser trees exists. There is a lack of knowledge about self- and cross-fertility of autochthonous and especially introduced cultivars under Dalmatian environmental conditions. The object of the research was to determine the duration of flowering period, self- and cross-compatibility within and between major autochthonous and introduced cultivars in conditions of Middle Dalmatia.

Materials and methods

The experiment was conducted in the Split area of Middle Dalmatia (Latitude: 43˚52' N, Longitude: 16˚51' E) during the 2005 flowering season. Twenty years old orchard received regular fertilization and summer irrigation. Four autochthonous cultivars 'Drobnica', 'Lastovka', 'Levantinka', 'Oblica', and two introduced cultivars 'Leccino' and 'Pendolino' were included in the study. The data about flowering period were obtained by visual examination of trees every three days according to Barranco et al. (1994). The duration of full bloom period was noticed. Three olive trees of uniform size per each cultivar were selected to test self-pollination, cross-pollination and free-pollination. 'Drobnica' and 'Pendolino' were observed only in the role of polleniser while the others were used as pollen acceptors as well. Four uniform shoots per tree, with twenty inflorescence each, were selected for pollination with each polleniser, for self-pollination and open-pollination. The shoots aimed for cross-pollination and self-pollination were bagged before anthesis until loss of stigma receptivity while those for free-pollination were marked but not isolated (Cuevas and Polito, 1997). Flowers within the bags were not emasculated to accomplish field conditions. Paper bags were used for isolation of the branches. The pollination was conducted during the full bloom. Cross-pollination was carried out by opening the bags, applying the appropriate pollen and enclosing the bags. Isolated branches aimed for self-pollination stayed enclosed to the end of anthesis. Final fruit set was determinated 45 days after full bloom. Data for percentage of fruit set were arcsine transformed and then subjected to analysis of variance using proc GLM of the SAS-software. Mean separations were done by the LSD test at $P \leq 0.05$.

Results and Discussion

The flowering period of studied cultivars lasted from May 24 to May 31. The beginning of anthesis was firstly noticed at cultivars 'Lastovka and 'Levantinka' (May 24), and one day later at 'Drobnica' and 'Oblica'. The latest anthesis was noticed at 'Leccino' and 'Pendolino' (May 26). The full bloom of studied cultivars started three days after the beginning of the flowering and lasted two days. The significance of all pollination combinations showed that the final fruit set is influenced by efficiency in pollination of selected polleniser (Table 1).

Table 1. Final fruit set (%) of studied cultivars following self-pollination, cross-pollination and free-pollination

	Final fruit set (%)			
Pollen source	Lastovka	Leccino	Levantinka	Oblica
Lastovka	0.95 c*	5.07 bc	6.91 a	3.96 a
Leccino	4.57 b	1.38 d	3.08 bc	3.34 a
Levantinka	7.15 a	4.58 bc	2.16 c	2.56 a
Oblica	2.39 c	7.18 a	2.34 bc	1.11b
Drobnica	4.69 b	5.97 ab	2.99 bc	3.41 a
Pendolino	2.65 c	5.89 ab	3.62 abc	3.17 a
Free-pollination	3.09 b	2.43 cd	6.54 ab	2.86 a

*Different letters within column indicate significant differences at $P \leq 0.05$ by LSD test.

At 'Lastovka' the highest percentage of fruit set (7.15%) was noticed when 'Levantinka' was used as pollen source, while 'Lastovka' was the best polleniser (fruit set 6.91%) for 'Levantinka'. There was no significant difference in pollination efficiency of 'Oblica' by

'Drobnica', 'Lastovka', 'Leccino', 'Levantinka' and 'Pendolino'. In our study 'Leccino' has shown a high fruit set when it was pollinated with 'Drobnica', 'Oblica' and 'Pendolino'. Several clones of 'Leccino', one of the most widespread cultivar in Italy were described as self-compatible, even if this ability may vary according to year (Bartolini et al., 2002). In our study fruit set in self-pollination ranged from 0.95% ('Lastovka') to 2.16% ('Levantinka'). Compared to other tested cultivars 'Levantinka' was described as self-compatible (Vlašić, 1980).

Conclusions

Cross-pollination increases fruit set. 'Lastovka and 'Levantinka', 'Drobnica' and 'Oblica', 'Leccino' and 'Pendolino' are compatible cultivars with simultaneous flowering period that ensure their successful cross-pollination. Such cultivars are recommended to be planted together in the orchards. Lower final fruit set in self-pollination was recorded at all cultivars comparing to almost all cross-pollination combination.

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