SHORT COMMUNICATION

Possible cause of low fruit set in the sweet cherry cultivar 0900 Ziraat

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Mert, C. and Soylu, A. 2007. **Possible cause of low fruit set in the sweet cherry cultivar 0900 Ziraat.** Can. J. Plant Sci. **87**: 593–594. The possible cause of low fruit set in 0900 Ziraat sweet cherry (*Prunus avium* L.) was investigated. Pollination conditions, ovule development, incompatibility, and fruit set were evaluated under natural conditions. Results indicated that pollen transfer to the stigmas was sufficient, and pollen tube growth was normal. Ovule development in most pistils examined was not normal, and this was likely the cause of the low set in this cultivar.

Key words: Fruit set, incompatibility, ovule, pollination, sweet cherry

Mert, C. et Soylu, A. 2007. **Cause possible d'une piètre nouaison chez le cerisier 0900 Ziraat**. Can. J. Plant Sci. **87**: 593–594. Les chercheurs ont tenté d'élucider la faible nouaison du cultivar 0900 Ziraat du cerisier (*Prunus avium L.*). Ils ont évalué la pollinisation, le développement de l'ovule, l'incompatibilité et la nouaison dans des conditions naturelles. Les résultats indiquent qu'il y a un transfert suffisant de pollen aux stigmates et que le tube pollinique se développe normalement. Toutefois, le développement de l'ovule était anormal dans la plupart des pistils examinés, ce qui explique sans doute la nouaison décevante du cultivar.

Mots clés: Nouaison, incompatibilité, ovule, pollinisation, cerisier

Turkey is the leading sweet cherry producing country in the world and is the second most important exporter. The sweet cherry cultivar 0900 Ziraat is one of the most important grown in Turkey because of its suitability for export. However, it is not a self-fertile cultivar and needs pollenizers in its plantings. In addition, it has low fruit set, which leads to low productivity.

Fruit set in tree fruits depends on many factors, such as normal development of male and female gametes, close proximity of pollenizers in the orchard, climatic conditions, and sexual compatibility between the cultivars (Williams 1970; Westwood 1978). Environmental factors can affect tree physiological conditions, the viability of ovules and pollen and the progress of pollination and fertilization.

Pollination and fertilization are the most important phenomena for fruit set in sweet cherry as self- and cross-incompatibilities are common within the species. In some 0900 Ziraat orchards, low fruit set has been reported despite there being abundant pollenizers in the plantings. The aim of this study was to observe and characterize pollination, fertilization, and the development of the female gametophyte of 0900 Ziraat under natural conditions to gain insight into the cause of poor fruit set.

The study was conducted in a sweet cherry orchard near the county of Bayramiç in Çanakkale province in Turkey. The trees were 5-yr-old 0900 Ziraat grafted on mazzard rootstock. Pollenizers in the planting were Starks Gold, Bigarreau Gaucher, and Merton Late, with one pollenizer tree planted per five 0900 Ziraat trees in the rows.

Normally developed and underdeveloped fruits per cluster were counted on 500 spurs on four randomly selected trees 1 mo after full bloom. Fruit set ratios were calculated as the ratio of the number of fruitlets to initial flower number.

Pistils were randomly collected from the trees under natural pollination conditions at 3, 5, and 12 d after full bloom (DAF). The pistils were fixed in formalin and acetic acid solution (FAA; formalin, glacial acetic acid, alcohol and water at 10:5:50:35 by volume) (Sass 1958).

Styles of 59 pistils were separated from the ovaries, washed in distilled water for an hour, softened and cleared for 30 h at 40°C in 8 N NaOH and washed for 2 h in distilled water before the styles were stained overnight for observation either with lacmoid for light microscopy (Brooks et al. 1950) or with aniline blue in 0.1 N tripotassium phosphate ($K_3PO_4.3H_2O$) for fluorescent light microscopy. For observation, the stained styles were placed on a microscope slide with a drop of glycerin and covered with a cover slip. For the fluorescent light microscopy, a filter that transmitted light at 350–400 µm was used (Martin 1959).

Abbreviations: **DAF**, days after full bloom; **FAA**, formalin, glacial acetic acid, ethanol solution

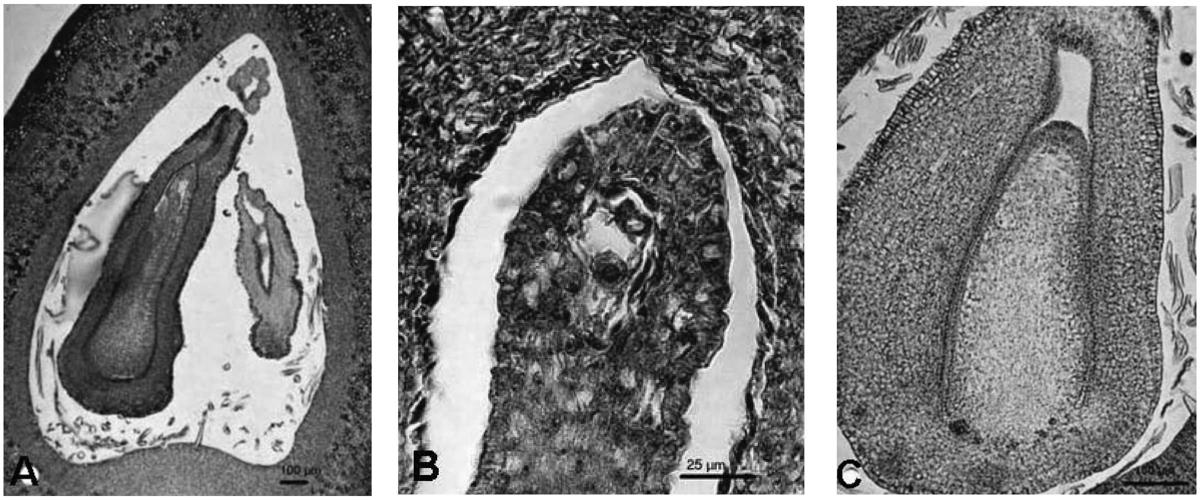

Fig. 1. (A) Abnormal ovules within an ovary (bar = 100 µm); (B) developing 2-nucleate stage ovule (bar = 25 µm); (C) normal but underdeveloped ovule in the pistil at 3 DAF (bar = 100 µm).

The prefixed ovaries were dehydrated in a series of ethanol in water solutions at 50, 70 and 95%, and then twice in 100% ethanol. The samples were gradually infiltrated and embedded in paraffin by a standard procedure (Brooks et al. 1950). The embedded ovaries were sectioned 7–8 µm thick with a rotary microtome, stained with a combination of iron-alum and hematoxylin (Brooks et al. 1950) and observed under light microscope for ovule development.

One month after full bloom 13.4% of the developing fruitlets appeared normal and 13.4% appeared to be underdeveloped. The underdeveloped fruitlets were about 1/3 to 1/2 the volume of the normally developed fruitlets. Drop of the flowers and fruitlets reached 73.2%.

There was a high number of pollen grains on the stigmas, indicating that pollen transfer to the stigmas was sufficient in the orchard for good fruit set. Most (70.4–87.5%) of the stigmas had >50 pollen grains per stigma, and most of the pollen had germinated. Six (10.2%) of the stigmas had no germinated pollen grains. Only three (5.1%) of the stigmas examined had no pollen.

The average length of the pollen tubes in the styles was approximately 60% of the style length by 3 DAF when numerous pollen tubes were observed growing down the style. A few pollen tubes had swollen ends in the style indicating incompatibility between the pollen and the style, perhaps resulting from self-pollination. However, numerous compatible pollen tubes were observed in the same style. By 5 DAF over 30% of the pistils had pollen tubes entering the ovules. These results indicate that pollination conditions in the orchard were conducive to good set and the apparently incompatible pollen tubes found in some styles likely did not cause the low fruit set.

There were two ovules per pistil in all 21 samples examined. Most of the ovules were aborted or underdeveloped at 3 DAF (Fig. 1). Only one pistil examined had a normally developed embryo sac. Developing embryos were observed in two of 10 pistils examined at 12 DAF. The other pistils contained aborted ovules.

This condition of having poor or underdeveloped ovules seems to be a varietal characteristic and is probably responsible for the low fruit set in 0900 Zirat. The 13.4% set observed in this study is considered poor for sweet cherry, as 25–50% set is needed for a full crop (Teskey and Schoemaker 1978). Abnormalities in the development of ovules and embryo sacs have also been detected in a number of other fruit species and are considered as the cause of low fruit set (Hartman and Howlett 1954; Eaton 1962; Lillecrapp et al. 1999).

Some clones of 0900 Ziraat have been reported to produce high yields in some orchards. The developmental difference between low- and high-set clones is unknown, and will require further research to be revealed.

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