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Blooming phenology and self-incompatibility of some commercial cherry (*Prunus avium* L.) cultivars in Iran

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ABSTRACT

Self-sterility in cherry (*Prunus avium* L.) is one of the most important problems in commercial cherry orchards in Iran and many other countries. The main objective of this research was to determine self-fertility rate and blooming phenology of 25 commercial cherry (*P. avium* L.) cultivars in Iran. This study was conducted during 2006–2007.

Results revealed that the stage of bud swell in all cultivars began late second decade of March, which lasts 8–11 days. In all cultivars the duration end bloom to petal fall stage took 5 days. Cherry cultivars were classified into three groups considering their overlapping pollination. The cultivars each group had a great overlapped pollination toward each other. The results also showed that there was a significant difference among cultivars in respect of the fruit set ($P < 1\%$). The fruit set of open pollination treatment among the cultivars varied in range of 7.36–41.58%. However fruit set was not observed in isolated pollination (artificial and natural self-pollination). In open pollination, the cultivars were also classified into four groups, i.e. weak fertility (Moreau and Ferracida), mean fertility (Siah Mashhad, Napelon, Proteva, Haj usefy, Lambert, Roshun, Sefid Ghermeze Baghno, Arak, Belamarka, Siah Shabestar, Ghermeze Rezaeyeh, Abardeh, Soraty Lavisan and Victoria), good fertility (Peshrase Mashhad, Dovoumras Mashhad, Bing, Shesheiy Mashhad, Siah Ghazvin and Sefid Rezaeyeh), very good fertility (Zarde Daneshkadeh, Dirrase Italia and No. 1 karaj). All cultivars were found to need cross-pollination and included in self-sterile group.

1. Introduction

Sweet cherry (*Prunus avium* L.) belongs to the Rosaceae family and Prunoideae sub-family planted in cold and temperate zones (Wunsch and Hormaza, 2004). Sweet cherry is one of the most commercially important species. Turkey, the U.S.A., Iran, Germany, Russia, Italy and Spain are among the major producers of cherry in the world. Iran with 225,000 tonnes production (Faostat, 2007) is the third producers.

Self-incompatibility plays an important role in yield reduction of some fruit trees, specially sweet cherry which is highly self-sterile (Tehrani and Browns, 1992). This phenomenon has adverse effect on sweet cherry production (Arzani, 1998). Most cherry cultivars need a pollinator tree because of self-incompatibility. In addition to self-incompatibility, some cherry cultivars show also incompatibility toward each other. Therefore, identification of the compatible and incompatible groups is of great importance for the establishment of cherry orchard (Roger, 1986).

Evaluation of the blooming phenology is very important because of self-incompatibility problem in cherry. Maliga (1980) reported that the estimation through observation is the simplest method for determining the blooming phenology. Among fruit trees, the cultivars classified in a same group cannot fertilize each other. Therefore their compatible groups should be determined (Janick and James, 1983). Incompatibility in cherry is also genetic and gametophytic kind, like the most fruit trees in moderate zone especially Rosaceae family (Choi et al., 2002; Kao and McCubbin, 1996; Tobutt et al., 2004).

The objective of this research was to evaluate the stages of blooming phenology and determining the self-compatibility or incompatibility in 25 cherry commercial cultivars in the geographical situation of Mashhad, Iran.

2. Materials and methods

The experiment was conducted at the fruit experimental station of Khorasan Razavi Natural Resource Agricultural Research Centre, Mashhad (Northeast of Iran). Cherry cultivars under study included: Siahe Mashhad, Peshrase Mashhad, Dovoumras Mashhad, Shesheiy Mashhad, Zarde Daneshkadeh, Napelon, Proteva,

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Dirrase Italia, Bing, Haj Yousefy, Siah Ghazvin, Moreau, Ferracida, Lambert, Roshun, No. 1 karaj, Sefid Ghermeze Baghno, Arak, Belamarka, Siah Shabestar, Ghermeze Rezaeyeh, Sefide Rezaeyeh, Abardeh, Soraty Lavisan and Victoria.

These cultivars were planted in uniform environmental conditions and similar garden management during this study.

2.1. Phenological observation

In this experiment, during 2006–2007, the phonological stages, IBPGR (1985) and UPOV (2006) cherry (*P. avium* L.) descriptors were determined by direct observation in the orchard. The cultivars were evaluated with respect to the flowering season (too early, early, mean, late and too late blooming), flower density (little, mean and much) and flowering phenological stages (bud swell, side green, bud burst, early white bud, white bud, first bloom, full bloom, final bloom and petal fall). The stages including full bloom (75% of the flowers are bloomed), end bloom (over 95% of the flowers are bloomed) and petal fall (5% of the flowers still have petals) were determined based on Tzoner and Yamaguchi (1999).

2.2. Determining the rate of self-fertility

To determine self-fertility two methods known as isolated pollination (artificial and natural self-pollination) and open pollination were used. Four branches, in four geographical directions with about one hundred flowers were chosen. Meanwhile, apart from the branches related to the open pollination treatment which were considered as the control group without isolation, the remaining branches were isolated with the cotton bags in order to prevent unwanted pollination.

For artificial pollination, pollen grains were collected when the buds were in white bud stage. To be ensured from viability of the pollens during the pollination operation stages TTC (2,3,5-triphenly tetrazolium chloride) and IKI (iodine + iodine potassium) tests were carried out (Bolat and Pirlak, 1999).

In artificial self-pollination, the isolated flowers of each cultivar were pollinated with the pollen grains collected from the same cultivar 2 days after white bud stage. Following the pollination operations, the numbers of the pollinated flowers in each branch were counted. The isolated bags were placed on branches again until the end of the blooming period. Two, 4, and 6 weeks after pollination and at the harvest time, the numbers of the fruits were counted and the percentage of the fruit set was calculated. In isolated and open pollination, the rate of fertility was determined (Nyeki, 1989; Brozik et al., 1980).

Statistical analysis was performed using SPSS (SPSS Inc., USA) and EXCEL, for windows statistical software. The percentage data were first transformed to arcsine square root transformation (Fernandez, 1992), and all data were subjected to analysis of variance and Duncan's multiple range tests were used to compare the treatment means.

3. Results and discussion

3.1. Flowering phenology

Phenological phases of 25 cherry cultivars are illustrated in Fig. 1. The beginning of bud swelling of cultivars occurred in the

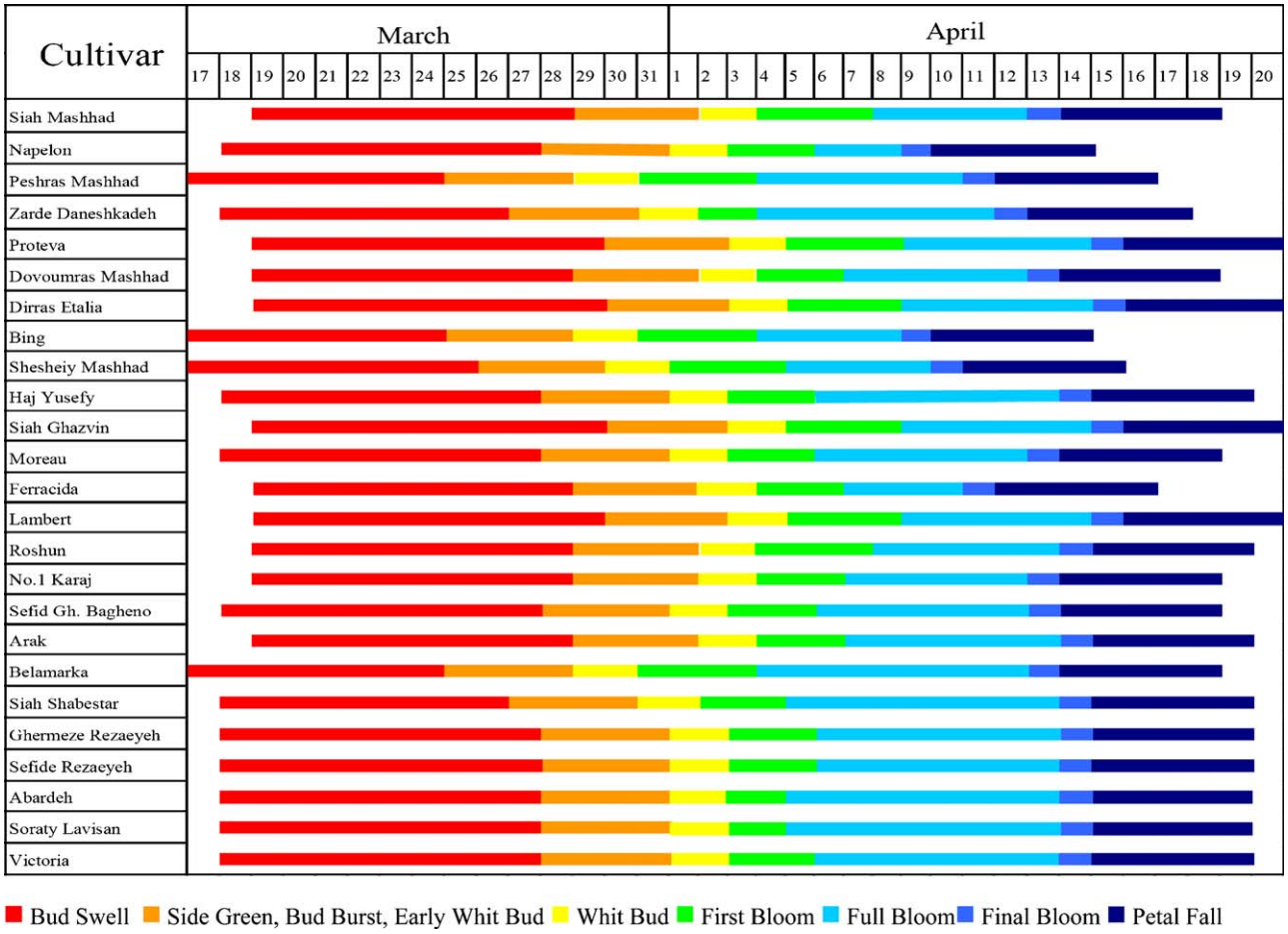

Fig. 1. Different stages of flowering phenology in some of commercial sweet cherry (*Prunus avium* L.) cultivars in Iran.