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DETERMINATION OF POLLEN VIABILITY AND POLLEN GERMINATION CHARACTERISTICS OF SOME SHARKA DISEASE RESISTANT APRICOT CULTIVARS

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Abstract
Turkey is leading the apricot production in the world and also has an important genetic diversity. With the advantage of having different ecological conditions, apricots are produced for different purposes (early table, table, jam, dry). Biotic and abiotic stress factors affect the apricot production of important value, causing yield and quality losses. Apricots' most important problems in breeding are low fruit yield, spring late frosts, and self-incompatibility in some cultivar, diseases and pests. In these factors, Plum Pox Virus (PPV) the agent of the sharka disease is the most important disease in the apricot and stone fruits with the lost odf production and social effects it made. The best solution for this disease is using resistant cultivars in production. At this point, breeding programs especially including the sharka resistant cultivars are important. For breeding programs, determining pollinator cultivars' pollen quality parameters is important.
In this study, pollen viability and pollen germination parameters are determined for "Stark Early Orange" (SEO), "Harleyne", "Harcot" and "Zard" cultivars. These cultivars are resistant to sharka and may be used in breeding studies as pollinators. Pollen viability was determined with 2,3,5-Triphenyltetrazolium chloride (TTC) and pollen germination was determined with agar in the Petri (1% Agarose and 10% sucrose) method. The cultivar with the highest pollen viability rate (57.8%) is SEO. "Harcot" had the least amount of pollen viable with 28.3%. "Harleyne" cultivar had the best germination rate with 69.8%. Harcot had the lowest pollen germination rate (19.8%). According to the results, there were significant differences among cultivars in the pollen viability and germination rates.

Keywords: pollen quality, prunus armeniaca, sharka disease

1. INTRODUCTION

Apricot is in the Rosaceae family, *Prunus* genus and is named *Prunus armeniaca* species. According to FAOSTAT data, world apricot production was 3.7 million tons in the world. When we glance at the FAOSTAT 2020 data, Turkey's apricot production in 2020 was 833 thousand tons as Turkey lead the apricot production in the world (FAO, 2020). Also, Turkey has an important genetic diversity and different ecologic conditions altogether, so productions for different purposes are possible. But different stress factors are limiting production at an important rate and due to that being the cause of the important losses in economic production. Climate conditions, pests, and diseases, and different affinity problems in the species affect production at an important rate. Due to that, using the resistant cultivars in the production, breeding of the resistant cultivars and using of the cultivars that have the wanted features in the breeding.

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In apricot breeding, low yield, spring late frosts, sterility in the different cultivars and pests and diseases are the important problems due to that low yield. With spring late frosts and low yields doing important harm does so much harm together with pests and diseases. Sharka disease vector plum pox virus (PPV) does important damage. Sharka disease is one of the most important diseases of the stone fruits and apricot. The best solution for that is using resistant cultivars in production.
Insufficient fruit set is one of the most important factors that negatively affect yield in fruit trees. This situation, which is the most important part of production, is related to success pollination. (Martinez-Gomez et al., 2002). With pollination, adequete amount of pollen grain reaches the stigma, pollen tube is formed and fertilization occurs. Insects provide pollination in apricot and many other fruit species, and the most important agent is honey bees. Apart from parthenocarpic fruit set, pollination and fertilization are required for fruit formation in general. A high level of viability and germination power with healthy pollen production is necessary for fertilization in plants. Nonfunctional or weak pollen production are factors that reduce fertilization. It has been reported that conditions such as environmental conditions and nutritional status of the species and varieties grown are related to the germination success of pollen (Ercişli, 2007; Pal et al. 2015). Some fruit species such as sweet cherry (*Prunus avium*), almond (*Prunus dulcis*), apple (*Malus domestica*) and apricot (*Prunus armeniaca*) are self-incompatible (SI) and need pollination from suitable pollinators in order to bear fruit (Yılmaz et al. 2016).This study was aimed determination of pollen quality parameters such as viability and germination of four apricot cultivars resistant to Sharka disease. The results obtained reveal information about the fertilization status of the cultivars and their pollinator selection.

2. MATERIALS AND METHODS

Four apricot (‘Stark Early Orange (SEO)’, ‘Harcot’, ‘Harleyne’ and ‘Zard’) cultivars located at Erciyes University, Kayseri was conducted for this study. These cultivars are resistant to Sharka disease, one of the most important diseases on apricots. Flower samples of the varieties were collected from three plants of each variety before the start of flowering. TTC (1% 2, 3, 5 triphenyl tetrazolium chloride) was used to evaluate pollen viability (Norton, 1966; Eti, 1990). Agar in petri dish method was used to determine pollen germination status (Stanley and Liskens, 1985). One percent agar and 10% sucrose were used for pollen germination medium. Using a brush, pollen was dispersed to the media in the petri dish. Three lamellae and five regions on each lamella were examined in the measurement of pollen viability of cultivars. Viable (dark red dyed) and nonviable (unstained) pollen were counted and evaluated. Similarly, three petri dishes and five regions in petri dishes were evaluated for pollen germination status.The pollen tube diameter is bigger than the pollen half-diameter pollens counted as germinated. Germinated pollen count rated to total pollen count and pollen germination rates were determined.

3. RESULTS AND DISCUSSIONS

Apricot cultivars showed variations for pollen quality parameters.. Pollen viability rates obtained from four apricot are given in Figure 1. The highest pollen viability rate was determined with 57.81% in the ‘SEO’ cultivar. ‘Harcot’ cultivar was the lowest viability rate with 28.03% of viability,.
Mısırlı et al. (2004), found the pollen viability rates of apricot cultivars between 75.93% and 52.66%. Bircan and Kargı (2013) revealed that pollen viability in thirteen apricot cultivars is ranged from 70.68% to 46.40%. Ozelci et al. (2014) detected pollen viability in apricot genotypes

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between 64.03 and 47.53%. While the pollen viability levels obtained in our study were consistent with previous studies for some cultivars, this value was found as lower for some cultivars (‘Harcot’ and ‘Zard’) than other studies. It was reported that pollen viability levels may differ depending on the variety, year, tree nutrition, location of the flower on the tree, branch load and other factors (Bircan and Kargı, 2013).

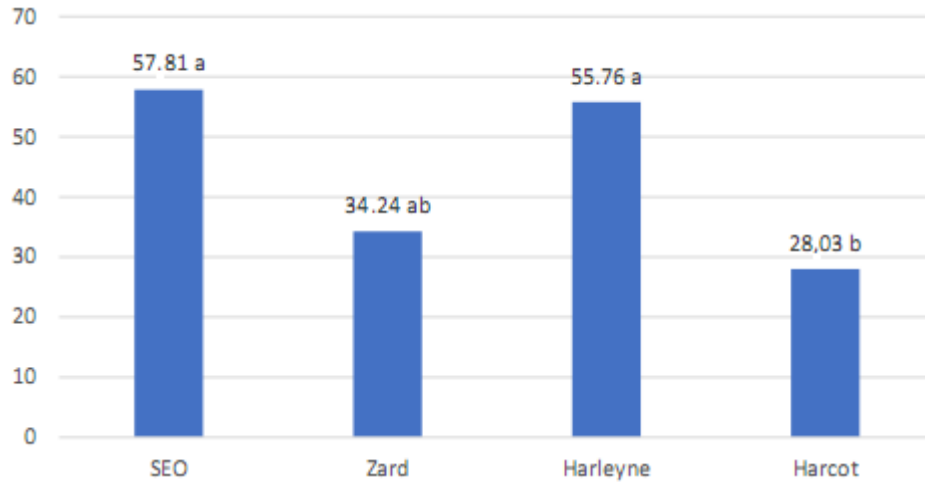

Figure 1. Pollen viability level (%) of apricot cultivars

Pollen germination rates

Pollen germination rates of apricots presented in Figure 2. The highest pollen germination rate was determined with 69.82% in ‘Harleyne’, the lowest was in ‘Harcot’ (19.86%). A higher than average pollen germination was observed in ‘SEO’, ‘Zard’ and ‘Harleyn’ cultivars, while germination was lower in ‘Harcot’ cultivar.

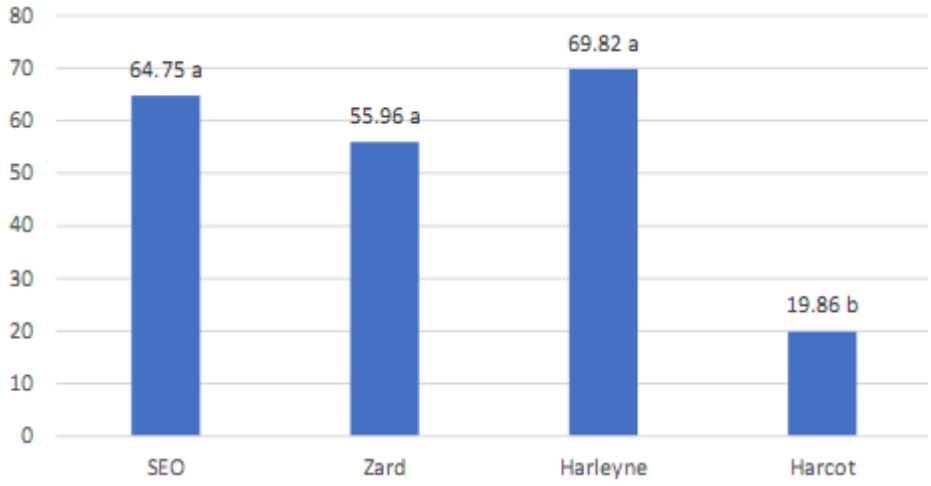

Figure 2. Pollen germination rate (%) of apricot cultivars

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Researchers found pollen germination rate of 49.77-72.90% for 15% sucrose concentrations in some apricot cultivars (Bolat and Pirlak, 1999). Asma (2008) investigated that pollen germination levels of some apricot genotypes ranged from 53.3% to 78.4% with 1% agar and 15% sucrose. Muradoglu et al. (2010) determined the average pollen germination rate of 58.3% in 'Bebeco' and 'Kabaaşı' cultivars. Abaci and Asma (2014) determined the germination of some apricots to be between 11.4 and 96.3%. In addition, Acarsoy Bilgin and Misirli (2017) found this value to be 11.67-28.44% in apricots. On the other hand, Uzun et al. (2018) determined the pollen germination levels of 'Casna Drenova', 'Ninfa' and 'Beliana' apricot cultivars as 38.6%, 13.6% and 7.8%, respectively. It was reported that environmental conditions (temperature, humidity, etc.) and the media components used may be effective for pollen germination (Gözlekçi and Kaynak, 1998). In addition, variety differences may also be a factor for germination.

4. CONCLUSIONS

Recently, in apricot breeding studies, the subject of resistance to Sharka disease has been particularly emphasized. Therefore, cultivars resistant to this disease should be used in breeding. Evaluation pollen quality of the these cultivars is important to determine them as pollinator cultivars. In the selection of pollinator cultivars, choosing one with high pollen viability and germination level, as well as fruit quality characteristics, will be beneficial for high yield and successful results.

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