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Abnormalities of the stigma of sour cherry cultivar

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Summary: The objective of this study was to evaluate the ratio of blackness of the surface of stigma of sour cherry cultivars. At the full bloom time of sour cherry 100 new opened flowers were marked in the internal (Inside), external (outside), bottom and upper parts of the crown of each cultivars including sour cherry cultivars 'Érdi bőtermő', 'Debreceni bőtermő', 'Kántorjánosi', 'R. clone', 'Petri', 'Pándy', and 'D. clone'. The trees were replicated four times. The numbers of flowers with black stigma were counted and the percentage of dead stigma was calculated. In addition, tissues of black stigmata were investigated for blossom pathogens by microscopy. After flowering time the fruit set of the marked flowers counted and then percentage fruit set was calculated. Numbers of counted flowers were between 300 and 980 depending on the four position of the tree. Black color of stigma could be seen only on three cultivars ('Debreceni bőtermő', 'Érdi bőtermő' and 'Petri') out of seven assessed cultivars. The highest numbers of black colored stigma were found on cultivar 'Érdi bőtermő' which ranged between incidences of 12 and 21%. Black stigma was never able to produce a fruit set. Microscopic examination revealed no pathogens associated with black stigma. Different part of the tree resulted different amount of black stigma. Black stigma was the largest on the outer part of the tree on cv. 'Érdi bőtermő' but also bottom part of the tree also produced larger number of black stigma on cvs. 'Debreceni bőtermő' and 'Érdi bőtermő'. Though symptoms were not typical to frost damage, we believe that black stigma is probably due to environmental factors during flowering. This might be associated with late spring cold coming from the soil surface as the bottom and outer part of the tree was more suffered from the disease.

Key words: stigmata, sour cherry, floral biology, fruit set

Introduction

The receptivity of stigma and adequate pollination are critical in Horticultural crops. Abnormalities of the stigma limit the pollination process and obstacle the fruit set of fruit trees. The stigma is the receptive surface for providing nutrients to the pollen and direct pollen tube growth. According to *Johri* (1984) cited by *Weiguang* et al. (2006) the stigmatic surface must have the correct physiology and sufficient weather supply. Any damage to the stigmatic surface by diseases or fungicide sprays may potentially cause the pollination process to fail. The effective pollination period (EPP) which introduced by *Williams* in 1966 is limited by three main events during the reproductive process: stigma receptivity, pollen tube kinetics and ovule longevity. Stigma receptivity refers to the ability of the stigma to support germination of viable, compatible pollen. It has been implicated as a factor limiting the EPP and fruit set in kiwifruit (*Gonzalez* et al., 1995), apricot (*Egea & Burgos*, 1992), pear (*Sanzol* et al., 2003b) and cherry (*Guerrero-Prieto* et al., 1985; *Furukawa & Bukovac*, 1989) cited by *Weiguang* et al. (2006). A short life span of ovules is limiting to EPP in sweet and sour cherries (*Postweiler* et al., 1985; *Cerovic & Ruzic*, 1992) and apricot (*Burgos & Egea*, 1993). Sour cherry *(Prunus cerasus)* is an important self-incompatible or auto incompatible fruit that bloom in spring and requires cross-pollination for certain production. It has been reported that the percentage of fruit set in commercial orchard is 30% (*Nyéki*, 1974, 1980, 1989).

At the spring 2008 when we were observing the phonological state of flowering and fruit set of sour cherry cultivars in Újfehértó research station of Hungary, it is observed that the color of whole or some parts of the stigma surface of sour cherry flowers instead of light green are deep brown (black) in the immediately,(uninterruptedly) (exactly) after opening of flowers. On the surface of stigma of those flowers didn't appear any kind of secretions and enzymes required for pollination. Whereas according to *Bruce* et al. (1976) during maturation of the stigma after opening of the flower, a layer is secreted onto the papillar surface. The appearance of this layer coincides with development of the capacity to bind labeled protein and to receive compatible pollen. The secretion product stains for proteins and lipids and contributes to adhesion of pollen.

The objective of this study was to evaluate the ratio of blackness of the surface of stigma of sour cherry cultivars.

Materials and methods

The study was carried out on a sour cherry collection at the Fruit Research and Extention Center for fruit growing, Újfehértó, located in northeastern Hungary. The latitude is 38°10′ longitude is 30°37′, and altitude is 1,050 m. The mean annual temperature is 9.5°C, and the annual rainfall over 50 years was 583 mm. In general the weather conditions during flowering time of sour cherry were partially rainy and the pollination period occurs in rainy weather, with the exception of May 7, when it was sunny. Winds are predominantly blowing from the east-northeast.

At the spring 2008 when our observation was conducted for phonological state of flowering and fruit set of sour cherry cultivars, it was observed that the surface color of some of the stigma of flowers of sour cherry cultivars are deep brown (black) immediately after opening of flowers while the anthers were normal. By the way the experiments on the basis of completely randomized design for evaluating of the ratio of stigma whit black color were conducted.

At the full bloom time of sour cherry 100 new opened flower-clusters were marked in the internal (Inside), external (outside), bottom and upper parts of the crown of each cultivars including sour cherry cultivars 'Érdi bőtermő', 'Debreceni bőtermő', 'Kántorjánosi', 'R. clone', 'Petri', 'Pándy', and 'D. clone'. The trees were replicated four times.

The numbers of flowers with black stigma were counted and the percentage of dead stigma was calculated. In addition, tissues of black stigmata were investigated for blossom pathogens by microscopy. After flowering time the fruit set of the marked black colour flowers were counted and then fruit set was calculated.

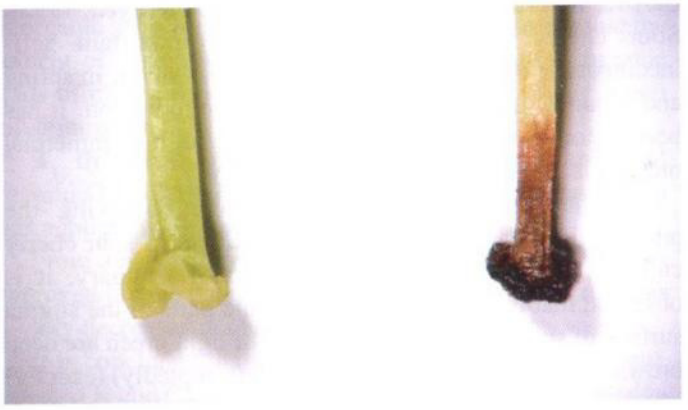

Figure 1 Black color of stigma and pistil of cultivar 'Erdi bőtermő' sour cherry flowers in comparison with the healthy stigma and pistil

Results and discussion

Numbers of counted flowers were between 300 and 980 depending on the four position of the tree (*Tables 1–4*). Black color of stigma could be seen only on three cultivars ('Debreceni bőtermő', 'Érdi bőtermő' and 'Petri') out of seven assessed cultivars. The highest numbers of black colored stigma were found on cultivar 'Érdi bőtermő' which

Table 1 Fruit set of cultivar 'Érdi bőtermő' from black stigma of sour cherry cultivars form the outer surface of the tree (Újfehértó, 2008)

Cultivars	Number of Flowers	Number of Black stigma	Fruit set on Black stigma
Debreceni bőtermő	823	48	0
Érdi bőtermő	774	136	0
Kántorjánosi	575	0	–
Petri	842	10	0
R-klón	750	0	–
Pándy	700	0	–
D-klón	600	0	–

Table 2 Fruit set of cultivar 'Érdi bőtermő' from black stigma of sour cherry cultivars form the inner surface of the tree (Újfehértó, 2008)

Cultivars	Number of Flowers	Number of Black stigma	Fruit set on Black stigma
Debreceni bőtermő	664	15	0
Érdi bőtermő	738	114	0
Kántorjánosi	750	0	–
Petri	524	11	0
R-klón	750	0	–
Pándy	800	0	–
D-klón	700	0	–

Table 3 Fruit set of cultivar 'Érdi bőtermő' from black stigma of sour cherry cultivars form the bottom part of the tree (Újfehértó, 2008)

Cultivars	Number of Flowers	Number of Black stigma	Fruit set on Black stigma
Debreceni bőtermő	802	51	0
Érdi bőtermő	1000	120	0
Kántorjánosi	300	0	–
Petri	773	17	0
R-klón	250	0	–
Pándy	280	0	–
D-klón	300	0	–

Table 4 Fruit set of cultivar 'Érdi bőtermő' from black stigma of sour cherry cultivars form the upper part of the tree (Újfehértó, 2008)

Cultivars	Number of Flowers	Number of Black stigma	Fruit set on Black stigma
Debreceni bőtermő	980	18	0
Érdi bőtermő	875	89	0
Kántorjánosi	700	0	–
Petri	750	12	0
R-klón	750	0	–
Pándy	450	0	–
D-klón	400	0	–

ranged between incidences of 12 and 21 %. Black stigma was never able to produce a fruit set. Microscopic examination revealed no pathogens associated with black stigma.

Different part of the tree resulted different amount of black stigma. Black stigma was the largest on the outer part of the tree on cv. 'Érdi bőtermő' (*Table 1*), but also bottom part of the tree also produced larger number of black stigma on cvs. 'Debreceni bőtermő' and 'Érdi bőtermő'.

Though symptoms were not typical to frost damage, we believe that black stigma is probably due to environmental factors during flowering. This might be associated with late spring cold coming from the soil surface as the bottom and outer part of the tree was more suffered from the disease.

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