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Susceptibility of Sweet Cherry Cultivars to Rain Induced Fruit Cracking in Region of Sarajevo

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Abstract

Susceptibility of 5 sweet cherry cultivars, grafted on Gisela 5, to rain induced fruit cracking was studied in the region of Sarajevo, during a two – year period (2010 – 2011). Testing of fruit cracking was done using index by Christensen. During the testing period, significant differences in susceptibility to fruit cracking among both the cultivars and the years of testing were found. All the cultivars had the highest fruit cracking index in 2010 year. The highest susceptibility to rain induced fruit cracking was evidenced in cultivar ‘Burlat’ during both years. Cultivars ‘Kordia’, ‘Regina’, ‘Karina’ and ‘Schneider’s Späte Knorpelkirsche’ were moderately susceptible to fruit cracking.

Key words: sweet cherry, cultivar, fruit cracking index

Introduction

One of the main problems in the sweet cherries production in the whole world is rain-induced fruit cracking occurring just before or at the time of picking of fruits. This phenomenon happens as a result of heavy rainfall during the ripening season and is one of the biggest problems when it comes to growing sweet cherries. In fact, due to the large amount of rainfall, fruit cracking occurs in susceptible cultivars, which leads to fruit inadequacy for consumption when they are fresh, and such fruits are more susceptible to the attack of diseases and pests. All this directly leads to a reduction in economic benefits of the production. Christensen (1972) believes that the main cause of sweet cherry fruit cracking is absorption of water through the fruit skin, which is caused by the differences of osmotic pressures between the surface of the fruit and the fruit juice. This author believes that the susceptibility of sweet cherry fruits to cracking

is highest in the morning, when the fruit turgor is largest, and then significantly reduces during the hottest part of the day, if there are no rainfalls.

According to Yamamoto and Satoh (1994), the internal increase of turgor caused by inflow of water from the root system is the reason for the fruit cracking. Jedlow and Schrader (2005), state that the fruit cracking is caused by the differences in the composition of the cuticle at different varieties. According to the same authors, the elasticity of the cuticle is affected by varietal characteristics, too. Fruit cracking is caused by both external and some internal factors i.e. by the characteristics of the cultivar and the substrate (Jimenez et al., 2004; Duralija et al., 2007).

Cracking of cherry fruit is affected by fruit size, firmness of fruit pulp, anatomy of epidermis, cuticle properties, soluble solids, but also by the environmental factors and especially precipitation and temperature, as in years with higher precipitation, the fruit cracking is more intense. This characteristic is also affected by the phase of sweet cherries development. Actually, the fruit cracking is caused by late rains just before or at the time of picking of cherries. This is particularly evident in the first phase of growth of the fruit i.e. fruits are the most susceptible during the last two - three weeks of growth, i.e. during the third phase of intensive growth of fruit (Christensen, 1976; quoted by Duralija et al., 2007). Christensen (1973), states that the susceptibility to cracking begins 10-25 days before picking of fruits, depending on the variety, and increases towards the date of picking.

It is important to emphasize that the susceptibility or resistance of certain cultivars of sweet cherry fruit to cracking varies from year to year and from one area to another (Webster & Cline, 1994).

Determination of susceptibility of cultivars to fruit cracking is done in field or laboratory conditions. Much more common method is determination in a laboratory conditions by determining the so-called index of fruit cracking.

The aim of this study was to determine the index of cracking of cherry fruits cultivars that are grown in the conditions of Sarajevo, so that an assessment and recommendations for growing of those cultivars that are less susceptible to cracking could be provided on the basis of the data obtained.

Materials and methods

The tests were done in the area of Sarajevo in 2010 and 2011. The research facility was introductory plantation of sweet cherries of the Federal Bureau of Agriculture of Bosnia and Herzegovina, located in the settlement of Butmir – Ilidža. The experimental plantation was built in the spring of 2007 at an altitude of 600 meters. The plantation is located on the southwest exposure. Cultivation form is a modified form of a slender spindle with a row distance of 4 x 2 m (1250 trees/ha). The substrate for all tested cultivars was Gisela 5, and the area of plantation under the cherry trees was 640 square meters. The plantation it is built on soil type fluvisol (alluvial soil). The five cultivars are used as the material in this paper: 'Kordia', 'Regina', 'Karina' and 'Schneider's Späte Knorpelkirsche' and 'Burlat'. All the cultivars are grafted on vegetative ground of low density Gisela 5.

Susceptibility to fruit cracking i.e. fruit cracking index was determined by the method of Christensen (1996). To determine the index of fruit cracking 50 well-developed, uniform fruits, which were immersed in 2 liters of distilled water at the temperature of 20°, were used. Examination of fruits was carried out after 2, 4 and 6 hours after immersion in water. During each examination, the fruits were counted and the cracked fruits were put aside. Fruit cracking index was calculated by the following formula:

$$IP = \frac{(5a + 3b + c) \times 100}{250}$$

where: a - the number of cracked fruits after 2 hours, b - the number of cracked fruits after 4 hours, c – the number of cracked fruits after 6 hours.

The results were statistically analyzed using analysis of variance, and the significance of differences between mean values was determined by using Duncan test of multiple intervals for P = 0.05

Results and discussion

The lowest average value of fruit cracking index in two years of testing was recorded in the cultivar ‘Karina’ (15.8), while the highest value was in the cultivar ‘Burlat’ (41.2). Also, significant differences were found between the years of study. The lower value of the cracking index was in 2011 (14.4), a higher value was recorded in 2010 (42.0). It is important to mention that the higher values of the fruit cracking index were recorded in 2010. in the case of all of the cultivars which can primarily be explained by climatic conditions. In fact, according to the data of the Federal Hydro meteorological Institute of Bosnia and Herzegovina, the total amount of rainfall in 2011. was significantly lower compared to the previous year, as well as to the average rainfalls. This explains the obtained lower values of the fruit cracking index of the cultivars tested in 2011. Index values of fruit cracking during a two-year period of examination are given in Table 1.

According to the fruit cracking index values, all varieties can be divided into four groups: low susceptible (cracking index lower than 10.0), moderately susceptible (cracking index from 10.1 to 30.0), susceptible (cracking index 30.1 to 50.0) and highly susceptible (cracking index > 50.1) (Milatović and Djurović, 2010).

Based on our examination, we can see that none of the cultivars belongs to the first group, that ‘Karina’, ‘Schneider's Späte Knorpelkirsche’, ‘Regina’ and ‘Kordia’ were moderately susceptible, that ‘Burlat’ was susceptible, while none of the cultivars belonged to the group of highly susceptible cultivars.

Duralija et al. (2007) studied the index of fruit cracking in 11 varieties of sweet cherries in the conditions of Zagreb and the following values of the fruit cracking index were obtained: 0 - 59.2. Our values for cultivars ‘Kordia’, ‘Karina’ and ‘Regina’ were much higher. According to the same group of authors, the media have a significant influence on this characteristic.

Tab. 1. Susceptibility of sweet cherry cultivars to fruit cracking in the region of Sarajevo (2010 – 2011)

Osjetljivost sorti trešanja na pucanje ploda u sarajevskoj regiji (2010 - 2011)

Cultivar <i>Sorta</i>	Fruit cracking index <i>Indeks pucanja ploda</i>		
	2010	2011	Average <i>Prosječno</i>
Burlat	42,0	40,4	41,2 a
Kordia	19,6	17,2	18,4 bc
Schneider's Späte Knorpelkirsche	18,0	14,8	16,4 c
Karina	17,2	14,4	15,8 c
Regina	24,0	21,6	22,8 b

Note: The mean values are marked with the same letter and are not significantly different according to Duncan test of multiple intervals for $P = 0.05$

Napomena: Srednje vrijednosti su označene malim slovima i nisu značajno različite prema Dankenovom testu višestrukih intervala za $P = 0.05$

In the conditions of the Belgrade's Danube area, Milatović and Djurović (2010) studied the fruit cracking in 17 sweet cherry cultivars grafted on wild cherry tree. The obtained values for the fruit cracking index were in the range from 3.8 to 72.7. The Cultivar 'Burlat' was among the tested varieties and our values for fruit cracking were slightly higher.

Milatović et al. (2011) obtained the values of fruit cracking index from 15.3 to 63.9 in 15 sweet cherry cultivars grafted on Gisela 5 near Šabac. In our work, we obtained a lower value for the cultivar 'Kordia' and slightly higher value for the cultivar 'Regina'.

The susceptibility of the cherry cultivars to fruit cracking varies depending on both the year and the area of cultivation. Thus, on the basis of the obtained results, we cannot claim that the cultivars that were resistant to fruit cracking during one year of the study would be resistant during another year, too, and even less can we be sure that it would be that way in some different growing areas.

In our example, we can see that the fruit cracking index depends on the ripening period, because the variety Burlat, as one of the cultivars that ripens earliest, had the highest fruit cracking index value. In fact, the varieties that are ripening later were less susceptible to fruit cracking, unlike early-ripening cultivars.

According to some authors, different values of sweet cherry fruit cracking index occur in the case of the same varieties. The reasons can be different environmental conditions as well as the ground which the cultivar is grafted on (Duralija et al., 2007).

On the basis of these results it can be concluded that there are differences in the susceptibility of the sweet cherry cultivars to cracking and the most resistant varieties can be recommended for certain climatic conditions. In addition to lower susceptibility to fruit cracking, the cultivars 'Kordia' and 'Regina' have good pomological characteristics, and can be recommended for the commercial cultivation in Sarajevo (Stojanović et al., 2012).

Conclusion

Based on a two-year study of susceptibility to fruit cracking of the five sweet cherry cultivars grafted on Gisela 5 cultivated in the Sarajevo area, the following can be concluded:

1. The minimum value of the fruit cracking index was determined in the cultivar 'Karina' (15.8), and highest in the cultivar 'Burlat' (41.2).
2. The fruit cracking index value was lower in 2011 year (14.4) and higher in 2010 year (42.0).
3. Based on the fruit cracking index, the cherry cultivars studied can be divided into two groups: moderately susceptible ('Karina', 'Schneider's Späte Knorpelkirsche', 'Regina' and 'Kordia') and susceptible ('Burlat').
4. Observed as a whole, the cultivars 'Karina' and 'Schneider's Späte Knorpelkirsche' showed the best characteristics as cultivars with the lowest fruit cracking index values among the cultivars tested for resistance to fruit cracking.

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Osjetljivost sorti trešanja izloženih kiši na pucanje ploda u sarajevskoj regiji

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Sažetak

Osjetljivost 5 sorti trešanja, kalemljenih na podlozi Gizela 5, na pucanje ploda usljed kiše, ispitivana je u sarajevskoj regiji tokom dvogodišnjeg perioda od (2010 – 2011). Test pucanja voća obavljen je indeksom po Christensen-u. Tokom ovog perioda značajne rezlike u osjetljivosti na pucanje ploda i kod sorti i kod godine testiranja su uočene. Sve sorte imale su visok indeks pucanja u 2010. Najviša osjetljivost na pucanje ploda usljed kiše je evidentirana je kod sorte 'Burlat' tokom obje godine. Sorte 'Kordia', 'Regina', 'Karina' i 'Schneider's Späte Knorpelkirsche' bile su umjereno osjetljive na pucanje ploda.

Cljučne riječi: trešnja, sorta, indeks pucanja ploda

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