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Disease threshold for cherry leaf spot incidence on commercial sweet cherry cultivars

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Summary: The aim of this study was to demonstrate the 10% threshold level for cherry leaf spot incidence on 23 commercial sweet cherry cultivars in two training systems. Twenty three cherry cultivars were evaluated in the two training systems with a spacing of 4 x 1 m and with a spacing of 2 x 5 m. Results showed that leaves of many cultivars were heavily infected, e.g. cultivars (cvs) 'Biggareau Burlat', 'Sunburst', while others showed low disease incidence e.g. cvs 'Celeste' and 'Blaze Star'. According to the 10 % threshold level, cv 'Celeste' proved to be the most resistant cultivar to leaf infection, while cv 'Münchebergi korai' exceeded extremely the 10% threshold level. Leaf spot incidence was affected by training system on most cultivars. Thirteen cultivars had less than 10% infection in the 4 x 1 m spacing (i.e. they did not reach the 10% disease threshold level). At the same time, only 3 cultivars showed less than 10% infection in the 5 x 2 m spacing.

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Key words: cherry leaf spot, *Blumeriella jaapii*, disease threshold, cultivars

Introduction

There are some possibilities for assessing plant disease levels by precision agriculture techniques. It is known that remote sensing can be used to examine e.g. the plant diseases on leaves. Such a disease can be cherry leaf spot (*Blumeriella jaapii*) which significantly reduces yield of cherries (e.g. Kaszonyi, 1966; Pedersen & Løschenkohl, 1997; Jenser & Véghelyi, 2003; Holb & Veisz, 2005; Király & Szentpéteri, 2006; Holb, 2009; Holb et al., 2010, 2011, 2014; Vámos & Holb, 2013). *Blumeriella jaapii* causes defoliation by the end summer and only poor quality fruit produced by the trees. The epidemics of cherry leaf spot can lead to full and early defoliation of the trees and can cause serious economic damage especially in rainy years. Due to early defoliation, tree conditions are weaken and only weak buds develop as well as frost sensitivity of the trees is also increased (Kaszonyi, 1966; Howell & Stackhouse, 1973; Sjulin et al., 1989; Jenser & Véghelyi, 2003; Holb & Veisz, 2005; Borovinova et al., 2007, 2014; Holb, 2009; Proffer et al., 2013; Borovinova & Petrova, 2015). The situation can be worse if plant protection does not reach the expected level. The disease development is also affected by training system and cultivars. However, threshold level of cherry leaf spot for the cherry cultivars is needed in order to successfully apply remote sensing options in integrated plant protection as part of the precision fruit technology.

Aim of our study was to present the 10% threshold level for cherry leaf spot incidence on 23 commercial sweet cherry cultivars in two training systems.

Materials and methods

The study was carried out in Debrecen (Pallag Experimental Station, Debrecen University) in a sweet cherry orchards planted where trees were planted in two training systems with a spacing of 4 x 1 m and with a spacing of 2 x 5 m. Trees were grafted on *Prunus mahaleb* and were grown from the year of 2000. Twenty-three sweet cherry cultivars (cvs) were evaluated: 'Celeste', 'Blaze Star', 'Vega', 'Szomolyai fekete', 'Rita', 'Cristallina', 'Katalin', 'Aida', 'Lapins', 'Izabella', 'Stella', 'Van', 'Germersdorfi 3', 'Krupnodlodnaja', 'Vera', 'Axel', 'Linda', 'Margit', 'Valerij Csaklov', 'Sunburst', 'Biggareau Burlat', 'Solymári gömbölyű' and 'Münchebergi korai'.

Eight fungicide applications were used against fungal diseases of sweet cherry according to the Integrated Fruit Protection guidelines. Copper hydroxide was used at dormant bud stage and then 6 additional sprays were applied during the season with the active ingredients of tebuconazole, pyraclostrobin, captan and dodine. The final spray was copper used in August.

Disease observation was prepared at the end of August. A minimum of four trees were observed and 4 x 25 leaves were assessed for disease. Percentage of cherry leaf spot was determined. Then a 10 % threshold level of disease incidence was determined for each cultivar and for both training systems.

Results and discussion

All cherry cultivars were infected to a greater or lesser extent, but most infection was in the category of lower than 10% disease threshold level. Leaves of many cultivars were heavily infected, e.g. cvs 'Biggareau Burlat' and 'Sunburst', while

others showed low infection of the pathogen e.g. cvs 'Celeste' and 'Blaze Star'.

According to the 10 % threshold level, cv 'Celeste' proved to be the most resistant cultivar to leaf infection (***Figure 1***). The rate of leaf infection did not exceed 10%, and the symptoms appeared mainly at the edge of the leaf. The cv 'Blaze Star' showed also a lower infection rate. The tolerant cultivar, 'Szomolyai fekete' was slightly diseased but only partially confirmed its tolerance known from the literature.

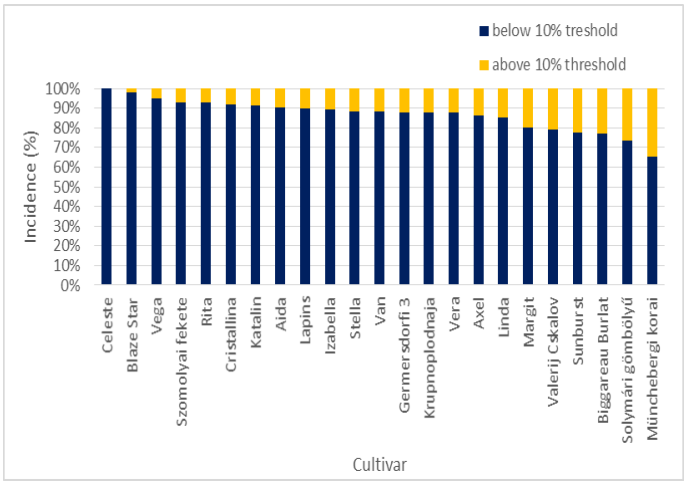

Figure 1. Overall classification of 23 sweet cherry cultivars according to the 10% disease threshold level for chery leaf spot (distributions of above and under 10% disease incidence).

Cultivar 'Münchebergi korai' exceeded extremely the 10% threshold level. Almost all the leaves of this cultivar were diseased. Cultivars 'Biggareau burlat', 'Solymári gömbölyű' and 'Sunburst' also showed considerable diseases on the leaves.

The threshold classification of the cultivars was modified by the tree spacings (***Figures 2-3***). Thirteen out of the 21 cultivars had less than 10% infection in the 4 x 1 m spacing (i.e. they did not reach the 10% disease threshold level). At the same time, only 3 out of the 18 cultivars showed less than 10% infection in the 5 x 2 m spacing. In the more intensive cultivation of 4 x 1 m spacing, the lower disease level can be explained by the fact that leaves can dry more easily in the smaller canopy of the smaller trees; therefore, leaves can not be infected so easily than on larger trees of the 5 x 2 m spacing.

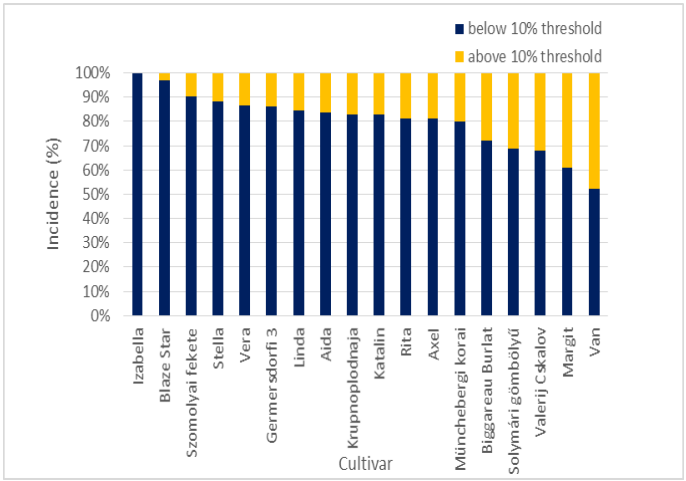

Figure 2. Classification of 18 sweet cherry cultivars for the spacing of 5 x 2 m according to the 10% disease threshold level for chery leaf spot (distributions of above and under 10% disease incidence)

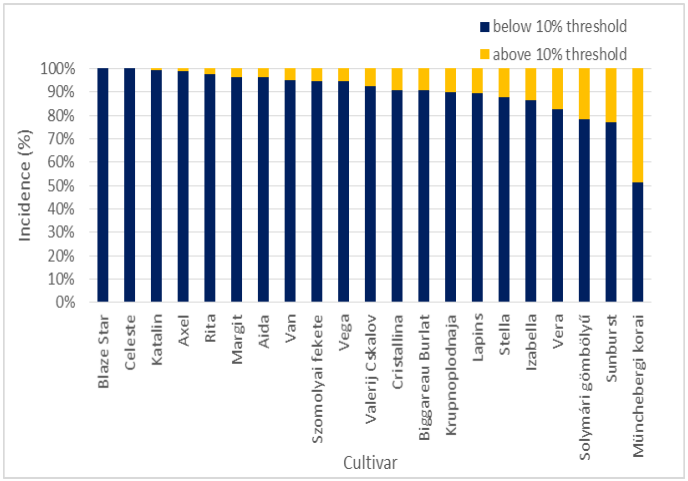

Figure 3. Classification of 21 sweet cherry cultivars for the spacing of 4 x 1 m according to the 10% disease threshold level for chery leaf spot (distributions of above and under 10% disease incidence)

In the case of moderately susceptible and less susceptible cultivars, the tree spacing showed a significant difference for some cultivars e.g. 'Van' and 'Izabella'. In the case of cv 'Van', only 5% of the leaves were diseased with more than 10% disease threshold in the 4 x 1 m spacing, while at the 5 x 2 m spacing this value increased above 40%. At the same time, cv 'Izabella' showed almost no infection in the spacing of 5 x 2 m, while 14% of the leaves exceeded 10% disease threshold in the 4 x 1 m spacing.

Conclusions

This study proved that leaf spot incidence is affected by training system on most sweet cherry cultivars. Various effect colud be seen on moderately susceptible and less susceptible cultivars. In general, higher tree density (4 x 1 m) resulted in lower cherry leaf spot incidence for most cultivars compared to lower tree density (5 x 2 m) but not all cultivars follow this role.

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