

# Incidence of two leaf fungal diseases in two plum training systems

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**Summary:** In a two-year study, we aimed to determine the susceptibility of four plum cultivars to two fungal pathogens of plum (*Stigmia carpophila* and *Polystigma rubrum*) in two training systems with tree spacings of 4 x 1.5m and 6 x 3m. Results showed that shothole symptoms were not detected on cvs 'Bluefre' and 'Stanley' in August, 2016. Disease incidence was above 50% in the case of 'Čačanska leptotica' in both training systems in 2016. There were no significant difference between the two training systems. Shot hole incidence was lower in the 6 x 3m spacings compared to the 4 x 1.5m spacings on cv 'President' in 2016. Cultivar 'Čačanska leptotica' showed the highest incidence of *Stigmia carpophila* in the 4 x 1.5m spacing in 2017. Disease incidence of *Stigmia carpophila* was significantly lower in the 6 x 3m spacing compared to the 4 x 1.5m spacing. Shothole incidences on cv 'President' were similar to the values in 2016 ranging from 40% to 60%. Leaf disease incidence was higher in the 4 x 1.5m spacing compared to the 6 x 3m plot. Low disease incidence (below 10%) was observed on cv 'Stanley' in 2017 and only in the 4 x 1.5m spacing. There were no visible symptoms of blackhorn dotty in 2016 due to inadequate weather conditions for the *Polystigma rubrum* fungus. However, all the four cultivars were infected by *Polystigma rubrum* in 2017. The most susceptible cultivar was cv 'Čačanska leptotica' with the highest disease incidence in the 4 x 1.5m spacing. Disease incidence of this cultivar was lower in the 6 x 3m spacing which was significantly less than in the 4 x 1.5m spacing. The least susceptible cultivar was 'Bluefre' and symptoms were observed only in the spacing of 4 x 1.5m. The disease incidence of cv 'President' was similarly low to cv 'Stanley' in both spacings.

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**Key words:** plum, *Stigmia carpophila*, *Polystigma rubrum*, training system

## Introduction

European plum (*Prunus domestica* L.) is the second largest fruit crops in Hungary. Disease management of plum covers only a few (5-9) sprays during the season and harvested fruit is used mainly for industrial purpose (Holb, 2005; Földes et al., 2015). As plum orchards do not receive intensive spraying program, plum trees are usually under a higher disease pressure and incidence of foliar and fruit fungal diseases are high. Most sprays during the season are used to prevent damage caused by plum moth (*Grapholita funebrana* L.) which also prevent infection of *Monilinia* sp. on fruit. Foliar fungal diseases receive no or little attention during the season. The most important foliar diseases of plum in Hungary are shothole disease (*Stigmia carpophila* L.), and blackhorn dotty (*Polystigma rubrum* L.). *Stigmia carpophila* causes small holes in developing leaves and causes leaf fall around harvest (Teviotdale et al., 1989; Adaskaveg et al., 1990; Adaskaveg, 1995; Ahmadpour et al., 2006; Ivanová et al., 2012; Yousefi and Hagian Shahri, 2014). Reaction of plum cultivars to shoot hole was assessed previously (Bubici et al., 2010). *Polystigma rubrum* causes large red spots on leaves (Borovinova, 2002).

Only few study assessed foliar diseases of plum although the diseases can have either a direct or indirect effect on leaf health and fruit quality. In Hungary, 90 % of plum producers still grow conservative cultivars (e. g. 'Bluefre', 'Čačanska', 'President' and 'Stanley') and use old-fashioned extensive training system with spacings over 5 x 3 m. Most of these cultivars are highly susceptible to plum pox potyvirus. Training system were studied

previously and authors stated that spray applications are not effective enough in large trees in the extensive training systems against foliar diseases (Mika et al., 1998; Milosevic et al., 1998).

The aim of this study was to determine the susceptibility of four traditional plum cultivars ('Bluefre', 'Čačanska', 'President' and 'Stanley') to two fungal pathogens of plum (*Stigmia carpophila* and *Polystigma rubrum*) in a low density (6 x 3m) and in a high density (4 x 1.5m) training systems.

## Materials and methods

### Orchard site

The study was conducted in an experimental plum orchard near Debrecen in Eastern Hungary in 2016 and 2017. Orchard was established in 1997 and trees were grafted on Myrobalan 'C 359' rootstock. Orchard soil type was sandy loam. The orchard consisted of four cultivars ('Bluefre', 'Čačanska leptotica', 'President' and 'Stanley'). Each cultivar was planted a 0.25 ha plot replicated four times. The orchard was managed under integrated fruit growing guidelines.

Trees were planted in a 0.25 ha plots replicated four times. Trees were planted in a low density (6 x 3m) and in a high density (4 x 1.5m) training systems. Trees were planted in 8 rows, one spacing means 2 rows. The 4 x 1.5m plot spacing has a 1667 tree per hectare. The 6 x 3m plot consisted 556 trees per hectare.

### Spraying schedule

The orchard received 6 and 5 fungicide treatments in 2016 and 2017 respectively. In 2016 sprayings started from 8 March and continued until the 3 August, while in 2017 the first spraying occurred on 4 April and the last on 30 June.

### Disease assessments

Four trees of each cultivar-training system plot were assessed at the end of August in 2016 and at the beginning of September in 2017. Twenty five leaves were selected randomly on each tree, giving a total of 100 leaves per plot. *Stigmia carpophila* and *Polystigma rubrum* were assessed on leaves. A leaf was considered to be diseased if one spot was already visible on its surface (Figures 1 and 2).

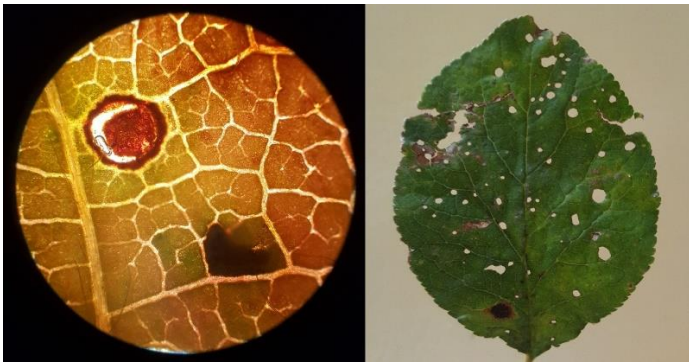


Figure 1. Symptoms caused by *Stigmia carpophila* on leaves of cultivar 'Čačanska leptotica' (right) and under stereo microscope (60x) (left).



Figure 2. Symptoms caused by *Polystigma rubrum* on leaves of cultivar 'Čačanska leptotica'.

### Data analyses

Incidence of *Stigmia carpophila* and *Polystigma rubrum* on leaf were calculated. ANOVA were used to evaluate the effect of training system and cultivar on disease incidence. Means were separated with LSD t-test at 0.05 level.

### Results

#### Incidence of *Stigmia carpophila*

Shothole symptoms were not detected on cvs 'Bluefre' and 'Stanley' in August, 2016. Disease incidence was above 50% in the case of 'Čačanska leptotica' in both training systems in 2016 (Figure 3). There were no significant difference between

the two training systems. Shot hole incidence was lower in the 6 x 3m spacings compared to the 4 x 1.5m spacings on cv 'President' in 2016.

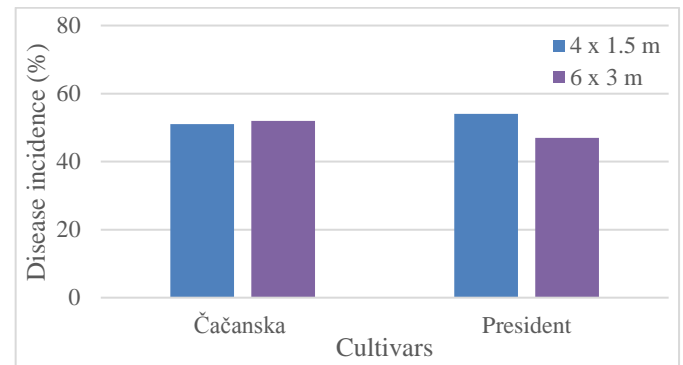


Figure 3. Incidence of shothole disease caused by *Stigmia carpophila* in 2016 (Debrecen-Pallag).

Cultivar 'Čačanska leptotica' showed the highest incidence of *Stigmia carpophila* in the 4 x 1.5m tree spacing in 2017. Disease incidence of *Stigmia carpophila* was significantly lower in the 6 x 3m spacing compared to the 4 x 1.5m spacing (Figure 4). Shot hole incidences on cv 'President' were similar to the values in 2016 ranging from 40% to 60%. Leaf disease incidence was higher in the 4 x 1.5m spacing compared to the 6 x 3m plot. Low disease incidence (below 10%) was observed on cv 'Stanley' in 2017, but only in the 4 x 1.5m spacing.

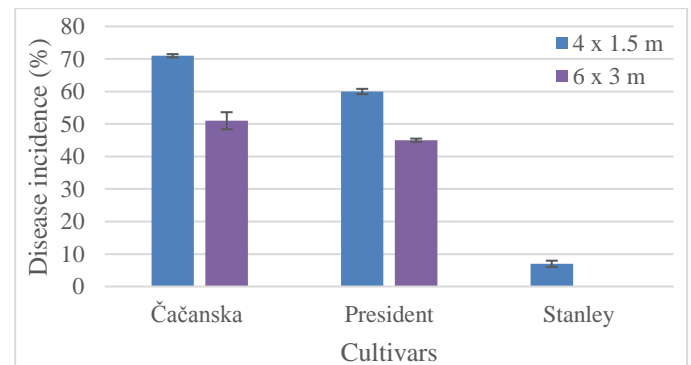


Figure 4. Incidence of shothole disease caused by *Stigmia carpophila* in 2017 (Debrecen-Pallag).

#### Incidence of *Polystigma rubrum*

There were no visible symptoms of blackhorn doty in 2016 due to inadequate weather conditions for the *Polystigma rubrum* fungus. However, all the four cultivars were infected by *Polystigma rubrum* in 2017 (Figure 5).

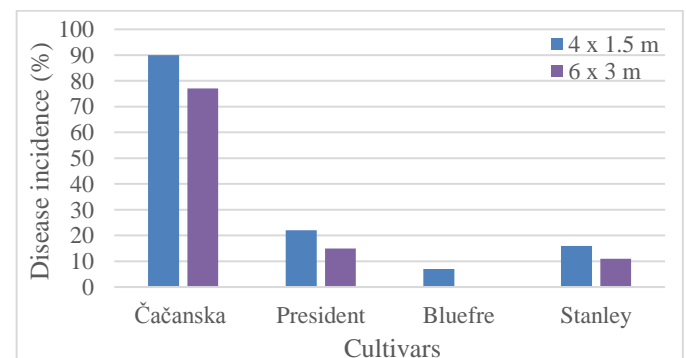


Figure 5. Incidence of blackhorn doty caused by *Polystigma rubrum* in 2017 (Debrecen-Pallag).

The most susceptible cultivar was cv 'Čačanska leptotica' with the highest disease incidence (90%) in the 4 x 1.5m spacing. Disease incidence of this cultivar was lower (78%) in the 6 x 3m spacing which was significantly less than in the 4 x 1.5m spacing. The least susceptible cultivar was 'Bluefre' and symptoms were observed only in the spacing of 4 x 1.5m. The disease incidence of cv 'President' was similarly low to cv 'Stanley' in both spacings.

## Conclusions

Our study demonstrated that there were significant differences in disease incidences of *Polystigma rubrum* and *Stigmium carpophila* between tree spacings and cultivars. However, the disease levels were dependent on the weather conditions of the years. These results provide that not only year and cultivar but tree spacings also play an important role in the level of fungal disease on plum.

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