Responses of apricot genotypes to brown fruit rot (*Monilinia* spp.) to artificial and natural infections

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Abstract

The objective of this study was evaluation of apricot genotypes resistance to brown fruit rot causing by fungi from Monilinia species. Totally 46 apricot cultivars and hybrids were evaluated in the three growing seasons from the year 2009 to the year 2011. In the year 2009 lower fruit brown rot injury was recorded after artificial infection on fruits of cultivars ´Goldrich´, ´Harcot´, ´Harogem´ and hybrid ´NPL 13/77´. In contrary high injury was recorded on fruits of genotypes ´Lou Tuo´, ´Sundrop´, ´NPL 14/35´ and ´NPL 13/151´. Low rots were recorded on fruits of genotypes ´Sundrop´ and ´NPL 13/70´ after natural infection, sensitivity to fruit rots was recorded on cultivars ´Velkopavlovická´ and ´Lou Tuo´ to this infection. In the year 2010 higher resistance to brown fruit rot after artificial infection by fungi from Monilinia ssp. showed cultivars ´Harogem´, ´Harlayne´, ´Harval´ and ´Darina´, in contrary lower showed cultivars ´Freda´, ´Veharda´ and ´Kompakta´. Cultivar ´Harlayne´ were evaluated as the most resistant, cultivar ´Freda´ as the most sensitive after natural infection. As resistant to brown fruit rot were in the year 2011 evaluated hybrid ´M 52´ and cultivar ´Betinka´, on the contrary the most sensitive were evaluated cultivars ´Candela´, ´Roxana´ and ´Veecot´ both after artificial and natural infection by fungi from Monilinia spp. Results showed differences among tested apricot cultivars and hybrids to infection by fungi from Monilinia spp. both after artificial inoculation and in conditions of natural infection.

Key words: *Monilinia laxa*, *Monilinia fructigena*, brown fruit rot, *Monilinia* spp.

Introduction

Apricot (*Prunus armeniaca*) can be damaged by a wide range of specific pathogens which can destroy both the yield and tree health or life. Therefore the study of apricot resistance to these pathogens is the major objective of the breeding program carried out at the research stations in lots of countries (Gutermuth et al., 2010). Brown fruit rot is serious fungal disease of apricot causing extensive economic losses in many growing areas in Europe (Wormald, 1954; Byrde & Willets, 1977; Batra, 1991; Holb, 2004a). Casual agent are fungi from *Monilinia* species: *Monilinia laxa* (Aderh. et Ruhl) Honey ex Dennis and *Monilinia fructigena* (Schröt. ex Aderh. et Ruhl) Honey ex Dennis (Batra, 1991). Potential casual agent of brown fruit rot could be another two closely related fungi *Monilinia fructicola* with origin in North America and *Monilinia polystroma* with origin in Asia. *M. laxa* tends to prevail upon vegetation organs therefore attacking twigs, leaves, shoots and flowers causing blossom blight, whilst *M. fructigena* is more common on fruits. Total amount of the pathogen spores and precipitation during blooming significantly influence infection of flowers (Luo and Michailides, 2001). Rainy and warm weather in harvesting time increase development of fruit rot whereas when weather conditions were dry and hot brown rot incidence of fruits is lower (Drén et al., 2007).

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M. laxa attacks flowers that dry and turn brown, the leaves wither and dry, remaining on the branches which, if infected, show brown concavities and then fissures from which comes rubber out. The fruits can be attacked both at the start of development and once mature. In both cases, they rot and become subsequently covered in mould. Infected mature fruits 'mummify', i.e. they dry out, decrease in volume remaining on branches. Good preventive practice includes reducing potential sources of contagion, pruning the affected branches and removing the mummified fruits that remain on the plant. The collected material should be destroyed in early spring (Leeuwen et al., 2000, 2002). In hybrid offspring of parental combinations is possible evaluate resistant selections (Cociu et al., 1991; Nicotra et al., 2006). The potential apricot cultivars resistant to brown fruit rot were recorded in this trial. The results showed variation of the evaluated cultivars with resistance to infection by fungi from *Monilinia* spp. both after artificial inoculation and in conditions of natural infection.

Material and methods

Totally 46 apricot cultivars and hybrids were evaluated in the three growing seasons from the year 2009 to the year 2011 to brown rot resistance both after artificial and nature infection by fungi from *Monilinia* spp. Tested cultivars and hybrids were collected in the experimental orchards of the Research and Breeding Institution of Pomology Holovousy Ltd. and the Mendel University in Brno. Infections by fungi from *Monilinia* spp. during blossom didn´t show any resistance differences among cultivars and hybrids. Artificial infections of blossom were conducted in a special moister chamber with high relative humidity (near 100 %). Very high blossom injury was recorded among all tested cultivars and hybrids (from 90 to 100 % of blossom). For this reason the evaluation of resistance was focused only to fruit brown rot after infection by fungi from *Monilinia* spp. Inoculum for artificial infection was prepared by washing of spores from mummified fruits and was applied by a micropipette to the surface of fruits. By the sterile needle a flat injury of the fruit peel were done at the place of infection. The number of spores was adjusted under the microscope in the Bürker´s chamber by dilution with water to $4x10^4$ spores in 1 ml. Samples of fruits were gathered from the experimental orchards which were every year treated by copper in early spring and by fungicide Sporgon during blooming to avoid blossom blight. In the years 2009 and 2010 two fungicides (Baycor, Talent) were applied against to brown fruit rot before harvesting due to high precipitations. In the sample 10 fruits of each cultivar respective hybrid were artificially infected and 10 fruits were observed with nature infection by fungi from *Monilinia* spp. Samples of apricots were placed in storage room with temperature 5 – 8°C. Every week was recorded number of healthy fruits and rotted fruits. The size of fruit rots were measured in diameter and the injury was evaluated according the scale 0 – 9 (0 – no visible symptoms, 1: up to 5 mm; 2: 5 – 10 mm; 3: 10 – 15 mm; 4: 15- 20 mm; 5: 20-25 mm; 6: 25 – 30 mm; 7: 30 – 35 mm; 8: 35 – 40 mm; 9: > 40 mm in diameter). Morphological variation of fungi was not distinguish, the injury was evaluated as rot infection by fungi from *Monilinia* spp. without detection whether causal agent is fungi *M. fructigena*, *M. laxa* or alternatively related fungi. Other fungal diseases and mould were not involved into the evaluation.

Results

Year 2009:

Totally 21 samples of cultivars and hybrids collected in the experimental orchards in the Research and Breeding Institution of Pomology Holovousy Ltd. (RBIP Holovousy Ltd.) were involved into the evaluation this year. Samples of genotypes ´Goldrich´, ´Harcot´, ´Sundrop´ and ´NPL 14/172´ were collected from two locations of the experimental orchard

and marked as I respective II. Samples were harvested according fruit ripening from July 21st to August 1st and evaluated on subsequent five weeks. Results are shown in the Figure 1. Low fruit brown rot injury was recorded after artificial infection on fruits of cultivars ´Goldrich´ I, ´Harcot´ I, ´Harogem´ and hybrid ´NPL 13/77´. In contrary high injury was recorded on fruits of genotypes ´Lou Tuo´, ´Sundrop´, ´NPL 14/35´ and ´NPL 13/151´. Low rots were recorded on fruits of genotypes ´Sundrop´ and ´NPL 13/70´ after natural infection, sensitivity to fruit rot was recorded on cultivars ´Velkopavlovická´ and ´Lou Tuo´ to this infection.

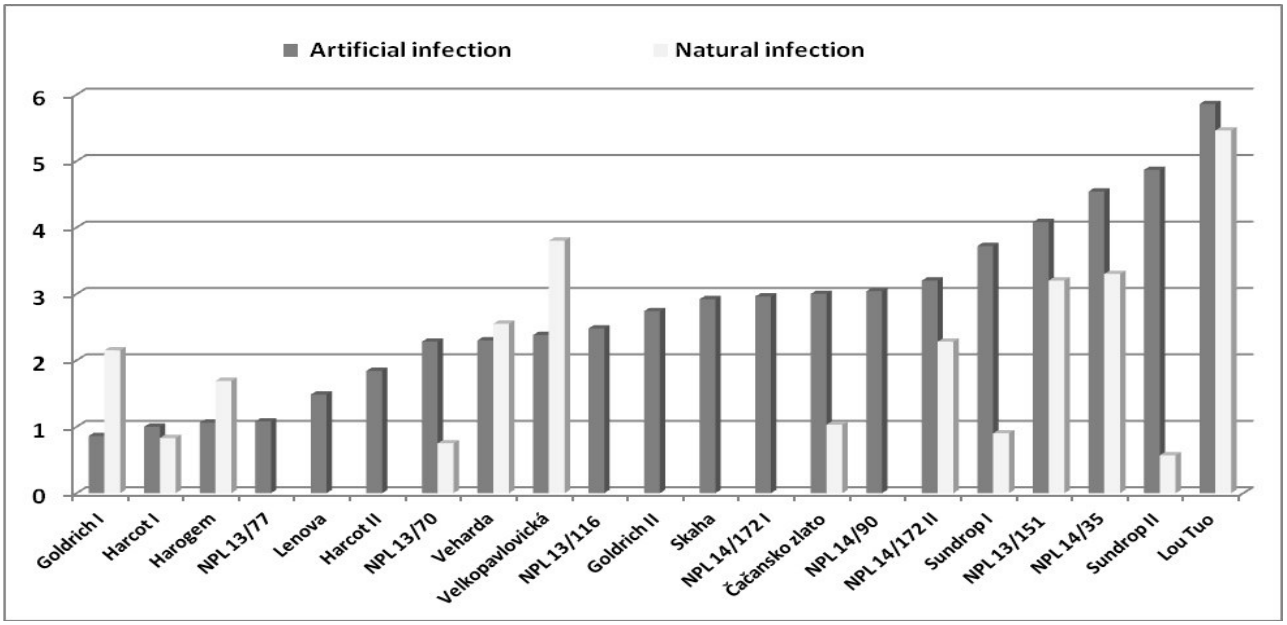

Figure 1: Response of apricot genotypes to brown fruit rot after infection by fungi from *Monilinia* spp. in the year 2009 (scale 0 – 9).

Year 2010:

Totally 16 samples of cultivars and hybrids from the experimental orchard in the RIBP Holovousy Ltd. were involved into the evaluation this year. Samples were harvested according fruit ripening from July 27th to August 11th and evaluated on subsequent five weeks. Cultivars ´Goldrich´, ´Harogem´ and ´Veharda´ were collected from different locations of the experimental orchard and samples were marked as I, II respective III. Results are summarized in the Figure 2.
Higher resistance to brown fruit rot after artificial infection by fungi from *Monilinia* spp. showed cultivars ´Harogem´, ´Harlayne´, ´Harval´ and ´Darina´ in contrary lower showed cultivars ´Freda´, ´Veharda´ and ´Kompakta´. The cultivar ´Harlayne´ were evaluated as the most resistant and on the contrary the cultivar ´Freda´ as the most sensitive after natural infection.

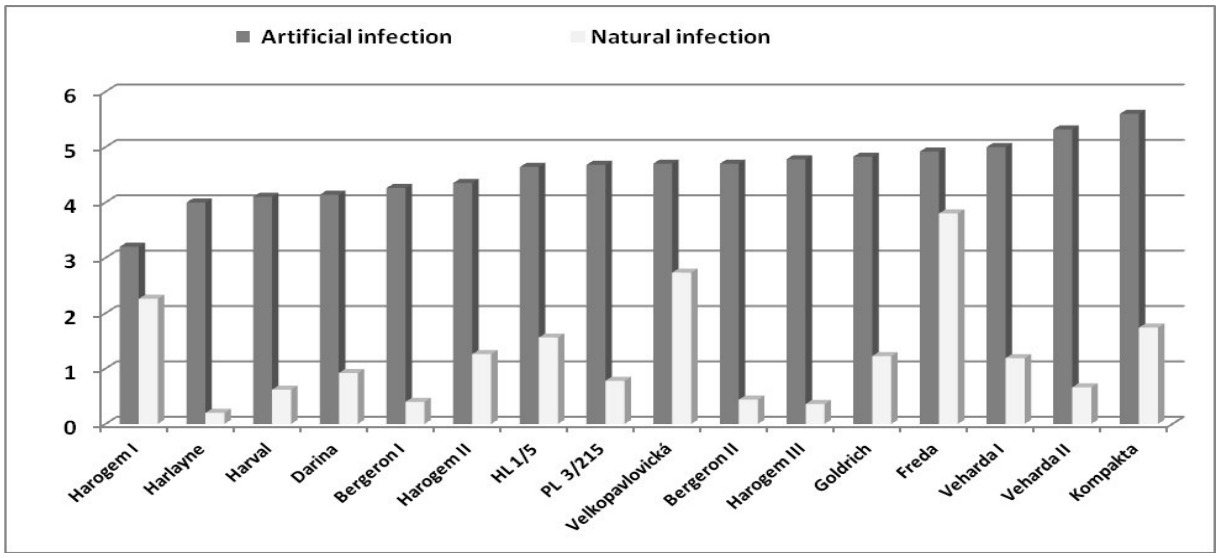

Figure 2: Response of apricot genotypes to brown fruit rot after infection by fungi from *Monilinia* spp. in the year 2010 (scale 0 – 9).

Year 2011:

Severe spring frost totally damaged crop of apricots in the orchards of RIBP Holovousy Ltd. in this year. Therefore cultivars and hybrids for testing were collected in the other place of the Czech Republic situated in southern Moravia. Fruits from experimental orchards in location Lednice of the Mendel University in Brno were transported and subsequently tested. Totally 26 samples were involved into the evaluation in this year that were harvested from July 14th to 27th. The results are presented in the Figure 3. Hybrid ´M 52´ was harvested in two terms of maturity July 14th and 21th. Early harvested sample marked as ´M 52´ (I) shown less susceptibility than the late harvested one marked as ´M 52´ (II). This proved that more matured and soft fruits are more susceptible to infection with fungi from *Monilinia* spp. (Michailides et al., 2000) than less matured. As tolerant to brown fruit rot were recorded hybrid ´M 52´ and cultivar ´Betinka´, on the contrary the most sensitive cultivars were evaluated cultivars ´Candela´, ´Roxana´ and ´Veecot´ both after artificial and natural infection by fungi from *Monilinia* spp.

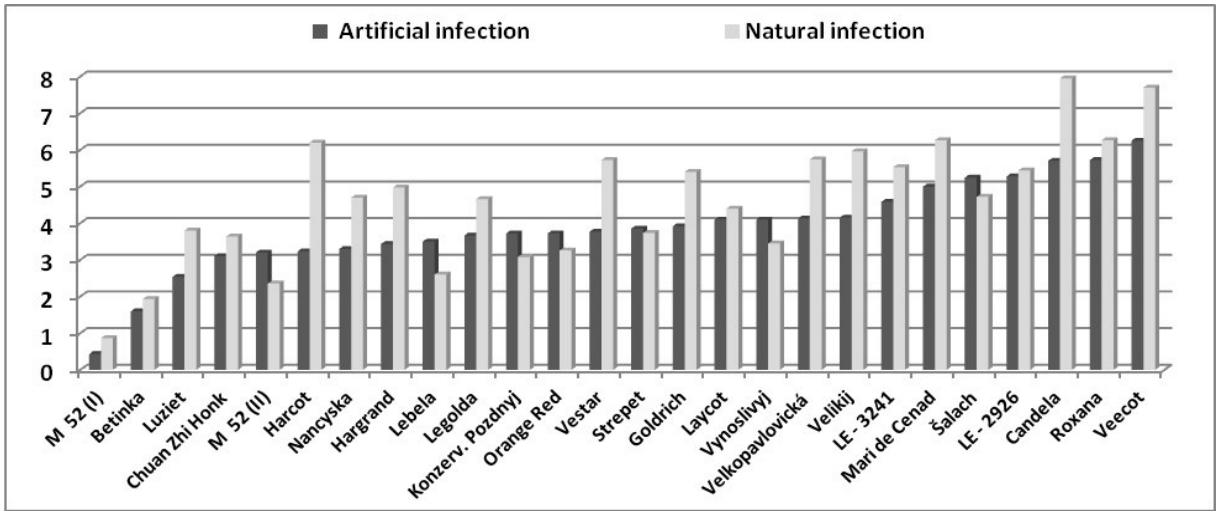

Figure 3: Response of apricot genotypes to brown fruit rot after infection by fungi from *Monilinia* spp. in the year 2011(scale 0 – 9).

Discussion

Results showed differences among tested cultivars and hybrids to infection by fungi from *Monilinia* spp. both after artificial inoculation and in conditions of natural infection. This knowledge is very important especially for growers with organic apricot production due to impossibility to use chemical fungicides. From evaluations of rots in individual years are evident differences in fruit injury after natural infections by fungi *Monilinia* spp. In rainy season of the years 2009 a 2010 were two treatments of fungicides applied (May 4th and June 10th respective May 21th and June 4th). These treatments depressed incidence of brown fruit rot in the years 2009 and 2010 compared to the year 2011 with untreated samples after blooming. Infection of flowers causing blossom blight has to be solved by treatment by copper (or chemical fungicides in IP) during tree blooming. The new cultivar ´Betinka´ and the hybrid marked ´M 52´ that show high tolerance to infection by fungi from *Monilinia* spp. rise to the challenge to depress economic losses of brown fruit rots in organic apricot production.

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