Breeding of *Monilinia laxa* resistant sour cherry cultivars in Hungary

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Abstract

In the last 20 years *Monilinia laxa* (Aderhold & Ruhl.) Honey caused serious infections in Hungarian sour cherry orchards. Beside cherry leaf spot (*Blumeriella jaapii*) the brown rot (*Monilinia laxa*) is the most important disease of sour cherry. The most important Hungarian sour cherry cultivar, 'Érdi bőtermő', is susceptible to both diseases. Its importance in the Hungarian sour cherry growing is high because this cultivar is grown on 4,000 ha. During the examinations of *Monilinia* susceptibility of sour cherry cultivars it was discovered that the *Blumeriella* resistant 'Csengődi' cultivar had a high tolerance also against *Monilinia laxa*. Currently 'Érdi bőtermő' is used in our resistance breeding programme as mother plant and the 'Csengődi' cultivar as pollen donor. The most important aims of our breeding programme are: i) the selection of hybrid seedlings resistant or tolerant to *Monilinia laxa*; ii) the fruit characteristics and productivity of the selected hybrids should be equal or higher than 'Érdi bőtermő'; iii) the hybrid must be self-fertile. As result of our breeding programme a new sour cherry candidate cultivar, 'Érdi bíbor', was applied for state registration in 2014.

Keywords: resistance, seedling

INTRODUCTION

In sour cherry breeding it is important that the hybrids have sufficient tolerance against the most dangerous pathogens of sour cherry. *Monilinia laxa* causes the most important plant protection problem in the Hungarian sour cherry growing. Local cultivars and landraces can be good sources of resistance, while selected accessions can be suitable for commercial growing or can be used in breeding. The most important result of our breeding program is the state registered 'Csengődi' cultivar which is resistant to cherry leaf spot (*Blumeriella jaapii* (Rehm) Arx) (Apostol et al., 1995), cytospora cancer (*Cytospora cincta* Sacc. and *Cytospora leucostoma* (Pers.) Sacc.) (Rozsnyay and Apostol, 2005) and brown rot (*Monilinia laxa* (Aderhold & Ruhl.) Honey ex Dennis) (Sződi et al., 2008).

MATERIALS AND METHODS

120 sour cherry hybrid seedlings of the cross 'Érdi bőtermő' × 'Csengődi' were evaluated. From this hybrid population 10 accessions were selected according to fruit quality and productivity, and have been tested for *M. laxa* susceptibility under orchard and laboratory conditions (Figure 1). 'Érdi bőtermő' and 'Csengődi' cultivars were used as control cultivars. The applied method for evaluating disease resistance of hybrid seedlings and determination of pathogenicity of different *Monilinia laxa* strains are based on descriptions of Rozsnyay (1977). According to this method the phloem necrosis of infected shoots was determined. The method of Xu and Robinson (2000) was used for infection of flowers with conidia. With this method ten flowering twigs are infected for each accessions. The infected twigs were incubated in a climate chamber during 35 days at 20-22°C.

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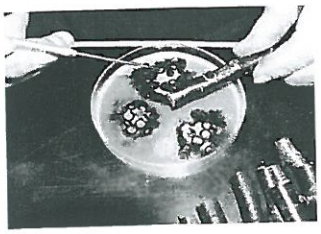

Figure 1. Artificial inoculations of sour cherry genotypes with *M. laxa*.

RESULTS

Examination of pathogenicity of *M. laxa* isolates

'Érdi bőtermő' was inoculated with five different *M. laxa* strains. 'M14' and 'M4' strains showed significantly more phloem necrosis compared to 'M10', 'M16', 'M22'. Therefore the strain 'M4' will be used in the future for artificial infection (Figure 2).

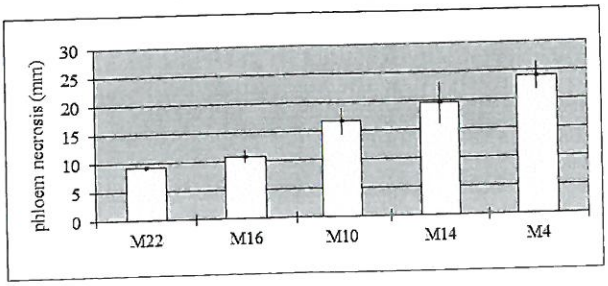

Figure 2. Phloem necrosis caused by five different *M. laxa* isolates on 'Érdi bőtermő'.

Artificial flower infections

Despite of significant flower infection no shoot dieback was observed on '7/136', '9/91', '7/47', '7/67-68', 'Csengődi', '7/141', '9/7-8' and '9/21' (Table 1). On the other hand 'Érdi bőtermő' and '9/79-80' showed high symptoms of susceptibility.

Table 1. Artificial flower infections of the selected sour cherry genotypes.

Genotypes	Number of flowers inoculated with *M. laxa*	Number of infected flowers	Rate of flower infection (%)	Rate of shoot dieback 1 month after infection (%)
7/136	90	18	20	0
9/91	77	16	21	0
7/47	113	37	33	0
7/67	73	28	38	0
9/5-6	119	46	39	60
Csengődi	130	54	42	0
7/141	91	38	42	0
9/9-10	222	104	47	60
9/24	56	29	52	25
9/7-8	91	52	57	0
Érdi bőtermő	122	74	61	100
9/79-80	98	76	78	100
9/21	61	53	87	0

Spontaneous infections in

Among all tested geno
caused by natural infections
8', '7/141' and '7/77-78' hy
'7/47', '9/21' and '9/79-8
'Csengődi' (Figure 3).

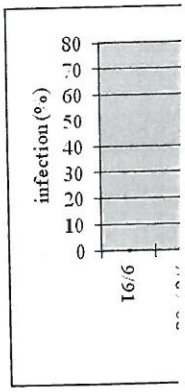

Figure 3. Percentage of *M*
(2010-2012).

Artificial infections in lal

Artificial infections
resulted in extreme infecti
necrosis was the hybrid '7
'Csengődi'. The most susc
'7/77-78', '7/136' and '9
'Csengődi' (Figure 4).

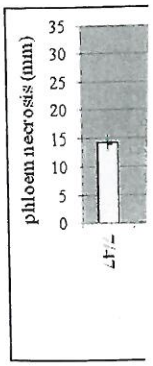

Figure 4. Artificial *M. la*
2012).

Fruit examinations

The hybrids with t
and '7/67-68' (7,9 g). Th
'Csengődi' (Figure 5).

Spontaneous infections in the field

Among all tested genotypes 'Érdi bőtermő' was the most susceptible. No shoot dieback caused by natural infections was detected for the '9/91' and '7/67-68' hybrids.'7/136', '9/7-8', '7/141' and '7/77-78' hybrids showed a similar level of resistance as 'Csengődi', while '7/47', '9/21' and '9/79-80' hybrids were significantly more susceptible compared to 'Csengődi' (Figure 3).

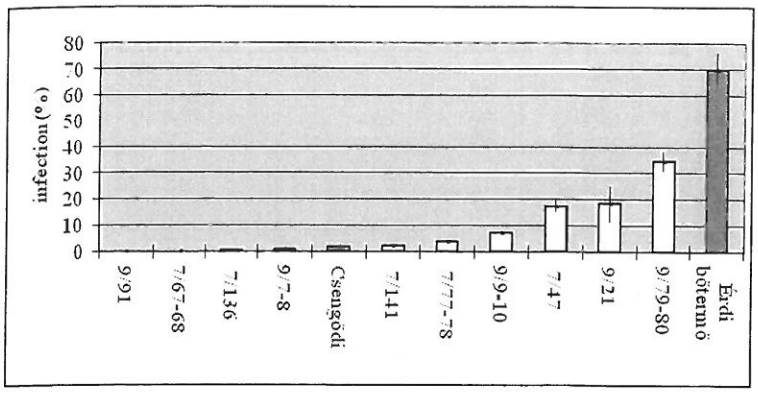

Figure 3. Percentage of *M. laxa* shoot infections of selected sour cherry hybrids in the field (2010-2012).

Artificial infections in laboratory

Artificial infections under optimal conditions for the development of the pathogen resulted in extreme infections and strong shoot necrosis. The genotype showing less phloem necrosis was the hybrid '7/47'. The infection progress of this hybrid was less compared to 'Csengődi'. The most susceptible selections were '9/79-80' and 'Érdi bőtermő'. The '9/21', '7/77-78', '7/136' and '9/91' seedlings showed similar results like the tolerant cultivar 'Csengődi' (Figure 4).

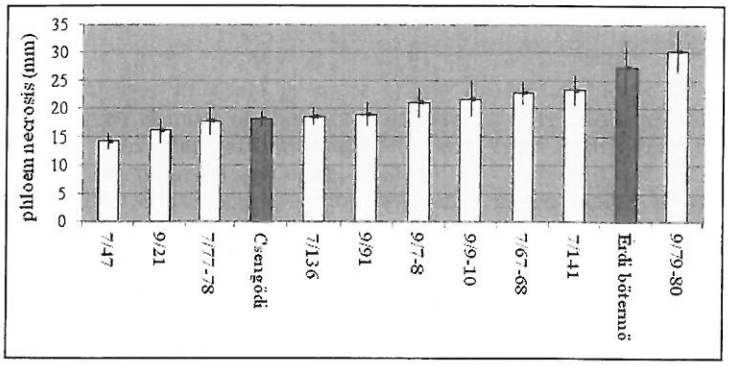

Figure 4. Artificial *M. laxa* infection of selected sour cherry hybrids in laboratory (2010-2012).

Fruit examinations

The hybrids with the highest average fruit weight were '9/21' (7,2 g), '9/91' (7,4 g), and '7/67-68' (7,9 g). Their average fruit weight is higher than those of 'Érdi bőtermő' and 'Csengődi' (Figure 5).

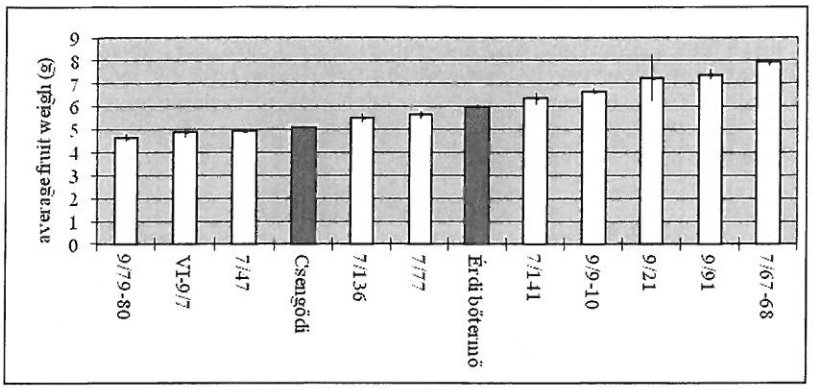

Figure 5. Average fruit weight of selected sour cherry genotypes (2010-2012).

DISCUSSION

Based on these results a registration for the hybrid '7/67-68' as 'Érdi bíbor' was applied.

Literature cited

Apostol, J., Véghelyi, K., Iezzoni, A., and Jones, A.L. (1995). A cooperative program between Hungary and Michigan (USA): breeding of disease resistant sour cherry cultivars, in hungarian language. Horticulture *1* (*1-2*), 1-3.

Rozsnyay, Z.D. (1977). Cytospora cancer and dieback of Apricots. EPO Bull. *7* (*1*), 69-80 http://dx.doi.org/10.1111/j.1365-2338.1977.tb02408.x.

Rozsnyay, Zs., and Apostol, J. (2005). Breeding for sweet and sour cherry disease resistance in Hungary. Acta Hortic. *667*, 117-122 http://dx.doi.org/10.17660/ActaHortic.2005.667.15.

Sződi, Sz., Rozsnyay, Zs., Rózsa, E., and Turóczi, Gy. (2008). Susceptibility of sour cherry cultivars to isolates of *Monilia laxa* (Ehrenbergh) Saccardo et Voglino. Int. J. Hortic. Sci. *14* (*1-2*), 83-87.

Xu, X.M., and Robinson, J.D. (2000). Epidemiology of brown rot (*Monilinia fructigena*) on apple: infection of fruits by conidia. Plant Pathol. *49* (*2*), 201-206 http://dx.doi.org/10.1046/j.1365-3059.2000.00437.x.

Pyramiding of mu marker-assisted s

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Abstract

The durability of resi improvement. Regarding a gene *Rvi6* are commerciall selections is at least com commercial interest is still diffusion could be the *Rvi6* many European countries; order to pursue a durable the same genotypes has be breeding programs worldv resistant cultivars with ad of the Italian AGER Projec made among *Rvi6* resista carrying different resistan chosen according to their quality traits and good agr produced, and the MAS for and *Rvi4* have been started are going to be grafted fo agronomic performance.

Keywords: *Venturia inaequa*

INTRODUCTION

The main pathogen *inaequalis*) and a large nun Therefore, various environ impact apple crop sustainab

The introduction of species, is an alternative ap apple productions. To date, carrying the *Rvi6* (*Vf*) mono the last advanced selections their commercial interest is is also the resistance breaki et al., 1993; Roberts and Cr locus gives resistance to fi *inaequalis*. To date, in Italy t a recent survey in various E

Following the breakd have intensified the searc programs. The main altern *Rvi13* and *Rvi15* (names acc et al., 2011). Most of the

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