

Evaluation of Native Hybrids of *Prunus fruticosa* Pall. as Cherry Interstocks

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Abstract: Searching for growth reducing cherry rootstocks, researchers have produced and tested numerous hybrids of *Prunus fruticosa* Pall. Some of them have proved to be promising as dwarfing rootstocks in cherry growing. The native flora of Hungary is rich in native hybrids of *Prunus fruticosa* Pall. identified and described under different names, but this rich genetic diversity has never been evaluated and used as cherry rootstocks. A total of 25 native hybrids were identified in different locations of Hungary, clonally propagated and planted in the repository of our research station. Based on their phenotype characteristics they were identified as *Prunus* $\times$ *mohácsyana* Kárp., *P. eminens*, *Prunus* $\times$ *jávorkae* Kárp. (supposedly *P. fruticosa* $\times$ *P. mahaleb*) and *Prunus fruticosa* f. *aucta* Borb. Using the clones of the above mentioned hybrids as interstems, cherry trees of cultivar Sunburst were raised for field testing and planted into an orchard trial in spring 2000. The root of the trees was *Prunus mahaleb*. As control, Sunburst trees with Gisela 5 interstems were also planted. Growth of trees (trunk girth, canopy size), yield and fruit size were measured every year. Health status and incompatibility symptoms on trees and survival rate were also evaluated. Based on their growth, productivity and compatibility characteristics, three clones of *P. eminens* (3H, FV1 and KV2) and four clones of *P. x mohácsyana* Kárp. (3H, KV2, PZ2, PZ5) were selected for further evaluation as cherry rootstocks. We are aware that the selected interstems used later as rootstocks may differ in certain characteristics, but this pre-selection method seems to be a useful tool for selection in the hybrid screening stage.

Key words: incompatibility, interstock, screening trial, growth vigour, yield efficiency.

Introduction

The species *Prunus fruticosa* Pall. is utilized in several rootstock breeding projects (Cummins 1972, 1979; Plock 1973; Hein 1979; Gruppe 1985; De Palma *et al.*, 1996; Hrotkó 2004; Rozpara and Grzyb 2005). Searching for growth reducing cherry rootstocks, researchers produced and tested numerous hybrids. Some of them

proved to be promising dwarfing rootstocks in cherry growing, but with significant shortcomings, namely the variable compatibility, poor anchorage, severe trunk shrinking and virus sensitivity (Lang et al., 1998; Lankes et al., 2007). Also from the GiSelA series the *P. fruticosa* derivatives (GiSelA 1, and GiSelA 10) have been withdrawn (Walther and Franken-Bambenek 1998). The species *Prunus fruticosa* Pall. (Steppe or Ground Cherry, $2n=32$) is a small shrub, 30-50 cm high. In Central Europe its range overlaps with *P. avium* and *P. mahaleb*, allowing spontaneous hybridization in certain years (Kárpáti 1944; Wojcicki 1991; Hrotkó and Facsar 1996). The native flora of Hungary is rich in spontaneous hybrids of *Prunus fruticosa* Pall., identified and described under different names, but this rich genetic diversity has never been evaluated and used as cherry rootstocks. In different locations of Hungary, 25 native hybrids were identified, clonally propagated and planted in the repository of our research station. Based on their phenotype characteristics they were identified as *Prunus x mohácsyana* Kárp., *Prunus eminens*, *Prunus x jávorkae* Kárp. (supposedly *P. fruticosa* x *P. mahaleb*) and *Prunus fruticosa* f. *aucta* Borb. Planting interstem trees is a well-known technique in fruit production, but this practice has proved to be useful as rootstock preselection in field conditions (Hrotkó et al., 1998; Mielke and Sugar 2004). As the first-stage hybrid screening, interstem trees were produced and evaluated on growth, productivity and incompatibility symptoms.

Materials and Methods

Using the clones of the above mentioned hybrids as interstems, cherry trees of cultivar 'Sunburst' were grown for field testing and planted into an orchard trial in spring 2000. The root of the trees was *Prunus mahaleb*. As control, 'Sunburst' trees with Gisela 5 interstems were also planted. Trees were trained to spindle at a spacing of 4x2 m. Growth of trees (scion and interstem trunk girth, canopy size) and yield were measured each year, and fruit weight was measured in 2007. Health status and incompatibility symptoms on trees were also evaluated by general tree condition rating.

In the experimental orchard, the soil is sandy loam, with a high lime content (11.1%), low humus content (0.8%) and pH: 7.7. Mean meteorological characteristics in the last fifteen years are as follows: average yearly temperature is 11.3 °C, total sunshine is 2079 hours a year and rainfall is 560 mm year⁻¹.

Data are tabulated and statistically analyzed; means are separated using the Duncan's Multiple range test of Statgraphics software. The means differing significantly are displayed in tables using different letters.

Results and Discussion

Based on their trunk and canopy size, trees with various interstems were classified into four vigour groups: dwarf, semi dwarf, medium vigorous and vigorous. Largest TCSA of scion cultivar is produced with interstem *P. eminens* KV1. Compared to this, trees with Gisela 5 interstem as control showed 44% (semi dwarf) growth vigour, while the most dwarfing interstem was Prob (26%), which is a *P. fruticosa* f. *aucta* hybrid (Hrotkó and Facsar 1996; Hrotkó et al

1998). Interestingly, both CAB 11E and F 12/1 showed similar scion trunk thickness as trees with semi dwarf interstems. Tab. 1. shows data on the growth and productivity of promising interstem combinations. Based on the scion trunk cross sectional area, trees with *P. x mohácsyana* KV 2 and *P. x eminens* KV 2 are classified as vigorous, *P. x mohácsyana* 3H, PZ2, and *P. x eminens* 3H and FV1 as moderately vigorous interstems.

Table 1. Main characteristics of promising cherry hybrids as interstems

Interstem	Tree health 1-5	TCSA		Interstem girdling %	Four-year average yield		Fruit weight		Yield t/ha
		cm ²			kg/tree		2007		
Prob	2.1	51.49	a	67	8.07	a	10.2	ab	10.0
Gisela 5	3.6	87.02	abc	85	10.58	ab	11.6	abc	13.2
<i>P. x moh.</i> KV 2	4.4	186.47	h	50	19.67	de	10.9	abc	24.6
<i>P. x moh.</i> 3H	4.9	150.84	e-h	76	20.27	de	11.2	abc	25.3
<i>P. x moh.</i> PZ 5	3.9	128.56	c-g	45	20.44	de	11.8	bc	25.5
<i>P. x moh.</i> PZ 2	4.4	157.68	fgh	58	23.28	e	10.6	ab	29.1
<i>P. x emin.</i> 3H	4.3	152.03	e-h	75	19.14	de	10.3	ab	23.9
<i>P. x emin.</i> KV 2	4.4	187.63	h	52	20.50	de	12.1	bc	25.6
<i>P. x emin.</i> FV 1	4.9	168.79	gh	94	20.69	de	13.3	c	25.9

However, some of the promising interstems resulted in larger trunk cross sectional area (TCSA cm²) than those grafted with Gisela 5, but their canopy fitted well into the 4x2 m spacing. Although the scion trunk was thicker, there was no considerable difference in canopy size of trees compared to Gisela 5 interstem trees. The majority of interstems as part of the trunk showed shrinkage in interstem shank (Tab. 1), the girdling effect of interstem reaching 45%. The one exception is F 12/1, which produced swelling in interstem shank (34%).

Some interstem trees showed yellowish leaves and stunting growth, which we evaluated as symptoms of incompatibility. Their tree condition rating ranged from 0 to 3. Only those interstem combinations were evaluated as promising, of which the general tree condition resulted in a minimum rating 4 or higher.

Based on their growth, productivity (calculated yield t/ha) and compatibility characteristics, four clones of *P. x mohácsyana* Kárp. (KV2, 3H, PZ2, PZ5), and three clones of *P. eminens* (3H and FV 1 and KV 2) were selected for further evaluation as cherry rootstocks (Table 1). We are aware that the selected interstems may differ in certain characteristics during further usage as rootstocks, but this method seems to be useful as pre-selection in the hybrid screening stage. Further trials are planned to find an optimal propagation method for candidate hybrids, and also trials, where the hybrids are used as own rooted rootstocks.

References

- Cummins N.J. (1972) Vegetatively propagated selections of *Prunus fruticosa* as dwarfing stocks for cherry. *Fruit Var. Hort. Dig.*, 26, 76-79.
- Cummins J.N. (1979) Interspecific hybrids as rootstocks for cherries. *Fruit Var. J.*, 33, 85-89.
- De Palma, L, Palasciano M., Godini, A. (1996) Interspecific hybridization program aimed at obtaining dwarfing and non-suckering rootstocks for sweet cherry. *Acta Hort.*, 410, 177-181.
- Gruppe W. (1985) An overview of the cherry rootstock breeding program at Giessen. *Acta Hort.*, 169, 189-198.
- Hein K. (1979) Zwischenbericht über eine Prüfung der Steppenkirsche (*P. fruticosa*) und anderen Süsskirchenunterlagen und Unterlagenkombinationen. *Erwerbsobstbau*, 21, 219-219.
- Hrotkó K. (2004) Cherry rootstock breeding at the Department of Fruit Science, Budapest. *Acta Hort.*, 658, 491-495.
- Hrotkó K., Facsar G. (1996) Taxonomic classification of Hungarian populations of *Prunus fruticosa* (Pall.) Woronow hybrids. *Acta Hort.*, 410, 495-498.
- Hrotkó K., Magyar L., Simon G. (1998) Growth and productivity of sweet cherry interstem trees. *Acta Hort.*, 468. Vol.I, 353-362.
- Kárpáti Z. (1944) Vizsgálatok a hazai *Cerasus alnemizetségbe* tartozó hazai *Prunus*okon, *Bulletin of the Hungarian College for Horticulture and Vineculture, Budapest*, X., 66-80.
- Lang G., Howell W., Ophardt D. (1998) Sweet cherry rootstock/virus interactions. *Acta Hort.*, 468, 307-314.
- Lankes C. (2007) Testing of *Prunus* Rootstock Clones for Virus Tolerance. *Acta Hort.*, 732, 351-354.
- Mielke E.A., Sugar D. (2004) Pear cultivars used as interstem show promise after eight years in two Oregon locations. *Acta Hort.*, 658, 199-205.
- Plock H. (1973) Die Bedeutung der *Prunus fruticosa* Pall. als Zwergunterlage für Süss- und Sauerkirschen. *Mitt. Klosterneuburg.*, 23, 137-140.
- Rozpara E., Grzyb Z.S. (2005) Frutana – A New Interstock for Sweet Cherry Trees. *Acta Hort.*, 658, 247-250.
- Walther E., Franken-Bambenek S. (1998) Evaluation of interspecific cherry hybrids as rootstocks for sweet cherries. *Acta Hort.*, 468, 285-290.
- Wojcicki J.J. (1991) *Prunus x stacei* (Rosaceae), a new spontaneous hybrid of *P. fruticosa*, *P. cerasus* and *P. avium*. *Fragm. Flor. Geobot.*, 35 (1-2), 139-146.

OCENA DOMAĆIH HIBRIDA *Prunus fruticosa* Pall. KAO MEDJUPODLOGA ZA TREŠNJU I VIŠNJU

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Rezime

Istražujući krzljave podloge za trešnju i višnju, istraživači su stvorili i testirali brojne hibride *Prunus fruticosa* Pall. Neki od njih su se pokazali kao veoma perspektivne krzljave podloge za uzgoj trešnje i višnje. Lokalna flora Mađarske obiluje domaćim hibridima *Prunus fruticosa* Pall. utvrđenim i opisanim pod različitim imenima, ali ova velika genetska raznovrsnost nikada nije ocenjivana i korišćena kao podloge za trešnju i višnju. Utvrđeno je ukupno 25 domaćih hibrida na različitim lokacijama u Mađarskoj. Izvršeno je njihovo klonsko razmnožavanje i sadnja u našoj istraživačkoj stanici. Na osnovu njihovih fenotipskih karakteristika, određeni su kao *Prunus x mohácsyana* Kárp., *P. eminens*, *Prunus x jávorkae* Kárp. (verovatno *P. fruticosa* x *P. mahaleb*) i *Prunus fruticosa* f. *aucta* Borb. Sa klonovima pomenutih hibrida kao medjupodlogama, sadnice Sunburst sorte trešnje dobijene su za poljsko istraživanje i zasejane u oglednom voćnjaku u proleće 2000. Koren sadnica je *Prunus mahaleb*. Kao kontrola, upotrebljene su sadnice sorte Sunburst sa Gisela 5 kao medjupodlogom. Svake godine mereni su rast (obim debla, veličina krošnje), prinos i veličina ploda. Takođe su ocenjivani: zdravstveno stanje, simptomi nekompatibilnosti na sadnicama i broj odgajenih sadnica. Na osnovu rasta, rodnosti i kompatibilnosti, tri klona *P. eminens* (3H, FV1 i KV2) i četiri klona *P. x mohácsyana* Kárp. (3H, KV2, PZ2, PZ5) odabrana su kao podloge za trešnju i višnju za dalja ispitivanja. Jasno je da se odabrane medjupodloge upotrebljene kasnije kao podloge mogu razlikovati po nekim osobinama, ali ovaj metod predselekcije je korisno sredstvo za selekciju u fazi skrininga hibrida.