

## EVALUATION OF THE NOVEL BRED PERSIAN WALNUT GENOTYPES

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### Abstract

*The Persian walnut (*Juglans regia* L.) is the most important shell fruit species in Hungary. A double selected Persian walnut population was established to select some novel bred genotypes. The examined genotypes originated from the following combinations: 'Milotai 10' x 'Pedro', 'Pedro' x 'Alsószentiváni 117', 'Alsószentiváni 117 x Pedro' as well as selection from the local population. Significant differences in blooming time were found. All genotypes reached 32 mm in fruit diameter. Most of the fruit weight of the selected genotypes exceeded the results of 'Alsószentiváni 117'. Only two genotypes reached 50% in kernel rate. 11 genotypes reached 70% in creaking rate. Based on the results three genotypes (tree no. V/2/28-30, tree no. V/3/30-31 and tree no. BD6) were found, which had excellent values.*

**Key words:** walnut, phenology, breeding, progeny, Hungary.

### INTRODUCTION

There is a keen interest in Persian walnut (*Juglans regia* L.) production in Hungary, therefore the growing area of the country become three times larger than it was in 2001 (in 2001 the total walnut production area was 3 200 ha in Hungary, in 2018 it increased to 9 000 ha). With this large increase in orchard surface, was observed during the past 2 to 3 decades, the walnut stepped on the third place among the grown fruit species in Hungary. Parallel with the huge increase in the orchard surface the harvested yield doubled; in 2001 4 800 t dried shelled walnut was harvested, which will be reached 10 000 t dried nuts with shell in 2018 (HSO, 2003, 2018).

The Persian walnut breeding started at the Horticultural Research Institute under leadership of prof. Peter Szentiványi in 1950. The breeder chose the selection from the local population among the breeding methods, which resulted the following state-registered cultivars: Alsószentiváni 117, Milotai 10, Tiszacsécsi 83. Beside the selection from the local population, starting from the 1970s the cross breeding was used by the breeder. In the frame of this stage of the breeding the US-bred Pedro was involved to the breeding program as paternal parent. There was a big stress on the following breeding aims late leafing out time, big yield on

the lateral buds as well as good fruit quality (at least 32 mm in diameter, light shell colour, smooth shell surface, light kernel, 40% in kernel rate, good taste) during the breeding work. In this stage of the breeding Milotai bőtermő, Milotai kései®, Milotai intenzív, Bonifác® and Alsószentiváni kései® were realised on the National Variety List (Bujdosó et al., 2010/a; Bujdosó and Szentiványi, 2014). In Hungary the walnut growers use Hungarian bred cultivars mostly. The Milotai 10 and the Alsószentiváni 117 cultivars dominate in the production, which growing rates are 57% as well as 23% (HSO, 2018). The Hungarian bred cultivars are grown not just in the Hungarian production, but they play an important role in Southern part of Slovakia, Transcarpatia region of Ukraine, Transylvania province of Romania, Vojvodina province of Republic of Serbia, Northern part of Croatia and Slovenia, together with Eastern part of Austria. Furthermore, the Hungarian-bred cultivars have dominate role in the Persian walnut growing of Bulgaria, Georgia and Baden-Württemberg Federal State of Germany.

The Hungarian bred walnut cultivars have a unique genetic background derived from the Carpathian race (Ebrahimi et al., 2017), it is characteristics for them the early ripening time, large fruit size, good fruit characteristics (Kónya et al., 2015; Bujdosó et al., 2018) as

well as good inner content value (Bujdosó et al., 2010/b, 2014, 2016, 2019) and good frost resistant and winter hardiness (Szügyi-Bartha et al., 2016, 2018, 2019).

Aim of this paper is to introduce the Persian walnut breeding activities at NARIC Research Institute for Fruit growing and Ornamentals.

## MATERIALS AND METHODS

The Experimental Orchard, is located at the Experimental Fields of the Research Institute in Érd-Elvira major, contains a double selected walnut population. The genotypes are mostly from Milotai 10 x Pedro, Alsószentiváni 117 x Pedro, and Pedro x Alsószentiváni 117 crossings, but there are some selected genotypes from the local population in the progeny. All genotypes were planted in spring of 1997, the planting distance is 5 m in the row, and 10 m between the rows.

The trial was planted on chernozem soil with high lime content (compactness index KA=40, pH=8, total lime content in the top 60 cm layer 5%, humus content 2.3-2.5%). Site conditions were the following between 1970 and 2017: average yearly temperature: 10.7°C; average during the growing season: 16.6°C; the average yearly sunny hours: 1981 hours; average yearly precipitation: 515 mm (Szűcs, 2018).

Data were collected about the leafing out time, blooming time, blooming characteristics, ripening time, fruit quality, kernel rate and cracking rate of the genotypes between 2012 and 2017. Those data were compared to Milotai 10 and Alsószentiváni 117, like the most grown cultivars in the Hungarian production. Starting of the leafing out time meant, when the terminal bud reached to 2.5 cm; the end of the

leafing out time was on that day, when the leaves, developed from the terminal buds, become full-grown. That day was recorded as starting of catkins, when those started to expand, finishing this phenological stage with their drying out. In the case of the female flowers we started to record the blossom, when those appeared on the top of the young shoots. Drying of the pistil meant the end of this stage. The data collection was made three times weekly. The ripening time started to record, when at least 50% of the husks were open.

During the ripening fruit sample was collected and dried to 10 to 12% moisture content. After drying the samples were stored at +8 degrees C in a dark room till evaluation of the samples.

During evaluation of the samples the fruit diameter was measured, the fruits were weighted and were cracked to check the kernel weight. The kernel ratio was calculated as quotient of kernel weight and the whole fruit weight.

The cracking rate was scored as quotient of „halves” and the whole kernel weight. Together with the evaluation of the fruits color examination of the shell was done using Konica Minolta Croma Meter CR-400 (Konica Minolta, Japan). Based on the results the three promising genotypes were selected; V/1/26-28 (Milotai 10 x Pedro), V/3/30-31 (Pedro x Alsószentiváni 117) hybrid genotypes and the selected BD6.

## RESULTS AND DISCUSSIONS

Leafing out times of the selected three genotypes were at the same time, like the control cultivars (Figure 1).

No. of trees	March			April										May		
	25	27	31	2	4	7	9	11	14	17	23	28	30	5	7	12
<b>V/2/26-28</b>																
<b>V/3/30-31</b>																
<b>BD6</b>																
<b>Milotai 10</b>																
<b>Alsószentiváni 117</b>																

Figure 1. Leafing out time of the selected walnut genotypes and control cultivars (2012-2017)

Blooming time of the selected genotypes was the same like the control cultivars, but they had different blooming habit. However the control cultivars had proterandric blooming, the selected genotypes were protogynic.

There was difference in the ratio of homogamy, ratio of homogamy on the selected genotypes was shorter compared to the control combination (Figure 2).

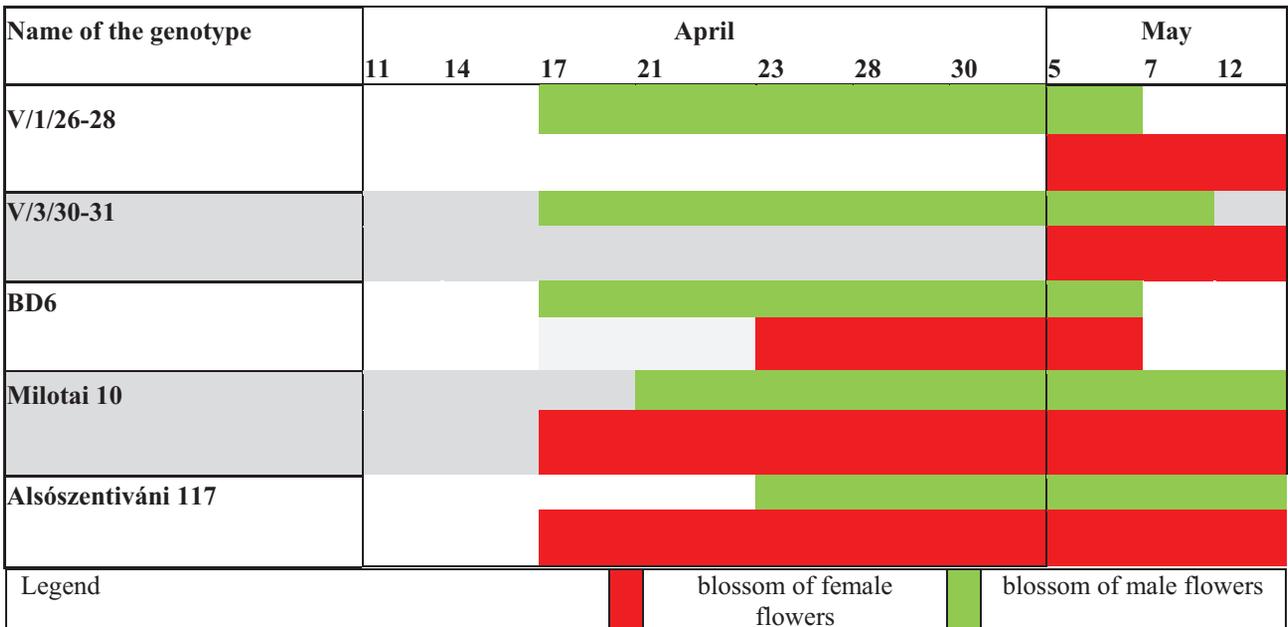


Figure 2. Blooming time of the selected genotypes and control cultivars (2012-2017)

Ripening time in the Persian walnut growing become an important character during the past time, because the early appearance on the market is more important. All three genotypes

had earlier ripening time compared to the control cultivars, so the genotypes suit to this criterion (Figure 3).

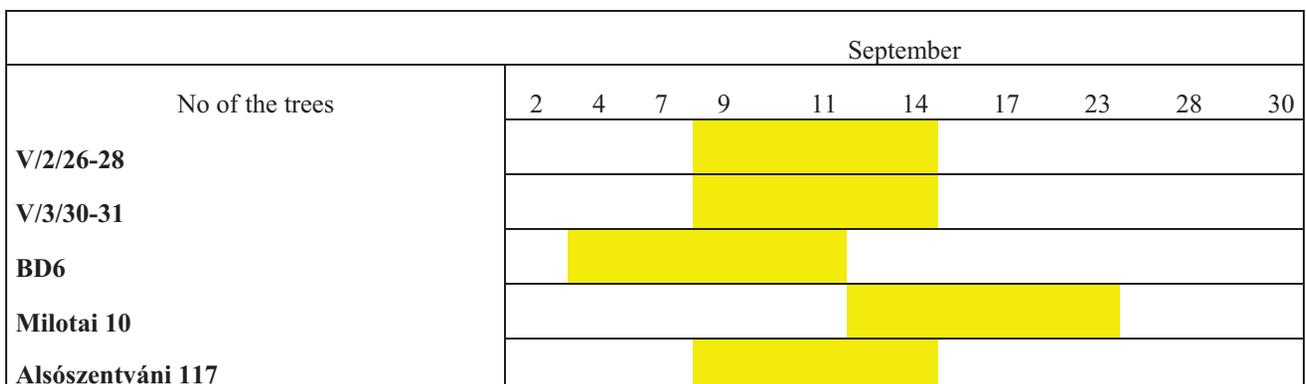


Figure 3. Ripening time of the selected genotypes and control cultivars (2012-2017)

In the point of view of the fruit diameter the 32 mm in diameter is the lower border of the first grade fruits. It is characteristics for the genotypes derived from the Carpathian race to

reach this fruit size among non-irrigated conditions. All genotypes during the selection reached the lower border of the premium fruit size category without irrigation (Figure 4).

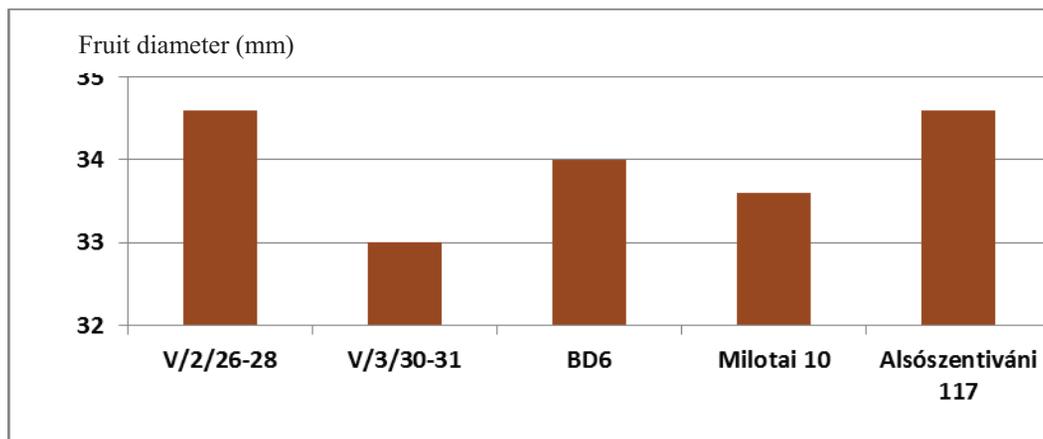


Figure 4. Fruit diameter of the selected genotypes and control cultivars (2012-2017)

Based on our experience, if the kernel ratio of a genotype reaches at least 40%, that genotype can be grown on profitable level in the

commercial orchards. Except V/2/26-28 genotype, all genotypes reached this border among non-irrigated conditions (Figure 5).

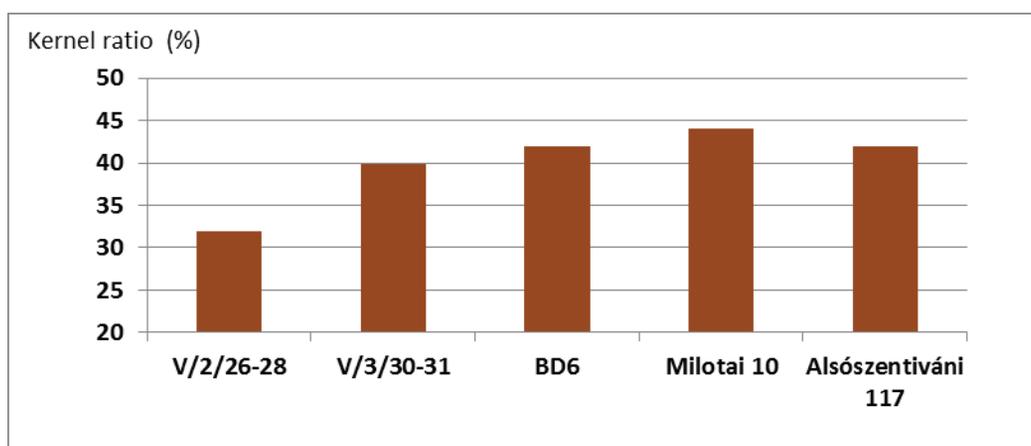


Figure 5. Kernel ratio of the selected genotypes and the control cultivars (2012-2017)

It is important to know the cracking rate, especially selling the walnut in kernel, because this character shows the “halves” after cracking. Cracking rate of all selected genotypes exceeded 70% (Figure 6).

The shell having light colour can be sold easily and on high price. As on the Figure 7 can be seen all selected genotypes’ shell colour were similar to the Milotai 10 control cultivar during the instrumental examination.

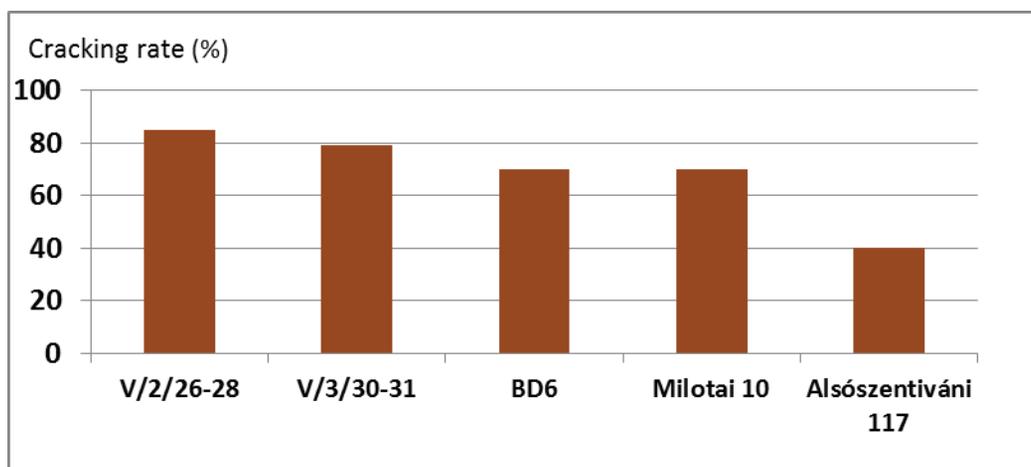


Figure 6. Cracking rate of selected genotypes and control cultivars (2012-2017)

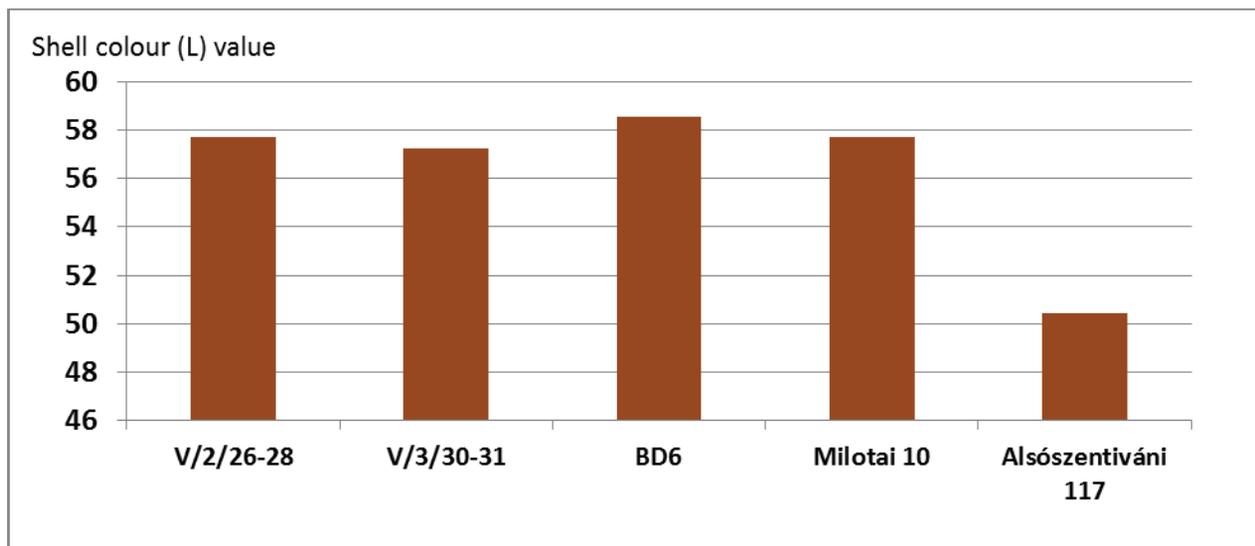


Figure 7. L values of the shell of the selected genotypes and control cultivars (2012-2017)

## CONCLUSIONS

On the grounds of current results all three selected genotypes are promising for the production.

Their value is increased by the walnut harvest season. Early harvest as well as early appearance on the market is a unique value of the Hungarian Persian walnut growing.

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