FOLIA OECOLOGICA – vol. 38, no. 2 (2011). ISSN 1336-5266

Effect of fruit size, parental trees origin and trial conditions on the growth characteristics of European chestnut seedlings

Milan Bolvanský[1], Martin Užík[2]

[1]Branch for Woody Plants Biology Institute of Forest Ecology, Slovak Academy of Sciences, Akademická 2, 949 01 Nitra, Slovak Republic, E-mail: milan.bolvansky@savzv.sk,
[2]Research Institute of Plant Production, Bratislavská 122, 921 68 Piešťany, Slovak Republic, E-mail: uzik@vurv.sk

Abstract

Bolvanský, M., Užík, M. 2011. Effect of fruit size, parental trees origin and trial conditions on the growth characteristics of European chestnut seedlings. *Folia oecol*., 38: 146–155.

In the spring of 2005, a field trial was established in forest nursery Hladomer, near community Lovce, Slovakia with the aim to find out an effect of different origin of fruits on growth characteristics of seedlings. Fruits were collected from twelve half-sib families of European chestnut, grown at an experimental plot in Horné Lefantovce. All studied families originated from old trees grown at four different localities of Slovakia (three half-sib families per locality) and exhibited above-average growth characteristics among all of 120 progenies grown at the experimental plot. Variability of growth characteristics (stem height and stem diameter) of both one- and two-year-old seedlings was significantly affected by their origin (locality of parental tree and half-sib family derived from these trees) and by different nut size used in three trial replications. In three of four studied origins, non significant differences in stem height of one-year-old seedlings between second and third replications changed to significant ones in two-year-old seedlings. These differences were assigned to different light and soil conditions on two trial blocks caused by partial shading of first and second trial blocks. Between weight of fruits and studied growth characteristics either low correlations (for data of individual fruits) or medium strong correlations (data grouped by fruit groups of different weight) were observed. Correlation between stem height means of families and stem height means of one-year-old and/or two-year-old seedlings derived from these progenies was only medium strong (r = 0.52 and 0.54) however similar inter-generation in stem diameter was very low and nonsignificant.

Key words

Castanea sativa Mill., correlation, half-sib families, seedlings, stem diameter, stem height, variability

Introduction

Although in the Slovak Republic the European chestnut is known rather as fruit tree, total area of chestnut orchards, in majority composed of old trees of seed origin, is only about 130 ha including some 30 ha of relatively young chestnut plantations established 30 to 40 years ago. Just at that time also the more intensive exploitation of chestnut in forestry begun by establishing plantations of different large area (from 1 to 20 ha) situated within indigenous forest stands or in open land. Young chestnut stands, at age up to 20 years, represent the largest proportion of chestnut plantation area in our country (about 75% of total 1,400 ha). This increased interest for chestnut resulted from favourable ecological-production characteristics observed in this species in the area of its distribution in Slovakia (high growth increment, good wood properties, intensive decomposition of litter, favourable influence on accompanying tree species, good natural regeneration). Simultaneously with chestnut plantations for forest purposes, also several experimental plots in pure and mixed chestnut

stands respectively were established to study stand, production and some bio-ecological characteristics in relation to thinning interventions and species mixture. The obtained results suggested a rather good growth and production characteristics of young pure and also mixed chestnut stands (Tokár, 1985; Tokár, 1990; Tokár, 1992; Tokár, 1994; Tokár, 1999).

In addition to the mixed seed lots from old chestnut stands also seed samples from single old chestnut trees from different sites of Slovakia were used to establish experimental plots with pure chestnut stands at the experimental site Horné Lefantovce in 1965 and 1969. This method was applied in order to find a suitable source of seed for establishing future chestnut stands, with good quality timber production. Since the age of 10 years the stands of half-sib-families were periodically in five-year intervals evaluated for production and ecological parameters (basal area, stand volume, aboveground biomass, leaf area index etc.) in relation to social classes and thinning interventions. The significant differences among stands of different families in most of production characteristics observed during first evaluation were observed also in subsequent periodical evaluations (Benčať and Tokár, 1979, 1980; Benčať and Golha, 1980; Benčať and Tokár, 1984; Tokár, 1996; Tokár and Bolvanský, 2002; Tokár, 2003).

The main objective of this work has been to test capability of the selected half-sib families of European chestnut to reproduce their above average growth potential by seed. Particularly stem height and stem diameter of one-year-old and two-year-old seedlings were studied in relation to: a) seed size, b) affiliation to different half-sib family and c) different environmental conditions at the experimental plot.

Material and methods

Study site

Experimental plot with the chestnut seedlings was established in the Nursery center Hladomer near of the village Lovce. This nursery belongs under national company Forests of Slovak Republic, enterprise Semenoles Liptovský Hrádok. It is situated at altitude 310 m a.s.l., in the south part of Tribeč Mts (48°26'41" N, 18°20'15" E). Soil in the forest nursery is clayey and in the part with our experiment has pH 7.2, content of phosphorus 233 mg, potassium 231 mg and magnesium 295 mg per 1 kg of dry soil.

Plant material

On the experimental plots in Castanetarium Lefantovce twelve half-sib families of European chestnut exhibiting above average parameters of growth characteristics were selected in order to collect fruits for growing seedlings. The selected progenies were derived from 12old mother trees grown on four different localities of Slovakia, 3 trees from each locality (Jelenec, Horné Lefantovce, Tlstý Vrch and Duchonka). At the time of fruit fall in 2004, about 150 fruits were randomly collected under trees of each progeny. Out of this amount 90 fruits were detached and divided to three groups per 30 nuts. The first group contained nuts with relatively large size and remaining two groups medium-sized and small-sized nuts respectively. Sorting was done visually. Nuts in each group were labeled with white permanent marker with numbers from 1 to 30 and individually weighted. Then the sorted fruits and remaining fruits were stored in plastic bags in refrigerator at the temperature of about 5 °C. During the storage, in one month intervals, the nuts were checked for their health condition and those damaged and spoiled by fungi and chestnut weevil larvae were discarded and replaced by healthy weighted nuts of similar size labeled with the same number as discarded nuts.

Nuts of each size-group from all 12 families were sown separately in three randomized blocks in forest nursery Hladomer. Because of space restrictions, experimental plot was of atypical, protruded rectangular shape (1.4 m × 28 m) and was congruent with the shape of beds used in this nursery. Nuts of each progeny were seeded in rows with 20 cm between rows and 15 cm within row. Number of germinated seedlings per progeny varied from 57 to 82.

In late autumn 2005 and early spring 2007, during dormancy period, in all seedlings grown from planted seed, stem height and stem diameter at the base were measured. Stem height was measured in cm with accuracy of 0.5 cm and stem diameter in mm with accuracy of 0.01 mm (by electronic sliding gauge).

Data analysis

Morphometric data of studied chestnut seedlings were subjected to computing of descriptive statistics, multifactor analysis of variance – General Linear Model, correlation analysis (Pearsons coefficients) and regression analysis. Stem height and stem diameter means for different origins were compared using Bonferroni's Multiple comparison procedure with construction of intervals for all means. Consequently in the Multiple Range Tests these intervals were used to determine which means are significantly different from which others. Computing was carried by statistic program package STATGRAPHIC PLUS 5 for Windows.

Results and discussion

Variability of fruit size

Analysis of variance proved significant effect of visual sorting fruits to three size groups (Table 1). However only first group of fruits was of significantly higher

weight and remaining two fruit groups did not differed significantly. Total weight of 12 lots of fruits from different families in each group was 1,586, 1,392 and 1,367 g respectively. Particular families and different origins also significantly affected weight of fruits. While analyzing variability separately for particular origin (locality) effect of both families and fruit groups showed to be significant except of family effect in Duchonka origin (Fig. 1). Differences in progeny means of fruit weight within the particular origin were the highest in Tlstý Vrch origin. Fruits collected from progeny TV 2 were 1.7-times bigger than fruits from progeny TV 8 and were the biggest among fruits of all twelve families (Table 2). This finding is interesting in relation to the size of fruits produced by mother tree TV 2 grown at locality Tlstý Vrch. Namely these fruits used to be in average for six years two-times smaller than those produced by mother tree TV 8 (Bolvanský, 1988). The second highest difference in fruit weight among families was observed in Horné Lefantovce origin. Fruits from progeny HL A were in average 1.4-times bigger than those of HL 17. Also 1-year-old and 2-year-old seedlings grown from fruits of TV 2 and HL A progenies were higher than seedlings from fruits of progenies TV 8 and HL 17. Similar finding was reported earlier by Benčať and Tokár (1972), who pointed at the higher height of seedlings derived from fruits collected from mother tree TV 2 in spite of fact the fruits were of small size.

Variability of growth characteristics of seedlings

Variability of stem height and stem diameter of 1-year-old and 2-year-old seedlings was significantly affected by all assumed sources of variations – fruit group, origin, progeny within origin (Tables 3 and 4).

Table 1. Results of analysis of variance for weight of fruits collected from 12 progenies of four different origins and used for growing seedlings

Source	Sum of squares	Df	Mean square	F-ratio	P-value
Fruit group	64.861	2	32.431	19.96	0.0000
Origin	32.997	3	10.999	6.77	0.0002
Progeny (origin)	294.241	8	36.780	22.64	0.0000
Residual	1322.6	814	1.6248		
Total (corrected)	1723.13	827			

Table 2. Progeny and origin means and standard errors (SE) of fruit weight in fruits used for growing seedlings

Origin	Progeny	n	Fruit weight [g]	
			Mean	SE
Tlstý Vrch	TV 2	59	5.29 a	0.19
	TV 8	79	3.05 b	0.11
	TV 9	73	3.42 b	0.10
	Total	211	3.80 A	0.10
Horné Lefantovce	HL A	67	4.87 a	0.15
	HL 17	73	3.38 b	0.15
	HL 18	73	3.70 b	0.10
	Total	213	3.96 A	0.09
Duchonka	D 3	64	4.28 a	0.21
	D 5	64	3.80 a	0.20
	D 13	57	3.85 a	0.25
	Total	185	3.98 A	0.13
Jelenec	J 20	61	4.49 ab	0.17
	J 50	82	4.19 a	0.12
	J 11	76	4.65 b	0.15
	Total	219	4.43 A	0.08

Different small letters in column within an origin indicate significant differences ($P \leq 0.05$) between progeny means and different capital letters significant differences between origin means.

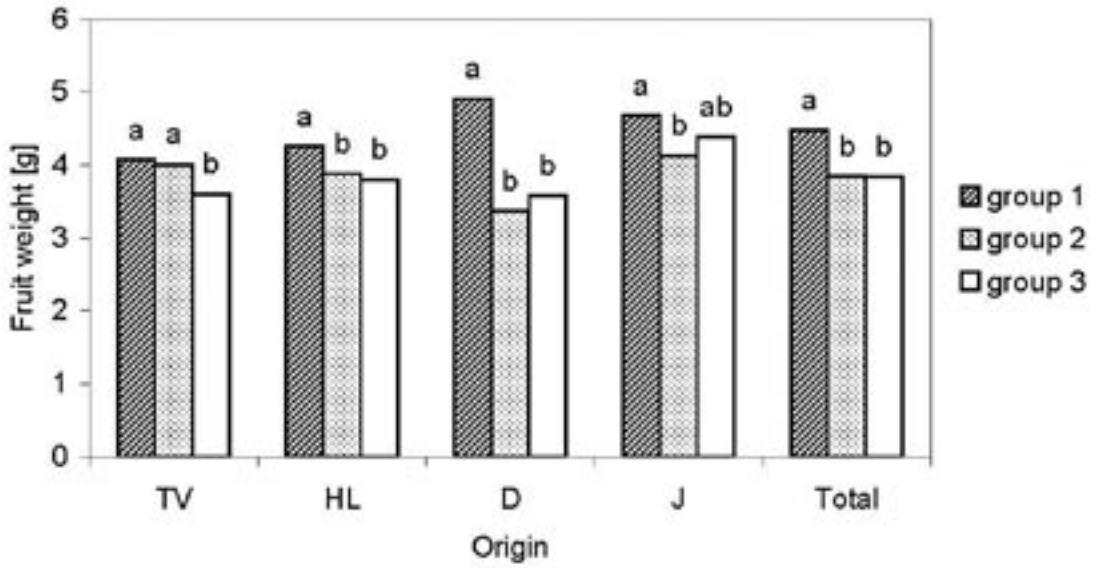

Fig. 1. Mean fruit weight of three fruit groups originated from open pollinated families of different origin (TV, Tlstý Vrch; HL, Horné Lefantovce; D, Duchonka; J, Jelenec). Different letters above columns within single origin indicate significant differences between means.

Table 3. Results of analysis of variance for stem height of 1-year-old and 2-year-old chestnut seedlings derived from 12 halfsib families of four different origins

Source	Df	1-year-old seedlings			2-year-old seedlings		
		Mean square	F-ratio	P-value	Mean square	F-ratio	P-value
Fruit group	2	1,628.4	58.94	0.0000	2,6405.00	111.17	0.0000
Origin	3	424.784	15.37	0.0000	3,949.05	16.63	0.0000
Progeny (origin)	8	219.347	7.94	0.0000	1,540.08	6.48	0.0000
Residual	814	27.6297			237.52		
Total (corrected)	827						

Table 4. Results of analysis of variance for stem diameter of 1-year-old and 2-year-old chestnut seedlings derived from 12 half-sib families of four different origins

Source	Df	1-year-old seedlings			2-year-old seedlings		
		Mean square	F-ratio	P-value	Mean square	F-ratio	P-value
Fruit group	2	11.0985	7.66	0.0005	133.729	14.35	0.0000
Origin	3	22.1547	15.28	0.0000	74.7451	8.02	0.0000
Progeny (origin)	8	9.3032	6.42	0.0000	59.0676	6.34	0.0000
Residual	814	1.4495			9.3208		
Total (corrected)	827						

Significantly the highest growth of 1-year-old and 2-year-old seedlings was observed in the block where the fruits of first fruit group were planted. 1-year-old seedlings in the second block and in the third block did not differed significantly. These differences are in accord with differences in weight among fruit groups. However the stem height in 2-year-old seedlings was significantly lower in third block than in the second one. The reason of this growth differentiation was apparently in different environmental conditions in particular blocks of experimental plot. While the first block and a part of the second block replication were afternoon under the shade of trees grown about 7 meters far of the plot margin, another part of block 2 and whole block 3 were without any shading during day. The positive effect of shading on seedling growth could be mediated indirectly through the higher soil humidity in the shaded parts.

Our results are partially in accord with those reported by Anagnostakis (2007) who observed that American chestnut (*Castanea dentata*) seedlings grown for three seasons in full sun or under a shade tent (65% shade) were larger, and fewer died from winter injury in the shade. However in another experiment started with 10 day-old germinants of American chestnut under irradiance reduced to 35, 15, and 5% of full sunlight the results after two months where rather different. The height and diameter of seedlings decreased with decreasing irradiance (et al., 2006). In both experiments the seedlings were watered on an as need basis. Cork oak (*Quercus suber* L.) seedlings grown during their first growing period under different shade levels showed increasing stem height with decreasing light, which was significantly higher only at 5% of photosynthetic active radiation. At this radiation level the collar diameter of seedlings was twice lower than at the remaining treatments (100%, 50% and 21% of lighting). It was observed that lower reduction of lighting did not significantly affect either stem height or root collar diameter (Cardillo and Bernal, 2006).

From breeding and silvicultural point of view the most important showed to be significant effect of origin and progenies within origin on growth characteristics of studied seedlings. Significantly the highest in both years and thickest in the second year were the seedlings of Horné Lefantovce origin. This was due to the very good growth performance of seedlings derived from HL A half-sib family. These seedlings were the highest and thickest among all 12 progenies studied (Table 5). On the contrary the lowest stem height and lowest stem diameter of seedlings of Duchonka origin was due to the lowest stem height of seedlings derived from D 5 half-sib family and the lowest stem diameter of seedlings coming from D 3 half-sib family.

Effect of fruit size on growth characteristics of seedlings

Correlation coefficients calculated between fruit weight and stem height and stem diameter of 1-year-old and 2-year-old seedlings based on progeny means and fruit group means pointed at medium strong correlation especially in 1-year-old seedlings (Table 6). Correlation coefficients calculated from basic data of fruit weight, stem height and stem diameter grouped by individual progenies differed markedly between families of the same origin and suggested none to medium strong correlation between fruit size and growth characteristics of seedlings (Table 7). The lowest correlation coefficients (r = 0.0095–0.1368) were calculated for fruits and seedlings from family TV 2, which produced the largest fruits within origin Tlstý Vrch and also among all 12

Table 5. Progeny and origin means and standard errors (SE) of stem height and stem diameter of 1-year-old and 2-year-old seedlings derived from fruits collected in 12 different families

Origin	Progeny	n	Stem height [cm]				Stem diameter [mm]			
			1-year-old		2-year-old		1-year-old		2-year-old	
			Mean	SE	Mean	SE	Mean	SE	Mean	SE
Tlstý Vrch	TV 2	59	12.47 a	0.85	37.73 a	2.21	4.50 a	0.14	11.11 a	0.41
	TV 8	79	10.23 b	0.56	35.53 a	2.00	4.13 b	0.13	10.51 a	0.32
	TV 9	73	11.78 b	0.50	37.85 a	1.70	4.53 a	0.13	11.06 a	0.33
	Total	211	11.39 C	0.37	36.95 C	1.13	4.37 B	0.08	10.87 B	0.20
Horné Lefantovce	HL A	67	17.34 a	1.09	53.66 a	2.50	5.50 a	0.17	13.90 a	0.40
	HL 17	73	10.99 c	0.64	38.82 c	2.27	4.33 b	0.14	10.72 c	0.37
	HL 18	73	13.36 b	0.89	46.44 b	2.27	4.45 b	0.17	11.99 b	0.39
	Total	213	13.80 A	0.54	46.10 A	1.49	4.74 A	0.10	12.16 A	0.24
Duchonka	D 3	64	11.00 a	0.39	38.89 a	1.81	4.00 a	0.12	10.62 a	0.33
	D 5	64	9.54 b	0.35	32.22 b	1.44	4.22 a	0.14	11.54 a	0.40
	D 13	57	11.05 a	0.51	40.25 a	2.72	4.11 a	0.13	11.24 a	0.45
	Total	185	10.51 C	0.24	37.00 BC	1.18	4.11 C	0.08	11.13 B	0.23
Jelenec	J 20	61	12.91 a	0.82	38.13 b	2.15	4.56 b	0.16	11.07 b	0.40
	J 50	82	13.48 a	0.69	44.14 a	1.61	4.94 ab	0.14	12.22 a	0.36
	J 11	76	12.25 a	0.42	39.11 b	1.80	5.01 a	0.15	12.24 a	0.35
	Total	219	12.90 B	0.37	40.72 B	1.06	4.86 A	0.09	11.91 A	0.22

Different small letters in columns within each origin indicate significant differences ($P \leq 0.05$) between progeny means and different capital letters in columns show significant differences between origin means.

families studied. Also relatively the largest fruits within origin Duchonka from the family D 3 gave emerged the seedlings, which stem height and stem diameter also did not correlate with fruit weight (r = 0.0226–0.2012). On the contrary families which produced fruits of lower size resulted to the stronger correlation between fruit weight and growth characteristics.

Correlation between basic data of fruit weight and growth characteristics of seedlings differed also when calculated by the fruit groups or by blocks. While in blocks 1 and 2 no or very low correlation was observed (0.097–0.296) in replication 3 correlation coefficients were higher (0.44–0.63) and pointed at medium strong relationship. Seedlings in the block 3 were in the first year of the same height like seedlings in the block 2 and only in the second year were lower (Fig. 2). Seedlings of both blocks were derived from the groups of fruits with the same weight so the height of seedlings in block 3 might be affected by environmental conditions or interaction progenies × environment (low soil humidity in this place). This suggests that under less favourable soil conditions growth of seedlings depends more on fruit size than in more favourable conditions. Here, apparently the real growth potential of seed can be manifested. Medium strong correlation between fruit weight and growth of 1-year-old and 2-year-old chestnut seedlings grown from these fruits was observed also in previous studies (Tokár and Benčať, 1972). In this case, strength of correlation varied significantly by year and by individual mother trees. Even in six year-old seedlings, a positive effect of fruit weight on height of the seedlings was observed (Benčať and Tokár, 1979).

Table 6. Correlation coefficients between fruit weight and growth characteristics (stem height and stem diameter) of 1-year-old and 2-years-old seedlings grown from these fruits. Entry data were progeny means, nut group means within origin and within progeny. Number of matched data is displayed in parentheses

		Stem height		Stem diameter	
		1-year	2-year	1-year	2-year
Fruit weight	Progeny means (n = 12)	0.5574*	0.3290	0.5327	0.4670
	Nut group means within origin (n = 12)	0.4087	0.5119	0.2998	0.6160*
	Nut group means within progeny (n = 36)	0.5148	0.4534	0.4489	0.5493

*significant at P = 0.05.

Table 7. Correlation coefficients between basic data of fruit weight and stem height and stem diameter of 1-year-old and 2-years-old seedlings grown from these fruits calculated by progenies, replications and in total

Name of data set / (sample size)	1-year-old seedlings		2-year-old seedlings	
	Fruit weight correlated with		Fruit weight correlated with	
	Stem height	Stem diameter	Stem height	Stem diameter
TV 2 (59)	0.1368	0.0818	0.0095	0.0805
TV 8 (79)	0.3840**	0.2561*	0.3618**	0.3042**
TV 9 (73)	0.4122**	0.1222	0.2755*	0.3478**
HLA (67)	0.2881*	0.3279**	0.3032*	0.3840**
HL 17 (73)	0.4771**	0.3715**	0.4031**	0.2842*
HL 18 (73)	0.2775*	0.2413*	0.2775*	0.2588*
D 3 (64)	0.1075	0.1075	0.2012	0.0226
D 5 (64)	0.6085**	0.450**	0.5888**	0.5490**
D 13 (57)	0.2733*	0.2575	0.4198**	0.3440**
J 20 (61)	0.3741*	0.4493**	0.2791*	0.3313**
J 50 (82)	0.3872**	0.5149**	0.2380*	0.2866**
J 11 (76)	0.409**	0.4464**	0.2799*	0.5402**
1st nut group (283)	0.2833**	0.2960**	0.2603**	0.2668**
2nd nut group (293)	0.1180*	0.1726*	0.0970	0.1662*
3rd nut group (252)	0.6251**	0.5403**	0.4448**	0.5074**
Total (828)	0.3330**	0.3279**	0.2962**	0.3252**

*and **significant at P = 0.05 and P = 0.01.

Small fruits of some trees produced more vigorous seedlings than bigger fruits of other trees. Seiwa et al. (2002) observed that stem height of one-year-old *Castanea crenata* seedlings was significantly affected by sowing depth but not by nut size. In the optimal depth (5 cm), there was little difference in the seedling height among nut-size classes although seedling biomass was dependant on nut size.

Differences in the growth of seedlings emerging from seeds of different sizes within a species have been little studied in woody plant species. Gupta et al. (1983) (studying *Leucaena leucocephala*) and Negi and Todaria (1997) (studying *Acer oblongum, Kydia calyciana, Terminalia tomentosa, Terminalia bellerica* and *Terminalia chebula*) reported faster growth in seedlings produced from large seeds. Khurana and Singh (2000) observed that seedlings from large seeds were taller and heavier, had a greater leaf area and were more tolerant of long-term extreme water stress compared to those from smaller seeds. Larger seeds have the ability to store greater amounts of carbohydrate in their endosperm or cotyledons than small seeds. This may

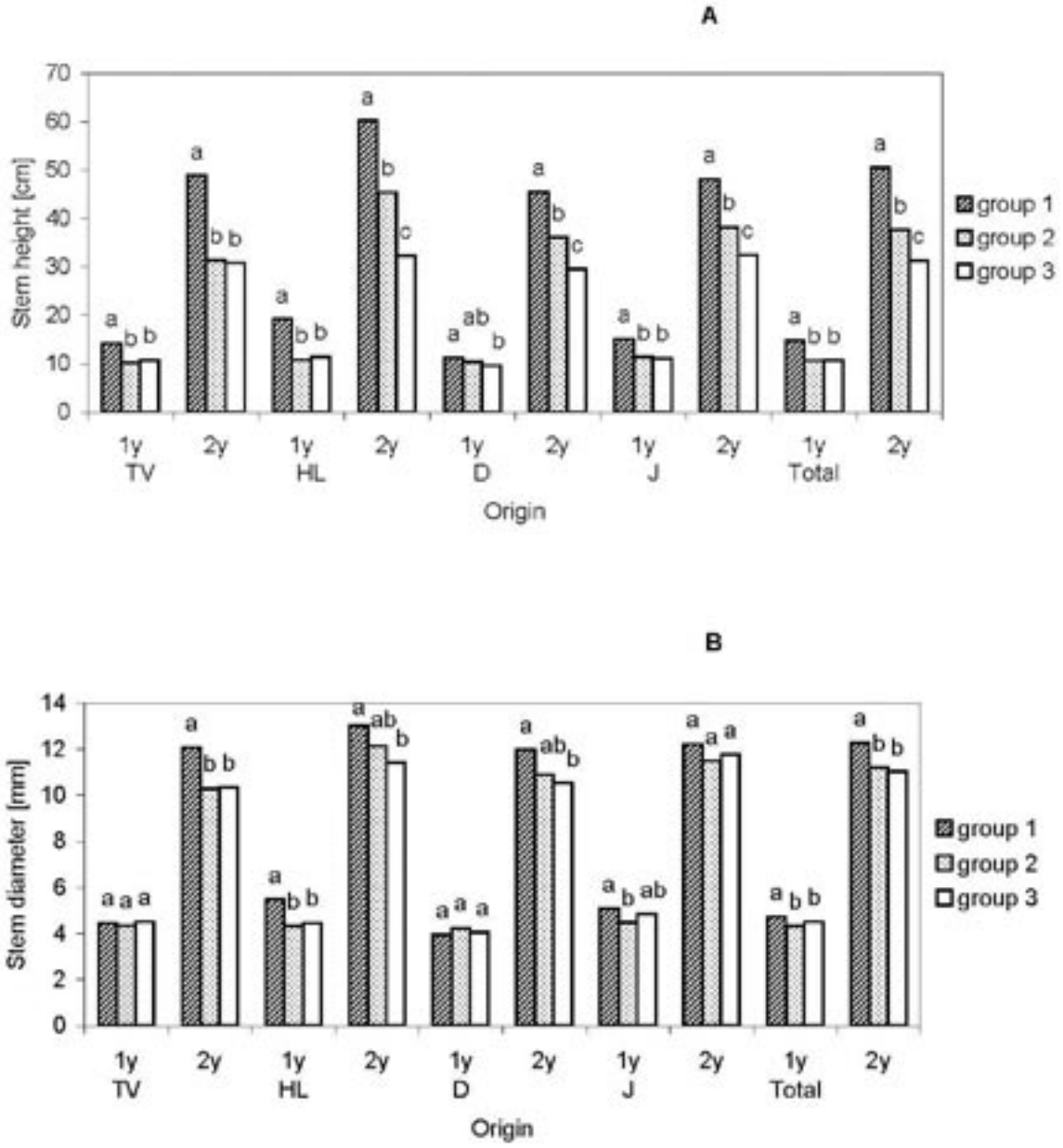

Fig. 2. Mean stem height (A) and stem diameter (B) of one-year-old (1y) and two-year-old (2y) chestnut seedlings by their origin (TV, Tlstý Vrch; HL, Horné Lefantovce; D, Duchonka; J, Jelenec) and by fruit groups. Different letters above columns within single origin and single year indicate significant differences between means.

enable early development of an enlarged resource gathering system (root or photosynthetic tissue) to produce a faster growing plant (Hewitt, 1998).

Correlations between growth characteristics of seedlings

Inter-annual correlation coefficients between stem heights and between stem diameters of one-year-old and two-year-old seedlings by individual families suggest that annual growth increments of seedlings nearly in all progenies reflected growth performance demonstrated in the first year (Table 8). Correlation coefficients for stem heights varied from 0.56 in TV 9 to 0.79 in HL 18 family and for stem diameter from 0.39 in TV 9 to 0.75 in J 20 family. Inter-annual correlations between heights and between diameters were stronger when progeny means of both growth characteristics were correlated (for heights r = 0.9147 and for diameters r = 0.8826) (Table 9). Similarly also inter-annual correlations between progeny means of stem heights of 1-year-old and stem diameter of 2-year-old seedlings and vice versa were of rather high value (0.834 and 0.702).

Inter-generation correlations between two growth characteristics of 1-year-old and 2-year-old seedlings and similar characteristics of 35-year-old seedlings belonging to 12 different progenies suggested only medium strong correlation between heights but no correlation between diameters (Table 8). However, also inter-generation correlations between heights were statistically not significant because of low number of correlated data.

In case the higher number of progenies would be involved into study the stronger inter-generation correlations could be expected. Namely evaluation of growth characteristics of F 1 progenies was apparently biased by several factors affecting to a different degree growth and vitality of trees on individual experimental plots. For instance, in some plots number of trees was during last ten years drastically reduced due to the mortality caused by fungal diseases mainly by *Phytophtora* ssp. and partially also by *Cryphonectria parasitica* (Tokár

Table 8. Correlation coefficients between basic data of stem heights and stem diameters of 1-year-old (1y) and 2-year-old (2y) seedlings by individual progenies

Origin	Progeny	n	Heights 1y – 2y	Diameters 1y – 2y
Tlstý Vrch	TV 2	59	0.6674**	0.6561**
	TV 8	79	0.7058**	0.5991**
	TV 9	73	0.5581**	0.3941**
Horné Lefantovce	HL A	67	0.6354**	0.6428**
	HL 17	73	0.7339**	0.6861**
	HL 18	73	0.7951**	0.7140**
Duchonka	D 3	64	0.6562**	0.4077**
	D 5	64	0.5791**	0.6274**
	D 13	57	0.6704**	0.7369**
Jelenec	J 20	61	0.7546*	0.7528**
	J 50	82	0.6229**	0.7165**
	J 11	86	0.7257**	0.6897**
	Total	828	0.6933**	0.6657**

*and **significant at P = 0.05 and P = 0.01.

Table 9. Correlation coefficients between progeny means of stem height and stem diameter of 1-year-old (1y), 2-year-old (2y) and 35-year-old (35y) seedlings. Sample size in all correlation n = 12

	Diameter 1y	Height 2y	Diameter 2y	Height 35y	Diameter 35y
Height 1y	0.8619**	**0.9149****	0.8340**	0.5244*	–0.0216
Diameter 1y		0.7020**	**0.8826****	0.3410	0.0327
Height 2y			0.7996**	0.5442*	– 0.1651
Diameter 2y				0.3782	0.1084
Height 35y					–0.2795

*and **significant at P = 0.05 and P = 0.01.

et al., 2004). This is true for progenies from Tlstý Vrch provenance, which exhibited a high mortality rate during last ten years. While having the highest performance till the age of 30 years, these progenies were overtopped in height by progenies from Duchonka provenance during consecutive five years (Tokár and Bolvanský, 2002). Another source of error in data from half-sib families could be represented by the effect of environment as this factor was not minimized by trial replications. Each family was namely planted only in one plot.

Our results suggesting similar progeny ranking in stem height and rather different ranking in stem diameter at different age of European chestnut are in accord with the study on full-sib families of black walnut at age of 11 and 21 years (Peng et al., 1992). In black walnut an early height showed to be a good indicator of later height (Mc Keand et al., 1979; Rink, 1984).

Although repeatability of growth characteristics of observed 12 progenies was not very high in some progenies with high growth performance this repeatability was very high. This is true especially for half-sib family HL A of Horné Lefantovce origin, which could be used to produce seeds for establishing chestnut plantations.

Acknowledgement

This work was supported by grants of the Scientific Grant Agency of the Ministry of Education of Slovak Republic and the Slovak Academy of Sciences VEGA 2/7165/7 and VEGA 2/0214/10.

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Vplyv hmotnosti plodov, pôvodu materských stromov a podmienok pokusu na rastové charakteristiky semenáčikov gaštana jedlého

Súhrn

Na jar roku 2005 bol založený v lesnej škôlke Hladomer, neďaleko obce Lovce pokus v poľných podmienkach za účelom sledovania rastových charakteristík semenáčikov gaštana jedlého v závislosti na pôvode experimentálneho materiálu. Plody na výsadbu boli zozbierané zo 45-ročných jedincov 12 polosúrodeneckých rodín (potomstiev pochádzajúcich z voľného opelenia jednotlivých stromov) a nachádzajúcich sa na experimentálnej ploche „Castanetárium Horné Lefantovce“. Materské stromy sledovaných potomstiev rástli a niektoré ešte aj rastú na lokalitách Horné Lefantovce, Jelenec, Duchonka a Tlstý vrch. Vybrané potomstvá pri posledných dvoch hodnoteniach (1995 a 2000) vykazovali nadpriemerné hodnoty rastových charakteristík spomedzi 86 potomstiev nachádzajúcich sa na experimentálnej ploche. Variabilita rastových charakteristík (výška a hrúbka kmeňa) jedno- a dvojročných semenáčikov získaných z týchto potomstiev bola štatisticky významne ovplyvnená pôvodom materských stromov potomstiev, lokalitou – provenienciou materských stromov ako aj veľkostnou kategóriou plodov. Pri semenáčikoch, ktorých rodičovské jedince pochádzali z lokalít Horné Lefantovce, Jelenec a Duchonka, sa pôvodne štatisticky nevýznamné rozdiely vo výške 1-ročných semenáčikov medzi druhým a tretím blokom pokusu zmenili na štatisticky významné pri 2-ročných semenáčikoch. Tieto rozdiely možno pričítať vplyvu rozdielnej vlhkosti pôdy na pokusných parcelách (vyššia vlhkosť na parcele druhého bloku v dôsledku čiastočného zatienenia). Medzi hmotnosťou plodov a rastovými charakteristikami semenáčikov získaných z týchto plodov bola v obidvoch rokoch pozorovaná jednak slabá závislosť (r = 0,29 až 0,33 pri jednotlivých plodoch) alebo slabá až stredne silná závislosť (r = 0,30 až 0,62 pri plodoch zoskupených do veľkostných kategórií). Najvyššie hodnoty obidvoch rastových charakteristík boli pozorované pri semenáčikoch získaných z potomstiev pôvodu Horné Lefantovce najmä z potomstva HL A. Priemerná výška kmeňa jedincov v tomto potomstve preukazne prevyšovala výšku kmeňa pri iných potomstvách zahrnutých do pozorovaní s 5-ročným intervalom. Korelácie medzi priemernou výškou kmeňa týchto potomstiev a priemernou výškou kmeňa jednoročných a dvojročných semenáčikov získaných z týchto potomstiev boli iba stredne silné (r = 0,52 a 0,54). Podobné medzigeneračné korelácie v priemere kmeňa boli veľmi nízke a nepreukazné. Výsledky ukázali, že pri zakladaní porastu semenom, pri gaštane jedlom je prospešné zberať plody z porastov, ktoré majú dlhodobo nadpriemerný výškový rast.

Received November 26, 2010
Accepted February 28, 2011