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Evaluation of some Growing Characters in Gene Pool of Apricots (*Prunus armeniaca* L.)[1]

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Abstract: Growth vigour of 33 apricot cultivars and new hybrids grafted on apricot seedling rootstock (*Prunus armeniaca L.*) was evaluated on the base of measurements of stem girth from the 4th to the 10th year after planting, There were important differences in growth vigour of genotypes under study. The control cultivar ´Harlayne´ may be classified as a genotype with an average growth vigour. In individual years , variability of growth vigour was relatively low an ranged from 11.74 to 13.82 %. Only two genotypes (´Parnas´ and ´M 78´) were found with significantly and/or highly significantly higher intensity of growth than that of control cultivar ´Harlayne´ in all experimental years. Only one genotype (´LE-SEO-50´) was found with lower growth vigour in the most of years then that of control cultivar ´Harlayne´.

Keywords: apricot, correlation, cultivar, difference, hybrid, growth vigour

Introduction

Apricot species, groups and cultivars vary greatly in growth vigour, size and growth habit. Species range in size from the small trees of *Prunus sibirica*

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L. to the large trees of *Prunus mandshurica L.* and *Prunus armeniaca L.* (Mehlenbacher et al., 1991). Depending on their growth vigour, apricot trees can reach the heights from 4 to 10 metres (Smykov, 1989, Vachun, 1971). In pomological publications, the growth vigour of cultivars is evaluated as weak, medium and strong (Kutina et al., 1991). It is necessary to evaluate the growth vigour of genotypes on the identical rootstocks, because their influencing can bee very important. In spite of the fact that e.g. girth of the stem is an easily measurable parameter for the evaluation of growth vigour in comparable conditions, concrete values for individual varieties are usually not given.

To obtain genotypes with a different growth vigour (with a different size) is one of the objectives of stone-fruit trees breeding. In apricots, this was not the main objective of selection, but it was also not fully neglected (Paunovic, 1986, Vachun, 1986). Genotypes showing a reduced growth vigour were studied in Italy (Quarta et al., 1986), in Moldavia (Smykov, 1988) or in China (Gu, 1988). It seems to be sources of genes for different growth vigour.

Significant differences were observed not only between cultivars but also between clones. As compared with the control clone of cultivar ´Velkopavlovická´ these differences made as much as 30% (Vachun, 1995, 1996).

Growth vigour represents above all a genetic trait but it can be influenced by the site, pruning and health conditions of propagated clone or rootstock. An ill rootstock (infested by viroses or by phytoplasmoses) reduces the growth vigour by 10 to 15%, increases consumption of nutrients by as much as 50% and decreases the yields of grafted varieties by 10 to 15% (Dosba et al., 1991).

Differences in growth vigour , resulting from cultivar, rootstock and/or stem forming cultivar, should be respected when deciding about spacing of trees (Nitransky, 1996, Vachun, 1971). For example the girth reduced by 10% reduces the crown diameter by approximately 0.5 m (Vachun, 1971).

The aim of presented research work was the evaluation of differences in growth vigour of apricot genotypes *Prunus armeniaca L.* to use selected genotypes in the further breeding work and/or as components inhibiting or supporting the growth in indirect vegetative propagation.

Material and Methods

The experimental plantation was established in the spring of 1991. Apricot seedlings *(Prunus armeniaca L.)* were used as rootstocks. This study evaluates the growth vigour of 33 genotypes (cultivars and selected hybrids) within the period from the 4^{th} to the 10^{th} year after planting. Obtained data cover completely a period of seven years. Genotypes in experimental plantation were established in blocks. Each genotype had five replications, it is with five individually evaluated trees. As a control cultivar ´Harlayne´ was used.

Girth of stem (circumference) in mm in 0.8 m above the soil was mesured every year in autumn. Experimental set of trees involved older cultivars and also some new apricot cultivars and hybrids. Cultivars ´Harlayne´, ´Harogem´, ´Moongold´ and ´NJA 1´ originated from U.S.A., ´Veharda (VS-

25/38)´ ´VS-22/32´ and ´VS-27/12´ were from Slovak Republic, ´Mamaia´ and ´Callatis´ from Roumania, ´Nancy´ originated from France, ´Vynoslivyi´, ´Volshebnyi´, ´Sem. Bademerik´, ´Priusadebnyi´, ´Kostjuzhenskii´, ´Parnas´, ´Gvardeiskii´ and ´Arzami aromatnyi´ were from Ukraine, the cultivar ´In-bej-sin´ originated from China. Remaining genotypes were from Czech Republic. Genotypes with initial letters LE and originated from the breeding programme of the Faculty of Horticulture MUAF in Lednice. Numbers and letters behind some names of genotypes indicate clones.

Before statistical calculations Bartlett test of homogeneity was used. Statistical analysis of date about growth vigour was carried out in such a way that data from each year were analysed separately using intervals of confidence so that it was possible to test the significance of differences between the evaluated genotype and the control cultivar ´Harlayne´. As significantly or highly significantly different from the control only those genotypes were considered, in which significant and/or highly significant differences were recorded in all seven experimental years (from 1993 to 1999) or in most years to the end of this period.

Results and Discussion

Within the seven-year period were important differences in growth vigour in the set of genotypes under study. (Table 1.)

Table 1. Girth of sistem in apricot genotypes within the period 1983-1999 Plantation established in the spring of 1991.

Number	Genotype	Girth of stem (mm) within years						
		1993	1994	1995	1996	1997	1998	1999
1	ARZAMI AROMATNYI	177	222	238	271	315	350	372
2	CALLATIS	101	134	147	185	220	234	258
3	GVARDEISKII	148	184	215	266	301	335	358
4	**HARLAYNE ***	**138**	**180**	**198**	**229**	**255**	**279**	**303**
5	HAROGEM	144	186	197	226	269	295	304
6	IN-BEJ-SIN	143	178	197	218	254	285	301
7	K-2 P-klon	144	180	205	240	268	297	328
8	KOSTIUZHENSKII	108	140	157	190	222	255	273
9	LE-1271	128	168	200	239	285	306	320
10	LE-1917	155	193	224	250	291	305	331
11	LE-1951	121	159	187	211	244	274	306
12	LE-2267	152	184	204	239	276	300	317
13	LE-390	142	186	207	246	279	313	317
14	LE-392	120	152	175	205	220	268	280
15	LE-SEO-50	135	164	175	187	212	226	241
16	LENOVA (LE-1952)	125	159	175	198	219	235	254
17	M 72 A	95	131	167	203	255	283	318
18	M-25	130	166	195	242	269	300	333
19	M-45	154	196	222	266	303	311	354
20	M-78	163	210	241	277	306	350	368
21	MAMÁIA	130	168	191	224	259	280	304
22	MOONGOLD	129	155	183	216	250	277	317
23	NANCY	116	156	186	235	270	296	327
24	NJA -1	133	171	192	216	245	269	279
25	PARNAS	169	220	255	303	348	376	400
26	PRIUSADEBNYI	141	178	190	215	249	279	296
27	SEM. BADEMERIK	138	168	186	206	239	271	284
28	VEHARDA (VS-25/38)	133	175	202	235	274	303	330
29	VELKOPAVLOVICKÁ LE-6/2	130	171	203	238	271	293	317
30	VOLSHEBNYI	167	211	235	274	315	349	385
31	VS-22/32	159	194	217	236	281	315	338
32	VS-27/12	131	183	225	257	318	346	369
33	VYNOSLIVYI	159	199	216	255	292	308	336
Average		138.12	176.39	200.2	233.3	268.9	295.8	318.7

* control cultivar 'Harlayne'

The most vigour genotype ´Parnas´ in 9th year after planting (in 1999) reached the average girth of stem 400 mm and the less vigour genotyp ´LE-SEO-50´ only 241 mm. The control cultivar ´Harlayne´ was classified as a variety with an below-average growth vigour. (Table 2.) Genotypes with a higher or lower intensity of growth can be used in further breeding work and/or as inter stock components increasing the growth in programmes of indirect vegetative propagation.

Tab. 2. Rank of apricot genotypes according to the girth of stem in mm in 1999.

Rank	Genotype	Girth of stem in mm
1	LE-SEO-50	241
2	LENOVA (LE-1952)	254
3	CALLATIS	258
4	KOSTIUZHENSKII	273
5	NJA -1	279
6	LE-392	280
7	SEM. BADEMERIK	284
8	PRIUSADEBNYI	296
9	IN-BEJ-SIN	301
10	**HARLAYNE ***	**303**
11	HAROGEM	304
12	MAMAIA	304
13	LE-1951	306
14	LE-2267	317
15	LE-390	317
16	MOONGOLD	317
17	VELKOPAVLOVICKÁ LE-6/2	317
18	M 72 A	318
19	LE-1271	320
20	NANCY	327
21	K-2 P-klon	328
22	VEHARDA (VS-25/38)	330
23	LE-1917	331
24	M-25	333
25	VYNOSLIVYI	336
26	VS-22/32	338
27	M-45	354
28	GVARDEJSKII	358
29	M-78	368
30	VS-27/12	369
31	ARZAMI AROMATNYI	372
32	VOLSHEBNYI	385
33	PARNAS	400

* control cultivar ´Harlayne´

Evaluation of the significance of differences, calculated for each year separately, proved that only by two genotypes (´Parnas´ and ´M 78´) was the growth significantly higher than by control variety ´Harlayne´ in all years of controled period. Genotypes ´Arzami aromatnyi, ´Volshebnyi´, ´VS-27/12´ and ´Vynoslivyi´ were found with the significantly higher growth vigour in most years of evaluated period. Only one genotype (´LE-SEO-50´) was found with lower intensity of growth then that of control genotype ´Harlayne´ in the most years. Table 3. As an example only one of all confidence intervals, calculated for individual years, was presente (fig. 3).

There was a highly significant relationship between the rank of the growth vigour of apricot genotypes in individual pairs of years within evaluated period. This was demonstrated by highly significant correlation coefficients from r=0,64++ to r=0,97++. As far as the time difference between years in individual pairs of years was higher, the correlation coefficients was lower (Fig. 1. and fig. 2).

Table 3. Significance of differences in growth vigour of apricot genotipes evaluated on the base of the stem girth (circumference) in relation to the control cultivar "Harlayne" within the period 1993-1999

Number	Genotype	Significance of differences in growth vigour in years						
		1993	1994	1995	1996	1997	1998	1999
1	ARZAMI AROMATNYI	'+ H	0	'+ H	0	'+ H	'+ H	'+ H
2	CALLATIS	'+ L	'+ L	'+ L	0	0	0	0
3	GVARDEISKII	0	0	0	0	'+ H	'+ H	'+ H
4	**HARLAYNE ***	**0**	**0**	**0**	**0**	**0**	**0**	**0**
5	HAROGEM	0	0	0	0	0	0	0
6	IN-BEJ-SIN	0	0	0	0	0	0	0
7	K-2 P-klon	0	0	0	0	0	0	0
8	KOSTJUZHENSKII	'+ L	'+ L	'++ L	0	'+ L	0	0
9	LE-1271	0	0	0	0	0	0	0
10	LE-1917	0	0	'+ H	0	0	0	0
11	LE-1951	'+ L	'+ L	0	0	0	0	0
12	LE-2267	0	0	0	0	0	0	0
13	LE-390	0	0	0	0	0	0	0
14	LE-392	0	0	0	0	0	0	0
15	LE-SEO-50	0	0	'+ L	'+ L	'+ L	'+ L	'++ L
16	LENOVA (LE-1952)	0	0	'+ L	'+ L	'+ L	nL	0
17	M 72 A	'++ L	'+ L	'+ L	0	0	0	0
18	M-25	0	0	0	0	0	0	0
19	M-45	0	0	'+ H	0	'+ H	'+ H	'+ H
20	M-78	'+ H	'+ H	'++ H	'++ H	'++ H	'++ H	'++ H
21	MAMAIA	0	0	0	0	0	0	0
22	MOONGOLD	0	'+ L	0	0	0	0	0
23	NANCY	'+ L	0	0	0	0	0	0
24	NJA -1	0	0	0	0	0	0	0
25	PARNAS	'+ H	'+ H	'+ H	'++ H	'++ H	'++ H	'++ H
26	PRIUSADEBNYI	0	0	0	0	0	0	0
27	SEM. BADEMERIK	0	0	0	0	0	0	0
28	VEHARDA (VS-25/38)	0	0	0	0	0	0	0
29	VELKOPAVLOVICKÁ LE-6/2	0	0	0	0	0	0	0
30	VOLSHEBNYI	'+ H	'+ H	0	'+ H	'+ H	'+ H	'+ H
31	VS-22/32	0	0	'+ H	0	0	0	0
32	VS-27/12	0	0	0	'+ H	'++ H	'++ H	'++ H
33	VYNOSLIVYI	'+ H	0	'+ H	'+ H	'++ H	'+ H	'+ H

* control cultivar 'Harlayne'

'++ H	Girth of stem highly significantly higher than in control
'+ H	Girth of stem significantly higher then in control
'++ L	Girth of stem highly significantly lower than in control
'+ L	Girth of stem lower than in control
0	Non-significant difference

Values of variability coefficients were relatively low and ranged from 11,74% to 13,82 (fig. 2). Variability of growth vigour was influenced by generatively propagated non-selected rootstock from *Prunus armeniaca L.* It could be reduced, if such selected apricot rootstocks (e. g. 'M-LE-1', 'M-VA-2', 'M-VA-3', 'Manicot' and others) were used. Unfortunately, these selected rootstock were not available at the moment of the establishment of this experiment.

A generally lower danger of occurrence of viroses is one of the most important advantages of the use of rootstocks propagated by seeds from *Prunus armeniaca L.*. By pollen and seeds only some viroses are disseminated, e. g. PNRSV (Prunus Necrotic Ring Spot Virus). Seed material used for the production of rootstocks was obtained from mother trees non-tested for the occurrence of PRNSV so that it was not possible to eliminate a potential effect of this and/or some other of until now uncontrolled factors.

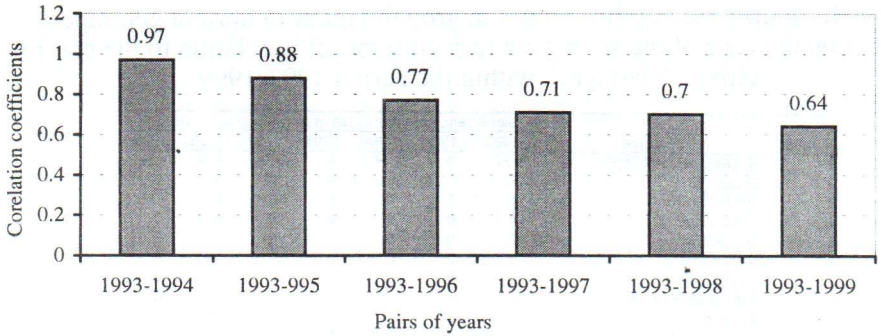

Fig. 1. Corelation coefficients of growth vigour existing between apricot genotypes in the pairs of years

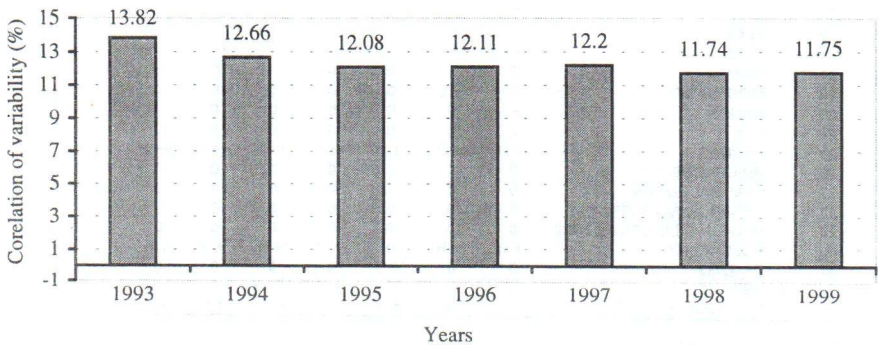

Fig. 2. Coefficients of variability in growth vigour of apricot genotypes in individuales years evaluated on the base of girth value of stm in mm

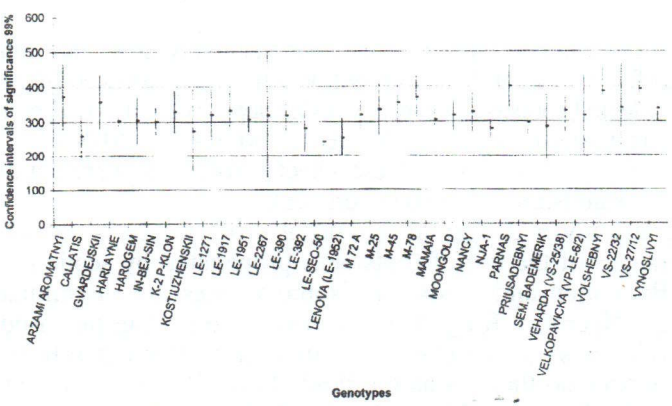

Fig. 3. Confidence intervals for girth of stem (mm) of apricot genotipes in 1999.

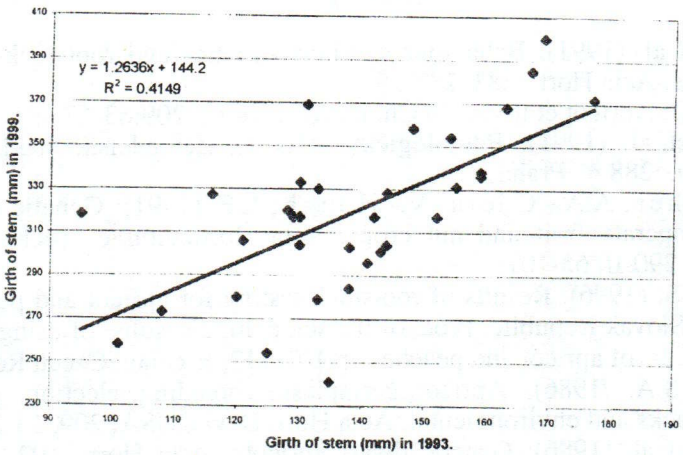

Fig. 4. Corelation between girth values of stem (mm) of 33 apricot genotypes in 1993 and 1999.

Conclusion

Growth vigour of 33 apricot cultivars and new hybrids grafted on apricot seedling rootstock (*Prunus armeniaca L.*) was evaluated on the base of measurements of stem girth from the 4th to the 10th year after planting, There were important differences in growth vigour of genotypes under study. The control cultivar ´Harlayne´ may be classified as a genotype with an average growth vigour. Within the whole experimental period, the rank of growth vigour of genotypes did not change. This was demonstrated by highly significant coefficients of correlation existing between individual pairs of years (r=0.64++ to r=0.97++). In individual years , variability of growth vigour was relatively low an ranged from 11.74 to 13.82 %. Only two genotypes (´Parnas´ and ´M 78´) were found with significantly and/or highly significantly higher intensity of growth than that of control cultivar ´Harlayne´ in all experimental years. Genotypes ´Arzami aromatnyi´, ´Volshebnyi, ´VS-27/12´ and ´Vynoslivyi´ were found with the significantly higher growth vigour in most years of evaluated period. Only one genotype (´LE-SEO-50´) was found with lower intensity of growth in the most of years then that of control cultivar ´Harlayne´. Genotypes with different growth vigour can be used in further breeding programmes and/or as components inhibiting or supporting the growth in indirect vegetative propagation.

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EVALUACIJA NEKIH OSOBINA RASTA KAJSIJE (*Prunus armeniaca* L.) NA GENETSKOJ BAZI

-originalni naučni rad-

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Rezime

Bujnost rasta, kod 33 sorte, kajsije i novi hibridi kalemljeni na podlozi kajsije (*Prunus armeniaca* L.) su praćeni na bazi merenja porasta obima stabla od šeste do desete godine posle sadnje. Uočene su značajne razlike u bujnosti razvoja izučavanih genotipova. Kontrolna sorta 'Harlayene' može se klasifikovati kao genotip srednje bujnosti. U pojedinim godinama varijabilnost razvoja bujnosti bila je relativno niska i kretala se od 11.74 do 13.82%. Samo dva genotipa ('Parnas' i 'M 78') su imali signifikantan i visoko signifikantno viši intenzitet rasta u poređenju sa kontrolnom sortom 'Harlayne' u svim godinama ispitivanja. Samo jedan genotip ('LE-SEO-50) je imao slabiju bujnost razvoja u većini godina ispitivanja od kontrolne sorte 'Harlayne'.