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EVALUATION OF AUTOCHTHONOUS ECOTYPE OF BITTER ALMOND AS PEACH ROOTSTOCKS

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Abstract

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This work presents the results from the study of the important morphological, biological and economic characteristics of 22 eco-types of bitter almond, selected from the rich autochthon population in the Republic of Macedonia, suitable for use as rootstocks in the peach nursery production. The researches have been made in the period from 2002 - 2004.

The seed used as control is from the almond cultivar *texas* and seeds from vineyard peach.

The research included the pomological and the chemical characteristics of the fruits, the quality of the seedlings, variability of the seedlings and nursery trees and the economical value of the types. The selected types mainly have larger dimensions of the nuts and the kernel respective to the controls. The weight of the CI-3 type has the largest nuts (5.11 g), whereas the type CI-2 has the largest weight of the kernels (1.15 g). The kernels with an intensively bitter taste have a larger content of amygdaline which is from 18.4 mg/100g to 275.9 mg/100g. The seedlings from the Ci-8 type have the most uniformed development. The IZ-1 and the VE-1 type have the highest first development of the pre-branches (13 cm), whereas the CI-6 type has the lowest (6.5 cm). The variability of the development of the plants is highest at the CI-5 type, and the lowest at the IZ-1 type. The following types have the highest marks for economic value, even higher than the controls: CI-4 (76), US-1 (75), CI-8 (74), BA-6 (73), BA-1 (72) and VE-2 (72). They are the promising types for the production of generative rootstocks.

Key words: autochthon types, amygdaline, seedlings, variability, economic characteristics, generative rootstocks

Introduction

Today's selection program of the rootstocks is also as dynamic as the peach assortment. It is based on the new genotypes suitable for different pedoclimatic conditions and different training systems (Giorgi et al., 2005). The spectrum of rootstocks suitable for the peach is big and it consists of different fruit species and their interspecies hybrids such as the peach, the almond, the plum, the apricot and the peach x almond hybrids. In the Mediterranean countries with the most contemporary peach production, the mostly used rootstocks are the interspecies hybrids of the peach and almond. The reason for this is their tolerance towards the carbonates which cause chloroses (Moreno et al., 1994). Mostly used peach rootstock in the R. Macedonia is the vineyard peach, followed by the bitter almond.

The seeds which are used for the production of the rootstocks are usually a mixture of different genotypes which results with non-uniform seedlings with different vigorousness. A serious selection of the types of vineyard peach and almond hasn't been done so far. The use of almond as a rootstock is limited because of the lack of good types. Since most of the used almond rootstocks are seedlings with no homogenous character, this problem seeks a more serious approach. The availability of the types of almond rootstocks with good nursery characteristics and possibility for good anchorage, can lead to a solution for this problem. In fact, the healthy clone selections show higher uniformity, and their compatibility with the peach varieties is higher.

According to Stylianidis (1989), the use of the bitter almond respective to the sweet one, is much more practical because of its resistance towards the pests (*Capnodis tenebrio-*

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nis), mice and birds. Some authors point out that the seedlings from the bitter almond are resistant to the bacterial root cancer (*Agrobacterium tumefaciens*).

Materials and Methods

Individual selection of 22 autohtonous types of bitter almond has been performed, based on their suitable productive characteristics, long lasting and vitality of the trees and the habitus of the crown. The fruits have been gathered in their full maturity and pomologically analyzed by measuring their weight, dimensions and kernel randman. The content of fats has been determined acc. to the „Soxhlet" method, whereas the content of proteins, acc. to the „Kjeldahl" method. The percentage of dry materia and ashes in the kernel has been determined throughout an indirect method, by kernel drying at 105°C in an dryer and by burning in a muffel furnace at 500°C. For the determination of the amygdaline, we have performed a modified reverse faze HPLC method. For the production of peach plants and the research of the nursery characteristics of the bitter almond types, we have used a standard technology of production. The experiment in the orchard has been established in three repetitions, each planted with 30 seeds at a standard distance of 110 cm x 15 cm. The seedlings have been grafted with the red haven peach variety as controls were used the vineyard peach and the almond variety texas.

Results and Discussion

Pomological characteristic of the fruits. The dimensions of the nuts and the kernels (height, width and thickness), represent their shape and size.

The large seeds have a higher energy of sprouting, more reserve materia for the sprout's nourishment, which gives an advantage for its further lasting in the vegetative growth of the seedlings (Borojević and Borojević, 1971).

The dimensions of the nuts at the researched almond types are presented in Table 1. The type BA-7 has the largest dimen-

Table 1
Pomological characteristic of the fruits

Type	Nut				Kernel				Randman, %
	Width, mm	Height, mm	Width, mm	Thickness, mm	Width, mm	Height, mm	Width, mm	Thickness, mm	
BA-1	4.56	35.79	22.66	14.76	0.94	25.66	12.03	6.07	20.61
BA-2	3.24	30.47	20.63	12.97	0.92	23.4	12.83	5.77	28.4
BA-3	3.11	32.5	18.85	11.7	0.94	24.75	11.5	6.2	30.23
BA-4	2.73	24.4	19.97	13.2	0.59	17	10.77	5.97	21.61
BA-5	4.72	35.33	24.44	14.48	1	26.11	14.07	5.93	21.19
BA-6	2.47	25.17	17.97	12.87	0.66	18.4	11.33	6.57	26.72
BA-7	4.64	36.1	21.93	13.8	1.14	25.5	12.47	6.93	24.57
CI-1	2.76	26.71	17.86	13.39	0.6	19.57	10.75	5.93	21.74
CI-2	4.3	31.8	22.6	15.33	1.15	22.73	14.83	7.27	26.74
CI-3	5.11	35.47	21.1	14.93	0.96	25.47	11.7	5.83	18.79
CI-4	3.96	35.73	19.2	14.03	0.78	25.03	11.23	6.07	19.7
CI-5	3.09	29.69	18.76	12.66	0.69	20.34	11.79	5.66	22.33
CI-6	4.31	32.53	21.8	15.6	0.88	21.27	12.53	5.87	20.42
CI-7	2.62	25.57	20.5	15.73	0.88	19	12.37	7.53	33.59
CI-8	3.21	29.67	20.13	12.97	0.81	21.87	11.77	6.03	25.23
CI-9	2.81	25.78	18.09	12.78	0.7	19.48	11.26	5.91	24.91
CI-10	2.18	27.63	18.25	12.88	0.68	20.25	10.38	6.38	31.19
IZ-1	2.46	32.27	19.77	12.1	0.7	22.6	11.9	5.27	28.46
VE-1	2.38	26.07	19.57	14.5	0.71	18.63	12.33	6.67	29.83
VE-2	4.54	31.07	22.7	14.37	0.95	22.33	14	5.47	20.93
US-1	4.25	32	22.55	15.15	0.92	22.15	13.4	5.95	21.65
SO-1	3.45	32.44	21.78	13.78	0.91	22.89	12.78	5.22	26.38
Vineyard peach	3.52	30.28	20.32	15.96	0.36	15.89	10.32	4.95	7.95
Texas	2.49	28.2	20.04	16.18	1.15	21.66	12.41	9.5	46.74

sions of the nut (height 36.10 mm, width 21.93 mm and thickness 13.80 mm), whereas the type BA-4 has the smallest dimensions of the nuts (height 24.40 mm, width 19.97 mm and thickness 13.20 mm). Respective to the control variety Texas, except the types BA-4, BA-6, CI-1, CI-7, CI-9, CI-10 and VE-1, all the other types characterize with larger nut dimensions.

The BA-5 type has the largest dimensions of the kernel (height 26.11 mm, width 14.07 mm and thickness 5.93 mm), whereas the type BA-4 has the smallest dimensions of the kernel (height 17.00 mm, width 10.77 mm and thickness 5.97 mm). The randman of the kernels at the types varied from 18.79% at CI-3 to 33.57% at the CI-7 type. The control vineyard peach had a significantly lower randman of the kernel respective to the researched types (7.95%), whereas the almond variety Texas had the expected highest randman of the kernels (46.74%). This is due to the fact that the Texas variety is a selected variety mostly for consumption.

Analizing 17 autochthonous types of almond, Aslanta and Güleryüz (2001), determined that the percentage of the randman has been from 14.66% to 26.81%. According to the researched performed by Ristevski and Georgiev (1998), the percentage of the randman at some almond varieties has been from 20.78% to 59.97%.

Chemical characteristic of the kernels. The content of fat and protein has a positive influence to the growth and development of the seedlings, assuring a primary food for growth and development of the sprout. Barbera et al. (1994) points out that the almond kernels content: 5.93-7.27% water, 8.03-8.13% ash, 53.67-54.26% fat, 23.03-23.98% protein, 5.52% total sugar, 766 mg/100 g K, 364 mg/100 g P, 227 mg/100 g Mg and 185 mg/100 g Ca.

The content of cyanogenous components, amongst which the amygdaline, in the kernels is in correlation with the resistance of the seedlings to Capnodis tenebrionis (Mulas, 1994). The higher content of amygdaline in the seed has a positive effect towards its resistance to pests in the nursery production.

According to Barbera et al. (1994), the content of amygdaline respective to the dry mass can reach up to 3% with a large variation between the types.

According to Siami et al. (2002) the content of amygdaline in the wild almond types is from 10.68 mg/100g at Amygdalus urminensis, to 7.9 mg/100g at Amygdalus kotschyi. The con-

Table 2
Chemical characteristic of the kernels

Type	Dry matters, %	Ash, %	Respectively dry matters, %		Amygdaline, mg/100g	Index
			proteins	fats		(*Texas*)
BA-1	95.55	3.63	22.75	46.63	91.2	231.5
BA-2	95.31	4.51	27.95	45.12	87.2	221.3
BA-3	95.01	2.89	24.62	51.2	146.1	370.8
BA-4	93.48	2.01	23.33	53	82.8	210.2
BA-5	95.55	3.23	23.73	51.31	18.4	46.7
BA-6	95.77	2.52	21.26	55.34	212.1	538.3
BA-7	95.6	3.23	23.49	51.35	55.8	141.6
CI-1	95.48	3.13	22.82	51.32	41.1	104.3
CI-2	95.77	3.18	25.95	46.71	81.6	207.1
CI-3	95.58	3.56	25.82	54.01	275.9	700.3
CI-4	95.48	3.08	24.2	55.07	186.4	473.1
CI-5	95.4	3.3	25	45.66	97.8	248.2
CI-6	95.57	3.13	22.99	50.94	270.4	686.3
CI-7	96.08	3.36	22.04	56.13	58.1	147.5
CI-8	94.76	2.7	25.1	49.42	230.8	585.8
CI-9	95.86	2.78	18.51	58.22	45.23	114.8
CI-10	95.59	3.23	18.98	52.75	104.1	264.2
IZ-1	95.54	3.58	22.34	49.8	117.7	298.7
VE-1	96.01	2.39	19.17	51.25	144.6	367
VE-2	95.91	3.08	22.34	54	238.5	605.3
US-1	95.58	2.95	22.36	48.66	92.6	235
SO-1	95.73	3.23	22.52	45.03	139.2	353.3
Texas	95.44	3.32	20.53	57.26	39.4	100

tent of amygdaline at the Amygdalus communis species is 9.65 mg/100g.

Table 2 shows the data for the chemical content of the kernels of the researched types and the control variety Texas.

The kernels from the type CI-7 have the highest percent of dry materia (96.08%), whereas the type BA-4 has the lowest (93.48%). The percentage of ashes was 2.01% at BA-4 to 4.51% at BA-2. The percentage of proteins had been calculated respective to the dry mater. BA-2 had the highest percent of proteins (27.95%), whereas CI-9 had the lowest percentage of proteins (18.51%). Just like the content of proteins, also the content of fat is very similar to the previous researches of several authors. The percentage of fat at the researched types was from 45.03% at SO-1, to 58.22% at CI-9.

The highest variability respective to the type's chemical content had been noticed at the determination of amygdaline. The content of amygdaline in the kernels had been from 18.4 mg/100g at BA-5, to 275.9 mg/100g at CI-3. During our researches, we noticed that the content of amygdaline in the fruit's kernel determines the intensity of its bitterness. The intensively bitter types also have higher content of amygdaline.

Quality characteristic of seedlings. The quality and the ability for grafting is being determined by the diameter of the seedlings. The grafting of the seedlings at standard nursery production is performed at a height of 10 cm, and it is important that the seedling is well developed with suitable thickness at the moment of grafting (diameter from 7 to 10 mm).

Table 3 shows the data for the diameter of the seedlings at the moment of their grafting. According to the average values, BA-7 has the most intense trunk growth (11.5 mm), whereas CI-10 had the poorest trunk growth (9.0 mm).

All the researched types characterize with larger diameter of the trunk compared to the vineyard peach control whose trunk diameter measured at height of 10 cm was 8.2 mm.

Table 3
Quality characteristic of seedlings

Type	Diameter, mm	Index		Height, cm	Index		Height of the first branching, cm
		vineyard peach	Texas		vineyard peach	Texas	
BA-1	11.1	135.4	100	116.23	125.61	120.82	10.5
BA-2	11	134.2	99.1	92.47	99.94	96.12	7
BA-3	10.6	129.3	95.5	101.1	109.26	105.09	7
BA-4	11.2	136.6	100.9	97.1	104.94	100.94	8.5
BA-5	10.5	128.1	94.6	85.2	92.08	88.57	11
BA-6	10.3	125.6	92.8	99.73	107.78	103.67	10
BA-7	11.5	140.2	103.6	107.9	116.61	112.16	9.5
CI-1	9.8	119.5	88.3	82.37	89.02	85.62	10.5
CI-2	10.5	128.1	94.6	91.17	98.53	94.77	7.5
CI-3	11.4	139	102.7	86.53	93.52	89.95	8
CI-4	11.2	136.6	100.9	85.73	92.65	89.12	7.5
CI-5	10.8	131.7	97.3	87.35	94.4	90.8	10.5
CI-6	9.7	118.3	87.4	84.67	91.51	88.01	6.5
CI-7	10.9	132.9	98.2	96.2	103.97	100	10
CI-8	9.1	111	82	88.07	95.18	91.55	12
CI-9	10.2	124.4	91.9	94.63	102.27	98.37	11.5
CI-10	9	109.8	81.1	70.3	75.98	73.08	8.5
IZ-1	9.4	114.6	84.7	85.03	91.89	88.39	13
VE-1	9.6	117.1	86.5	98.3	106.24	102.18	13
VE-2	10.5	128.1	94.6	110.1	118.99	114.45	11.5
US-1	10.9	132.9	98.2	101.83	110.05	105.85	11.5
SO-1	10.8	131.7	97.3	96.2	103.97	100	11.5
Vineyard peach	8.2	100	73.9	92.53	100	96.19	10
Texas	11.1	135.4	100	96.2	103.97	100	9.5
$LSD_{0.05}$	*0.13*		*$LSD_{0.05}$*	*14.1*			
$LSD_{0.01}$	0.17		$LSD_{0.01}$	18.9			

The results for the trunk diameter go In favor for the fact that has been pointed out by several authors, that the large seed always has more reserve mater for the nourishment of the sprout, which gives an advantage which is present in the further growth of the seedlings (Borojević and Borojević, 1971).

The correlation between the seedling's diameter and the seed's mass has been r=0.379, which acc. To Römer Orphal table is a poor coefficient of correlation.

The height of the seedlings goes along with their growth in diameter. The higher the primary growth is, the higher the secondary growth of the tree will be, and therefore it will be developed and more suitable for grafting and production of quality plant propagating material.

According to the average values for the period of research, BA-1 had the most intense trunk growth (116.23 cm), whereas CI-10 had the poorest (70.30 cm).

An important segment at the grading of the quality of the rootstocks is also the determination of the height of their branching. The higher the branching is, the more approachable and more suitable the rootstock is for grafting. An operation for removal of the premature branches at a height of 10-15 cm is necessary at the branched seedlings, in order to get a "clean" rootstock for grafting, which raises the expenses for the production of plant propagating material.

The highest first branching we notice at type IZ-1 and VE-1 at 13 cm and the lowest at type CI-6.

Variability of seedlings and plants. The variability of the seedlings and the plants is an important factor from an aspect of their uniformity. In case the characteristic has a lower variability, the researched units will be more uniform. The uniformity of the seedlings is an important factor at their evaluation as rootstocks. The uniform seedlings (rootstocks) give more uniform and quality plants.

The data from Table 4 shows that the seedlings from the type CI-2 have the highest variability, whereas the type CI-8 had the lowest variability (1.28).

The purpose of the research of the variability of the plants was the determination of their homogeneousness. If the variability is lower, the plants are more uniform and homogenous.

Table 4
Variability of seedlings

Type	Diameter			Height		
	Variation	Coefficient of variation, %	standard deviation	Variation	Coefficient of variation, %	standard deviation
BA-1	8.4	18.27	2.02	71.5	16.1	18.8
BA-2	6.2	17	1.87	56	14.33	13.32
BA-3	7.3	20.87	2.21	80	20.69	20.96
BA-4	7.2	16.84	1.9	74.5	20.08	19.54
BA-5	6.4	19.03	1.99	72.5	24.04	20.48
BA-6	5.8	13.77	1.41	58	17.37	17.37
BA-7	5.9	16.31	1.88	87	19.91	21.6
CI-1	7	19.83	1.94	64	24.19	19.94
CI-2	9.2	22.53	2.36	82.5	27.7	25.27
CI-3	8.2	20.35	2.32	59.5	21.39	18.5
CI-4	5.7	13.52	1.52	45	16.59	14.24
CI-5	5.4	12.78	1.34	50	17.62	15.43
CI-6	7.3	22.44	2.17	49.5	17.48	14.81
CI-7	7.9	20.63	2.26	69	21.43	20.68
CI-8	4.8	14.01	1.28	57	17.56	17.77
CI-9	7.9	20.26	2.08	57	18.66	17.66
CI-10	6.3	19.09	1.7	49	21.87	15.26
IZ-1	5.7	17.01	1.59	90	28.88	24.53
VE-1	4.9	15.7	1.5	57.5	18.96	18.59
VE-2	8.2	21.58	2.26	79.5	22.71	24.98
US-1	7.8	18.54	2.03	76	19.79	20
SO-1	6.7	18.38	1.96	81.5	22.86	21.99
Vineyard peach	8.3	25.59	2.11	68	19.92	18.37
Texas	7.4	20.28	2.26	97.5	23.44	26.02

The data for the variability of the plants is shown in Table 5. The data from the chart show that the plants from the rootstocks from the type CI-5 have the highest variability (5.97), whereas the type IZ-1 had the lowest (2.00).

Economic value of the ecotypes. A great importance for the research of the new genotypes is the determination of their economical values. It is a complex evaluation which is a result of all the morphological, biological, production and quality characteristics of the genotype. From an aspect of nursery fruit production, this is the most important characteristic which helps determine the practical meaning of the researched genetic material and its place, role and perspective.

The data for the grading of the economical values of the almond types is presented in the Figure 1. Depending on its nature and meaning, separate characteristics had been graded according to the point scales. The following characteristics had been graded: nut mass, content of amygdaline, soil germination, uniformity of the germination, uniformity of the seedlings, branching of the seedlings, graft up taking, development of the plants, uniformity of the plants and quality of the root.

According to the data from the chart, we have concluded that the types CI-4 (76), US-1 (75), CI-8 (74), BA-6 (73), BA-1 (72), VE-2 (72), CI-3 (71) and VE-1 (71) received the highest number of points at the grading and should serve as perspective types for production of generative rootstocks.

Conclusion

The almond types mainly characterize with larger dimensions of the nuts respective to the texas control, with the exception of the BA-4, BA-6, CI-1, CI-7, CI-9, CI-10 и VE-1 types. The BA-7 type has the largest dimensions of the nut, whereas the BA-4 has the smallest.

All of the tested types of almond have larger kernel dimensions compared to the vineyard peach. Also, most types have larger kernel dimensions than the texas control. The BA-4, BA-6, CI-1, CI-6, CI-7, CI-9, CI-10 и VE-1 types are an exception. In general, the type BA-5 has the largest dimensions of the kernel, and the type BA-4 has the smallest.

Table 5
Variability of nursery trees

Type	Diameter			Height		
	Variation	Coefficient of variation, %	standard deviation	Variation	Coefficient of variation, %	standard deviation
BA-1	12.5	16.06	3.28	78.5	11.96	22.25
BA-2	13	20.94	3.68	125.5	21.86	36.29
BA-3	14	20.99	3.87	84	15.72	25.86
BA-4	13.5	20.15	3.63	80	12.59	21.6
BA-5	13	21.29	3.95	76.5	14.09	24.46
BA-6	12.5	24.66	4.14	93.5	21.8	35.7
BA-7	13.5	19.7	3.81	81	12.93	23.59
CI-1	12	21.09	3.67	97.5	16.66	27.52
CI-2	13.5	20	3.66	88	15.82	26.64
CI-3	12	20.73	3.59	72.5	14.08	22.71
CI-4	11	16.79	3.28	90	13.5	23.6
CI-5	21	28.5	5.97	97.5	16.46	26.51
CI-6	11	20.79	3.02	87.5	16.08	25.24
CI-7	10.5	16.33	3.03	65	11.23	20
CI-8	12.5	22.71	3.69	77.5	14.21	23.25
CI-9	13.5	20.59	3.51	71.5	11.38	19.43
CI-10	11.5	18.64	3.04	75	13.9	23.27
IZ-1	6.5	11.49	2	55	10.08	17.3
VE-1	11	19.52	3.16	83	14.89	22.83
VE-2	11.5	19.19	3.25	79	14.36	23.84
US-1	10	17.16	2.76	77.5	14.61	23.82
SO-1	10	20.34	3.16	49.5	8.6	14.1
Vineyard peach	14	20.9	4.11	77	12	21.54
Texas	16	16.34	4.06	101.5	15.64	26.9

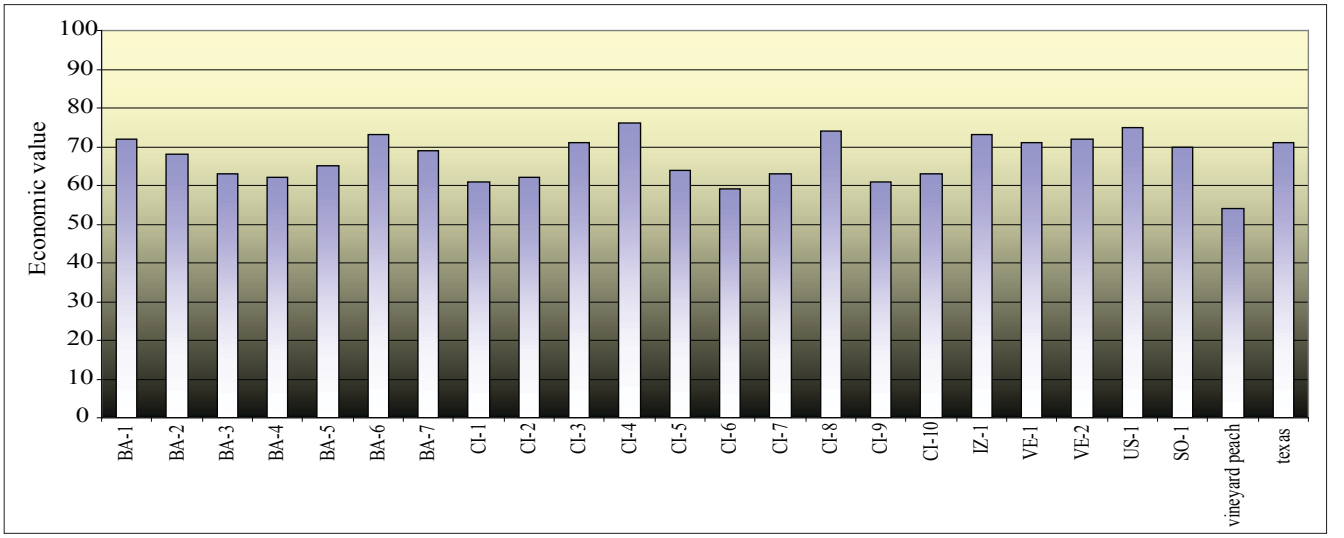

Fig. 1. Economic value of the ecotypes

The randman of the kernels at the researched types is from 18.79% at the type CI-3 to 33.57% at the type CI-7. The control vineyard peach has a drastically lower randman (7.95%), whereas expectedly, the control texas has the highest randman of the kernels (46.74%).

The content of dry matters, ash, proteins and fat at the examined almond types does not defer much compared to the content of the control variety texas.

The percentage of ash goes from 2.01% at type BA-4 to 4.51% at type BA-2. The kernels from the type BA-2 have the largest percent of proteins (27.95%), whereas the type CI-9 has the smallest percent (18.51%). The content of fat is from 45.03% at type SO-1 to 58.22% at CI-9.

The content of amygdaline in the fruit kernel, determines the intensity of its bitterness. The types with intensive bitter kernels have a larger content of amygdaline. It is from 18.4 mg/100 g at type BA-5 to 275.9 mg/100 g at CI-3.

The seedlings from the almond types characterize with a larger trunk diameter compared to the vineyard peach control. The type BA-7 has the most intensive growth of the stem diameter of the seedlings, whereas the type CI-10 has the lowest. The seedlings from the type BA-1 characterize with the most intensive growth of the trunk, whereas the type CI-10 has the weakest growth.

The seedlings from the type CI-8 have the largest uniformity of the trunk diameter, whereas the type CI-2 has the smallest.

The highest pre-branching begins at the IZ-1 and VE-1 types, whereas the type CI-6 has the lowest.

The variability in the development of the plants is mostly expressed at the CI-5 type, and less expressed at the IZ-1 type.

The types CI-4 (76), US-1 (75), CI-8 (74), BA-6 (73), BA-1 (72), VE-2 (72) have the highest marks for economic value, higher than the controls. They are promising types for production of generative rootstocks.

References

Aslanta, R. and M. Güleryüz, 2001. Almond selection in microclimate areas of northeast Anatolia. *CIHEAM–Options Méditerranéennes,* **56:** 339-342.

Barbera, G., L. Di Marco, T. La Mantia and M. Schirra, 1994. Effect of rootstock on productive and qualitative response of two almond varieties. *Acta Horticulturae,* **373:** 129-134.

Borojević, S. and K. Borojević, 1971. Genetika. *Kulturni centar*, Novi Sad, pp. 25.

DeJong, T. M., A. Weibel, W. Tsuji, J. F. Doyle, R. S. Johnson and D. Ramming, 2001. Evaluation of size controlling rootstocks for California peach production. *Acta Horticulturae,* **557**: 103-110.

De Salvador, F. R., G. Ondradu and B. Scalas, 2002. Horticultural behaviour of different species and hybrids as rootstoks. *Acta Horticulturae,* **592**: 317-322.

Giorgi, M., F. Capocasa, J. Scalzo, G. Murri, M. Battiono and B. Mezzetti, 2005. The rootstock effects on plant adaptability, production, fruit quality, and nutrition in the peach (cv. 'Suncrest'). *Scientia Horticulturae,* **102**: 36-42.

Ristevski, B. and D. Georgiev, 1998. Nine Hungarian almond cultivars in the Republic of Macedonia. *CIHEAM–Options Méditerranéennes*, **33:** 191-196.

Siami, A., R. Heidari and M. Mohseni, 2002. Comparative study of amygdalin, fat and total protein of 7 species of wild almond in western Azerbaidjan (Iran). *Acta Horticulturae,* **591:** 181-187.

Stylianidis, D. C. and G. D. Syrgianidis, 1989. Rootstock for almond Historical review, present situation and perspectives in Greece. *CIHEAM–Options Méditerranéennes–Série Séminaires,* **5**: 69-71.

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