

Study of genetic Variation in some Iranian Apricot Cultivars using Fruit Characteristics (Morphological Markers)

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ABSTRACT : In this research thirty five fruit morphological characters were studied in twenty apricot genotypes to identify of any cultivars based on international descriptor (UPOV ipgri 1980) as follows : **Fruit:** Size, Shape in lateral view, Shape in ventral view, Height, Lateral width, Ventral width, Ratio height/ventral width, Ratio lateral width/ventral width, Symmetry in ventral view, Suture, depth of stalk cavity, Shape of apex, Present of macro, Surface, Pubescence, Glossiness, Ground color, Relative area of over color, Hue of over color, Intensity of over color, Color of flesh, Texture of flesh, Firmness of flesh, Adherence of stone to flesh, Weight, Volume, PH, Pressure tester, sugar, Time of beginning of fruit ripening. **Kernel :** Shape in lateral view, Bitterness, Weight, Volume, Ratio weight of stone /weight of fruit. Cultivars name as follows : BN-KB 21, BN-HS 524, BN-RE527, Jahangiri, Sharood 49, Sharood 15, Sharood 48, BN-KB 29, BN-KB 576, Sharood 48 A, BN-KB 31, Azgadi, BN-NO 512, BN – KB 7, Sharood 31, BN- SH 723, Royal, Sharood 18, BN-KB 40, BN-KB 24. As a result : The Different between cultivars was significant and the different between almost of fruit Morphological characters can be used to distinguish of cultivars in Iran Apricots.

Key words : Apricot; Characters; Fruit; Morphological markers; UPOV

INTRODUCTION

Apricot (*prunus armeniaca*) has an important place in human nutrition and can be use as fresh dried or processed fruit. Apricot has an important place in term of human health. Morphological traits of apricot fruit are used to describe and identify cultivars select the most suitable genotypes for growing, define classes in quality standards and sort apricot fruit (vachun, 2003). Many studies have reported about physical and mechanical property of seed and fruit such as Gezer *et al.* (2002) and Fathollahzadeh (2008) for apricot physical characteristics of agricultural products are the most important parameters to determine the proper standards of design of grading, conveying processing, and packaging systems (tabatabaefar and rajabipour 2005). Among these physical characteristics, mass, volume, projected area are the most important ones in determining sizing systems (khodabandehloo, 1999). Information regarding dimensional attributes is used in describing fruit shape which is often necessary in horticultural research for a range of differing purposes including

cultivar description in application for plant variety rights or cultivar registers (Schmidt *et al.*, 1995, Beyer *et al.*, 2002). J. Nyéki (1989) studied some morphological and phenological properties in apricot fruit. Morphological characters in studying base on international descriptive (UPOV 2008 IPGRI 1980). This information can be used for distinguishing cultivars. The aim of this research was to develop quantitative method for description of the apricot cultivars.

MATERIAL AND METHODS

This research carried out in seed and plant improvement research institute of Karaj, Iran. Twenty genotypes evaluated. Thirty five characters on fruit studied. All of cultivars were Iran native including : BN-KB 21, BN-HS 524, BN-RE527, Jahangiri, Sharood 49, Sharood 15, Sharood 48, BN-KB 29, BN-KB 576, Sharood 48 A, BN-KB 31, Azgadi, BN-NO 512, BN – KB 7, Sharood 31, BN- SH 723, Royal, Sharood 18, BN-KB 40, BN-KB 24. This genotypes were Iran native and were six years old. Fruits collected at any

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genotypes random at from spring until summer. Characters evaluated base on international descriptor (UPOV) as follow : **Fruit:** Size, Shape in lateral view, Shape in ventral view, Height, Lateral width, Ventral width, Ratio height/ventral width, Ratio lateral width/ventral width, Symmetry in ventral view, Suture, depth of stalk cavity, Shape of apex, Present of macro, Surface, Pubescence, Glossiness, Ground color, Relative area of over color, Hue of over color, Intensity of over color, Color of flesh, Texture of flesh, Firmness of flesh, Adherence of stone to flesh, Weight, Volume, PH,

Pressure tester, sugar, Time of beginning of fruit ripening. **Kernel :** Shape in lateral view, Bitterness, Weight, Volume, Ratio weight of stone / weight of fruit. Some characters measured by "kolis" for example fruit height. Some characters measured by "scale" for example weight of fruit and some other evaluated by visual view base on UPOV for example pattern of over color. Some characters measured by special instrument for example Ph. Mean value of characters were determined. Obtained results were processed by ANOVA in the statistic program MSTATC.

Table 1
Fruit Characters

<i>Character</i>	<i>Unit</i>	<i>Max</i>	<i>Min</i>	<i>Mean</i>
1. Size	Coding	8.4	4	6.36
2. Shape in lateral view	Coding	8	1	2.7
3. Shape in ventral view	Coding	5	2	2.97
4. Height	Millimeter	49.72	31.11	39.76
5. Lateral width	Coding	43.53	27.15	35.76
6. Ventral width	Coding	39	27.42	33.79
7. Ratio height/ventral width	Coding	7	5	5.62
8. Ratio lateral width/ventral width	Coding	7	5	5.26
9. Symmetry in ventral view	Coding	6	1.2	3.66
10. Suture	Coding	3	1.2	2.37
11. Depth of stalk cavity	Coding	6	3.1	5.11
12. Shape of apex	Coding	3	1	2.01
13. Present of macro	Coding	9	1	4.77
14. Surface	Coding	1.5	1	1.05
15. Pubescence	Coding	5	1	1.76
16. Glossiness	Coding	2.4	1	1.80
17. Ground color	Coding	4	2	3.37
18. Relative area of over color	Coding	5.8	2.6	4.36
19. Pattern of over color	Coding	5	1	1.91
20. Intensity of over color	Coding	6	4	4.82
21. Color of flesh	Coding	6	1	3.02
22. Texture of flesh	Coding	3.5	1	1.76
23. Firmness of flesh 3. 88	Coding	7	2	3.88
24. Adherence of stone to flesh	Coding	3	1	1.36
25. Shape in lateral (kernel)	Coding	3.3	2	2.96
26. Bitterness kernel	Coding	2	1	1.04
27. Time of beginning of fruit Ripening	Coding	8	4	5.92
28. Fruit weight	Gr	50.92	14.19	31.04
29. Stone weight	Gr	3.36	1.01	2.19
30. Stone volume	Mm3	4.2	1.5	2.61
31. Fruit volume	mm3	52.1	13.5	33.09
32. PH	—	5.4	3.5	4.60
33. Sugar	Percent	25.2	9.9	17.21
34. Pressure tester	Pascal	44.4	4.9	29.51
35. Stone weigh/ Fruit weigh	(%)	12.05	4.22	6.46

Tables 2
Characters Mean in Apricot Fruit

<i>Genotypes</i>	<i>Size (coding)</i>	<i>Shape in lateral view (coding)</i>	<i>Shape in ventral view (coding)</i>	<i>Height (Millimeter)</i>	<i>Lateral width (coding)</i>
BN-KB 21	8	2	4	48.47	4.35
BN-HS524	5	2	2	34.88	3.28
BN-RE527	6.8	2	2	43.87	3.36
Jahangiri	5	2	2	37.73	2.99
Shahrood 49	7	2.5	2.5	42.67	3.75
Shahrood 15	8	6	4.5	40	3.89
Shahrood 48	6	1.5	2	43.48	3.42
BN-KB 29	6	5	5	39.23	3.83
BN-KB 576	7	1	2	49.72	3.77
Shahrood 48 A	3.2	2	2	28.64	2.71
BN-KB 31	5	2	2	31.11	3.58
Azghandi	7	1.5	5	41.5	3.88
BN- NO512	5	2	2	34.51	2.99
BN-KB 7	7	4	4	37.34	3.49
Shahrood 31	4	3.5	3.5	34.59	3.00
BN-HS 723	7	1.5	2	45.35	3.55
ROYAL	7	3.5	5	33.42	3.26
Shahrood18	7.5	1.7	2	46.19	3.96
BN-KB40	7	2	5	41.17	4.13
BN-KB24	7.8	2	2	38.37	3.84

<i>Genotypes</i>	<i>Ventral width (coding)</i>	<i>Ratio height/ ventral width (coding)</i>	<i>Ratio lateral width/ventral (coding)</i>	<i>Symmetry in ventral view (coding)</i>	<i>Suture (coding)</i>
BN-KB 21	3.89	6	6	1.7	2.1
BN-HS524	3.26	5	5	2.5	2.8
BN-RE527	3.32	6	5	1.5	2.5
Jahangiri	2.79	6	5	2.3	2.9
Shahrood 49	3.26	6.6	5	2	2.6
Shahrood 15	3.56	5	5	2	4
Shahrood 48	3.52	6	6	1.4	1.9
BN-KB 29	3.86	5	5	2	2.8
BN-KB 576	3.55	7	7	1.2	2
Shahrood 48 A	2.77	5.2	5	3	2.2
BN-KB 31	2.74	5	5	3	3
Azghandi	3.88	5	5	3	2.3
BN- NO512	2.81	7	5	3	2.6
BN-KB 7	3.44	5	5	3	2.7
Shahrood 31	3.06	5	5	3	2
BN-HS 723	3.38	7	6	3	2.5
ROYAL	3.19	5	5	3	2.5
Shahrood18	3.65	6.6	5.6	2.6	2.4
BN-KB40	3.9	5	5	3	2.4
BN-KB24	3.39	3.1	5	3	1.2

contd. table 2

<i>Genotypes</i>	<i>Depth of stalk cavity (coding)</i>	<i>Shape of apex (coding)</i>	<i>Presence of macro (coding)</i>	<i>Surface (coding)</i>	<i>Pubescence (coding)</i>
BN-KB 21	5.8	2	3	1	9
BN-HS524	6	1	3	1	9
BN-RE527	6	1	3	1	9
Jahangiri	5	1	3	1	9
Shahrood 49	6	1	3	1	9
Shahrood 15	5	1	2	1	9
Shahrood 48	5.6	1.4	3	1	9
BN-KB 29	5	1	3	1	9
BN-KB 576	3.1	1.7	3	1	9
Shahrood 48 A	5.4	1.2	3.3	1	9
BN-KB 31	5	3	3	1	9
Azghandi	5.4	1.3	3	1	9
BN- NO512	5	1	3	1	9
BN-KB 7	5	1.8	3	1	9
Shahrood 31	5	1	3	2	9
BN-HS 723	6	1.6	3	1	9
ROYAL	5	1	3	1	9
Shahrood 18	5	1.4	3	1	9
BN-KB 40	3.8	1.8	3	1	9
BN-KB 24	5.3	1	3	1	9
<i>Genotypes</i>	<i>Ground color (coding)</i>	<i>Relative area of over color (coding)</i>	<i>Hue of over color (coding)</i>	<i>Intensity of over color (coding)</i>	<i>Color of flesh (coding)</i>
BN-KB 21	3.36	3.8	4	4.47	2
BN-HS524	1.17	2	2.5	4.45	5
BN-RE527	1.17	2	2.5	4.45	5
Jahangiri	1.33	2.2	2.5	4.52	6
Shahrood 49	2.06	3.1	4	4.53	4
Shahrood 15	2.65	4.2	3.7	4.77	2
Shahrood 48	1.62	2.8	3.7	4.65	4
BN-KB 29	2.14	2.3	2.4	4.78	5
BN-KB 576	1.7	3.2	4	3.52	2
Shahrood 48 A	1.71	2.4	1.3	3.67	1
BN-KB 31	1.35	2.2	1.2	3.76	5
Azghandi	2.84	2.9	3.9	4.92	2
BN- NO512	1.49	2	2.2	5.26	4
BN-KB 7	1.35	2.1	3	5.26	3
Shahrood31	1.64	2.2	2.2	4.83	4
BN-HS723	1.44	2.4	3.3	4.58	3
Royal	1.01	1.5	2.7	5.26	5
Shahrood 18	2.54	3.3	4	4.58	2
BN-KB 40	3.34	3.1	4	4.5	3
BN-KB 24	1.79	2	3.5	5.4	1

contd. table 2

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<i>Genotype</i>	<i>Firmness of flesh (coding)</i>	<i>Yield (Kg/hc)</i>	<i>Fruit weigh (gr)</i>	<i>Texture of flesh (coding)</i>	<i>Time of beginning of fruit Ripening (coding)</i>
BN-KB 21	4	12.8	50.92	2	7
BN-HS 524	4	13	24.57	3	8
BN-RE 527	3	12.6	29.47	3	7
Jahangiri	4	12	21.5	2	5
Shahrood 49	5	11.9	40	3	5
Shahrood15	5	9	35.79	3	3
Shahrood 48	2.6	10.8	31.49	3	5
BN-KB 29	4	12.5	30.33	2	7
BN-KB 576	2	9	40.19	2	3
Shahrood 48 A	3.6	7	14.19	3	1
BN-KB 31	7	8.2	15.37	3	3
Azghandi	3	8	41.18	1	3
BN- NO512	3.4	8.7	18.94	2	3
BN-KB 7	4	11	28.67	3	5
Shahrood 31	3	11.2	19.76	3	5
BN-HS 723	4	11.3	33.64	2	5
ROYAL	3	12	22.36	3	7
Shahrood18	5	11.7	40.39	3	5
BN-KB 40	4	8.5	40.21	2	3
BN-KB 24	3	12.3	32.51	2	7

<i>Genotype</i>	<i>Fruit volume (mm3)</i>	<i>PH</i>	<i>Tss (sugar) (percent)</i>	<i>Glossiness (coding)</i>	<i>Pressure tester (skin) (Pascal)</i>
BN-KB 21	47.4	4.47	13.7	3	16.2
BN-HS524	25.9	4.45	21	2	44.2
BN-RE527	35	4.39	18	2	18.8
Jahangiri	25.8	4.52	25.2	2	20.3
Shahrood 49	52.1	4.53	19.9	3	44.4
Shahrood 15	37.8	4.77	14.6	3	42.9
Shahrood 48	37.8	4.65	17.9	2	33.5
BN-KB 29	24.9	4.78	21.1	2	24.2
BN-KB 576	44.2	3.52	13.2	3	28.6
Shahrood48A	13.5	3.67	11.8	1	33.7
BN-KB 31	12	3.76	21.4	1	36.4
Azghandi	39.9	4.92	15	3	4.9
BN- NO512	22.7	5.26	19.99	2	27.8
BN-KB 7	30.2	5.26	15.6	2	37.4
Shahrood 31	22	4.83	19.5	2	38.7
BN-HS 723	33.9	4.58	16.2	3	28.6
ROYAL	27.3	5.26	21.7	2	30
Shahrood 18	43	4.58	15	3	30.7
BN-KB 40	41.3	4.5	15.6	3	20
BN-KB 24	35.2	5.4	9.9	2	27.8

contd. table 2

<i>Genotype</i>	<i>Stone weigh (Gr)</i>	<i>Adherence of stone to flesh (Coding)</i>	<i>Shape in lateral (kernel) (Coding)</i>	<i>Bitterness (Coding)</i>	<i>Stone volume (Mm³)</i>	<i>Stone weigh/ Fruit weigh (%)</i>
BN-KB 21	3.36	2	3	1	3.8	6.6
BN-HS524	1.17	1	3	1	2	4.76
BN-RE527	1.58	1	3	1	2	5.36
Jahangiri	1.33	1	3	1	2.2	6.18
Shahrood 49	2.06	1	3	1	3.1	5.15
Shahrood 15	2.65	1	2	1	4.2	7.4
Shahrood 48	1.62	1.4	3	1	2.8	5.14
BN-KB 29	2.14	1	3	1	2.3	7.05
BN-KB 576	1.7	1.7	3	1	3.2	4.22
Shahrood 48 A	1.71	1.2	3.3	1	2.4	12.05
BN-KB 31	1.35	3	3	1	2.2	8.79
Azghandi	2.84	1.3	3	1	2.9	6.89
BN- NO512	1.49	1	3	1	2	7.86
BN-KB 7	1.35	1.8	3	1	2.1	4.7
Shahrood31	1.64	1	3	2	2.2	8.29
BN-HS723	1.44	1.6	3	1	2.4	4.28
Royal	1.01	1	3	1	1.5	4.51
Shahrood 18	2.54	1.4	3	1	3.3	6.28
BN-KB 40	3.34	1.8	3	1	3.1	8.3
BN-KB 24	1.79	1	3	1	2	5.5

Table 3
Avova (Fruit Characters)

<i>size</i>	<i>sv</i>	<i>df</i>	<i>ss</i>	<i>ms</i>	<i>f</i>	<i>prob</i>
	replication	3	0.409	0.136	5.9009	0.0014
	A	19	140.281	7.383	319.2751	
	error	57	1.318	0.023		
	total	79	142.009			
	c.v	2.41				
<i>Firmness of flesh</i>	<i>sv</i>	<i>df</i>	<i>ss</i>	<i>ms</i>	<i>f</i>	<i>prob</i>
	replication	3	0.038	0.013	0.2759	0.000
	A	19	90.698	4.774	102.6184	
	error	57	2.651	0.047		
	total	79	93.387			
	c.v	5.62				
<i>Fruit weight</i>	<i>sv</i>	<i>df</i>	<i>ss</i>	<i>ms</i>	<i>f</i>	<i>prob</i>
	replication	3	2.133	0.711	1.1987	0.3185
	A	19	7538.912	396.785	668.9809	0.000
	error	57	33.808	0.593		
	total	79	7574.853			
	c.v	2.52				
<i>Stone weight</i>	<i>sv</i>	<i>df</i>	<i>ss</i>	<i>ms</i>	<i>f</i>	<i>prob</i>
	replication	3	0.009	0.003	0.1681	00.00
	A	19	36.487	1.92	105.6667	
	error	57	1.036	0.018		
	total	79	37.802			
	c.v	7.08				

contd. table 2

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<i>Stone volume</i>	<i>sv</i>	<i>df</i>	<i>ss</i>	<i>ms</i>	<i>f</i>	<i>prob</i>
replication		3	0.411	0.137	2.1437	0.1047
A		19	34.557	1.819	28.4335	0.00
error		57	3.646	0.064		
total		79	38.615			
c.v		9.83				
<i>Fruit volume</i>	<i>sv</i>	<i>df</i>	<i>ss</i>	<i>ms</i>	<i>f</i>	<i>prob</i>
replication		3	3795.634	1265.211	0.9709	0.1738
A		19	34187.327	1799.33	1.3807	
error		57	74281.288	1303.18		
total		79	112264.24			
c.v		9.86				
<i>suger</i>	<i>sv</i>	<i>df</i>	<i>ss</i>	<i>ms</i>	<i>f</i>	<i>prob</i>
replication		3	53.321	17.774	3.3897	0.024
A		19	1303.489	68.605	13.0842	0.00
error		57	298.87	5.24		
total		79	1655.68			
c.v		13.51				
<i>yield</i>	<i>sv</i>	<i>df</i>	<i>ss</i>	<i>ms</i>	<i>f</i>	<i>prob</i>
replication		3	6.698	2.233	2.6808	0.0554
A		19	337.115	17.743	21.2975	
error		57	47.487	0.833		
total		79	391.3			
c.v		8.63				
<i>Time of beginning of fruit ripening</i>	<i>sv</i>	<i>df</i>	<i>ss</i>	<i>ms</i>	<i>f</i>	<i>prob</i>
replication		3	11.25	3.75	3.155	0.0316
A		19	76.55	4.029	3.3897	0.0002
error		57	67.75	1.189		
total		79	155.55			
c.v		18.4				

RESULT

Some fruit characters are not different between varieties and cannot be used to distinguish varieties in this genotypes, including: Ventral width, Present of macro, Surface, Kernel shape and /Ratio lateral width kernel, bitterness of kernel. About other characters there are difference between all varieties.

SUGGESTION

Azghandi and Bn-kb 576 are suitable to use as fresh because firmness of fruit is less than others. This varieties will be known as a palatable cultivar in this research that will be consumed fresh. BN-KB 24 is not market-friendly because suger percent is low and size of fruit is small.

REFERENCE

- [1] Fathollahzadeh, H., H. Mobli, B. Beheshti, A. Jafari and A. M. Borghei (2008), Effect of moisture content on some physical properties of apricot kernel (c. v. Sonnati Salmas). *Agricultural Engineering International: the CIGR EJournal*, 10, 08-008.
- [2] Gezer, I., H. Haciseferogullari and F. Demir. (2002), Some physical properties of Hacıhaliloğlu apricot pit and its kernel. *Journal of Food Engineering*, 56, 49-57.
- [3] Khodabandehloo H. (1999), Physical properties of Iranian export apples. M. Sc Thesis, University of Tehran, Iran.
- [4] Nyék J. I, Z. Szabó, A. Andrásfalvy, Z. Erdős (1989), Morphological Properties and Phenology of the Giant ("Óriás") Type Apricot Varieties and their Fertility Relations. *ISHS Acta Horticulturae* 488: XI International Symposium on Apricot Culture.

- [5] Schmidt H., Vittrup Christensen J., Watkins R., Smith RA (1995), Cherry descriptors. ECSC, EEC, EAEC, Brussels, Lux and Int Board. Plant Gen Res, Rome, Italy p: 22.
- [6] Tabatabaefar A., Rajabipour A. (2005), Modeling the mass of apples by geometrical attributes. *Sci Horticulturae J.* 105:373-382.
- [7] UPOV (2008), Protocol for Distinctness, Uniformity and Stability Tests: Apricot. Community Plant Variety Office. CPVO-TP/070/2 Final.
- [8] VACHUN, Z. (2003), Variability of 21 apricot (*Prunus armeniaca* L.) cultivars and Hybrids in selected traits of fruit and stone. Hort Sci. (Prague), 30, 90-97.