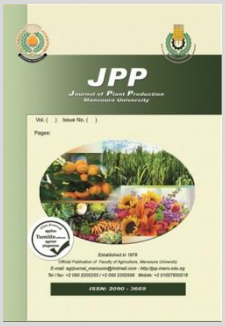
Journal of Plant Production

Journal homepage: www.jpp.mans.edu.eg
Available online at: www. jpp.journals.ekb.eg

Morphological Evaluation and Genetic Identification of some Local Apricot Lines

Nahla A. Awad[1*] ; M. A. Gabr[1] and M. S. Gawish[2]

[1]Horticulture Research Institute- Agriculture Research Center- Egypt
[2]Department of pomology, Fac. Agric., Damietta Univ., Egypt



ABSTRACT

This study was carried out to evaluate some selected local apricot strains cultivated in private orchards of El-Amar region- Qaliubia governorate, Egypt. The present investigation was included several important pomological traits and genetic relationships among the selected lines. Different pomological characteristics of the strains as beginning of blooming date, date of full bloom, fruit set percentage and date of fruit ripening were determined as well as physical and chemical characteristics of fruits. Among 15 lines, AE1 was the earliest strain concerning all dates of bloom, full bloom and ripening times meanwhile, AL3 was the latest line as for these tested traits. The obtained results revealed the significant differences between all studied strains with regard to fruit physical and chemical characteristics. AM1, AM2, AM12, AM15 and AL3 recorded higher values concerning fruit weight. Regarding TSS %, a slight difference was noticed among the tested strains. Strains AM1 and H recorded the highest values of TSS% in the first and second season, respectively The genetic relationships among 15 apricot strains was estimated by using randomly amplified polymorphic DNA (RAPD) technology for PCR reactions. The tested primers showed reproducible polymorphic patterns. These primers produced 207 bands, out of which 179 were polymorphic. The genetic similarity ranged from 0.61 to 0.93.The highest genetic similarity (0.93) was noticed between strain EA1 and strains EA2.. These molecular and pomological variations cleared that this germplasm contains promised plant materials for apricots selection, breeding and improvement programs that can extending the maturity dates and longing the marketing periods.

Keywords: apricot, genotypes, cluster analysis, diversity; RAPD

INTRODUCTION

Apricot is a cold-zone fruit, but some cultivars and types can be grown in temperate and subtropical zones; despite apricot having a very large spreading area over the world, its cultivation is still located in only certain limited places (Önal, 2014).

Apricot trees are cultivated world-wide mainly for their high-quality fruit, which is consumed fresh, processed by the food industry, or preserved by drying. Fruit quality is a combination of physical and chemical characteristics accompanied by sensory properties (appearance, texture, taste and aroma), nutritional values, chemical compounds, mechanical properties, and functional properties (Cejpek, 2007).

In Egypt, it is known that some of the cultivated area of apricot are planted by seeds and named Balady, Amar, and Hamawy. Trees vary greatly in size, yield, quality of fruit and date of maturity (Bakr *et al.*, 1985 and Seif & Hassan, 1992) and these seedling trees have a short marketing ability and therefore, many attempts were studied in order to increase the marketing ability period of apricot fruits. This can be achieved by selecting the early, middle and later harvested apricot cultivars from locally grown trees or introducing new varieties.

Accordingly, the selection of valuable individuals within the seedling populations that display great diversity might contribute to the apricot breeding progress. RAPD markers have the advantages of simplicity and the ability to detect relatively small amounts of genetic variation and also need no prior information on the genome. However, RAPDs do not give information about the genome. The technique has already been successfully applied to estimate genetic relationships in apricot trees (Marinello *et al.*, 2002), assessment genetic diversity among closely related cultivars; in the present study RAPD marker has selected to assess the genetic diversity among fifteen selected apricot strains. The objective of this study is to evaluate and compare the fruit quality attributes of fifteen apricot genotypes; it is a very difficult breeding task to combine the valuable pomological traits together with environmental adaptability and yield reliability and estimate genetic diversity among the selected apricot strains from ElAmmar region to provide a scientific data base for future selection and germplasm management.

MATERIALS AND METHODS

This study was carried out at ElAmar region- Qaliubia governorate, Egypt during 2016 and 2017 growing seasons on 35 years old apricot trees planted at a distance 5 x 6 M. Data was recorded on one-hundred trees which appeared as good strains and only data of 15 strains were promising as recorded in the results. The selected strain was given abbreviated names according to date of

* **Corresponding author.**
E-mail address: nohawad@yahoo.com
DOI: 10.21608/jpp.2019.61130

fruit ripening, or skin and flesh color and fruit size, i.e; the group AE included (the strains that ripened in early of the season), AM (the strains that ripened in mid-season) and AL (The strains that ripened in late season. While the group AW included (the strains that have white skin and flesh color), and the blooming parameters were studied:

A) Flowering:

Total number of flowers and percentage of fruit set % on spurs of the selected secondary branches were estimated four times (February and March) during both growing seasons.

D) Fruit characteristics:

During April and May, ripping fruits of 15 apricot strains were collected and estimated the following characteristic: (i) fruit weight (g); (ii) fruit diameter (cm); (iii) fruit height (cm); fruit firmness was measured with pressure tester expressed as $1gm/mm^2$ using needle of 2mm in diameter; (iv) weight of seeds (g); (iv) total soluble solids (TSS): A hand refractometer was used to determine the percentage of total soluble solids of juice in (^{0}Brix%); and (v) Titratable acidity % of the juice was determined in terms of citric acid percentage per 100 g of fresh juice after being tartrate with 0.1 sodium hydroxide using phenolphthalein as indicator according to A.O.A.C (1975).

E) Yield:

Yield was estimated (average fruits weight X total number of fruits/tree)

Random amplified polymorphic DNA (RAPD-PCR) procedure

A set of ten random 10-mer primers (Table 5) were used in the detection of polymorphism among evaluated apricot strains. RAPD-PCR was carried out according to the procedure given by Williams *et al.,* (1990) with minor modifications. The amplification reaction was carried out in 25 µl reaction volume containing 1X PCR buffer, 1.5 mM MgCl2, 0.2 mM dNTPs, 1 µM primer, 1 U Taq DNA polymerase and 25ng template DNA.

Statistical analysis:

Agronomical data was subjected to analysis of variance (ANOVA) according to Snedecor and Cochran (1980). Differences between means were compared by Duncans multiple rang test as described in the SAS (SAS, 1988).

A similarity matrix using the similarity coefficient of Nei and Li (1979) was constructed for RAPD data based on the presence (coded as 1) or absence (coded as 0) of the resulted fragments for each primer.

RESULTS AND DISCUSSION

Blooming and fruit set %:

Data in Table (1) revealed different trend regarding bloom and full bloom date, strains AE1 and AE2 were the earlier ones; meanwhile, AL2 and AL3 were the latest strains in the beginning of bloom. Strains AE1 and AE2 showed an early date for full bloom, a vice versa trend was observed within strains AM12 and AM15. Fruit ripening was affected by beginning of flowering, strains AE1 and AL3 were the earliest and latest strains, respectively.

Average number of flowers on spurs of the selected secondary branches recorded a maximum values (41.4 and 40.7) with the strains AM2 and AM15, in the first and second seasons, respectively (Table 1). It is clear that flowers number decreased within strains AM11 and AM12 (23.7 and 27.7, respectively).

Fruit set % varied among the tested strains during both growing seasons {(Table 1)}. Some of them showed the highest percentage of fruit set during first and second seasons, strains AM1 and AM1 recorded the highest percentage of fruit set (71.4% and 71.2%, respectively). Strain AS gave the lowest fruit set %(45.3% and 50.2%, in the first and the second seasons, respectively). It is clear that there is no obvious trend to the effect of the tested strains or dates on the fruit set percentage; this may be due to the origin of these strains as seedy plants.

Table 1. Flowering characterization, fruit set % and ripening date of some selected apricot strains.

Lines	bloom Date		Full bloom Date		Av. Number of flowers on spurs/secondary branches		Av. Fruit set %/		Ripening Date	
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
AE1	Jan. 20	Jan. 25	Feb.9	Feb.11	29.1	35.7	70.1	65.2	Apr.20	Apr.24
AE2	Feb.2	Feb.6	Feb.27	Mar.3	35.2	35.2	62.3	59.4	May.1	May.6
H	Feb.10	Feb.15	Mar.3	Mar.5	32.4	29.4	50.2	52.9	May.15	May.21
AM1	Feb.15	Feb.20	Mar.6	Mar.9	26.9	30.9	71.4	64.7	May.5	May.21
AM2	Feb.8	Feb.15	Mar.3	Mar.5	41.4	32.4	61.8	66.3	May.5	May.15
AM11	Feb.15	Feb.20	Mar.5	Mar.9	23.7	31.2	59.1	65.4	May.10	May.21
AM12	Feb.17	Feb.22	Mar10	Mar.15	28.6	27.7	64.2	66.8	May.10	May.21
AM15	Feb.18	Feb.22	Mar11	Mar.15	33.4	40.7	64.8	59.5	May.10	May.21
AR	Feb.12	Feb.17	Mar.5	Mar.10	35.3	29.6	58.2	62.7	May.15	May.21
AS	Feb.15	Feb.20	Mar.9	Mar.13	31.7	33.7	45.3	50.2	May.15	May.25
AW1	Feb.5	Feb.10	Mar.4	Mar.9	25.9	29.7	55.0	56.7	May.5	May.15
AW3	Feb.1	Feb.3	Feb.28	Mar.3	32.1	35.2	61.2	64.1	May.15	May.21
AL1	Feb.15	Feb.20	Mar.6	Mar.10	25.4	29.7	45.9	51.4	May.15	May.21
AL2	Feb.17	Feb.23	Mar.7	Mar.10	30.4	34.2	46.2	59.4	May.15	May.25
AL3	Feb.17	Feb.23	Mar.7	Mar.8	31.7	39.4	58.9	61.5	May.20	Jun.1

Fruit physical and chemical characteristics:

There were significant differences among tested genotypes regarding the physical characterization (Table 2, 3 and 4).

Fruits weight ranged from 10.98 to 29.89 gram in the first season and 12.45 to 37.23 gram in the second season. The genotype AE1 always showed lowest value for fruits weight, flesh weight, seed weight and flesh % in both seasons. Previous studies on apricot also reported a high variability among cultivars regarding this parameter (Hernandez *et al*., 2010; Milošević *et al.,* 2010).

Table 2. Physical fruit characteristics of some selected apricot strains.

Lines	Fruit weight (g)		Flesh weight (g)		Seed weight (g)		Flesh %		Seed %	
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
AE1	10.98 f	12.45 j	9.36 d	10.34 j	1.62 g	2.11 ij	85.24 g	83.02 j	14.75 b	16.97 a
AE2	27.84 ab	33.29 b	25.27 ab	29.66 bc	2.57 cd	3.63 a	90.76 ab	89.08 g	9.23 fg	10.91 d
AM1	25.74 cd	29.31 de	23.33 b	26.69 de	2.41 cd	2.62 cd	90.63 ab	91.03 cd	9.36 fg	8.96 fg
AM2	25.80 cd	22.15 g	23.10 b	19.36 g	2.69 c	2.79 bc	89.55 bc	87.36 h	10.44 de	12.63 c
AM 11	29.89 a	34.05 b	27.25 a	31.35 b	2.63 cd	2.69 cd	91.16 ab	92.05 b	8.83 gh	7.94 i
AM 12	29.74 a	30.06 cd	27.22 a	27.47 cd	2.52 cd	2.58 cd	91.49 ab	91.36 bc	8.50 gh	8.63 gh
AM 15	27.42 ab	37.23 a	24.87 ab	34.23 a	2.55 cd	3.00 b	90.64 ab	91.92 bc	9.35 fg	8.07 hi
AL 1	12.49 f	16.23 hi	10.28 d	14.04 hi	2.20 de	2.19 hi	82.34 h	86.49 hi	17.65 a	13.50 bc
AL 2	12.63 f	14.09 ij	10.88 d	12.13 ij	1.75 fg	1.96 j	86.08 fg	86.06 i	13.91 bc	13.93 b
AL 3	28.33 ab	32.51 bc	25.22 ab	30.26 bc	3.11 b	2.25 gh	88.93 cd	93.06 a	11.06 de	6.93 j
H	26.36 bc	23.85 fg	23.71 b	21.54 fg	2.64 cd	2.31 fg	89.93 ab	90.27 ef	10.06 ef	9.72 ef
AR	19.45 e	25.06 fg	17.17 c	22.60 f	2.28 cd	2.46 de	88.26 de	90.17 ef	11.73 de	9.82 ef
AS	19.15 e	17.96 h	16.77 c	15.66 h	2.38 cd	2.30 fg	87.50 ef	87.17 h	12.49 cd	12.82 c
AW 1	25.33 d	24.09 fg	23.24 b	21.67 fg	2.08 ef	2.42 ef	91.77 a	89.94 fg	8.22 h	10.05 de
AW 3	29.02 ab	26.78 ef	25.47 ab	24.24 ef	3.55 a	2.53 de	87.62 ef	90.54 de	12.37 cd	9.45 ef
F. Test	**	**	**	**	**	**	**	**	**	**

Table 3. Physical characteristics of fruit and yielding

Lines	Fruit height (cm)		Fruit diameter (cm)		H/D ratio		Firmness g/mm^2		Yield (Kg.)/tree	
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
AE1	2.77 e	3.05 gh	2.83 l	2.77 i	1.02 bc	1.07 b	215.4 de	240.12 a	10.23	20.23
AE2	3.66 bc	4.14 a	3.82 de	3.69 de	1.02 bc	1.08 b	238.66 de	235.20 ab	20.41	40.45
AM1	3.40 d	3.68 ef	3.94 cd	3.80cd	0.92 de	0.93 ef	311.24 bc	153.82 de	150.12	200.78
AM2	3.39 d	3.18 g	3.57 gh	366 ef	0.90 de	0.88 g	389.58 a	143.46 de	150.31	220.22
AM 11	3.55 cd	3.88 bc	4.15 ab	4.05 a	0.89 de	0.93 ef	266.66 cd	202.76 bc	120.45	170.01
AM 12	3.59 bc	3.60 ef	4.00 bc	3.98 ab	0.90 de	0.90 fg	363.04 ab	73.39 de	180.22	220.32
AM 15	3.40 d	3.91 bc	4.29 a	4.04 a	0.89 de	0.91 fg	374.86 a	205.42 be	250.41	350.47
AL 1	2.80 e	3.21 g	2.99 jl	2.74 i	1.13 ab	1.07 b	188.68 ef	133.42 ef	30.14	50.55
AL 2	2.74 e	2.92 h	3.04 j	2.96 h	0.95 de	0.96 de	233.54 de	148.88 de	100.63	150.23
AL 3	3.85 ab	4.21 a	4.09 bc	3.94 ab	1.01 ab	1.02 c	222.56 de	201.80 be	100.12	120.79
H	3.69 bc	3.52 f	3.64 fg	3.65 ef	1.00 bc	0.96 de	165.86 f	177.70 cd	60.47	80.27
AR	3.39 d	3.75 cd	3.65 ef	3.31 g	1.14 a	1.02 c	216.24 de	107.78 f	120.20	150.69
AS	2.85 e	3.21 g	3.26 i	3.27 g	0.86 e	0.98 d	362.08 ab	163.24 de	70.47	100.54
AW 1	3.98 a	4.05 ab	3.46 h	3.55 f	1.09 ab	1.17 a	220.76 de	141.40 e	70.39	110.67
AW 3	3.82 ab	3.71 de	3.75 ef	3.83 bc	0.97 cd	0.98 cd	262.28 cd	149.30 de	40.12	60.59
F. Test	**	**	**	**	**	**	**	**		

Table 4. Chemical fruit characteristics.

Lines	TSS ^{0}Brix %		Acidity%	
	2016	2017	2016	2017
AE1	14.30 b	14.03 cd	0.31 bc	0.31 ef
AE2	13.80 b	12.21 f	0.32 ab	0.45 a
AM1	15.13 a	14.10 cd	0.32 ab	0.29 f
AM2	14.00 b	13.45 de	0.32 ab	0.36 cd
AM 11	13.60 bc	15.00 ab	0.25 e	0.31 ef
AM 12	12.86 de	12.90 e	0.27 de	0.29 f
AM 15	12.93 cd	14.90 ab	0.31 bc	0.31 ef
AL 1	11.73 h	14.00 cd	0.37 a	0.40 bc
AL 2	13.93 b	13.65 d	0.27 cd	0.27 f
AL 3	14.33 b	15.00 ab	0.33 ab	0.38 bc
H	13.73 bc	15.30 a	0.25 e	0.31 ef
AR	12.06 fg	15.10 ab	0.33 ab	0.35 de
AS	12.66 ef	12.00 f	0.27 cd	0.29 f
AW 1	13.60 bc	13.73 d	0.34 ab	0.42 ab
AW 3	12.00 gh	14.50 bc	0.24 e	0.23 g
F. Test	**	**	**	**

Fruit weight is a major quantitative inherited factor determining the yield, fruit quality, and consumer's acceptability (Dirlewanger *et al*. 1999). Most of the selected genotypes had a desirable fruit size, attractive medium-sized fruits which are desired for apricot breeding (Guerriero *et al*. 2006).

Strains AE1 recorded the lowest value for flesh weight and seed weight in both seasons. Meanwhile, earlier strains AM1, AM2, AM11, AM12 and AM15 revealed highest flesh weight and almost a low value for seed weight. Flesh weight and seed weight were affected both of flesh % and seed %. It was clear that the previous earlier strains had the highest flesh weight and lowest seed % in the first season. These findings were in accordance with Evica *et al.* (2011).

Results showed that fruit length was highest (3.98 cm) with strain AW1 and (3.85) cm with strain AL3 in the first and second seasons, respectively. However, the lowest value of fruit height (2.74 cm) was observed by strain AL2, 2.80 cm for strain AL1 and 2.85 cm in first and second seasons, respectively with no significant differences. On the other hand, fruit diameter revealed significant differences among the tested strain. i.e., the highest value recorded by strains AM15 and AM11 in the first and second seasons, respectively. While the lowest value was obtained by strains AE1 and AL1 in the first and second seasons, respectively. The ratio between fruit height (H) and fruit diameter (D) was calculated to determine the differences among the tested strains in shape. This ratio (H/D) was ranged from 0.89 (strain AM11 and AM15) to 1.14 (strain AR) in the first season, and from 0.88 (strain AM2) to 1.17 (strain AW1) in the second one. It is apparent that fruit shape was influenced by the H/D ratio, all the tested strains takes almost a roundish shape (Fig. 1).

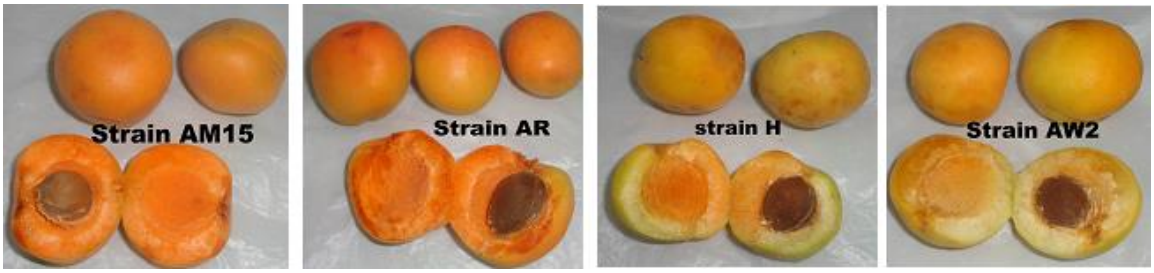


Fig. 1. Different genotypes of locally selected apricot strains

On the other hand, no trend was observed by firmness among the selected strains, firmness values gives a great difference in the first season when compared to the second season for the same strain.

Table (3) summarizes the average yield of each strain; it is obvious that strains AM have the potential to produce the highest average yield (150.41- 350.47 Kg.) in both of the studied seasons; however, strain AM15 recoded the highest yield followed by AM12 in both seasons.

Meanwhile, strains AL, AR, AS and AW showed an intermediate values. The lowest average of yield was obtained by strain AE1 (10.23 and 20.23 Kg) in both seasons, respectively. Previous studies on apricot trees also reported a high variability among cultivars regarding this parameter (Ruiz & Egea 2008; Hernandez *et al*.,2010; Milošević *et al*., 2010).

Table (4) showed the effect of the studied strains on its chemical contents. Concerning T.S.S, there was no clear trend observed in both seasons. A slight difference was noticed among the tested strains. Strains AM1 and H recorded the highest values (15.13 and 15.30, of TSS% in the first and second season, respectively). The lowest record was detected by AW3 (12) in the first season; meanwhile strains AE2 and AS showed lowest TSS% values 12.11 and 12 in the second season (, respectively). An intermediate values of T.S.S was recorded by strains AM11, AS and AW1 in both seasons.

As for acidity, the highest acidity %(0.37 and 0.45%) were obtained for strains AL1 and AE2 (in the first and second seasons, respectively). However, the lowest percentage was obtained for strain H and AW3 in the first season (0.25 and 0.24%), respectively with no significant differences. However, AW3 recorded the lowest values of acidity % in the second season (0.23%).

This findings are in accordance with Evica *et al*.,(2011) but the values are generally lower than those for a group of Turkish genotypes (Asma & Ozturk (2005); Asma *et al.,* 2007). On the other hand, Ruiz and Egea (2008) reported that TSS content is a very important quality attribute, influencing notably the fruit taste. In addition, Ishag *et al.* (2009) reported that a TSS content of the fresh apricot cultivars was 11.8%. The differences between the present results and those of the above mentioned authors were likely due to the different eco-geographical groups between apricot genotypes tested and the environmental conditions of those obtained by (Evica *et al.*, 2011)

Polymorphism and genetic similarity estimated by RAPD markers:

Table (5) indicated the results obtained from using ten primers of RAPD marker. All of the tested primers were reproducible and securable (Fig.2).

Table 5. Primer sequence, Monomorphic bands, polymorphic band, Total number of bands, number of and percentage of polymorphism of fifteen apricot strains.

Primer Name	Primer sequence	Monomorphic bands	number of polymorphic amplicon	Total number of amplicon	percentage of polymorphic amplicon
OPA-16	AGCCAGCGAA	2	10	12	83.3
OPB-01	GTTTCGCTCC	2	19	21	90.4
OPB-15	GGAGGGTGTT	4	22	26	84.6
OPB-16	TTTGCCCGGA	1	14	15	93.3
OPC-15	GACGGATCAG	3	15	18	83.3
OPG-12	CAGCTCACGA	2	18	20	90.0
OPG-20	TCTCCCTCAG	3	20	23	86.9
OPK-15	CTCCTGCCAA	5	17	22	77.3
OPO-08	CCTCCAGTGT	4	21	25	84.0
OPO-15	TGGCGTCCTT	2	23	25	92.0
Total		28	179	207	86.47

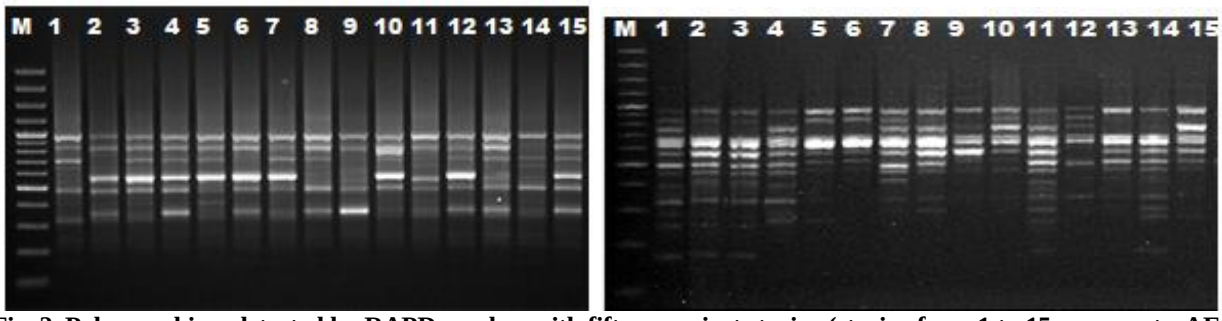


Fig. 2. Polymorphism detected by RAPD marker with fifteen apricot strains (strains from 1 to 15 represents, AE1, AE2, AM1, AM2, AM11, AM12, AM15, AL1, AL2, AL3, H, AR, AS, AW1 and AW3, respectively). M: Ladder molecular weight marker.

Primers produced monomorphic amplicons ranged from one to five (OPB06 and OPK15, respectively). On the other hand, primers OPB16 and OPO15 recorded a highest percentage of polymorphism (93.3 and 92, respectively). Primer OPB15 introduce the highest number of amplicon (26), four of these amplicons were monomorphic; while, twenty-two were polymorphic. The total number of amplicon produced by the ten primers was 207, twenty eight of these amplicon were monomorphic and 179 (86.43%) were polymorphic. In this respect, Sezai *et al.*(2009) stated that, the size of the amplified fragments ranged from 500 to 5000 bp. Each primer generated from 5 to 13 RAPD bands. OPA-1, OPA-2, OPA-4, OPA-13, OPH-14, OPH-17, OPH-18, OPW-11, OPW-13, OPW-17, OPW-18, OPW-20 produced 10, 9, 15, 6, 12, 5, 13, 11, 6, 12, 9, and 10 polymorphic bands, respectively. 97.5% of the total bands were polymorphic.

Genetic similarity

Genetic similarity was estimated according to Dice coefficient (Sneath and Sokal, 1973). The genetic similarity ranged from 0.61 to 0.93 (Table 6). The highest genetic similarity (0.93) was between strain EA1 and strains EA2. However, the lowest genetic similarity recorded between strain H and strain AM11. It is obvious that genetic similarity between the tested strains were comparatively low, this may attributed to its origin as a seeds. Sezai *et al.*(2009) found that, the average genetic distance of 0.596 among the cultivars clearly shows that significant genetic diversity exists among the apricot cultivars. Hence, these cultivars are to be preserved as valuable genetic resources for breeding. The high genetic diversity present among these cultivars clearly suggests that they must have originated from genetically divergent parents or have a long history of adaptation to their respective micro-climatic regions.

Table 6. Genetic similarity matrixes computed according to Dice Coefficient from RAPD marker.

	AE1	AE2	AM1	AM2	AM11	AM12	AM15	AL1	AL2	AL3	H	AR	AS	AW1	AW3
AE1	1.00														
AE2	0.93	1.00													
AM1	0.90	0.89	1.00												
AM2	0.86	0.83	0.86	1.00											
AM11	0.87	0.89	0.87	0.86	1.00										
AM12	0.86	0.88	0.86	0.87	0.86	1.00									
AM15	0.81	0.85	0.82	0.82	0.86	0.87	1.00								
AL1	0.72	0.81	0.84	0.85	0.89	0.87	0.89	1.00							
AL2	0.77	0.79	0.82	0.84	0.85	0.84	0.87	0.90	1.00						
AL3	0.76	0.78	0.86	0.84	0.83	0.82	0.85	0.86	0.86	1.00					
H	0.69	0.75	0.63	0.71	0.61	0.78	0.75	0.78	0.80	0.68	1.00				
AR	0.80	0.82	0.85	0.87	0.82	0.83	0.79	0.82	0.84	0.84	0.82	1.00			
AS	0.82	0.84	0.83	0.83	0.82	0.80	0.80	0.78	0.81	0.82	0.83	0.88	1.00		
AW1	0.86	0.76	0.85	0.83	0.85	0.83	0.81	0.81	0.83	0.84	0.80	0.86	0.87	1.00	
AW3	0.83	0.79	0.84	0.85	0.87	0.79	0.80	0.84	0.85	0.87	0.82	0.87	0.90	0.89	1.00

Cluster Analysis

Dendrogram obtained from UPGMA cluster analysis of genetic distances (Fig.3) revealed that, all of the tested genotypes were separated into two clusters.

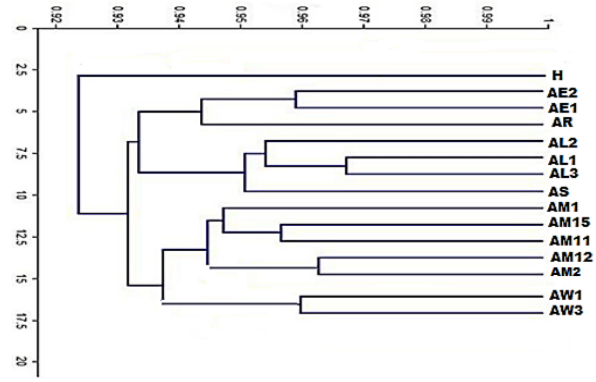


Fig. 3. Dendrogram using average linkage (between groups)

The first cluster includes H strain only. However, the second cluster was divided into two sub-clusters; the first one was divided into two groups, one of these groups include AE1, AE2 and AR. While, the second group collected strains AL1, AL2 AL3 and AS. The second sub-cluster was also divided into two groups, one of these groups comprises strains AM1, AM2, AM11, AM12 and AM15, meanwhile, the second ones grouped strains AW1 and AW3. Hurtado *et al.* (1999) used a set of 45 RAPD primers in order to analyze 18 apricot cultivars and the Harcot cultivar was clustered with the Stark Early Orange (SEO) and Sunglo cultivars within the group of North-American cultivars. Baránek *et al.* (2006) suggested that NorthAmerican cultivars originated by hybridization between European and Asian apricots. Chroboková *et al.* (2011) demonstrated that in RAPD dendrograms, the cultivars were classified into five groups, according to their geographic origin: hybrids originated by hybridization among cultivars of European and Asian origin, European cultivars, American cultivars, Asian cultivars and interspecific hybrids.

CONCLUSION

The apricot genotypes that selected in this study at Al-Amar region in Egypt showed the significant variations of its studied characteristics such as pomological traits (Dates of blooming, full bloom, fruit ripening, physical and chemical fruit properties) and genetic variations. These molecular and pomological variations cleared that this germplasm contains rich and promised plant materials for apricots selection, breeding and improvement programs that can extending the maturity dates and longing the marketing periods. Moreover, these results call for recommendation to complete the evaluation of them at the commercial level and compare it with the cultivated and imported cultivars in the future. Furthermore, the distinguished pomological characteristics of these genotypes may be lead to expansion it to several Egyptian regions and conditions,

REFERENCES

A.O.A.C (1965) Association of Official Analytical Chemists, Official Methods of Analysis, published by A.O.A.C, Washington D.C., USA.

Asma B.M., Ozturk K. (2005): Analysis of morphological, pomological and yield characteristics of some apricot germplasm in Turkey. Genetic Resources and Crop Evolution, 52: 305–313.

Asma B., Kan T., Birhanli O. (2007): Characterization of promising apricot (*Prunus armeniaca* L) genetic resources in Malatya, Turkey. Genetic Resources and Crop Evolution, 54: 205–212.

Bakr, E.I.; M.M. Hassan; I.Y. Yassin and G. Stino (1985). Selection of superior Apricot seedling trees in Egypt. *Egypt. J. Hort. 12 . (1) 41-50* .

Baránek M., Raddová J.and Pidra M. (2006). Comparative analysis of genetic diversity in Prunus L. as revealed by RAPD and SSR markers. *Scientia Horticulturae*, 108: 253–259.

Chroboková E., Raddová J., Vachůn M., Krška B. and Pidra M. (2011). An analysis of apricot cultivars by random amplified polymorphic DNA and microsatellite primers. *Hort. Sci.* Vol. 38, 2011, No. 4: 125–133.

Dirlewanger E., Moing A., Rothan C., Svanella L.,Pronier V., Guye A., Plomion C., Monet R. (1999). Mapping QTLs controlling fruit quality in peach [*P. persica* (L.) Batsch]. *Theoretical and Applied Genetics*, 98:18–31.

Evica M., Bojan P., Tomo M. and Melpomena P. (2011). Evaluation of Apricot Fruit Quality and Correlations Between Physical and Chemical Attributes. *Czech J. Food Sci*. Vol. 29, 2011, No. 2: 161–170.

Guerriero R., Lomi F. and Onofrio C. (2006). Influence of some agronomic and ecological factors on the constancy of expression of some descriptive characters included in the UPOV apricot descriptor list. *Acta Horticulturae*, 717: 51–54.

Hernandez F., Pinochet J., Moreno M.A., Martinez J.J., Legua P. (2010): Performance of Prunus rootstocks for apricot in Mediterranean conditions. *Scientia Horticulturae*, 124: 354–359.

Hurtado M.A., Badenes M.L. and Llácer G. (1999). Random amplified polymorphic DNA as a tool for apricot cultivar identification. *Acta Horticulturae*,488:281–287.

Ishag S., Rathore A.H., Majeed S., Awan S., Ali Shan Z.S. (2009): The studies on the physico-chemical and organoleptic characteristics of apricot (*Prunus armeniaca* L.) produced in Rawalakot, Azad Jammu and Kashmir during storage. Pakistan Journal of Nutrition, 8: 856–869.

Marinello, L, Sommella, M.G., Srrentina, A., Forlani, M., Porto, R.(2002). Identification of Prunus armeniaca cultivars by RAPD and SCAR markers. Biotechnology Letters, 24:749- 755.

Milošević T., Milošević N., Glišić I., Krška B. (2010). Characteristics of promising apricot (Prunus armeniaca L.) genetic resources in Central Serbia based on blossoming period and fruit quality. *Horticultural Science*, 37: 46–55.

Nei M. and W. Li (1979). Mathematical model for studying genetic variation in terms of restriction endonucleases. Proc. Nat. Acad. Sci. USA 76 (10): 5269-5273.

ÖNAL M. Kubilay (2014). Characterization and Evaluation of Wild Apricot (Prunus armeniaca L.) Materials Collected from Southeast Anatolia Region of Turkey. International Conference on Chemical, Environment & Biological Sciences (CEBS-2014) Sept. 17-18, 2014 Kuala Lumpur (Malaysia).

Ruiz D., Egea J. (2008). Phenotypic diversity and relationships of fruit quality traits in apricot (*Prunus armeniaca* L.) germplasm. *Euphytica*, 163: 143–158.

SAS.(1988).Statistical analysis system SAS User Guide: Statistical SAS Institute Inc. Editors, Cary, N.

Seif, A.S. and M.M. Hassan (1992). Growth, yield, chilling and growing degree hours requirements of apricot trees. *Egypt. J. Hort. 19 (1): 43-54.*

Sezai E., Guleray A., Nalan Y., Ahmet E. and Emine O. (2009). Identification of apricot cultivars in Turkey (*Prunus armeniaca* L.) using RAPD markers. *Romanian Society of Biological Sciences*. Vol. 14, No.4, 2009, pp. 4582-4588.

Sneath, P. H. A. and Sokal, R. R.(1973). Numerical taxonomy. Freeman, San Francisco, California

Snedecor, G. W. and Cochran, W.G. (1980). Statistical methods. 7th ed. Iowa. State Univ. Press, Ames, Iowa, USA pp. 507.

Vijayan, K., (2004). Genetic relationships of Japanese and Indian mulberry (*Morus spp*.) genotypes revealed by DNA fingerprinting. Plant Systematics and Evolution 243:221-232.

Williams J.G., Kubelik, A.R., Livak, K.J., Rafaiski, J.A. and Tingey, S.V. (1990) DNA Polymorphisms amplified by arbitrary primers are useful as genetic markers, Nucl. Acid Res., 18, 6531-6535.

تقييم الخصائص المورفولوجية والتعريف الوراثي لبعض سلالات المشمش المحلي

نهلة عبد الفتاح عوض[١]، محمد عبد السلام جبر[١]و محمد سعد جاويش[٢]

[١]معهد بحوث البساتين – مركز البحوث الزراعية- مصر

[٢] قسم الفاكهة –كلية الزراعة –جامعة دمياط - مصر

أجريت هذه الدراسة لتقييم بعض سلالات المشمش المحلية المنتخبة و المنزرعة في بساتين خاصة بمنطقة العمار بمحافظة القليوبية ، مصر. شملت الدراسة العديد من الصفات الهامة والعلاقات الوراثية بين السلالات المختارة. تم تحديد الخصائص المورفولوجية المختلفة للسلالات بداية من تاريخ الإزهار وتاريخ الإزهار الكامل ونسبة العقد وتاريخ نضج الثمار بالإضافة إلى الخصائص الطبيعية والكيميائية للثمار. من بين ١٥ سلالة ، كانت السلالة AE1 الأولى فيما يتعلق بجميع مواعيد الإزهار وأوقات النضج في الوقت نفسه ، كانت السلالة AL3 اكثرهم تأخرا بالنسبة لهذه الصفات. وقد أظهرت النتائج التي تم الحصول عليها وجود فروق ذات معنوية إحصائياً بين جميع السلالات المدروسة فيما يتعلق بالخصائص الطبيعية والكيميائية للثمار. سجلت سلالات AM1، AM2، AM12، AM15 و AL3 قيمًا أعلى فيما يتعلق بوزن الثمار. وبالنسبة لقيم المواد الصلبة الذائبة TSS ، لوحظ اختلاف بسيط بين السلالات. حيث سجلت سلالات AM1 و H أعلى قيمة TSS في الموسم الأول والثاني ، على التوالي تم تقدير العلاقات الوراثية بين السلالات ١٥ سلالة باستخدام تقنية التضخيم العشوائي للحمض النووي RAPD بإستخدام تفاعل PCR. واتضح من نتائج إختبار تككنيك RAPD إظهار عدد ٢٠٧ حزمة ، منها ١٧٩ كانت متعددة الاختلافات. تراوح التشابه الجيني من ٠.٦١ إلى ٠.٩٣. لوحظ أعلى تشابه جيني (٠.٩٣) بين سلالة EA1 والسلالات EA2. اظهرت نتائج تحليل المجاميع الوراثه UPGMA أن السلالات المختبرة قسمت إلى مجموعتين رئيسيتين . تتضمن المجموعة الأولى سلالة H فقط. وكذلك تم تقسيم المجموعة الثانية إلى مجموعتين فرعيتين ، تم تقسيم كل من المجموعتين الفرعيتين إلى مجموعتين.أوضحت هذه الاختلافات الجزيئية والمورفولوجية أن هذه السلالات المدروسه من المشمش المحلي تعد مادة وراثية واعدة يمكن استخدامها فى برامج الانتخاب و التربية وتحسين اشجار المشمش لانتاج اصناف ذات مواعيد نضج مختلفة الامر الذي يساعد على إطالة فترة عرض الثمار في الأسواق.