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A COMPARATIVE STUDY BETWEEN TWO APRICOT CULTIVARS IN RELATION WITH PROTEIN PROFILE

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ABSTRACT

The two tested apricot cultivars (Amal and Canino) which grown under Giza conditions were compared, for their tree growth, fruiting, yield as well as fruit quality and protein profile.

Results showed that the chilling requirements for Canino trees are higher than there for Amal apricot cultivar. The shoot length and leaf area were greater for Amal trees than Canino. In both cultivars the majority of the fruits were on one year old shoots.

The fruit weight and size were greater for Canino than Amal. Consequently, the yield in killograms per tree was higher for Canino than Amal. The other fruit characters were highly similar.

The protein profile indicated a close genetic relationship between the two caltivars. The total number of bands for each cultivar is eleven, eight of them are the same for the two cultivars.

INTRODUCTION

Apricot is one of the most important deciduou fruits planted in Egypt a long time ago, and some cultivars were introduced recently. Many attempts had been carried out to introduce high quality cultivars from abroad as Royal, Tilton and Belenheim, but they were not successful because of their high chilling requirements (Guerriero and Scalabraelli, 1982). Some cultivars showed great success specially in newly reclaimed desert areas, among these cultivars Canino apricot. It is considered a beneficial high cash crop and highly appreciable by both the grower and consumer. However it is a late cultivar which mature in June. The chilling requirement hours for Canino apricot trees is 570 hr. below 7.2^{o}C to break the rest period (Guerriero and Scalabraelli, 1982 and Teskey and Shoemaker,1982). Khalil et al., 1999 reported that the best quality of Canino apricot cultivar was obtained from all concentrations of hydrogen cyanamide and significantly different of those obtained from control.

Another cultivar, called Amal, was introduced in early eightys by some growers. Its trees showed good vegetative growth, high yield and superior fruit quality. It is close to Canino apricot cultivar with respect to most of the growth characters, although some minor differences exist between their fruits.

Cultivars could be identified by the presence of characteristic protein bands at the end of protein banding region (Mazzola and Carter, 1988). Estrella et al., 1988 cleared the mechanism by which any organism control the production of proteins by the differential expression which were first linked. Khalil (1995) used some dechnologies documents identity of imported

stocks and cultivars of apple. El-Sheik et al., (1998) used variability in protein profiles to identify apple cultivars and cultivars on different rootstocks among cultivated plants.

The present investigation was conducted during two successive seasons of 1997 and 1998 to evaluate the two new introduced apricot cultivars (Canino and Amal) with regards to vegetative growth fruiting, yield and fruit physical and chemical properties. The method of seed protein profile may also used to compare between two apricot cultivars.

MATERIALS AND METHODS

The present work was performed during 1997 and 1998 seasons on fruited trees of two apricot cultivars trees named Amal and Canino. The trees were planted in 1992, budded on apricot seedlings and grown on sandy soil in a private orchard, pocated at desert road in Giza governerate.

Eighteen trees as uniform as possible were selected for this study (Nine trees for each cultivar). The trees were planted at 5.0 X 5.0 m. apart, and treated with normal agricultural practices. The orchard is irrigated by drip irrigation, and complete randomized block design was applied. The following parameters were studied in both seasons:

1. **Vegetative growth:** 1-1 length and diameter for ten one year old shoots were measured per tree at the end of each season

   1-2- Length and width of leaf, petiole of leaf and leaf area were measured by area meters C.D 2001 USA at the end of July for each season. The percentage of leaf dry weight was determined, after oven dried at 60^{o}c to a constant weight.

   1-3- Trunk circumference for each tree was measured with a tape at a fixed point above graft union (10 cm), at the end of each seasons.

   1-4- Tree dimensions: Canopy dimensions were measured at the end of each season. Tree size was calculated according to the equation as follow: $\frac{3}{4}\pi ab^2$ (π = 3.14, a= ½ major axis and b= ½ minor axis), Westwood, (1992).
2. **Fruiting:** fruits were harvested at maturity stage from each tree of various replicates and yield were recorded (No. per tree and Kg. per tree). The percentage of fruits on spurs and on shoots calculated. The number of fruits per 10 cm of shoot length was calculated.
3. **Fruit quality:** including physical properties. Fruit weight (gm.), fruit size (cm^3), fruit dimensions (diameter and height in cm.), and chemical properties (T.S.S %) by hand refractometer and acidity according to A.O.A.C (1965). Skin and flesh color of fruits was estimated by matching with color chart (Robert, 1938).
4. **Flesh percent:** flesh percentage was calculated by the formula:

$$\frac{\text{flesh weight X 100}}{\text{fruit weight}}$$

5. Data were statistically analyzed according to Snedecor and Cochran (1990), and L.S.D test was used for the comparison between treatments.
6. **Protein electrophoresis:** A sample of 0.2 gm of dry seed for each cultivar (Amal and Canino) was grounded to a powder with a mortar. Samples

were transferred to tube which contained 1.5 ml of tissue sample to 3.0 ml of water soluble extraction buffer (6.0 ml 1M tris (PH 8.8), 0.8 ml 0.25 M EDTA and distilled water up to 100 ml), and left in refrigerator overnight. Solution was centrifuged at 10.000 rpm at 4°c for 8 min. The supernatants was transferred to new tubes and kept at deep-freeze until use.

SDS- PAGE of total protein extracts under non-reducing conditions was carried out in the discontinuous buffer system according to Laemmli (1970). The supernatant was taken for loading on 12.5% polyacrylamid gels.

Coomassie brilliant blue-R 250 stain solution was made of 1 g coomassie brilliant blue-R 250, 450 ml. methanol, 90 ml.glacial acetic acid and distilled water up to 1000 ml. This stock solution was well mixed with magnetic stirrer and kept at room temperature in an opaque bottle. Destaining solution was made of 140 ml methanol, 40 ml glacial acetic acid and distilled water up to 700 ml.

The gel was placed in plastic bags containing destaining solution and agitated gently on a shaker. The destaining solution was changed several times until the gel background was clear.

Gel was scanned with Bio-Rad Video densitometer Model 620, at a wave length of 577 nm. Software data analysis for Bio-Rad densitometer Model 620 and IBM compatible personal computer 165-2072, were used.

RESULTS AND DISCUSSION

Table (1) showed the differences between dates of bud-burst, full bloom fruit-set and beginning of harvest of the two apricot cultivars in the two seasons under study. Full bloom date of Amal cultivar was earlier three to four weeks than Canino cultivar and also harvested date was earlier 24-25 days in the two seasons respectivly. Teskey and Shoemaker, 1982 cleared that the chilling requirement for Canino apricot trees are high (570 hr. below 7.2 °c) to break the rest period. So, it could be concluded that the chilling requirement for Amal cultivar is lower.

Table 1: Date of bud-break, full bloom, fruit-set and beginning of harvest for two apricot cultivars., Amal and Canino in 1997 and 1998.

Cultivars	Bud burst		Full bloom		Fruit set		Beginning of harvest	
Season	**1997**	**1998**	**1997**	**1998**	**1997**	**1998**	**1997**	**1998**
Amal	Feb. 15	Feb. 19	Feb. 28	Feb. 26	Mar.18	Mar.15	May.10	May.7
Canino	Mar.10	Mar.12	Mar.21	Mar.24	Apr. 5	Apr. 10	Jun. 3	Jun. 1

Table (2) indicated the data of vegetative growth measurements for Amal and Canino apricot cultivars in the two seasons 1997 and 1998. It shows significant differences for all vegetative characters under study in the first season while, the second season, Canino apricot cultivar showed an increase in tree size and trunk circumference with insignificant differences between the two cultivars. Amal cultivar had one-year-old shoot length ranging between 110.40 and 107.37 cm. The shortest were those of Canino apricot cultivar (between 49.60 and 35.57 cm). The shoot diameters of the

two apricot cultivars gave a slight differences in the first season, and insignificant differences in the second season.

Table 2: Vegetative growth of Amal and Canino apricot cultivars in 1997 and 1998 seasons.

Vegetative characters	Season	Amal	Canino	L.S.D at 0.05
Tree size (m^3)	1997	8.23	6.37	1.65
	1998	9.27	8.70	N.S
Trunk circumference (cm)	1997	21.97	24.47	1.72
	1998	25.20	27.17	N.S
Length of one year old shoot (cm)	1997	110.4	49.60	3.90
	1998	107.37	35.57	2.82
Diameter of one year old shoot (cm)	1997	0.41	0.50	0.03
	1998	0.50	0.53	N.S

Data for leaf characters of the two apricot cultivars which shown in Table (3) reveal that the highest values for leaf area were for Amal cultivar (57.23 and 58.17 cm^2), while such values for Canino cultivar was (37.07 and 41.53 cm^2), in the two seasons respectively. Leaf petiole and leaf width gave insignificant differences in the first season and slight differences in the second one. Concerning leaf length for Amal apricot cultivar, it was higher values (8.70 and 8.73 cm), than for Canino apricot cultivar (6.73 and 6.50 cm), in the two seasons, respectively. The percentage of dry weight gave insignificant differences between the two cultivars in the two seasons under study.

Table 3: Leaf characters of Amal and Canino apricot cultivars in 1997 and 1998 seasons

Leaf characters	Season	Amal	Canino	L.S.D at 0.05
Leaf area (cm^2)	1997	57.23	37.07	8.36
	1998	58.17	41.53	11.78
Leaf petiole (cm)	1997	3.13	2.87	N.S
	1998	3.53	3.07	0.29
Leaf width (cm)	1997	9.03	7.73	N.S
	1998	8.10	7.13	0.38
Leaf length (cm)	1997	8.70	6.73	1.23
	1998	8.73	6.50	1.74
Dry weight (%)	1997	51.77	50.43	N.S
	1998	52.07	52.17	N.S

Fruiting behaviour of the two apricot cultivars is presented in Table (4). The number of fruits per 10 cm of shoot length showed some differences ranged between 3.90 to 4.47 fruits for Amal cultivar and between 2.53 to 2.80 fruits for Canino cultivar in the two seasons respectively. The percentage of fruits on spurs or on shoots showed insignificant differences in the first season, while the same percentage was significantly different in the second

season for the two cultivars under study. In both seasons, the number of fruits per tree showed no differences for the two cultivars. As regards to the yield in kilogram per tree, it was for Canino cultivar (42.27 and 51.80 kg), higher than for Amal cultivar (30.25 and 36.19 kg) in the two seasons, respectively.

Table (5) shows the characteristics for mature fruits of both apricot cultivars. Statistical analysis revealed significant differences were existed in weight and size of fruits in the two seasons. The higher fruit weight was (32.40 and 34.53 gm) and fruit size (31.33 and 27.33 cm^3) were for Canino cultivar, the lower fruit weight was (25.33 and 24.18 gm), and lowest fruit size was (24.27 and 23.03 cm^3) for Amal cultivar, in the two seasons, respectively. Fruit diameter was not significantly differed in the first season it was 3.6 cm for the two cultivars. In second season, the variation in fruit diameter was being in the range 3.4 to 4.0 cm. In 1997, fruit height varied between 3.0 to 3.3 cm and in 1998 between 3.4 to 3.9 cm.

The two apricot cultivars had insignificant values for T.S.S % it was ranged from 18.2 to 19.0 % for the two seasons. The values for percentage of acidity were very close and ranged from 0.580 to 0.657 % for the same two cultivars under study. Statistical significant variation was detected in flesh percentage for the two cultivars, its values in 1997 and 1998 were respectively, 94.6% - 92.7% and 95.1% - 92.4% for Amal and Canino cultivars. The skin and flesh color were determined by color chart (Robert, 1938) and presented in Table (5) for the two seasons.

Table 4: Number of fruits per 10 cm. of shoot length, percentage of fruits (on spurs and shoots) and yield/tree for Amal and Canino apricot cultivars in 1997 and 1998 seasons:

Characters	Season	Amal	Canino	L.S.D at 0.05
No. of fruits / 10 cm of shoot length	1997	3.90	2.53	1.12
	1998	4.47	2.80	1.00
The percentage of fruits on spurs	1997	21.37	19.40	N.S
	1998	23.33	20.97	3.69
The percentage of fruits on shoots	1997	78.63	80.60	N.S
	1998	75.33	79.03	5.86
Yield fruit No. / tree	1997	1260	1350	N.S
	1998	1500	1580	N.S
Yield (Kg / tree)	1997	30.25	42.27	4.46
	1998	36.19	51.80	7.81

Table 5: Fruit characters of Amal and Canino apricot cultivars in 1997 and 1998 seasons.

Fruit characters	Season	Amal	Canino	L.S.D at 0.05
Fruit weight (gm)	1997 1998	25.33 24.18	32.40 34.53	2.63 1.19
Fruit size (cm^3)	1997 1998	24.27 23.03	31.33 27.33	1.37 3.25
Fruit diameter (cm)	1997 1998	3.6 3.4	3.6 4.0	N.S 0.14
Fruit height (cm)	1997 1998	3.0 3.4	3.3 3.9	N.S 0.38
T.S.S (%)	1997 1998	18.2 19.0	18.6 18.8	N.S N.S
Acidity (%)	1997 1998	0.603 0.580	0.637 0.657	0.03 0.02
Flesh percent (%)	1997 1998	94.6 95.1	92.7 92.4	0.03 0.04
Skin color	1997 1998	Marigold Orange page 11 part II	Cadmium Orange 8/1 page 8 part I	
Flesh color	1997 1998	Persimon Orange 710/3 part I	Cadmium Orange 8 part I	

Protein profiles.

Protein banding patterns in seeds of the two apricot cultivars (Amal and Canino), were analyzed by SDS polyacrylamide gel electrophoresis under reducing conditions. The approximate molecular weight (MW) and intensity of electrophoretic protein bands are presented in Table (6) and illustrated in Fig (I.) Protein banding patterns of the two cultivars showed some differences in the density of the bands. The total number of bands in the profiles of the two genotypes was fourteen representing MW ranging between 199.000 to 8.370 daltons. There are eight common bands (No.2; 4; 5; 6; 7; 8; 9; 10) with MW (120.000; 101.000; 87.000; 83.000; 50.000; 48.000; 35.000; 29.000 dalton, respectively), in seed protein profiles of two apricot cultivars. The bands No. 3, 12, 13 with MW. of 107.012, 18.850 and 11.110 dalton were characteristic of Amal cultivar. The three bands 1, 11, 14 with MW. 199.000, 20.900 and 8.370 dalton were characteristic of Canino cultivar.

This behavior may indicate some genetic relationship between the two apricot cultivars Amal and Canino. The similarities existed (both shared 8 bands), this trend indicating certain close genetic relationship between them. Although there are considerable variations among trees, all have several common characteristics. Each named (cv) represents a unique gene combination which ordinarily must be perpetuated by some means of asexual propagation such as budding or grafting. Very rarely, fruit of consistent quality can be obtained from seedlings because seed embryos, except in some cvs which are polyembryonic, develop from new and different combinations of genes contributed by the sperm and egg. Since the majority of cvs were

selected over very long periods of time, new gene combinations result in fruit and other plant characteristics which may be superior or in some cases inferior (Tanksley and Orton, 1993).

From the above mentioned results, it could be concluded that from Table (2), the vegetative growth of two apricot cultivars in the first season was slightly differences, except the length of one year old shoot. It is confirmed that the relationship between the two apricot cultivars. Table (3) and fig II illustrates that the largest leaf area for Amal cultivar, may be attributed to the earlier budburst of the same that cultivar. Statistical analysis revealed that insignificant differences occurred in most fruiting characters for two apricot cultivars under study (Table 4). The number of fruits per 10 cm of shoot length was more for Amal cultivar, although the length of shoot was the tallest, and the yield was the lowest thus it could be concluded that the number of shoots was lower for Amal cultivar than for Canino cultivar. In both seasons, Table (5) and fig (III) showed significant differences for fruit weight and size. So, it was a negative correlation between yield per tree in kilogram for Amal and Canino apricot cultivars.

Previous evaluation of the two apricot cultivars have focused primarily on classifying vegetative growth, fruit quality and protein profile to compare between them. Close relationship was measured. These observations are in agreement with those of Tanksley and Orton (1983), and Mazzola and Carten (1988) who stated that peach rootstock could be identified in the early spring by the presence of characteristic protein bands at either end of the protein banding region.

Table 6: Approximate molecular weight and relative mobility of protein bands in seed of Amal and Canino apricot cultivars in 1998 season.

No. of band	Molecular weight (MW)	Relative mobility	Amal	Canino
1	199.000	0.118	-	+
2	120.000	0.165	+	+
3	107.012	0.208	+	-
4	101.000	0.220	+	+
5	87.000	0.270	+	+
6	83.000	0.320	+	+
7	50.000	0.340	+	+
8	48.000	0.400	+	+
9	35.000	0.430	+	+
10	29.000	0.490	+	+
11	20.900	0.540	-	+
12	18.850	0.550	+	-
13	11.110	0.570	+	-
14	8.370	0.630	-	+

+ present band **- absent band**

Figure I: Protein banding patterns of Amal and Canino apricot cultivars by SDS-PAGE under a reducing agent.

Figure II: Fruit and leaf of Amal apricot cultivars.

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دراسة مقارنة بيت صنفين من المشمش و إرتباط ذلك بالخريطة البروتينية

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أجريت هذه الدراسة خلال موسمي 1997 و 1998 على أشجار صنفين من المشمش (أمل ـ كانينو) مطعومة على أصل مشمش بذري ـ منزرعة عام 1992 في مزرعة خاصة بالطريف الصحراوي بالجيزة . تمت دراسة مقارنة بين الصنفين من ناحية مواعيد التحرك الخضري و الزهري و النمو الخضري و الإثمار و صفات الثمار و ميعاد جمع الثمار وكذلك درست الخريطة البروتينية لهما.
و أظهرت النتائج الآتي :

1. أن صنف المشمش أمل إحتياجاته من ساعات البرودة أقل من إحتياجات صنف مشمش كانينو ـ وانعكس ذلك على ميعاد التحرك الزهري و بالتالي نضج المحصول .
2. كانت هناك فروق بسيطة في النمو الخضري إلا في أطوال الفروع عمر سنة ـ حيث كانت طويلة في حالة صنف أمل عن صنف كانينو .
3. كانت هناك فروق واضحة في مساحة الورقة وربما ذلك نتيجة إختلاف عمر الورقة في الصنفين.
4. كان الإثمار الدابري حوالي 20% في كلا الصنفين و الإثمار على الفروع عمر سنة 80% تقريباً في موسمي الدراسة .
5. هناك فرق واضح في وزن وحجم ثمرة مشمش الكانينو و إنعكس هذا على المحصول بالوزن للشجرة الواحدة.
6. أثبتت دراسة لخريطة البروتينية للبذور أن هناك علاقة قرابة قوية بين الصنفين حيث انهما اشتركا في 8 حزم بروتين و إختلفا في 3 حزم فقط ـ وكان كلاهما قد أظهر 11 حزمة بروتين.