

## **PHYSIOLOGICAL AND TAXONOMICAL STUDIES ON SOME PEACH CULTIVARS.**

### **A: VARIATIONS IN FLORAL CHARACTERISTICS, FRUIT SET, YIELD AND FINGERPRINTING BY RAPD.**

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### **ABSTRACT**

**This study was conducted during two successive seasons 2003 and 2004 on twelve peach cultivars namely, Robin, Rubidoux, Spring Time, Desert Red, Bemto, Florida Red, Fla 16/33, Fla 3/2, Hagazy, Soltani and Tejon. The trees are three years old, grown in sand soil and budded on Nemaguerd rootstock and grown in El-Noubaria region, El-Behera governate under the same conditions and cultural practices. This study aimed at evaluating the performance of these cultivars under Egyptian conditions in terms of floral characteristics (such as bud differentiation, bud burst, and pollen viability), fruit set, yield and identification of such cultivars by using the finger print technique known as RAPD (Random Amplified Polymorphism DNA). The results revealed that Rubidoux was the earliest in bud burst while Shamy and Tejon were the latest. Similar trend was found for the time of the full bloom of the twelve cultivars. The staining test provides that Florida Red had the highest pollen viability while Shamy had the least. Furthermore, the germination test provided evidence that pollen grains of Tejon had the highest percentage as compared with the other cultivars while Spring Time pollen had the least germination percentage. The highest percentage of fruit set was obtained with Fla 3/2 as compared with other cultivars in both seasons, while the least percentage of fruit set**

was found in Robin. However, Shamy did not significantly vary from Robin in the second season. With regard of tree yield, Tejon tree attained the highest yield in both seasons. However, its yield was not significantly different from that of some other cultivars such as, Shamy and Fla 16/33. Early ripening cultivars such as Rubidoux, Robin, and Spring Time were also earlier in bud differentiation in summer as compared with that of mid-season and late cultivars. The results also revealed the possibility of using RAPD technique to identify peach cultivars and it could be helpful in breeding programs. Using 10 random primers, there were differences between the twelve cultivars in the number and molecular weight of obtained bands. The use of the primer A3 (CAGGCCCTTC), for example, resulted in three specific bands for Hagazy, Shamy and Soltani while using the primer C13 (AAGCTTCGTC) resulted in two specific bands one of them to Robin and the second for Fla 3/2. The cultivars analysis revealed the similarity between studied cultivars ranged from 0.47 % to 0.81 % and there was a possibility through RAPD to establish a relationship tree among the twelve tested peach cultivars.

## INTRODUCTION

Peach (*Prunus persica* L. Batsch) which belongs to the family "Rosaceae" is originated in China and considered one of the most important fruits in the world. It ranks second to apple among temperate zone deciduous fruit trees from the standpoint of production and values (Childers, 1978). Peaches are highly demanded by Egyptian consumer. Grown peach area was established to 78646 faddans in 2004 produced 302667 tons of fruits (Annual Book of Statistics, A.R.E in 2004). There are many peach cultivars growing more widely now throughout the world. Originally the varieties grown resulted from the selection of chance seedlings, but most of today's varieties are result of controlled breeding programs (James and Scott, 1989). During the past few years, Agriculture Development System Project and some peach growers had introduced some low chilling requirement peach cultivars. These cultivars still vary in such

requirements and their sensitivity to the fluctuations in temperature during the endo-dormancy period. The adoption of many temperate fruits in warm winter region resulted in some problems that affected the time of bud burst and full bloom. It has been reported that the chilling requirements for peach cultivars ranges between 200 to 1100 chilling hours under 7°C (Ryugo, 1988). It was also documented that new peach cultivars grown in warm winter region, where there is no sharp change between fall and winter temperature, delay their leaf abscission. Such delay results in the translocation of inhibitors or more to differentiated buds which delays bud burst and full bloom. (Ryugo, 1988). Molecular technique DNA-based procedures have been proposed for cultivars identification and to investigation the relationships among studies cultivars. William *et al.* (1990), Welsh and McClelland (1990) reported a method based on the amplification of band DNA sequences by polymerase chain reaction (PCR) with arbitrary primers. RAPD (Random Amplified Polymorphism DNA) markers are now used for cultivar characterization (Hu and Quiros, (1991), Koller *et al.*, (1993)). The present study aimed at studying the performance of newly introduced peach cultivars to Egyptian agriculture in terms of their floral characteristics fruit set and yield. It also examined the possibility of identifying the fingerprint of such cultivars through molecular characterization as novel procedure of detecting their genetic relationship.

## MATERIALS AND METHODS

The present investigation was carried out during the two successive growing seasons of 2002/2003 and 2003/2004 to evaluate twelve peach cultivars (*Prunus persica* L.) namely Hegazy , Shamy , Soltani , Desert Red , Robin , Tejon , Rubidoux , Spring time , Bemto , Florida Red ,Fla 16/33 and Fla 3/2. The trees were three years old, grown in sandy soil budded on Nemaguard rootstock and spaced at 4 × 6 meters apart in research center at West Noubaria region, El-Behera governorate. The trees were annually irrigated with about 2500 cubic meters per feddan using drip irrigation system. During the winter time, a mixture of organic manure, ammonium sulfate, potassium sulfate and mono phosphate super at the rates of 22m<sup>3</sup>, 100-

150 kg, 150 kg and 50 kg kg/feddan, respectively was annually ditched in the peach trees soil at a depth of 50 cm from the soil surface and 60 cm from the tree. In the growing season, 300 kg ammonium sulfate (21% nitrogen), 250 kg potassium sulfate (43.2% potassium) per feddan were also added to the irrigation water and 125 cm phosphoric acid each 1 m<sup>3</sup> irrigation water. In both seasons, seventy two trees, as uniform as possible, were selected. from the experimental cultivars .Six trees, three replicates with two trees each, almost uniform in vigor were chosen at random from each cultivar and were utilized in this investigation; i.e. seventy two trees from the experimental cultivars (12 cvs. × 3 replicate × 2 trees = 72 trees). The studied trees were arranged in Random Complete Blocks Design (Snedecor and Cochran, 1972). Dates of bud burst were recorded for different cultivars. In each season, the percentage of fruit set was calculated using the total number of flowers / trees from full bloom to three weeks after later. Pollen fertility was determined by using the staining and direct germination tests. This technique was previously described by Minessy *et al.*, (1970) and Ibrahim (1974). The germination test of pollen grains of each cultivar was done by using a germination medium according of the technique of El-Makhtoum (1981). The ripening date was recorded according to the commercial harvesting date for each cultivar. To determine vegetative and flower bud initiation, samples were collected at 20-6-2004 and 20-7-2004 from all cultivars. All collected samples were kept in formalin-acetic-alcohol fixative for subsequent histological studies. Sections for permanent mounts were prepared according to the schedule given by Sass (1951), after removing the scales using paraffin method. These sections were cut at 15-20 micron thickness. Staining was done according to Sharman (1943) after some modifications. Flattening and elongation of the apical meristem and the concurrent appearance of the flower primordial were used as criteria of flower initiation as used by Tufts and Morrow (1925).

#### **Identification of peach cultivars by RAPD marker:**

PCR (Polymerase Chain Reaction) analysis was carried out using genomic DNA of peach cultivars: Hegazy, Shamy, Soltani, Desert Red, Robin, Tejon, Rubidoux, Spring time, Bemto, Florida Red, Fla 16/33 and Fla 3/2. DNA was isolated from fresh young leaves of terminal shoots for cultivars by the Dellaporta method (Dellaporta *et al.*, 1983).

Determination of DNA concentration by spectrophotometer was according to (Sambrook et al., 1989).

### **PCR amplification:**

Ten primers (Table 5), were used in this experiment to amplify the template DNA). Amplification reaction volumes were 25  $\mu$ l each containing 1 $\times$ PCR buffer with MgCl<sub>2</sub> (50 mM KCl; 10 mM Tris- HCl, pH 9; 2 mM Mg Cl<sub>2</sub> and 1% Triton  $\times$ -100), 200 M each of dATP, dCTP, dGTP and dTTP, 50 pmole primers, 50ng template DNA and 1.5 U of Taq polymerase. Reaction mixtures were overlaid with 15  $\mu$ l mineral oil and subjected to PCR. Amplification was performed in thermal cycler (MJ Research PTC-100) and programmed for initial denaturation at 94°C for 3 min; followed by 45 cycles of 1 min. at 36°C, 2 min. at 72°C, and a final 7 min. extension at 72°C. Amplification products were visualized along with a DNA marker (100 bp DNA ladder marker, produced by Amersham Pharmacia Biotech Inc, USA.) on 1.6% agarose gel with 1 $\times$ TBE buffer and detected by staining with ethidium bromide solution which added to agarose gel. Gels were photographed on Polaroid films under UV light.

### **Data Handling and Cluster Analysis:**

Data were scored for computer analysis on the basis of the presence "1" or absence "0" of the amplified products for each primer. Paris-wise comparison of peach cultivars, based on the presence or absence of unique and shared polymorphic products, was used to regenerate similarity coefficients ( Vierling and Nhuyen,1992). The similarity coefficients were used to construct a Dendrogram by UPGMA (Unweighted Pair-Group Method with Arithmetical Averages) using NTSYS\_PC program (Rohlf, 1993).

## **RESULTS & DISCUSSIONS**

The study concerning the average dates of bud burst, flowering, pollen fertility, fruit set, yield, fruit quality, bud differentiation and the identification of cultivars by RAPD markers of the experimental twelve peach cultivars was carried out during the two successive seasons of 2003 and 2004.

**Bud burst:**

The data representing the average dates of bud burst of the twelve studied peach cultivars during 2003 and 2004 growing seasons were presented in Table (1). In the first season, the present results showed that Rubidoux cultivars had the earliest bud burst than all tested cultivars in both seasons (Jan 18, 15 on both seasons, respectively). On the other hand, Shamy cultivar had the latest bud burst than all tested cultivars (on Feb 23, 2003).

The differences between other cultivars were 5, 12, 15, 19, 19, 23, 23, 29, 29, 33 and 36 days in Desert Red, Florida Red, Robin, Spring time, Fla 16/33, Fla 3/2, Bemto, Hegazy, Soltani, Tejon and Shamy, respectively as compared with Robidoux cultivar.

In the second season, Florida Red cultivar had the earliest bud burst than all tested cultivars in (16-1-2004). The data showed that Tejon cultivar had the latest bud burst than all tested cultivars in (Feb. 27, 2004). The differences between other cultivars were 2, 12, 15, 18, 18, 18, 19, 21, 35 and 42 days in Desert Red, Robin, Bemto, Spring time, Fla 16/33, Hegazy, Soltani, Fla 3/2, Shamy and Tejon, respectively as compared with Florida Red cultivar. The variations among the peach cultivars were supported the findings previously reported by many other investigators such as Elsherbini et al. (1986), Jackson (1986), Mansour and Stino (1986), Mansour and Stino (1987) and Aly (1988).

**Flowering:**

The results representing the dates of full bloom of the experimental peach cultivars during 2003 and 2004 growing seasons are presented in Table (1). In the first season, the present data showed that Rubidoux cultivar had the earliest full bloom than all tested cultivars 20-2-2003. The data also showed that Shamy cultivar had the latest full bloom date than all tested cultivars, 26-3-2003. The differences among other cultivars were 2, 5, 11, 12, 13, 17, 17, 26, 28, 32 and 34 days in Desert Red, Florida Red, Fla 16/33. Robin, Fla 3/2, Spring Time, Bemto, Hegazy, Soltani, Tejon and Shamy, respectively from Robidoux cultivar.

In the second season, Florida Red cultivar had the earliest full bloom than all tested cultivars, in 12-2-2004, while Tejon cultivar had

the latest full bloom than all tested cultivars, in 27-3-2004. The differences between other cultivars were 4, 8, 18, 18, 19, 22, 22, 23, 26, 40 and 44 days in Robidoux, Desert Red, Robin, Fla 16/33, Bemto, Spring time, Soltani, Fla 3/2, Hegazy, Shamy and Tejon, respectively from Florida Red cultivar.

The above mentioned results are in agreement with these previously reported by many investigators such as Sherman *et al.* (1982), El-Sherbini *et al.* (1986), Aly (1988), Rodriguez and Sherman (1990) and Johnson *et al.* (1994).

#### **Pollen fertility:**

The data concerning percentage of pollen grains stain-ability for the experimental peach cultivars during 2003 growing season are presented in Table (2). The data showed that Shamy cultivar had the lowest pollen stain-ability percentage 47%, while the percent of pollen grains stain-ability for other cultivars ranged from 75.67 % and 96% in Spring time and Florida Red, respectively. However, the differences among all cultivars, except Shamy cultivar were not significant. The above mentioned results were in agreement with those previously reported by many investigators such as Dallorto *et al.* (1985), Lagutova (1988) and Duric (1990).

The data concerning the percentages of pollen grains germination of the studied peach cultivars during 2003 growing season was presented in Table (2). The data showed that Tejon cultivar had the highest significant pollen grains germinability than those of the other experimental cultivars. The percentages of pollen grains germinability were 99.33, 99.33, 98.67, 98, 97.33, 96.67, 96.67, 96.33, 96.00 and 95% for Soltani, Florida Red, Desert Red, Bemto, Hegazy, Fla 3/2, Robin, Rubidoux, Fla 16/33 and Shamy cultivars, respectively. The data also showed that the percentage of pollen grains germinability for Spring time cultivar was the lowest one 93%.

The above mentioned results were in agreement with those previously reported by many investigators such as Tolstolik (1990), Bajwa *et al.* (1991), Mahanoglu *et al.* (1995), Obonova (1995), El-shanhorey (1997) and Andres *et al.* (1999).

**Fruit set:**

The data concerning the average fruit set percentages of the experimental peach cultivars during 2003 and 2004 growing seasons are presented in Table (3).

In the first season, the present results showed that Fla 3/2 cultivar had a significantly higher average fruit set percentage than all other studied cultivars, Soltani cultivar had a significantly higher average fruit set percentage than the rest cultivars. No significant variations were found between Spring Time and Desert Red, and also among Tejon, Hegazy, Bemto and Florida Red. It was also found that Robin cultivar had the lowest average fruit set percentage.

In the second season, Fla 16/33 and Fla 3/2 cultivars had a significantly higher average fruit set percentages than all other cultivars. No significant variations were found between Spring time and Desert Red. Bemto and Soltani had significantly higher average fruit set percentages than the rest other cultivars. It was found that Robin cultivar had the lowest average fruit set percentage. Similar results were obtained by Leuty *et al.* (1981), Mansour and Stino (1986), Aly (1988), and Johnson *et al.* (1990).

**Yield:**

The results of tree yield as influenced by the variations among peach cultivars are shown in Table (3). When the data was related to the time of maturity of various cultivars, it was clear that early maturing cultivars such as Robin, Rubidoux and Spring time didn't yield more fruits per tree as compared with late maturing cultivars such as Hegazy. Even within each category of cultivars when divided according to the harvest time, there were significant variations in tree yields.

For example, in late maturing cultivars, Tejon tree yielded more fruits than Hegazy while Shamy didn't significantly vary from Tejon in fruit yield in both seasons. Hegazy, Shamy and Soltani were selections of the local cultivar Meet Ghamr and that might explain the variations of these selected strains from peach seedlings. The mid-season cultivars in this study didn't show a consistent trend in tree yield.



For example, Desert Red and Florida Red significantly yielded less fruits than that found in Fla 16/33 and Fla 3/2 and this was a consistent trend in both seasons the highest yield was obtained with Tejon trees in both seasons even though fruit weight and flesh weight of such cultivar were significantly lower than most studied cultivars in both seasons. Thus, the higher yield of Tejon could be attributed to the number of fruits per tree in this study. If we try to relate the variations in yield to stone freeness, this study revealed that there was no relationship between both. However, selections of the local cultivar, namely Hegazy and Shamy tended to have clingstone. Early ripening peach fruits are usually not free stone as documented by Williams and Crocker (2000). It was reported by Smole (1992) that in addition to fruit characteristics and disease resistance, yield is one of the important characteristics in the successful acceptance of new cultivars. These indicated traits play a primary role in selecting a plant type to be adopted for commercial agriculture.

In support of our results, Marini and Sowers (2000) reported that variations in yield were genetically controlled while Johnson and Handley (1989) found that May Crest peach cultivar produced smaller fruit at all crop loads than June Lady.

#### **Bud differentiation:**

It is known that the apical meristem of vegetative bud has a smooth rounded form with a distinct tunica and corpus region. The axis of such a bud is very short, when vegetative bud under goes transition to a flower bud, the first induction of the transition is seen in general enlargement, with both elongation and broadening of the axis in the region of the crown, which is accompanied by an enlargement and elongation of the growing point it self.

On the basis of the previous description, the results concerning the variations in bud differentiation among the experimental peach cultivars during 2004 growing season are shown in Table (4) and illustrated in Figures (1 to 8) as examples of some early and late maturing cultivars.

In the first date June 30, the results indicated that early season cultivars such as Robin on that date, 15 buds out of 20 examined buds showed flower primordia, Rubidoux on June 30, 18 buds out of 20 examined buds showed flower primordia and Spring Time at the same date, 16 buds out of 20 buds examined showed

flower primordia. For mid-season, the data showed that Desert Red, Bemto, Florida Red, Fla 16/33 and Fla 3/2 cultivars at the same sampling date, 12, 14, 11, 17 and 16 buds out of 20 buds examined showed flower primordia, respectively.

The data also showed that for the late season cultivars such as Hegazy, Shamy, Soltani and Tejon at that date, 3, 2, 3 and 0 buds out of 20 buds examined showed flower primordia, respectively.

In the second date July 31, the data showed that early season cultivars such as Robin on July 31, 7 buds out of 10 buds examined showed flower primordia, Rubidoux and Spring Time at the same date, 9, 8 buds out of 10 buds examined showed flower primordia, respectively. In the meantime, mid-season cultivars such as Desert Red, Bemto, Florida Red, Fla 16/33 and Fla 3/2 on the same date, 6, 7, 8, 7 and 7 buds out of 10 buds examined showed flower primordia, respectively. The data shown in Table (4) indicated that the late season cultivars such as Hegazy, Shamy, Soltani and Tejon at July 31, 3, 5, 3 and 4 buds out of 10 buds examined showed flower primordia, respectively. The data also indicated that there were differences in the time of initiation according to the cultivar and also there were slight differences in the time of initiation between early, mid-season, and late seasons cultivars. Variations in bud differentiation among various cultivars in this study were in agreement with the results previously reported by other investigators such as Fulford (1962), El-Azzoni et al. (1967), Hassan (1972), Boonprakob et al. (1996) and Reinoso et al. (2002).

#### **Identification of peach cultivars using RAPD markers.**

Ten primers of arbitrary nucleotide sequences were used to amplify DNA segments for the genomic DNA of the twelve tested peach cultivars. The numbers of amplified products produced by each primer varied from 4 in primer O3 to 18 in primer C13. Ten tested primer gave clearly differences among peach cultivars on the bases of amplified product patterns were illustrated in Figures 9 and 10, as an example of the resulting images. Percentages of polymorphism were ranged from 25% up to 100% (Table 5).

Results indicated that 85 polymorphic DNA fragments (bands) were obtained out of 112 amplified DNA products, which produced by the ten primers. The remaining products, 27 bands were monomorphic shared across the twelve tested cultivars.

The comparison between the twelve tested peach cultivars showed differences in the number and size (MW) of amplified fragments produced by each primer for each cultivar. Some bands were common among all tested cultivars while others were considered specific for cultivars.

Results of Table (5) showed that primer A1 (CAG GCC CTTC) produced 3 specific bands, one for Hegazy cultivar, one for Shamy and one for Soltani and produced 13 DNA fragments among the tested cultivars, the number of DNA fragments ranged from 3 to 11 in Robin and Hegazy, respectively. Primer C1 (TTC GAG CCAG) produced 6 DNA fragments among the tested cultivars, the number of DNA fragments ranged from 2 to 5 in Bemto and Fla 16/33, respectively.

Primer C13 (AAG CTT CGTC) showed two specific bands, one for Robin and one for Fla 3/2 and produced 18 DNA fragments among the tested cultivars, the number of DNA fragments ranged from 1 to 10 in Rubidoux and Soltani, respectively.

Primer C15 (GAC GGA TCAG) showed 10 DNA fragments among the tested cultivars, number of DNA fragments ranged from 8 to 9 in Hegazy and Robin, respectively. Primer D17 (TTT CCC ACGG) produced 10 fragments among the tested cultivars, number of DNA fragments ranged from 5 to 7 in Robin and Fla 3/2, respectively. Primer O3 (CTG TTG CTAC) showed 3 fragments in all tested cultivars, except Desert Red and Fla 3/2 gave 4 fragments. Primer O5 (CCC AGT CACT) showed 12 fragments among the tested cultivars, the number of DNA fragments ranged from 3 to 11 in Hegazy and Fla 16/33, respectively.

Primer O6 (CCA CGG GAAG) showed 13 DNA fragments among the tested cultivars, the number of DNA fragments ranged from 6 to 11 in Tejon and Hegazy, respectively. Primer O7 (CAG CAC TGAC) showed 14 DNA fragments among the tested cultivars, the number of DNA fragments ranged from 8 to 13 in Hegazy and Spring Time, respectively. Primer O16 (TCG GCG GTTC) showed 12 DNA fragments among the tested cultivars, the number of DNA fragments ranged from 7 to 10 on Desert Red and Fla 3/2, respectively.

**RAPD Analysis (Cluster Analysis):**

The RAPD markers (bands) that produced by the ten positive primers were analyzed using UPGMA method to construct a similarity matrix Table (7), and to generate a dendrogram indicating the relationships between the twelve tested cultivars were illustrated in Figure (11). The presence or absence of any particular DNA band was a factor only considered in the computer analysis. Variations in band intensity were observed between the same (Mw) bands of different cultivars but not considered in this analysis.

The genetic similarities between the twelve tested peach cultivars ranged from 0.47 to 0.81 (Table 7). The values of genetic similarity obtained between Shamy and each of Hegazy, Soltani, Desert Red, Robin, Tejon, Rubidoux, Spring time, Bemto, Florida Red, Fla 16/33 and Fla 3/2 were 0.72, 0.65, 0.7, 0.54, 0.64, 0.74, 0.68, 0.64, 0.58, 0.65 and 0.63, respectively.

The dendrogram indicated that the twelve tested cultivars were classified into two main clusters (cluster I and cluster II). Cluster I was divided into two sub-clusters, sub-cluster I that included Hegazy and Shamy cultivars, whereas sub-cluster II included Soltani and Desert Red cultivars. The cluster II was divided into two sub-cluster, sub-cluster II contained Robin and sub-cluster I divided into two groups, groups I included Fla 3/2 and Florida Red cultivars and group II divided into two sub-groups, sub-group I included Fla 16/33 and Bemto cultivars and sub-group II divided into two sub-sub-groups, sub-sub-group I included Spring Time and Rubidoux cultivars and sub-sub-group II contained Tejon Figure (11).

These results were similar to those reported by others (Chaparro *et al.*, 1994, Lu *et al.*, 1996, Dirlwanger *et al.*, 1998 and Zhang *et al.*, 1998).

The results showed that the resulted RAPD markers were useful for the identification of peach cultivars and could be of particular importance in future research dealing with breeding programs.

Table (1): Bud burst and full bloom dates of studied peach cultivars during the two seasons 2003 and 2004.

Cultivars	Bud burst		Full bloom	
	2003	2004	2003	2004
1- Robin	2-2-2003	28-1-2004	4-3-2003	1-3-2004
2- Rubidoux	18-1-2003	15-1-2004	20-2-2003	16-2-2004
3- Spring Time	6-2-2003	3-2-2004	9-3-2003	5-3-2004
4- Desert Red	22/23-1-2003	18-1-2004	22-2-2003	20-2-2004
5- Bcmto	10-2-2003	31-1-2004	9-3-2003	2-3-2004
6- Florda Red	30-1-2003	16-1-2004	25-2-2003	12-2-2004
7- Fla 16/33	6-2-2003	3-2-2004	3-3-2003	1-3-2004
8- Fla 3/2	10-2-2003	6-2-2004	5-3-2003	6-3-2004
9- Hegazy	16-2-2003	3-2-2004	18-3-2003	9-3-2004
10- Shamy	23-2-2003	20-2-2004	26-3-2003	23-3-2004
11- Soltani	16-2-2003	4-2-2004	20-3-2003	5-3-2004
12- Tejon	20-2-2003	27-2-2004	24-3-2003	27-3-2004

Table (2): Staining test and germination (%) test for pollen grains of the studied peach cultivars during 2003 season.

Cultivars	Staining test (%) 2003	Germination test (%) 2003
1- Robin	94.00 <sup>a</sup>	96.67 <sup>bc</sup>
2- Rubidoux	89.33 <sup>a</sup>	96.33 <sup>bc</sup>
3- Spring Time	75.67 <sup>a</sup>	93.00 <sup>c</sup>
4- Desert Red	90.00 <sup>a</sup>	98.67 <sup>ab</sup>
5- Bemto	77.33 <sup>a</sup>	98.00 <sup>ab</sup>
6- Florda Red	96.00 <sup>a</sup>	99.33 <sup>ab</sup>
7- Fla 16/33	89.00 <sup>a</sup>	96.00 <sup>bc</sup>
8- Fla 3/2	85.00 <sup>a</sup>	96.67 <sup>bc</sup>
9- Hegazy	81.67 <sup>a</sup>	97.33 <sup>b</sup>
10- Shamy	47.00 <sup>b</sup>	95.00 <sup>c</sup>
11- Soltani	84.00 <sup>a</sup>	99.33 <sup>ab</sup>
12- Tejon	95.33 <sup>a</sup>	100.00 <sup>a</sup>
L.S.D. <sub>0.05</sub>	22.97	2.27

\* Means, within a column, followed by the same letter(s) are not significantly different according to L.S.D.0.05.

Table (3): Fruit set percentages and yield (kg/tree) of the studied peach cultivars during the two seasons 2003 and 2004.

Cultivars	Fruit set (%)		Yield (kg/tree)	
	2003	2004	2003	2004
1- Robin	18.00 <sup>e</sup>	17.43 <sup>e</sup>	37.67 <sup>bc</sup>	34.00 <sup>bc</sup>
2- Rubidoux	19.40 <sup>dc</sup>	18.40 <sup>d</sup>	33.67 <sup>c</sup>	36.33 <sup>b</sup>
3- Spring Time	26.60 <sup>e</sup>	24.53 <sup>b</sup>	32.33 <sup>cd</sup>	27.67 <sup>c</sup>
4- Desert Red	26.00 <sup>e</sup>	23.50 <sup>b</sup>	28.67 <sup>d</sup>	28.33 <sup>c</sup>
5- Benito	22.07 <sup>d</sup>	21.40 <sup>e</sup>	39.00 <sup>b</sup>	34.33 <sup>b</sup>
6- Florida Red	22.07 <sup>d</sup>	19.40 <sup>d</sup>	33.00 <sup>c</sup>	30.67 <sup>c</sup>
7- Fla 16/33	20.73 <sup>dc</sup>	27.90 <sup>a</sup>	42.33 <sup>ab</sup>	40.33 <sup>a</sup>
8- Fla 3/2	33.00 <sup>a</sup>	26.97 <sup>a</sup>	39.67 <sup>ab</sup>	36.00 <sup>b</sup>
9- Hegazy	22.70 <sup>d</sup>	19.33 <sup>dc</sup>	32.67 <sup>cd</sup>	33.33 <sup>bc</sup>
10- Shany	20.03 <sup>dc</sup>	18.17 <sup>c</sup>	40.67 <sup>ab</sup>	37.67 <sup>ab</sup>
11- Soltani	29.20 <sup>b</sup>	21.33 <sup>c</sup>	38.33 <sup>b</sup>	38.00 <sup>ab</sup>
12- Tejon	23.23 <sup>d</sup>	20.57 <sup>cd</sup>	43.67 <sup>a</sup>	41.00 <sup>a</sup>
L.S.D. <sub>0.05</sub>	2.53	1.21	4.26	3.42

\* Means, within a column, followed by the same letter(s) are not significantly different according to L.S.D.0.05.

Table (1): Time of flower bud differentiation of the experimental peach cultivars 2001.

Dates of sampling Cultivars	No. buds examined	June 30		No. buds examined	July 31	
		Vegetative buds	Flower buds		Vegetative buds	Flower buds
1- Robin	20	5	15	10	3	7
2- Rubidoux	20	2	18	10	1	9
3- Spring Time	20	4	16	10	2	8
4- Desert Red	20	8	12	10	4	8
5- Bemto	20	8	14	10	3	7
6- Florda Red	20	9	11	10	2	8
7- Fla 16/33	20	3	17	10	3	7
8- Fla 3/2	20	4	16	10	3	7
9- Hegazy	20	17	3	10	7	3
10- Shany	20	18	2	10	5	5
11- Soltani	20	17	3	10	7	3
12- Tejon	20	20	0	10	6	4



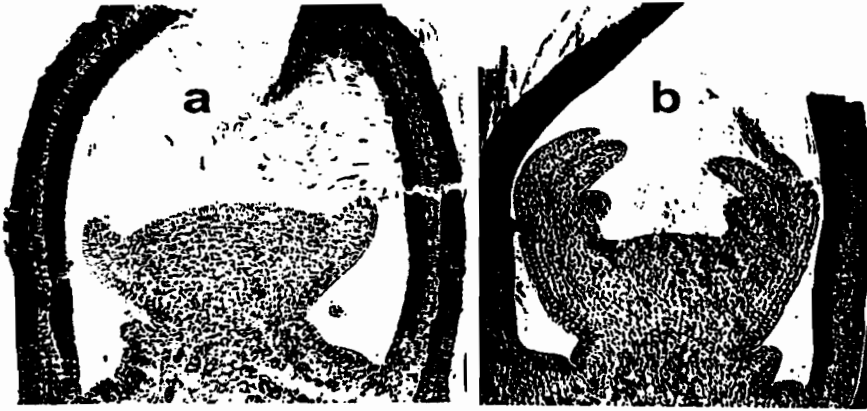
Table (5): Nucleotide sequences of the ten used primers, number of amplified and polymorphic products and the percentage of polymorphism.

Primers	Nucleotide Sequence (5' to 3')	No. of Amplified Products (a)	No. of Polymorphic Products (b)	% Polymorphism 100) ×(b/a
A <sub>1</sub>	CAGGCCCTTC	13	13	100.0
C <sub>1</sub>	TTCGAGCCAG	6	4	66.7
C <sub>13</sub>	ΛAGCTTCGTC	18	18	100.0
C <sub>15</sub>	GACGGATCAG	10	3	30.0
D <sub>17</sub>	TTTCCCACGG	10	8	80.0
O <sub>3</sub>	CTGTTGCTAC	4	1	25.0
O <sub>5</sub>	CCCAGTCACT	12	11	91.7
O <sub>6</sub>	CCACGGGAAG	13	7	53.9
O <sub>7</sub>	CAGCAC TGAC	14	12	85.7
O <sub>10</sub>	TCGGCGGTTC	12	8	66.7



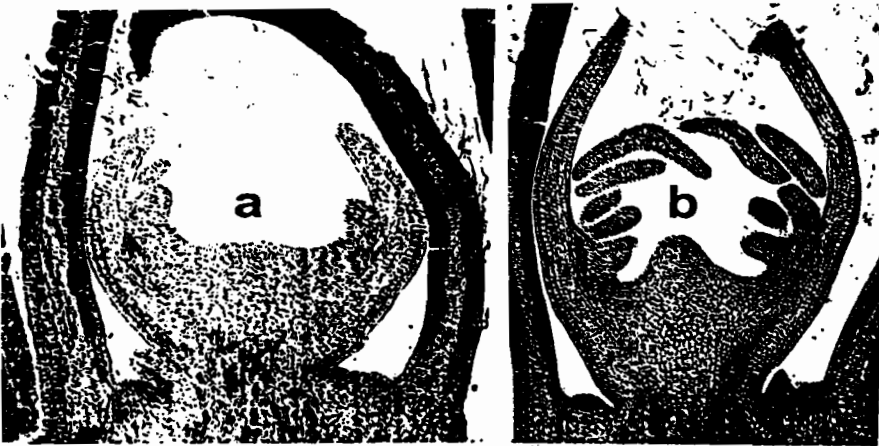
Table (7): Similarities between peach cultivars based on RAPD markers and Jaccard index.

Peach Cultivars	Hegazy	Shamy	Solltani	Desert Red	Robin	Tejon	Rubidoux	Spring time	Bento	Florida Red	Fla 16/33	Fla 3/2
Hegazy	1											
Shamy	0.72	1										
Solltani	0.61	0.65	1									
Desert Red	0.52	0.7	0.69	1								
Robin	0.54	0.54	0.63	0.51	1							
Tejon	0.59	0.64	0.54	0.54	0.59	1						
Rubidoux	0.65	0.74	0.69	0.63	0.63	0.8	1					
Spring Time	0.58	0.68	0.59	0.6	0.68	0.78	0.81	1				
Bento	0.58	0.64	0.58	0.58	0.62	0.74	0.77	0.78	1			
Florida Red	0.47	0.58	0.49	0.51	0.54	0.64	0.63	0.64	0.71	1		
Fla 16/33	0.56	0.65	0.58	0.58	0.58	0.76	0.74	0.71	0.76	0.75	1	
Fla 3/2	0.55	0.63	0.52	0.51	0.66	0.71	0.72	0.73	0.69	0.72	0.75	1



## Robin

Fig. (1): Histological sections of lateral bud of Robin peach cultivar (a) at 30/6/2004 (b) at 31/7/2004.



## Rubidoux

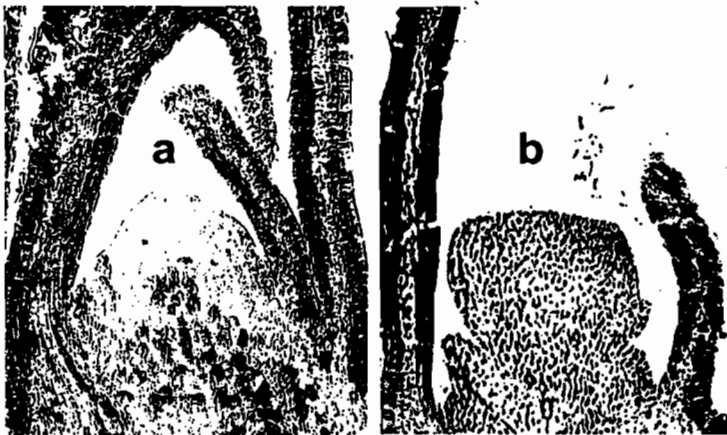
Fig. (2): Histological sections of lateral bud of Rubidoux peach cultivar (a) at 30/6/2004 (b) at 31/7/2004.



### Spring time

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Fig. (3): Histological sections of lateral bud of Spring Time peach cultivar (a) at 30/6/2004 (b) at 31/7/2004.



### Desert Red

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Fig. (4): Histological sections of lateral bud of Desert Red peach cultivar (a) at 30/6/2004 (b) at 31/7/2004.



### Hegazy

Fig. (5): Histological sections of lateral bud of Hegazy peach cultivar (a) at 30/6/2004 (b) at 31/7/2004.



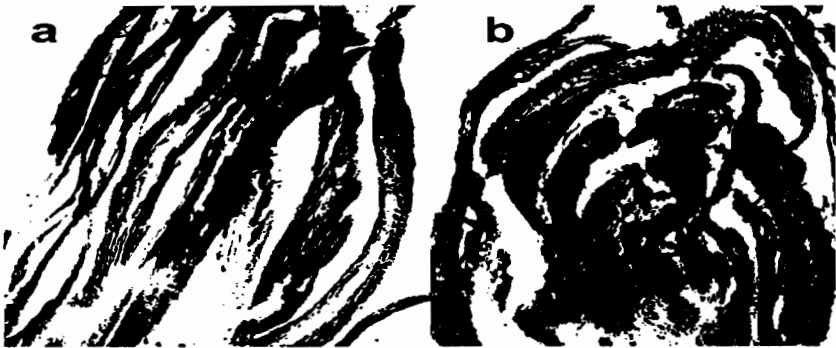
### Shamy

Fig. (6): Histological sections of lateral bud of Shamy peach cultivar (a) at 30/6/2004 (b) at 31/7/2004.



### Soltani

Fig. (7): Histological sections of lateral bud of Soltani peach cultivar (a) at 30/6/2004 (b) at 31/7/2004.



### Tejon

Fig. (8): Histological sections of lateral bud of Tejon peach cultivar (a) at 30/6/2004 (b) at 31/7/2004.



Fig. (9): RAPD fragments amplified from genomic DNA of the twelve tested cultivars generated by primer O<sub>5</sub> (CCCAGTCACT). Lane M represents 100 bp DNA ladder marker, Lane 12 represent Fla 3/2, Lane 11 represent Fla 16/33, Lane 10 represent Florida Red, Lane 9 represent Bemto, Lane 8 represent Spring time, Lane 7 represent Rubidoux, Lane 6 represent Tejon, Lane 5 represent Robin, Lane 4 represent Desert Red, Lane 3 represent Soltani, Lane 2 represent Shamy and Lane 1 represent Hegazy.

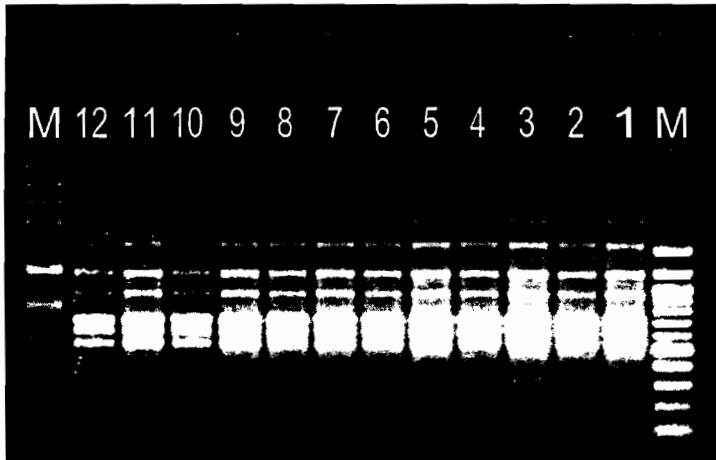


Fig. (10): RAPD fragments amplified from genomic DNA of the twelve tested cultivars generated by primer O<sub>6</sub> (CCACGGGAAG). Lane M represents 100 bp DNA ladder marker, Lane 12 represent Fla 3/2, Lane 11 represent Fla 16/33, Lane 10 represent Florida Red, Lane 9 represent Bemto, Lane 8 represent Spring time, Lane 7 represent Rubidoux, Lane 6 represent Tejon, Lane 5 represent Robin, Lane 4 represent Desert Red, Lane 3 represent Soltani, Lane 2 represent Shamy and Lane 1 represent Hegazy.



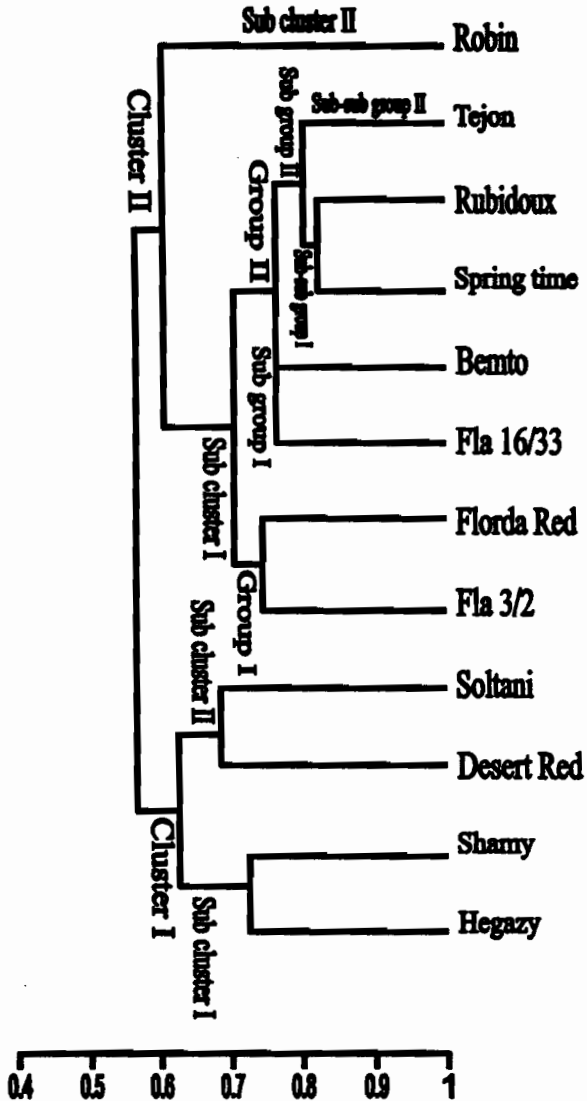


Fig. (11): Similarity obtained by the UPGAMA method showing relationships among the twelve tested peach cultivars based on RAPD polymorphism.

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### الملخص العربي

دراسات فيسيولوجية وتقسيمية على بعض أصناف الخوخ. A: الاختلافات في الخصائص الزهرية و العقد و المحصول و البصمة الوراثية باستخدام تقنية RAPD

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اجرى هذه البحث خلال موسمين 2003 ، 2004 على اثنتي عشرة صنف من اشجار صنف الخوخ و هي: روبن، روبيدوكس، سبرنج تايم، فلوريدا ريد، فلا 32/16، فلا 2/3، ديزرت ريد، بيمتو، حجازي، شامي، سلطاني، و تيجن. و كانت هذه الاشجار عمرها 3 سنوات منزرعة في ارض رملية و مطعومة على اصل النيماتاجارد و نامية في منطقة النوبارية بمحافظة البحيرة تحت نفس الظروف و المعاملات الحقلية، و استهدفت هذه الدراسة تقييم تلك الاصناف تحت ظروف البيئة المصرية من حيث بعض الخصائص الزهرية مثل تكشف و تفتح البراعم و حيوية حبوب اللقاح و نسبة العقد و كمية المحصول و تعريف بعض تلك الاصناف باستخدام البصمة الوراثية عن طريق تقنية تضاعف المتشابهات في المادة الوراثية Random Amplified Polymorphism DNA او ما يعرف باختصار RAPD . اتضح من النتائج ان الصنف روبيدوكس كان الاكثر تباكيرا في ميعاد تفتح البراعم بينما تاخر ذلك في الصنفين شامي و تيجن، و كان ذلك هو الاتجاه بالنسبة للوصول لمرحلة الازهار الكامل، كما اثبت اختبار الصبغة ان الصنف فلوريدا ريد كان الاعلى في حيوية حبوب اللقاح، بينما للصنف شامي هو الاقل، اما مع استخدام اختبار نبات حبوب اللقاح فقد اتضح ان الحبوب الخاصة بالصنف تيجن هي الاعلى بينما حيوية حبوب لقاح الصنف سبرنج تيم هي الاقل. و قد حقق الصنف فلا 2/3 اعلى نسبة من عقد الثمار خلال الموسمين بالمقارنة ببقية الاصناف الاخرى بينما كانت اقل نسبة عقد مع الصنف روبين و لم تختلف عن الصنف شامي معنويا في الموسم الثاني. اما بالنسبة لكمية المحصول فقد اعطى الصنف تيجن اعلى محصول خلال الموسمين لكنها لم تختلف معنويا عن محصول اصناف شامي، فلا 33/16. اما من حيث تكشف البراعم، فقد وجد ان الاصناف المبكرة مثل روبيدوكس و روبين و سبرنج تايم قد اعطت ايضا تكشف مبكر للبراعم في لواخر الصيف مقارنة بالاصناف التي تتضح في منتصف الموسم و الاصناف المتأخرة. و قد لوضحت النتائج امكانية استخدام تقنية RAPD في تعريف اصناف الخوخ كما يمكن ان تفيد بصفة خاصة من ناحية برامج التربية، و قد لوحظ مع استخدام 10 بادئات Primers عشوائية وجود اختلافات بين الاصناف الاثنتي عشرة في عدد و الوزن الجزيئي للشريط الناتج. و قد نتج عن استخدام البادئ A1 (CAGGCCCTTC) مثلا شرائط مميزة ادهم للصنف حجازي و الثاني للصنف شامي و الثالث للصنف سلطاني، بينما نتج عن استخدام البادئ C13 (AAGCTTCGTC) شريطين مميزين احدهما للصنف روبين و الاخر للصنف فلا 2/3، و قد امكن من خلال التحليل المعنوي ايضا ليضاح مدى التشابه بين الاصناف المدروسة و التي تراوحت بين 0.47% الى 0.88 % و امكن عن طريق تلك التقنية و وضع شجرة نسب للاصناف المختبرة.