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MORPHOLOGICAL AND PHYSIOLOGICAL STUDIES ON SOME *Zizuphus jujube Mill* VARIETIES UNDER GIZA CONDITIONS

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ABSTRACT

The present investigation was carried out during 2003 and 2004 seasons to study the morphological characteristics (tree dimensions as well as vegetative characteristics of zig-zag branches, branchlets and leaves) and fruit quality (fruit characteristics and fruit chemical constituents) of five jujube varieties namely: Li, Lang, Toffahi, Zaytoni and Date growing at Horticulture Research Institute, Giza Governorate, Egypt.

Results clearly showed wide significant differences in all vegetative growth characteristics of the studied jujube varieties. As for tree dimensions, Toffahi and Zaytoni varieties recorded the highest values of tree height, top circumference and trunk girth in both seasons. Concerning vegetative growth the zig-zag branches considered the main part of the jujube tree. Also, average length of zig-zag branches, number of nodes / branch and internodes length differ significantly according to variety and season. In addition, branchlets do not form a part of the permanent of jujube tree.

Moreover, Toffahi variety exhibited the maximum average number of branchlets, whereas, Li and Date varieties appeared to be the minimum in this concern. Leaf length, width and leaf area showed significant difference among the five studied varieties. Jujube varieties varied significantly in fruit dimensions and fruit length/width ratio in both seasons. Date variety recorded the highest values of fruit length /width ratio (i.e. of elongate shape), meanwhile; Toffahi variety recorded the lowest ones (i.e. fruit of about round shape). More over, Li and Lang varieties had the heaviest average fruit and pulp weights. Also, fruits with the heaviest values have the highest pulp/seed ratio and visa versa.

Slight differences were recorded in the average seed weight among such varieties. This may be due to the presence of high percentage of undeveloped seed kernels in the jujube varieties. As for chemical constituents, Date variety recorded the highest values of dry matter %, total soluble solids % (TSS), ascorbic acid %, sugars, protein, and carotenoids mg/100g. Whereas, the highest values of moisture %, total acidity%, protein, av. pectin (mg/100g) appeared in Toffahi variety. However, Lang variety exhibited the highest polyphenols content, while, Date and Zaytoni varieties recorded the lowest ones. Generally, Date and Toffahi varieties considered as a good source of different chemical components.

From the above mentioned results, it may be concluded that Li, Lang and Date varieties have good characteristics and can be recommended to grow under the same conditions of this study.

INTRODUCTION

The Jujube belongs to the genus *Zizuphus*, which is in the Rhamnaceae Family. The genus includes about 40 species of plants in tropical and subtropical regions of the northern hemisphere *(Lyrene, 1979)* of which the specie *Zizuphus jujuba Mill* is the most important in terms of distribution and economic significance. It is native to China, where it is known

as Chinese date or Chins Jujube where they have been cultivated for more than 4000 years and where there are over 400 cultivars. It is an important crop in semi-arid region of the world. Moreover, the rapid seasonal development cycle as well as the drought resistance of jujube made it very promising plant for dry fruit growing regions *(El-Baz 1972 and fruit for the future, 1998)*. The Jujube trees can withstand a wide range of temperatures and tolerance of marginal land *(Reddy et al, 1998)*.

Jujube is a small, deciduous tree, with very hard and strong wood. The tree is graceful, ornamental in appearance and often thorny branches growing in a zig-zag pattern. Jujube cultivars vary in size and conformation, with some being very narrow in habit and others being more wide spread. Jujube fruit is varying from round to elongate and from cherry-size to plum-size depending on cultivar *(Lyrene & Crocker, 1994 and California Rare fruit Growers, 1996)*. *Singh et al., (1971 and 1972)* have formulated keys to the classification of ber cultivars on the basis of vegetative and fruit characters of 39 types .The fruits have a spongy, sweet-testing pulp, good flavour and an excellent source of ascorbic acid and carotenoids and were suitable for fresh consumption and for drying and processing *(Bal & Mann, 1978; Ristevski, et al., 1982; Abbas, et al., 1988 and Abbas, 1997)*. Furthermore, *Esterbauer et al., (1992)* reported that polyphenols have the inhabitation of the oxidation of low-density lipoproteins and decreasing the risk of heart diseases. *Morton, (1987)* appeared the medicinal uses of jujube, the fruits are employed in pulmonary ailments and fever; indigestion and biliousness. The dried ripe fruit is a mild laxative. They check diarrhoea and are poultice on wounds. The leaves are helpful in liver troubles, asthma and fever. Juice of the root bark is said to alleviate gout and rheumatism. An infusion of the flowers serves as an eye lotion. Thus, the present investigation was carried out to study the morphological characteristics (tree dimensions as well as vegetative characteristic of zig-zag branches, branchlets and leaves) and fruit quality and chemical constituents of five jujube varieties namely: Li, Lang, Toffahi, Zaytoni and Date, growing at Horticulture Research Institute, Giza Governorate.

MATERIALS AND METHODS

The present investigation was carried out during 2003 and 2004 seasons, on trees of five jujube (*Zizuphus jujuba* L) varieties namely, Li, Lang, Toffahi, Zaytoni and Date. The experimental Jujube trees of each variety were about 35 years-old and grafted on seedling rootstocks. They were planted at 5 x 6 meters apart in loamy soil at the experimental orchard of Horticulture Research Institute, Giza Governorate. This study included fifteen trees, three replicates/ variety (one tree/replicate). The trees were similar in vigour, sound, free from any pathogens, and received the regular cultural managements.

Some descriptive observations and measurements were recorded to identify the specific differences prevailing in the five Jujube varieties. Differences among these varieties were observed concerning their morphological characteristics (tree dimensions as well as vegetative

characteristic of zig-zag branches, branchlets and leaves) and fruit quality (fruit characteristics and fruit chemical constituents). The following characters were investigated for each individual tree:-

I - Morphological studies:

I - 1 - Tree dimensions:

Height, top circumference and trunk girth of each tree in all the studied varieties were measured, using Meter Scale.

I – 2- Vegetative growth:

On June, 15 branches/replicate tree from fully development growth were taken to study:

I-2-1- Zig-Zag branches characters: Branch length (cm), average number of internodes / branch and internodes length (cm).

I-2-2- Branchlets characters: Average number of branchlets emerging from each node, number of leaves / branchlet and number of fruits / branchlet was counted.

I-2-3- Leaf characters: Samples of twenty fully growth leaves (from the middle of new growth branches) were picked from each tree in both seasons to study leaf length and width (cm) as well as leaf area (cm^2).

II - Physical characteristics (Fruit quality):

II -1- Fruit characteristics:

During August month, 50 freshly harvested fruits from each variety were randomly taken and used to determine the average fruit dimensions (cm), fruit length / width ratio, fruit and pulp weight (g.), seed dimensions (cm), seed weight (g.) and pulp / seed ratio.

II -2 - Chemical constituents:

Jujube fruits of the studied varieties were picked at the mature stage and transferred in the same day to the laboratory of Food Technology Research Institute, to determine the moisture content, total soluble solids (by Hand-refractometer), total acidity (as citric acid), protein (Kjeldahl methods), total sugars and ascorbic acid, according to the methods described in the *A.O.A.C. (1995)*. Carotenoids were determined according to the methods described by *Wettestein (1957)*. Polyphenol compounds were determined by Folin-Denis methods as described by *Swain &Hillis (1959)*.

The experimental treatments were arranged in a Randomized Complete Block Design. Data recorded in both seasons were subjected to analysis of variance according to *Snedecor & Cochran (1980)* and means were differentiated using Duncan's Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

I –Morphological Studies:

Results presented in Tables (1) and Figures (1 &2) clearly showed the morphological characteristics of the five studied jujube varieties during 2003 and 2004 seasons.

I - 1 - Tree dimensions:

Measurements of the jujube tree dimensions (tree height, top circumference and trunk girth) in the two studied seasons are presented in Table (1). Results clearly showed wide significant differences in tree dimensions characteristics of the studied jujube varieties. In this respect, the average tree height varied from 3.96& 4.30 m in Lang variety to reach 6.32 & 7.00 m and 5.67& 6.33 m in Toffahi and Zaytoni varieties in the two studied seasons, respectively.

Concerning trunk girth, it can be noticed that, the highest values were observed in Toffahi and Zaytoni varieties. On the other hand. Date variety showed the least values in this concern.

As for top circumference, the highest values were recorded in Toffahi (11.27& 12.10 m) and Zaytoni (11.47&12.03m) varieties, while, Li, recorded the lowest ones (6.50 & 6.77m) in both seasons, respectively.

Table (1): **Morphological characteristics of the five studied jujube varieties during 2003 and 2004 seasons.**

Variety	Average tree height (m)		Av. Top circumference (m)		Average trunk circumference (cm)	
	2003	2004	2003	2004	2003	2004
Li	4.65 C	5.13 D	6.50 D	6.77 D	83.80 C	100.30 C
Lang	3.96 D	4.30 E	7.20 C	7.83 C	83.20 C	106.80 C
Toffahi	6.32 A	7.00 A	11.27 A	12.10 A	137.80 A	147.50 A
Zaytoni	5.67 B	6.33 B	11.47 A	12.03 A	113.80 B	129.20 B
Date	4.55 C	5.67 C	10.13 B	10.23 B	72.00 D	21.07 D

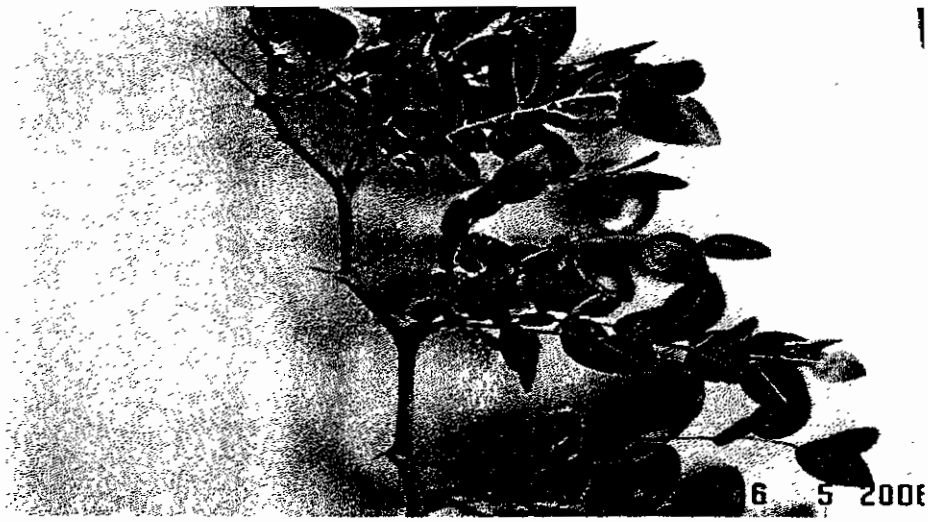

Figure (1): The Zig-Zag branches of jujube tree.

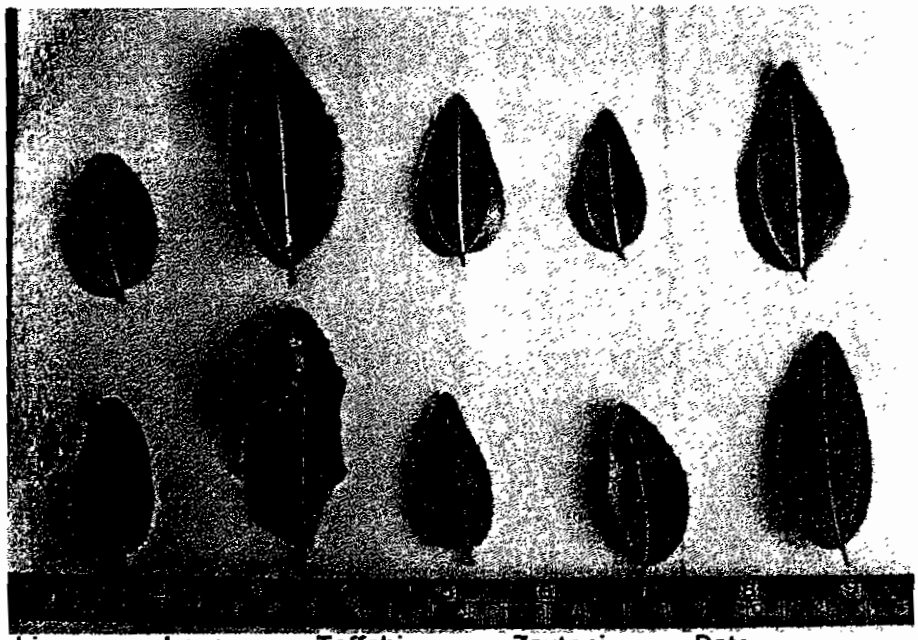

Figure (2): Leaves of the five jujube varieties.

I – 2- Vegetative growth:

Results clearly showed wide significant differences in all vegetative growth characteristics of the studied jujube varieties.

I-2-1- Zig-Zag (Scorpioid) branches characters:

As illustrated in Figure (1), the zig-zag branches were considered the main part of the jujube trees. The observation during the two growing seasons of study appeared that, these branches bear a number of buds at every node, some of these nods emerged into branchlets (flowering branches) and the other emerged into vegetative shoots which bearing new zig-zag branches. The abovementioned Figure also showed that, the zig-zag branches may bear branchlets on some of their nods, while other nods still dormant.

Data presented in Table (2), clearly showed that, the five studied Jujube varieties varied significantly in the average length of zig-zag branches. In this concern, the maximum branch length was observed in Li (25.19 & 25.57cm) and Zaytoni (25.67 & 26.26 cm) varieties in the first and second seasons, respectively, followed in a decreasing order by Date (24.81 cm), Toffahi (23.55cm) and Lang (22.76) varieties ,in the first season, whereas no significant differences showed in these three varieties in the second season.

Conceming the number of internodes /branch, Li, Toffahi, Zaytoni and Date varieties recorded the highest internodes number as compared with Lang variety in the first season. On the other hand, Li variety only exhibited the highest values in the second season in this concern.

Table (2): Vegetative growth characteristics of the studied jujube varieties during 2003 & 2004 seasons.

Variety	Av. Branch length (cm)		No. of internodes/ branch		Internodes length (cm)		No. of branchlets/ branch		Branchlet length (cm)		No. of leaves / branchlet		No of fruits/ branchlet	
	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
Li	25.19 A	25.57 A	4.82 A	5.80 A	4.59 B	4.50 B	8.09 D	6.57 C	14.02 A	15.35 A	11.48 A	11.44 A	5.10 A	7.24 A
Lang	22.76 C	21.17 B	4.39 B	4.00 BC	5.32 B	5.35 A	8.75 C	9.67 B	12.93 B	13.88 AB	9.71 C	9.40 B	5.20 A	5.36 AB
Toffahi	23.55 B	22.64 B	5.13 A	4.81 B	4.89 AB	4.80 B	11.14 A	12.20 A	9.77 D	10.73 C	9.70 C	9.47 B	4.12 B	3.70 BC
Zaytoni	25.67 A	26.26 A	5.20 A	4.45 BC	5.29 A	5.36 A	9.79 B	10.25 AB	11.78 C	13.97 AB	11.03 B	11.35 A	4.13 B	4.30 BC
Date	24.81 AB	21.81 B	4.96 A	3.92 C	5.34 A	5.71 A	8.20 D	6.67 C	12.37 BC	13.55 B	8.88 D	9.34 B	2.94 C	2.81 C

Table (2) continue

	Av. Leaf length(cm)		Av. Leaf width(cm)		Av. Leaf area(cm)^2	
	2001	2002	2001	2002	2001	2002
Li	4.66C	4.70 BC	2.92 A	2.75A	8.99 D	8.56 B
Lang	6.11 A	6.18A	2.87 AB	2.83 A	11.61 A	10.95 A
Tofahi	4.18 D	4.10 C	2.58 C	2.20 B	7.12 E	5.95 C
Zitony	5.54 B	4.77 BC	2.65 BC	2.40 B	10.11 C	7.59 B
Date	5.72 AB	5.13 B	2.96 A	2.70 A	11.16 B	9.15 B

In regard to the internodes length, the obtained data in Table (2) also revealed that, Zaytoni and Date varieties showed maximum internodes length, while Li had the minimum records in both 2003 & 2004 seasons.

I-2-2- Branchlets characters:

As shown in Figure (1) several branchlets arised from buds present on the nodes of the zig-zag branches, these branchlets carrying both flowers and fruits but they do not form a branch because the observations during the two growing seasons also appeared that, these branchlets does not form a part of the permanent of the Jujube tree because of their annually dropping as the_leaves. The terminology of the word branchlet varied in other references, it was designated, flowering branches *(Gardener & Hooker1939)*; small fruiting branches *(Mowry & Wolfe, 1958)*; vegetative branches *(Ackerman, 1961)* and the new vegetative growth which emerges every year on different nodes *(Sari El-Deen, 1969)*.

- Average number of branchlets / branch:

Data presented in Table (2) also clearly showed that, Toffahi variety exhibited the maximum average number of branchlets (11.14&12.20), on the other hand, the minimum number appeared in Li (8,09&6.57) and Date (8.20&6.67) varieties in both seasons, respectively, whereas Lang and Zaytoni varieties showed the intermediate number of branchlets / branch.

- Average length of branchlet, number of leaves / branchlet and number of fruits / branchlet:

The obtained data presented in Table (2) revealed that, jujube varieties significantly varied in these respect. Li variety showed the highest branchlets length (14.02&15.35cm); number of leaves/branchlet (11.48&11.44) and number of fruits/branchlet/m (5.10&7.24) in 2003 &2004, respectively. On the other hand, Toffahi variety showed the lowest branchlets length (9.77&10.73 cm) in both seasons, whereas, Date variety exhibited the lowest number of leaves/branchlet (8.88) in the first season and the lowest number of fruit / branchlet/m (2.94&2.81) in both seasons, respectively.

I-2-3- Leaf characters:

- Leaf length, width and leaf area:

Data in Table (2) clearly showed that, there are significant differences in leaf length, width and leaf area among the five studied Jujube varieties. In this concern, Lang variety recorded the highest average length (6.11 & 6.18cm), width (2.87& 2.83 cm) and leaf area (11.61 & 10.95 cm^2) in 2003 and 2004 seasons, respectively. On the contrary, Toffahi variety recorded the lowest average length (4.18 & 4.10 cm), width (2.58 & 2.20 cm) & leaf area (7.12& 5.95 cm^2).

These observations and results are in general supported by those were obtained by *Gardner &Hooker (1939); Mowry &Wolfe, (1958); Bailey (1961); Sari El-Deen (1969); El-Baz (1972) and California Rare fruit Growers (1996).*

They reported that, there are significant differences in jujube varieties concerning vegetative characteristics of zig-zag branches, branchlets and leaves.

II –Physiological studies (fruit quality):

Data concerning fruit quality of the jujube varieties are shown in Tables (3&4) and Figures (2&3).

II - 1- Fruit characteristics:

- Fruit dimensions and fruit shape (fruit length/width ratio):-

As indicated in Table (3) and Figure (2) Jujube varieties varied significantly in fruit length and width in both studied seasons.

In this respect, Date and Lang varieties observed the highest values of fruit length (4.27&4.37cm) and (4.07&4.33cm) in both seasons, respectively, followed in a deceasing order by Li, Zaytoni and Toffahi varieties. On the other hand, Li and Lang varieties had significantly higher values of fruit width (3.31&3.37 cm) and (3.21 & 3.35 cm)) than that of the other studied varieties in 2003and 2004 seasons, respectively. Regarding fruit length / width ratio (L/w), Date variety observed the highest values which recorded 1.68&1.65 (i.e. of elongate shape), meanwhile, Toffahi variety was the lowest as it recorded 1.08&1.04 (i.e. fruit of about round shape). The other studied varieties were in between. Generally, fruits differed in their dimensions and fruit shape (L /W) according to variety. ***Hartmann & Papaioannou (1971)*** mentioned that length and width of fruit gave an indication for fruit shape.

Table (3): Fruit characteristics of the studied jujube varieties during 2003 & 2004 seasons.

Variety	Av. Length (cm)		Av. width (cm)		Length/width Ratio		Av. fruit weight (g)		Av. pulp weight (g)	
	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
Li	3.97 B	3.84B	3.31A	3.37 A	1.208C	1.14 C	18.79A	16.73 A	17.23 A	16.18 A
Lang	4.07 AB	4.33 A	3.21 A	3.35 A	1.27 B	1.317 B	19.42 A	16.51 A	17.57 A	15.89 A
Toffahi	3.45 C	3.58 C	3.01 B	3.31 AB	1.08 C	1.04 C	16.91 B	15.33 B	16.46 A	14.80 B
Zaytoni	3.22 C	3.33 C	2.57 C	2.67 B	1.25 B	1.26 B	9.64 D	8.18 D	9.23 C	7.71 D
Date	4.27 A	4.37 A	2.56 C	2.65 B	1.68 A	1.65 A	12.61 C	11.40 C	11.94 B	10.75 C

- Fruit and pulp weight (g.):

It can be noticed from Table (3) that, Li and Lang varieties had the heaviest fruit and pulp weights while, Zytoni was the lightest in both seasons under study.

- Seed dimensions (cm):

Data concerning seed dimensions of Jujube varieties are shown in Table (4) and figure (3). Results clearly showed that, there was noticeable significant varietals differences in the average seed length which varied from 1.17&1.12(cm) in Toffahi to 2.35 & 2.35(cm) in Date variety during 2003 & 2004 seasons, respectively. On the other hand, seed width varied from 0.52&0.66(cm) in Zaytoni variety to 0.70&0.80(cm) in Toffahi in both seasons of study, respectively.

- Seed weight (gm)

The obtained data in Table (4) also indicated that, no significant differences in the average seed weight among such varieties in the first season, while slight differences were recorded in the second one The insignificant differences in the average seed weight among the varieties may be due to the presence of high percentage of undeveloped seed kernels in the jujube varieties. The results agree with those were found by *Ackerman et al. (1961).*

Table (4): Seed length, width, weight and fruit / seed weight ratio of the studied jujube varieties during 2003 & 2004 seasons.

Variety	Av. length (cm)		Av. width (cm)		Av. seed weight (g)		Pulp/seed weight Ratio	
	2003	2004	2003	2004	2003	2004	2003	2004
Li	1.55 C	1.90 B	0.60 BC	0.60 B	0.55 A	0.52AB	31.32A	31.11 A
Lang	1.95 B	2.24 A	0.45 D	0.69 B	0.52 A	0.50 B	33.78A	31.78 A
Toffahi	1.17 D	1.22 C	0.70 A	0.80 A	0 61 A	0.67 A	26.98B	22.18 B
Zaytoni	1.55 C	1.85 B	0.52 CD	0.66 B	0 50 A	0.44 B	18.46C	17.52 C
Date	2 35 A	2.35 A	0.65 AB	0.65 B	0 68 A	0.63 A	17.48C	16.98 C

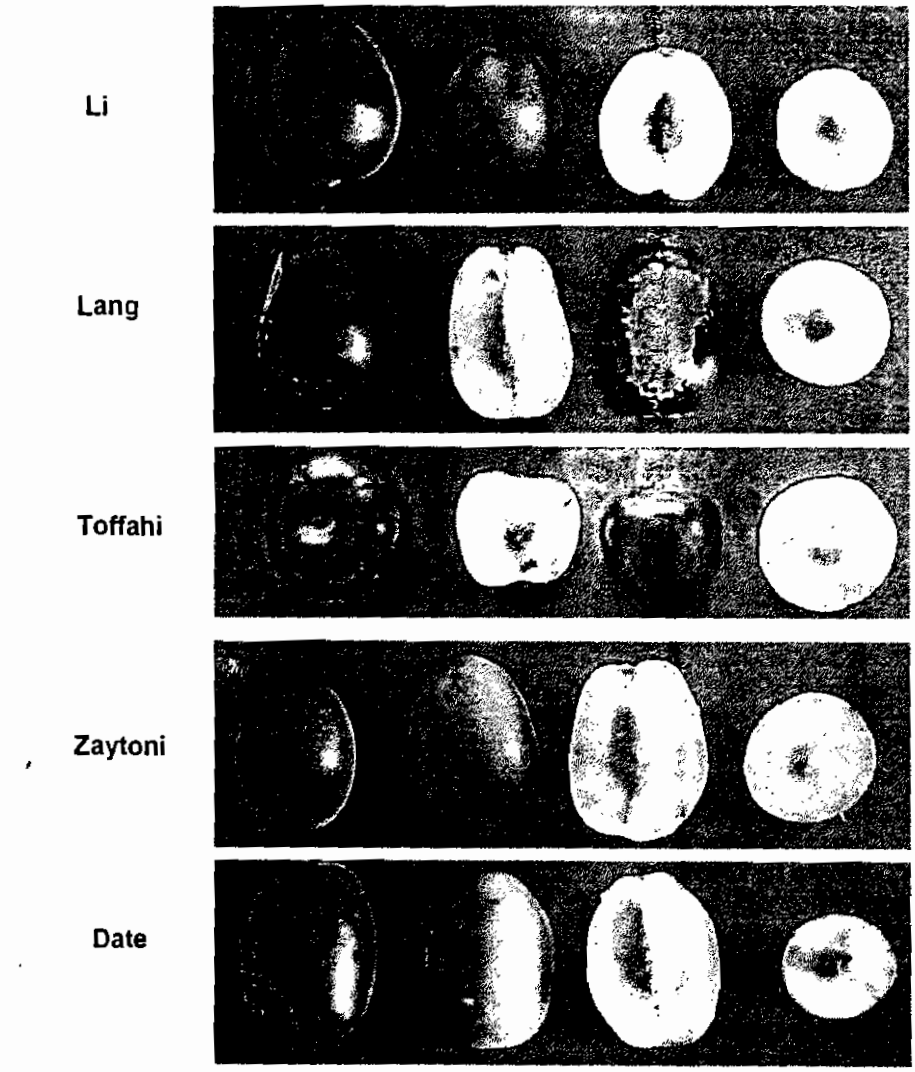

Figure (3): Fruits of the five studied jujube varieties.

- Pulp /seed ratio:

As indicated in Table (4) Lang and Li varieties were superior in pulp/seed ratio, which recorded (33.78&31.78) and (31.32&31.11), while Zaytoni (18.46&17.52) and Date (17.48&16.98) were the lowest in the first and second seasons, respectively. From the above-mentioned these results, it may be noticed that, fruits with the heaviest weight have the highest values of pulp/seed ratio and visa versa. These results are in agreement with the previous works of *Sari El- Deen (1969); Gupta et al (1983); Sivakav (1988); California Rare fruit Growers, (1996) and Gao et al.; (2003)*, who mentioned that Jujube varieties varied in their fruit and stone length and diameter, fruit weight and pulp/stone ratio, which are an important index in determining fruit quality. *Singh et al. (1971 and 1972)* had formulated keys to the classification of ber (Zizyphus mauritiana Lam) cultivars on the basis of vegetative and fruit characters of 39 types.

II -2 - Chemical constituents:

Moisture and dry matter content %:

It is evident from Table (5) that, the highest values of moisture content as percentage of the whole fruits were recorded in Toffahi, Li, and Lang varieties followed by Date and Zaytoni varieties in the two seasons of study. However, the dry matter content took an opposite trend in both seasons. The results are in agreement with those of *Sari El-Deen (1969); El-Baz (1972) and Sivakov et al. (1988).*

-Total soluble solids (TSS) %:

Data presented in Table (5) cleared that, Date variety had the highest values (22.14 & 22.54 %) followed in a decreasing order by Zaytoni (17.00 & 17.24 %), Toffahi (15.75 & 15.91 %), Li (14.24 & 14.40 %) and Lang (12.58 & 12.40 %) in the first and second seasons, respectively. The results clearly showed that, fruits of the five jujube varieties were not exactly alike in total soluble solids. These findings are in general supported by those were obtained by *Abass & Fandi (2002).*

-Total acidity %:

Results presented in Table (5) showed that, Toffahi variety recorded the highest percentages of total acidity calculated as citric acid. Meanwhile,

the rest of varieties appeared no significant differences in both seasons. The obtained results of total soluble solids (TSS) and total acidity are in agreement with those were found by *El-Baz, (1972) and Abbas &Fandi (2002)* who reported that , TSS and titratble acidity in fully ripe jujube fruits were 12.49 to 22.34% and 0.21 to 0.338%, respectively.

-Ascorbic acid %:

It is clear from Table (5) that, ascorbic acid in jujube fruits ranged from 122.9 & 124.2 mg/100g in Li variety to 157.4 & 159.5 mg/100g in Date variety (which is considered as a good source of ascorbic acid). Generally, all jujube varieties had high amounts of ascorbic acid compared with other common fruits such as apple and citrus *(Sari El-Deen, 1969).*

-Sugars content:

Data presented in Table (5) revealed that, Date was the richest variety in sugar content in both seasons, whereas, no significant differences were

observed between the other studied varieties in the first and second seasons. These results go in line with *Ristevski et al. (1982).*

-Protein content:

From the obtained data in Table (5), Toffahi, Zaytoni and Date varieties were the richest in protein content, whereas, Lang variety was the lowest in both seasons under investigation. The present results are in accordance with those were obtained by *Abbas &Fandi (2002).*

-Carotenoids content:

As shown in Table (5) carotenoids content in fruits arranged between o.62 & o.67mg/100g in Lang variety to reach 1.12 & 1.omg/100g in Date variety in 2003 & 2004seasons, respectively.

-Pectin content:

Data tabulated in Table (5) clearly showed that, Li and Toffahi varieties recorded the highest values of pectin content. On the other hand, Date variety recorded the lowest ones in the two studied seasons.

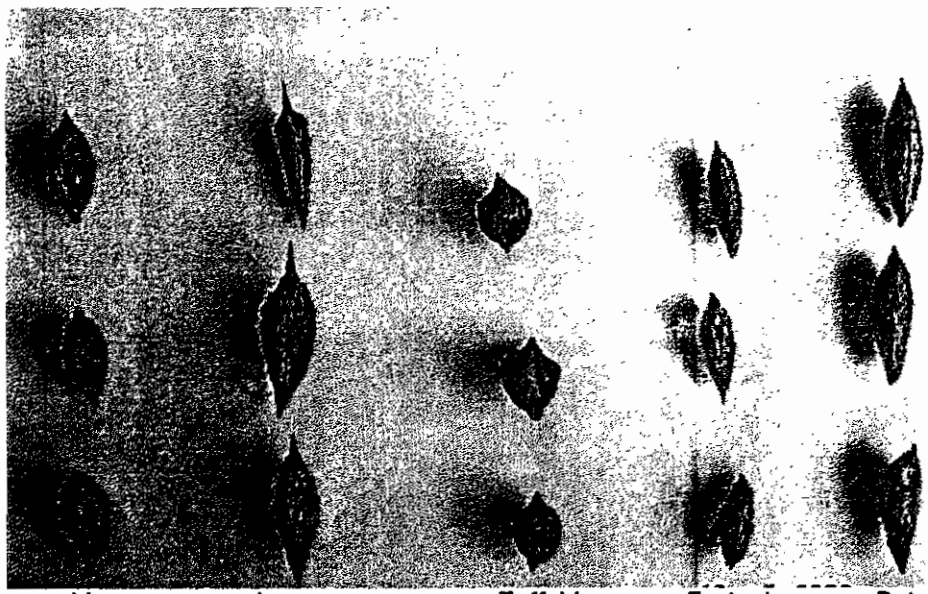

Figure (4): Seeds of the studied jujube varieties -Polyphenols content:

Polyphenols content in the studied jujube fruits showed large amounts in both seasons (Table, 5). The results revealed that, Lang variety exhibited the highest values of polyphenols (167.6 & 181.4), in contrary, Date (130.4 & 132.5) and Zaytoni (133.6&124.3) varieties recorded the lowest ones in 2003 and 2004 seasons, respectively. Polyphenols have many favourable effects on human health, such as the inhibition of the oxidation of low-density lipoproteins, thereby decreasing the risk of heart diseases *(Esterbauer et al., 1992).*

Table (5): Fruit chemical characteristics of the studied jujube varieties during 2003 & 2004 seasons (on fresh weight basis)

Variety	Moisture %		Dry matter %		Total soluble solids% (TSS)		Total acidity %		Ascorbic acid %		Total sugars %	
	2004	2004	2004	2004	2004	2004	2004	2004	2004	2004	2004	2004
Li	76.52 A	77.18 A	23.48 B	22.49 B	14.24 C	14.40 C	0.24 B	0.24 B	122.9 D	124.2 E	10.12 B	10.38 BC
Lang	77.33 A	77.11 A	22.67 B	22.89 B	12.58 D	12.40 D	0.25 B	0.24 B	124.1 D	126.7 D	10.04 B	10.32 BC
Toffahi	77.62 A	78.34 A	22.38 B	21.66 B	15.75 B	15.91 B	0.32 A	0.35 A	148.8 B	149.9 B	10.20 B	10.25 BC
Zaytoni	73.83 B	73.13 B	26.17 A	26.87 A	17.00 B	17.24 B	0.25 B	0.26 B	135.3 C	131.1 C	11.32 B	11.76 B
Date	72.87 B	72.39 B	27.13 A	27.61 A	22.14 A	22.54 A	0.27 B	0.25 B	157.4 A	159.5 A	12.94 A	13.54 A

Table (5): Continued

Variety	Protein %		Carotenoids mg / 100g		Pectin mg / 100g		Total polyphenols mg / 100g	
	2003	2004	2003	2004	2003	2004	2003	2004
Li	1.66 B	1.58 B	0.73 BC	0.81 BC	6.67 A	6.92 A	156.5 B	148.0 C
Lang	1.45 C	1.27 C	0.62 C	0.67 C	5.77 AB	5.91 AB	167.6 A	181.4 A
Toffahi	1.94 A	1.73 A	0.74 BC	0.82 B	6.74 A	6.95 A	152.3 C	154.2 B
Zaytoni	1.96 A	1.83 A	0.67 B	0.98 A	5.63 AB	5.81 AB	133.6 D	124.3 E
Date	1.92 A	1.84 A	1.12 A	1.03 A	4.91 B	5.14 B	130.4 E	132.5 D

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دراسات مورفولوجية و فسيولوجية على بعض أصناف العناب تحت ظروف منطقة الجيزة

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قسم بحوث الزيتون وفاكهة المناطق شبه الجافة-معهد بحوث البساتين- مركز البحوث الزراعية

تم إجراء هذا البحث أثناء موسمي ٢٠٠٣ و ٢٠٠٤ وكان الهدف من البحث هو دراسة الصفات المورفولوجية (أبعاد الأشجار –الصفات الخضرية للأفرع والفريعات والأوراق) وجودة الثمار (الصفات الثمرية والمكونات الكيميائية) لخمس أصناف من العناب هى لى ، لانج، تفاحي ، زيتوني وبلحى منزرعة فى المزرعة البحثية لمعهد بحوث البساتين بمحافظة الجيزة.

وقد أوضحت النتائج أن هناك إختلافات معنوية واضحة في صفات النمو الخضرى لأصناف العناب. حيث إتضح أن صنفى التفاحي والزيتونى قد سجلت أعلى قيم لارتفاع الأشجار ومحيط الجذع وقمة الشجرة فى كلا الموسمين. أما بالنسبة للنمو الخضرى فتلاحظ أن الأفرع المتعرجة تمثل الجزء الرئيسى فى شجرة العناب. وأوضحت النتائج أن معدل طول الأفرع المتعرجة(زجزاج) وعدد العقد على الفرع وطول السلاميات تختلف معنويا طبقاً للصنف والموسم. كما أظهرت الدراسة أن الفريعات لاتمثل الأفرع المستديمة لشجرة العناب وذلك لتساقطها فى نهاية الموسم وقبل تساقط الأوراق. علاوة على ذلك فإن صنف التفاحي أعطى أعلى معدل لعدد الفريعات في حين أن صنفى اللى والبلحى أظهرا أقل معدل في هذه الصفة ولقد اتضح أيضا إختلافات معنوية بين هذه الأصناف الخمسة في طول وعرض والمساحة الورقية. كما أن أصناف العناب تختلف معنويا في أبعاد الثمار ومعدل الطول/العرض في كلا موسمي الدراسة. وقد سجل صنف البلحي أعلى قيمة فى معدل الطول/العرض للثمار (أى أنها مستطيلة الشكل) ، بينما سجل صنف التفاحى أقل قيم لهذا المعدل (أى أن الثمار مستديرة الشكل). ومعدل وزن كل من الثمار واللب لأصناف اللى واللانج سجلت أعلى قيم. واتضح أيضا أن الثمار التى أعطت أعلى قيمة فى الوزن كانت أعلى فى معدل نسبة اللب/البذرة والعكس صحيح. وكذلك أوضح البحث أن هناك اختلافات طفيفة فى وزن البذرة بين هذه الأصناف ، وهذا ربما يرجع الى وجود نسبة عالية من البذور الغير مكتملة فى أصناف العناب تحت الدراسة. أما بالنسبة للمحتوى الكيماوى ، فقد سجل صنف البلحى أعلى قيم فى النسبة المئوية للوزن الجاف والمواد الصلبة الكلية الذائبة ، والنسبةالمئوية لحمض الأسكوربيك والسكريات والبروتين والكاروتينات (ملجم/١٠٠جرام). فى حين أن أعلى قيمة لنسبة الرطوبة والحموضة الكلية والبروتين ومعدل البكتين (ملجم/١٠٠جرام) إتضحت فى صنف التفاحى. وبالنسبة للمحتوى من الفينولات المتعددة فإن صنف اللانج أظهر أعلى قيم ، بينما البلحى والزيتونى أوضحا أقل القيم. وعامة صنفى البلحى والتفاحى هما أفضل الأصناف فى المحتوى الكيماوى للثمار.

وبناء على ماتقدم يمكن التوصية بزراعة أصناف لى، لانج والبلحى حيث ان ثمارها ذات صفات جودة عالية تحت نفس الظروف المشابهة لهذه الدراسة.