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EDITORIAL

The first two issues of Volume One have been highly acclaimed by researchers, specialists, International Organizations, Documentation Information Centres, and world-wide Abstracting and Indexing Services. With this issue we are launching Volume Two of the Journal.

The research papers published in the present issue logically fall into six categories, which represent a wide spectrum of subjects relevant to the date industries of the region.

There is an enormous number of palm varieties cultivated. This has led to much confusion and duplication and efforts to define varietal differences and compile keys for the identification and recognition of varieties have been only partially successful. Sawaya et al in their paper attempt a characterization of fifty-five important Saudi Arabian varieties based on morphological and physico-chemical characteristics of Khalal and Tamar fruit. Mohammed et al report on a similar study of fifty Iraqi cultivars.

Rapid propagation of elite date palms through tissue culture techniques holds up much scope for the date industry and encouraging progress has been made at several research centres in developing appropriate techniques for successful production of plantlets. A range of organs and tissues have been employed. Abdul Amir in his paper presents progress in production of callus and plantlets from embryos excised from date fruits at different stages of maturity.

Quantitative and qualitative deterioration of dates in storage through the activity of pests, is a source of considerable economic loss. Al Azzawi et al and Al Hakkak et al report on further work in the use of high temperature treatment and gamma irradiation as methods of disinfestation of stored dates.

In three related studies directed at improving the presentation of dates and processed products, Khatchadourian et al report on artificial chemical

NOTES FOR AUTHORS

The Date Palm Journal is published twice a year by the FAO Regional Project for Palm & Dates Research Centre (NENADATES), Baghdad, Iraq. Contributions to the Journal may be (a) papers of original research in any branch of date palms, (b) review articles, (c) short communications, and (d) news and views. The research papers submitted for publication in the Journal should not have been previously published or scheduled for publication in any other journal.

Manuscripts

Papers may either be in Arabic or in English with summaries in both. The manuscript should be typewritten (double spaced, with ample margins) on one side of the paper only. Two copies of the manuscript should be submitted, the original typed copy along with a carbon copy. Authors should organize their papers according to the following scheme as closely as possible: (a) title of paper, (b) author's name (and affiliation written at the bottom of the first page), (c) abstract, (d) introduction, (e) materials and methods, (f) results, (g) discussion, (h) conclusion, (i) acknowledgement (s), (j) literature cited (arranged alphabetically), using the following illustrated format:

Andlaw, R.J. (1977): Diet and dental caries – a review. J. Human Nutrition 31:45.

Francis, D.E.M. (1974): Diet for sick children, 3rd Ed. Oxford: Blackwell. 405 pp.

Lepesme, P. (1947): Les insects des palmiers. Paris: Lechevalier. 247-48.

Tahara, A.; T. Nakata & Y. Ohtsuka (1971): New type of compound with strong sweetness. Nature 233:619.

However, in case of short papers and communications, results and discussion could be combined in one section.

Tables

Tables should be reduced to the simplest form and should not be used where text or illustrations give the same information. They should be typed on separate sheets at the end of the text and must in no case be of a size or

treatments for softening Khalal dates and Asif and Al Taher on processing into 'date butter' and 'dates in syrup'. Yousef et al in their paper discuss the use of 4 Iraqi varieties for the preparation of "Khalal matbuukh".

Methods for using hitherto unutilized parts of the date palm and its fruit components can lead to increased profitability of the industry. Bukhaev and Zaki in their paper report on some analyses of date palm parts with a view to identifying chemical constituents that may lend themselves to economic utilization or as starting points for the fabrication of other chemical products that could be useful.

The Regional Project endeavours to provide through the "Date Palm Journal", information and views that could assist in further developing and strengthening the date industry and improving the returns to farmers, handlers and processors of date palm products.

The Editorial Board welcomes from readers any suggestions for further improving the technical standard, presentation and usefulness of the Journal.

T. J. Al Bandar

Chairman, Editorial Board

form that will not conveniently fit onto the Journal page size. Units of measurement should always be clearly stated in the column headings; any dates relevant to the tabulated information should be stated in the table title or in the appropriate column heading.

Illustrations

Line drawings and graphs must be in jet black ink, preferably on bristol board or tracing paper .Photographs should be on glossy paper, negatives being supplied where possible. Figures including both line drawings and photographs, should be numbered consecutively in the order in which they are cited in the text. The approximate position of tables and figures should be indicated in the manuscript.

Units

Units should follow the metric system. Yield or rate is expressed in metric tons/hectare or kg/hectare. Any reference to currency should be expressed in U.S. dollars or the equivalent to a local currency stated in a footnote.

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Correspondence

Contributions and correspondence should be addressed to the Chairman, Editorial Board, Date Palm Journal, c/o Regional Project for Palm & Dates Research Centre in the Near East & North Africa, FAO, P.O. Box 163, Baghdad, Iraq.

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The Project is planning to publish a directory of date palm researchers and projects and would solicit cooperation of the readers of the *Date Palm Journal* to provide information along the following lines and forward it to the Chairman, Editorial Board of the journal.

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7. _____
Name of university 8. Major subject

9. _____
Present field of specialization

10. _____
Total number of years experience

11. Field of work (Please tick applicable field (s) from those listed):

_____Botany, taxonomy & varieties
_____Breeding & genetics
_____Plant physiology
_____Soils
_____Nutrition & fertilizers
_____Propagation
_____Other cultural practices & techniques
_____Other activities (specify) _____

_____Insects & mites
_____Diseases
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_____Harvesting, fruit handling, packing
_____Fruit chemistry & processing
_____Economy & trade
_____Food & nutritional value

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PHYSICAL AND CHEMICAL CHARACTERISATION OF THE MAJOR DATE VARIETIES GROWN IN SAUDI ARABIA I. MORPHOLOGICAL MEASUREMENTS, PROXIMATE AND MINERAL ANALYSES

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ABSTRACT

Fifty-five varieties of dates *(Phoenix dactylifera L)* collected from four different regions in Saudi Arabia were studied for their physical and chemical characteristics, at Khalal and Tamar stages of fruit development. Physical measurements showed that the weights of the whole fruits at Khalal and Tamar stages respectiveiy varied from 5.8 to 26.8 and 4.8 - 18.3 g.; weights of the stones varied from 0.7 to 1.8 g. and 0.6 - 1.3 g. There was a consistent decrease in weights of the whole fruit and stones from Khalal to Tamar stage. Chemical analysis of dates at Khalal stage indicated low amounts of crude fat (0.1-0.6%) and protein (2.1-4.4%), fair amounts of ash (1.9-4.2%) and relatively high amounts of crude fiber (2.8-8.8%). Moisture, crude protein, crude fat, crude fiber and ash contents all decreased from Khalal to Tamar stage. Mineral analysis, in general, showed the presence of high levels of K compared to Na, fair levels of Ca, Mg and P, low levels of Zn and fairly significant levels of Fe and Cu. Manganese was present in trace amounts and F was not detected. In general, the contents of the macro- and micro-nutrients tended to decrease consistently from Khalal to Tamar stage in almost all the varieties tested.

المواصفات الكيمائية والفيزيائية لأصناف التمور الهامة بالمملكة العربية السعودية

القياسات المورفولوجية، وتحاليل العناصر

و.ن. صوايا، أ.م. مسكن، ج.ك. خليل، هـ أ. خاتجادوريان وأ.س. ماشادي

المشروع الاقليمي لمركز البحوث الزراعية والمياه/وزارة الزراعة والمياه ـ الرياض ـ المملكة العربية السعودية

الخلاصة

أجريت دراسات على الصفات الكيمائية والفيزيائية لخمسة وخمسين صنفاً من التمور التي جمعت من 4 اقاليم بالمملكة العربية السعودية في مرحلتي الخلال والتمر. بينت القياسات الفيزيائية ان الاوزان الكلية للثمار في مرحلتي الخلال والتمر على التوالي تتراوح بين 5.8 الى 26,8 ، و 4,8 الى 18,3 غرام، وتراوحت أوزان النوي بين 0,7 الى 1.8 جرام و 0,6 الى 1,3 غرام. لوحظ هبوط ثابت في الوزن الكلي للثمار ووزن النوى مع التحول من مرحلة الخلال للتمر. أوضحت التحاليل الكيمائية في مرحلة الخلال وجود نسبة قليلة من الدهن الخام (0,1 - 0,6%) والبروتين (2,1 - 4,4%) ونسبة متوسطة من الرماد (1,9 - 4,2%) وكمية عالية نسبياً من الليف الخام (2,8 - 8,8%) انخفضت نسب الرطوبة، والبروتين الخام، والدهن الخام، والليف الخام، ومحتويات الرماد وجميعها مع التحول من مراحل الخلال للتمر. وأوضحت التحاليل الكيمائية للعناصر وجود نسب عالية عموماً من البوتاسيوم بالمقارنة للصوديوم، ونسباً

متوسطة من الكالسيوم والماغنزيوم والفوسفور ونسباً ضئيلة من الزنك ونسباً واضحة من الحديد والنحاس. وجدت بعض الآثار للمانجانيز ولم يعثر على أي نسب من الفلورين. من ناحية عامة فان نسب العناصر الكبرى والصغرى تضاءلت بثبات واضح مع تحول الثمار من مراحل الخلال للتمر في كل الأصناف التي تم اختبارها.

INTRODUCTION

Dates *(Phoenix dactylifera L.)* are a staple food in the Kingdom of Saudi Arabia which is considered the fourth country in the world in date production. According to the latest local statistics (1977) of the Ministry of Agriculture and Water, the total estimated area under palm trees is about 589,000 dunums with a yearly production of about 400,000 tons. The estimated number of palm trees in the country is between 7 and 8 million producing trees, in addition to about 3 million unproductive and young trees (15). It is reported that there are over 400 different varieties of dates in Saudi Arabia (12). Only a few reports in the literature are available on their identification, morphological and chemical characteristics.

Al-Baker (6) in 1952 and Nixon (16) in 1954, described some of the date varieties growing in Saudi Arabia. However, there is no adequate information available in the literature about the morphological and chemical characteristics of the major important date varieties of Saudi Arabia except for the work reported by Hussein *et al* (13) on a few varieties.

In the present study, an attempt was made for collecting data on the complete chemical analysis and morphological changes at two different stages of development of fifty-five major date varieties growing in Saudi Arabia. Such data will complement available information in the literature on other date varieties grown in the principal date producing countries of the World. Furthermore, the data so obtained will provide information on the potential of the various date varieties with respect to their overall utilization, their packaging, syrup and/or sugar extraction, incorporation in other food products, as animal feed and any other possible use.

MATERIALS AND METHODS

Terminology

In this study, the Arabic terms will be used in referring to the stages of development of date fruits. These terms have been used by various workers (1, 7, 10, 11) as well as American date growers (18), and are defined as follows: a) Kimri, refers to young green-coloured dates; b) Khalal, the stage at which dates begin to change colour and reach maximum weight and size. At this stage, dates may be yellow, red pink, yellow-scarlet or yellow spotted with red depending on the variety; c) Rutab, when the fruits begin to soften and lose their astringency and start acquiring a darker and less attractive colour from the previous stage; d) Tamer, when the fruit contains the maximum total solids and is completely softened and becomes brownish in colour.

Collection of Samples

Date samples *(Phoenix dactylifera L.)* were collected from nine areas of four major date regions in Saudi Arabia. These included Hofuf and Qatif (Eastern region), Wadi Fatmah, Wadi Khleis, Wadi Rania, Tarabah and Bisha (Southwestern region), Al-Medina (Western region) and Gassim, Al-Kharj and Hail (Central and Northern regions). Field surveys were undertaken to collect fruit samples at two different stages of development, namely the Khalal (from June 7 to July 30, 1980) and Tamar (from September 2 to October 1, 1980). Fruit samples consisting of 300 individual dates were picked at random from the different bunches on each tree from strands located in different parts of each bunch. On an average about ten date palm trees were taken for the study. Special attention was given to avoid any injury or removal of the calyxes of the fruits. The fruits were transferred within 24 hours to the laboratory in perforated plastic bags in ice boxes.

Preparation of Samples

Thirty fruits from each variety were selected at random and the weight of each whole fresh fruit was taken after the calyx was removed. The fruits were then pitted and the average weight of stone/fruit determined. The

flesh was converted into date flour by drying it under vacuum at 100 mm of mercury and 70° C to a constant weight. The dried samples were ground into a fine powder and stored in a cool place in glass jars for further analysis.

Chemical Analysis

Moisture, ether extract (crude fat), crude protein (N x 6.25), crude fiber and ash were determined by the standard methods of AOAC (2). For the quantitative estimation of Na, K, Ca, Mg, P, Fe , Cu, Zn, Mn and F, the ash was dissolved in 5 ml of 20% Hcl and the volume made to 50 ml with deionised water. All minerals except Na, K, P and F were assayed with an atomic absorption spectrophotometer (Perkin Elmer, Model 603, Atlanta, Ga.). Na and K were determined with a flame photometer (Beckman, Klina flame, Geneva, Switzerland). P was determined by the procedure described by Watanabe and Olsen (20). F was determined with an autoanalyser (Technicon, Model SMA-9, Elmhurst, I11.).

RESULTS AND DISCUSSION

The various date regions which were selected for fruit sampling are shown in Figure 1. Results of the fruit growth determinations of the fifty-five varieties investigated including measurements of weights of fruits and seed/fruit as well as recording the colour of fruits at two stages of development, Khalal and Tamar, are shown in Tables 1, 2, 3 and 4. The data obtained show a wide variation in the weights of fruits ranging from 5.8 to 26.8 g in the Khalal stage with an average weight of 13.5 g, and 4.8 to 18.3 g in the Tamar stage with an average weight of 9.8 g. The Sukai variety grown in the Central region attained the maximum weight among the different varieties at the Khalal stage while the Hulwa Hail variety grown in the Northern region attained the maximum weight at the Tamar stage. Altogether, there are over 22 varieties at the Khalal stage with their weights exceeding the average and over 23 varieties in the Tamar stage.

As for the weight of seed and fruit, it ranged from 0.7 to 1.8 g in the Khalal stage and 0.6 to 1.3 g at the Tamar stage. The maximum weight of seed and fruit at the Khalal stage was attained by the Jasap variety grown

in the Southwestern region and at the Tamar stage by the Shalabi variety grown in the Western region.

The percentage of fruit pulp to the total fruit weight ranged from 86-96% with 38 varieties having values greater than 90% and 9 varieties with values greater than 94%. Out of the 55 varieties investigated, 62% were yellow in colour at the Khalal stage with the rest ranging from light to dark red. At the Tamar stage, the colour of the yellow varieties changed to golden brown while the colour of the other varieties became dark brown.

Proximate analyses of the edible portion of the fruits including moisture content, crude fat, crude protein, crude fiber and ash are shown in Tables 5, 6, 7 and 8. The moisture content of the fruits ranged from 57.2 to 81.4% in the Khalal stage with the majority decreasing to 7.8 - 27.6% at the Tamar stage and only one maintained a high level of about 37% moisture. The ripe fruits are usually picked when the moisture content is below 30% and most of the time when it is less than 26% thus permitting minimum spoilage during marketing (Saudi Standard Organization, Unpublished). In contrast to the Deglet Noor grown in the U. S. (17), the major date cultivars grown in Saudi Arabia have a higher moisture content at the Khalal stage which is characteristic of soft date varieties.

The crude fat content ranged from 0.1 to 0.6% at the Khalal stage and dropped to 0.1 - 0.4% at the Tamar stage. These values are relatively close to those reported by Chatfield and Adams (3) for dates grown in the U. S. but are low compared to those of some varieties grown in Iraq (4) and Egypt (19). The crude protein content ranged from 2.1 to 4.4% at the Khalal stage and decreased to 1.8 - 2.9% at the Tamar stage. Even though dates are not considered to be a rich source of protein, it is reported that dates contain high quantities of some essential amino acids (19). The results also revealed that the percentage of protein tended to decrease during fruit maturity and ripening in the fruits of all varieties. These findings are compatible with results of other soft date varieties reported by other workers (13,14).

The fiber content in the flesh of fruits in all varieties was substantial at the Khalal stage and decreased on a percentage basis as the fruits matured.

In the Khalal stage, the fiber content ranged between 2.8 and 8.8% and decreased at the Tamar stage to 2.0 - 4.1%. Similar results were obtained by Hussein *et al* (13) although Cleveland and Fellers (4) and Copertini (5) indicated that fully cured soft dates contain not more than 2% crude fiber or cellulose.

The ash content of dates ranged from 1.9 to 4.2% at the Khalal stage and 1.5 - 3.0% at the ripe Tamar stage. These results are in line with those reported by Haas (8) working on six date cultivars. Even though the ash content decreased at the Tamar stage, this change was considered to be very little when compared to other nutrients. However, the amount of minerals present is nutritionally significant (Tables 9, 10, 11, 12). The macro-element contents at the Khalal stage ranged for potassium between 701 and 1868 mg, sodium 15 - 47 mg, calcium 18 - 198 mg, magnesium 42 - 143 mg and phosphorus 37 - 143 mg/100 g dry wt. At the Tamar stage, the levels of all the macro-elements except sodium decreased consistently ranging between 566 and 1223 mg/100 g dry wt. for potassium, 9 - 81 mg for calcium, 32 - 88 mg for magnesium and 34 - 109 mg for phosphorus. The percentage of sodium, however, showed no consistent trend in the fruits of all varieties. These findings are in agreement with those reported by Haas and Bliss (9) working on Deglet Noor date fruits and Minessy *et al* (14) working on four soft date varieties grown in Egypt.

As for micro-element contents comprising iron, copper, zinc, manganese and fluorine, the results revealed the absence of fluoride from date fruits of all varieties and the presence of only traces of manganese at both stages of development. On the other hand, the content of iron, copper and zinc at the Khalal stage ranged from 1.2 to 3.9 mg, 0.3 - 1.2 mg and 0.3 - 1.1 mg/100 g dry wt., respectively. These levels at Tamar stage ranged from 1.1 to 4,3 mg for iron, 0.3 - 1.9 mg for copper and 0.2 - 1.3 mg/100 g dry wt. for zinc; generally there was a decrease in the levels of these elements from Khalal to Tamar stage. Haas and Bliss (9) obtained similar results with Deglet Noor variety. It is also clear from this data that iron concentration was higher than that of copper and zinc in the date fruits of all varieties. On the whole, the contents of micro-elements in date fruits are significant, besides the fact that the high potassium to sodium ratio is of dietetic value for people who

have restrictions on sodium intake.

In conclusion, we feel that the present study has provided base-line data on fifty-five major date varieties grown in Saudi Arabia in addition to revealing nutritionally important information on the major nutrient contents and the macro- and micro-elements especially potassium, iron and copper which occur in significant amounts.

ACKNOWLEDGEMENTS

We thank Messrs. W. M. Safi and H. Al-Muhammad for their technical assistance and Dr. Salah Abu-Shakra for his critical review of the manuscript.

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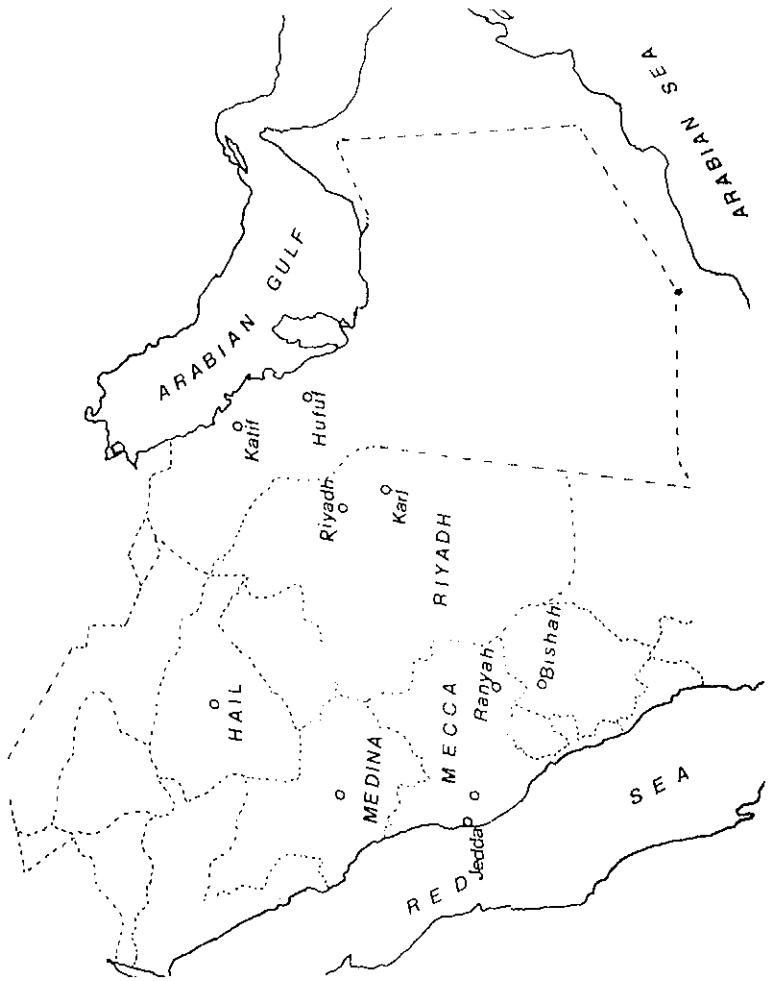

Fig. 1. Date producing Locations (Kingdon of Saudia Arabia)

Table 1: Weight of fresh fruit and stone and colour of the major date varieties in Gassim, Al-Kharj and Hail (Central & Northern Region), Kingdom of Saudi Arabia.

Location	Variety	Weight*/ fresh fruit (g)		Weight*/stone (g)		Colour	
		K**	T**	K	T	K	T
Gassim	Maktumi	25.6	13.7	1.5	1.0	Yellow	Golden brown
Gassim	Shakra	13.6	11.9	1.5	1.2	Light red	Brown
Gassim	Lahmia	12.2	10.4	1.5	1.2	Yellow	Golden brown
Gassim	Sukkari	18.3	12.5	1.7	1.2	Yellow	Golden brown
Gassim	Hulwa	16.4	14.4	1.5	1.2	Dark red	Dark brown
Al-Kharj	Nabbut Al-Seif	18.7	11.2	0.8	0.7	Yellow	Golden brown
Al-Kharj	Mukai	15.3	10.5	1.0	0.9	Yellow	Golden brown
Al-Kharj	Sukai	26.8	14.1	1.5	0.9	Light Yellow	Golden brown
Al-Kharj	Khudari	21.6	17.1	1.2	1.0	Dark red	Dark brown
Al-Kharj	Khashram	15.9	12.9	1.3	1.1	Dark red	Dark brown
Hail	Hulwa Hail	11.0	18.3	1.0	1.0	Light red	Brown
Hail	Daklat Khalaf	9.2	12.3	1.0	1.0	Yellow	Golden brown
Hail	Rakhimi	10.1	7.7	1.2	1.0	Light red	Brown
Hail	Suwairi	9.2	6.6	0.9	0.7	Yellow	Golden brown
Hail	Fankha	17.0	13.0	1.0	1.0	Yellow	Golden brown

* Average weight of 30 fresh fruits and stones

** K is the Khalal stage and T is the Tamar stage in this and the following tables.

Table 2: Weight of the fresh fruit and stone and colour of the major date varieties in Hofuf and Qatif (Eastern Region), Kingdom of Saudi Arabia.

Location	Variety	Weight*/ fresh fruit (g)		Weight*/stone (g)		Colour	
		K	T	K	T	K	T
Hofuf	Khlas	11.3	7.5	1.1	0.7	Yellow	Golden brown
Hofuf	Hatmi	13.7	7.2	1.3	0.8	Yellow	Golden brown
Hofuf	Khuneizi Hofuf	11.2	6.4	0.8	0.6	Red	Dark brown
Hofuf	Ghurra	8.0	6.4	0.9	0.7	Yellow	Golden brown
Hofuf	Shbibi	15.5	11.1	1.1	0.8	Yellow	Golden brown
Hofuf	Shishi	16.2	11.7	0.9	0.7	Yellow	Golden brown
Hofuf	Shahl	10.1	6.1	0.7	0.7	Rose red	Brown
Hofuf	Ruzeiz	9.3	7.6	0.9	0.7	Yellow	Golden brown
Hofuf	Woseili	11.0	8.6	1.6	1.2	Very dark red	Dark brown
Qatif	Khsab	13.9	11.7	0.8	0.9	Light red	Brown
Qatif	Khueizi Qatif	12.2	9.1	0.8	0.6	Dark red	Dark brown
Qatif	Uwaynat	10.6	8.2	0.8	0.6	Light red	Brown
Qatif	Hallaw	14.6	8.2	1.1	0.7	Dark red	Dark brown
Qatif	Bukeira	7.4	4.8	1.1	0.8	Yellow	Golden brown
Qatif	Abu Hallaw	12.1	8.3	1.0	0.9	Yellow	Golden brown

* Average weight of 30 fresh fruits and stones

Table 3: Weight of the fresh fruit and stone and colour of the major date varieties in Al-Madina (Western Region), Kingdom of Saudi Arabia.

Location	Variety	Weight*/ fresh fruit (g)		Weight*/stone (g)		Colour	
		K	T	K	T	K	T
Al-Madina	Rabia	10.8	7.3	1.7	0.9	Yellow	Golden brown
Al-Madina	Ajwa	11.4	5.9	1.6	1.0	Very dark red	Dark brown
Al-Madina	Barni	16.2	6.7	1.5	1.0	Yellow	Golden brown
Al-Madina	Shalabi	14.3	12.5	1.4	1.3	Red	Brown
Al-Madina	Safawi	17.0	9.6	1.3	0.9	Dark red	Dark Brown
Al-Madina	Ruthana	10.1	—	1.2	—	Yellow	Golden brown
Al-Madina	Hulwa	15.8	13.3	1.2	0.9	Red	Brown
Al-Madina	Barhi	-	9.0	-	0.6	--	--
Al-Madina	Sukkarat Al-Shark	12.6	9.0	1.4	1.2	Yellow	Golden brown
Al-Madina	Anbara	20.5	15.9	1.3	1.2	Red	Brown
Al-Madina	Beid	12.9	7.5	1.5	0.9	Yellow	Golden brown
Al-Madina	Sukkarat Yanbu	11.1	-	1.2	-	Yellow	Golden brown

* Average weight of 30 fresh fruits and stones

Table 4: Weight of fresh fruit and stone and colour of the major date varieties in Wadi Khleis & Fatmah, Tarabah, Rania & Bisha (Southwestern Region), Kingdom of Saudi Arabia.

Location	Variety	Weight*/ fresh fruit (g)		Weight*/stone (g)		Colour	
		K	T	K	T	K	T
Wadi Khleis & Fatmah	Mutalabban	10.4	6.2	1.1	0.9	Yellow	Golden brown
"	Luban	10.7	5.7	1.0	0.8	Yellow	Golden brown
"	Mushwek	15.8	8.7	0.9	0.6	Yellow	Golden brown
"	Sifri Khleis	5.8	5.6	0.8	0.9	Yellow	Golden brown
Tarabah & Rania	Sifri Tarabah	18.1	13.3	1.4	0.9	Yellow	Golden brown
"	Sari	12.6	13.7	1.4	0.9	Reddish yellow	Brown
"	Maqfizi	13.0	8.0	1.4	0.8	Yellow	Golden brown
Bisha	Shukal	25.6	11.0	1.1	0.7	Yellow	Golden brown
Bisha	Barni	10.8	6.7	1.6	0.9	Light red	Brown
Bisha	Hamar Amik	14.7	9.3	1.5	1.0	Dark red	Dark brown
Bisha	Jasap	9.1	8.3	1.8	1.1	Yellow	Golden brown
Bisha	Sifri Bisha	15.7	11.0	1.6	1.0	Yellow	Golden brown
Bisha	Lahak	10.3	7.8	1.5	0.9	Yellow	Golden brown

* Average weight of 30 fresh fruits and stones

Table 5: Proximate analysis of the major date varieties in Gassim, Al-Kharj, Hail (Central and Northern Region), Kingdom of Saudi Arabia (g/100 g dry wt.).

Location	Variety	Moisture*		Ether Extract		Protein (N x 6.25)		Fiber		Ash	
		K	T	K	T	K	T	K	T	K	T
Gassim	Maktumi	61.7	12.1	0.3	0.2	3.0	2.3	4.5	2.7	2.2	2.3
Gassim	Shakra	63.6	14.9	0.3	0.2	2.8	1.8	6.3	3.3	3.1	2.3
Gassim	Lahmia	65.3	10.8	0.3	0.2	2.6	1.8	6.0	3.2	3.3	2.7
Gassim	Sukkari	62.8	12.4	0.3	0.3	3.4	2.6	4.8	3.1	2.9	2.4
Gassim	Hulwa	64.4	11.1	0.2	0.3	2.6	2.2	5.1	3.3	2.6	1.7
Al-Kharj	Nabbut Al-Seif	63.8	16.6	0.4	0.2	3.3	2.4	4.6	2.5	2.8	2.1

Al-Kharj	Mukai	67.6	18.4	0.4	0.3	3.3	2.4	5.9	3.8	2.7	2.0
Al-Kharj	Sukai	64.1	26.0	0.3	0.2	3.1	2.3	3.5	2.8	2.2	2.1
Al-Kharj	Khudari	57.2	20.7	0.3	0.2	2.6	1.9	5.8	2.9	3.2	2.0
Al-Kharj	Khashram	58.8	15.7	0.3	0.2	2.8	2.2	3.7	2.5	2.5	1.9
Hail	Hulwa Hail	74.9	37.5	0.4	0.2	3.6	2.5	5.4	3.2	2.9	1.9
Hail	Rakhimi	62.5	14.0	0.3	0.1	4.4	2.8	4.9	2.8	2.0	1.7
Hail	Suwairi	68.3	14.8	0.1	0.2	3.8	2.3	4.6	2.7	2.1	1.8
Hail	Fankha	63.5	19.2	0.2	0.2	4.2	2.9	6.8	2.8	2.7	1.6
Hail	Duklat Khalaf	66.1	20.8	0.4	0.2	3.6	2.5	6.9	2.6	2.7	1.5

* Percent of fresh date pulp

Table 6: Proximate analysis of the major date varieties in Hofuf and Qatif (Eastern Region), Kingdom of Saudi Arabia (g/100 g dry wt).

Location	Variety	Moisture*		Ether Extract		Protein (N x 6.25)		Fiber		Ash	
		K	T	K	T	K	T	K	T	K	T
Hofuf	Khlas	66.3	12.3	0.4	0.3	3.0	2.3	5.1	2.9	2.0	1.7
Hofuf	Hatmi	72.5	15.1	0.3	0.2	3.3	2.4	6.1	3.0	2.0	2.4
Hofuf	Khuneizi Hofuf	57.4	16.0	0.5	0.3	3.1	2.6	4.6	2.9	2.2	2.1
Hofuf	Ghurra	75.5	13.6	0.4	0.2	4.0	2.2	4.6	3.9	2.7	1.9

Hofuf	Shbibi	64.6	13.4	0.4	0.2	3.0	2.3	4.5	3.2	2.1	1.7
Hofuf	Shishi	65.4	14.7	0.3	0.3	3.2	2.4	5.5	2.2	2.2	1.5
Hofuf	Shahl	71.4	27.6	0.4	0.3	3.2	2.1	7.2	3.6	2.3	1.9
Hofuf	Ruzeiz	71.9	21.1	0.5	0.3	3.7	2.4	6.0	2.8	2.7	2.1
Hofuf	Woseili	61.1	15.9	0.4	0.1	3.5	2.6	6.2	2.9	2.6	2.0
Qatif	Khsab	81.4	---	0.5	---	4.0	---	7.3	---	3.1	---
Qatif	Khuneizi Qatif	61.5	16.2	0.4	0.2	3.0	2.5	4.4	2.4	2.4	1.5
Qatif	Uwaynat	65.5	26.8	0.6	0.2	3.9	2.8	7.1	3.5	2.8	1.6
Qatif	Hallaw	68.2	18.2	0.3	0.1	3.4	2.5	5.5	3.5	1.9	1.5
Qatif	Bukeira	58.6	12.7	0.3	0.2	2.6	2.3	4.7	3.1	3.4	2.5
Qatif	Abu Hallaw	65.1	14.2	0.2	0.2	2.7	2.0	5.3	4.1	2.7	2.0

* Percent of fresh date pulp

Table 7: Proximate analysis of the major date varieties in Al-Madina (Western Region), Kingdom of Saudi Arabia (g/100 g dry wt.).

Location	Variety	Moisture*		Ether Extract		Protein (N x 6.25)		Fiber		Ash	
		K	T	K	T	K	T	K	T	K	T
Al-Madina	Rabia	71.4	14.6	0.2	0.4	3.9	2.0	5.5	2.3	2.7	2.6
Al-Madina	Ajwa	75.1	11.6	0.2	0.1	3.6	2.9	5.0	2.8	2.9	3.0
Al-Madina	Barni	62.6	11.1	0.2	0.1	3.2	2.5	5.0	3.0	2.7	2.3
Al-Madina	Shalabi	64.8	11.1	0.1	0.1	3.1	2.4	3.8	2.3	2.1	2.0
Al-Madina	Safawi	64.8	13.0	0.2	0.1	3.1	2.6	4.9	2.0	2.5	2.2
Al-Madina	Ruthana	63.1	---	0.3	---	3.2	---	5.1	---	2.6	---
Al-Madina	Hulwa	78.1	14.2	0.5	0.1	4.3	2.4	7.6	2.0	2.2	2.0
Al-Madina	Barhi	---	16.3	---	0.1	---	2.8	---	2.0	---	2.2
Al-Madina	Sukkarat Al-Shark	69.1	17.1	0.4	0.3	4.2	2.8	6.6	3.2	3.1	2.2
Al-Madina	Anbara	71.2	14.6	0.5	0.2	4.0	2.1	8.8	2.8	4.2	2.2
Al-Madina	Beid	59.0	10.2	0.2	0.2	3.2	2.5	4.8	2.8	2.8	1.7
Al-Madina	Sukkarat Yanbu	59.1	---	0.2	---	3.1	---	5.7	---	2.3	---

* Percent of fresh date pulp

Table 8: Proximate analysis of the major date varieties in Wadi Khleis & Fatmah, Tarabah, Rania & Bisha (Southwestern Region), Kingdom of Saudi Arabia (g/100 g dry wt.).

Location	Variety	Moisture*		Ether Extract		Protein (N x 6.25)		Fiber		Ash	
		K	T	K	T	K	T	K	T	K	T
Wadi Khleis & Fatmah	Mutallaban	59.1	10.5	0.2	0.2	2.9	2.2	5.1	3.5	2.8	2.0
"	Luban	59.5	8.6	0.2	0.2	2.6	2.1	5.0	3.1	2.7	1.8
"	Mushwek	59.5	11.3	0.3	0.2	2.6	2.3	5.4	3.1	2.6	1.7
"	Sifri Khleis	58.9	11.8	0.3	0.2	3.4	2.7	7.2	2.9	2.5	2.0
Tarabah & Rania	Sifri Tarabah	67.5	10.7	0.2	0.2	2.7	2.4	5.1	2.8	2.5	1.8
"	Sari	68.4	15.5	0.2	0.1	2.5	1.9	5.3	2.8	2.9	1.9
"	Maqfizi	72.5	11.7	0.3	0.2	3.3	2.3	6.8	3.8	3.3	1.9
Bisha	Shukal	58.8	9.8	0.2	0.2	2.6	2.3	2.8	2.5	2.1	2.3
Bisha	Barni	66.4	8.9	0.5	0.2	2.5	2.2	6.2	2.8	3.2	1.7
Bisha	Hamar Amik	62.1	10.2	0.2	0.2	2.5	2.2	6.0	2.9	2.4	2.4
Bisha	Jasap	65.7	10.0	0.3	0.2	2.6	2.2	4.0	2.9	2.4	2.6
Bisha	Sifri Bisha	61.6	9.6	0.2	0.2	2.4	2.2	4.1	3.0	2.0	2.2
Bisha	Lahak	62.6	7.8	0.2	0.2	2.1	1.8	3.6	3.0	2.7	2.8

* Percent of fresh date pulp

Table 9: Mineral analysis of the major date varieties in Gassim, Al-kharj & Hail (Central and Northern Region), Kingdom of Saudi Arabia (mg/100 g dry wt.).

Variety/ Element*	Na		K		Ca		Mg		P		Cu		Zn		Fe	
	K	T	K	T	K	T	K	T	K	T	K	T	K	T	K	T
Maktumi	29	21	776	972	30	14	65	54	109	109	0.7	0.4	0.4	0.3	1.8	2.0
Shakra	32	21	1173	887	57	25	72	50	107	80	0.5	0.3	0.4	0.3	1.7	1.6
Lahmia	47	32	1266	1081	29	21	63	55	119	99	0.8	0.4	0.6	0.4	1.7	1.2
Sukkari	30	28	1151	950	23	18	65	58	108	90	0.8	0.4	0.7	0.4	1.7	1.7
Hulwa	34	25	1130	696	55	28	66	54	83	59	0.7	0.4	0.5	0.3	1.4	1.4
Nabbut Al-Seif	26	25	1088	928	50	14	83	51	58	52	0.6	0.6	0.6	0.3	1.4	1.2
Mukai	20	23	963	858	49	19	56	55	37	56	0.6	0.6	0.4	0.4	1.2	1.3
Sukai	26	20	930	1000	74	20	67	53	72	49	0.7	0.6	0.4	0.4	1.9	1.1
Khudari	24	30	993	884	101	44	64	45	55	43	0.7	1.3	0.5	0.7	1.4	1.1
Khashram	31	27	971	776	97	18	60	52	60	58	0.6	0.6	0.4	0.4	1.7	1.2
Hulwa Hail	22	29	1126	664	79	24	53	54	67	40	0.6	0.5	0.5	0.4	1.9	1.2
Daklat Khalaf	42	19	1045	602	158	47	68	49	50	34	0.7	0.5	0.7	0.2	1.9	1.3
Rakhimi	16	19	835	705	112	19	65	37	64	44	0.5	0.3	0.7	0.3	1.6	1.3
Suwairi	15	26	701	647	107	52	51	43	56	52	0.4	0.3	0.5	0.3	1.2	1.2
Fankha	17	28	1286	655	93	31	60	43	70	41	1.0	0.5	1.1	0.2	1.4	1.7

* Mn was present in trace amounts and F was absent in all varieties in both stages of development.

Table 10: Mineral analysis of the major date varieties in Hofuf and Qatif (Eastern Region), Kingdom of Saudi Arabia (mg/100 g dry wt.).

Variety/ Element*	Na		K		Ca		Mg		P		Cu		Zn		Fe	
	K	T	K	T	K	T	K	T	K	T	K	T	K	T	K	T
Khlas	18	32	847	566	63	38	68	50	64	56	0.6	0.5	0.5	0.3	1.4	1.7
Hatmi	26	36	854	933	70	41	76	57	67	53	0.9	0.7	0.7	0.3	2.0	1.5
Khuneizi Hofuf	23	31	972	776	90	39	70	53	60	43	0.7	0.5	0.5	0.3	1.8	1.6
Ghurra	20	31	1147	730	98	35	84	43	59	36	0.7	0.5	0.7	0.3	1.8	1.1
Shbibi	25	33	863	716	48	16	55	43	62	55	0.7	0.9	0.7	0.9	1.7	1.6
Shishi	21	20	897	635	75	47	73	53	72	54	1.2	0.6	0.8	0.4	1.3	1.1
Shahl	21	21	1093	836	64	26	55	51	65	41	0.6	0.6	0.6	0.2	1.8	1.6
Ruzeiz	27	24	1054	896	71	26	63	49	97	64	1.1	1.0	0.8	0.4	2.0	1.7
Woseili	32	29	897	769	72	30	69	64	98	66	0.7	0.6	0.7	0.4	1.9	1.7
Khsab	30	23	1040	1083	146	81	108	88	104	86	0.5	0.6	0.9	0.5	2.0	1.6
Khuneizi Qatif	25	18	702	660	37	18	56	53	75	60	0.4	0.4	0.6	0.4	1.5	1.1
Uwaynat	27	20	858	739	82	42	78	54	102	67	0.4	0.4	0.6	0.3	1.2	1.3
Hallaw	31	27	818	735	19	9	42	40	81	60	0.4	0.4	0.4	0.4	1.7	1.6
Bukeira	33	22	1210	1031	115	49	84	74	70	65	0.5	0.3	0.4	0.3	1.5	2.0
Abu Hallaw	33	21	1035	915	36	23	59	44	66	49	0.3	0.5	0.4	0.3	1.4	1.7

* Mn was present in trace amounts and F was absent in all varieties in both stages of development.

Table 11: Mineral analysis of the major date varieties in Al-Madina (Western Region), Kingdom of Saudi Arabia (mg/100 g dry wt.).

Variety/ Element*	Na		K		Ca		Mg		P		Cu		Zn		Fe	
	K	T	K	T	K	T	K	T	K	T	K	T	K	T	K	T
Rabia	35	36	1096	1200	34	27	73	51	143	43	0.7	0.4	0.9	0.3	2.5	4.3
Ajwa	41	24	1074	1223	27	14	58	51	119	55	0.7	0.3	0.7	0.3	3.9	1.4
Barni	25	25	1211	896	38	15	68	42	114	51	0.8	0.4	0.7	0.3	3.5	2.4
Shalabi	22	25	969	741	42	17	61	43	104	51	0.7	0.5	0.6	0.2	2.8	1.8
Safawi	22	24	1170	812	18	10	56	43	126	57	0.6	0.3	0.5	0.2	2.4	1.4
Ruthana	21	--	1209	--	21	--	57	--	119	--	0.9	--	0.6	--	2.4	--
Hulwa	28	21	935	623	75	16	86	47	116	60	0.5	0.3	0.7	0.2	2.4	2.1
Barhi Sukkarat	--	22	--	842	--	18	--	69	--	76	--	0.6	--	0.5	--	2.1
Al-Shark	25	41	1287	892	37	14	86	53	135	72	0.8	0.5	1.1	0.5	2.4	2.1
Anbara	25	43	1868	913	80	13	98	45	142	54	0.8	0.6	0.9	0.2	2.4	1.4
Beid	24	38	1051	685	72	32	71	54	121	61	1.1	0.6	0.7	0.4	3.8	1.8
Sukkarat Yanbu	23	--	975	--	73	--	67	--	121	--	0.4	--	0.7	--	1.8	--

* Mn was present in trace amounts and F was absent in all varieties in both stages of development.

Table 12: Mineral analysis of the major date varieties in Wadi Khleis & Fatma, Rania & Bisha (Southwestern Region), Kingdom of Saudi Arabia (mg/100 g dry wt.).

Variety/ Element*	Na		K		Ca		Mg		P		Cu		Zn		Fe	
	K	T	K	T	K	T	K	T	K	T	K	T	K	T	K	T
Mutalabban	22	38	1081	856	198	42	143	42	82	57	0.6	0.7	0.7	0.6	1.4	1.6
Luban	30	18	1007	701	107	55	109	53	66	53	0.7	0.5	0.5	0.3	1.4	3.3
Mushwek	31	21	1007	732	107	42	115	53	64	35	0.8	0.4	0.4	0.2	2.4	2.3
Sifri Khleis	31	41	967	769	35	27	80	45	111	56	0.7	1.9	0.4	1.3	2.6	2.6
Sifri Tarabah	31	21	1271	738	56	30	55	45	77	55	0.5	0.4	0.6	0.3	2.8	2.4
Sari	26	22	1293	815	25	17	53	44	58	45	0.8	1.5	0.6	1.1	2.7	1.4
Maqfizi	24	27	1443	909	35	24	60	44	67	44	0.8	0.6	0.7	0.2	2.1	2.5
Shukal	39	30	845	774	26	14	44	32	54	53	0.8	0.8	0.6	0.3	2.6	1.6
Barni	26	22	1407	769	40	20	53	49	68	45	0.5	0.4	0.6	0.5	1.9	1.3
Hamar Amik	28	42	1019	801	75	17	53	42	57	43	0.6	0.6	0.8	0.2	2.0	2.1
Jasap	19	34	1010	932	109	48	73	57	67	44	0.7	0.6	0.4	0.3	1.2	1.3
Sifri Bisha	26	33	932	700	27	20	42	42	58	47	0.5	0.4	0.3	0.2	1.4	1.5
Lahak	16	33	1177	1000	101	76	78	58	42	35	0.7	0.6	0.3	0.2	1.7	1.8

* Mn was present in trace amounts and F was absent in all varieties in both stages of development.

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EVALUATION AND IDENTIFICATION OF IRAQI DATE CULTIVARS: FRUIT CHARACTERISTICS OF FIFTY CULTIVARS

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ABSTRACT

Fruit of fifty Iraqi date cultivars, commercial and non-commercial, were compared for length, width, length/width ratio, weight, volume, pulp weight, seed weight, pulp/seed ratio, moisture, total soluble solids, sucrose invert sugar, total sugars. Enormous variation was observed in the fruit characteristics of these cultivars. Different characteristics in a cultivar were classified into five different classes: i) very small or very low or very light ii) small or light or low iii) medium iv) high, heavy or big v) very high or very heavy or very big.

Frequency of occurrence of different classes among the various fruit characteristics was determined. Performance of most of the cultivars studied was medium except for a few cultivars which were rated either lowest or highest in the rank with regard to the different fruit characteristics. Non-commercial cultivars such as Khiyara and Hilwat Al-Jabal were found to be superior to the commercial cultivars, particularly in the size and pulp/seed ratio.

الخلاصة

اجريت قياسات لطول وعرض ونسبة الطول للعرض والوزن والحجم ووزن اللب والبذرة ونسبة اللب للبذرة والرطوبة والمواد الصلبة والسكريات المختزلة

والكلية على خمسين صنف من التمور العراقية التجارية وغير التجارية . وجد تباين كبير في الصفات الثمرية . قسمت الصفات لخمس مجموعات :

(1) صغيرة جداً أو قليلة جداً أو خفيفة جداً . (2) صغيرة أو قليلة أو خفيفة ، (3) وسط (4) كبيرة أو عالية أو ثقيلة ، (5) كبيرة جداً أو عالية جداً أو ثقيلة جداً

أجرى تحديد لمدى تواجد المجموعات المختلفة بين الصفات الثمرية المختلفة .

كانت معظم الأصناف التي أجريت عليها الدراسة تنتمي الى مجموعة الوسط ما عدا أصناف قليلة ادرجت في قائمة مجموعة القليلة جداً أو عالية جداً من حيث الصفات الثمرية . وجد ان بعض الأصناف غير التجارية مثل خيارة وحلوة الجبل تفوق الأصناف التجارية في جودة الصفات التمرية خاصة في الحجم ونسبة اللب للبذرة .

INTRODUCTION

Most cultivated fruit crops possess numerous recognized cultivars and their productivity largely depends on the successful performance of the more popularly established planted cultivars. Different cultivars of a given fruit crop differ in their performance and these differences are governed by genetical, cultural and environmental factors. Due to the variations in performance of different cultivars the suitability of these cultivars from the consumer's point of view are often evaluated from different angles. A study of pomologically important external and internal characteristics of fruit forms one of the important criteria for the evaluation of cultivars.

In several fruit crops, studies have been performed to evaluate their cultivars for fruit characteristics. Onur (10) evaluated local and foreign pear cultivars by studying physical properties of fruits. Bellin (3) examined fruit characteristics such as size, shape, colour of the skin and flesh, consistency of flavour, etc. in pear cultivars. Similarly, twelve mango cultivars were evaluated (11) for their bearing behaviour and fruit quality.

At present approximately 2,000 or more different cultivars of date palm are known to exist all over the world and Iraq alone has over 25% of the world's total date cultivars (7). Although a large number of date cultivars already exist only a few important ones (date palm cultivars of the world) have been described and evaluated for their performance and fruit quality. Reviewing literature on date palm cultivars, Nixon (9) pointed out that most of the published descriptions of date varieties in the old world lack sufficient details for positive identification and qualitative performance.

Dowson (6) first gave valuable information about the cultivars of the date palm in the southern region of Iraq and called attention to the outstanding characters of both palm and fruit but most of his descriptions were meagre. A few more attempts (1, 7-8) were made to list the names of various date cultivars with insufficient descriptions. Outside Iraq studies have been performed to evaluate various Iraqi date cultivars (2, 4) but it was limited to a few important commercial cultivars.

As many as 450 or more different date cultivars are found in Iraq but only 8 or ten are grown on a commercial scale. The present commercial cultivars are not outstanding in different fruit characters with the exception of a few. Those cultivars which have qualified as outstanding in quality are often susceptible to diseases, insect pests and subject to some other physiological disorders. It seems that the qualitative and quantitative performance of commercial cultivars are not keeping pace with the present increasing demand for the quality and quantity of dates.

Inadequate evaluatory work on Iraqi date palm cultivars and the poor performance of existing commercial cultivars necessitate a thorough investigation on the bearing behaviour and fruit quality of various date cultivars. In keeping with this fact, a series of investigations have been launched to evaluate and group Iraqi date cultivars from different viewpoints. Assessment of important fruit characteristics of different commercial and non-commercial date cultivars could provide valuable information to promote the production and quality of dates in Iraq. This paper reports fruit characteristics of fifty Iraqi date cultivars and their classification on the basis of these traits.

MATERIALS AND METHODS

Samples

Fruit samples of different date cultivars during Khalal and Tamar stages were obtained separately from Zaafrania Horticultural Experiment Station, Baghdad. Different external fruit characteristics such as length, width, length/width ratio, weight, volume, pulp weight, seed weight, pulp/seed ratio, moisture percentage, total soluble solids, total invert sugar, sucrose were determined. 50 fruits were used for recording each characteristic.

Classification

On the basis of variation in different fruit characteristics, cultivars were classified into five different classes for each character. Maximum and minimum ranges in each class for a single character were fixed as mentioned below. This was done by dividing the range between the smallest and largest figure for each measurement, into five equal shares

Character	Class	Range	
		Khalal	Tamar
Fruit Length	Very small	2.50-2.99 cm	2.34-2.39 cm.
	Small	3.00-3.49 cm.	2.40-3.25 cm.
	Medium	3.50-3.99 cm.	3.26-3.71 cm.
	Big	4.00-4.49 cm.	3.72-4.17 cm.
	Very big	4.50-5.00 cm.	4.18-4.64 cm.
Fruit Width	Very small	1.75-1.99 cm.	1.66-1.85 cm.
	Small	2.00-2.24 cm.	1.86-2.05 cm.
	Medium	2.25-2.49 cm.	2.06-2.25 cm.
	Big	2.50-2.74 cm.	2.26-2.45 cm.
	Very big	2.75-3.00 cm.	2.46-2.66 cm.
Length/width ratio	Very low	1.00-1.19	1.13-1.34
	Low	1.20-1.39	1.35-1.56
	Medium	1.40-1.59	1.57-1.78
	High	1.60-1.79	1.79-2.00

Character	Class	Range	
		Khalal	Tamar
	Very high	1.80-2.00	2.01-2.23
Fruit weight	Very light	4.50-7.49 g	3.50-6.19 g
	Light	7.50-10.49 g	6.20-8.89 g
	Medium	10.50-13.49 g	8.90-11.59 g
	Heavy	13.50-16.49 g	11.60-14.29 g
	Very heavy	16.50-19.50 g	14.30-17.00 g
Fruit volume	Very low	5.00-7.99 cc	4.50-7.49 cc
	Low	8.00-10.99 cc	7.50-10.49 cc
	Medium	11.00-13.99 cc	10.50-13.49 cc
	High	14.00-16.99 cc	13.50-16.49 cc
	Very high	17.00-20.00 cc	16.50-19.50 cc
Pulp weight	Very light	3.50-6.49 g	2.50-5.19 g
	Light	6.50-9.49 g	5.20-7.89 g
	Medium	9.50-12.49 g	7.90-10.59 g
	Heavy	12.50-15.49 g	10.60-13.29 g
	Very heavy	15.50-18.50 g	13.30-16.00 g
Seed weight	Very light	0.80-0.99 g	0.43-0.57 g
	Light	1.00-1.19 g	0.58-0.72 g
	Medium	1.20-1.39 g	0.73-0.87 g
	Heavy	1.40-1.59 g	0.88-1.02 g
	Very heavy	1.60-1.79 g	1.03-1.18 g
Pulp/seed ration	Very low	3.00-5.99	3.94-6.73
	Low	3.00-8.99	6.74-9.53
	Medium	9.00-11.99	6.54-12.33
	High	12.00-14.99	12.34-15.13
	Very high	15.00-17.99	15.14-17.94
Moisture	Very low	40.00-48.99%	15.00-20.99%
	Low	49.00-57.99%	21.00-26.99%
	Medium	58.00-66.99%	27.00-32.99%
	High	68.00-75.99%	33.00-38.99%
	Very high	76.00-85.00%	39.00-54.00%

Character	Class	Range	
		Khalal	Tamar
Total soluble soids	Very low	20.00-25.99%	50.00-57.99%
	Low	26.00-31.99%	58.00-65.99%
	Medium	32.00-37.99%	66.00-73.99%
	High	38.00-43.99%	74.00-81.99%
	Very high	44.00-50.00%	82.00-90.00%

Statistical analysis

Standard error of means of data on different fruit characteristics were calculated.

RESULTS

Khalal Stages

The data in Table 1 shows that fruit length ranged from 2.57 cm in Kirkani to 4.80 cm in Shuwaithi and fruit width from 1.73 cm in Degal Badmi and Shitwi Wardi to 2.81 cm in Um Al-belaliz. Highest length to width ratio (2.21) was obtained in Degal Bitta followed by 2.17 in Shuwaithi. Kirkani had the lowest length/width ratio (1.11). Maximum fruit weight (18.74 g) and volume (20.50 cm^3) were recorded in Um Al-belaliz followed by 18.06 g fruit weight and 20.00 cm^3 fruit volume in Khiyara. Minimum fruit weight (4.90 g) and fruit volume (5.90 cm^3) were found in Shitwi Wardi and Degal Badmi respectively. Um Al-Belaliz also recorded the highest fruit pulp weight (17.30 g) followed by Khiyara (16.80 g). Shitwi Wardi had the lowest fruit pulp (3.87 g). The seed weight (1.80 g) was maximum in Degal Safra and minimum (0.84 g) in Sukkari, leading to highest pulp to seed ratio (16.61). Lowest pulp to seed ratio (3.83) was obtained in Shitwi Wardi. Amount of moisture varied from 42% in Mibraya to 81.06% in Ashrasi Hibhib and total soluble solid content from 18.91% in Um Al-Belaliz to 48.53% in Jobana.

Tamar stage

Fruit characteristics during the tamar stage are presented in Table 2. Highest fruit length (4.35 cm.) and fruit width (2.68 cm.) were recorded in Khiyara, whereas the lowest fruit length (2.34 cm.) and fruit width (1.52 cm.) were found in Shitwi Wardi. The ratio between length and width varied from 1.13 in Awenat Ayoub to 2.22 in Degal Bitta. Fruit weight (13.25 g) and fruit volume (13.01 cm^3) were maximum in Hilwat Al-Jabal whereas minimum fruit weight (4.41 g) and fruit volume (3.00 cm^3) were recorded in Degal Badmi and Shitwi Wardi. Highest pulp weight (15.85 g) was noted in Khiyara and lowest (2.80 g) in Shitwi Wardi. As heavy as 1.18 g seeds were found in Banafsha and Shamoosi closely followed by 1.17 g heavy seeds in Degal Safra. In Khastawi Basra seed was light in weight (0.61 g). The ratio between pulp and seed was maximum (16.08) in Khiyara and minimum (3.94) in Shitwi Wardi. Percentage of moisture differed from the lowest (13.78%) in Ukhat Al-Qsab to the highest (43.06%) in Shitwi Wardi and total soluble solids from 56.82% in Shitwi Wardi to 86.02% in Ukhat Al-Qsab.

Sugar Content

Table 5 shows that the sucrose content varied from the lowest (1.8%) in Barhee and Qazal Maktoom to the highest (9.8%) in Sukkari. As regards the invert sugar, the lowest (24.7%) was recorded in Safar Kjal and the highest (82.0%) in Rummania. Consequently the lowest (30.4%) and the highest (91.9%) total sugars were found in Safar Kjal and Rummania respectively.

Classification of fruit characteristics

Fruit characteristics of different cultivars during khalal and tamar stages were classified (Tables 3 and 4) to facilitate the distinctions in cultivars. Fruit characteristics of commercial cultivars were found to fall in one of the first four classes: (i) very low or very light or very small, (ii) low or light or small, (iii) medium, (iv) high or heavy or big. All types of classes ranging from very small or very low or very light to very big or very high or very heavy were found in non-commercial cultivars. In most of the cultivars classes of different characteristics remained the same during the khalal and

tamar stages but in some cultivars it changed. For example, fruit length of Bahree, Braim, Jobana and Safar Kjal were small during khalal as well as tamar stage whereas khadarwi Basra and Bairagh Dar had medium fruit length during khalal which changed to small during the tamar stage.

Frequency of occurrence of classes

Figures from 1 to 5 demonstrate frequency of occurrence of various classes of fruit characteristics in different cultivars. Majority of the cultivars (34% in khalal and 32% in tamar) were found to have medium fruit length. Maximum number of cultivars i.e. 46% in khalal and 40% in tamar stages had medium fruit width and only 2% cultivars in khalal as well as tamar stage had very big fruit width. Cultivars having medium fruit weight and volume during the khalal stage were 42% (Fig. 2). During the tamar stage 40% and 52% cultivars had light fruit weight and low fruit volume respectively. Very heavy fruit having high volume were found in 8% and 2% of cultivars during the khalal and tamar stages respectively Fig. 3 illustrates that the pulp weight of 46% cultivars was medium in khalal stage but light in tamar stage. Percentage of cultivars having very heavy pulp was only 8% in khalal and 2% in tamar stages. Seeds of 24% cultivars during the khalal stage were very light whereas during the tamar stage none had very light seeds.

During the khalal stage 30% and 28% cultivars were found to have light and medium heavy seeds respectively. During the tamar stage 32% and 28% cultivars had medium heavy and heavy seeds respectively. The ratio between pulp and seed was low in 36% cultivars during the khalal stage and in 56% cultivars during tamar stage. Higher percentage of cultivars had high length/width ratio in khalal. Low and medium length/width ratio were found in 30% cultivars during the tamar stage. Lowest percentage (4%) of cultivars had very low length/width ratio during the khalal and very high length/width ratio during the tamar stage. Maximum percentage (40%) of cultivars showed medium amount of moisture. Cultivars having very low moisture during the khalal and tamar stages were 2% and 24% respectively (Fig. 5). Total soluble solids content was high in 34% cultivars during the khalal stage and was medium in 44% cultivars during the tamar

stage. Only 2% cultivars had very low total soluble solid content during the tamar stage and 10% cultivars during the khalal stage.

DISCUSSION

Evaluation and description of fruit characteristics of date cultivars in the present investigation revealed a big variation in the fruit quality, Nixon (1950) and Barett (1975) evaluated some date cultivars and found differences in their fruit quality. The variations in the fruit characteristics of date cultivars are expected to occur, because most of them are chance seedlings and genetically highly heterozygous. Fruit characteristics of some of the cultivars varied widely but the difference in others was rather narrow. Only few cultivars were found to possess fruit characteristics which were highly desirable. A large number of cultivars possessed characteristics which were a combination of desirable and non-desirable characters. In the rest of the cultivars, non-desirable characteristics were higher than the desirable ones.

Study of fruit characteristics in two different stages, i.e. khalal and tamar was carried out because the former stage represents full development of a fruit, whereas in the latter stage only fruit ripening takes place. Data obtained on various important fruit characteristics of different cultivars provided a good guidance about the performance of different cultivars with regard to the various fruit characteristics. Differences in the performance of many cultivars during the khalal and tamar stages were observed. Cultivars differed either in one or more fruit characteristics during the khalal and tamar stages. A possible explanation for the change in the performance is the higher loss of moisture during the period of conversion from khalal to tamar. In other words, some cultivars are likely to lose higher moisture as compared to the others during a change from khalal to tamar under similar climatic conditions and vice versa.

It was interesting to note that the presence of sucrose varied in all cultivars under study. Some of the non-commercial cultivars contained higher amount of sucrose as compared to the commercial cultivars. Occurrences of sucrose in the cultivars may be attributed in the past to the lack of inversion of sucrose at the time of collection of samples. Furthermore, storage of samples at low temperature (deep freeze) might have reduced the

inversion of sucrose. The presence of only 24.7% invert sugar in the cultivar Safar Kjal is rather unusual. Low amount of invert sugar in the Safar Kjal implies that this variety did not ripen fully when invert sugar was analysed. Cavell (1947) considered the twelve varieties of dates grown in Iraq unripe if the reducing sugars calculated as invert sugars were below 25%.

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Table 1:

Fruit characteristics

Cultivar	Fruit length cm	Fruit diameter cm	Length/ diameter ratio	Fruit weight g
	I	II	III	IV
Commercial				
Barhee	3.23 (S)	2.54 (B)	1.27	12.10
Braim	3.34 (S)	2.29 (M)	1.46	11.11
Hallawi	3.82 (M)	2.03 (S)	1.28	8.98
Khadrawi (Basra)	3.58 (M)	2.19 (S)	1.63	9.50
Khastawi	2.89 (VS)	2.08 (S)	1.39	7.43
Zahdi	3.29 (S)	2.33 (M)	1.41	9.44
Non-commercial				
Ashrashi Hibhib	3.16	2.44	1.70	8.96
Awenat Ayoub	3.27	2.45	1.33	13.32
Bairagh Dar	3.67	2.25	1.63	10.97
Banafsha	4.40	2.18	2.02	10.82
Bawa Adam	3.36	2.24	1.50	9.58
Beni Rabba	4.07	2.32	1.75	11.64
Degal Ajam	3.38	2.53	1.34	12.17
Degal Amin	4.10	2.40	1.71	13.58
Degal Badmi	3.11	1.73	1.80	6.04
Degal Bitta	4.41	2.00	2.21	10.21
Degal Safra	3.83	2.01	1.67	7.73
Degal Taha	3.51	2.64	1.33	14.26
Hilwat al-Jabal	3.90	2.55	1.53	15.05
Hasawi	3.62	2.06	1.76	9.31
Jamal al-Din	3.99	2.20	1.81	11.66
Jobana	3.37	2.36	1.43	10.54
Khadrawi Mandli	3.86	2.41	1.60	13.62

of fifty date cultivars

Fruit volume cc	Pulp weight g	Seed weight g	Pulp/ seed ratio	Moisture %	Total soluble solids %
V	VI	VII	VIII	IX	X
11.50	11.20	0.88	12.73	61.50	30.22
11.00	9.78	1.29	7.52	74.28	27.12
9.00	7.53	1.34	5.62	74.22	26.33
9.50	8.31	1.13	7.35	70.90	33.12
7.50	6.46	0.92	7.02	64.40	29.12
9.70	8.55	1.37	6.24	61.56	38.13
11.20	11.66	1.35	8.63	81.06	20.91
14.00	12.41	0.89	13.94	69.11	30.52
10.50	9.86	1.07	9.21	57.69	37.23
12.50	9.62	1.65	5.83	64.83	38.73
9.50	8.68	0.88	9.86	63.42	35.22
11.50	10.67	1.16	11.00	50.93	48.13
11.50	10.51	1.62	6.49	56.89	40.83
14.00	12.22	1.34	9.12	67.05	30.83
5.90	4.91	1.12	4.38	59.03	39.63
11.20	8.69	1.48	5.87	59.92	38.73
8.30	6.56	1.80	3.64	59.67	39.22
14.00	13.26	0.96	13.81	53.91	42.03
14.55	13.88	1.14	12.18	79.60	20.71
8.30	7.18	1.09	6.59	50.36	48.13
12.00	10.66	0.97	10.99	52.08	47.52
9.90	9.59	0.90	10.66	52.09	48.53
14.00	11.89	1.71	6.95	64.39	36.08

Continue Table 1.

Cultivar	Fruit length cm	Fruit diameter cm	Length/ diameter ratio	Fruit weight g
Cultivar	I	II	III	IV
Khiyara	4.61	2.74	1.68	18.06
Kirkani	2.57	2.32	1.11	7.20
Khoshly Azraq	3.61	2.27	1.59	10.86
Laqaitoona	3.82	2.29	1.66	10.88
Makkawi	3.18	2.42	1.31	10.73
Mibraya	3.07	2.28	1.35	9.29
Nabati	4.05	2.36	1.72	13.52
Nehar Silli	2.68	2.25	1.19	7.15
Qazal Naktoom	3.70	2.40	1.54	12.43
Rummania	4.00	2.60	1.54	15.41
Saai	4.26	2.58	1.65	17.40
Sisandaki	3.95	2.54	1.55	14.15
Shitwi Wardi	2.65	1.73	1.52	4.90
Sukkari	4.36	2.35	1.86	14.82
Shuwaithi	4.83	2.23	2.17	12.55
Sultani	3.75	2.32	1.62	11.23
Safar Kjal	3.38	2.03	1.67	7.77
Shilani Ahmer	3.80	1.96	1.94	8.87
Shukkar	4.10	2.19	1.87	11.56
Tibarzel	3.00	2.30	1.30	10.46
Ukhat al-Qsab	4.06	2.42	1.68	13.14
Um al-Belaliz	4.56	2.81	1.62	18.74
Um al-Dehin	4.18	2.26	1.85	12.59
Um al-Jam	3.98	2.22	1.79	11.91
Um al-Asafir	3.04	2.36	1.71	12.87
Zubair	4.48	2.60	1.72	17.38
Shamoosi	4.07	2.63	1.50	10.57
S.E. ±	0.07	0.03	0.03	0.42

Fruit volume cc	Pulp weight g	Seed weight g	Pulp/ seed ratio	Moisture %	Total soluble solids %
V	VI	VII	VIII	IX	X
20.00	16.80	1.24	13.55	63.68	37.23
7.00	6.22	0.98	6.35	77.02	28.33
11.50	9.27	1.55	5.98	60.22	39.12
10.20	9.68	1.16	8.34	74.14	26.52
13.00	9.38	1.36	6.90	55.91	44.62
9.30	8.29	0.98	8.46	42.01	45.33
13.10	12.27	1.21	10.14	58.16	41.53
7.00	6.04	1.09	5.54	71.73	27.42
12.50	11.49	1.42	8.09	60.86	38.11
15.50	14.05	1.34	10.49	54.30	45.13
17.00	16.13	1.25	12.90	66.45	36.23
14.50	12.87	1.26	10.21	60.47	39.63
9.50	3.87	1.01	3.83	72.46	27.32
14.50	13.95	0.84	16.61	75.94	24.02
14.00	11.18	1.36	8.22	62.06	37.13
10.70	10.18	1.05	9.70	70.82	28.82
7.8	6.71	1.04	6.49	60.59	38.69
8.00	7.80	1.06	7.36	62.22	39.13
12.00	10.24	1.29	7.94	69.06	30.92
9.00	9.53	1.10	8.66	79.99	19.31
14.70	11.97	1.14	10.50	60.02	39.13
20.50	17.30	1.42	12.18	80.43	18.91
12.30	13.34	1.23	10.85	56.13	43.22
11.50	10.98	0.90	12.20	69.27	30.42
12.50	11.84	1.00	11.84	56.05	43.03
17.50	16.19	1.17	13.84	71.23	28.12
10.50	9.53	0.90	10.58	71.29	28.52
0.44	0.42	0.03	0.41	1.24	1.11

Table 2:

Fruit characteristics of fifty

Cultivar	Fruit length cm	Fruit diameter cm	Length/ diameter ratio	Fruit weight g
	I	II	III	IV
Commercial				
Barhee	3.05	2.46	1.24	10.14
Braim	2.90	2.27	1.28	8.73
Hallawi	3.56	1.80	1.98	6.42
Khadrawi (Basra)	2.96	1.86	1.59	6.21
Khastawi	2.90	1.86	1.56	5.53
Zahdi	3.27	2.08	1.54	7.91
Non-commercial				
Ashrashi Hibhib	2.64	2.07	1.28	5.53
Awenat Ayoub	2.56	2.26	1.13	6.55
Bairagh Dar	3.18	1.81	1.76	6.27
Banafsha	3.72	2.05	1.81	9.47
Bawa Adam	2.91	2.07	1.41	5.83
Beni Rabba	3.75	2.20	1.70	11.34
Degal Ajam	3.24	2.29	1.41	9.33
Degal Amin	3.96	2.40	1.62	12.61
Degal Badmi	2.98	1.66	1.80	4.44
Degal Bitta	4.30	1.94	2.22	9.65
Degal Safra	3.36	1.93	1.78	6.96
Degal Taha	3.31	2.38	1.39	8.12
Hilwat al-Jabal	3.78	2.43	1.56	13.25
Hasawi	3.32	1.98	1.62	9.81
Jamal al-Din	3.86	2.14	1.80	8.58
Jobana	3.13	2.12	1.48	7.26
Kirkani	2.35	2.00	1.18	5.64
Khadrawi Mandli	3.13	2.30	1.36	9.57
Khiyara	4.35	2.68	1.62	16.82
Khoshly Azraq	3.45	2.27	1.52	8.90

date cultivars during 'tamar' stage

Fruit volume cc	Pulp weight g	Seed weight g	Pulp/ seed ratio	Moisture %	Total soluble solids %
V	VI	VII	VIII	IX	X
9.00	9.22	0.64	14.41	19.20	79.63
7.20	7.97	0.82	9.72	23.39	72.90
6.80	5.46	0.96	5.69	24.27	75.76
7.00	5.46	0.75	7.28	27.55	72.90
6.00	4.92	0.61	8.07	25.57	73.50
8.50	7.01	0.90	7.79	20.94	79.70
6.00	4.56	0.95	4.80	33.04	66.90
6.00	5.92	0.63	9.40	17.09	82.03
5.00	5.55	0.72	7.71	18.11	80.86
10.20	8.29	1.18	7.02	27.10	72.62
6.50	5.22	0.69	7.57	26.36	73.62
11.00	10.15	0.97	8.75	23.98	76.70
9.00	7.51	1.09	6.89	20.68	78.80
9.00	11.54	1.02	11.31	28.65	70.86
4.50	3.70	0.75	4.93	15.54	84.06
8.80	8.51	1.15	7.40	29.52	69.82
8.00	5.86	1.17	5.00	19.54	79.22
9.50	7.42	0.71	10.45	26.80	73.66
13.01	12.38	0.86	14.39	36.21	64.50
8.00	6.93	0.87	7.97	26.79	74.02
7.50	7.83	0.74	10.58	23.16	76.66
7.50	6.62	0.64	10.34	29.10	68.96
4.70	4.85	0.72	6.74	34.58	65.62
9.50	8.42	1.16	7.26	30.60	69.36
19.50	15.85	0.95	16.08	35.46	64.12
9.50	7.86	1.05	7.49	23.47	76.06

Continue Table 2:

	Fruit length cm	Fruit diameter cm	Length/ diameter ratio	Fruit weight g
Cultivar	I	II	III	IV
Laqaitoona	3.75	2.06	1.82	9.31
Makkawi	3.05	2.20	1.39	9.78
Mibraya	2.76	2.03	1.36	6.06
Nabati	4.05	2.06	1.97	10.34
Qazal Maktoom	3.42	2.33	1.47	9.58
Nehar Silli	2.58	2.24	1.15	7.07
Rummania	3.67	2.11	1.74	8.58
Sisandali	3.82	2.42	1.57	12.28
Saai	3.61	2.19	1.65	8.84
Shitwi Wardi	2.34	1.52	1.54	3.54
Sukkari	3.69	2.12	1.74	8.40
Shamoosi	4.06	2.10	1.88	10.76
Shuwaithi	4.11	1.96	2.10	10.44
Sultani	3.59	2.06	1.74	9.47
Safar Kjal	2.96	1.78	1.66	5.79
Shilani Ahmer	3.52	1.80	1.96	6.27
Shukkar	3.53	1.83	1.93	7.13
Tibarzel	2.64	2.21	1.19	7.70
Ukhat al-Qsab	3.26	2.09	1.56	6.82
Um al-Bilaliz	3.48	1.96	1.78	7.87
Um al-Dehin	3.80	2.02	1.88	9.33
Um al-Jam	3.49	2.18	1.60	11.11
Um al-Asafir	2.79	2.00	1.40	7.53
Zubair	3.77	2.07	1.82	11.15
S.E. ±	0.07	0.03	0.03	0.34

Fruit volume cc	Pulp weight g	Seed weight g	Pulp/ seed ratio	Moisture %	Total soluble solids %
V	VI	VII	VIII	IX	X
8.00	8.40	0.90	9.33	20.10	79.46
8.00	8.88	0.90	9.87	21.72	77.63
7.00	5.42	0.71	7.63	27.71	72.82
9.5	9.42	0.89	10.58	17.56	82.66
9.50	8.57	1.06	8.08	16.58	83.63
6.70	6.21	0.84	7.39	28.22	71.62
10.00	7.65	0.93	8.23	18.30	80.42
9.50	11.35	0.94	12.07	31.15	68.63
7.5	8.02	0.82	9.78	21.71	78.22
3.00	2.80	0.71	3.94	43.06	56.82
8.00	7.75	0.63	12.30	28.04	72.63
10.50	10.54	1.18	8.03	41.42	58.42
9.20	9.47	0.93	10.18	35.83	63.06
8.30	8.57	0.86	9.97	31.96	78.52
5.50	5.02	0.75	7.36	33.53	66.82
6.80	5.63	0.80	7.04	16.76	83.22
7.00	6.30	0.83	7.59	30.01	68.42
7.50	6.57	0.89	7.38	38.26	61.30
8.00	6.07	0.75	8.09	13.78	86.02
7.50	6.99	0.90	7.71	17.21	82.02
6.00	8.36	0.96	8.71	28.10	71.06
7.50	10.33	0.75	13.77	31.55	68.30
5.70	6.68	0.81	8.25	26.65	74.30
9.30	10.36	0.79	13.11	30.61	68.43
0.34	0.33	0.02	0.36	0.97	0.96

Table 3:

Classification of fruit characters of fifty

Cultivar	Fruit length	Fruit width	Length/ width ratio	Fruit Weight
	I	II	III	IV
Commercial				
Barhee	Small	Big	Low	Medium
Braim	Small	Medium	Medium	Medium
Hallawi	Medium	Small	Low	Light
Khadrawi (Basra)	Medium	Small	High	Light
Khastawi	V. small	Small	Low	V. light
Zahdi	Small	Medium	Medium	Light
Non-commercial				
Ashrashi Hibhib	Small	Medium	High	Light
Awenat Ayoub	Small	Medium	Low	Medium
Bairagh Dar	Medium	Medium	High	Medium
Banafsha	Big	Small	V. high	Medium
Bawa Adam	Small	Small	Medium	Light
Beni Rabba	Big	Medium	High	Medium
Degal Ajam	Small	Big	Low	Medium
Degal Amin	Big	Medium	High	Heavy
Degal Badmi	Small	V. small	High	V. light
Degal Bitta	Big	V. small	V. high	Light
Degal Safra	Medium	Small	High	Light
Degal Taha	Medium	Big	Low	Heavy
Hilwat al-Jabal	Medium	Big	Medium	Heavy
Hasawi	Medium	Small	High	Light
Jamal al-Din	Medium	Small	V. high	Medium
Jobana	Small	Medium	Medium	Medium
Khadhrawi Mandli	Medium	Medium	Medium	Heavy
Khiyara	V. big	Big	High	V. heavy
Khoshly Azraq	Medium	Medium	Medium	Medium

date cultivars during 'Khalal' stage

Fruit volume	Pulp weight	Seed Weight	Pulp/ seed ratio	Moisture	Total soluble solids
V	VI	VIIM	VIII	IX	X
Medium	Medium	V. light	High	Medium	Low
Low	Medium	Medium	Low	High	Low
Low	Light	Medium	V. low	High	Low
Low	Light	Light	Low	High	Medium
V. low	V. light	V. light	Low	Medium	Low
Low	Light	Medium	Low	Medium	High
Medium	Medium	Medium	Low	V. High	V. low
Medium	Medium	V. light	high	High	Low
Medium	Medium	Light	Medium	Low	Medium
Medium	Medium	V. heavy	V. low	Medium	High
Low	Light	V. light	Medium	Medium	Medium
Medium	Medium	light	Medium	Low	V. High
Medium	Medium	V. heavy	Low	Low	High
Medium	Medium	Medium	Medium	High	Low
V. low	V. light	Light	V. low	Medium	High
Medium	Light	Heavy	V. low	Medium	High
Low	V. light	V. heavy	V. low	Medium	High
Medium	Heavy	V. light	High	Low	High
High	Heavy	Light	High	V. high	V. low
Low	Light	Light	Low	Low	V. high
Medium	Medium	V. light	Medium	Low	V. high
Low	Medium	V. light	Medium	Low	V. high
Medium	Medium	V. heavy	Low	Medium	Medium
V. high	V. heavy	Medium	High	Medium	Medium
Medium	Light	Heavy	V. low	Medium	High

Continue Table 3:

Cultivar	Fruit length	Fruit width	Length width ratio	Fruit Weight
Cultivar	I	II	III	IV
Kirkani	V. small	Medium	V. low	V. light
Laqaitoona	Medium	Medium	High	Medium
Makkawi	Small	Medium	Low	Medium
Mibraya	Small	Medium	Low	Light
Nabati	Big	Medium	High	Heavy
Nehar Silli	V. small	Medium	V. low	V. light
Qazal Maktoom	Medium	Medium	Medium	Medium
Rummania	Medium	Big	Medium	Heavy
Saai	Big	Big	High	V. heavy
Sisandali	Medium	Big	Medium	Heavy
Shitwi Wardi	V. small	V. small	Medium	V. light
Sukkari	Big	Medium	V. high	Heavy
Shuwaithi	V. big	Small	V. high	Medium
Sultani	Medium	Medium	High	Medium
Safar Kjal	Small	Small	High	Light
Shilani Ahmer	Medium	V. small	V. high	Light
Shukkar	Big	Small	V. high	Medium
Tibarzel	Small	Medium	Low	Light
Ukhat al-Qsab	Big	Medium	High	Medium
Um al-Belaliz	V. big	V. big	High	V. heavy
Um al-Dehin	Big	Medium	V. high	Medium
Um al-Jam	Medium	Small	High	Medium
Um al-Asafir	Small	Medium	High	Medium
Shamoosi	Big	Big	Medium	Medium
Zubair	Big	Big	High	V. heavy

Fruit volume	Pulp weight	Seed Weight	Pulp/ seed ratio	Moisture	Total soluble solids
V	VI	VII	VIII	IX	X
V. low	V. light	V. light	Low	V. high	Low
Low	Medium	Light	Low	High	Low
Medium	Light	Medium	Low	Medium	High
Low	Light	V. light	Low	V. low	V. high
Medium	Medium	Medium	Medium	Medium	High
V. low	V. light	Light	V. low	High	Low
Medium	Medium	Heavy	Low	Medium	High
High	Heavy	Medium	Medium	Low	V. high
V. high	V. heavy	Medium	High	Medium	Medium
High	Heavy	Medium	Medium	Medium	High
Low	V. light	Light	V. low	High	Low
High	heavy	V. light	V. high	High	V. low
Medium	Medium	Medium	Low	Medium	Medium
Low	Medium	Light	Medium	High	Low
V. low	Light	Light	Low	Medium	High
Low	Light	Light	Low	Medium	High
Medium	Medium	Medium	Low	High	Low
Low	Medium	Light	Low	V. high	V. low
High	Medium	Light	Medium	Medium	High
V. high	V. heavy	Heavy	High	V. high	V. low
Medium	Heavy	Medium	Medium	Low	High
Medium	Medium	V. light	High	High	Medium
Medium	Medium	Heavy	Medium	Low	High
Low	Medium	V. light	Medium	High	Low
V. high	V. heavy	Light	High	High	Low

Table 4:

Classification of fruit characteristics of fifty

Cultivar	Fruit length	Fruit width	Length/ width ratio	Fruit weight
	I	II	III	IV
Commercial				
Barhee	Small	Big	V. low	Medium
Braim	Small	Big	V. low	Light
Hallawi	Medium	V. small	High	Light
Khadrawi (Basra)	Small	Small	Medium	Light
Khastawi	Small	Small	Low	V. light
Zahdi	Medium	Medium	Low	Light
Non-commercial				
Ashrashi Hibhib	V. small	Medium	V. low	V. light
Awenat Ayoub	V. small	Medium	V. low	Light
Bawa Adam	Small	Medium	Low	V. light
Bairagh Dar	Small	V. small	Medium	Light
Banafsha	Medium	Medium	High	Medium
Beni Rabba	Big	Medium	Medium	Medium
Degal Ajam	Small	Big	Low	Medium
Degal Amin	Big	Big	Medium	Heavy
Degal Badmi	Small	V. small	High	V. light
Degal Bitta	V. big	Small	V. high	Medium
Degal Safra	Medium	Small	Medium	Light
Degal Taha	Medium	Big	Low	Light
Hilwat al-Jabal	Big	Big	Low	Heavy
Hasawi	Medium	Small	Medium	Light
Jamal al-Din	Big	Medium	High	Light
Jobana	Small	Medium	Low	Light
Kirkani	V. small	Small	V. low	V. light
Khadrawi Mandli	Small	Big	Low	Medium

date cultivars during 'tamar' stage.

Fruit volume	Pulp weight	Seed weight	Pulp seed ratio	Moisture	Total soluble solids
V	VI	VII	VIII	IX	X
Low	Medium	Light	High	Low	High
V. low	Medium	Medium	Medium	Low	Medium
V. low	Light	Heavy	V. low	Low	High
V. low	Light	Medium	Low	Medium	Medium
V. low	V. light	Light	Low	Low	Medium
Low	Light	Heavy	Low	V. low	High
V. low	V. light	Heavy	V. low	Light	Medium
V. low	Light	Light	Low	V. low	V. high
V. low	Light	Light	Low	Low	Medium
V. low	Light	Light	Low	V. low	High
Low	Medium	V. heavy	Low	Medium	Medium
Medium	Medium	Heavy	Low	Low	High
Low	Light	V. heavy	Low	Low	High
Low	Heavy	V. heavy	Medium	Medium	Medium
V. low	V. light	Medium	V. low	V. low	V. high
Low	Medium	V. heavy	Low	Medium	Medium
Low	Light	V. heavy	V. low	V. low	High
Low	Light	Light	Medium	Low	Medium
Medium	Heavy	Medium	High	High	Low
Low	Light	Medium	Low	Low	High
V. low	Light	Medium	Medium	Low	High
V. low	Light	Light	Medium	Medium	Medium
V. low	V. light	Light	Low	High	Low
Low	Medium	V. heavy	Low	Medium	Medium

Continue Table 4:

Cultivar	Fruit length	Fruit width	Length/ width ratio	Fruit weight
	I	II	III	IV
Khiyara	V. big	V. big	Medium	V. heavy
Khoshly Azraq	Medium	Big	Low	Medium
Laqaitoona	Big	Medium	High	Medium
Makkawi	Small	Medium	Low	Medium
Mibraya	V. small	Small	Low	V. light
Nabati	Big	Small	High	Medium
Nehar Silli	V. small	Medium	V. low	Light
Qazal Maktoom	Medium	Big	Low	Medium
Rummania	Medium	Medium	Medium	Light
Sisandali	Big	Big	Medium	Heavy
Saai	Medium	Medium	Medium	Light
Shitwi Wardi	V. small	V. small	Low	V. light
Sukkari	Medium	Medium	Medium	Light
Shamoosi	Big	Medium	High	Medium
Shuwaithi	Big	Small	V. high	Medium
Sultani	Medium	Medium	medium	Medium
Safar Kjal	Small	V. small	Medium	V. light
Shilani Ahmer	Medium	V. small	High	Light
Shukar	Medium	V. small	High	Light
Tibarzel	Small	Medium	V. low	Medium
Ukhat al-Qsab	Small	Medium	Low	Light
Um al-Bilaliz	Medium	Small	Medium	Light
Um al-Dehin	Big	Small	High	Medium
Um al-Jam	Medium	Medium	Medium	Medium
Um al-Asafir	V. small	Small	Low	Light
Zubair	Big	Medium	High	Medium

Fruit volume	Pulp weight	Seed weight	Pulp seed ratio	Moisture	Total soluble solids
V	VI	VII	VIII	IX	X
V. high	V. heavy	Heavy	V. high	High	Low
Low	Light	V. heavy	Low	Low	High
Low	Medium	Heavy	Low	V. low	High
Low	Medium	Heavy	Medium	Low	High
V. low	Light	Light	Low	Medium	Medium
Low	Medium	Heavy	Medium	V. low	V. high
V. low	Light	Medium	Low	Medium	Medium
Low	Medium	V. heavy	Low	V. low	V. high
Low	Light	Heavy	Low	V. low	High
Low	Heavy	Heavy	Medium	Medium	Medium
Low	Medium	Medium	Medium	Low	High
V. low	V. light	Light	V. low	V. High	V. low
Low	Light	Light	Medium	Medium	Medium
Medium	Medium	V. heavy	Low	V. High	Medium
Low	Medium	Heavy	Medium	High	Medium
Low	Medium	Medium	Medium	Medium	High
V. low	V. light	Medium	Low	High	Medium
V. low	Light	Medium	Low	V. low	High
V. low	Light	Medium	Low	Medium	Medium
Low	Light	Heavy	Low	High	Low
Low	Light	Medium	Low	V. low	V. high
Low	Light	Heavy	Low	V. low	V. high
V. low	Medium	Heavy	Low	Medium	Medium
Low	Medium	Medium	High	Medium	Medium
V. low	Light	Medium	Low	Low	High
Low	Medium	Medium	High	Medium	Medium

Table V

Quantity of different types of sugar in fifty date cultivars during tamar stage (percent dry weight)

Cultivar	Sucrose %	Invert Sugar %	Total Sugars %
Commercial			
Barhee	1.8	42.8	44.8
Braim	5.5	46.6	52.4
Hallawi	4.6	81.4	86.3
Khadrawi (Basra)	4.8	67.0	71.2
Khastawi	7.5	43.8	51.8
Zahdi	6.2	55.8	62.4
Non-Commercial			
Ashrasi Hibhib	3.7	71.3	75.2
Awenat Ayoub	7.6	80.6	88.7
Bairagh Dar	4.4	65.0	69.6
Banafsha	5.5	52.5	58.4
Bawa Adam	7.4	61.4	69.3
Beni Rabba	5.8	55.6	61.1
Degal Ajam	8.0	56.4	64.9
Degal Amin	8.6	77.4	86.5
Degal Badmi	5.5	67.6	73.5
Degal Bittar	7.1	48.6	56.1
Degal Safra	3.5	52.0	55.7
Degal Taha	9.2	58.5	68.3
Hilwat Al-Jabal	9.0	47.5	57.0
Hasawi	2.4	50.7	58.2
Jamal Al-Din	8.9	68.8	78.2
Jobana	2.9	84.7	87.8
Khadrawy Mandli	7.9	75.5	83.9
Khiyara	4.0	63.7	67.9
Kirkani	6.2	78.3	84.4
Khoshly Azraq	6.4	61.1	67.8

Continue Table V

Cultivar	Sucrose %	Inverst Sugar %	Total Sugars %
Laqaitoona	5.5	81.2	87.0
Makkawy	3.2	54.4	57.8
Mibraya	8.6	62.0	71.1
Nabati	2.2	79.0	81.4
Qazal Maktoom	1.8	53.6	55.6
Nehar Silli	5.0	76.6	84.9
Rummania	9.0	82.0	91.9
See Sandli	3.6	79.6	83.4
Saai	8.4	71.5	80.4
Shitwi Wardi	5.1	76.2	81.6
Sukkari	9.8	77.9	87.2
Sharnoosi	2.4	86.2	88.8
Shuwaithi	9.3	49.4	59.3
Sultani	9.7	66.8	77.1
Safar Kijal	5.4	24.7	30.4
Sheelani Ahmer	9.4	71.4	81.3
Shukkar	4.7	58.1	63.0
Tibarzel	2.9	59.9	62.9
Ukhat Al-Qsab	8.9	76.0	84.4
Um Al-Balaliz	2.4	30.6	33.2
Um Al-Dehin	9.7	51.2	61.5
Um Al-Jam	9.2	78.1	87.8
Um Al-Asafir	9.7	71.6	81.9
Zubair	4.9	78.2	83.4

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PLANT REGENERATION FROM CALLUS CULTURES OF *PHOENIX DACTYLIFERA* L.

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ABSTRACT

Immature embryos of *Phoenix dactylifera* L., excised from fruits at the green stage of development, showed callus proliferation when cultured on a medium supplemented with equal parts of IAA and kinetin. Plant regeneration was observed upon further subculturing of the callus on fresh medium of the same composition. Organogenesis from callus bypassed the role of cotyledons, a phenomenon usually associated with seed germination.

No callus was produced when embryos from yellow colored fruits were excised and placed in culture. Similarly, intact seeds, derived from green fruits showed no sign of callus initiation, however, normal cotyledon growth was observed as in mature seeds.

اخلاف نباتات نخيل التمر *(Phoenix dactylifera)* من مزارع الكالس

عبد الأمير مهدي مطر كلية الزراعة/ جامعة البصرة

الخلاصة

أدت زراعة أنسجة أجنة النخيل المستأصلة من ثمار في المرحلة الخضراءعلى وسط غذائي اصطناعي يحتوي ٢ ملغم في اللتر من الاوكسين IAA والكاينتين Kinetin إلى نمو نسيج الكالس، أعقبه تولد نباتات نخيل كاملة بعد فترة من نقل الكالس إلى وسط غذائي طري من نفس التركيب. أما تسلسل تكون الأعضاء من نسيج الكالس فقد تجاوز دور الفلقة الذي يحدث عادة خلال الانبات الطبيعي للبذرة. أما الأجنة المستأصلة من ثمار في المرحلة الصفراء من النضج أو مرحلة النضج التام وكذلك البذور الكاملة من المرحلة الخضراء فلم تولد نسيج الكالس بل أن الفلقة نمت منها بصورة طبيعية كما هي في حالة البذور الناضجة.

INTRODUCTION

The Date palm *(Phoenix dactylifera* L.) is one of the oldest fruit trees to be cultivated in the valley of the Euphrates in Iraq since 3000 B. C. (4). The cultivation of date palms has not been optimized because commercial propagation of superior cultivars depends strictly upon offshoots. Offshoots are lateral buds in the axils of the leaves and usually arise at the base of mature palms during the juvenile phase of growth. This is the only vegetative method, although slow, that is available for date growers. One of the major problems facing clonal propagation through offshoots is their in-

sufficient number for increasing superior selections that produce the most excellent fruits and yield (1).

Recently there have been serious attempts to apply tissue culture techniques to many extensive cultivars of date palms. Schroeder employed various tissues excised from the heart of the palm and offshoot but the explants failed to grow or to differentiate (7). The extensive investigations reported by Reuveni *et al* on tissue and organ culture of date palms indicated negative results (6). Eeuwens and Blake used young stem and leaf sections of date and coconut in vitro and obtained callus and roots (2). Eeuwens also investigated the effects of hormones on growth and development of date explants and obtained shoot and root growth from inflorescence sections (3). Reynold and Murashige utilized tissue culture of excised embryo from immature fruits of dates (5). They were able to produce callus and subsequently embryoids. Recently, Tisserat reported about the production of free-living date palms through callus culture (8).

This investigation of tissue culture of date palm evidenced organogenesis and formation of date plants from callus explants in a basic medium containing IAA and Kinetin.

MATERIALS AND METHODS

Green, yellow and ripe fruits at Chimry , Khalal and Tamr stages respectively, of the finest local cultivar Barhee and the commercial cultivar Halawy were harvested from young healthy palms at Shatt al-Arab orchards in Basrah, Iraq during the seasons of 1980 and 1981.

The fruits were first cut open, their ovules (or seeds) were removed and the pellicle surrounding the ovule was peeled away to reveal the germpore (the developing micropyle). Portion of the endosperm tissue measuring 3x3x3 mm and surrounding the tiny embryo was excised and placed over moist filter paper inside Petri dishes and stored temporarily prior to surface sterilization. Intact whole ovules at the three stages of fruit development were also used as explants for comparison. The explants were surface sterilized by immersing for 15 min. in 10% (v/v) solution of sodium hypochlorite containing two drops of Tween-20 emulsifier and rinsed two times with sterile distilled water. Three segments of germpore sections or

intact ovules were placed over the surface of nutrient medium in the culture flask. Ten cultures were initiated for each type of tissue or medium. Manipulations were carried out under aseptic conditions.

The medium for excised embryo culture and callus establishment composed of Murashige and Skoog basal salts plus the following (in mg per liter): sucrose, 30,000; NaH_2PO_4. $2H_2O$, 170; meso-inositol, 100; thiamine-Hcl , 0.5; pyridoxine- Hcl, 0.5; adenine sulfate, $2H_2O$, 40; 3-indole acetic acid (IAA), 0, 2 or 5; kinetin, 2; phytagar, 8000. The pH of the medium was adjusted to 5.5 with 0.1 N NaOH or in Hcl prior to addition of agar. The nutrient media were dispensed into 125-ml conical flasks at a rate of 50 ml. The flasks were covered with spongy stoppers, their necks covered with aluminium foil and sterilized by autoclaving for 15 min. under 1.05 Kg/cm2 and a temperature of 120°C.

The initiated callus was subcultured and maintained on fresh medium of same composition or on medium devoid of hormones at 8 weeks intervals.

All cultures were incubated in an electronically temperature-controlled cabinet at 27° C under 16 hrs daily exposure to low intensity of 1000 Lux illumination.

RESULTS AND DISCUSSION

No growth was apparent on the cultured explants excised from green fruits of Barhee (Fig. 1) and, Halawy, during the first seven weeks. Four weeks later the explants developed white grainy callus masses on the germpore side of the sections. The callus masses were more than twice the explant size (Fig. 2). Germpore sections excised from the yellow fruits of Barhee, (Fig. 3) and 'Halawy' or from ripe fruits did not produce callus. However, cotyledons emerged normally from the germ pores and elongated, their bases enclosed the shoot and root apices, while their tips remained attached to the explants (Fig. 4). Later, cotyledons grew in to a complete plant with normal root and shoot (Fig. 5). In media with high auxin (5 mg IAA/l), explants from green fruits produced much more callus than those grown on media devoid of auxin. Likewise, explants from yellow and ripe fruits produced much shorter and thicker cotyledons. In contrast to excised embryo, intact ovules (whole seeds) at green color stage

gave rise to normal cotyledon growth and took almost the same time as for excised embryo to produce callus tissue (Fig. 6).

After 12 weeks in culture, the callus was subdivided into small segments (2 mm in diameter) and transferred to fresh media of the same composition or to media devoid of hormones. Two weeks thereafter the callus segments enlarged to about 8 mm in diameter without showing any sign of differentiation. However, after a further two weeks, white organized tissue differentiated from many callus segments (Fig. 7).

Ten days later the newly growing organs developed into young green shoots and shortly thereafter white roots appeared from the bases of the shoots (Fig. 8). Best growth and differentiation occurred on media supplemented with 2mg/1 of IAA and Kinetin. The associated callus masses continued to grow along with the differentiated plants. A representative plant is shown in Figure 9. Examination of the attached callus tissue under the microscope revealed many other shoots or root-like structures on the callus surface. Many young differentiated plants were successfully transferred to grow in blocks of compressed sphagnum peat which were used as temporary propagating beds .

This research has shown that organogenesis occurred in callus tissue derived from immature (green stage) date embryo. The finding also confirms the observation of asexual embryogenesis in callus tissue that originated in young embryo explants (5). This investigation also showed that differentiation of date shoots occurred in new callus growth that arose after subculture to fresh media, followed by root differentiation and bypassed cotyledon prior growth and elongation. Tisserat (1979) found that the morphogenetic response from embryo callus varied and indicated that callus grown on media supplemented with high auxin gave rise to root only or to root and plantlets. In this investigation, excised embryos at yellow or nature stages of development always followed the sequence growth and elongation of cotyledon, emergence of root and then growth of shoot, similar to the sequences of growth in mature intact seeds of date. Sequence of differentiation in callus tissue, however, showed that the cotyledon was very short and embedded in the callus mass. Tisserat (1980) also found that development of seeds and embryos excised from mature fruits are

similar except for minor deviations in the cotyledon. Although he did not use immature excised embryo, his observation of adventive embryogenesis from lateral bud-derived callus indicates that immature tissues tend to produce callus and this in turn differentiates into roots, shoots, embryoids or plantlets. Sequence of growth and formation of cotyledons, shoots and roots from lateral bud callus seems to be the same as those that occurred in immature embryo callus grown on media containing lower levels of IAA and Kinetin than those employed in this investigation.

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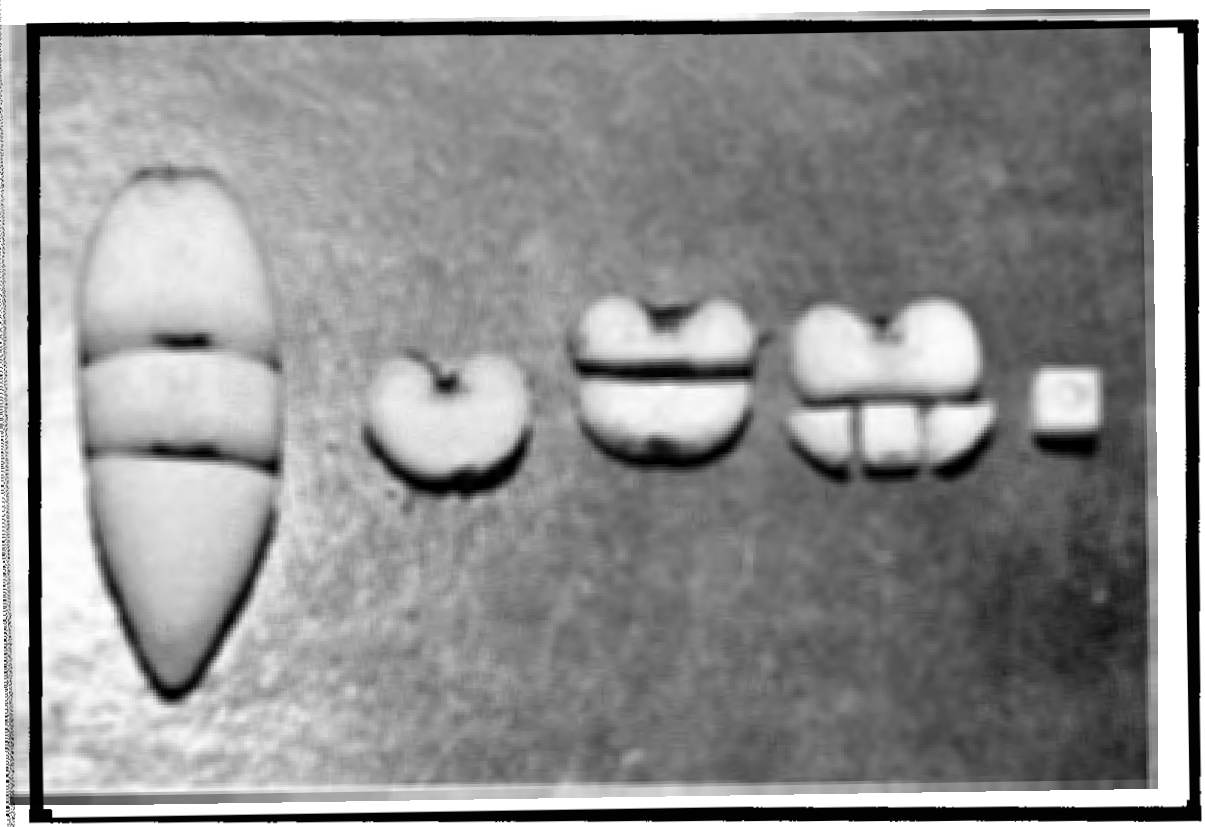


Fig. 1. Germpore section excised from ovule of Barhee at green color stage (Chimry stage) measuring 3x3x3 mm surrounding the embryo (far right). Method of preparing the section is shown from left to right.

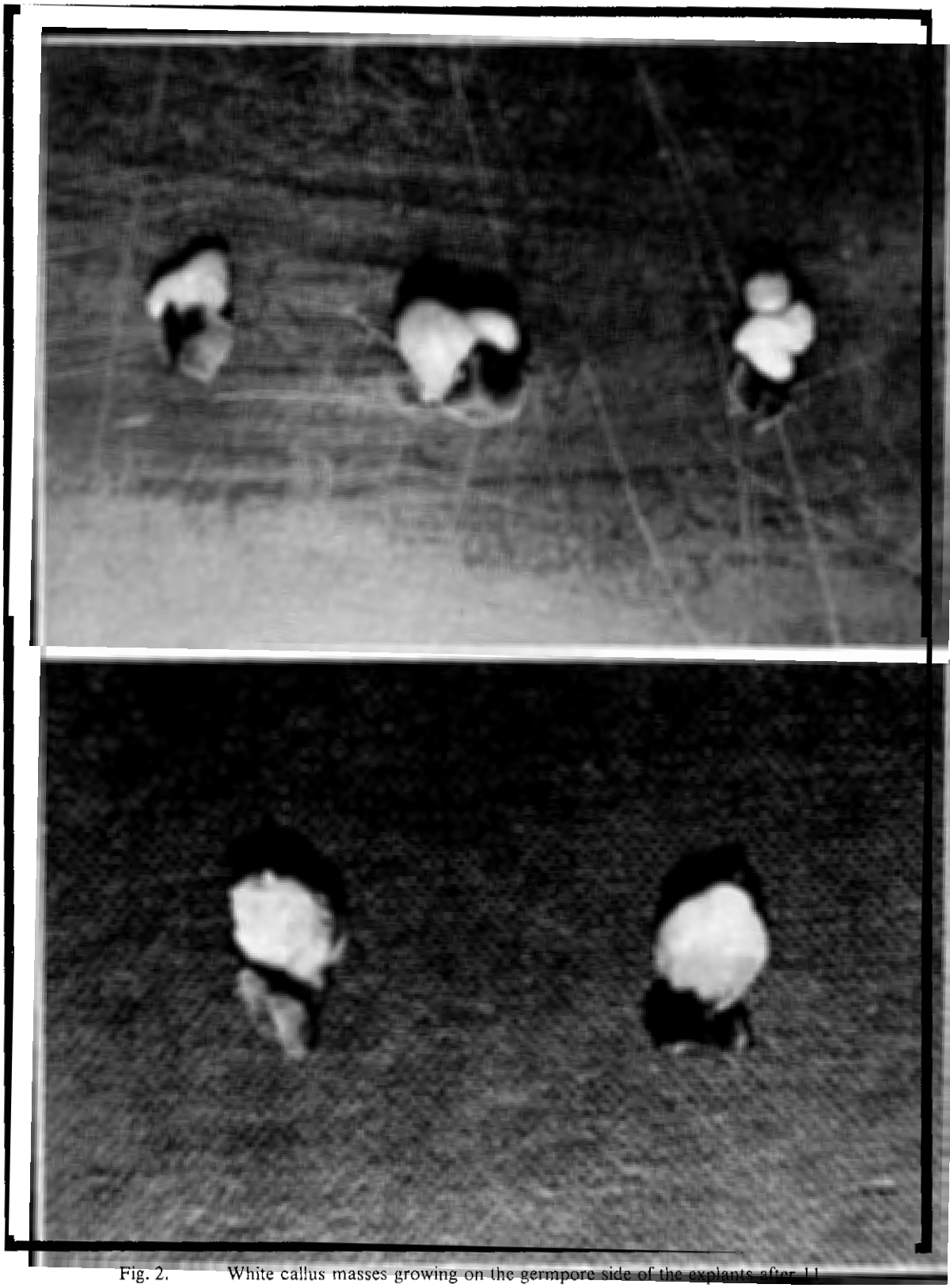


Fig. 2. White callus masses growing on the germpore side of the explants after 11 weeks in culture over basal medium containing IAA and Kinetin. Upper row for Barhee , lower row for Halawy .

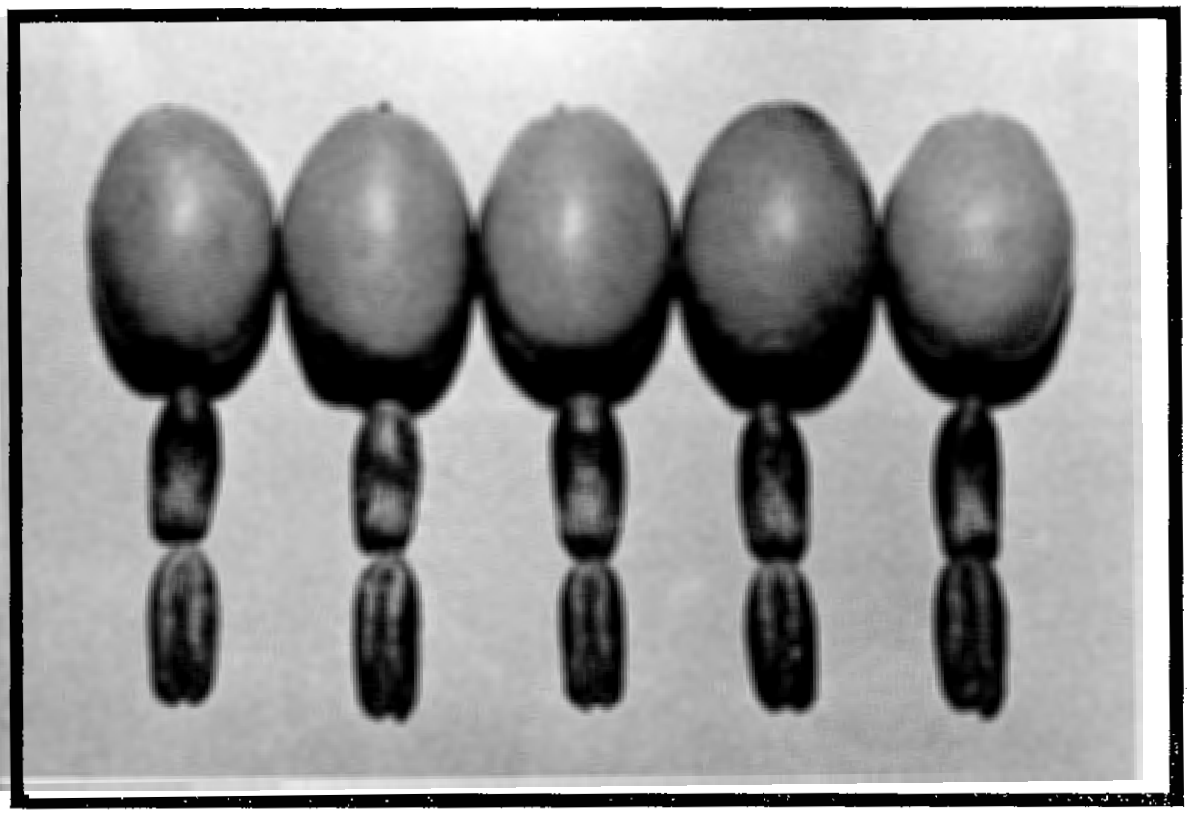


Fig. 3. Barhee fruits at yellow color stage (Khalal) with two rows of their ovules at this stage. The upper row showing the dorsal side of the ovules and the germ pore positions where explant sections were excised.

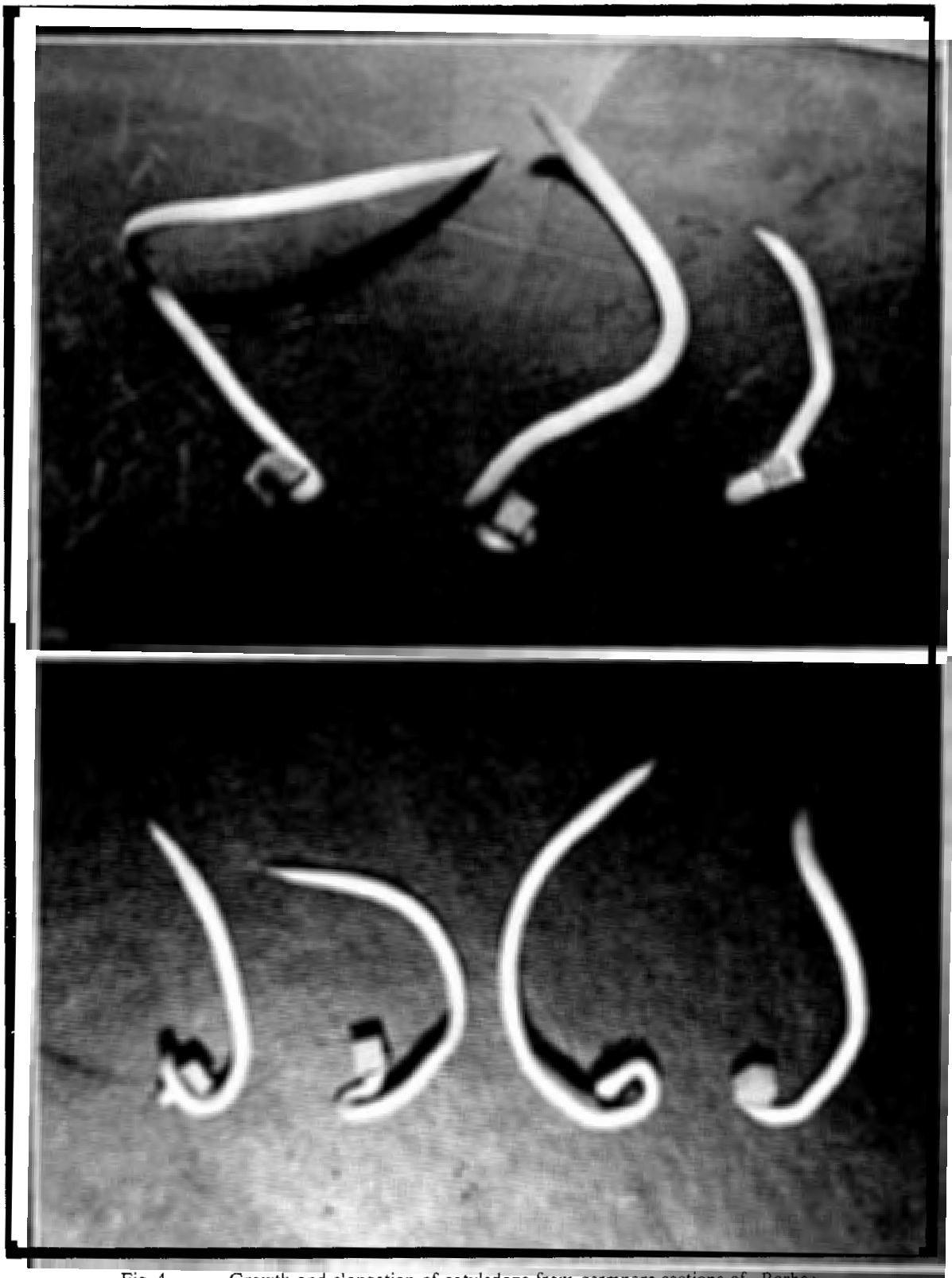


Fig. 4. Growth and elongation of cotyledons from germpore sections of Barhee (upper row) and Halawy (lower row) excised at yellow color stage (Khalal).

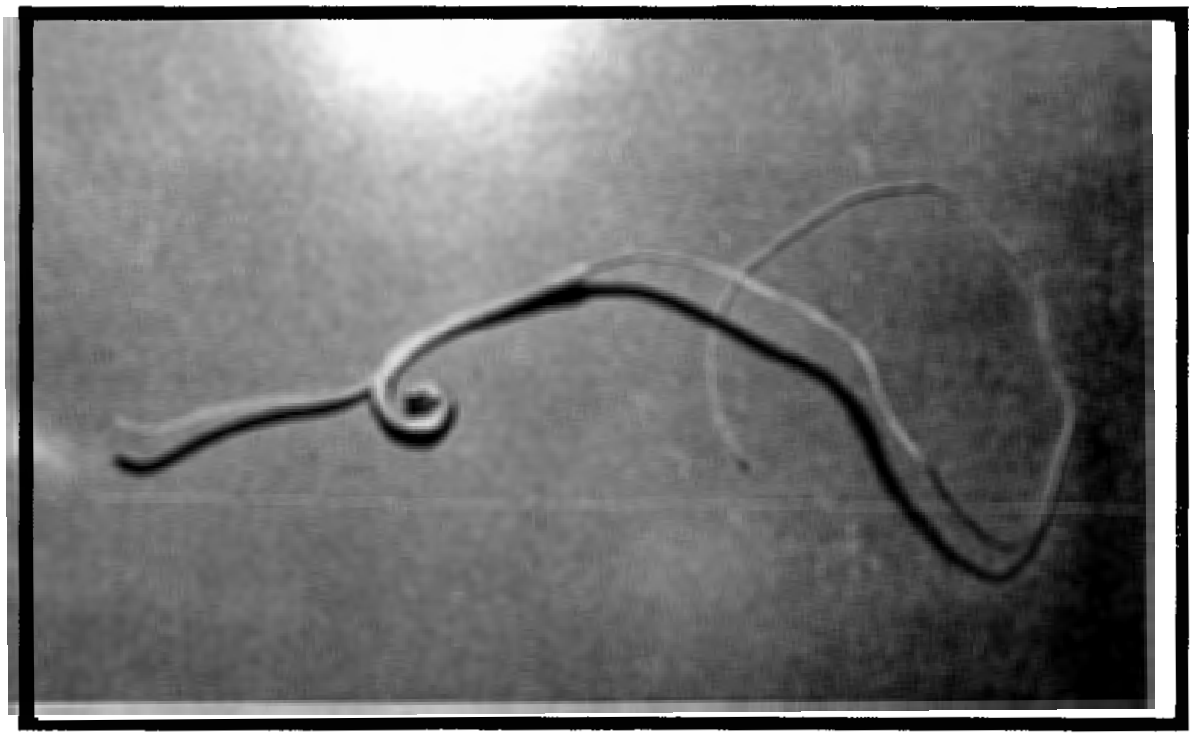


Fig. 5. Complete plant of date with shoot (left), root (right) and cotyledon in the middle originating from germpore section of Barhee excised at yellow color stage (Khalal).

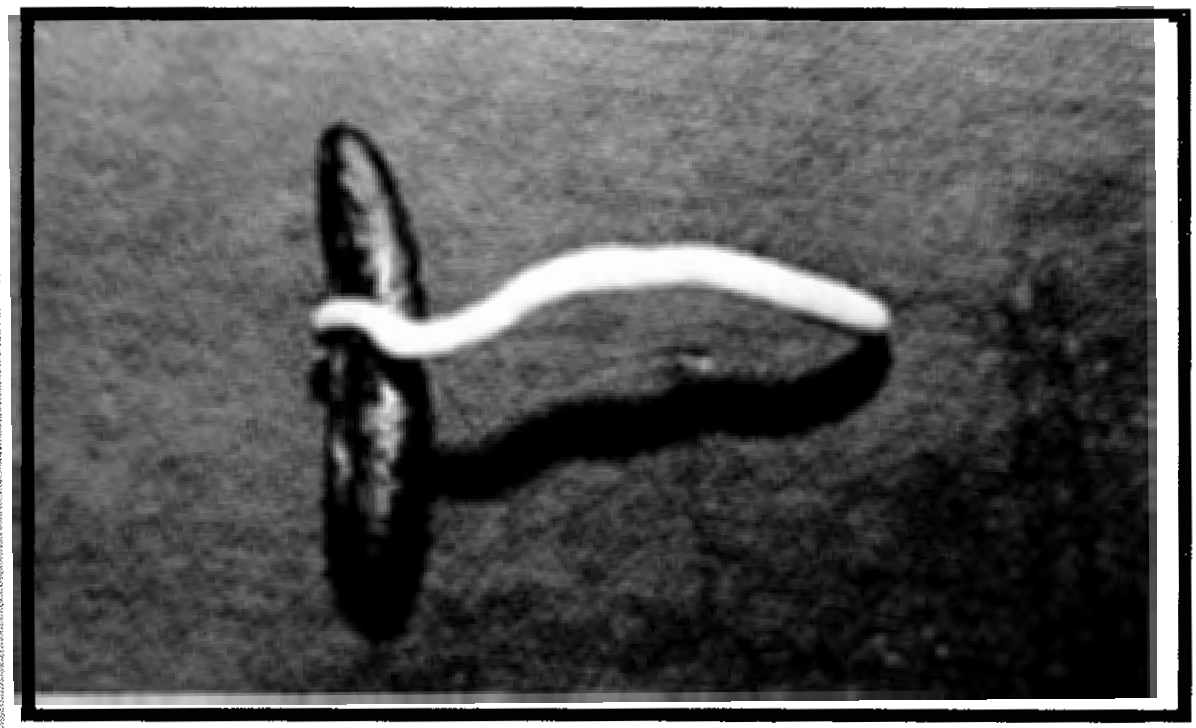


Fig. 6. Intact ovule of Halawy at green colour stage (chimry) showing cotyledon emergence from the germpore after 11 weeks of culture on basal medium containing IAA and Kinetin.

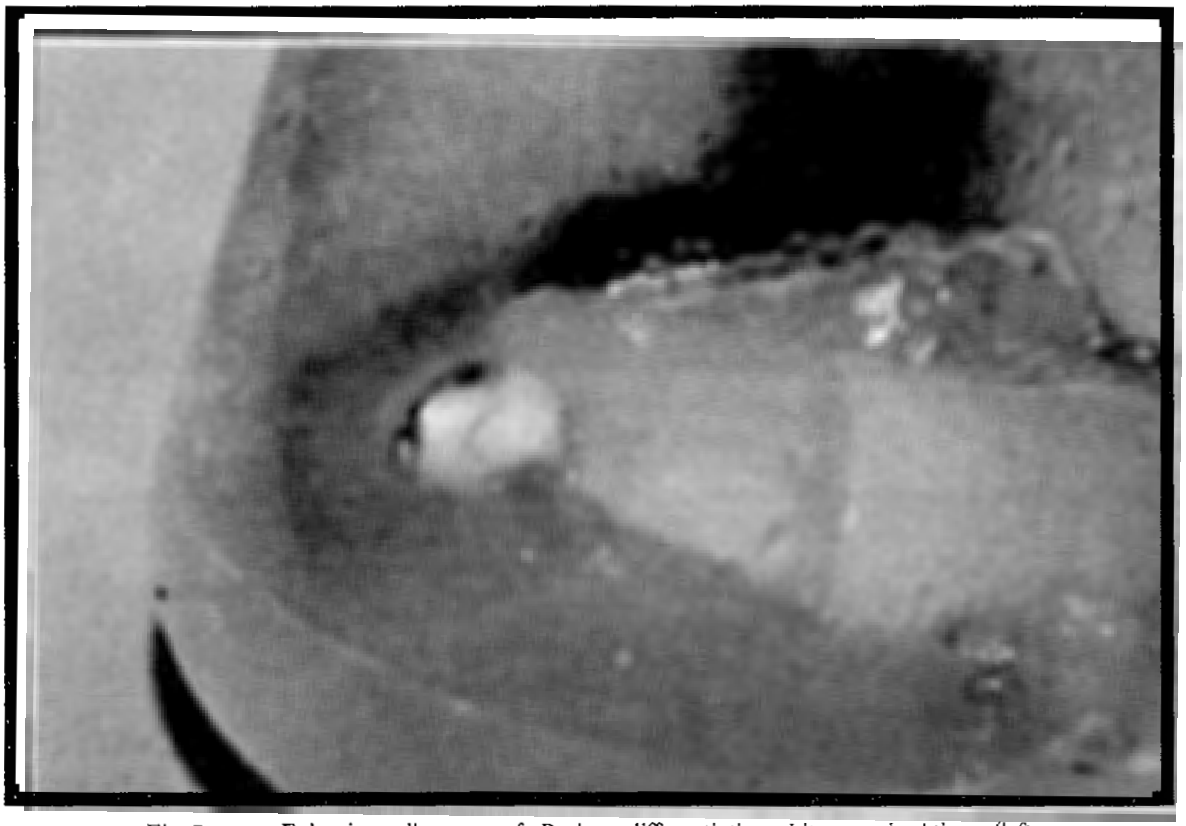


Fig. 7. Enlarging callus mass of Barhee differentiating white organized tissue (left side) after 4 weeks of subculture in fresh medium containing IAA and Kinetin.

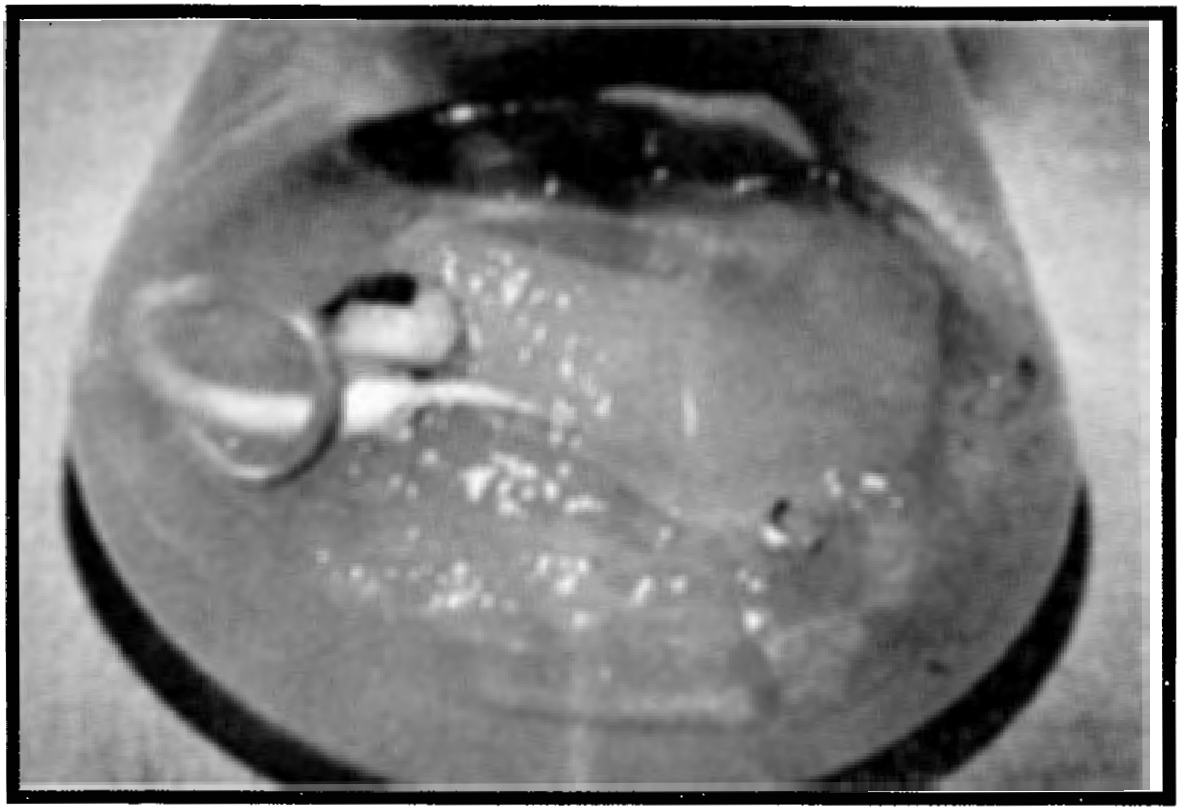
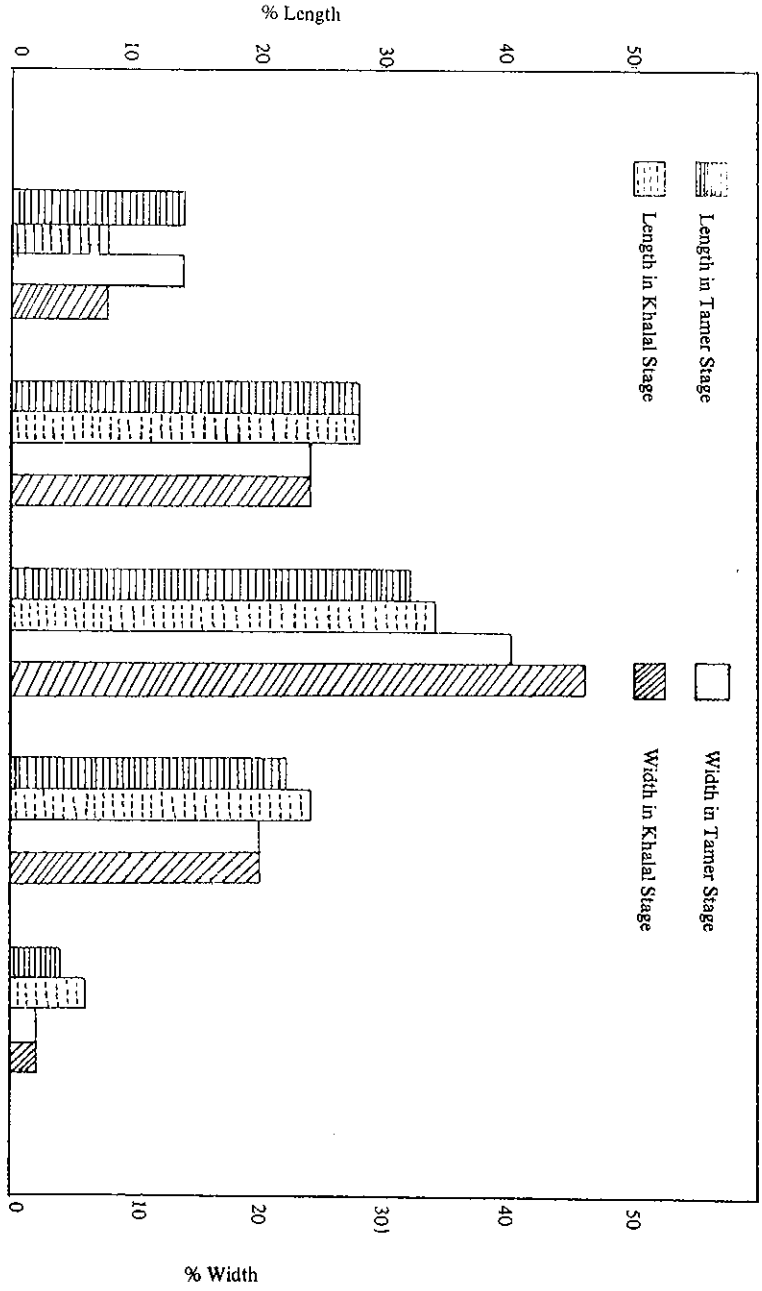


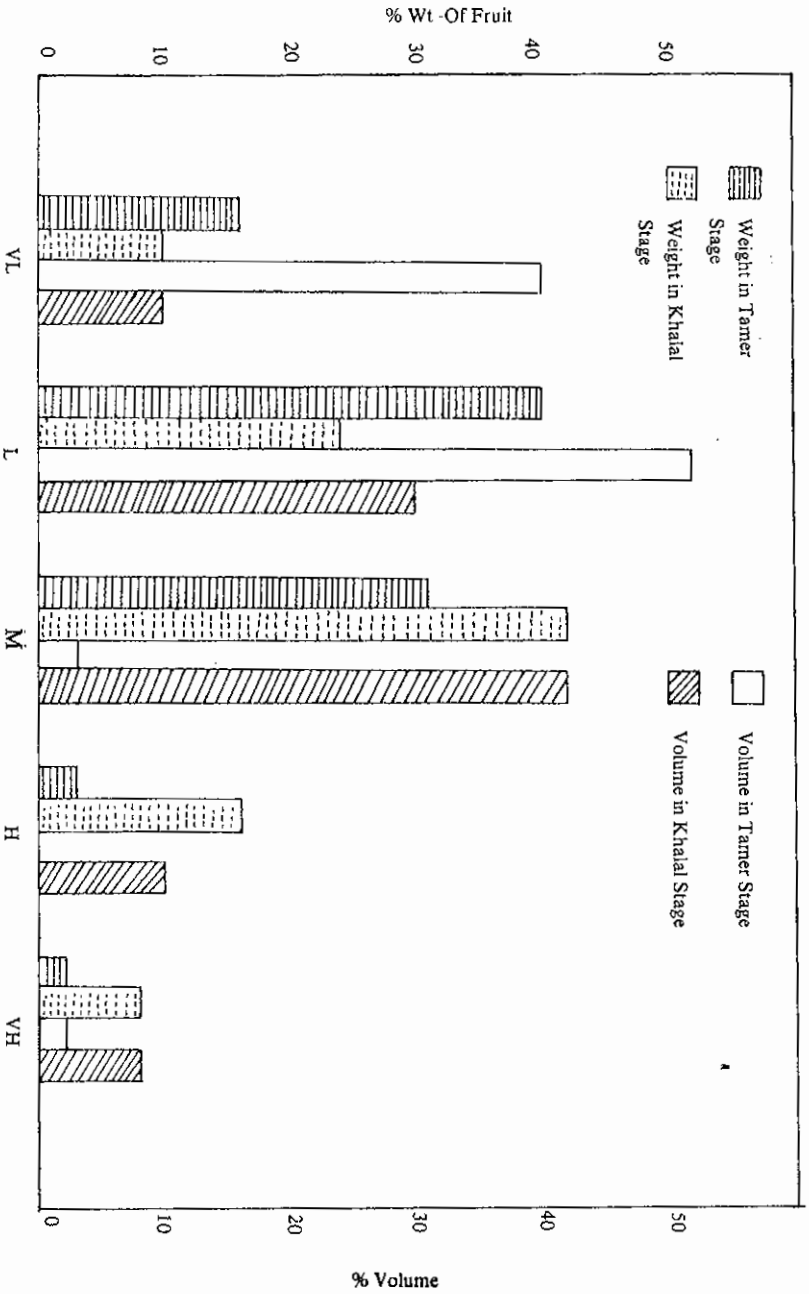
Fig. 8. Differentiation of green shoot and white root from callus segment of Barhee six weeks after callus subculture in fresh medium containing IAA and Kinetin.

Fig. 9. Whole plant of date palm with green shoot (left) and white slender root (right) originating from growing segment of callus tissue of Barhee 50 days after subculture to fresh medium containing IAA and Kinetin.



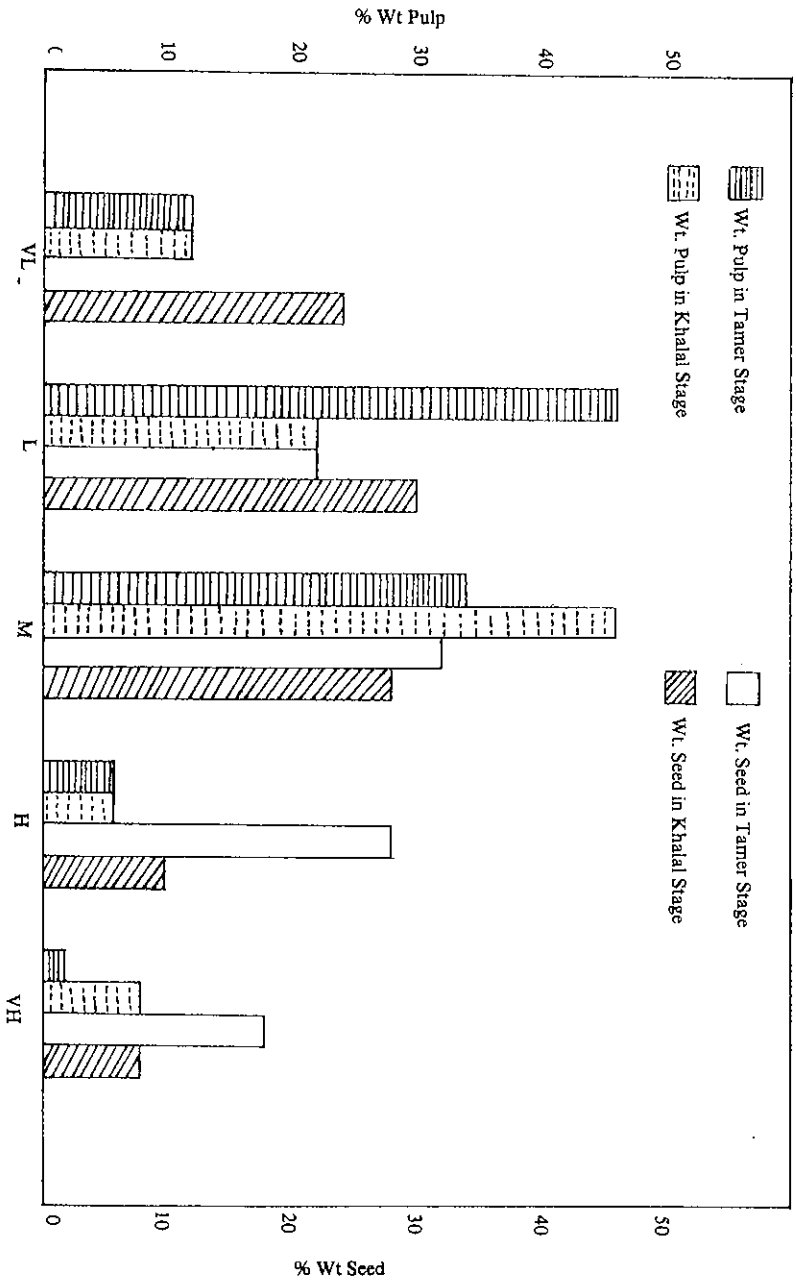
Legend: VS = Very small, S = Small, M = Medium, B = Big, VB = Very big

Figure 1. Frequency of occurrence of five classes of fruit length and width among fifty date cultivars.



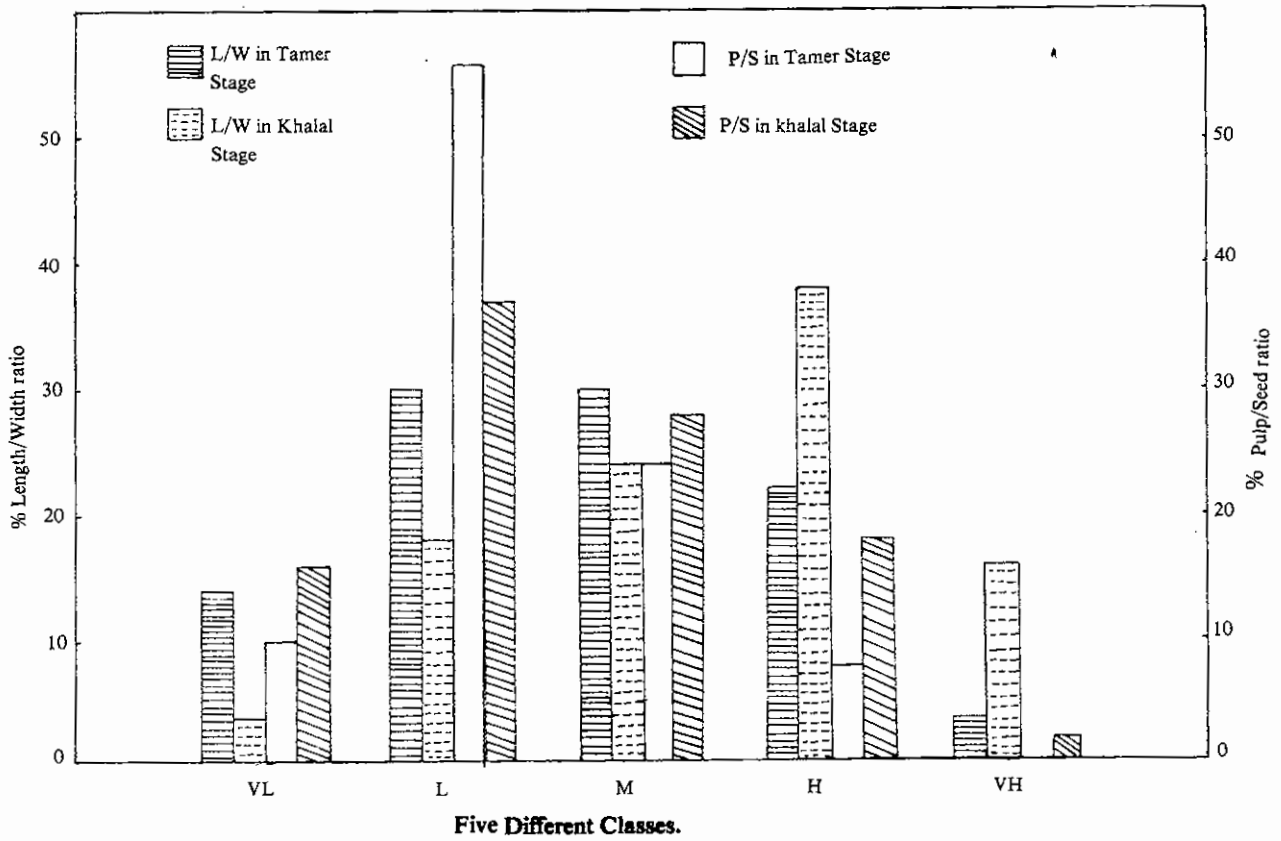
Legend: VL = Very light or low, L = Light or low, M = Medium, H = Heavy or High VH = Very heavy or high

Figure 2. Frequency of occurrence of five classes of fruit weight and volume among fifty date cultivars.



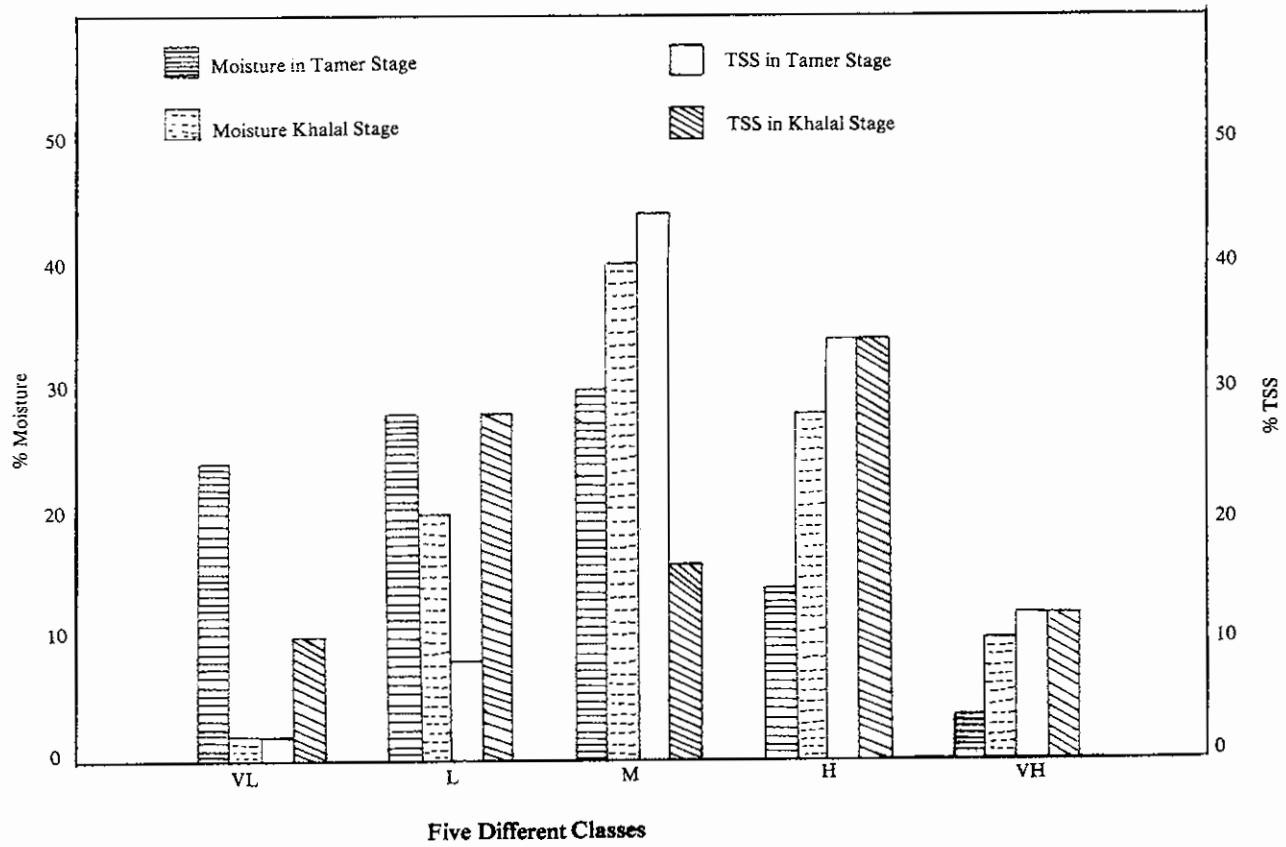
Legend: VL = Very light, L = Light, M = Medium, H = Heavy, VH = Very heavy

Figure 3. Frequency of occurrence of five classes of pulp and seed weight in fruits of fifty date cultivars.



Legend: VL = Very low, L = Low, M = Medium, H = High, VH = Very high

Figure 4. Frequency of occurrence of five classes of length/width ratio and pulp/seed ratio in fruits of fifty date palm cultivars.



Legend: VL = Very low, L = Low, M = Medium, H = High, VH = Very high

Figure 5. Frequency of occurrence of five classes of moisture and TSS in fruits of fifty date palm cultivars.

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EFFECT OF HIGH TEMPERATURES ON FIG MOTH *Ephestia cautella* Walker (Lepidoptera: Pyralidae) IN IRAQ

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ABSTRACT

The present study was undertaken in an attempt to use heat as a means of control against the fig moth *Ephestia cautella* to replace pesticides. Eggs, first and fourth larvae, pupae and adults of this pest were exposed to 45, 50 55 and 60°C with 20 and 70% R.H. for different lengths of time to obtain 100% mortality. Results indicated that various stages showed appreciable differences in susceptibility with temperatures but not with relative humidity. Therefore, time required to obtain 100% mortality of eggs, 1st and 4th instar larvae, pupae and adults at 60°C with 20%/R.H. is 0.33, 0.17, 0.50, 0.50 and 0.41 hours respectively whereas 15,00, 15.00, 18.00, 10.00 and 12.00 hours is required for the same stages under 45°C with 20% R.H. This gives the freedom to choose any temperature for the suitable length of exposure to cause 100% mortality of this insect.

تأثير درجات الحرارة العالية على حشرة عثة التين *Ephestia Cautella* في العراق

عبدالله فليح العزاوي — كلية الزراعة / جامعة بغداد

حيدر صالح الحيدري — الهيئة العامة لوقاية المزروعات

فوزية محمد عزيز أمل خضير مراد — مركز البحوث الزراعية والموارد المائية .

الخلاصة

تهدف الدراسة الحالية الى امكانية استخدام الحرارة لمكافحة عثة التين بدلا من المبيدات الكيمياوية حيث عرضت الادوار المختلفة لهذه الحشرة (بيض ، يرقات العمر الأول والرابع ، العذارى والحشرات الكاملة الى درجات حرارة عالية ,45 (50 ,55 ,60 °م تحت 20 و70% رطوبة نسبية للحصول على 100% قتل لهذه الادوار . دلت النتائج ان الاطوار المختلفة لهذه الحشرة تختلف في حساسيتها بالنسبة لدرجات الحرارة بينما لم يظهر تأثير محسوس للرطوبة النسبية وهناك حرية اختيار درجات الحرارة المناسبة والوقت اللازم لقتل الادوار المختلفة لعثة التين فعند استعمال 60° م و 20% رطوبة نسبية نحصل على 100% قتل للبيض ويرقات الطور الأول والرابع والعذارى والحشرات الكاملة بعد 0.33 ,0.17 ,0.50 ,0.50' و 0.41 ساعة من تعريض هذه الادوار لدرجة الحرارة المذكورة اما في حالة استعمال درجة حرارة 45°م و 20% رطوبة نسبية فنحتاج الى ,15.0 ,15.0 18.0, 12.0, 10.0 ساعة من التعريض .

INTRODUCTION

The fig moth *Ephestia cautella* Walker is the most serious pest of date in storage. Infestation plays a major role in marketing of dates locally and internationally.

Infestation starts on late varieties or late harvested dates, on wind-fallen dates and dates being kept in the field before being transferred to store houses. In store houses infestation increases gradually, reaching up to 86% among Zahdi variety (5).

Treating store houses with insecticides and fumigation of dates with fumigants is a standard procedure. However, chemical control of insects in food store houses is becoming an undesirable method because of the development of insect strains resistant to insecticides or because of insecticide residue on food (1,7). Therefore, alternative insect control methods are becoming very desirable.

Heat as a mean of controlling insects has been used in flour mills since 1914 (4,6). Hussain (5) reported that larvae of the fig moth when exposed to 60-70°C for four hours resulted in 36.3 – 100% kill.

The present study aims at finding the lethal time required to kill each stage of the fig moth when exposed to upper lethal temperatures as an attempt to use heat as a method to control stored date insects.

MATERIALS AND METHODS

A culture to secure any stage of the fig moth was maintained in the entomology laboratory of the Agriculture and Water Resources Centre, Council of Research in Baghdad. To start the culture, adults were obtained from a date store room in the building of the Centre.

Each treatment and its control, consisted of 3-5 replicates, with 10-50 insects per replicate and the control for each treatment was kept under 25°C and 70% R.H. When control's mortality exceeded 10% the test was repeated. Mortality was calculated according to Abbot's formula.

Equal numbers of both sexes were placed inside glass cages (lantern lamps) used for egg laying. The cage bottom was closed with a fine cloth, under which a Petri-dish was fitted and fastened with cellophane tape to the glass. The cage top was covered with fine cloth having a hole in its centre with a piece of cotton soaked with 10% sugar solution serving as food for the adults. Eggs laid fell inside the Petri-dish and were collected regularly either for egg experiments or for hatching to obtain other stages of the insect.

To obtain other stages, eggs were placed over black filter paper in a Petri-dish. When hatched, larvae were fed a mixture of 12% glycerine and 88% ground wheat. Pupation took place on a thin layer of cotton inside the Petri-dish. Pupae were then used for experiments or placed into small test tubes, and were kept in the incubator. Emerging adults were used for experiments or were placed in glass cages for egg production.

Rearing of all stages was carried out in an incubator kept at 25°C and 70% R.H. Humidity was maintained by water in four plastic containers of 7 × 7 × 8.5cm.

To study the effect of a given temperature on any stage, a number of eggs, larvae, pupae or adults of known age were transferred to a petri-dish inside desicators that were kept in incubators which were adjusted to temperatures between 45, 50, 55 and 60°C with 20 and 70% relative humidity which was maintained inside the desicators with solutions of potassium hydroxide.

After exposure to a definite temperature and relative humidity, insects were transferred to another incubator at 25c and 70% R.H.

Mortalities for each lethal temperature (45, 50, 55 and 60°C with 70% R.H.) was plotted against exposure times on logarithmic probability graph paper no. 3128 (Codex Book Co. Inc., Mass., U.S.A.) to obtain estimates from a linear graph of the lethal times for 50 or 95% mortalities of the population expressed as LT 50% or LT 95%.

RESULTS AND DISCUSSIONS

The lethal time required to kill 100% of each stage of the fig moth under

45, 50, 55 and 60°C with 20 and 70% R.H. is shown in Table 1. Data indicate that 45, 50, 55 and 60°C killed all eggs after 15.00, 1.50, 0.50 and 0.33 hour respectively with 20% R.H. and 15.00, 3.00, 0.5 and 0.33 hours with 70% R.H.First instar larvae required 15.00, 0.75, 0.25 and 0.17 hours to get 100% mortality under 45, 50, 55 and 60°C with 20 and 70% R.H., while the 4th instar larvae required 18.00, 1.75, 1.17 and 0.50 hours and 18.00, 1.50, 1.11 and 0.58 hours under the same conditions. One hundred per cent mortality of pupae occured after 10.00, 4.00, 0.75 and 0.50 hours of exposure time to 45,50,55 and 60°C with 20% R.H. and 10.00, 3.00, 0.75 and 0.50 hours under the same temperatures and 70% R.H. Complete kill of adults occured after 12.00, 1.25, 0.66 and 0.41 hours of exposure time to 45, 50, 55 and 60°C with 20% R.H. and 12.00, 1.25, 0.50 and 0.33 hours under the temperatures and 70% R.H.

Lethal time (LT) in hours estimated for 50 and 95% mortality of the population of any insect stage may be expressed as LT50 and LT95, and could be obtained as estimates from a linear graph drawn as in the probit analysis for insecticidal toxicity which was first reported by (2). Table 2 shows the LT50 and LT95 for each lethal temperature of each stage of the fig moth which is useful for comparison. This table indicates that the first instar larvae is the most sensitive stage of this insect to lethal temperatures of 50, 55 and 60°C in terms of LT50 and LT 95.

It is a well known fact that insects live, develop and reproduce within a range of temperature particular to the species or even in its developmental stages. When temperature changes beyond the species range, activities slow down, then stops and the insect eventually dies. For most insects, the upper lethal temperatures for a short exposure is within the range of 40-50°C. Death is a result of various factors such as proteins being denatured or the disturbance of metabolic processes or exhaustion of food reserve or desication (8,3). Temperature, therefore, could be used to main advantage to protect stored commodities from insect damage.

In subtropical and hot countries such as Iraq, the use of high lethal temperature to control insects of stored food costs less than the use of low lethal temperatures. To put this into practice, the upper lethal temperature and exposure times could be determined for each stage of each insect that

attack a particular commodity under study.

The most important aspect of this study is to find the lethal time for 100% mortality for any of the insect stages. This is shown in Table 1. Data in this table revealed that 100% mortality occured after 0.17-0.50 of exposing any stage of the fig moth to 60°C at 20% R.H. or 0.25-1.17 hours to 55°C at 20 and 70% R.H. or 0.75-4.00 hours at 50°C and 20% R.H. or 10.00-18.00 hours to 45°C with 20 and 70% R.H. This gives the freedom to choose any temperature for the suitable length of exposure time to cause 100% mortality of this insect.

The above results could be put into practice by finding the time required to raise the temperature to a lethal level in the centre of date mass.

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Table 1

Lethal time in hours for 100% mortality of different stages of *E. cautella* under various constant temperatures and 20 and 70% relative humidity

Stage	20% R.H.				70% R.H.			
	45	50	55	60°C	45	50	55	60°C
Egg	15.00	1.50	0.50	0.33	15.00	3.00	0.50	0.33
Larva								
1st instar	15.00	0.75	0.25	0.17	15.00	0.75	0.25	0.17
4th instar	18.00	1.75	1.17	0.50	18.00	1.50	1.11	0.58
Pupa	10.00	4.00	0.75	0.50	10.00	3.00	0.75	0.50
Adult	12.00	1.25	0.66	0.41	12.00	1.25	0.50	0.33

Table 2

Lethal time (LT) in hours estimated for 50% and 95% mortality of different stages of *Ephestia cautella* with 70% R.H.

Stage	45°C		50°C		55°C		60°C	
	LT50	LT95	LT50	LT95	LT50	LT95	LT50	LT95
Egg	6.6	12.0	1.4	2.0	0.3	0.4	0.24	0.3
Larva								
1st instar	9.0	11.0	0.45	0.56	0.15	0.20	0.13	0.15
4th instar	8.0	11.0	1.18	1.3	0.65	0.8	0.4	0.47
Pupa	6.8	7.8	1.3	1.8	0.4	0.5	0.24	0.3
Ault	6.0	7.8	0.98	1.0	0.3	0.4	0.2	0.2

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WHOLESOMENESS STUDIES WITH A FULL DIET OF IRRADIATED DATES, USING THE INSECT *Ephestia cautella* (Walker):

I. DISINFESTATION DOSES OF GAMMA RADIATION.

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Nuclear Research Centre, Tuwaitha, Baghdad, Iraq.

ABSTRACT

The study deals with the effect of feeding irradiated dates as a whole diet on some biological parameters of the fig moth *Ephestia cautella*. Statistical analyses of the results indicated that the differences in the following parameters were insignificant when measured and compared with insects reared wholly either on irradiated or on unirradiated dry dates fruits.

1. Average numbers of larvae and pupae produced out of 400 seeded eggs after 30 days of incubation.
2. Average percentage of adult survival and their sex-ratio.
3. Mating frequency (Average number of spermatophores per female) of the survived adults.
4. Average number of eggs laid per female.
5. Average percentage of egg hatchability.
6. Mating frequency, average number of eggs per female and average percentage of egg hatchability of F_1 progeny adults produced from insect parents reared on 100% diet of irradiated as well as on unirradiated dates.

★ Present addrss: SRC. Biological Research Centre, Jadiryia, Baghdad, Iraq.

Therefore, it could be concluded that disinfestation of date fruits by such a range of doses (50-100 krad) of gamma radiation might not have any adverse effect on the fig moth.

دراسات حول سلامة التمور المشعة المستعملة كغذاء كامل لحشرة عثة التين *Ephestia cautella*

١ ـ تأثير الجرعات المقترحة من أشعة كاما لتعقيم التمور من الحشرات

★ زهير صادق الحكاك، صديقة رجب علي، محمد سعيد هاشم أحمد وصديقة كاطع المالكي مركز البحوث النووية ـ التويثة ـ بغداد ـ العراق.

الخلاصة:

إن الدراسة الحالية تبحث في تأثير اطعام تمور على بعض القياسات الحيوية لحشرة عثة التين *E. cautella* . لقد دلت التحليلات الاحصائية للنتائج أن الفروق في القياسات الحياتية التالية كانت غير معنوية احصائياً إذا تمت المقارنة بين حشرات نامية بكل اطوارها سواء على تمور مشعة أو تمور غير مشعة: ـ

١ ـ معدل اعداد اليرقات والعذارى الناتجة بعد 30 يوماً حضانة من زرع 400 بيضة.

٢ ـ معدل النسبة المئوية والنسبة الجنسية للحشرات الكاملة الحية.

٣ ـ القابلية التزاوجية للبالغات الناتجة مقاسه بمعدل عدد حاملات السبرمات الموجودة في الجهاز الجنسي للاناث بعد تشريحها.

٤ ـ معدل عدد البيض الموضوعة للأنثى الواحدة.

★ العنوان الحالي:

مركز بحوث علوم الحياة ـ الجادرية ـ بغداد ـ العراق

٥ ـ معدل النسبة المئوية لتفقيس البيض .

٦ ـ القابلية التزاوجية ، معدل عدد البيض للأنثى الواحدة ومعدل النسبة المئوية لتفقيس البيض لحشرات الجيل الأول الناتجة من آباء تغذت ونمت طوال دورة حياتها على غذاء متكون من 100% تمور غير مشععة أو تمور مشععة بأشعة كاما .

لذا فمن الممكن الاستنتاج أن تعقيم التمور الجافة المخزونة باستخدام أشعة كاما (50 - 100 كيلوراد) لا يسبب أي تأثير ضار على عثة التين مقارنة بالتمور غير المشععة

INTRODUCTION

It is generally accepted that all developing countries need to increase their reserves of food commodities, not only for home consumption, but also to improve those agricultural products which can be exported for hard currency. These countries are greatly suffering from major losses in their output of agricultural products due to infestation with insect pests during the several steps of production. This might be mainly attributed to the fact that the current conventional methods of using chemicals, as methyl bromide in disinfestation of these products, impose several .limitations such as:

a) Adequate penetration of any fumigant might be difficult to obtain in some packaging materials even when proper fumigation techniques are used (8).

b) The development of resistant populations of the insects to the used chemicals (33).

c) Chemical treatments might create problems by injuring the products or by accumulation of undesirable residues after several fumigations (30).

d) Incomplete kill of the resistant insect stages to the used insecticide such as the eggs, pupae and possibly diapausing larvae (2).

In Iraq, large quantities of dry dates are usually infested in storage with several different species of stored-product insects causing considerable damages annually (17). Consequently, and due to the nutritive importance of these fruits for human consumption, date industry is continuously seeking a safer and more economical means of efficient control of insect pests during storage and exportation.

Accordingly, a new technique has been proposed and developed as an alternative method of controlling insect pests in dates and in a variety of raw and processed agricultural commodities. This technique involves the use of the lethal effect of gamma radiation to sterilize foodstuffs by the induction of sterility, life-shortening and death of the different insect species (1, 3, 4, 5, 7, 29). In this respect, a research program to thoroughly explore the potential of gamma radiation for the control of stored date insects was initiated at the Nuclear Research Centre, Baghdad in 1967. So far, the results obtained from the numerous studies carried out within this program are very promising (2, 7, 8). Furthermore, it has been initially realized that since insect disinfestation of dates by such method will necessitate the irradiation of the commodity, therefore simultaneous studies were also performed on the detection of any changes that might occur in the chemical composition (i.e. sugar, proteins and flavour compounds) of irradiated dates (12, 13, 18). The results from these studies have led to a conclusion that utilization of low doses (50-100 krad) of gamma radiation from a cobalt-60 source might offer an excellent solution to the problem of dry date disinfestation from insects in Iraq in order to comply with the quarantine inspection measures at the borders of importing countries. However, it is generally inevitable that wholesomeness tests be performed before any international clearance could be granted to irradiate any food. As usual, such tests have been mainly based on animal feeding, using the same criteria as for the safety assessment of food aditives (23). However, it has been recently realized that in such feeding trials, the given diet always constitute only a small fraction of irradiated food, hence, it might lead to non-realistic conclusions (25.26). Furthermore, the joint FAO/IAEA/WHO expert committee on the wholesomeness of irradiated food has recently considered that food irradiation is a food - treatment

process, comparable to other physical processes, and recommended that safety evaluation of these foods should be approached on the basis of better knowledge of both qualitative and quantitative changes in the food caused by radiation (31). Furthermore, a number of investigators have considered the use of insects as a laboratory organism in the safety assessment of irradiated food. This might be due to the fact that some stored-product insects can be fed and reared on a 100% diet of irradiated agricultural products, and secondly they possess high and rapid reproductivity making their cost of rearing and experimentation relatively low. Irradiated flour, wheat, raisin, nutmeat and dates have been fed to several insect species. However, the majority of the reported results of different physiological aspects of these insects indicated that these foods items have no deleterious effect on the insects studied (6, 9, 14, 20, 21, 22). On the other hand the reported results of the mutagenic effect of different food components in semisynthetic diet of *Drosophila melanogaster* appear to be conflicting and need further investigations. (16, 19, 20, 24, 28).

Ephestia cautella is a very serious pest of stored date in Iraq, and dry date fruits constitute an adequate natural food for the larvae of this moth. Therefore, the present studies were carried out to explore the genetical and developmental effects of irradiated date fruits using this moth as a test animal in feeding experiments in order to contribute some needed informations on the wholesomeness of disinfested dates by comparatively low doses of gamma radiation.

MATERIALS AND METHODS

The required numbers of Zahdi date fruits were selected, their perianths gently removed using a fine forceps, then put in polythelene bags before irradiation with the designated doses of gamma radiation from Cobalt-60 source of the type Gamma-Cell 220 at a dose rate of 50 krad per second. The first batch of dates irradiated with 50 krad, the second one with 100 krad. The third untreated batch was kept alongside as a control. Immediately after treatment, these fruits were placed into a number of one-litre beakers, each one with 40 dates, and kept aside to be seeded later with

Ephestia cautella eggs.

The wild type strain of *Ephestia cautella* used in the present study was originally obtained from IAEA Entomological laboratories in Vienna, and maintained as a culture for several years on a special rearing medium composed of 70% crushed wheat, 12% glycerine, 12% date syrup (dibis) and 6% dried baker's yeast in an approximate ratio of one gram food to one seeded egg.

The eggs were obtained by placing 12-15 pairs of young adults in a glass lantern fitted with a mesh screen and fixed onto crystallizing dish. The laid eggs usually dropped through the screen into the dish. The eggs were collected within a period of 48 hours and were divided into several batches of 400 eggs each, and placed on a wet black filter paper.

The infestation of irradiated dates were carried out by transferring each one of the egg batches onto the upper surface of the dates in the beakers, then all beakers were tightly sealed and incubated at 25° C and 50-60% R.H.

After an incubation period of 30 days, all the beakers were opened and each date fruit was carefully examined. Insects at all developmental stages were counted and recorded. The pupae from all beakers were taken out, counted then sexed using the easily distinguished testes through the dorsal surface of the male. Usually every 2-3 pupae of each sex were put in a single shell vial, and incubated at the above mentioned environments for adult emergence. On the other hand, the immature stages (larvae) were left in the beakers to complete their development for another 30 days. During this period, all beakers were examined 2 times a week for pupation and subsequent adult emergence. The adults collected were counted and different crosses were made either between themselves or with moths from the laboratory wild type stocks which are usually fed on the medium previously mentioned. Female fecundity, as measured by the average number of eggs per female, mating frequency determined by the number of spermatophores per female, and the percentage of egg hatchability as an indicator for the induction of dominant lethal mutations have been assessed.

Furthermore, in some experiments samples of eggs from all crosses were reared on laboratory medium and the F_1 adults were studied for inherited sterility.

RESULTS AND DISCUSSIONS

Table 1 shows the developmental results of larvae and pupae on Zahdi dates treated with 0 (control), 50 or 100 krad of gamma radiation. It can be conspicuously seen that no deleterious effect could be found on the average numbers of larvae and pupae produced out of 400 eggs. In fact, slight but insignificant increment was noticed in the survival of the larvae when reared on dates irradiated with 100 krad of gamma radiation. Similarly, slight but not significant improvement was also noticed in the survival of adult moths reared on 100-krad irradiated dates, as it is shown in Table 2. Furthermore, no significant differences could be found in the sex-ratio of the survived adults as well as in the average numbers of malformed adults produced.

The results of different crosses made between adults developed either on unirradiated or on 50 and 100 krad irradiated date fruits, and adults of the opposite sexes reared on laboratory medium are listed in Tables 3 and 4, respectively. Statistical analyses of these results clearly indicate that irradiation of dry date fruits with such doses of gamma radiation did not cause significant changes in the average numbers of eggs or matings per female, as well as in the rate of induced dominant lethal mutation reflected by the average percentage of egg hatchability.

Table 5 shows the results of different crosses of F_1 progeny adults produced from parents developed from egg to adult on 100-krad irradiated Zahdi dates. These progeny reared from egg to adult on laboratory diet. The overall data indicate no significant differences could be detected in the studied physiological and genetical parameters in F_1 insects whose parents were developed on irradiated dates, suggesting that inherited sterility has not been induced as a consequence of feeding the parents on irradiated dry date fruits with low doses of gamma radiation (1-5, 7, 8).

The presented data are in a good agreement with the results reported by

several authors using other insects species on different irradiated food items (6, 10, 11, 15, 20, 21, 22); Brower and Tilton 1973; Ahmed et al. 1973. Accordingly, these results are considered of major importance to date industry in Iraq, because they throw some light on the validity of utilizing gamma radiation as an effective, clean and safe technology for the disinfestation of dry dates from stored-product insects. In this respect, it is worth mentioning that the results presented herein were included as a priliminary data in the list of scientific reports examined as evidence by the Joint FAO/IAEA/WHO Expert Committe convened in Geneva in 1980 to asses the whole-someness of irradiated food. The evaluation was unconditional acceptance of dates irradiated for the purpose of controlling insect infestation at an average dose of up to 1 KGy (i.e. 100 krad) (32).

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Table 1:

Average Numbers of Larvae and Pupae Developed from 400 Eggs of *Ephestia cautella* Reared on Irradiated or on Unirradiated Dates (Zahdi Variety) for 30 Days (10 Replicates).

Dose krad	No. of Larvae ± S.D.	No. of Pupae ± S.D.	No. of Larvae + Pupae ± S.D.	% Survival ± S.D.
0	147.10 ± 7.03 a	0.80 ± 0.79 a	147.90 ± 6.72 a	36.98 ± 1.68 a
50	149.80 ± 8.92 a	1.00 ± 0.82 a	150.80 ± 8.64 a	37.70 ± 2.11 a
100	154.00 ± 10.24 a	0.90 ± 0.74 a	154.90 ± 9.94 a	38.78 ± 2.48 a

N. B. Averages of the same column, followed by the same letter are not significantly different at $P < 0.05$.

Table 2:

Average Number of Normal and Malformed Adults Developed from 400 Eggs of *Ephestia cautella* Reared on Irradiated or on Unirradiated Dates (Zahdi) for 60 Days. (10 Replicates).

Dose krad	No. of normal adults ± S.D.	no. of malformed adults ± S.D.	No. of total adults ± S.D.	% Survival ± S.D.	% female ± S.D.
0	99.20 ± 7.32 a	5.60 ± 1.35 a	104.80 ± 6.92 a	26.20 ± 1.73 a	54.12 ± 4.35 a
50	97.20 ± 7.05 a	6.80 ± 1.48 a	104.00 ± 6.76 a	26.00 ± 1.50 a	53.23 ± 4.44 a
100	102.80 ± 9.86 a	5.80 ± 1.93 a	108.60 ± 10.32 a	27.15 ± 2.58 a	58.82 ± 5.64 a

N.B. Averages of the same column, followed by the same letter are not significantly different at $P < 0.05$.

Table 3:

Fecundity, Egg Hatchability and Mating Frequency of Different Crosses of *Ephestia Cautella* Adults Reared on 50 krad Irradiated or on Unirradiated Dates.

Crosses	Control Zahdi Dates				50 krad Irradiated Zahdi Dates			
FXM	No. of pairs	No. of eggs/ ♀ ± S.D.	Hatch. % ± S.D.	No. of spermatophore ± S.D.	No. of pairs	No. of eggs/ ♀ ± S.D.	Hatch. % ± S.D.	No. of spermatophore ± S.D.
N X R	44	283. 64 ± 105.70	82.89 ± 17.80	1.41 ± 0.58	53	325.19 ± 103.62	81.38 ± 18.01	1.53 ± 0.95
R X N	50	270.00 ± 110.10	88.71 ± 14.48	1.38 ± 0.60	38	273.66 ± 105.06	84.72 ± 13.36	1.39 ± 0.64
R X R	48	271.81 ± 73.49	82.21 ± 15.09	1.35 ± 0.78	41	294.05 ± 99.45	84.15 ± 18.62	1.29 ± 0.60
N X N	40	316.95 ± 90.16	83.92 ± 14.23	1.40 ± 0.67				

N = Control Adults i.e. (fed on crushed wheat + 12 % glycerine).

R. = Treated Adults i.e. (fed on either irradiated or on unirradiated dates).

Table 4:

Fecundity, Egg Hatchability and Mating Frequency of Different Crosses of *Ephestia cautella* Adults Reared on 100 krad Irradiated or on Unirradiated Dates.

Crosses	Control Zahdi Dates				100 krad irradiated Zahdi Dates			
FXM	No. of Pairs	No. of eggs/0 ♀ ± S.D.	hatch.% ± S.D.	No. of spermato-phore ± S.D.	No. of Pairs	No. of eggs/0 ♀ ± S.D.	Hatch.% ± S.D.	No.of sper matophore ± S.D.
N X R	49	317.16±70.43	85.92±13.24	1.35±0.67	48	328.25±67.93	83.10±12.81	1.41±0.65
R X N	54	259.57±62.72	85.47±14.28	1.24±0.52	49	250.76±71.20	88.76±9.18	1.26±0.49
R X R	47	256.55±66.60	83.11±15.46	1.37±0.84	38	257.16±66.78	86.39±10.01	1.29±0.80
N X N	25	329.60±100.76	81.83±17.00	1.32±0.63				

N: Control Adults i.e. (fed on crushed wheat + 12% glycerine).

R: Treated Adults i.e. (fed on either irradiated or on unirradiated dates).

Table 5:

Fecundity, Egg Hatchability and Mating Frequency of F_1 Progeny Adults of *Ephestia cautella* when their Parents were Reared on 100 krad Irradiated or Unirradiated Zahdi Dates.

Crosses	Control (Unirradiated Date)				100 krad Irradiated Date			
FXM	No. of pairs	No. of eggs/ female±S.D.	Hatch.% ± S.D.	No. of spermato-phore±S.D.	No. of pairs	No. of eggs/ female±S.D.	Hatch % ± S.D.	No. of sper-matophore ± S.D.
N X R	49	317.2±70.4	85.9 ± 13.2	1.3±0.6	48	328.2±67.9	83.1±12.8	1.4±0.6
N X F_1	24	312.0±109.9	77.9±15.0	1.1±0.3	19	265.7±88.4	75.7±19.3	1.7±0.9
F_1 X N	19	366.6±93.5	88.3±7.6	1.6±0.7	18	327.2±107.3	83.4±15.5	1.5±1.0
F_1 X F_1	23	399.1±81.1	80.9±13.0	1.3±0.51	22	298.9±86.5	80.7±12.5	1.4±1.2
R X N	54	259.5±62.7	85.4±14.3	1.2±0.5	49	250.7±71.2	88.7±9.1	1.3±0.5
N X F_1	22	336.9±88.8	84.5±8.4	1.1±0.3	22	291.1±82.1	77.5±23.6	1.5± .8
F_1 X N	23	290.3±112.1	83.1±18.6	1.9±0.4	21	338.5±91.4	85.4±9.4	1.4±0.6
F_1 X F_1	19	332.6±68.3	82.6±11.6	1.2±0.4	22	350.2±58.1	80.6±13.6	1.4±0.6
R X R	47	256.5±66.6	83.1±15.4	1.4±0.8	38	257.1±66.9	86.3±10.0	1.1±0.3
N X F_1	14	248.3±84.7	78.2±17.0	1.2±0.4	17	283.0±69.5	80.6±10.4	1.0±0.0
F_1 X N	21	255.6±76.6	87.0±8.0	1.3±0.7	19	308.6±108.6	78.8±23.0	1.3±0.6
F_1 X F_1	18	355.5±102.2	80.1±11.8	1.2±0.4	15	342.3±74.6	82.5±11.4	1.2±0.6

F & N: Adults developed on rearing medium, R: Adults developed on 100 krad irradiated or on unirradiated dates.

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PROCESSING OF FIVE MAJOR SAUDI ARABIAN DATE VARIETIES INTO 'DATE BUTTER' AND 'DATES IN SYRUP'

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ABSTRACT

Five major Saudi Arabian date varieties, namely, Khudari, Sullaj, Barni, Ruzeiz and Sifri, were studied for their suitability in "date-butter" and "dates-in-syrup" processing both with and without the addition of flavours such as Banana, Orange, Grapefruit, Almond and Cloves. The products were processed in a food pilot plant and the prepared products were tested for their physico-chemical and organoleptic characteristics. Physico-chemical measurements indicated that "date-butter" and "dates-in-syrup" products conformed to the desired product stadards. Sensory evaluation tests showed that acceptable "date-butter" and "dates-in-syrup" products could be prepared from all the tested date varieties. The inclusion of flavours in both of the products, at specific levels were found equally acceptable, except that almond flavour adversely affected the acceptability of date-butter products.

تصنيع زبدة التمر والتمر في الشراب لخمسة اصناف رئيسية في السعودية

هـ . ا . خاتجادوريان ، و . ن . صوايا ، ج . ك . خليل وا . س . ماشادي

المشروع الاقليمي لمركز البحوث الزراعية والمياه

/وزارة الزراعة والمياه

الرياض ـ المملكة العربية السعودية

الخلاصة

أجريت دراسة لصلاحية ثمار خمس أصناف من تمور المملكة العربية السعودية

وهي خضيري، سلاج، بارني، رزيز وصفري لتصنيع (زبدة التمر) و(التمر في الشراب) مع اضافة نكهة كالموز، البرتقال، القريبفروت، اللوز والقرنفل وعدم اضافة النكهة. تم اعداد المنتجات في مختبر للغذاء ثم أجرى اختبار لخصائصها الفيزيوكيمائية والعضوية. أوضحت الاختبارات مطابقة زبدة التمر والتمر في الشراب للمواصفات القياسية المطلوبة لهذه المنتجات. وأوضح اختبار التذوق صلاحية جميع الأصناف المدروسة لصناعة هذه المنتجات. زادت اضافة النكهة لمدى الاقبال على المنتوجين عدا اللوز، حيث لوحظ ان اضافته لزبدة التمر ينفر المستهلك.

INTRODUCTION

Dates (*Phoenix dactylifera* L.) are a high-energy fruit and have been used as a staple food for thousands of years in the desert regions of the world. The Kingdom of Saudi Arabia, with over 400 varieties of dates, and a yearly production of 350,000 tons is regarded as one of the major producers of dates in the world (3).

Most of the dates in the Kingdom are consumed fresh at their 'Rutab' and 'Tamar' stages of development. However, large quantities of surplus dates are dried and used later during the off-season. The availability of large quantities of dates in the Kingdom offers a possibility to process dates into various products, Some date varieties have been studied for their suitability for jam-making in different countries (6, 10). A food commodity called date-syrup and locally known as Rub Al-Tamar is produced in Libya (5). In general, studies dealing with the development of new date products are limited in the literature.

The present study was undertaken to investigate the possibilities of utilizing five major date varieties from the Kingdom, namely, Khudari, Sullaj, Barni, Ruzeiz and Sifri, into the processing of 'Date-butter' and 'Dates in Syrup'.

MATERIALS AND METHODS

Collection and Preparation of Samples

Samples of five major date varieties, Khudari, Sullaj, Barni, Ruzeiz and Sifri, were collected from the palm-tree plantation adjacent to the Regional Agriculture and Water Research Center, Riyadh, Saudi Arabia. The collected samples of the date fruits of all the varieties were sorted, washed in a stainless steel basin and dried by spreading on a stainless steel table. For the preparation of date butter, date-pulp was prepared from the freshly collected dates (Tamar stage) by boiling weighed amounts of dry dates in potable water (1:6) in a cooking kettle (Lee Metal Products, Philadelphia) for 40 minutes until soft. The date pulp was obtained by passing the cooked dates through a pulper finisher (Langsen Kamp, Indianapolis, U.S.A. Model 18) to separate the seeds and culls. The pulp so obtained was weighed and the percentage of dates in the pulp calculated.

In case of 'dates in syrup' processing, the washed and dried dates (Khalal stage) were placed in an abrasive drum peeler (Champion Products, England) for about 2 minutes to remove the peel and thus facilitate the diffusion of the syrup inside the fruits. The peeled dates were pitted manually to be utilized for dates-in-syrup products.

PREPARATION OF PRODUCTS

a) *Date-butter*

Before processing, several parameters were studied such as the sugar/dates in the pulp ratio, different acidulents to adjust the pH and kinds and levels of flavourings. These trials resulted in the recommendation of the final recipe for the five date cultivars shown in Table 1. In all the trials, the pH of the pulp (5.60-5.90) was adjusted to 4.6 by the addition of 20% solution of citric acid in the preliminary trials and calculating the amount of the solid acid needed for the test trials. The pulp was added to a cooking pan and heated for a few minutes after which the necessary amount of sugar was added. The mixture was cooked with continuous stirring. The calculated amount of citric acid was added a few minutes before the total soluble solids

value approached 74-75° Brix. After reaching the desired Brix value, cooking was stopped and the various natural flavours were added. The flavours added were orange and banana at 0.045% and almond at 0.036% of the amount of sugar plus dates-in-pulp. The products were then filled into plastic cups, tightly covered and stored at room temperature. The product designated as control did not contain any added flavour. In another batch that was similarly processed, 0.1% of potassium sorbate was added (2) and mixed thoroughly before filling into the plastic cups.

b) *Dates-in-syrup*

For the dates-in-syrup processing, the peeled and pitted dates were placed in a syrup of 50° Brix whose pH was adjusted from 7.25 to 2.8, and boiled for a period of 30-40 minutes in a cooking kettle. The calculated amount of citric acid was added before the total soluble solids reached a value of 75° Brix and the product was mixed thoroughly. Finally, various flavours including orange, banana, grapefruit and almond (Givaudan Corp., Clifton, J.J., U.S.A.) and clove buds were added. The amounts of orange (F-1625), banana (R-1075) and grapefruit (F-7468) added were 0.045% and that of almond (R-370) flavour 0.029% of the amount of sugar plus dates-in-syrup. The amount of clove buds added was 10g buds for every 550 g of dates-in-syrup. The end product was reached when the final Brix of the syrup reached 75° Brix. The products were filled in glass jars, capped and stored. The product designated as control did not contain any added flavour.

Physical Characterization Tests

The pH of the date pulp in case of date butter and syrup in cases of dates-in-syrup, as well as the pH of the finished products, were measured by a pH meter (Beckman, Model 35000). Total Soluble Solids (TSS) expressed at Brix° were determined by using an Abbe Refractometer with temperature adjustment (American Optical, Model 10450).

Analysis for Yeast and mold

Samples of date-butter, both with and without potassium sorbate, were examined for the growth of yeast and molds. The yeast and mold count was done by using standard bacteriological and analytical method (BAM) using potato-dextrose acidified medium (1).

Sensory Evaluation

The finished products were presented to a taste panel of 12-16 judges selected randomly from colleagues at the Research Center including Saudi nationals as well as expatriates. Each judge was presented with three samples at one time including one control and two test samples. The judges were asked to evaluate the products for colour, taste and overall acceptability on the basis of preference test using the hedonic scale from 9-1 with 9 being the most liked and 1 the most disliked (4). The data so obtained was statistically analysed by the analysis of variance method (9). The F-values were calculated and the significance of probability at 5% level determined.

RESULTS AND DISCUSSION

Physical and Chemical Characteristics of the Date Varieties

Information on the physical and chemical characteristics of the different date varieties under investigation to be utilized for the manufacturing of the various date products is considered of practical importance, especially for the selection of the most suitable varieties for such a purpose. Such data were selected from published work from our laboratory (6,7).

Physical Analysis

1. *Date-Butter*

   Each of the five varieties of dates (Sullaj, Khudari, Barni, Sifri and Ruzeiz) was separately employed in the preparation of date-butter. The pH and Brix° of the various date-butters prepared from the five date varieties are shown in Table 4. There was an increase in the pH of all the date butters after a storage period of 90 days at 25°C. The initial pH of 4.60 increased to a range of 4.73-4.75 for all the prepared butters. This might be explained on the basis that the equili-

brium in pH was reached after a time elapse when there was no more ionic disequilibrium.

The Brix° of the date-butter at filling ranged between 75.0-75.2°. There was a slight decrease in the total soluble solids after a storage period of 90 days at 25°C. This change is explained on the basis that there is a tendency of a slight loss of moisture from the dates-in-pulp to the preserving medium (sugar) till an equilibrium in solute concentration is reached.

2. *Dates-in-syrup*

Three varieties of dates, namely, Sullaj, Ruzeiz and Khudari, were employed in the preparation of dates-in-syrup. The pH and Brix° values of the different dates-in-syrup products are listed in Table 5. The initial pH of the syrups exhibited an increase after storage for 90 days at 25°C. This increase occurred from 2.80 to a mean value of 3.40 for syrups prepared from Ruzeiz and Khudari varieties and to 3.47 for the syrup from Sullaj dates because of equilibration of solutes as in the case of date-butter.

The Brix° values of the syrup were different in the various syrups at the time of filling. The average Brix° value for syrup prepared from Sullaj dates was 74.9°, for Ruzeiz 75.5° and for Khudari 75.2°. After storage for 90 days at 25°, these products showed a decrease in the total soluble solids to 71.9°, 72.2° and 71.5° for the syrups prepared from Khudari, Sullaj and Ruzeiz varities, respectively. The decrease in the Brix° values was probably due to the diffusion of sugars in the syrup to the fruits until an equilibirum was established.

Mold and Yeast Growth

Since the date-butter was stored in plastic cups instead of hermetically sealed jars, it was necessary to investigate the vulnerability of the prepared date-butter to the growth of yeast and molds. For this purpose, 0.1% of potassium sorbate was included in one batch of the processed date-butter. After a storage period of 18 months at room temperature, the date-butters with and without sorbate were examined for yeast and molds. The results

showed that in both batches the total number of yeast cells and mold were 10/g sample. Therefore, storage of date-butter for 18 months without the addition of any antimicrobial agent is possible and will not allow growth of yeast or mold cells.

Sensory Evaluation

Date-butter

Results of the sensory (hedonic) evaluation of the date-butter are presented in Table 6. The data are the mean scores of 14 responses. The panelists' preference ranged in the control products from liking the products slightly (score 6) to liking it moderately (score 7) with respect to colour, from liking it moderately (score 7) to liking it very much (score 8) with respect to taste and overall acceptability on the basis of a 9-point hedonic scale. The addition of 0.045% orange and banana resulted in products which were comparable to the control. However, the inclusion of 0.036% almond flavour adversely affected the scores for taste and overall acceptability of the product made from Ruzeiz, Sullaj, Sifri and Barni varieties of dates. Only Khudari variety showed scores for almond flavoured date-butter which did not differ significantly from the control with respect to colour, taste and overall acceptability. It may be concluded that acceptable date-butter can be prepared from date pulp alone and with the addition of flavours such as orange and banana flavours.

Because date varieties differ in their physical and chemical characteristics, it was considered desirable to study the effect of the individual date variety on the organoleptic properties of the final product. Results obtained (Table 7) showed that there was no significant difference of the five date varieties employed with respect to colour, taste and overall acceptability, suggesting that acceptable and comparable date-butters can be prepared from all the five date varieties used in this study.

Dates-in syrup

Results of the sensory evaluation of dates-in-syrup prepared from three date varieties, Sullaj, Ruzeiz and Khudari with and without the addition of five flavours, orange, grapefruit, banana, almond and cloves, are shown in Table 8. In all the products, the average score ranged between 6-8 for co-

lour, taste and overall acceptability on a 9-point hedonic scale. Only the taste score for the product made from Sullaj variety of dates and containing banana flavour was significantly lower than that of the control product. This low score, however, did not affect significantly the overall acceptability of the product. The data showed that acceptable dates-in-syrup product can be processed from the above three date varieties with and without the addition of the different flavours used in this experiment.

When the control products made from the three date varieties were compared with one another by a triangular test (Table 9), no significant differences were observed for the colour, taste and overall acceptability scores which ranged between 6-8, and suggested that equally acceptable products could be obtained from any of the date varieties studied.

In conclusion, it can be stated that various date varieties can be successfully employed in the manufacture of date-butter and dates-in-syrup. Various flavours such as banana, orange, grapefruit and clove buds can also be included to diversify the product range enabling the consumer to exercise his choice from a variety of products. The successful preparation of date-butter and dates-in-syrup points toward the possibility of introducing new date-based products into the market thus introducing a new channel for the utilization of large quantities of surplus dates available in the Kingdom and other date producing countries.

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Table 1

Recipes for "Date-Butter" and "Dates-in-syrup" made from various date varieties.

	Date-Butter					Dates-in-syrup			
Variety	pH of Pulp	Adjusted pH of pulp	% Dates in pulp	Citric acid[a] added (%)	Sugar Dates in pulp ratio	pH of syrup	Adjusted pH of syrup	Citric acid[a] added (%)	Sugar/dates ratio
Khudari	5.60	4.6	27.5	0.20	40/60	7.25	2.8	0.15	66/34
Sullaj	5.90	4.6	27.7	0.22	40/60	7.25	2.8	0.17	66/34
Barni	5.90	4.6	32.0	0.19	40/60				
Ruzeiz	5.70	4.6	37.1	0.18	40/60	7.25	2.8	0.16	66/34
Sifri	5.70	4.6	32.9	0.18	40/60				

a. Amount of citric acid added was percent of sugar plus dates-in-pulp or sugar plus dates-in-syrup.

Table 2
Physical characteristics[a] of dates at the Khalal and Tamar stages of maturity.

Variety	Stages of maturity	Weight/ fresh fruit (g)	Weight/stone (g)	Pulp %[b]	Fruit length (mm)	Fruit diameter (mm)	Color
Khudari	Khalal	17.10	1.51	91.2	46.4	26.1	Red
	Tamar	13.96	0.97	93.1	42.6	24.5	Dark brown
Sullaj	Khalal	8.42	1.39	83.5	36.9	20.2	Yellow
	Tamar	7.83	0.82	89.5	36.9	20.3	Golden brown
Barni	Khalal	12.18	1.58	87.0	36.7	23.5	Golden yellow
	Tamar	9.83	1.39	85.9	35.4	23.2	Dark brown
Ruzeiz	Khalal	10.46	1.13	89.2	29.7	23.4	Golden yellow
	Tamar	9.31	0.71	92.4	27.5	22.0	Dark brown
Sifri	Khalal	10.57	1.37	87.0	38.5	22.7	Golden yellow
	Tamar	8.72	0.78	91.2	33.0	19.2	Reddish brown

a. Selected from Sawaya et al (6, 7).

b. $\text{Pulp } \% = \frac{\text{wt. of fruit} - \text{wt. of stone}}{\text{wt. of fruit}} \times 100$

Table 3

Chemical composition[a] of dates at Khalal and Tamar stages of maturity.

Variety	Stages of maturity	Moisture (%)	Dry weight basis (%)								
			Protein	Crude fat	Crude fiber	Ash	Total Sugar	Reducing sugar	Sucrose	Vit.-A (I.U./100g pulp)	Vit-C mg/100g pulp
Khudari	Khalal	67.7	3.13	0.18	4.68	2.87	78.9	53.2	25.7	—	6.51
	Tamar	27.8	2.38	0.20	2.41	2.01	85.1	83.7	1.4	—	1.32
Sullaj	Khalal	73.0	3.69	0.15	5.61	2.68	69.9	50.4	19.5	—	6.58
	Tamar	19.6	2.31	0.16	2.96	2.31	73.8	72.3	1.5	—	1.83
Barni	Khalal	40.7	2.87	0.36	3.15	2.90	84.0	73.6	10.4	183	5.68
	Tamar	26.6	2.56	0.20	2.35	2.23	84.7	79.8	4.9	43	2.68
Ruzeiz	Khalal	62.9	3.37	0.19	5.47	2.96	75.8	61.4	14.4	187	3.66
	Tamar	9.6	3.12	0.32	4.24	2.56	75.9	70.9	5.0	63	2.95
Sifri	Khalal	73.0	4.06	0.14	4.03	2.11	83.9	59.4	24.5	347	6.14
	Tamar	11.3	3.62	0.12	2.69	2.01	79.9	76.1	3.8	75	2.21

a. Selected from Sawaya et al (6, 7)

Table 4
pH and Brix° values[a] of date butter.

Variety used	Pulp pH	Adjusted pH of pulp	pH of date butter[b] after 90 days at 25°C	Brix° at filling[b]	Brix° after 90 days
Sullaj	5.90	4.60	4.75 (4.70-4.80)	75.0 (74.3-75.9)	74.6 (73.9-75.2)
Khudari	5.60	4.60	4.75 (4.70-4.80)	75.20 (74.8-75.6)	74.4 (74.0-74.7)
Barni	5.90	4.60	4.73 (4.70-4.75)	75.1 (74.9-75.4)	74.6 (73.9-75.0)
Sifri	5.70	4.60	4.74 (4.70-4.80)	75.0 (74.6-75.5)	74.9 (73.8-75.9)
Ruzeiz	5.70	4.60	4.74 (4.70-4.85)	75.1 (74.8-75.0)	74.7 (74.1-75.9)

a. Means of 4 randomly selected cups for each type of product including the flavored ones.
b. Figures in parentheses indicate the range values of pH and Brix° for the control and the flavored date butters.

Table 5.

pH and Brix° values[a] of dates-in-syrup products.

Variety used	Pulp pH	Adjusted pH of pulp	pH of syrup[b] after 90 days at 25°C	Brix° at filling[b]	Brix° after 90 days[b]
Sullaj	7.25	2.80	3.47 (3.40-3.50)	74.9 (74.3-75.3)	72.2 (70.9-72.7)
Ruzeiz	7.30	2.80	3.40 (3.30-3.50)	75.5 (74.8-76.4)	71.5 (70.8-71.8)
Khudari	7.25	2.80	3.40 (3.25-3.50)	75.2 (74.4-76.7)	71.9 (71.2-72.6)

a. Means of 4 randomly selected jars for each type or product including the flavored products.

b. Figures in parentheses indicated the range values of pH and Brix° for the control and the flavored products.

Table 6.

Sensory Evaluation Scores[a] of "Date Butter" Products Processed from Five Different Date Varieties and with Different Flavors.

Date variety and flavor	Characteristics Evaluated		
	Color	Taste	Overall acceptability
Ruzeiz Control	6.86	7.14	7.36
Ruzeiz Banana	6.79	7.29	7.14
Ruzeiz Orange	6.64	7.27	7.29
Ruzeiz Almond	6.64	6.00[b]	6.21[c]
LSD 5%	1.02	1.24	1.14
Sullaj Control	6.86	7.43	7.50
Sullaj Banana	6.57	7.07	7.00
Sullaj Orange	6.43	7.43	7.21
Sullaj Almond	6.50	5.93[d]	6.14[e]
LDS 5%	1.50	1.04	0.96
Khudari Control	6.57	6.93	6.57
Khudari Banana	6.64	6.93	6.79
Khudari Orange	6.86	7.57	7.36
Khudari Almond	6.71	6.86	6.86
LSD 5%	1.35	1.10	1.16
Sifri Control	6.64	7.57	7.64
Sifri Banana	6.50	6.93	7.08
Sifri Orange	6.57	7.21	7.17
Sifri Almond	6.57	6.50[f]	6.57[g]
LSD 5%	1.48	1.02	0.99
Barni Control	6.64	7.36	7.50
Barni Banana	6.64	6.93	7.07
Barni Orange	6.57	6.86	7.07
Barni Almond	6.43	6.50	6.43[h]
LSD 5%	1.55	1.20	0.97

a: Scores mean of 14 responses

b, c, d, e, f, g, h: Significant differences at the 5% level ($P < 0.05$)

Table 7.

Sensory Evaluation Scores[a] of "Date Butter"[b] Products Processed from Five Different Date Varieties.

Variety	Characteristics Evaluated		
	Color	Taste	Overall acceptability
Khudari	5.84	6.50	6.25
Sullaj	6.34	7.00	6.92
Barni	5.58	6.08	5.92
Ruzeiz	6.50	6.67	6.50
Sifri	5.58	6.42	6.00

a. Scores mean of 12 responses.

b. "Control" products used for sensory evaluation.

Table 8.

Sensory Evaluation Scores[a] of "Dates in Syrup" Products Processed from Three Different Varieties and with Five Different Flavors.

Date variety and flavor	Characteristics Evaluated		
	Color	Taste	Overall acceptability
Khudari Control	7.07	7.43	7.43
Khudari Orange	7.50	7.50	7.43
Khudari Grapefruit	6.93	6.71	6.79
Khudari Banana	7.57	7.21	7.14
Khudari Cloves	7.36	7.00	7.14
Khudari Almond	7.14	7.14	7.21
Sullaj Control	6.71	7.00	7.00
Sullaj Orange	6.79	6.29	6.64
Sullaj Grapefruit	7.07	7.07	7.14
Sullaj Banana	7.21	5.36[b]	5.86
Sullaj Cloves	6.64	7.71	6.29
Sullaj Almond	6.86	7.14	7.00
Ruzeiz Control	7.79	7.36	7 43

Continue Table 8.

Date variety and flavor	Characteristics Evaluated		
	Color	Taste	Overall acceptability
Ruzeiz Orange	7.64	7.36	7.36
Ruzeiz Grapefruit	7.57	7.29	7.00
Ruzeiz Banana	7.79	7.57	7.57
Ruzeiz Cloves	7.50	6.71	6.71
Ruzeiz Almond	7.29	6.43	6.71

a. Scores mean of 14 responses.
b. Significant differences at the 5% level ($P < 0.05$).

Table 9.

Sensory Evaluation Scores[a] of "Dates in Syrup[b]" Products Processed from Three Different Date Varieties.

Variety	Characteristics Evaluated		
	Color	Taste	Overall acceptability
Khudari	7.61	7.71	7.71
Sullaj	6.89	6.86	6.93
Ruzeiz	7.71	7.36	7.32

a. Scores mean of 14 responses.
b. Control Products without flavors.

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RIPENING OF KHASAB DATES BY SODIUM CHLORIDE AND ACETIC ACID

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ABSTRACT

Studied the effects of varying levels of NaCl and acetic acid alone and in combination on Khasab dates, harvested at Khalal stage. Both NaCl and acetic acid induced softening of berries. However, the action of NaCl was far more intense than that of acid. In combination treatments (NaCl + acetic acid) the action of acid was more strong and effective than when used singly. Maximum softening was noted in 1% NaCl + 2% acetic acid, and 4% NaCl treatments. Treatments also influenced fruit appearence, weight, % pulp, seed weight, pulp/seed ratio and water content. The softened dates were edible, agreeable and marketable.

انضاج ثمار الخصاب بكلوريد الصوديوم وحامض الخليك

مير . ي آصف وعثمان الطاهر
كلية الزراعة/جامعة الملك فيصل/ المملكة العربية السعودية

الخلاصة

أجريت دراسة لاستخدام معايير مختلفة من كلوريد الصوديوم وحامض الخليك منفردة ومجمعة لانضاج ثمار الخصاب المحصودة في مرحلة الخلال . كان اضافة المادتين مؤثراً في انضاج الثمار غير أن مادة كلوريد الصوديوم كانت أكثر مفعولاً من الحامض . في المعاملات المجتمعة (كلوريد الصوديوم + حامض

الخليك) كان أثر الحامض أكثر من استخدامه منفرداً . لوحظ أن أكثر المعاملات فعالية هي 1% كلوريد الصوديوم + 2% حامض الخليك 4% كلوريد الصوديوم . أثرت المعاملات أيضاً على مظهر الثمار ووزنها ونسبة اللب ووزن البذور ونسبة اللب للبذور ومحتويات الماء . كانت الثمار الناضجة مقبولة وصالحة للأكل والتسويق .

INTRODUCTION

Khasab is a medium sized soft fruited cultivar of date (*Phoenix dactylifera* L.) widely grown in the Kingdom of Saudi Arabia. It is the latest ripening date in the Eastern Province, where at least some palms of Khasab are maintained in almost every garden. It finds ready acceptance and is in demand. This late harvested date is not adapted to curing. Softening and ripening on the palm is very slow. It is not uncommon for the bunches to be held on the palm until February of the next year. Lowering temperature and increasing humidities of early fall help in slowing down softening. Probably chemical and anatomical changes associated with softening and ripening do not proceed far enough for the desirable soft texture to occur. Often growers give up at least some portion of the crop. Some way of enhancing softening and ripening in these fruits could help save these losses.

Hydrolytic enzymes polygalacturonase and cellulase in mature dates are believed to cause softening of tissue by solubilization or breakdown of cementing structural material like pectin and cellulose (10). Invertase also plays an important role in softening as it converts sucrose into simple invert sugars with release of water molecules (3, 4). The activity of enzymes increased sharply as the berries assume late Khalal stage. (10).

Vinson (10) reported that premature ripening could be induced artificially in dates by the action of various chemicals. Smolensky (9) induced softening of green dates by using Pectinal 42-E, a good grade pectic enzyme preparation. In Egypt growers often steep unripe dates in salt water to hasten ripening (1). There are indications in literature about the use of vinegar to hasten ripening in date berries. Kalra et al (6) used sodium

chloride and acetic acid in inducing softening in dates of a couple of varieties but failed to do so in other varieties.

This study tested varying levels of sodium chloride and acetic acid singly and in combination in inducing softening in Khasab dates and evaluated their effects on some quality factors.

MATERIALS AND METHODS

Fully developed uniform fruits of Khasab cultivar of date, harvested at Khalal stage (2), having acquired dark pink to deep purple color were obtained. The fruits were from a commercial crop. The fruits were treated with 0.5, 1, 2, or 4% NaCl; 0.25, 0.5, 1, or 2% acetic acid; or 1% NaCl plus 0.25, 0.5, 1, or 2% acetic acid. Thirteen treatments including a distilled water treated control were replicated four times in a randomized block design. Two kilogram of fruits were used for each treatment. The required quantities of NaCl and acetic acid were thoroughly and uniformly sprayed on the berries. In case of combination treatments the fruits were first sprayed with required amount of acetic acid and were then treated with 1% NaCl.

The treated fruits were put in covered plastic containers lined with paper. The fruits were placed in the laboratory at room temperature. They were checked after 24 hours and observations were recorded on the degree of softening, appearance, average weight of berry, percent pulp, seed weight, pulp/seed ratio and water content. Observations related to taste, flavour, edibility, agreeability, and marketability were also noted. When more than 1/3 of berry was soft it was considered soft. Softened and unsoftened fruits were separated and the percentage by weight of original weight is obtained. Appearance of the fruit was ranked from 1 to 10, 10 represented the best appearance. Weight of soft fruit was recorded and average weight was determined. The fruits were pitted and the percent pulp, seed weight and pulp-seed ratio were recorded. Water content was estimated by drying in oven.

RESULTS AND DISCUSSION

Data pertaining to different parameters studied, is given in Table 1. In-

creasing concentrations of NaCl resulted in a progressive increase in the percentage of fruits softened. Acetic acid also showed a similar trend, but, the degree of softening was far less in acid than in NaCl. Combination treatments also induced considerable amount of softening. Apparently the chemicals tested helped softening of Khasab dates. Maximum softening was noted in NaCl plus 2% acetic acid treatment followed by NaCl 4%, and NaCl plus 1% acetic acid treatments. In unripe fruits invertase exists in the intracellular or endoform and possibly forms an isoluble compound with the protoplasm. As ripening initiates, the invertase passes into the extracellular or ectoform and solubilizes readily in water. Hydrolytic enzymes like polygalacturonase and cellulase also cause softening of dates by solubilizing the pectin and cellulase which are the structural bodies holding the cells together (5). Softening has been induced in green dates by Pectinal 42-E, a good grade pectic enzyme preparation high in pectinestrase, polygalacturonase, and cellulase activities (9). Softening caused by NaCl and acetic acid in this study is in conformity with some earlier reports (6). However, the mode of action is not known. Further studies at physiological and biochemical levels are needed. These agents may cause softening and ripening by tearing the epidermal cells and the protoplasm, whereby invertase gets activated. Vinson (10) observed that heat treatment of fruits killed the protoplasm but induced ripening by activating enzymes. Dissociation of cell walls occurs during natural softening of fruits (7). Evidently in the present study the action of salt was fast and intensive whereas that of acetic acid was less intense and slow.

The ranking values indicated that appearence of NaCl treated fruits was better than acetic acid. Treatment with acetic acid caused light to dark brown unappealing spots on some of the berries. Moreover some of the acid treated fruits had surface fungal infection. These effects were intensified with increasing concentrations of acid. Combination treatments also effected the appearence of berries, but to a less extent. Some of the fruits in treatments 4% NaCl, and in combination treatments of 2% acid were oversoft.

Average fruit weight of NaCl treated fruits was higher than that of acid treated as well as water treated control fruits. Reduction in weight of fruit

was more intense in combination treatments. The higher fruit weight in NaCl treated fruit may be attributed to high fruit pulp percent. Percent pulp was higher in NaCl treated fruits than in other treatments, especially in acid treatment. In combination treatments the reduction in percent pulp was less than in acid alone treatment. However, the difference between NaCl treated and control was very narrow. Mean seed weight was maximum in NaCl treatment and least in combination treatments. Seed weight values of control were less than NaCl and acid treatment, and combination treatments were less than control. Increasing concentrations of NaCl increased seed weight up to 2% NaCl while increasing levels of acid decreased seed weight. Apparently acid treatment resulted in reducing seed weight and the effect was more intense in combination treatments.

Mean values of pulp seed ratio were higher in NaCl than in acid treatment, alone or in combination. However, NaCl treatment and control did not vary significantly. Water content in fruit pulp was slightly higher in acid than in NaCl treatments. This may be because acid treated fruits were more watery and juicy and some of them even developed water spekcs and blotches on the surface. Fruits from control were higher in water content than in NaCl treatment.

Fruits treated with high concentrations of NaCl were slightly saltish in taste and flavour in spite of washing in water. While the acidic taste was not detectable in acid treated fruits, except for over softened fruits which had slight acidic flavour. The softened fruits were not astringent in taste and flavour, as the tannins remaining in the fruit may have been converted into insoluble form (8). As mentioned earlier, in 4% NaCl and combination treatments with high level of acid, some of the berries were over soft and such fruits developed some degree of disagreeable taste and flavour compared to fruits from other treatments and less soft berries. The fruits of Khasab softened by treatments were edible, agreeable and marketable.

Major limitation in date palm culture and production is the requirement of long hot and dry atmosphere for proper maturation, softening and ripening of fruits. Rainfall, humidity, or any other kind of precipitation damages maturing and ripening fruits. There are places where date palm is grown but often palms fail to carry berries through to natural softening and

ripening because of the occurrence of increased humidity. In such cases the bunches could be harvested and artificially softened. Preferably this could be done by using NaCl especially 2% without much change in appearance and taste.

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Table 1: Effects of NaCl and Acetic Acid singly and in combination on different parameters studied.

Treatment	Fruit softened %	Appearence* ranking value	Weight/ fruit g	Pulp %	Weight/seed g	Pulp/seed ratio	Water content %
Control	2	9.4	5.14	88.23	0.57	7.56	14.47
NaCl 0.5%	11	9.2	6.14	89.69	0.59	8.74	16.81
NaCl 1.0%	23	9.0	5.60	89.38	0.60	8.44	12.08
NaCl 2.0%	58	8.2	4.65	87.28	0.64	6.92	13.53
NaCl 4.0%	88	7.6	5.22	88.55	0.60	7.67	11.94
Acetic acid 0.25%	7	5.4	4.82	86.30	0.61	6.34	17.34
Acetic acid 0.5%	11	5.2	4.10	86.00	0.0	6.00	14.50
Acetic acid 1.0%	14	3.6	4.66	86.67	0.54	6.56	13.81
Acetic acid 2.0%	18	3.2	4.47	85.80	0.57	6.07	13.10
1% NaCl + Acetic acid 0.25%	48	7.2	4.34	85.61	0.59	5.97	10.25
1% NaCl + Acetic acid 0.5%	65	6.5	4.40	86.89	0.53	6.37	14.88
1% NaCl + Acetic acid 1.0%	87	5.5	4.30	84.78	0.54	5.59	13.50
1% NaCl + Acetic acid 2.0%	91	5.2	4.96	87.71	0.57	7.18	18.29
S.E.	1.43	1.07	1.19	0.31	0.21	1.16	1.24

* Ranking values range from 1-10, 10 being the best.

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A STUDY OF SOME CONSTITUENTS OF DATE PALM PARTS IN IRAQ

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ABSTRACT

Ash, moisture, furfural, lignin, ∝ - cellulose and holocellulose contents of various parts of date palm (*Phoenix dactylifera* L.) were determined. The ash content was different for different parts. The 1% NaOH solubility was high for spathe and low for spadix fruit stalk and fibre. The leaflets and spathe samples had high percentages of alcohol - benzene (1:2) and ether solubility. Percentage of potential furfural ranged from 9.17 in the leaflets to 16.23 in the frond midrib and 16.69 in the spadix stem.

∝ -cellulose content was high in frond midrib and spathe samples but lower in frond bases and spadix fruit stalk. The lignin content of spadix fruit stalks, spadix stem, frond midrib and four samples of spathes were low as compared with frond bases, leaflets and fiber.

دراسة لمحتويات بعض أجزاء نخلة التمر في العراق

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الخلاصة

تم تقدير محتويات أجزاء النخلة المختلفة من الرماد والرطوبة والفورفورال

واللكنين والالفا سليولوزات والهولو سليولوزات . اختلفت محتويات الرماد بالأجزاء المختلفة . كان الذوبان في 1% هايدروكسيد الصوديوم عالية في غلاف الطلعة (الجف) وقليلة في الاغريض وساق العثق (العرجون) والليف . كانت عينات الوريقات (الخوص) والجف سريعة الذوبان في كحول ـ بنزين (2:1) ، والايثر . تراوحت النسب المحتملة من الفورفورال من 9,17 في الوريقات إلى 16,23 في الجريد و 16,69 في ساق الاغريض (العرجون) .

كانت محتويات الالفا سليولوز عالية في عينات الجريد والجف ولكنها كانت قليلة في الكرب وساق العثق . كانت محتويات سيقان العذوق وساق الاغريض والجريد و٤ عينات من الجف من اللكنين قليلة بالمقارنة لمحتويات اللكنين في الكرب والوريقات والليف .

INTRODUCTION

The aim of the research reported here was to study the chemical composition of some presently wasted date palm parts for their possible industrial utilization.

The date palm (*Phoenix dactylifera* L.) is an important crop grown in Iraq. Iraq is the world's largest producer of dates with its estimated palm population of more than 21 million of trees (11). Annual production is about 370 thousand tons of fruit (11).

The large number of date palm trees growing in Iraq probably provide a very large quantity of non-fruit materials e.g. frond bases, rachis (frond midrib), leaflets (lamina), spadix stem (axis) spadix fruit stalks (branches), spathes, date palm fibre (fibrous sheath around the stem). For example, the calculated fronds cut number 317 million annually and old leaf bases removed 210 million (12).

Petiole = frond midrib
Pinnae = leaflets
Stipules = date palm fibre

Presently, some use is made of the mature parts of the palm tree: trunk (walls, rafters, doors, shutters and stairs of buildings), fronds (fences, thatched roofs, crates, chicken coops, boats and for fuel), frond bases (for fuel and floats for fishing nets), leaflets (woven mats and baskets), etc. (13).

The value of the date palm can be increased by finding industrial uses for its various parts.

After a thorough perusal of the available literature, it is evident that very little research work has been done so far either on chemical composition (except for some studies on date palm leaf) or physical properties of non-fruit components.

The preliminary evaluation of the suitability of date palm leaves for the manufacture of pulp and paper was carried out first by Numan (17) in 1935 in the Forest Products Laboratory at Madison, U.S.A. Ezzat (14) also studied the technical feasibility of using date palm leaves for the production of pulp and paper. Date palm fronds have in the recent past, attracted the attention of pulp and paper manufactures. For example, a Basrah paper mill has recently demonstrated the successful use of date leaves for the manufacture of pulp and paper.

Some investigations (1, 10, 15, 20, 21) were performed in Iraq at Palm and Dates Department, Agricultural and Water Resources Research Centre, on chemical properties of some date palm parts and on production of furfural, lignin, chloro and nitro lignins from them.

The machinery manufactured by Dr. Ernst Fehrer GMbH, Austria, is capable of producing fibre from date palm leaves which could be processed in the same way as coconut husk fibres into rubberized mats or needled felts (19).

MATERIALS AND METHODS

Preparation of raw material

For these studies, 25-year-old palms of the varieties Zahdi and Sayer were used. The parts studied were frond bases, frond midribs, leaflets, spadix stems, spadix fruit stalks and date palm fibers. For spathe studies,

25 year old Ghannami Ahmar, and Ghannami Akhdar were also included. Materials were supplied by Date Palm Section of Zafaraniah station - Baghdad. All materials were collected in winter. All parts were green or almost green, while spadix stem, spadix fruit stalks and date palm fibre were dry, when they were cut from the trees. For moisture determinations samples were taken immediately after collection while other analyses were carried out on cleaned, air-dried samples.

The samples were powdered using a grinding mill (Sargent - Welch). For determination of furfural and lignin contents the portion passing through a 40 mesh sieve (2) was employed.

In case of preparations of extractive free wood, the samples were ground to pass through a 60 mesh sieve and to be retained on an 80 mesh sieve, according to ASTM standard method (3).

For the holocellulose determination the dust was prepared according to ASTM standard method (4). In case of α - cellulose dust was passed through a 60 mesh sieve (5).

CHEMICAL ANALYSIS

The potential yield of furfural was determined by two methods i.e. the aldehyde group reaction as recommended in AOAC and the furan - ring reaction (bromate) (10). Other chemical analyses were carried out employing TAPPI and ASTM standard methods. These analyses included moisture (6) and ash contents (7), cold water solubility, hot water solubility (8), 1% NaOH solubility (22), ether solubility (23), alcohol: benzene solubility (1:2) (24), lignin content (2), holocellulose (4) and α - cellulose contents (5).

RESULTS AND DISCUSSIONS

Ash content of various parts of date palm trees (Zahdi and Sayer varieties) are presented in Table 1. The ash content in all parts, except spathe, and date palm fibre of Zahdi was high and agreed well with the results reported by Mason (16). Browning (9) also noticed that some wood samples particularly from tropical areas may have high ash contents up to 5% or more.

Moisture contents shown in Table 1 varied considerably from one part to another. The leaflets, frond midrib, frond bases and spathes were almost green at the time of collection and this is the reason for the higher moisture contents in these parts. Moisture percentage ranged from 37.50% up to 66.49%, while it was 8.93% for date palm fibre and 20.10% for spadix stem of Zahdi variety.

The potential yields of furfural are presented in Table 2.

The results obtained by the two methods are in good agreement. It is also observed, that spadix stem and frond midrib contain the highest percentage of potential furfural. Leaflets and wood samples, on the other hand, showed the lowest percentages.

Solubilities of parts of date palm tree in different solvents are given in Table 3. All parts of the date palm tree, except the fibre, have a high extractability in different solvents (cold and hot water, 1% NaOH solution, alcohol - benzene (1:2) mixture). The lower solubility of date palm fibre in 1% NaOH suggests that it may be more durable than coir, when used in Iraqi soils, which have a neutral to alkaline reaction (1).

While date palm fibre shows the lowest extractabilities with most solvents, with ether the figures for leaflets, spadix fruit stalks and fibre are comparable. This is probably due to high contents of lipids, especially waxes, in these parts.

Numan (17) carried out analysis of hot water, 1% NaOH and ether extractability of petiole and leaflets of date palm; his figures are within the ranges obtained in our study.

The analyses for lignin, holocellulose and α - cellulose are presented in Table 4. It is evident, that holocellulose and α - cellulose contents are appreciably high in all the four spathe samples. On different parts of the frond - the midrib has the highest holocellulose and α - cellulose contents followed by frond bases, leaflets. The stem has a higher α - cellulose content than the fruit stalks. The lignin content of spathes that varies from 19.35% in the case of Sayer (female cultivar) to 21.42% in the case of Ghannami Ahmar (male cultivar) is low when compared with the average lignin content of 24.10% to 33.00% in the case of soft wood (9).

The low lignin content may be an advantage in reducing the cost of delignification during pulp and paper manufacturing processes. It is evident that leaflets have the highest lignin contents as shown also by Numan (17) and Ezzat (14). Numan's figures of 34.85% and 28.90% of ∝-cellulose contents for midrib and leaflets as compared to our figures of 33.50% and 28.00% respectively are in close agreement.

On the basis of our research results it can be concluded that the high content of ash found in parts of date palm may be useful as a substitute for bagasse ash in glass manufacture (18).

Date palm parts, such as the spadix stem, frond midrib, fruit stalks and frond bases can be a good source of furfural. On the other hand, frond midrib, spathes, spadix stem for pulp and paper manufacture, cellulose, rayon and boards. The high lignin in frond bases gives the possibility of production of lignin and its derivatives. Date palm fibre can be used as an improved filtration material for covering sub-surface drainage pipes and they can also be processed into rubberized mats.

Further phytochemical investigations are being carried out for isolation of waxes from leaflets and spadix fruit stalks; tannin extraction from leaflets, frond midribs and for isolation of phenolic and steroidal compounds and volatile oils from spathes, spadix fruit stalks, flowers, pollen and seeds.

The suitability of the use of processed date palm residues for incorporation into animal feeds is also being studied.

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Table 1:

Ash and Moisture contents of different parts of date palm.
(Figures for ash are percentages based on oven dry weight).

Contents	Date palm leaf of Z and S cvs						Spadix stem		Spadix fruit stalks		Fiber	Spathes			
	frond bases		frond midrib		leaflets										
	Z	S	Z	S	Z	S	Z	S	Z	S	Z	Z	S	GA_m	GA_k
Ash	11.69	9.88	9.97	8.43	10.50	11.50	8.91	5.56	8.06	6.30	4.27	5.50	6.60	7.08	6.42
Moisture	66.49	55.60	60.05	65.70	40.30	37.50	20.10	21.80	24.00	22.60	8.93	65.31	61.17	47.15	54.01

Z = Zahdi
S = Sayer
GA_1 = Ghannami Ahmar
GA_2 = Ghannami Akhdar

Table 2:

Potential yields of furfural in different parts of date palm (Zahdy cvr) by two methods (% on oven dried materials).

Parts	Percentage of furfural	
	AOAC method	Bromate method
Frond midrib	16.23	16.15
Spadix stem	16.69	16.62
Spadix fruit stalks	14.06	13.75
Trunk wood	10.96	11.06
Frond bases	13.87	13.35
Leaflets	9.17	9.30

Table 3:

Solubility of different parts of date palm tree (Zahdy cultivar) in different solvents (Percentage loss of weight on extraction of oven dried materials).

Determination (Contents)	Date palm leaf			Spadix stem	Spadix fruit stalks	Fiber	Spathes			
	frond bases	frond midrib	leaflets				Z	S	GA_m	GA_k
Hot water solubility	18.88	22.75	16.05	21.00	19.45	8.12	16.30	18.50	14.77	15.23
Cold water solubility	14.57	18.41	12.80	19.10	15.80	7.00	12.20	11.54	10.51	13.42
1% NaOH solubility	43.34	44.50	44.60	43.50	27.80	24.95	55.10	52.93	52.38	48.56
Ether solubility	0.58	0.43	3.14	1.35	3.28	3.17	1.75	1.60	1.32	1.25
Alcohol: benzene (1:2) solubility	4.30	4.00	8.00	5.60	6.30	3.88	11.83	10.42	9.05	8.91

Table 4:

Hollocellulose, ∝ - Cellulose and lignin in samples of date palm parts (Zahdy cvr). (Figures as percentages on the basis of extractive free oven dried materials.

Contents	Date palm leaf			Spadix stem	Spadix fruit stalks	Fiber	Spathes			
	frond bases	frond midrib	leaflets				Z	S	GA_m	GA_k
Holocellulose	54.50	55.60	48.00	60.40	55.00	62.72*	64.92	64.30	62.20	63.43
∝ - Cellulose	22.50	33.50	28.00	30.00	26.00		38.18	35.50	38.50	37.50
Lignin	27.00	21.50	28.10	21.00	12.00		19.40	19.35	20.00	21.42

* Only single determination.

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DOCUMENTATION

ABSTRACTS OF RECENT RESEARCH ON THE DATE PALM

S. MOHAN

Production

NASR, T.A.; KELEG, F.M. & SABROUT, M.B.I. Effect of pollen type on some physical and chemical characters of fruits in some Egyptian soft date varieties. *In* Abstract in XXIst International Horticultural Congress Hamburg, German Federal Republic; International Society for Horticultural Science 1982 Vol. I Abstract No. 1372.

The effects of the pollen of Zaghlool, Samani, Hayani and Bint-Aisha male palms on the physical and chemical characters of fruits of Zaghlool, Samani, Hayani and Bint-Aisha female palms were studied in 1977 and 1978. In 1977 fruit weight was higher with Bint-Aisha pollen, whereas in 1978 it was higher with a mixture of all the pollens. In 1977, fruit moisture content was greater with Samani pollen whereas in 1978 it was higher with Bint Aisha pollen. Seed length and total sugars were higher with Samini pollen in both years. Total chlorophyll was greater with the pollen in mixture in both years. Anthocyanin content was greater with Zaghlool pollen in both years. Other physical and chemical characters were not consistently affected.

Propagation

DEMASON, D.A. & THOMSON, W.W. Structure and ultrastructure of the cotyledon of date palm (*Phoenix dactylifera* L.). Botanical Gazette 1981, 142 (3) 320-328.

The cotyledon of the date palm embryo, extracted from seeds of the cv. Medjhool, is composed of the parenchyma, protoderm and procambium which can be distinguished on the basis of position, size and shape within the embryo. The procambial strands in the cotyledon consist of a ring of sympodia that diverged from the hypocotyl; each sympodium bifurcates 2 to 3 times to form 49 or more separate bundles at the distal end of the embryo, where they are situated very close to the cotyledon surface. The most prominent organelles are protein and lipid bodies but all cells also contain crystalline protein fibres and small electron-dense bodies bound in vacuoles. The amount of water in the fixative effected several structural features of the cells, primarily the appearance of the plasmalemma. The most realistic primary fixation was obtained with 2% formaldehyde in 80% glycerol.

(Abstract taken from *Horticultural Abstracts* verbatim)

DEMASON, D.A. & TISSERAT, B. The occurrence and structure of apparently bisexual flowers in the date palm, *Phoenix dactylifera L.* (Arecaceae). Botanical Journal of the Linnean Society 1980, 81 (4): 283-292.

Some individuals of *P. dactylifera* have expanded pistillodes or pseudocarpels which are located in the centre of the male flowers and are surrounded by stamens. The gynoecium has the characteristic 3 carpellate arrangement commonly found in female date palm flowers. Pseudocarpels from male flower buds can expand into parthenocarpic fruit. The histology of expanded pistillodes or pseudocarpels is similar to that of normal carpels from pistillate plants. Nutrient medium containing 10 mg/l of 2,4-D or p-CPA and 0.3% activated neutralized charcoal enhanced the development and outgrowth of the pseudocarpels of cultured male flowers.

(Abstract taken from *Horticultural Abstracts* verbatim)

TISSERAT, B. Factors involved in the production of plantlets from date palm callus cultures. Euphytica 1982, 31 (1): 201-214.

Embryogenic callus derived from date palm lateral bud explants was subjected to treatment with various auxins, including CPA, NAA and 2,4-D, in liquid and agar media. Plantlet production from callus sub-

cultured from media containing 0.0, 1.0 and 10.0 mg/1 auxin was notably lower than from callus precultured on 0.1 mg/1 auxin. In order to improve *in vitro* adventitious rooting, isolated plantlets were cultured on media containing 0.0, 0,1, 1.0 and 10.0 mg/1 IAA or NAA in various physical environments. Optimum adventitious rooting and subsequent plant survival were obtained by culturing plantlets in medium containing 0.1 mg/1 auxin for 8-16 weeks prior to transplanting to soil. Axillary shoot outgrowths were common in plantlets cultured on a variety of media once an adequate root-shoot system was developed.

(Abstract taken from *Horticultural Abstracts* verbatim)

ULRICH, J.M., FINKLE, B.J. & TISSERAT B. Effects of cryogenic treatment on plantlet production from frozen and unfrozen date palm callus. Plant Physiology 1982, 69 (3): 624-27.

Embryogenic date palm (Medjool cultivar) callus cultures were (1) treated with a cryoprotective mixture of polyethylene glycol, glucose and dimethylsulphoxide (10%/8%/10%, w/v), (2) treated with the cryoprotective mixture, frozen to - 196° C and then thawed, or (3) left untreated. The growth of frozen and thawed calli was greatly inhibited during the first 9 weeks of culture, compared with the other treatments, but this inhibition disappeared in subcultured tissue. In all treatments, cultures initiated plantlets after 9 weeks. Isozyme patterns of alcohol dehydrogenase, esterase, peroxidase, phosphoglucoisomerase and phosphoglucomutase were similar in leaves of regenerated plantlets from all treatments.

Processing & Products

SACHDE, A.G., AL-KIASI, A.M. & NORRIS, R.A.A study on the possibility of producing quality wines from some commercial varieties of Iraqi dates. Mesopotamia J of Agriculture 1981, 16 (1): 93-96 (En with Ar summ).

The processing procedure is described. White wine was produced from Zahdi cultivar and brownish-pink wine from Hillawi and Sayer cultivars.

Protection

BOUNAGA, A. Date palm and *Fusarium* disease. VII. Effects of some mercapto-2-azoles on the *in vitro* growth of *Fusarium oxysporum* f. sp. *albedinis* (Killian & Maire) Gordon. Phytopathologische Zeitschvift 1980, 98 (3): 210-217 (Fr, with en, de summs, 23 ref., 4 tab.).

Mercapto-2-benzoxazole at 1.5 mM and mercapto-2-benzothiazole (0.4) completely inhibited mycelial growth. The number of atoms in the heterocycle and the nature of position 1 appeared to be important in mercapto-2-azole activity.

(Abstract taken from *Review* of *Plant Pathology*)

GAFAR. K.; ABED EL MONEM, S.; SAID, K.; NECOLA, N. BADR, N. & ABD EL MEGID, K. Studies on false smut of date-palm trees and its control. Agricultural Research Review 1979, publ. 1980, 57 (2): 1-9 (En, with Ar summ)

Symptoms of the disease caused by *Graphiola phoenicis* are described. The pathogen grew well *in vitro* on PDA at 20-30° C. Effective field control was achieved with Dithane M-45 (mancozeb), Cuprosan 311 Super D, Cupravite (cooper oxychloride) and Kocide-101 (cupric hydroxide), when applied 3-4 times at 15-day intervals in early summer.

(Abstract taken from *Review* of *Plant Pathology*)

GAFAR. K.; NECOLA, N.; BADR, N. & ABD EL MEGID, M.K. Inflorescence decay of date-palm *Phoenix dactylifera* L. Agricultural Research Review 1979, publ. 1980, 57 (2): 19-28 (En, with Ar. summ, 8 ref., 4 fig., 4 tab.).

A terminal bud rot, caused by *Thielaviopsis (Ceratocystis) paradoxa,* is described. The decay impairs fruit set, causing serious losses. *In vitro* cultural studies and effects of fungicides on fungal growth on PDA are reported.

(Abstract taken from *Rew* of *Plant Pathology*)

HOWARD, F.W.; THOMAS, D.L.; DONSELMAN, H.M. & COLLINS, M.E. Susceptibilities of palm species to mycoplasmalike organism-associated diseases in Florida. FAO Plant Protection Bulletin 1979, 27 (4): 109-117 (En, 40 ref., 3 fig., 4 tab.)

Lethal yellowing (LY), a disease associated with mycoplasma-like organisms, affects coconut in Fla., the Bahamas and parts of the Caribbean and West Africa. Similar or identical MLOs apparently cause lethal declines of 24 additional palm spp. LY was 1st reported on the Fla. mainland in 1971. By 1974, 13 palm spp. were known to be susceptible to lethal decline. The yearly rate at which additional susceptible spp. have been reported has decreased since 1974. About half the commonly planted palms in Fla. are susceptible. *Veitchia merrillii,* one of the most popular, is one of the most susceptible. Losses due to lethal declines of spp. in Fairchild Tropical Garden showed that coconut, *Corypha elata* and *Pritchardia* spp. were highly susceptible. In some spp., e.g. *V. merrillii,* losses in the Garden were low compared with losses in urban areas, possibly because of the relatively high plant diversity in the Garden. Evidence indicates that lethal decline is almost entirely a problem of palms exotic to Fla. and the Caribbean. The economically important palmyra and the date palms are affected by lethal decline.

(Abstract taken from *Review* of *Plant Pathology* verbatim).

McCOY, R.E.; MILLER, M.E.; THOMAS, D.L. & AMADOR, J. Lethal decline of *Phoenix* palms in Texas associated with mycoplasmalike organisms. Plant Disease 1980, 64 (11): 1038-1040.

A rapid lethal decline of *P. canariensis* and *P. dactylifera* palms was recently observed in the lower Rio Grande Valley, Texas. Symptoms were identical with those of declines associated with lethal yellowing of these palms in Fla. Mycoplasma like organisms were detected in phloem sieve elements of affected palms in Texas and confirmed this increase in the geographical range of the lethal yellowing disease.

McCOY, R.E.;MILLER, M.E.& WILLIAMS, D.S. Lethal yellowing in Texas *Phoenix* palms. Principes 1980, 24 (4): 179-180 (En, 4 ref., 2 fig.).

A rapidly spreading lethal disease of date palm and *P. canariensis* in Texas was identified as lethal yellowing on the basis of symptoms, pattern of spread, the presence of mycoplasma-like organisms and conformity to the lists of susceptible and resistant palm spp. in Fla. It threatens the susceptible P. spp. in the Rio Grande Valley and increases the possibility of spread to other areas.

SABAOU, N.; AMIR, H. & BOUNAGA, D. Date palm and *Fusarium* disease. X. – Numbers of rhizosphere actinomycetes; their antagonism against *Fusarium oxysporum* f. sp. *albedinis*. Annales de Phytopathologie 1980, 12 (3): 253-257 (Fr, with en summ, 16 ref., 2 tab.)

Actinomycetes constituted a large part of the microflora of soil from a SW Algerian oasis. Numbers were similar in the rhizospheres of susceptible and resistant cvs. Of 271 actinomycetes tested against the pathogen, 50% were antagonistic.

(Abstract taken from *Review* of *Plant Pathology*).

Entomology

ZAHAR, M. A. & ELBAGOURY, M.E. A new tydeid mite, *Paralorryia bakeri* n. sp. from Egypt (Prostigmata: Tydeidae). Acarologia 1981, 22 (2): 179-180.

A new species of *Paralorryia* collected from date palm at Kaluobeia is illustrated and described from the adult female as *P. bakeri* sp.n.

SALEH, M.R.A. & KAMEL, A.H. Chemical control of the mite *Oligonychus* spp, infesting date fruit bunches in the New Valley, Egypt. Bulletin of the Entomological Society of Egypt, Economic Series 1976/77, publ. 1981, No. 10: 125-127.

In a field experiment to evaluate the effectiveness of 9 pesticide sprays

for the control of *Oligonychus* spp. on date palms, the results indicated that 7 of the test compounds reduced the pest population by 95.7-99%; these were, in order of decreasing effectiveness, dimethoate at 0.15%, phosphamidon (Dimecron) at 0.20%, phosalone (Zolone) at 0.15%, tetradifon (Tedion) at 0.15%, micro-sulfur at 0.25%, sulfur at 1% and dicofol (Kelthane) at 0.15%.

جدول رقم - 6 -

تحليل التباين لصنفين من الخلال المطبوخ هما زهدي وجبجاب

مصادر الاختلاف	درجات الحرية	مجموع المربعات	متوسط المربعات	قيمة ف
الاصناف	1	3.3611	3.3611	1.3722
الذواقة	17	65.7500	3.8676	
الخطأ	17	41.6389	2.4493	
المجموع	35	11.7500		

جدول رقم ـ 4 ـ

تحليل التباين لثلاث نماذج من الخلال المطبوخ
كانت مدة طبخها 45, 30, 15 دقيقة

مصادر الاختلاف	درجات الحرية	مجموع المربعات	متوسط المربعات	قيمة ف
النماذج	2	8.2667	4.1300	7.149 **
الذواقة	9	9.2000	1.0222	
الخطأ	18	10.4000	0.5777	
المجموع	29	2.8667		

★★ قيمة ف معنوية جداً

جدول رقم ـ 5 ـ

معنوية متوسطة الدرجات لثلاث نماذج من الخلال المطبوخ أ، ب، جـ
طبخت لمدة 45, 30, 15 دقيقة على التوالي

النماذج	مستوى معنوية 5% الفرق اكثر من 0.71	مستوى المعنوية 1% الفرق أكثر من 0.98
أ، ب	نعم	نعم
أ، جـ	نعم	نعم
ب، جـ	لا	لا

تابع جدول رقم – 3 –

الصنف	مدة الطبخ (دقيقة)	حدوث الترطيب	تكون التجاعيد	تكون الشقوق	وجود الطعم القابض
	بدون				++
	15	+	+	٠٠	+
السابر	30	++	++	٠	+
	45	+++	+++	+	+
	60	+++	+++	++	+

★ اخذت الملاحظات السابقة على النماذج بعد طبخها مباشرة (٠) غير موجود، (+) بسيط، (++) متوسط، (+++) كبير

جدول رقم ـ 3 ـ

تأثير مدة الطبخ على بعض الصفات المظهرية والطعم القابض في الخلال المطبوخ(★)

الصنف	مدة الطبخ (دقيقة)	حدوث الترطيب	تكون التجاعيد	تكون الشقوق	وجود الطعم القابض
الجبجاب	بدون				+++
	15	+	+	.	++
	30	++	++	.	++
	45	++	+++	+	+
	60	++	+++	++	+
الزهدي	بدون				+++
	15	+	+	.	+++
	30	++	+	.	+
	45	+++	++	.	+
	60	+++	+++	+	+
البرم	بدون				++
	15	+	.	.	+
	30	++	+	.	+
	45	+++	++	.	+
	60	+++	++	+	+

رقم - 2 -

على الصفات الفيزيائية
الصنفين برم وساير

معدل اللب/النواة	الرطوبة ٪	الملاحظات
9.33	64.64	اللون أخضر مصفر والطعم قابض
9.97	13.50	اللون بني مصفر والطعم جيد
5.65	15.95	اللون بني فاتح والطعم جيد
5.80	12.05	اللون بني فاتح والطعم جيد
4.87	10.52	اللون بني مصفر والطعم جيد
5.67	14.25	اللون بني فاتح والطعم جيد
5.54	9.36	اللون بني فاتح والطعم جيد
8.71	48.83	اللون أصفر والطعم قابض
5.99	10.52	اللون بني فاتح والطعم مقبول
6.80	10.94	اللون بني والطعم مقبول
7.47	10.44	اللون بني والطعم مقبول
6.84	12.75	اللون بني فاتح والطعم مقبول
6.72	9.77	اللون بني والطعم مقبول
5.90	10.97	اللون بني والطعم مقبول

جدول

تأثير الطبخ والتجفيف للخلال من

مدة الطبخ (دقيقة)	التجفيف نوع	معدل وزن الثمرة غم	نسبة اللب ٪	نسبة النواة ٪
بدون		13.65	90.32	9.68
15	شمسي	7.02	88.16	8.84
30	=	7.05	84.97	15.03
45	=	6.02	85.30	14.70
15	فرن	5.17	82.95	17.05
30	=	6.82	85.02	14.98
45	=	5.85	84.72	15.28
		السابر		
بدون		11.78	89.70	10.30
15	شمسي	7.55	85.70	14.30
30	=	7.17	87.17	12.82
45	=	7.51	88.19	11.81
15	فرن	6.65	87.25	12.75
30	=	7.12	87.06	12.94
45	=	6.53	85.50	14.50

رقم – 1 –

الفيـزيـائيـة للخلال مـن الصنفين وزهدي

معدل اللب / النواة	الرطوبة ٪	الملاحظات
9.20	69.48	اللون أصفر مخضر والطعم غير مقبول
3.90	11.19	اللون بني فاتح والطعم جيد
3.30	11.68	اللون بني والطعم جيد جيد
4.45	9.33	اللون بني داكن والطعـم جيد جداً
2.95	13.80	اللون بني فاتح والطعم جيد
3.40	15.05	اللون بني والطعم جيد جداً
4.20	15.23	اللون بني داكن والطعـم جيد جيداً
10.95	53.20	اللون أصفر ذهبي والطعـم قابض
4.47	15.70	اللون بني فاتح والطعـم جيد
6.28	12.84	اللون بني محمر والطعـم جيد جداً
5.55	10.84	اللون بني محمر والطعـم جيد جداً
4.67	12.31	اللون بني مصفر والطعـم جيد
5.17	14.20	اللون بني فاتح والطعم جيد جداً
5.31	9.65	اللون بني فاتح والطعـم جيد جداً

جدول

تأثير الطبخ والتجفيف على الصفات جبجاب

مدة الطبخ (دقيقة)	نوع التجفيف	معدل وزن الثمرة غم	نسبة اللب ٪	نسبة النواة ٪
		الجبجاب		
بدون طبخ		18.91	90.20	9.80
15	شمسي	7.76	79.61	20.39
30	=	6.68	76.79	23.21
45	=	8.89	81.95	18.05
15	فرن	6.80	74.70	25.30
30	=	7.79	76.50	22.50
45	=	8.35	80.79	19.21
		الزهدي		
بدون		11.98	91.63	8.37
15	شمسي	6.13	81.72	18.27
30	=	6.87	86.26	13.74
45	=	6.82	84.74	15.26
15	فرن	5.36	82.37	17.63
30	=	7.05	83.81	16.19
45	=	6.70	84.17	15.83

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شكر وتقدير

يتقدم الباحثون بالشكر الجزيل للدكتور حسن شبانه رئيس قسم بحوث النخيل والتمور على دعمه وتشجيعه المستمر أثناء القيام بهذه الدراسة كما يتقدم الباحثون بالشكر الجزيل الى الاتحاد العام للجمعيات الفلاحية التعاونية ـ فرع البصرة على تعاونه ومساعدته لنا في جمع نماذج الخلال من أحد البساتين التابعة له .

الاجابات التفصيلية لاحد النماذج عن الآخر يجب أن تكون 18 للحصول على فروق معنوية و20 للحصول على فروق معنوية جداً .

من نتائج هذا الاختبار يتضح أنه ليست هناك فروق معنوية بين التجفيف الشمسي أو التجفيف بالفرن وأنه يمكن استعمال كلا الطريقتين في التجفيف . ان هذه النتائج تدعونا الى القول بضرورة مكننة عملية انتاج الخلال المطبوخ واستعمال الافران في التجفيف بدلا من أشعة الشمس حيث أن ذلك سيؤدي الى عدم تعرض الثمار للاصابة بالحشرات أو تلوثها بالاتربة أثناء التجفيف الشمسي .

تحديد أنسب الاصناف ملائمة لعملية انتاج الخلال المطبوخ : ـ

استعمل في هذه التجربة نموذجان من الخلال المطبوخ المنتج في مختبرات المركز الاول من الصنف زهدي والثاني من الجبجاب كما استعمل نموذج ثالث للمقارنة هو الخلال المطبوخ من الصنف جبجاب والمنتج في محافظة البصرة من قبل القطاع الخاص .

تم انجاز هذه التجربة بعمل اختبار للتذوق المسمى Multiple Comparison وكان عدد أعضاء فريق الذواقة 18 شخصاً .

بعد الحصول على النتائج تم تحليلها احصائياً وكان نتيجة التحليل الاحصائي (جدول رقم 6) أن قيمة ف غير معنوية حيث أن قيمة ف المحسوبة (1.37) كانت أقل من قيمة ف الجدولين (4.45) . أن ذلك يعني عدم وجود فروق معنوية بين الخلال المطبوخ من الصنفين زهدي وجبجاب . ان هذه النتيجة تدعم نتيجة الاختبارات الفيزيائية والنتيجتان معاً تقودنا الى القول بامكانية استعمال الخلال من الصنف زهدي في انتاج خلال مطبوخ يمتاز بدرجة عالية من الجودة ولا يقل بأي حال من الأحوال عن الخلال المطبوخ المنتج من تمور الجبجاب ان لم يكن أفضل منه .

تشير نتائج اختبارات التذوق التي أجريت على نماذج من الخلال المطبوخ والتي طبخت لمدة 15, 30, 45 دقيقة الى وجود اختلافات بين هذه النماذج خاصة فيما يتعلق بالطعم واللون، حيث أنه من نتائج الجدول رقم (4) يتضح أن قيمة ف كانت معنوية عند حدوث ثقة 1% .

ويتضح من الجدول رقم (5) أن النموذج (أ) والذي كانت مدة طبخه 15 دقيقة يختلف معنوياً عن النموذج (ب) والذي كانت مدة طبخه 30 دقيقة وعن النموذج (جـ) والذي كانت مدة طبخه 45 دقيقة . ان نتائج التحليل الاحصائي (الجدولين 4, 5) تدل على أن الطبخ لمدة 15 دقيقة يعتبر غير كاف وذلك لارتفاع نسبة التانينات المسؤولة عن الطعم القابض في الثمار وأن الطبخ يجب أن يكون في حدود 30 ـ 45 دقيقة للحصول على خلال مطبوخ يمتاز بدرجات عالية من الجودة .

ان هذه النتائج التي تم التوصل اليها تختلف عن نتائج الدراسة الهندية التي قام بها كالرا وجماعته (4) .

تحديد أنسب طريقة لتجفيف الخلال المطبوخ : ـ

لغرض تحديد أنسب طريقة للتجفيف تم اجراء اختبار التذوق المسمى Paired Comparison على نماذج من خلال مطبوخ مجففة في الشمس واخرى مجففة في الفرن . وكانت نتيجة الاختبار أن 14 عضواً من فريق الذواقة فضلوا الخلال المطبوخ المجفف في الفرن بينما الباقي وعددهم 11 عضواً فضلوا الخلال المطبوخ المجفف في الشمس . وعند اعادة الاختبار مرة ثانية لوحظ أن 15 شخصاً فضلوا الخلال المطبوخ المجفف في الفرن وعشرة أشخاص فقط فضلوا الخلال المطبوخ المجفف في الشمس .

وعند الرجوع الى الجدول الخاص بهذا الاختبار (5) وجدنا أنه عند اختبار نموذجيين لغرض التفضيل وعندما يكون عدد الذواقة 25 شخصاً فان عدد

ان النتائج المدونة في الجدول رقم (3) توضح أن هناك علاقة طردية بين مدة الطبخ وطراوة الثمار حيث أنه بزيادة مدة الطبخ تزداد الثمار طراوة وذلك في جميع اصناف الخلال المستعملة في هذه الدراسة .

كما يلاحظ من الجدول رقم (3) أن هناك أيضاً علاقة طردية بين مدة الطبخ وتكون التجاعيد في الخلال بعد طبخه . الا أن ظهور التجاهيد في الخلال المطبوخ من الصنفين زهدي وبريم كان أبطأ منه في حالة الخلال المطبوخ من الصنفين جبجاب وساير .

وفيما يتعلق بتشقق الثمار نتيجة الطبخ فيمكن ملاحظة أن طبخ الخلال من الصنفين بريم وزهدي لمدة 45 دقيقة لم يؤد الى حدوث التشققات في ثمار هذين الصنفين بينما ظهرت التشققات في الصنفين الآخرين جبجاب وساير عند طبخهما لنفس المدة (45 دقيقة) . وبزيادة مدة الطبخ الى 60 دقيقة لوحظ زيادة كبيرة في حدوث التشققات في ثمار الخلال المطبوخ .

وعند أخذ الطعم القابض بعين الاعتبار نجد أن هناك علاقة عكسية بين مدة الطبخ ووجود الطعم القابض حيث أنه بزيادة مدة الطبخ يقل الطعم القابض في الخلال المطبوخ كما يمكن ملاحظة أن اختفاء الطعم القابض كان أسرع في حالة الخلال المطبوخ من الصنفين بريم وساير في الوقت الذي كان اختفاءه بطيئاً في الخلال المطبوخ من الصنف جبجاب .

بناء على النتائج المدونة في الجدول رقم(3) يمكن القول أن الطبخ لمدة 15 دقيقة لم يكن كافياً لاحداث الترطيب المناسب في الثمار وكذلك لازالة الطعم القابض منها ، بينما الطبخ لمدة 60 دقيقة أدى الى حدوث تشققات بنسبة كبيرة في الثمار .أن هذه النتائج تقودنا الى الاستنتاج بأن الطبخ لمدة 30 الى 45 دقيقة هو الانسب خاصة اذا أخذنا بعين الاعتبار أن زيادة مدة الطبخ تزيد من ادكنان لون الثمار (جدول رقم 1) .

يتضح أن الخلال المطبوخ من الصنف ساير كان يحوي على أعلى نسبة من اللب يليه البريم فالزهدي فالجبجاب . كما يتضح من هذه النتائج أيضاً أن مدة الطبخ ونوع التجفيف لم يكن لهما تأثير يذكر على نسب اللب في الخلال المطبوخ لأصناف التمور الأربعة المستعملة في هذه الدراسة .

أما فيما يتعلق بنسبة النواة في الخلال قبل الطبخ فقد كانت حوالي 9 ,8 ,10 10% وأصبحت بعد الطبخ والتجفيف 11 ,16 ,15 ,13% لكل من الجبجاب والزهدي والبريم والساير على التوالي . ان هذا الارتفاع الكبير في نسبة النواة بعد الطبخ والتجفيف جاء نتيجة للفقد الكبير في رطوبة الثمار والتي تتركز في اللب أثناء التجفيف .

ان نتائج معدل وزن اللب الى وزن النواة قبل وبعد انتاج الخلال المطبوخ تشير الى امكانية انتاج الخلال المطبوخ من الصنفين زهدي وساير وأنه ليس هناك من مبررات لاقتصار عملية انتاج الخلال المطبوخ على الصنفين جبجاب وبريم . ففي حالة خلال الزهدي فقد أمكن الحصول على خلال مطبوخ يمتاز بلون جذاب وطعم جيد كما أن معدل الفقد في وزن ثماره كانت قليلة .

كما أن معدل وزن اللب الى وزن النواة وكذلك نسبة اللب في الخلال المطبوخ من تمور الزهدي كانت أفضل مما هي عليه في الخلال المطبوخ من تمور الجبجاب والبريم فاذا أخذنا بعين الاعتبار أن ما يزيد على 60% من انتاج التمور في العراق هو من صنف الزهدي وأن هذه التمور أسعارها غير مشجعة أدركنا أهمية احلال تمور الزهدي في انتاج الخلال المطبوخ وخاصة بدلاً من البريم الذي يباع بأسعار عالية جداً وهو ما زال في مرحلة الرطب .

تحديد أنسب مدة لعملية الطبخ :

تم تحديد أنسب مدة لعملية طبخ الخلال بطريقتين الاولى بدراسة تأثير مدة الطبخ على بعض الصفات المظهرية والطعم القابض في الخلال المطبوخ (جدول رقم 3) والثانية باستخدام اختبارات التذوق (الجدولين رقم 4 ,5) .

الصفات الفيزيائية لأربعة أصناف من التمور العراقية في مرحلة الخلال وهي الجبجاب، الزهدي، البريم والساير. يلاحظ من نتائج الجدولين السابقين ان اختلاف مدة الطبخ كان لها تأثيراً كبيراً على لون الخلال المطبوخ فكلما زادت مدة الطبخ زاد اللون ادكناناً. أما بخصوص الطعم فقد لوحظ أنه بزيادة مدة الطبخ يزداد طعم الخلال المطبوخ تحسناً، ويمكن تفسير ذلك بأن زيادة مدة الطبخ تؤدي الى فقدان كمية أكبر من التانينات المسؤولة عن الطعم القابض في الخلال في ماء الطبخ. كما توضح نتائج الجدولين رقم (2, 1) أنه لم يكن هناك تأثير يذكر لطريقة التجفيف على كل من لون أو طعم الخلال المطبوخ.

ان معدل وزن الثمرة للخلال المطبوخ من الصنف جبجاب كانت تتراوح ما بين 6.68 الى 8.89 غم (جدول رقم 1)، وهذا يشكل حوالي 40% من وزن الثمرة في مرحلة الخلال، أي أن 60% من وزن الثمار يفقد نتيجة عمليات الطبخ والتجفيف أما في الاصناف الاخرى من الخلال فنجد أن نسبة الفقد في وزن الثمار نتيجة عمليات الطبخ والتجفيف كانت حوالي 46 ,54 40% لكل من الزهدي والبريم والساير على التوالي.

ومن نتائج الجدولين رقم (2, 1) يلاحظ عدم وجود علاقة واضحة بين مدة الطبخ ومعدل الفقد في وزن الثمار وكذلك بين مدة الطبخ ومقدار الفقد في رطوبة الثمار، وهذه النتائج لا تتفق مع نتائج كالرا وجماعته (4) والذين أشاروا الى أنه بزيادة مدة الطبخ يزداد الفقد في معدل وزن ثمار الخلال المطبوخ. وعند أخذ نوع التجفيف وتأثيره على الفقد في وزن الثمار بعين الاعتبار نجد أن التجفيف الشمسي أدى الى نسبة فقد أعلى في معدل وزن الثمار عن التجفيف في الفرن في معظم الاصناف تقريباً.

يتضح أيضاً من الجدولين رقم (2.1) أن نسبة اللب في الخلال قبل الطبخ كانت حوالي 90 ,92 ,90 ,90% وأصبحت بعد الطبخ والتجفيف 78 ,84 ,85 87% لكل من الجبجاب، الزهدي البريم والساير على التوالي. من هذه النتائج

ولتحديد أنسب طريقة للتجفيف ثم استخدام اختبار التذوق المسمى Paired comparison (5) حيث أخذت 50 ثمرة بطريقة عشوائية من كل من الخلال المطبوخ من صنف جبجاب والمجففة في الشمس وكذلك في الفرن ونزع النوى منها وقطعت ووضعت في أطباق زجاجية نظيفة وقدمت الى فريق من الذواقة يتكون من 25 عضواً ووزعت عليهم استمارة خاصة بها بعض الاسئلة التي طلب الاجابة عليها .

تم اجراء هذا الاختبار مرتين خلال اسبوع وبعد جمع الاستمارات تم تحليل النتائج تحليلاً احصائياً .

جـ ـ تحديد أنسب الأصناف ملائمة لعملية انتاج الخلال المطبوخ

نظراً لأن من أحد اهداف هذه الدراسة محاولة استعمال الخلال من الصنف زهدي في انتاج الخلال المطبوخ فقد استعمل الخلال المطبوخ من الصنف زهدي وكذلك من الصنف جبجاب والمنتج من قبل القطاع الخاص في محافظة البصرة كنموذج للمقارنة . واستعمل في هذه التجربة اختبار التذوق المسمى Multiple Comparison (5) حيث أخذت 100 ثمرة بطريقة عشوائية من كل من الخلال المطبوخ من الصنف زهدي والصنف جبجاب المنتجة في مختبرات المركز و100 ثمرة أخرى من خلال الجبجاب المطبوخ والمنتج من قبل القطاع الخاص في محافظة البصرة ونزع النوى من الثمار المختارة ومن ثم قطعت ووضعت في اطباق زجاجية نظيفة وقدمت الى فريق من الذواقة يتكون من عشرة أعضاء ووزعت عليهم استمارة خاصة وطلب منهم الاجابة على ما جاء بها من أسئلة . وبعد ترجمة الاجابات الى أرقام دونت في جدول حللت النتائج تحليلا احصائياً .

النتائج والمناقشة

تأثير الطبخ والتجفيف على الصفات الفيزيائية للخلال المطبوخ:

توضح النتائج المدونة في الجدولين رقم (1 ، 2) تأثير الطبخ والتجفيف عى

د ـ تقدير النسبة المئوية للرطوبة

تم تقدير النسبة المئوية للرطوبة بأخذ عينة زنة 5 ـ 10 غم من عينة الثمار المأخوذة بصورة عشوائية بعد تقطيعها وازالة البذور منها يؤخذ النموذج الموزون ويوضع في طبق من الالمنيوم أو الزجاج ومن ثم تنقل الى الفرن المفرغ بدرجة حرارة 65 م° وضغط 30 ملم زئبق ويبقى النموذج في الفرن فترة تتراوح ما بين 16 ـ 24 ساعة وذلك حتى ثبات الوزن ومن ثم تحسب النسبة المئوية لرطوبة الثمار .

ثالثاً ـ تحديد أنسب وقت لعملية الطبخ وأنسب طريقة للتجفيف وكذلك أنسب الاصناف الملائمة لعملية انتاج الخلال المطبوخ

أ ـ تحديد أنسب مدة لعملية الطبخ

تم تحديد أنسب مدة لعملية الطبخ بطريقتين : ـ الأولى بدراسة تأثير مدة الطبخ على الخلال بعد طبخه مباشرة وذلك من حيث حدوث عملية الترطيب وتكوين التجاعيد والشقوق واختفاء الطعم القابض . أما الطريقة الثانية فقد تناولت تأثير مدة الطبخ على الخلال بعد طبخه وتجفيفه واستعمل لهذا الغرض اختبار التذوق المسمى Scoring difference test (5) حيث تم اختبار 50 ثمرة بطريقة عشوائية من خلال الجبجاب الذي تم طبخه لمدة 15 ، 30 ، 45 دقيقة والذي تم تجفيفه في الشمس ، وبعد نزع النوى من الثمار قطعت ووضعت في اطباق زجاجية نظيفة وقدمت الى فريق يتكون من عشرة ذواقة ثم تدريبهم خصيصاً لهذا الغرض في قسم النخيل والتمور ووزعت عليهم استمارة وطلب منهم الاجابة على الاسئلة التي بها وتم تحليل النتائج احصائياً .

ب ـ تحديد أنسب طريقة للتجفيف

استخدمت في هذه الدراسة طريقتان للتجفيف كما سبق ذكره الاولى التجفيف الشمسي والثانية التجفيف في فرن مزود بمروحة لتحريك تيارات الهواء الساخن

التابعة للاتحاد العام للجمعيات التعاونية الفلاحية في قضاء القرنة بمحافظة البصرة . ولقد جلبت النماذج داخل أكياس من النايلون وبواقع 15 كغم من كل صنف . تم طبخ نماذج الخلال من الأصناف الأربعة بغمرها في ماء داخل قدور على درجة حرارة 95 - 97 م° وقد أخرجت الوجبة الأولى من خلال كل صنف من الماء المغلي بعد 15 دقيقة والوجبة الثانية بعد 30 دقيقة أما الوجبة الثالثة فقد تم غمرها في الماء لمدة 45 دقيقة . بعد الانتهاء من عملية الطبخ تم توزيع كل وجبة من الخلال المطبوخ إلى مجموعتين حيث جففت المجموعة الأولى على 50 م° داخل فرن مزود بمروحة لتحريك التيارات الهوائية بينما جففت المجموعة الثانية تحت أشعة الشمس بعد نشرها على حصير نظيف .

ثانياً ـ تقدير الصفات الفيزيائية للخلال والخلال المطبوخ .

أ ـ تقدير الوزن الكلي للثمرة

أخذت عشر ثمرات بصورة عشوائية من كل صنف من أصناف الخلال قبل وبعد عملية الطبخ ثم حسب معدل وزن الثمرة الواحدة .

ب ـ تقدير النسبة المئوية للنواة

تم تقدير النسبة المئوية للنواة بنزع نوى الثمار العشرة التي استعملت في ايجاد الوزن الكلي للثمرة ثم حسب معدل وزن النواة الواحدة وقسمت على معدل الوزن الكلي للثمرة الواحدة وضربت النتيجة في 100 .

جـ ـ تقدير النسبة المئوية للجزء اللحمي من الثمرة

تم تقدير النسبة المئوسة للجزء اللحمي من الثمرة باستعمال المعادلة التالية :

$$\text{النسبة المئوية للجزء اللحمي من الثمرة} = \frac{\text{الوزن الكلي للثمرة ـ وزن النواة}}{\text{الوزن الكلي للثمرة}} \times 100$$

التمور. فمثلاً في تمور الحلاوي والبرحي يلاحظ أن اختفاء الطعم القابض يكون سريعاً في بداية مرحلة الخلال ولذا نجد أن هذه التمور يمكن تسويقها وهي في هذه المرحلة وتباع بأسعار جيدة. أما بالنسبة للاصناف الاخرى مثل البريم والجبجاب والزهدى والساير فان اختفاء التانينات في مرحلة الخلال يكون بصورة بطيئة. ومن هنا كانت عملية طبخ الخلال ضرورية للتخلص من التانينات وبالتالي من الطعم القابض.

تم اجراء دراسة في جامعة البنجاب على الخلال المطبوخ من قبل كالرا وجماعته (4). كما قام عبد الحسين (3) بتحليل نماذج من الخلال المطبوخ للصنفين بريم وجبجاب للتعرف على محتواها من السكريات الكلية والمختزلة والسكروز.

ان تذبذب كميات الخلال المطبوخ المنتجة سنوياً يرجع الى الاختلاف في معدل الانتاج السنوي من الصنفين بريم وجبجاب وأن هناك اقبالا كبيراً من الدول المستوردة للخلال المطبوخ على مثل هذاالمنتوج. ويؤكد ذلك ارتفاع أسعار هذا المنتوج الامر الذي يستدعي البحث عن أصناف اخرى ذات انتاج غزير مثل الزهدي وتجربة استعماله في انتاج الخلال المطبوخ. وهذا يعتبر أحد أهداف هذه الدراسة. كما أن من أهداف هذه الدراسة أيضا محاولة تطوير صناعة الخلال المطبوخ عن طريق التعرف على أنسب الظروف الخاصة بعمليتي الطبخ والتجفيف.

المواد والطرق

أولاً ـ احضار النماذج واجراء عمليتي الطبخ والتجفيف

احضرت نماذج في مرحلة الخلال لأربعة أصناف من التمور العراقية وهي: الجبجاب والبريم والزهدي والساير في 15 آب 1978 وذلك من أحد البساتين

الاقتصادي لها أفضل مما هو عليه الآن وسيؤدي ذلك بالتالي الى الاهتمام بهذه الثروة القومية الهامة والمحافظة عليها .

الادبيات العلمية

تنتشر عملية طبخ الخلال في كل من العراق والمملكة العربية السعودية وايران وباكستان ولكنها غير معروفة في شمال افريقيا (2) . يسمى ناتج طبخ الخلال في العراق بالخلال المطبوخ والاصناف المستعملة هي الجبجاب والبريم وفي المملكة العربية السعودية يسمى ناتج طبخ الخلال بالسلوق أو القلائد والاصناف المستعملة هي الخنيزي والرزيز . وفي ايران فان ناتج طبخ الخلال يسمى خراك والاصناف المستعملة هي حلو وشاهاتي وفي مسقط يسمى بسال والصنف المستعمل هو المبصلي أما في الباكستان فانه يسمى جهوهاره ومن الأصناف المستعملة هلني ومزتي (8) .

تمر ثمار النخيل بعدة مراحل من النمو والتطور حتى يتم نضجها. وقسمت هذه المراحل من قبل عدد من الباحثين (1 ,6 ,8) الى خمسة مراحل وذلك اعتماداً على التغييرات في بعض الصفات الطبيعية والكيمياوية لهذه الثمار . ويمكن تلخيص المراحل التي تمر بها معظم أصناف نخيل التمور العراقية بما يلي : ـ

1 ـ الحبابوك 2 ـ الجمرى 3 ـ الخلال 4 ـ الرطب 5 ـ التمر .

ان ما يعنينا في هذه الدراسة هي مرحلة الخلال والتي تحدد ببدء التغيير في لون الثمرة من الاخضر الى الاصفر أو الاحمر وتستغرق من ثلاثة الى خمسة أسابيع . كما تمتاز هذه المرحلة باستمرار التناقص في معدلات الزيادة في الوزن والحجم كما يتناقص معدل تراكم السكريات المختزلة والحموضة ونسبة الرطوبة بينما تحصل زيادة سريعة في تراكم السكروز والسكريات الكلية والمواد الصلبة الذائبة (1) .

وذكر دواسن واتين (2) ان اختفاء الطعم القابض في الخلال المطبوخ يرجع الى تحول التانينات من الصورة الذائبة الى غير الذائبة ويعتمد ذلك على صنف

المقدمة

يعرف الخلال المطبوخ بأنه التمر الناتج من عملية طبخ بعض أنواع التمور بالماء وهي لا تزال في مرحلة الخلال . وتتم عملية الطبخ بغمر الخلال في ماء مغلي لمدة 20 ـ 40 دقيقة تفصل بعدها عن الماء وتنشر على أرض صلبة جافة في مكان مشمس ويفضل تغطيتها بالسعف .

ان تاريخ البدء بصناعة الخلال المطبوخ غير معروف ولكن من المعتقد أن هذه الصناعة قديمة قدم النخل نفسه أي أنها تعود الى 4000 سنة قبل الميلاد . أن من محاسن الخلال المطبوخ نكهته الجيدة وامكانية نقله وخزنه دون حدوث تغير في خواصه كما يمتاز الخلال المطبوخ بسهولة طحنه والحصول منه على مسحوق يمكن حفظه مدة طويلة ويمكن ادخاله في العديد من صناعات الأغذية . وتعتبر طريقة طبخ الخلال المستعملة في الوقت الحاضر طريقة بدائية اذ أنها تتطلب تشغيل أيدي عاملة كثيرة وكذلك استعمال مساحات واسعة للتجفيف واحتمال اصابة التمور بالحشرات والأتربة أثناء تجفيفها .

ان مكننة عملية انتاج الخلال المطبوخ سواء أثناء الطبخ أو التجفيف يعتبر حاجة ملحة حيث ستؤدي الى الحصول على منتج ذو جودة عالية وتتوفر به الشروط الصحية المطلوبة . تقتصر عملية طبخ الخلال في العراق على استعمال الصنفين جبجاب وبريم وتتراوح كميات الخلال المطبوخ من الصنف بريم في السنوات العشر الماضية ما بين 80 ـ 460 طناً ومن الجبجاب ما بين 5.000 الى 8.000 طناً سنوياً .أما بخصوص الاسعار فكانت حوالي 90 ديناراً للطن الواحد في موسم 1976/1975، ارتفع الى 200 دينار في موسم 1979/1978 (9) .

ان أرقام صادرات الخلال المطبوخ ومعدل أسعار بيعها المرتفعة يعتبر مؤشراً جيداً على امكانية التوسع في هذه الصناعة وكذلك محاولة تطويرها . ان ذلك كله سيعمل على ايجاد قنوات جديدة ومجدية في تصريف التمور حيث سيكون المردود

وفيما يتعلق بنوع التجفيف أشارت نتائج هذه الدراسة الى عدم وجود فروق معنوية بين التجفيف الشمسي والتجفيف بالفرن، الأمر الذي يؤكد امكانية نجاح عملية مكننة انتاج الخلال المطبوخ .

SUITABLE VARIETIES AND CONDITIONS FOR THE PRODUCTION OF KHALAL MATBUUKH

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ABSTRACT

Experiments were carried out to study the possibility of preparing Khalal matbuukh (cooking of dates at Khalal stage) from Zahdi, Sayer, Chibchab and Braim varieties.

The study included the determination of the effect of cooking and drying on some of the physical properties of dates at Khalal stage. The optimum conditions for preparing Khalal matbuukh were also studied.

Results of the physical study revealed that Khalal matbuukh prepared from Zahdi dates was better than that of Chibchab or Braim dates from point of view of taste, colour, average fruit weight loss and pulp ratio.

Results of scoring difference test revealed that cooking for 30-45 mins was the proper time since it produced Khalal matbunkh with desirable texture, appearance and eating quality. Cooking for 15 mins was insufficient in alleviating the astrengency of the prepared dates, and cooking for 60 mins caused a skin breakage and browning.

Furthermore, results of paired comparison preference test did not indicate significant differences between Khalal matbuukh dried either in the sun or by electrical oven.

Multiple comparison difference tests showed the possibility of preparing Khalal matbuukh from Zahdi cultivar as there was no significant differences between Khalal matbuukh prepared from either Zahdi or Chibchab cultivars.

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دراسة الأصناف والظروف الملائمة لانتاج الخلال المطبوخ

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الخلاصة

تم في هذه التجربة دراسة امكانية انتاج الخلال المطبوخ من تمور الزهدي والساير اضافة الى الصنفين المستعملين في الوقت الحاضر لهذا الغرض وهما الجبجاب والبريم . وشملت هذه الدراسة تحديد تأثير عمليتي الطبخ والتجفيف على بعض الصفات الفيزياوية للخلال كما تم أيضاً دراسة أنسب الظروف ملائمة لعملية انتاج الخلال المطبوخ وذلك من حيث مدة الطبخ ونوع التجفيف وأصناف التمور التي يمكن استعمالها .

أشارت نتائج هذه الدراسة الى صلاحية تمور الزهدي والساير (في مرحلة الخلال) لانتاج الخلال المطبوخ حيث كان الخلال المطبوخ المنتج منهما لا يقل جودة عن الخلال المطبوخ المنتج من تمور الجبجاب والبريم .

لقد دلت نتائج الدراسة الفيزيائية أن الخلال المطبوخ المنتج من تمور الزهدي كان أفضل من ذلك المنتج من تمور الجبجاب والبريم وخاصة من حيث الطعم واللون ومعدل الفقد في الوزن ونسبة اللب .

وأشارت نتائج هذه الدراسة أيضاً الى أن أفضل مدة للطبخ كانت في حدود 30 ـ 45 دقيقة حيث امتاز الخلال المطبوخ المنتج بطعم جيد ولون جذاب في حين أن الطبخ لمدة 15 دقيقة أدى الى الحصول على خلال مطبوخ ذو طعم قابض بينما الطبخ لمدة 60 دقيقة أدى الى ادكنان لون الخلال المطبوخ وتشقق الثمار .

المحتويات

رقم الايداع في المكتبة الوطنية ببغداد
٤٤٠ لسنة ١٩٨١

مجلة نخلة التمر

مجلة نصف سنوية تصدر عن مشروع المركز الاقليمي لبحوث النخيل والتمور في الشرق الأدنى وشمال افريقيا .

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