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EDITORIAL

This issue of the Date Palm Journal contains 11 research papers and a section on documentation. These papers represent a wide range of subjects important to the date growing countries of the region.

Mater reports on *in vitro* propagation of *Phoenix dactylifera* L. while Al-Salih et al did a study on comparative morphological and anatomical study of seed and embryo culture-derived seedling of *Phoenix dactylifera* L.

There are two papers on pollination: one on evaluation of seedling male palms used in pollination in the central region of Saudi Arabia by T.A. Nasr et al, while Hamood and co-authors report on the effect of mechanical pollination on fruit set, yield and fruit characteristics of date palm (*Phoenix dactylifera* L.) Zahdi cultivar.

Gupta and Siddiqi report on effect of time of cooking for the preparation of Chhuhara from date fruits.

Al-Ogaidi and Mutlak in their paper discuss the phenolic compounds of four date cultivars during maturity stages.

Al-Shaickly et al present their investigation on types and extent of microbial contamination on fresh Iraqi dates during maturation while Shukr discusses hygroscopicity of certain dried date products.

Al-Hakkak and co-authors present an account on effect of high doses of phosphine fumigation on the amino acid, protein and sugar composition of Iraqi dates.

There is also a survey of insect pests of date palm in Qatar by Al-Azawi.

Also presented is an analysis of market conduct in the date marketing system in Sind-Pakistan by Shah.

The following three papers are in Arabic with English summaries; studies on developmental anatomical changes in Khadrawi date palm in relation to time of pollination and cracks of spathes by Al-Attar, a histological study on date palm to determine the time of spathes infestation by *Mauginiella scattae* Cav. by Al-Hassan et al. and Production of soft drinks using date liquid sugar by Al-Ogaidi and co-authors.

Mohan (of the Regional Project) presents abstracts of 27 recently published papers on the date palm and related subjects.

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.

Dr. Hassan Khalid Hassan Al-Ogaidi
Chairman, Editorial Board

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 ofthe 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 insectes 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 illustration give the same information. They should be typed on seperate sheets at the end of the text and must in no case be of a size or 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

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IN VITRO PROPAGATION OF *PHOENIX DACTYLIFERA* L.

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ABSTRACT

Shoot tip explants excised from date offshoots of *Phoenix dactylifera* L. cv. Barhee and Hallawi were cultured on nutrient media supplemented with 2mg/l of BA and kinetin, and the auxins NAA or 2, 4-D at five levels (0, 0.1, 1, 10, 100 mg/l). Vigorous callus growth occurred in explants cultured on media containing high levels of auxins (10 and 100 mg/l). The callus had yellowish aggregated type, and could be subcultured on high auxin containing media to produce callus only, or to low auxin media (0 and 0.1 mg/l) to produce organs only. When subcultured on a medium devoid of auxin, the aggregates gave rise to leaves only, while it produced roots only if subcultured on NAA containing medium. No embryiod differentiation was observed in this type of callus.

Following repeated subcultures on media containing high levels of auxins, white colonies of embryogenic nodular callus composed of small friable nodule were initiated. Histological examination revealed that the tiny nodules were precursors of asexual embryos and originating from small single meristematic cells in the callus tissue.

Mature nodules were readily germinated within two months in one subcultur on a medium containing 0.1 mg/l of NAA. A second subculture of individual embryoids (5-10 mm long) to same medium was necessary to avoid competition among them in the first subculture, and to promote plantlet growth in the second subculture. The resulting plantlets (10-15 cm long after 2-3 months in the second subculture) survived transplanting to free living conditions of the soil.

اكثار نخلة التمر خارج الجسم الحي

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الخلاصة

زرعت قطع مكونة من ارباع البراعم الطرفية المستأصلة من فسائل نخيل البرحي والحلاوي على أوساط غذائية اصطناعية تحتوي على السايتوكاينين (N^6 Benzyladenine) والكاينتين (N^6 furfurylaminopurine) بمقدار 2 ملغم/اللتر لكل منهما والأوكسين (Naphtalene acetic acid) (NAA) أو الأوكسين (2,4-D) (2,4- dichlorophenoxyacetic acid) بخمسة تراكيز (صفر و 0.1 و1 و10و 100 ملغم/اللتر). نتج عن الزراعة احسن نمو لنسيج الكالس من القطع المزروعة فوق الأوساط الغذائية المحتوية على تراكيز عالية (10و 100 ملغم/اللتر) من أي من الأوكسينين وكان الكالس بشكل كتل مصفرة اللون وقد أمكن تقطيعه وإعادة زراعته فوق الأوساط العالية التراكيز لغرض إنتاج الكالس فقط أو الأوساط الواطئة التراكيز (صفر و 0.1 ملغم/اللتر) لغرض تكوين أعضاء نباتية. وعند زرعه في الوسط الخالي من أي أوكسين فإن كتل الكالس تنمو إلى اوراق فقط. وعند زرعه في الوسط الحاوي على 0.1 ملغم/اللتر من NAA فإن الكتل تنمو الى جذور فقط. ولم تتحور أجنة كاملة من هذا النوع من الكالس.

على أثر تكرار عمليات تقطيع وإعادة زرع الكالس المكون من الكتل الصفراء فوق الأوساط العالية التركيزات من الأوكسينين، ظهرت مستعمرات بيضاء من الكالس الجنيني العقدي القوام فوق سطوح الاوساط الغذائية المتروكة وذلك بعد مرور بضعة اسابيع من إزالة الكالس الكتلي المصفر والذي مضى عليه 6-8 أشهر في عمليات إعادة الزرع. وكان الكالس الجنيني الأبيض مكوناً من عقد صغيرة هشة القوام جداً بحيث يمكن طليها فوق سطح الوسط الغذائي الاصطناعي.

وقد كشفت الاختبارات النسيجية التشريحية بأن تلك العقد الدقيقة ما هي سوى بادئات للأجنة الخضرية وان أصل نشوئها يعود إلى خلايا مرستيمية صغيرة مفردة في نسيج الكالس.

ولدى إنبات العقد المكتملة في وسط غذائي على 0.1 ملغم/اللتر من NAA كخطوة أولى فقد اتضح سهولة نموها إلى أجنة خضرية خلال شهرين من إعادة الزرع. ثم وجد ان إجراء خطوة ثانية بإعادة زرع الأجنة النامية (التي تتراوح اطوالها بين 5-10 ملمتر) بشكل انفرادي فوق أوساط غذائية من نفس النوع ضرورية لتجنب المنافسة بين الأجنة في كل زجاجة زرع في الخطوة الأولى ولتعزيز النمو المستقل للنبيتات في زجاج الخطوة الثانية. إن النباتات الناتجة من هذه العمليات (التي تتراوح أطوالها بين 10-15 سم خلال 2-3 أشهر في خطوة الزرع الثانية) نقلت للتربة وواجهت الظروف الطبيعية للعيش الحر بنجاح.

INTRODUCTION

Commercial cultivation and expansion of superior cultivars of date palm (*Phoenix dactylifera* L.) has been restricted by slow asexual propagation through offshoots. Production of offshoots by the palm is naturally limited and limits its spread and propagation. Offshoots are axillary buds usually arise at the base of mature palms during the juvenile phase of growth. The conventional method of propagation by excising the offshoots from their mother palm is combersome and impractical. Propagation by seeds is also unsatisfactory because date palm is heterozygous and about half of the progeny will be males and half will be females which are not true to type.

Numerous attempts have been made to employ tissue culture techniques for propagation of date palm (1, 2, 3, 7, 9, 10, 11, 12). Some success has been reported in the initiation of whole plants from embryo callus of date palm (1, 5, 8, 9, 13, 17). Recently, tissue explanted from lateral buds and shoot tips of date palm offshoots have been reported to initiate embryogenic callus and subsequently plantlets through asexual embryogenesis (13, 15, 16).

In this investigation, segments consisting of quarters of shoot tip explants taken from offshoots were used to establish embryogenic callus. Free vegetative embryoids produced from this callus were employed for micropropagation of date palm through germination of embryoids and production of plantlets.

MATERIALS AND METHODS

Young offshoots (2-3 years old) were separated from date palm of Barhee and Hallawi cultivars grown at Harthah Date Station, Basra, Iraq. Offshoots were dissected acropetaly until the shoot tips were revealed. Shoot tips consisted of the apical meristem and soft inner leaves measuring 10 mm in length with a base of meristele tissue measuring 10 mm in width and 1 mm in thickness were excised (Fig. 1) and divided longitudinally into four equal segments (quarters). All excised segments of shoot tip explants were stored temporarily over moist filter papers inside Petri dishes until surface sterilization could be carried out.

Excised embryos used for comparative study were obtained from mature seeds of Barhee and Hallawi fruits. Seeds were soaked in distilled water for three days and sections measuring 3 mm in thickness containing the embryos were cut and removed from the middle portion of the seeds. The sections were opened from the ventral sides and the exposed embryos were removed and kept inside moist Petri dishes.

Sterilization of the explants was achieved by soaking shoot tip segments and excised embryos in 10% (V/V) sodium hypochlorite solution containing two drops of tween-20 emulsifier per 100 ml solution for 15 min. and rinsed two times with steril distilled water.

One segment (quarter) of shoot tip or three excised embryos were placed over the surface of solid nutrient medium in one culture flask or tube. Ten cultures were initiated for each type of tissue or medium.

The medium composed of Murashige and Skoog basal salts (6) plus the following (in mg/liter): sucrose, 30000; NaH_2PO_4. $2H_2O$, 170; meso-inositol, 100; thiamine-HCl, 0.5; adenine sulfate . $2H_2O$, 40; 6-benzyl adenine (BA), 2; 6-furfuryl amino purine (Kinetin), 2; activated nutralized charcoal, 3000; washed agar, 8000. The auxin 2, 4-dichlorophenoxyacetic acid (2, 4-D) or a-naphthalene acetic acid (NAA) were included in the nutrient media at 0.0, 0.1, 1, 10, and 100 mg/l concentrations. The pH of the media was adjusted to 5.7 with 0.1 N NaOH and HCl before addition of agar.

The nutrient media were dispensed into 125 ml conical flasks (Erlenmeyer) at a rate of 50 ml, or into 25 mm × 150 mm culture tubes at the rate of 25 ml per vessel.All flasks and tubes were stopped with spongy stoppers,their necks covered with aluminium foils and sterilized by autoclaving for 15 min. under 1.05 Kg/cm^2 and a temperature of 120° C. Data recording, reculture or subculture to fresh media were conducted every two months.

All cultures were incubated in a temperature controlled cabinets at 27 ± 1° C under 16 hours daily exposure to low intensity of 1000 lux illumination.

Tissue cultures used in histological observation were fixed in FAA (formalin: glacial acetic acid: 50% ethanol 5:5:90 V/V/V), dehydrated in ethanol series, and embedded in paraffin. Embedded tissues were sectioned 12μ thick and stained with saframin and fast green (4). Callus sections were made from cultures at various stages of development and concentration of auxins. Cell sizes were determined with ocular micrometer.

Micropropagation process was conducted by first transferring small masses of friable white embryogenic callus tissues (measuring 1-2 mm in diameter) from high auxin cultures to media containing 0.1 mg/l NAA, and second (two months later) picking up germinating vegetative embryos individually when they reached 5-10 mm long. This process was continued until germination was exhausted (within about four months). Such embryos were transferred to media of the same compositions to complete their germination and produce whole plants (ranging 10-15 cm long) where they could be transferred to free living conditions in the soil.

RESULTS

Establishment of Callus Cultures: Shoot tip explants cultured on media containing high levels of auxins (10 and 100mg/l) produced good callus growth whereas their vegetative growth was greatly inhibited. Shoot tip explants cultured on media containing low levels of auxins (0 and 0.1 mg/l) produced no callus,however, their vegetative growth was strongly stimulated (Fig. 2). Such explants cultured on medium containing 1 mg/l auxins initiated some callus and vegetative growth.

After few recultures on media containing high levels of auxins, shoot tip explants gave rise to yellowish aggregated type of callus tissue. This callus was sub-divided and cultured on fresh media of the same compositions to increase its quantity. It was characterized by a multitude of uniform and spherical aggregates (Fig. 3). When this aggregated callus was subcultured at this early stage to the medium devoid of auxins, the aggregates developed into green leaves only. Histological examination of these aggregates suggested them as leaf primodia of the original shoot tip explants. When the aggregated callus was subcultured to medium containing low levels of the auxin NAA (0.1 mg/l), some aggregates developed roots only. There was no embryoid differentiation from this callus at all levels of auxins.

Establishment of Embryogenic Callus Cultures: Following repeated subculturing of the aggregated yellowish callus on media containing high levels of auxins (10 and 100 mg/l), white embryogenic nodular callus was initiated from the superficial layers of the aggregates after 6-8 months of the first shoot tip cultures. This type of callus tissue was originated from the aggregated callus in the form of small white colonies appearing on the surfaces of the media few weeks later. The nodular white callus was embryogenic in nature, characterized by multitude of very small nodules on

grains (relative to the aggregates), very friable and could be easily propagated and maintained on fresh media containing high levels of auxins (10 and 100 mg/l). New colonies of embryogenic callus were established by subculturing small masses (1 mm in diameter) from other colonies. The friability of callus colonies permitted picking up of even individual free nodules. Subculturing of embryogenic nodular callus to media containing low levels of the auxin NAA (0, 0.1, and 1 mg/l) enhanced further seperation and enlargement of free single nodules (Fig. 4). Transfering of free nodules to media of the same composition resulted in their elongation and germination. Omission of NAA from the medium encouraged precocious elongation of the nodules before completion of their maturation. This resulted in the development of creamy coloured weak plantlets (Fig. 5). The 0.1 mg/l level of NAA enhanced maturation of the nodules and their subsequent germination into small normal white plantlets (Fig. 6). However, 1 mg/l of NAA supressed the normal elongation of the nodules and enhanced their maturation (complete differentiation of shootroot apices), but strongly delayed or even inhibited their germination. This eventually resulted in the formation of rosette plantlets. Thus best results and number of survived plantles were obtained when free nodules were subcultured to medium containing 0.1 mg/l of NAA (Fig. 6).

Histological Examination of the Embryogenic Callus: Microscopic examination of the sectioned nodules revealed that these nodules are precursors to asexual embryos. The embryogenic callus consisted of two types of tissues; a loose friable tissue and compact clumps (Fig. 7). The friable portion of the embryogenic callus composed of highly vacuolated, dull stained large cells exceeding 20 μ in diameter and surrounding the compact clumps. The compact clumps composed of semivasculated cells, intermediately sized (measuring less than 20 μ in diameter) and found in the interior regions of the clumps; and a more intensely stained smaller size meristematic cells measuring about 10 μ in diameter and located in the periphery of the clumps. Early meristematic loci were associated with compact clumps especially in epidermal and subepidermal regions. These loci were composed of meristematic cells, about 10 μ in diameter, and had prominent nuclei containing one or two nucleoli. The loci are enclosed by thickened cell walls separating each other in addition to other types of cells (Fig. 8). Expansion of the meristematic loci, produced separate other clumps, or free nodules (embryoids). At their early stages of development, nodules appeared as small groups of meristematic cells, spherical in shape and scattered within the friable portion of the callus tissue. They represented the proembryonic structures in their early stages of development on high auxin media (10 and 100 mg/l). Some proembryos were budded from meristematic loci or other proembryos, but most of them apparently initiated from single meristematic cells through a sequence of embryogenesis. Division of single cells resulted in the formation of two, four, eight, sixteen or more spherical proembryos

that were enclosed by thickened cell walls (Fig. 8) or by fragmented loose tissue. Further cell division of the meristematic cells of the proembryo, produced multicelled bipolar structure that is composed of two types of cells; meristeatic small cells and less-meristematic larger cells. The opposing poles of the proembryo developed into meristematic end(shoot-root end)which are composed of small meristematic cells; and less-meristematic end (haustorial end).This end is composed of less-meristematic highly vacuolated large cells. This ovate multicellular bipolar proembryo is enclosed by a thick cell wall, thus representing a single free nodule. Further development of the bipolar structures on low auxin media (0 and 0.1 mg/l) gave rise to mature embryiods (mature nodules) characterized by the presence of differentiated shoot-root apeces, procambial bundles or strands with internal cavity separating the shoot tip region from the rest of the cotyledon (Fig. 9).

Further growth of developing embryoids on medium containing 0.1 mg/l of NAA produced free white spherical or cylindrical nodules or grains corresponding to the excised zygotic embryos found in mature seeds prior to germination. Further transfering of free Embryoids to medium of the same composition, resulted in their germination and the elongation of cotyledon to 5-10 mm in one month (Fig. 6). A third transfer of individual embryoids to fresh medium of same composition, was necessary for elimination of competition among germinating embryoids in single culture vessel. This process stimulated further maturation and germination of new embryoids, and could be repeated long enough until production of embryoids from single culture vessel was exhausted.

Longitudinal section of elongating embryoids (about 5 mm long) showed the differentiation of shoot-root apex at one end of the cotyledon (the meristematic end) and elongation of the haustorium (the less-meristematic end of the cotyledon) which tends to grow and twist away from the medium or callus surfaces (Fig. 10). Tendency of the haustorial end to fold around itself few turns was a good sign of successful and continuous normal germination of embryiods. This was usually associated with the emergence of root tips and their growth in the media (Fig. 11). Subsequent stages of embryiod germination corresponded to those of zygotic embryos excised from the mature seeds.

The final transfer of individual embryos to the medium containing 0.1 mg/l of NAA allowed their normal development and production of plantlets with distinct shoots and primary roots ranging 10-15 cm in length during 2-3 months in the last cultures. A typical example of such plantlet is shown in (Fig. 12). Plantlets within such range of length and age could be easily transfered to free living conditions in the soil.

DISCUSSION

Shoot tip segments consisting of quarters of the apical bud were used in

this investigation since they represent the best source of starting tissues for establishment of callus cultures. They were superior to any other tissues in the offshoot. Tisserat tested different sources of palm tissues and concluded that shoot tips and lateral buds were the best materials for callus initiation and regeneration of plantlets (13). However, there was no observation in his results to the superiority of shoot tip explants. Our observation that high auxin levels in the media favoured callus growth and low auxin levels favoured normal vegetative growth of the shoot tip explants confirms his results (13). The histological study of development of vegetative embryoids in callus cultures also corresponded to those reported (16). However, in this study, the embryogenic callus composed of completely free or loose nodules, that their germination in the low auxin media gave rise to separate plantlets which required no effort for their picking up from culture vessels. This feature can probably facilitate the micropropagation method. Establishment of embryogenic callus that consists of free nodules originated from invisible tiny pieces of the apparantly active callus which were fragmented and left over the medium surface. The old aggregates of yellow callus seemed to enrich the remaining media with some promoting substances, and callus removal from the medium allowed the tiny masses of the white active callus to overcome the nutritional competition with the large aggregates and thus encourage colonic appearance.

In this investigation, subculturing of embryogenic callus onto medium devoid of auxins allowed embryiod development and their subsequent germination. This confirms observation of (15). However, the resulted plantlets and their survival were unsatisfactory. The method employed in this investigation was to subculture embryogenic callus to medium containing only 0.1 mg/l of NAA which produced normal plantlets. Inclusion of activated charcoal in all types of media employed in this investigation inhibited adventitious rooting at any concentrations of the auxins. This observation corresponded to (14) where he obtained best adventitious rooting when charcoal was excluded from the media and NAA concentration was 0.1 mg/l.

The micropropagation method employed in this investigation utilized two basic facts. First the auto-establishment of callus colonies of free nodules and their maintenance through continuous subcultures to media containing high levels of auxins. Second, germination of free nodules and production of plantlets through two successive subcultures of embryogenic callus to many small germinating embryoids (ranging 5-10 mm long) during the first two months. In the second subculture, individual embryoids were transfered to fresh medium. Removal of germinating embryoids at this stage stimulated further germination of other nodules in the culture vessels. The second subculture allowed fast growth of individual embryoids and their development into whole plantlets (ranging 10-15 cm long) during 2-3 months. Such

plantlets were able to survive the free living conditions of the soil.

This specific procedure demonstrated a very practical method of micropropagation and mass production of date palm plantlets.

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Fig.1 Freshly excised shoot tip from «Barhee» offshoot (10 mm long with a fleshy base 10 mm in diameter) ready to be cut longitudinally into four segments to be planted on nutrient media. X2

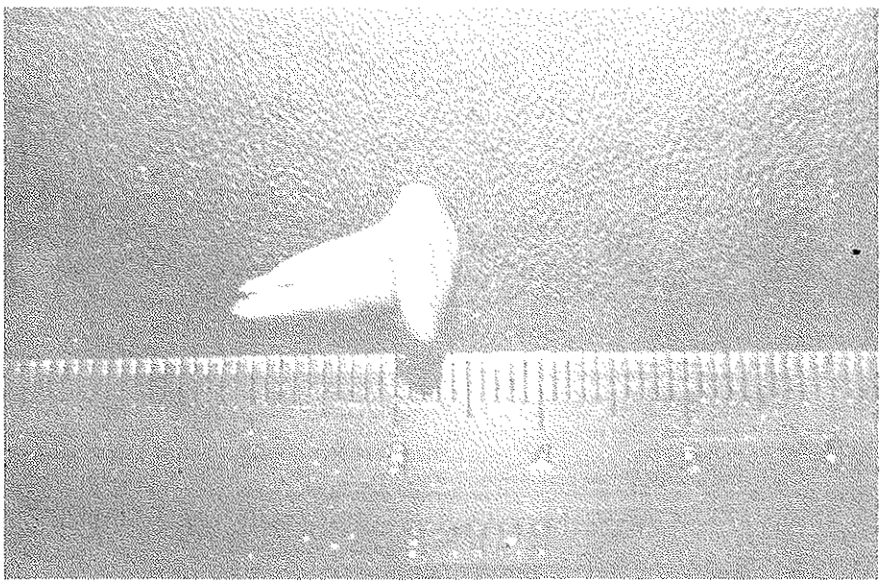


Fig.2 Vegetative development of shoot tip explant and the prevention of callus growth after one month in culture over medium containing 0.1 mg/l 2,4–D. X2

Fig.3 Yellowish aggregated type callus tissue obtained after repeated subcultures of the initial callus on media containing high levels of auxins (10 and 100 mg/l). X2

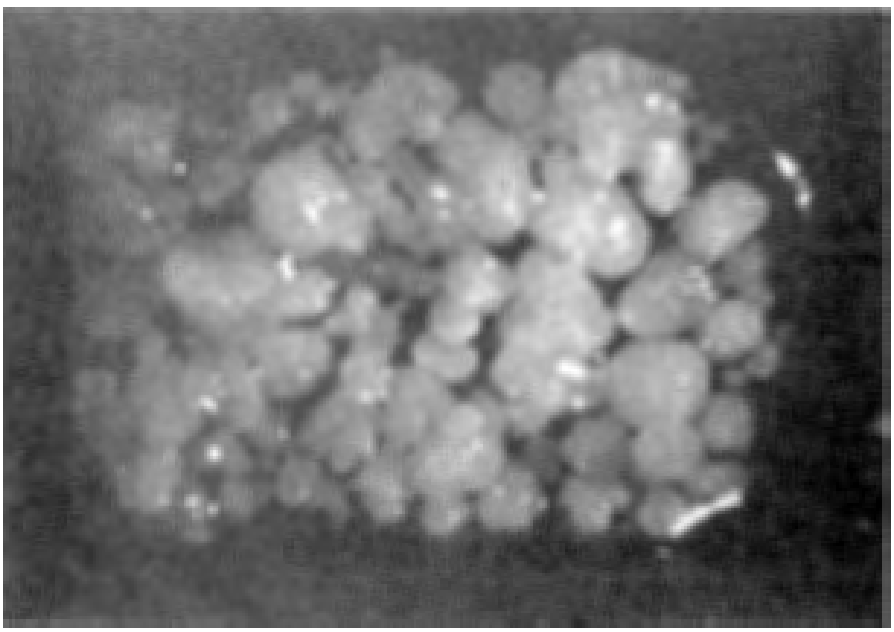
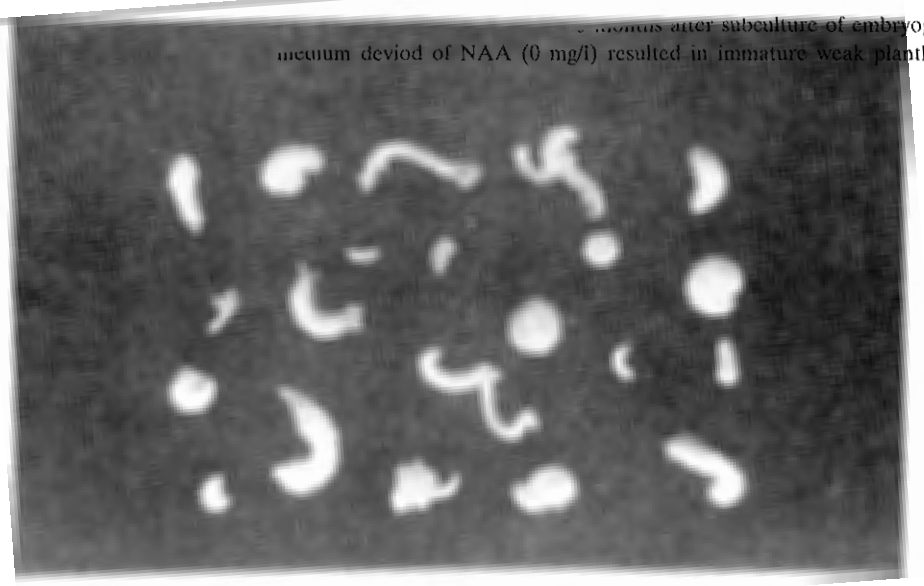


Fig.4 Free single nodules produced from culturing embryogenic callus to media containing low levels of auxins (0 and 0.1 mg/l) for one month. X7



months after subculture of embryogenic callus to medium deviod of NAA (0 mg/l) resulted in immature weak plantlets. X7

Fig.6 Germination of free nodules two months after subculture of embryogenic callus to medium containing low level of NAA (0.1 mg/l) resulted in mature normal plantlets X2

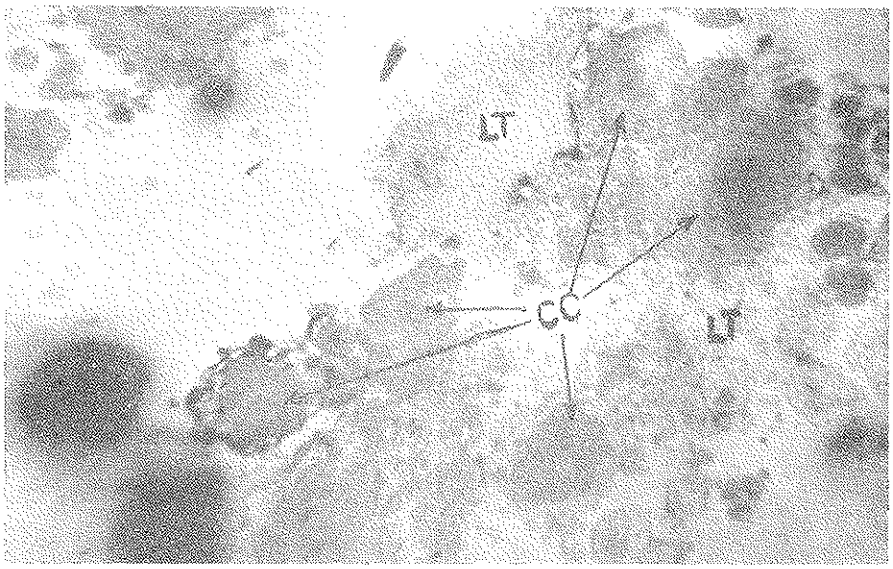


Fig.7 Transverse section through embryogenic callus, one month after subculture to high auxin medium. Several compact clumps (CC) were interdispersed among loose friable tissue (LT). X25

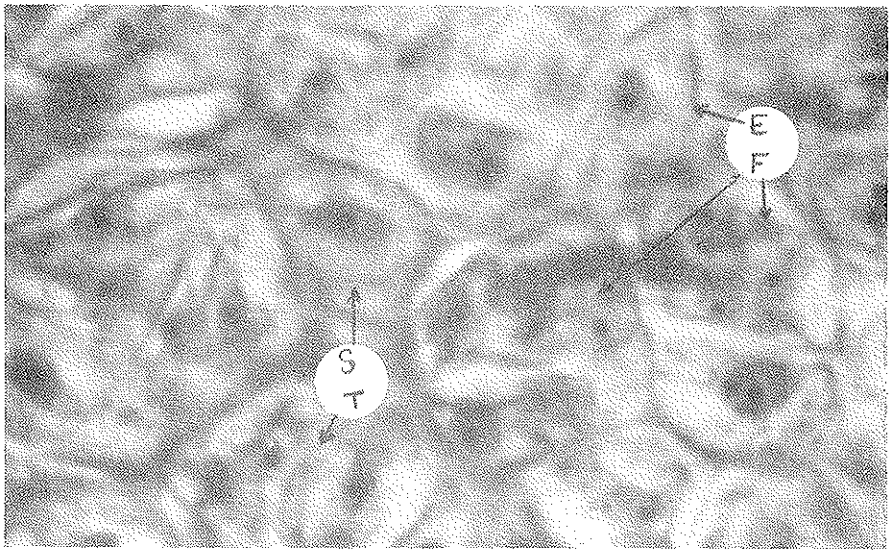


Fig.8 Occurence of single (S), two (T), four (F) and eight (E) celled spherical proembryos within callus clump.Note the prominent nucleoli and the thick-celled walls enclosing each proembryoid and separating merisiematic loci from other cells. X 400

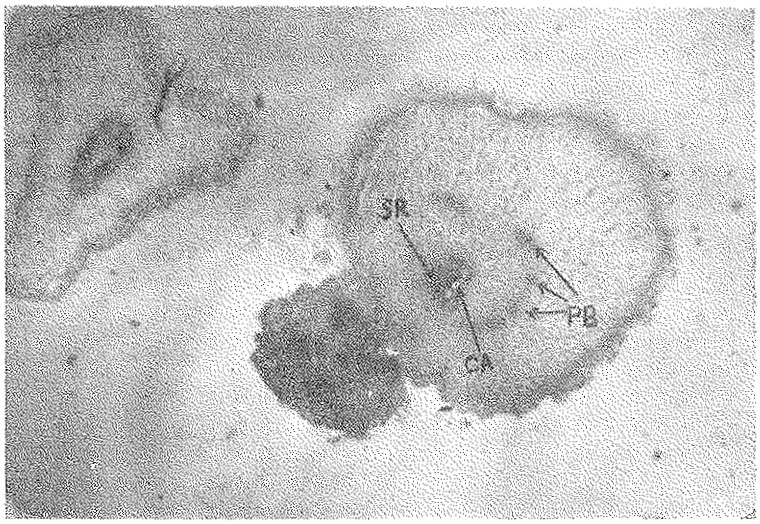


Fig.9 Transverse section through mature nodule one and half month after transfer to medium containing 0.1 mg/l of NAA showing development of mature embryoid with presence of shoot-root pole (SR) at the meristematic end, distinct cavity (CA) and procambial bundles (PB). X25

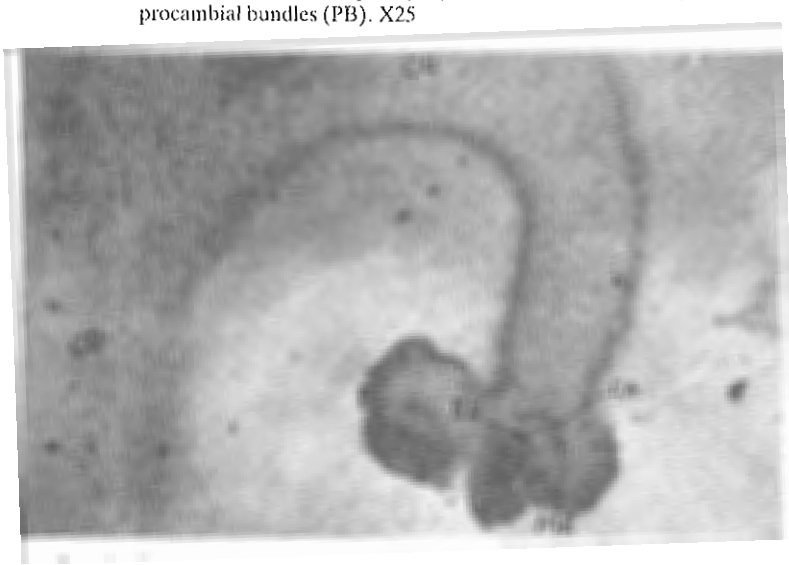


Fig.10 Longitudinal section through germinating embryoid on medium containing 0.1 mg/l of NAA showing elongation of cotyledon (Co) and its tendency to fold away from the meristematic end (ME). The later also showing shoot-root pole (SR) and cavity (CA). X25

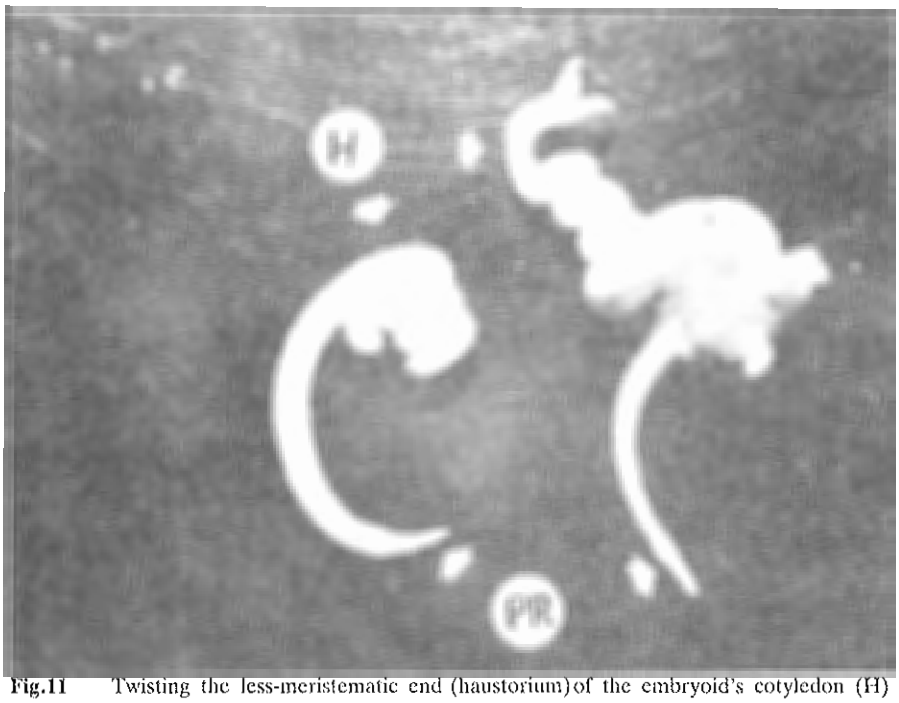


Fig.11 Twisting the less-meristematic end (haustorium) of the embryoid's cotyledon (H) several times about itself with the emergence of the primary root from the meristematic end (PR) after half month (left) and one month (right) of individual subculture of embryoids to medium containaing 0.1 mg/l of NAA. X35

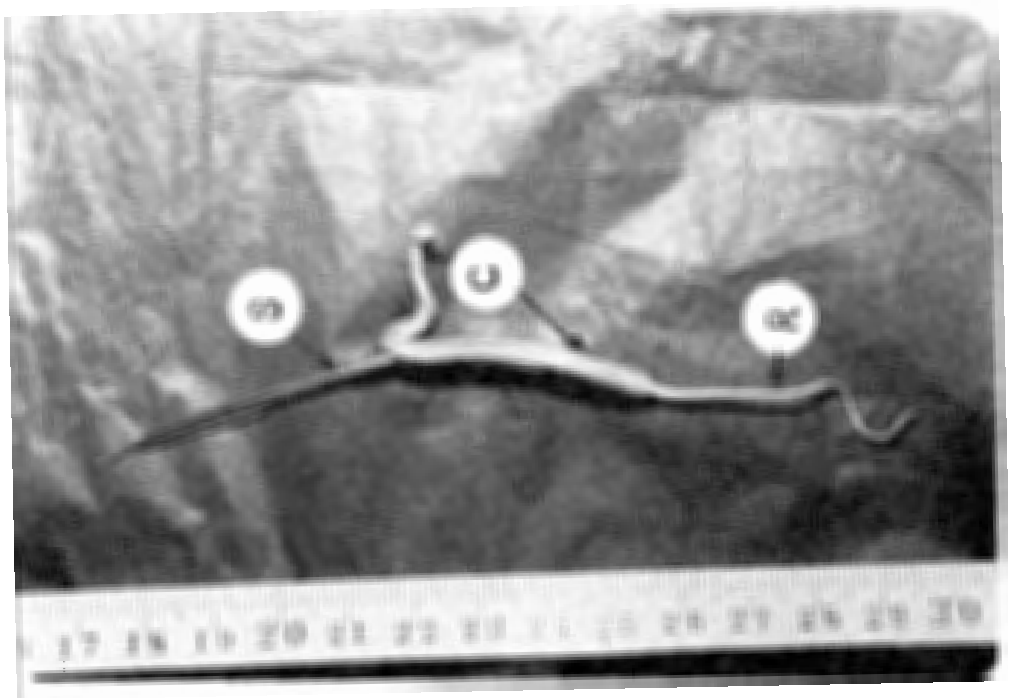


Fig.12 Typical Barhee plantlet shows distinct shoot (S), root (R), and cotyledon (C), produced after two subcultures of embryogenic callus to medium containing 0.1 mg/l NAA (3 months old). This plantlet survived transfer to soil. About X1

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A COMPARATIVE MORPHOLOGICAL AND ANATOMICAL STUDY OF SEED AND EMBRYO CULTURE — DERIVED SEEDLING OF *PHOENIX DACTYLIFERA* L.

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ABSTRACT

Date palm (*Phoenix dactylifera* L., cv. Braim) embryo culture — derived seedlings were studied morphologically and anatomically and compared with those derived from seeds. The results showed that embryo culture derived seedlings were generally smaller, thinner and weaker as compared with seed-seedlings. Embryo culture seedlings could not adapt themselves to the more natural conditions in soil pots, where they collapsed and died. This death may be related to the lack of root cell differentiation which may be attributed to deficiency in certain growth regulators, insufficient sugars, or hormonal and/or sugar imbalance. Lack of endodermis, xylem and phloem in root system of embryo culture derived seedling, associated with the relatively low humidity in the open pot culture, apparently did not substitute the loss of water by transpiration.

دراسة مقارنة مورفولوجية وتشريحية بين البادرات الناتجة من زراعة الأجنة والبذور في نخيل التمر *Phoenix dactylifera* L.

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الفضيلية ـ بغداد ـ العراق

الخلاصة

درست بادرات نخلة التمر الناتجة عن أجنة مرباة في مزرعة نسيجية دراسة مورفولوجية وتشريحية وقورنت ببادرات البذرة الاعتيادية، وقد اتضح ان بادرات المزرعة النسيجية كانت على العموم صغيرة ونحيفة وضعيفة مقارنة ببادرة البذرة الاعتيادية. وعندما نقلت بادرات المزرعة النسيجية إلى مزرعة أصص مكشوفة، لم تتمكن تلك البادرات ان تتواءم والبيئة الجديدة حيث انهارت وماتت في وقت قصير. وقد فسرت اسباب فشل بادرات المزرعة النسيجية بالاستمرار في نموها وتكشفها في الموطن الطبيعي، بأنها تتعلق بفقدان التميز الخلوي للجذر، خصوصاً في منطقة الاسطوانة الوعائية. ويعود سبب ذلك على الأكثر إلى نقصان بعض منظمات النمو أو السكر الكافي أو نقصان في التوازن بين منظمات النمو نفسها أو بين منظمات النمو والغذاء والعوامل المرافقة في الوسط الغذائي للمزرعة النسيجية. إن عدم وجود القشرة الداخلية والخشب واللحاء في جذر بادرة المزرعة النسيجية، وانخفاض الرطوبة النسبية في محيط الأصص، لم تساعد البادرة في التعويض عن فقدان الماء عن طريق النتح.

INTRODUCTION

Several attempts to grow date palm in tissue culture have been conducted in the past few years. Success has been reported on the initiation of adventitious plantlets from embryo — derived callus (3, 13, 14).

In our laboratories, date palm tissue culture program has been initiated with the hope of producing plantlets from economically important cultivars. Tissue culture technique will reduce the dependence on seeds and offshoots propagation, and development of large number of clonal varieties in a short period of time.

In this study seedlings derived from embryo culture are usually weak and does not survive transplantation in the soil. No such problem has been encountered in seed derived seedlings. Thus we attempted to investigate this problem from the morphological and anatomical points of view.

MATERIAL AND METHOD

Selection of Plant Material: Seeds of date palm *Phoenix dactylifera* L. cultivar 'Braim' were collected from the same tree from Za'faraniya Experimental Station near Baghdad. Uniform and healthy seeds were selected for each experiment. The seeds were washed with tap water for a few minutes and dried to get rid of the sticky flesh covering. They were then surface sterilized with 5% hydrogen peroxide for fifteen minutes. To enhance germination, the seeds were treated with 10 N NaOH for 15 min. (1), then washed in tap running water for one hour, other seeds were soaked in tap water for 48 hours, and to facilitate embryo excision and were used for embryo culture trails.

Seed Germination: Seeds were germinated on a filter paper, in sterilized petri-dishes moistened with distilled water as germination medium and incubated at 28 ± 2° C (1). The seed — seedlings were kept in the incubator until they formed the first leaf and root (2).

Embryo Culture: Embryos were aseptically excised and placed in culture tubes on a sterile Murashige and Skoog (12) medium (without hormones), under 30 ± 0.2° C in the dark. The embryos were allowed to develop on this medium for six weeks, where germination was evident, and the seedlings formed of the first leaf and root. The seedling were then transferred into open-pots (sterilized peat moss).

Seedling Part for Comparison: Certain parts of the seedlings were chosen for morphological comparison. These parts included the first root, the distal and proximal end of the mature scutellary sheath, the scutellary sheath, the scutellary neck and the coleoptile.

Preparation of Material for Anatomical Studies: The samples were prepared for histological examination as described (10) with minor modifications. They were fixed in FAA solution, dehydrated through tertiarybutyl alcohol series, embeded in parafin and sectioned 12 μm thick. They were double stained with safranin as primary stain and fast green as a counter stain (10). Then examined under 'Nikon' microscope and photographed with 'Nikon' camera.

RESULTS

Figure 1 (A & B) shows clearly that the organs of embryo culture — derived seedling are thinner, weaker and longer than those of the seed — seedlings. The distal part of the scutellum (the suctorial haustorium) undergoes some sort of discolouration and doesn't penetrate the nutrient medium (Fig. 1 B) as compared with the seed derived seedlings (Fig. 1A). It pushes its way at the expense of the dissolved and absorbed endosperm.

The root of the embryo-culture seedling is composed of a monolayer of epidermal tabulated cells (Fig. 2 A) and cortex of parenchymatous cells with large and numerous lacunae with no fibers or any sclerenchymatous cells (Fig. 2B). The vascular cylinder is well differentiated from other parts, but the procambium is not differentiated into vascular bundles with primary xylem and primary phloem. The endodermis and the pericycle are not differentiated either (Fig. 2 C & D).

Figure 3 shows that the root of seed — derived seedling consists of a monolayer epidermis, with exodermis composed of cells having lignified cell walls (3-4 layers). The cortex is composed of paranchyma cells, with large and numerous lacunae (Fig. 3B). The endodermis is composed of one layer of cells, with clear and thick tangential walls. The pericycle is 1-2 layers thick of parenchymatous cells. The vascular radial bundles (Fig. 3C) are very well differentiated into primary xylem and phloem. The number of vascular bundles ranges from 9-10, with very clear difference between protoxylem and metaxylem. The central region of the vascular cylinder is filled with pith cells which disintegrate later to form a central cavity (Fig. 3 D).

The development of the shoot system is shown in figure 4 (embryo culture derived seedlings) and figure 5 (seed derived seedlings). Three distinct regions can be easily recognized, such regions include the scutellary sheath, coloeptile and primary leaf.

It is evident that the embryo culture derived seedling is quite similar to the seed — derived seedling except the size of the cells and the thickness of the cell walls which are smaller and thinner in the former as compared with those of the seed-seedling.

DISCUSSION AND CONCLUSION

It has been well known that specialized functional significance is usually attributed to the products of differential development in tissues, as in the formation of sieve tubes, tracheids, fibers, endodermis and storage parenchyma (15).

The inception of vascular tissues is usually, associated with the active meristem of shoots, leaves, and roots (4). Therefore, it is a reasonable to assume that a region of active utilization of metabolic materials and water is established. The apical meristem sets up lines of tension in the differentiating tissues below. It may, therefore, be that the general contour of the nascent vascular tissue is primarily 'blocked out' in this way.

Meanwhile, a related line of research has been followed (5-9). They successfully demonstrated that Indole acetic acid (IAA) is causally involved in quantitative manners in differentiation of the normal and induced xylem strands in coleus.

In regeneration experiments and in other related investigations, it has been shown that there is a close relationship between the amount of (IAA) passing downwards from the actively growing young leaves, and the amount of xylem, i.e., number of wood vessels differentiated (11). A comparable effect on xylem differentiation was observed in experiments in which a synthetic auxin was applied (7).

Wetmore and Rier (16) showed that low concentrations of sugars, 1.5-2.5%, favoured xylem differentiation and higher concentrations (3-4%), favoured phloem formation. Intermediate concentrations (2.5-3.5%), however, induced both xylem and phloem differentiation. Wetmore and Rier contributed the interesting suggestion that the almost universal association of xylem and phloem in vascular bundles may have its basis in this intermediate range in sugar concentrations.

In this work cell differentiation in the root of embryo culture — derived seedling, was arrested at the period of procambium formation. The vascular cylinder is clearly delimited by two layers of parenchyma — like cells. The endodermis is not differentiated, and for this reason, it cannot be distinguished from the pericycle. The vascular cylinder center is occupied by a cavity and it is devoid of xylem and phloem.

In this investigation the cessation of differentiation may be attributed to lack of synthetic auxin in the culture media or to sugar concentration (5%) or to the critical balance between them.

The embryo-culture derived seedling continues to grow in the nutrient media, but it dies when transferred to open — pot media.

This may be due to the high level of relative humidity in the culture tube that reduces transpiration which is greatly associated with water and mineral translocation.

The lack of endodermis, xylem and phloem in the root of embryo culture derived seedling and the low relative humidity in the pot, could not help the seedling to substitute the loss of water by transpiration.

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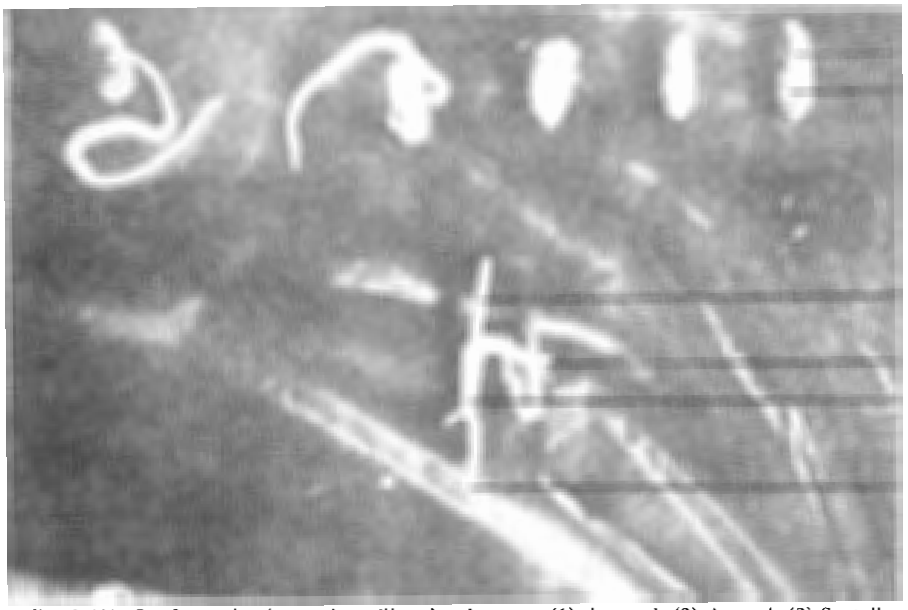

Fig.1 (A) Seed germination and seedling development (1) the seed. (2) Apocol. (3) Scutellary neck. (4) Coleoptile. (5) Scutellary sheath. (6) Seedling first root.

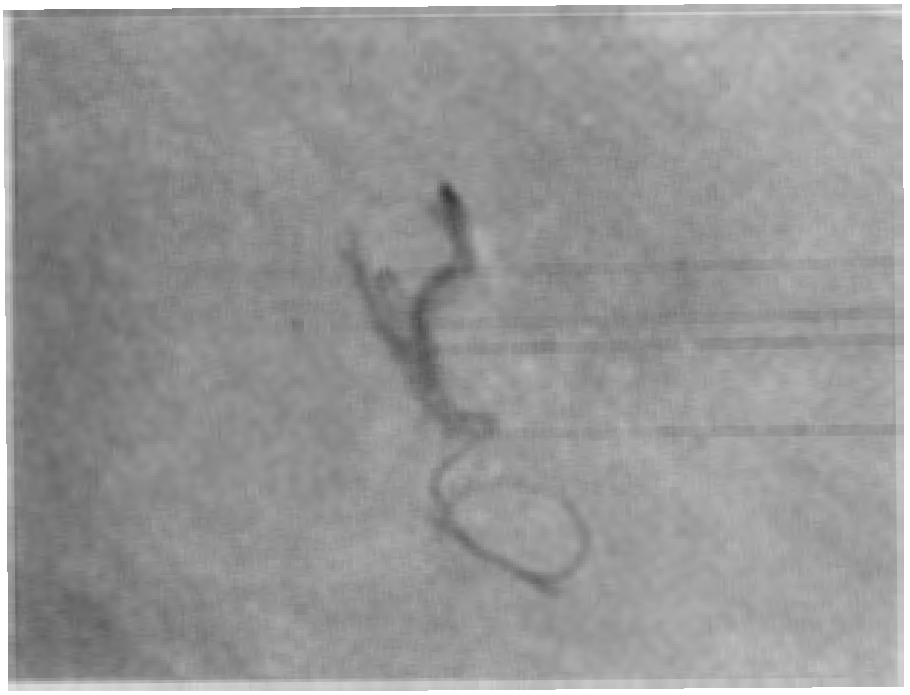

Fig.1(B) Embryo culture derived seedling development (1) First root (2) Scutellary sheath (3) Coleoptile (4) First leaf.

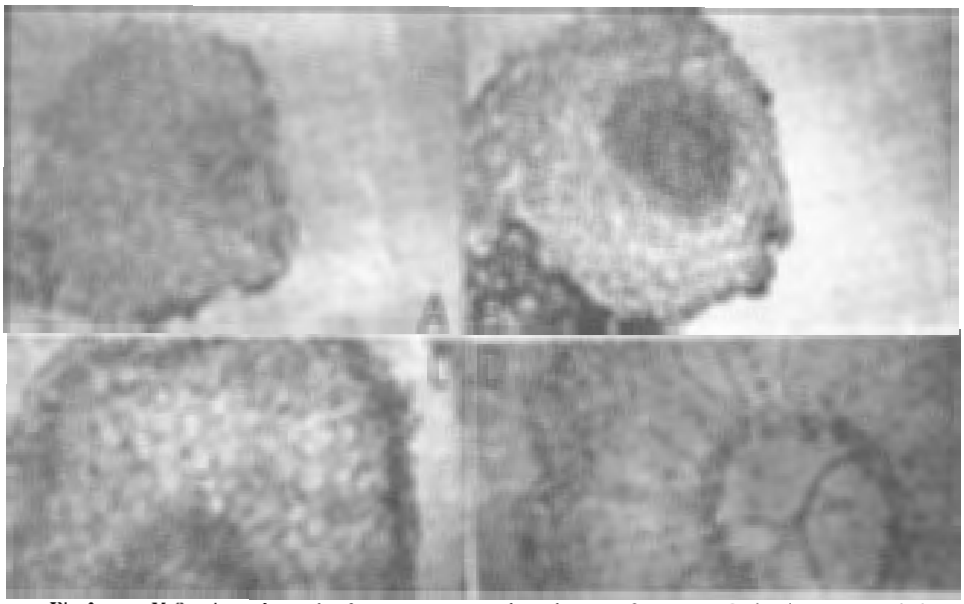

Fig.2 X-Section through the root apex of embryo culture — derived seedling (A) promeristem (B) beginning of differentiation (C) primary meristems (D) region of differentiation endodermis, xylem, and phloem have not been formed. x-(A,B) 10 × 3.3 (C,D) 15 × 3.3.

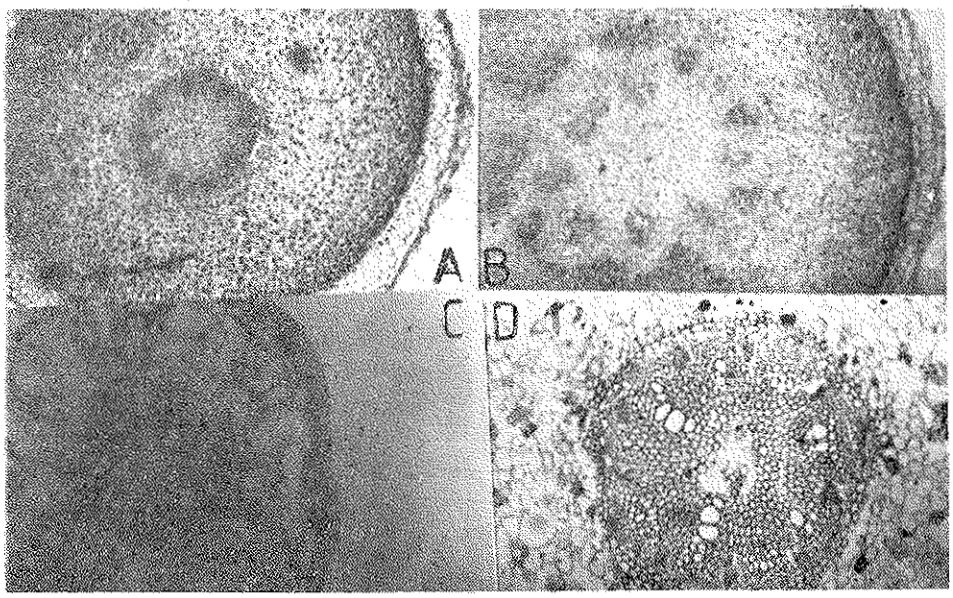

Fig.3 x-section through the root apex of seed seedling (A) beginning of differentiation into three types of primary meristems (B) formation of the phloem and beginning of the xylem formation (C) nine radial vascular bundles (D) formation of the central cavity. x-(A,B) 15 × 3.3 (C) 10 × 3.3 (D) 20 × 3.3.

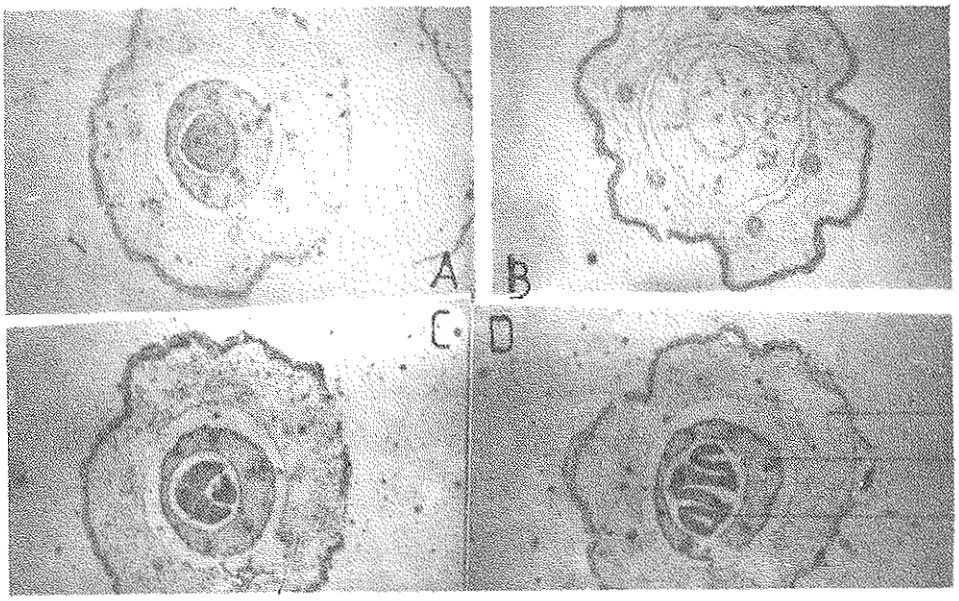

Fig.4 x-section through shoot apex of embryo culture derived seedling showing four stages of development (A,B,C) (D) 1. Scutellary sheath 2. coleoptile 3. primary leaf. x-10 × 3.3.

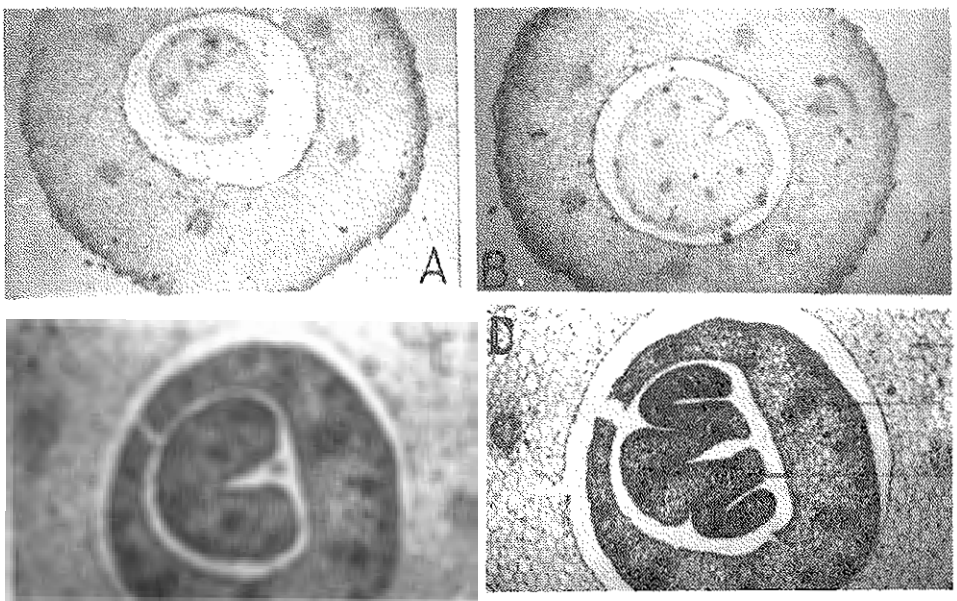

Fig.5 x-section through shoot apex of seed-derived seedling showing four stages of development (A,B,C) (D) 1. scutellary sheath 2. coleoptile 3. primary leaf x-10 × 3.3.

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EVALUATION OF SEEDLING MALE PALMS USED IN POLLINATION IN THE CENTRAL REGION, SAUDI ARABIA*

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ABSTRACT

One of the main objectives of this study was to select highly potent male palms to raise standard male varieties. This evaluation involved about 600 males located in 209 date palm orchards in different sects of the Central region of Saudi Arabia. The results showed that the time of flowering differed from one male to another. The males were classified into early, medium and late flowering groups.

The evaluation revealed that males differed in their spathe characteristics. Also, the amount of pollen grains produced per spathe varied greatly from one male to another, (0.02-82.29 gm/spathe). Viability of the pollen grains ranged from 44.60 to 100% in the acetocarmine method, whereas it ranged from 6.00 to 93.00% in the germination method. 102 males were selected for further morphological and biochemical studies to find how far these males are similar to standard female varieties. Selection was mainly based on the amount of pollen grains produced per spathe. Other characteristics including weight and size of the spathes, number of strands per spathe and number of flowers per strand were also taken into consideration in the selection.

(☆) This investigation is based upon work supported by the Saudi Arabian National Center for Science and Technology (SANCST) under grant No. AT 5-025.

تقييم ذكور النخيل المستخدمة في التلقيح بالمنطقة الوسطى في المملكة العربية السعودية

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الخلاصة

اشتمل هذا البحث على تقييم ذكور النخيل المستخدمة في التلقيح بالمنطقة الوسطى في المملكة العربية السعودية. وقد اجريت هذه الدراسة في كلية الزراعة بجامعة الملك سعود في عام 1984م. ومن الاهداف الرئيسية لهذا التقييم انتخاب الذكور ذات الكفاءة العالية واكثارها خضرياً بالفسائل الناتجة منها لتكون نواة لاصناف ثابتة الصفات. واحتوى هذا التقييم على اكثر من 600 من الذكور التي توجد في 209 من بساتين النخيل في القطاعات المختلفة من المنطقة الوسطى. وبينت النتائج التي حصل عليها في هذه الدراسة ان ميعاد الإزهار يختلف من ذكر إلى آخر. وقسمت الذكور الى ثلاثة أقسام هي: مبكرة ومتوسطة ومتأخرة الإزهار. وتدل النتائج كذلك على ان الذكور تختلف في صفات اغاريضها، كما ان كمية حبوب اللقاح التي تعطيها الأغاريض تختلف بدرجة كبيرة من ذكر إلى آخر، حيث وجد ان وزن اللقاح الناتج من الاغريض الواحد يختلف من 0.02 - 82.29 جم/أغريض. كما وجد ان حيوية حبوب اللقاح تتراوح نسبتها من 44.60 - 100 % بطريقة الاستيوكارمين، بينما تتراوح هذه النسبة من6.00-93.00% في طريقة الانبات. وتم انتخاب 102 ذكراً وستجري دراسة هذه الذكور مورفولوجياً وكيموحيوياً لمعرفة مدى تشابه هذه الذكور مع الاصناف المؤنثة الهامة. وكان الاساس المستعمل في الانتخاب هو كمية اللقاح التي تنتجها الاغاريض، هذا بالاضافة الى بعض الصفات الأخرى المميزة للأغاريض مثل وزن وحجم وعدد الشماريخ في الاغريض وعدد الأزهار في الشمراخ.

INTRODUCTION

In most date palm growing countries including Saudi Arabia, seedling males are used rather indiscriminately. These seedling males are highly variable, in the sense that they differ greatly in their growth vigour, spathe characteristics and pollen quality (13,7). In addition, date palm growers use any pollen that is readily available. As a result, yield and fruit quality of the palms, differ greatly from one year to another (11, 12, 1, 3, 14). For these reasons, the growers are now beginning to realize the value of selection of males.

In Saudi Arabia, no attempts have been made to evaluate the male palms used in pollination. Therefore, an intensive research project, sponsored by the Saudi Arabian National Center for Science and Technology was carried out by the College of Agriculture, King Saud University, to evaluate different male palms used in pollination in the Central region of Saudi Arabia; and thereafter, to propagate the most promising males vegetatively with their offshoots to be a parent tree of a new clone.

MATERIALS AND METHODS

This investigation was commenced in 1984, at the College of Agricutlure, King Saud University, to evaluate male palm used in pollination in the Central region. To attain this, the Central region was divided into 4 main sects, namely: (1) Riyadh and its suburbs; (2) Al-Kharj and Wadi El-Dawaser; (3) Sedaar and Shakra; and (4) Qassim.

This evaluation involved 601 male palms from 209 date palm orchards in the above mentioned sects. These males were chosen for vigour and for being disease free. It was also necessary to evaluate the males having offshoots to allow propagating promising males vegetatively with such offshoots. Males with no offshoots were not included in the evaluation.

At blooming time, a number of spathes, differing from 1-3, was collected from each male for further studies of spathe characteristics. In the meantime, classification of the males with respect to time of flowering (early. medium and late) was determined. The number of spathes formed each male was determined. The spathes were collected after being mature, i.e., shortly after the sheath had opened or that a crackling noise was produced when the middle part of the spathe was pressed between the thumb and forefinger. The spathes were then cut and taken to the laboratory for determining the morphological characteristics. These characteristics were: spathe weight, spathe length, spathe width, sheath weight, inflorescence weight, inflorescence length, length of strandless part of rachis, number of strands/ inflorescence, length of strands, length of strand part occupied with flowers,

number of flowers/strand, weight of pollen grains/spathe and viability of the pollen grains.

For pollen grains extraction, the strands of each spathe were cut off and spread in a thin layer on paper sheets for 3-4 days till they became dry. Then the pollen grains were separated from the flower parts by using fine sieves (40 mesh). The pollen grains were dried in descicators for 24 hours. Then the weight of the pollen grains of each spathe was determined.

For determining pollen grains viability, two methods were used. The first method was the differential stainability of the pollen grains with acetocarmine according to the procedure described by Moreira and Gurgel (10). A small amount of pollen grains was placed on a slide and 1-2 drops of 1% acetocarmine solution was added. The slides were placed for few minutes on a hot plate. The viability of the pollen grains were examined with the microscope at 200 X magnification power. Two slides were prepared from each male and 4 fields were tested from each slide. Pollen grains that stained red were considered viable, whereas, the colourless pollen grains were considered non-viable.

The second method was the germinaton ability of the pollen grains on germinating media according to Albert (2).

The media used consisted of 10% sucrose, 1% agar and 500 ppm boron.

A small amount of the pollen grains was added to the media in petri dishes. The dishes were placed in an incubator at 27° C for 24 hours. A square piece of the media of about 1 cm length was taken and placed on a slide for testing under the microscope. An initiation of a pollen tube growth was considered as evidence of germination. Germination counts were taken from 4 fields for each slide.

RESULTS AND DISCUSSION

Time of Flowering of the Males: It was observed that time of flowering differed from one male to another. The males were divided into 3 groups, namely: a) early flowering, during February, b) medium flowering, during March; c) late flowering, during April and sometimes extended till the first week of May.

Early flowering males are the only source of pollen grains to be used in the pollination of early flowering females. These early flowering males are considered important as date palm growers are not generally familliar with storage of pollen grains from one season to another.

Number of Spathes Formed per Male: This number varied from one male to another and it ranged between 10 and 40 in the different males studied in the different orchards.

Morphological Characteristics of the Spathes: The results obtained from the evaluation of male palm in the Central region showed great variability in the morphological characteristics of the spathes of the various males. These results are summarized as follows:

Spathe weight: The weight of the spathes ranged from 105 to 3683 gm. in the different males. The spathes could be divided into 3 groups according to their weights: a) light: (less than 500 gm), 25% of the tested males; b) Medium: (500-1000 gm), 34% of the males; c) Heavy: (more than 1000 gm), 40% of the males.

Spathe length: The length of the spathes ranges from 25 to 119 cm. They were divided into 3 groups: a) short: less than 50 cm., 41%, b) Medium: From 50-100 cm, 44%, c) long: more than 100 cm., 16%.

Spathe Width: The width of the spathes differed from 3.50 to 22.5 cm. and it could be divided into 3 groups: a) Small: Less than 10 cm., 16%; b) Medium: From 10-15cm., 54%; c) Big: More than 15 cm., 30%.

Other spathe characteristics (sheath weight, weight and length of inflorescence, length of strandless part of rachis) followed the same trend as of the above mentioned characteristics and the results of which are presented in Table 1 and figure 1.

Characteristics of the Strands:

Number of strands/inflorescence: The number of strands of each inflorescence varied form 23 to 420 strands. The inflorescence could be divided into 3 groups: a) Few: less than 100 strands, 22%; b) Medium: From 100-150 strands, 34%; c) Many: More than 150 strands, 44%.

Length of strands: Length of strands ranges from 5.20 to 38.01 cm. and the males were classified into 3 groups: a) Short: Less than 15 cm., 48%; b) Medium: From 15-20 cm., 35%; c) Long: More than 20 cm., 17%.

Part of strand occupied with flowers: Length of strand portion occupied with flowers was also classified into 3 groups: a) Short: Less than 10 cm., 29%; b) Medium: From 10-15 cm., 44%; c) Long: More than 15 cm., 27%.

Number of flowers/strand: Number of flowers/ strand ranged from 13.6 to 92.8 and the males were classified into 3 groups:

a) Low: Less than 25, 12%; b) Medium: From 25-50, 66%; c) High: More than 50, 22%.

Weight of pollen grains: Weight of pollen grains per spathe of different males ranged from 0.02 to 82.29 gm. Also, the males were divided into 3 groups according to the amount of pollen grains:

a) Poor: Less than 5 gm, 30%; b) Medium: From 5-15 gm, 36%; c) Rich: More than 15 gm, 24%.

Viability of the pollen grains: Pollen grains viability ranged from 44.60 to 100% in the acetocarmine test, whereas it ranged from 6.00 to 93.00% in the germination test. On the basis of the differential stainability of pollen grains with acetocarmine and germination on germinating media, males investigated could be divided into 3 groups: a) Low: Less than 50 per cent; b) Medium: From 50-75 per cent; c) High: More than 75 per cent.

Percentages of males pertaining to the above mentioned 3 groups of viability were 0.28, 4.71 and 95.01 in acetocarmine method, whereas these percentages were 39.16, 25.87 and 34.97 in germination method, respectively (Table 3 and Figure 3).

The results obtained in this study on viability tests generally showed that acetocarmine gave higher viability percentages as compared with germination on culture media. Variations in viability between various mehtods were reported (8,4,5). These results on viability also accounted for the selections of males dealt with in this evaluation.

It is evident from the foregoing results that the seedling males differ greatly in the morphological characteristics of the spathes. These results are in line with Nixon (13) who stated that no two seedling palms are alike. Along with this statement, Chandler (6) reported that fruit tree raised from seeds are greatly heterozygous. In Algeria, Monciero (9) showed that different males yielded different amounts of pollen grains. This amount ranged from 267 to 754 gm per single male in the same year. Wertheimer (15) came to the same conclusion as with Monciero. He found that the average yield of pollen grains was 740 gm/male, and that the highest yield of a single male reached about 2133 gm. In Egypt, different growth characteristics of the spathes in seedling males were reported (7).

On the basis of the above results, 102 seedling males are selected to be propagated by their offshoots which will always reproduce the partent type. Then it becomes essentially a new variety or clone.

The basis of selection of male palms was the amount of pollen grains produced as suggested by Nixon (13). He stated that in selecting male palms, the flowers should contain abundant pollen. The number of spathes produced per male was also taken into consideration. The number of spathes formed per each of the selected males was not less than 20 spathes per male. This number may reach up to 40 spathes per male. In addition, other morphological characteristics of the spathes were also taken into consideration in selection, such as weight, and size of the spathes, number of strands per spathe and number of flowers per strand. In other words, males that

produce spathes of small size and weight and few number of strands were avoided in selection.

CONCLUSION

Males selected in this evaluation are characterized with the following characteristics:

I. *Spathe characteristics:* Weight: More than 1000 gm; Length: More than 50 cm; Width: More than 10 cm; Number of strands: More than 100 strands.

II. *Strands characteristics:* 1. Length: More than 15 cm. 2. Number of flowers/strand: More than 40 flowers/strand.

III. *Pollen grains:* 1. Weight: More than 15 gm per spathe; 2. Viability: a. Acetocarmine: More than 75%. b. Germination: More than 50%.

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Table 1

Morphological characteristics of male spathes collected from different orchards of the Central region, Saudi Arabia

Character	Range	Percentage of the total		
Spathe weight (gm)	105-3683	< 500	500-1000	> 1000
		24.76	35,86	39.38
Spathe length (cm)	25-119	< 50	50-100	> 100
		41.35	43.96	14.69
Spathe width (cm)	3.5-22.5	< 10	10-15	> 15
		16.12	53.64	30.24
Sheath weight (gm)	20-1257	< 200	200-400	> 100
		40.94	37.52	21.54
Inflorescence weight (gm)	81-2426	< 500	500-1000	> 1000
		42.99	40.34	16.67
Inflorescence length (cm)	19-112	< 30	30-60	> 60
		7.15	68.3024.55	24.55
Length of Strandless part of rachis (cm)	0-43	< 5	5-10	> 10
		46.83	23.69	29.48

Table 2

Strands characteristics of the male spathes under evaluation

Character	Range	Percentage of the total		
Number of strands/ inflorescence	23-420	< 100	100-150	> 150
		22.47	33.85	43.68
Length of strands (cm)	5.20-38.01	< 15	15-20	> 20
		47.72	34.72	17.56
Length of strand part occupied with flowers	2.99-27.34	< 10	10-15	> 15
		29.13	43.97	26.90
Number of flowers/ strand	13.60-92.80	< 25	25-50	> 50
		11.69	66.38	21.93

Table 3

Weight of pollen grains/spathe and percentage of pollen grains viability tested with acetocarmine germination

Character	Range	Percentage of the total		
Weight of pollen grains (gm)	0.02-82.29	< 5 30.30	5-15 46.06	> 15 23.64
Viability:		< 50	50-75	> 75
Acetocarmine	44.60-100.00	0.28	4.71	95.01
Germination	6.00-93.00	39.16	25.87	34.97

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THE EFFECT OF MECHANICAL POLLINATION ON FRUIT SET, YIELD AND FRUIT CHARACTERISTICS OF DATE PALM (*PHOENIX DACTYLIFERA* L.) ZAHDI CULTIVAR

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ABSTRACT.

Mechanical pollinations were applied to Zahdi date palm (*Phoenix dactylifera* L.) cultivar. Treatments were: 3, 4, and 7 times mechanical pollination of 8% and 16% pollen concentrations (pollen: filler ratio); hand pollination; and natural air pollination. No significant differences in fruit set existed between mechanical pollinations of 4 and 7 times at both concentrations (8% and 16%), and the hand pollination treatment. On other hand, a highest yield was achieved by mechanical pollination of 7 times at both concentrations, and 4 times at 8% pollen concentration. Moreover, the results have indicated that there was an inverse relationship between the water content of the fruit and the number of mechanical pollination. However, the results of mechanical pollinations and hand pollination did not show a significant differences on TTS, total solube sugars, and reducing sugars.

تأثير التلقيح الميكانيكي على عقد وحاصل وخواص ثمار نخلة التمر صنف الزهدي

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الخلاصة

أجري هذا البحث لدراسة امكانية استخدام التلقيح الميكانيكي لتلقيح نخلة التمر صنف الزهدي. وقد شملت المعاملات تكـراز التلقيح الميكـانيكي 3, 4, 7 مرات خلال موسم التلقيح وبـالتراكيـز 8%و 16% (نسبة حبـوب اللقاح: مـادة مالئة) إضافة إلى استخدام معاملتي التلقيح اليدوي والهوائي كمعاملات مقارنة.

أظهرت النتائج عدم وجود فروقات احصائية في نسبة عقد ثمار بين معامـلات التلقيح الميكانيكي 4 و7 مـرات ولكلا الـتركيز بـين 8% و16% ومعاملة التلقيـح اليدوي.

أما كمية الحاصل فقد أظهرت زيادة احصائية في معاملة التلقيح الميكانيكي 7 مرات ولكلا التركيزين وكذلك معاملة التلقيح الميكانيكي 4 مرات بتركيز 8%.

أظهـر المحتوى الـرطوبي للثـمار وجود عـلاقة عكسيـة بينه وبـين عدد مـرات التلقيـح الميكانيكي. فيـما لم تكن هناك فـروقات احصـائية بـين معاملة التلقيـح اليدوي ومعاملات التلقيح الميكانيكي في التأثير على نسبـة المواد الصلبـة الذائبـة الكلية، السكريات الذائبة الكلية والمختزلة.

INTRODUCTION:

It has long been a practice in date palm hand pollination to insert 2-3 strands of the male inflorescence into each female spadix at the time it just

starts to crack, and this traditional method of pollination takes at least 2 to 3 times per season in order to get a satisfactory yield. Hand pollination cannot be done adequately and early enough, because of the current shortage in the specialized labour availability, high cost, and the height of date palm tree makes the hand pollination difficult. Mechanical pollination has been one of the most important alternative where the labour could be reduced by 50-70% (9). Two mechanical pollinators have been used (4); the palm duster which was operated from the ground improved fruit set as compared with the palm duster which was operated from the top of the tree, and/or the hand pollination method.

Apparently, the palm stigma has a limited period for pollen grain receptivity (10). Al-Heaty (1) found that the stigmas of Zahdi cultivar have a receptivity period for 10 days. Mechanical pollination from ground level for three times and with 1:4 (pollen: filler ratio)was recommended for high yield (9). Moreover, Shabana (12) indicated that repeating mechanical pollination for 4 times during the season by using 1:10 (pollen: filler) ratio increased the total yield of Zahdi cultivar. However, it seems that the frequencies of mechanical pollination as well as the suitable concentration of pollen: filler ratio are to be the most important factors in date palm pollination practice.

The need for more efficient means of mechanical pollination is obvious. Date palm growers are greatly interested in any technique that promises more positive and consistent pollination results. The objective of this study was to investigate the effect of mechanical pollination on fruit set and quality of Zahdi date palm cultivar.

MATERIAL AND METHODS

Experiment was conducted during 1983 season, at Al-Azizia Experimental Station, Governorate of Wasit, Iraq. Forty uniform date palm trees of Zahdi cultivars were selected. Treatments were replicated five times using whole tree replication (ten fruit bunches per tree) in a randomized complete block (RCB) design, to compare mechanical pollination with the traditional hand pollination, and the natural air pollination. Ghannami Ahmer male cultivar was selected as pollinator, because of its pollen availability and viability (1, 13, 14). Basically the experiment consisted of 2 main mechanical pollination treatments; in the first treatment, fresh dry pollen was mixed with flour (as a filler), at a ratio of 8 pollen: 92 flour (8% concentration of pollen) this mixture was applied at the following frequencies during the season: a) seven times at an interval of 5 days; b) four times at an interval of 10 days; and c) three times at an interval of 15 days, for mechanical pollinations. The second mechanical pollination treatment was similar to the first, except that the ratio of pollen to the flour was increased to 16% concentration. This mechanical pollination treatments were applied by using a pollinator machine carried on

tractor (Anter 70), manufactured by the General Establishment for Mechanical Industries, Alexandria, Iraq.

The extraction and collection of pollen grain used for mechanical pollination were done as described (6, 9). Hand pollination treatment was applied three times at an interval of 15 days during the season, using the usual traditional method. On the other hand air pollination treatment was left to the natural air pollination (Table 1).

The parameters under study included: fruit set, yield, fruit weight, water content, total soluble solids, total sugars, reducing sugars, and non reducing sugars.

Percentage of fruit set was determined as described by (11). Yield was determined by the total weight of ten bunches for each replication and then the total yield was extracted. Fruit weight was determined by the weight of 20 fruits per replication (and then extracted the total weight of each fruit). Water content was determined by crushing 10 grams of flesh which were taken from 10 fruit average per replication, and then dried in the oven at 70° C for 48 hours, then the moisture percentage was calculated as:

$$\% \text{ moisture} = \frac{\text{fresh weight-dry weight}}{\text{fresh weight}} \times 100$$

total soluble solids were determined by Abbe Refractometer as described by (2), sugars were extracted as described by Shubbar (1981) (15), while total and reducing sugars were determined as described by (3).

All data were subjected to analysis of variance and means were seperated by the LSD when the F-test was significant at the 5% level as described by (16).

RESULTS AND DISCUSSIONS

1. Fruit Set: No significant differences in fruit set resulted when 4 and 7 times mechanical pollinations were used at 16% pollen concentration when compared with hand pollination (Table 2). However, the data (Table 2) showed that 3 times mechanical pollination at both pollen concentrations resulted in a significant decrease in fruit set when compared with hand pollination. Otherwise, natural air pollination resulted in the lowest fruit set percentage (Table 2). These results support the works (4, 5, 8, 9).

2. Yield: The data presented in Table 2 showed that a highest yield was obtained with 7 applications at both concentrations and 4 times at 8% concentration of mechanical pollination when compared with the yield resulted from hand pollination. These results implies agreement with the works of (4) and (8).

3. Fruit Weight and Dimensions: No significant differences resulted in fruit weight among all methods of pollination, including natural air pollination (Table 3). This result supports the data of (8). Also, the data (Table 3) showed that fruit length and diameter did not result in significant increase in fruit size by the method of pollination, except that of air pollination, which resulted in larger fruit size. This result is in agreement with earlier work (7).

4. Water Content and Total Soluble Solids: There was a significant increase in water content of fruit resulted from natural air pollination as compared with all other methods of pollination (Table 4). However, three times mechanical pollination at both concentrations (8% and 16%) resulted in a greater water content as compared with all other mechanical pollination treatments and hand pollination treatment. This would indicate that as the concentration of pollen grains increases the water content of the fruit decreases. Moreover water content is related to the total soluble solids, and this is clearly explained in the case of air pollination, where the fruits were larger in size, there were a higher water content and lower total soluble solids. However, no significant differences resulted in the total soluble solids from all the pollination methods, except in the case of natural air pollination (Table 4).

5. Total Soluble Sugars: The data (Table 4) showed a significant decrease in total soluble sugars existed with natural air pollination method. However, no significant differences in total soluble sugar resulted with the all other methods of pollination (Table 4).

Finally, results from this study suggested that mechanical pollination of 7 times at both concentrations (8% and 16%); and 4 times at 8% pollen concentration gave a better yield and fruit quality as compared with the high cost and difficult hand pollination traditional practice. This would provide our commercial date palm growers with the apportunity to chose the four times mechanical application at 8% pollen concentration in order to achieve the more efficient yield and fruit quality from the Zahdi date palm cultivar.

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Table 1

Different pollination methods and frequencies for date palm, Zahdi cv. 1983

Treatments	Date of pollination						
	7.4	12.4	17.4	22.4	27.4	2.5	7.5
Hand pollination	×	—	—	×	—	—	×
Natural air pollination	—	—	—	—	—	—	—
Mechanical pollination 8% at 5 days intervalls	×	×	×	×	×	×	×
Seven times mechanical pollination 16%/5 days	×	×	×	×	×	×	×
Four times mechanical pollination 8%/10 days	×	—	×	—	×	—	×
Four times mechanical pollination 16%/10 days	×	—	×	—	×	—	×
Three times mechanical pollination 8%/15 days	×	—	—	×	—	—	×
Three times mechanical pollination 16%/15 days	×	—	—	×	—	—	×

×: pollination
—: No pollination

Table 2

Effect of different pollination methods on fruit set (%) and yield (Kg) of date palm Zahdi cv.

Treatment		Fruit Set (Khimri Stage)%	Total Yield Kg
Hand pollination		62.43	67.32
Natural air pollination		12.65	21.68
Mechanical pollination			
Concentration of pollen	**Frenquency (times/season)**		
	7	56.93	80.54
8%	4	55.09	72.36
	3	48.76	59.70
	7	66.81	78.84
16%	4	55.40	61.40
	3	50.04	52.86
L.S.D	0.05	10.17	18.92

Table 3

Effect of different pollination methods on some physical characteristics of date palm Zahdi cv.

Treatments	Fruit weight grm	Fruit length cm	Fruit diameter cm
Hand Pollination	7.690	3.292	2.180
Natural air pollination	7.980	3.568	2.210
Seven times mechanical pollination 8%	7.800	3.224	2.144
Seven times mechanical pollination 16%	7.320	3.220	2.108
Four times mechanical pollination 8%	7.900	3.320	2.182
Four times mechanical pollination 16%	7.840	3.278	2.166
Three times mechanical pollination 8%	7.930	3.496	2.212
Three times mechanical pollination 16%	7.880	3.422	2.206
L.S.D. 0.05	N.S	0.160	N.S.

Table 4

Effect of different pollination methods one some chemical characteristics of date palm Zahdi cv.

Treatment	water content %	total soluble solids %	total soluble sugars %	Reducing sugars %	Non Reducing sugars %
Hand pollination	13.50	74.90	72.32	66.75	5.57
Air pollination	17.08	62.80	51.42	39.36	12.06
Seven times mechanical pollination 8%	12.41	72.75	7032	63.90	6.42
Seven times mechanical pollination 16%	12.83	75.85	71.59	64.50	7.09
Four times mechanical pollination 8%	13.12	74.90	73.25	65.75	7.50
Four times mechanical pollination 16%	13.53	75.05	74.30	66.52	7.77
Three times mechanical pollintion 8%	15.32	74.25	71.45	62.00	9.45
Three times mechanical pollination 16%	15.53	73.21	73.21	64.64	8.59
L.S.D. 0.05	2.59	4.72	5.93	7.06	4.10

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EFFECT OF TIME OF COOKING FOR THE PREPARATION OF CHHUHARA FROM DATE FRUITS

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ABSTRACT

Chhuhara (Khalal Matbuukh) were prepared from Khadrawi and Shamran dates, harvested at doka (Khalal) stage of maturity, cooked for 10, 15, 20 and 25 minutes and dehydrated in solar drier. The chhuhara prepared from Khadrawi cultivar were better in quality in terms of high content of pulp, sugars, proteins as well as organoleptic rating as compared with Shamran cultivar. The quality of Khadrawi chhuhara improved with increase in the period of boiling whereas the quality of Shamran chhuhara deteriorated. The recovery of chhuhara from Khadrawi variety was also higher compared with shamran. No marked differences were observed in the mineral composition of chhuhara prepared by boiling at different intervals of periods.

تأثير فترة الطبخ على تحضير الخلال المطبوخ من ثمار النخيل

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الخلاصة

حضر الخلال المطبوخ من تمور الصنفين (الخضراوي، شامران) وقد طبخ الخلال لفترات مختلفة هي 10, 15, 20, 25 دقيقة على التوالي ومن ثم تمَّ تجفيفها بواسطة المجفف الشمسي. وقد وجدنا ان الخلال المطبوخ المحضر من صنف الخضراوي كان ذو نوعية احسن من حيث محتواه العالي من اللب والسكريات

والبروتينات وكذلك خواصه النكهية ذات القيمة العالية مقارنة بالصنف شامران. ووجد أيضاً ان نوعية خلال الخضراوي المطبوخ تتحسن بزيادة فترة الغليان بينما تتدهور نوعية خلال شامران المطبوخ. ان محصول الخلال المطبوخ من الصنف الخضراوي هو أعلى عند مقارنته بالصنف شامران. ولم تلاحظ فروقات واضحة في المحتوى المعدني للخلال المطبوخ المحضر بالغليان ولفترات زمنية مختلفة.

INTRODUCTION

Dates have been a staple food of Arabs owing to their high energy value. Dates are consumed fresh at their rutab and tamar stages of maturity. However, large quantity of surplus dates are dried for use during off-season and export. In India, the major wild plantation of date palm is in the area of Run and Kucch of Gujrat. Some plantation of important cultivars of date palm was done at Regional Fruit Research station, Abohar and at the experimental orchard, Department of Horticulture, Haryana Agricultural University, Hisar. The major date palm cultivars growing at Hisar are Khadrawi, Hissawi, Shamran, Zaghlool and Medjool.

However, their ripening time coincides with the monsoon season (on set of rains) and thus the tree ripening process does not proceed beyond the doka (Khalal) stage. If the picking is not done at this doka stage, the fruits get spoiled by rotting and fermentation. The berries at this stage, however, have attained their maximum size and total sugar (6). It has been reported that Khalal stage picking is ideal for production of chhuhara (Khalal Matbuuch) (3). Yousif *et al.* (14) indicated the necessity of picking dates at the end of Khalal stage for better quality of dry dates. Blanching of fruits in simple boiling water and then dehydrating them in oven has been employed by various workers for preparation of chhuhara (3,7). The present study was undertaken to find out the effect of time of boiling on the quality of chhuhara produced from Khadrawi and Shamran dates.

MATERIALS AND METHODS

The fruits of two promising and heavy bearing cultivars khadrawi and Shamran were picked as bunches at doka (end of Khalal) stage of maturity. The berries of uniform size with perianth intact were washed thoroughly with water, then loosely tied in muslin cloth and dipped in boiling water bath for 10, 15, 20 or 25 minutes. These fruits were then surface dried in air and dehydrated for 172 hours in aspirator type solar dehydrator) temperature inside ranged from 50-60° C during day time). The dehydrated dates were then put to physico chemical analysis. Physical observations on recovery percentage, pulp and stone weight, moisture percentage in chhuhara as

whole fruit and pulp alone were taken and calculated in term of percentage.

For biochemical analysis, the dried and well ground tissue material was extracted in aqueous ethanol (80%). The total soluble carbohydrates were estimated from this extract by the method of Yemm and Wills (12), total phenols by the method as described by Amorium *et al* (1), starch by Hassid and Neufeld (4) and the total proteins by Lowery *et al.* (10) method. For mineral analysis, the dried and well grinded tissue was digested in di-acid mixture and from the digest, the nitrogen was estimated by the method of Linder (9), phosphorus by Jackson (5) and calcium by EDTA-Versenate method. The estimations of iron, manganese, copper and zinc were done by atomic absorption spectrophotometric method. The organoleptic rating was done by a panel of four experts and the chhuhara scoring below 5 points out of total 10 points was considered to be of unacceptable (poor) quality.

RESULTS AND DISCUSSION

The study reveals that the recovery of chhuhara was better in Khadrawi cultivar as compared to Shamran (Table 1). No marked differences were observed in the recovery of chhuhara among various boiling timings. The dry weight of Khadrawi chhuhara was increased with increase in the period of boiling, whereas in Shamran chhuhara, it was just the reverse. The pulp weight was also higher in Khdrawi chhuhara as compared to Shamran. No consistent trend was observed with regard to the period of boiling. However, highest pulp content was found in 20 minutes boiling in Khadrawi and 10 minutes boiling in Shamran. Such variations in pulp and stone weight amongst various boiling timings were also reported (8).

There was an increase in total soluble carbohydrates in chhuhara prepared from 25 minutes boiling in Khadrawi cultivar but not much differences were observed at other timings of boiling (Table 2), whereas, in Shamran cultivar, the soluble carbohydrates were reduced significantly with the increase in the period of boiling. However, not much differences were observed in soluble carbohydrate content between the chhuhara prepared from both cultivars. The starch content was markedly decreased with the increase in period of boiling in Khadrawi cultivar, whereas in Shamran cultivar, differences in starch content at various boiling timings were not marked and the differences of starch content between these two cultivars were not statistically significant. Similarly, the protein content of chhuhara was increased with an increase in the period of boiling. However, this increase was found statistically significant in Khadrawi cultivar only and protein content of Khadrawi chhuhara was markedly higher as compared to Shamran chhuhara. The protein values are close to the values reported (11) in Egyptian dates and in Iraqi dates (2). In case of total phenols, no marked differences were observed between the various periods of boiling; however, total phenols in Shamran were markedly higher than in Khadrawi chhuhara.

In organoleptic rating, the chhuhara prepared from Khadrawi cultivar was much better than shamran chhuhara. The chhuhara of Khadrawi cultivar obtained by boiling for 25 minutes were much better in organoleptic rating as compared with other timings of boiling, whereas, in shamran chhuhara, the organoleptic rating deteriorated with an increase in the period of boiling. The increase in soluble carbohydrate and insoluble protein contents and simultaneous decrease in starch content with increase in period of boiling in Khadrawi cultivar might be due to the hydrolysis of starch into soluble sugars and coagulation of soluble proteins into insoluble proteins. The increase in sugars and proteins might have resulted in the increase in organoleptic rating of Khadrawi chhuhara. Whereas in shamran chhuhara, with the increase in boiling period, as hydrolysis of starch did not take place (no change in starch content) and the soluble sugars already present might have leeched out from the fruits causing a decrease in sugar content of chhuhara, thus deteriorating the organoleptic rating. Higher phenols, low proteins and higher starch contents in shamran might have further marked its organoleptic rating as compared to Khadrawi chhuhara.

No definite trend was observed in the mineral composition of chhuhara prepared after boiling at various intervals of timings (Table 3). Among macro elements, a slight reduction in nitrogen and calcium and also slight increase in phosphorus content of Khadrawi chhuhara increased with an increase in the boiling period, while in Shamran chhuhara, a reverse trend was observed. However, with regard to micro elements, like iron, manganese, copper, zinc, no such differences were observed in both cultivars. Similarly, not much variations were observed among various boiling timings. The values of P, Ca and Zn were higher and Mn and Cu was lower, whereas Fe values were close to the values reported (13).

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Table 1

Physical characters of chhuhara prepared from two cultivars of dates after boiling for various timings

Cultivar	Boiling period (minutes)	Recovery (%)	Pulp wt. (%)	stone wt. (%)	Dry wt. (%) of flesh	Moisture (%)
Khadrawi	10	42.0	81.5	18.5	83.7	16.3
	15	42.0	77.4	22.6	85.6	14.8
	20	42.0	82.1	17.9	85.5	14.5
	25	42.0	78.8	21.2	87.2	12.8
Shamran	10	37.0	80.7	19.3	86.0	14.0
	15	36.5	78.0	22.0	85.9	14.1
	20	37.0	79.6	20.4	86.7	13.3
	25	37.0	77.0	23.0	86.1	13.9

Table 2

Chemical composition of chhuhara prepared from two cultivars of dates after boiling for various timings

Cultivar	Boiling Period (minutes)	Composition				
		Total soluble carbohydrates (%)	Starch (%)	Total insoluble protein	Total phenols (%)	Organoleptic rating
Khadrawi	10	55.86	0.981	2.589	0.521	7.12
	15	56.45	0.904	2.513	0.505	7.00
	20	57.26	0.310	2.981	0.521	7.12
	25	58.40	0.754	3.320	0.524	7.25
Shamran	10	58.45	1.220	2.371	0.640	6.00
	15	55.86	1.256	2.313	0.665	5.65
	20	54.95	1.291	2.305	0.695	4.62
	25	54.83	1.221	2.589	0.690	4.25

Table 3

Mineral composition of chhuhara prepared from two cultivars of dates after boiling for various timings

Cultivar	Boiling period (minutes)	Concentration of macronutrients (percent of dry wt.)			Concentration of micronutrients (ppm)			
		N	P	Ca	Fe	Mn	Cu	Zn
Khadrawi	10	0.467	0.073	0.125	57	32	10	2.5
	15	0.501	0.084	0.120	57	33	9	2.3
	20	0.523	0.081	0.115	57	32	10	2.5
	25	0.498	0.083	0.115	56	33	9	2.3
Shamran	10	0.501	0.080	0.112	57	33	10	2.5
	15	0.473	0.076	0.125	57	34	10	2.5
	20	0.451	0.064	0.120	57	33	9	2.4
	25	0.536	0.076	0.125	57	33	9	2.5

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THE PHENOLIC COMPOUNDS OF FOUR DATE CULTIVARS DURING MATURITY STAGES

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ABSTRACT

Four Iraqi date cultivars, namely, Zahdi, Sayer, Kistawi, and Shukkar, were used to investigate their chemical constituents (TSS, water content, total soluble pehnolic compounds and soluble & insoluble tannins) at different stages of maturity (Kimri, Khalal, rutab and tamar). Zahdi dates showed a higher percentage of total soluble phenolic compounds and soluble tannin in the Kimri stage than Khistawi, Sayer and Shukkar. These compounds decreased as the fruits advanced to maturity, whereas the insoluble tannin increased. The soluble tannin completely disappeared from Shukkar in the tamar stage.

المركبات الفينولية لأربعة أصناف من التمور خلال مراحل النضج

الخلاصة

تناولت هذه الدراسة محتوى أربعة أصناف من التمور وهي الزهدي، السابر، الخستاوي والشكر من المواد الصلبة الذائبة الكلية، الرطوبة، المركبات الفينولية الذائبة الكلية، التانين الذائب خلال مراحل النضج المختلفة (الجمري، الخلال، الرطب والتمر).

وضحت النتائج بان تمور الزهدي تحتوي على أعلى نسبة من المركبات الفينولية الذائبة الكلية والتانين الذائب في مرحلة الجمري ثم تليها تمور

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الخستاوي، السايـر والشكر وان هـذه المركبـات انخفضت كلما تقدمت الثمـرة بالنضج وفي نفس الوقت ازدادت كمية التانين غير الذائب. وإن التانين الذائب قد اختفى نهائياً من تمور صنف الشكر في مرحلة التمر.

INTRODUCTION

Iraq leads the list of date producing countries and accounts for about 35% of the total world production (12). Various products such as dibbis (thick date juice), alcohol (arak), pure alcohol, vinegar and liquid sugar are produced on a commercial scale from dates (9).

It was found that sucrose was the predominant sugar during the Kimri and Khalal stages in the common varieties of Basrah dates in Iraq (2). Other studies reported that the sucrose was completely inverted in the tamar stage in all studied cultivars, except Zahdi in which an appreciable amount of sucrose was present in the tamar stage. Fibre decreases as the fruit advance in their development (3). Soluble pectins, protopectin and total pectin substances have been reported to decrease during ripening of dates (3). Protein was found in considerable amounts in the kimri stage but this decreases during ripening (1). The mineral content of dates also decreases as the fruit ripens (8).

Simple phenolics decrease during pre-ripening growth stages, maturation and post-harvest deterioration in Deglet Noor dates, while the soluble tannin increases from green to Khalal stage, followed by a decrease from khalal to the mature stage (6). It was found that at the same time an increase occurred in the amount of insoluble tannin. It appears that during ripening, soluble tannin is converted into soluble tannin (6). Of the simple phenolics, it was found that the flavans such as flavan 3, 4 diol and derivaties such as dactylifric acid (3, 4 caffeoylshikimic acid) underwent the greatest decrease during maturation (5,7). Several simple phenolics not present in immature fruit were formed during post-harvest deterioration, they appeared to be cinnamic acid derivaties (5).

The objective of this investigation was to study some selected chemical constituents (such as soluble phenolic compounds, soluble tannin, insoluble tannin, and total phenolic compounds) of several cultivars of dates (Zahdi, Sayer, Khistawi and Shukkar) during the different maturity stages.

These phenolic compounds are responsible for the astringent taste of the fruit and act as a substrate for the polyphenol oxidase and this enzyme is responsible for the production of undesirable colours, flavour and texture during processing and storage of dates.

MATERIALS AND METHODS

Zahdi, Sayer, Khistawi and Shukkar cultivars dates were chosen at Kimri, Khalal, rutab and tamar stages. Date samples were obtained from Zaafarania Experimental Station, Baghdad, Iraq.

Extraction Procedures: The method of Maier and Metzler (6) was used to extract phenolic compounds from dates. The extractions were concentrated under vacuum using Rotavapor (Buchi) at 60° C.

Soluble Phenolic Compounds Determination: The total soluble phenolic compounds and soluble tannin were determined according to the method of Swain and Millis (11). The Folin-Denis and Sodium carbonate reagents were prepared according to the published procedure (4). Calibration curves of soluble phenolic compounds and soluble tannin expressed as Mg (+) catechin/100 g dates (10).

$$\text{Mg (+) catechin/100g dates (wet-weight)} + \frac{\text{WXLXVXM}}{\text{SX 1000}}$$

W = weight of (+) catechin (μmole) can be obtained from the calibration curve according to the optical density.
V = the final volume of the solution (75 ml).
M = Molecular weight of (+) catechin (290.3).
S = Volume of sample taken (0.2 ml).
L = Path cell (1 cm).

Soluble and Insoluble Tannin: The soluble and insoluble tannin was determined according to method of Maier and Metzler (6). The published extinction coefficient of 29270 was used to calculate the amount of soluble and insoluble tannin present (10).

$$\text{Mg cyanidin chloride/100 g dates (wet-weight)} = \frac{\text{O.DXVXMXW}}{\text{EXLXS}}$$

O.D = Optical density
M = Molar extinction coefficient (29270)
L = Path cell (0.1 cm)
V = Final volume of the reagents (5 ml)
M = Molecular weight of cyanidin chloride (322.5)
S = Weight of sample taken (0.01 g).
W = Weight of tissue residue after drying.

Determination of Moisture: Three grams of stoned dates were put in oven under vacuum (30 mm Hg) at 65° C for 48 hours followed by percent moisture determination (6).

Total Soluble Solids: The total soluble solids (TSS) were measured using Carl Zeiss hand refractometer.

RESULTS AND DISCUSSION

Phenolic compounds in dates are responsible for the astringent taste of the fruit and this taste related to the presence of soluble tannin. These phenolic compounds take part in the enzymatic and non-enzymatic oxidative browning of date and result in undesirable changes in appearance, taste and food value of the fruit (10).

The amount of soluble phenolic compounds were determined according to the standard curve (Fig. 1). Figure 2 shows that the moisture of dates decreases as the date matured. Dates in the tamar stage have dried to a fairly firm consistency with moisture. The water activity is low enough to prevent the date undergoing fermenation (10). Figure 3 shows that the total soluble solids of dates increase as the fruit matured which means that nearly all the sucrose in the tamar stage has been converted into invert sugar in soft dates (Sayer, Khistawi and Shukkar), while in semi-dry dates (Zahdi) a small amount of sucrose remains (8).

Figure 4 shows that Zahdi cultivar contains a higher percentage of soluble phenolic compounds at maturity stages than the other cultivars. This soluble phenolic compounds decrease rapidly during the Kimri stage in all the cultivars, then gradually decreases in the other stages. This may be due to convertion of soluble tannin into insoluble tannin and also due to enzymatic oxidation which is an indication of disappearance of flavan and caffeoyl shikimic acid during the maturity stages (5, 7).

Figure 5. illustrates that Zahdi cultivar contains a higher amount of soluble tannin at the kimri stage when compared with khistawi, Sayer and Shukkar dates. This partially explains it unsuitability for human consumption at the kimri and khalal stages. Dates of these cultivars get exposed to rain, dust and insect damage. To avoid that, much research work has been carried out in an attempt to find the most suitable conditions for artificial ripening. For example, freezing of Zahdi dates at khalal stage will cause disappearance of the astringent tannin to be converted into insoluble tannin and consequently prevent astringency of the fruits (10). The insolubility of tannin could be due to its large molecular size or interaction with other insoluble tissue fraction such as cellulose, pectin, hemicellulose or protein (4,7). Figure 4 also shows that the soluble tannin continue to decrease gradually until tamar stage. This explains the suitability of Shukkar, Khistawi and sayer for human consumption in the rutab stage but Zahdi cultivar still contains the highest amount of soluble tannin. Thus, Khistawi, Sayer and Shukkar dates are preferred over Zahdi for consumption as well as economic consideration. To increase economic value of Zahdi dates most research has been directed toward the

use of this cultivar in the production of new food products which are preferred by the consumers such as using dates in confectionary, pastry, alcohol, vinegar, dibbis, etc.

Figure 6: shows the insoluble tannin constituents of dates during ripening stage. The results show that the rate of accumulation of insoluble tannin increases as the fruits matured and then decreased in the last stage of maturity. This decrease is most likely to be related to the non enzymatic oxidative browning of insoluble tannin in the tamar stage (10).

Figure 7. Shows that total phenolic constituent is high at the kimri stage, then decreases in the other following stages of maturity. Zahdi dates contain a higher amount of total phenolic compounds than Khistawi, Sayer and Shukkar.

CONCLUSION

Zahdi cultivar contains a high level of soluble tannin at the tamar stage than the other cultivars and these characteristics are responsible for its quality and economic value if to be used for human consumption, especially at rutab stage, which means the fruit must be left on the tree to complete ripening. This also exposes the fruit to damage by rain, insects, etc. So, the artificial ripening is very important for this cultivar to increase its value by improving its quality and to use this variety in the production in new food products such as using Zahdi dates in confectionary, pastry, alcohol, vinegar, dibbis, etc.

FURTHER WORK

1. A more accurate method than the Folin-Denis method for the determination of soluble phenolic compounds in dates needs to be developed in order to avoid interference from other materials in the ripe and stored dates.
2. An investigation needs to be carried out to separate and identify the phenolic compounds in these cultivars.
3. The bahaviour of the phenolic compound during processing and storage needs to be investigated.

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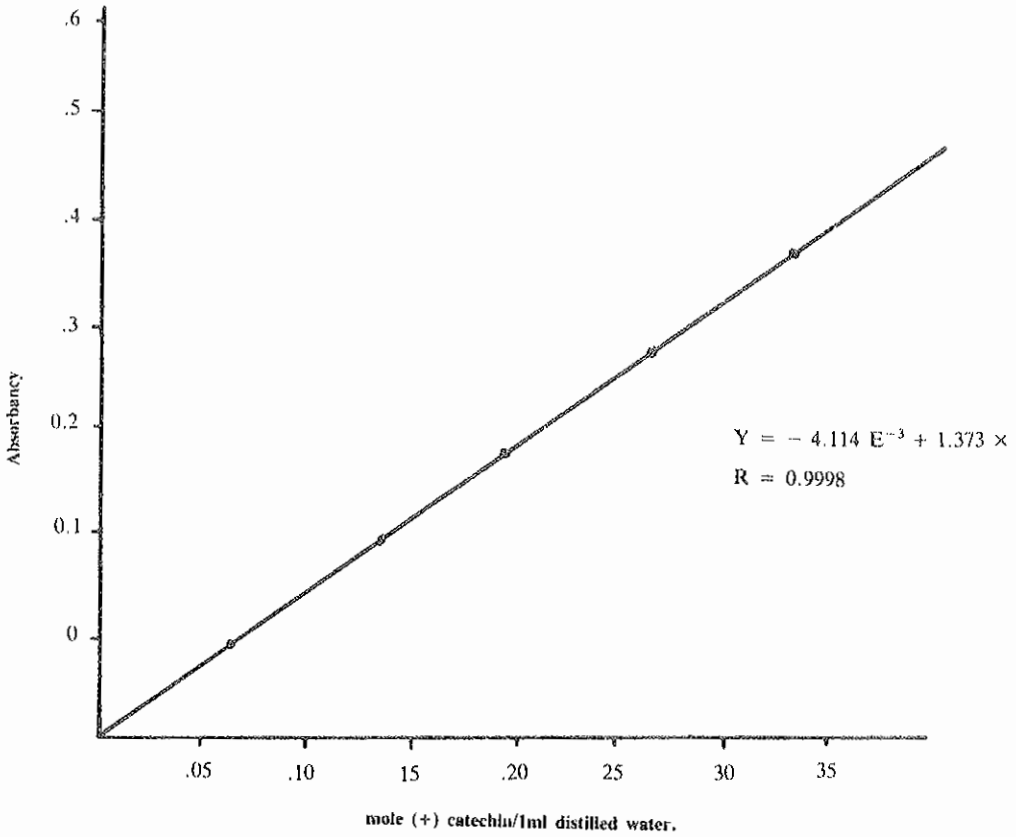

Fig.1 Standard curve of the total soluble phenolic compounds in dates.

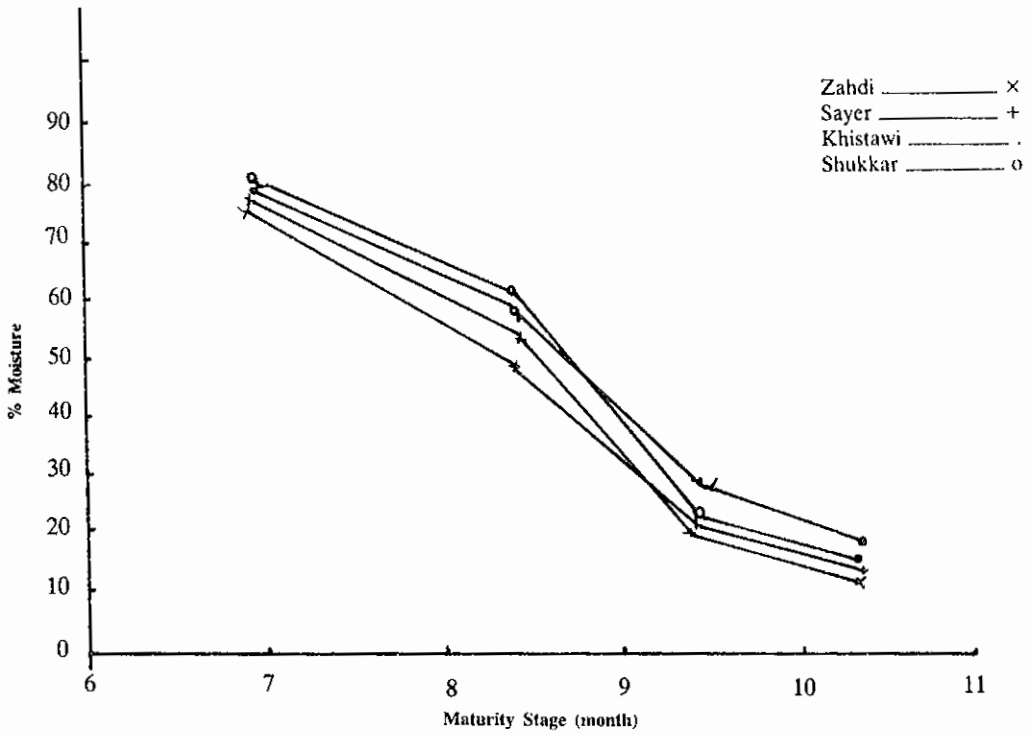

Fig.2 Moisture contents of dates

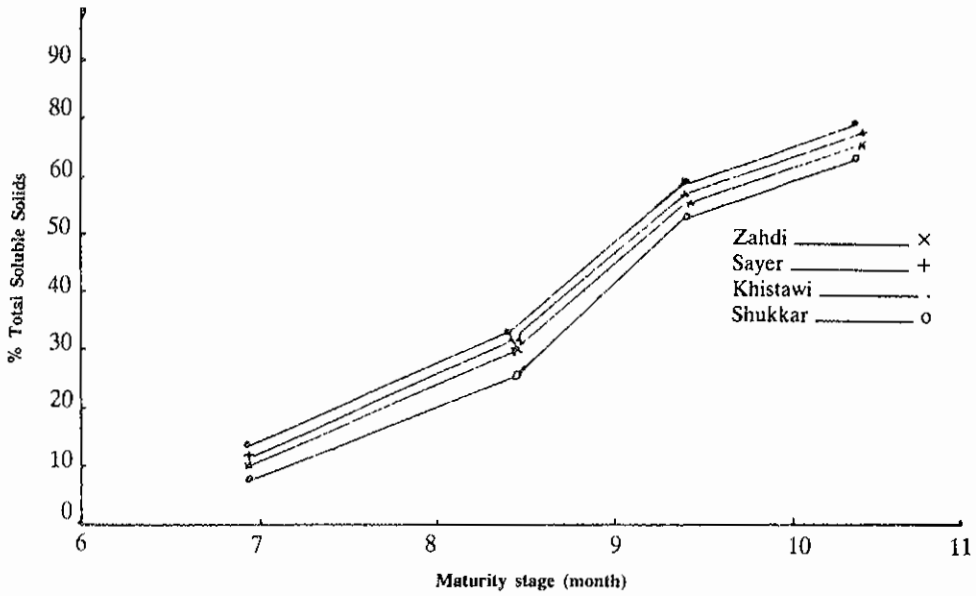

Fig.3 TSS Content of dates.

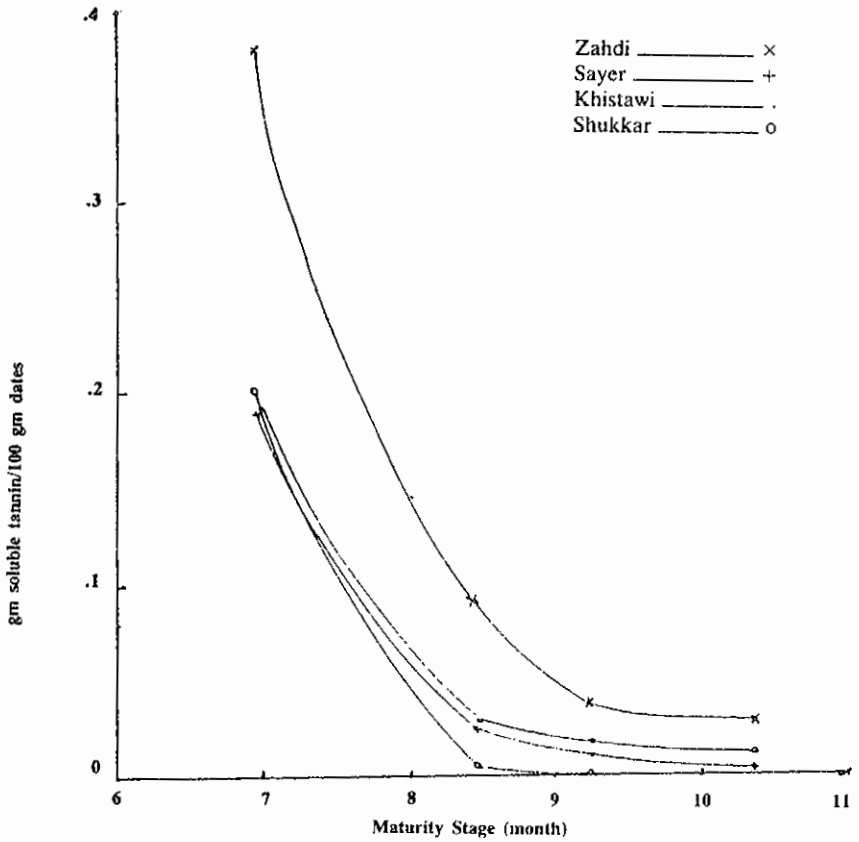

Fig.4 Soluble phenolic compounds content of dates

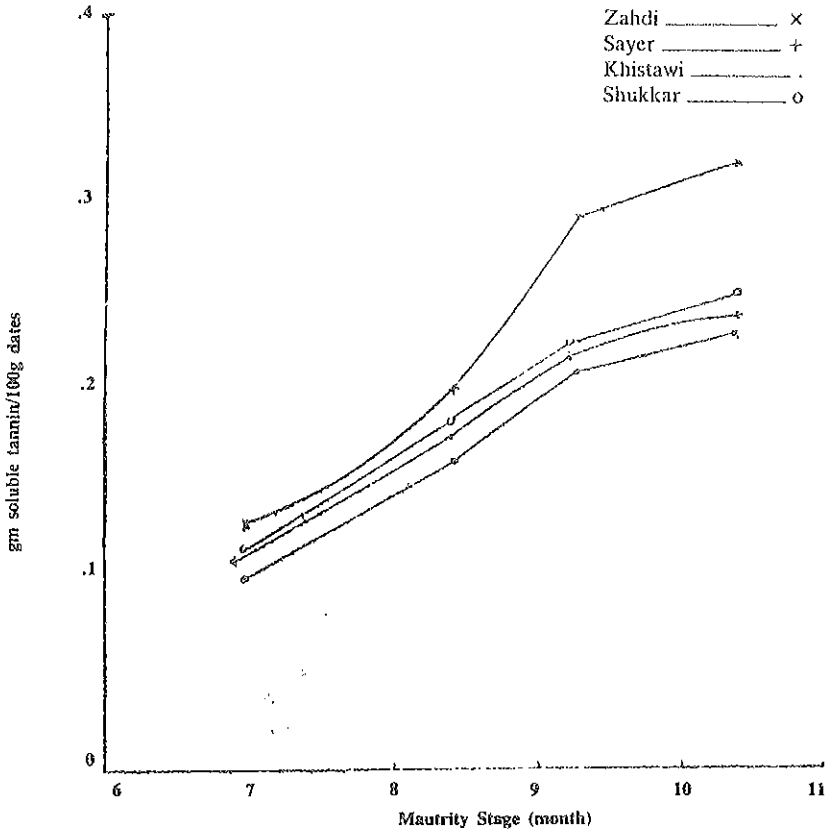

Fig.5 Solube tannin content of dates

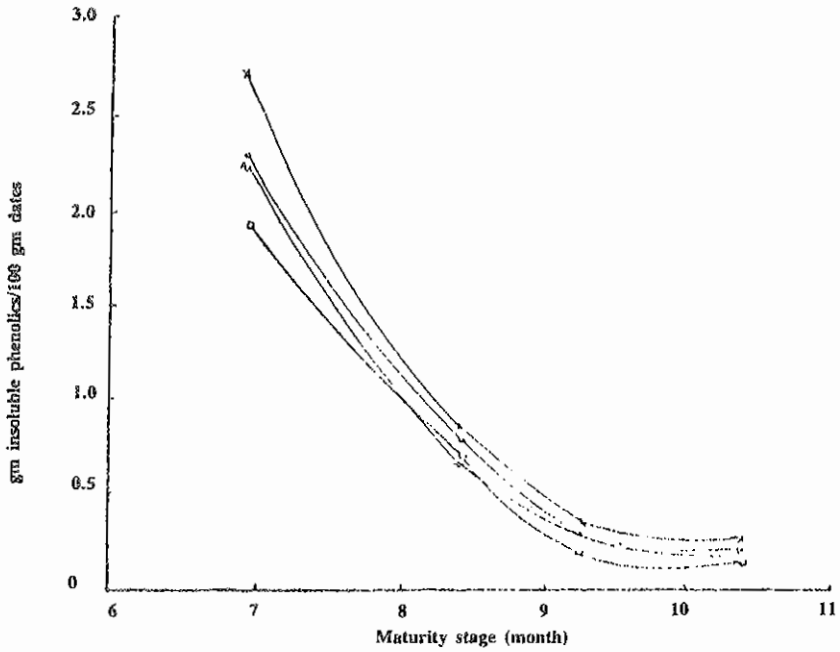

Fig.6 Insoluble tannin content of dates

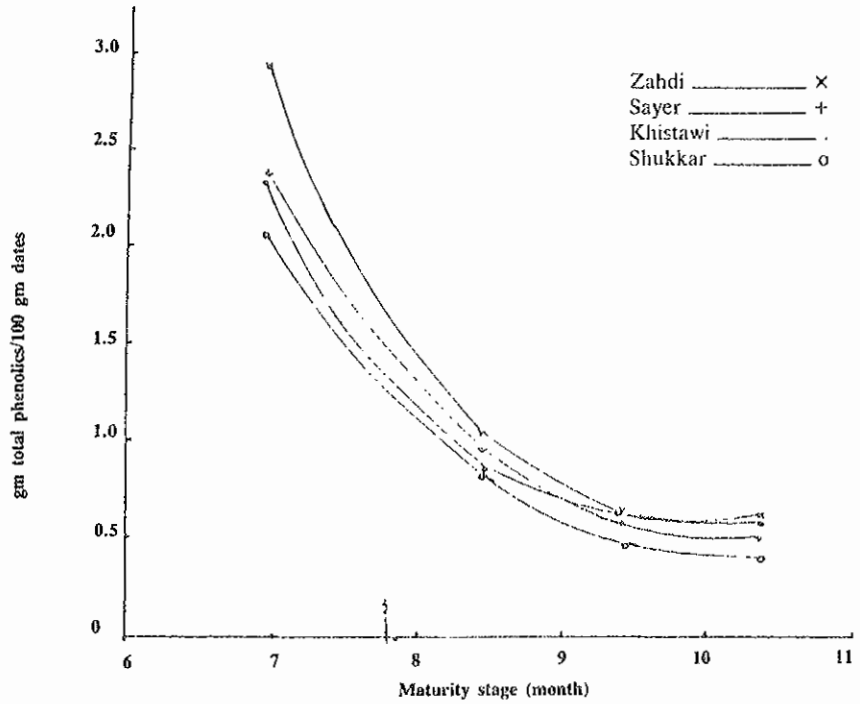

Fig. 1 Total phenolic compound content of dates.

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TYPES AND EXTENT OF MICROBIAL CONTAMINATION ON FRESH IRAQI DATES DURING MATURATION

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ABSTRACT

Types and amounts of bacteria, moulds and yeasts contaminating fresh dates during stages of maturity were determined. The study, which involved four popular Iraqi date varieties, was carried out under carefully recorded horticultural conditions and over four successive fruiting seasons. Unlike moulds, the intensity of bacterial and yeast contamination vary irregularly during stages of fruit maturity.. However, generally, they all followed a general pattern of variation throughout the tested period. They increased progressively towards advanced stages of maturity. The data pointed to the role played by water content, physical and biochemical changes in the fruit epicarp and changes of meterological conditions.

تلوث التمور الطرية بالميكروبات خلال مراحل نضجها

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الخلاصة

تحت ظروف طبيعية مسجلة، تم دراسة نوع وكمية التلوث الميكروبي على أربعة اصناف من التمور العراقية الطرية خلال مراحل نضجها ولأربعة فصول متتالية.

يختلف مقدار الاصابة بالبكتريا والخمائر بشكل متفاوت وغير منتظم خلال

مراحل النضج المتعاقبة وعلى العكس تنمو الفطريات، وبشكل عام فإن مقدار الزيادة في حجم الاصابة يزداد في مراحل النضج الأخيرة. تشير النتائج المستحصلة الى دور التغيرات الفيزيائية ـ الكيمياوية المتصلة بنضج الثمرة وكذلك إلى الظروف المناخية (حرارة ورطوبة) في هذا التغاير.

INTRODUCTION

It has been reported that 70% of the exported Iraqi dates is in dry (not fresh) form (3,7). This is due to the relatively short market life of fresh dates as well as their susceptibility to infestation and spoilage by different types of insects and microorganisms (1). Accordingly, Iraq suffers about 50% loss of this valuable product annually.

Microbial contamination of this carbohydrate rich fruit has been overlooked by many investigators for different reasons. Amongst these are the high concentration of soluble sugars which may plasmolyses invading cells, and the rigidity of the fruit membrane during different stages of maturity. On the other hand, other factors make dates more liable to microbial contamination and spoilage, e.g the physiochemical changes of the fruit during maturity, the moderate pH (near neutrality), variations in the meterological conditions (especially, temperature and humidity) coupled with variations in ripening seasons which may contribute to the microbial spoilage (1,11).

In this study, we saught to determine the extent and types of microbial loadings (bacteria, moulds and yeast) on four varieties of popular fresh Iraqi dates during stages of maturity over four successive fruiting seasons (1980-84).

MATERIALS AND METHODS

Collection of Samples: Samples of the four varieties (Maktoom, Khastawi, Tabarzal, Zahdi) were collected from labelled bunches from the Zafaraniyah Horticulture Research Station. Palm trees were grown under same natural conditions of temperature and humidity which were carefully recorded throughout this study. Five to six branches of each bunch were weekly cut and transferred, asceptically, to the laboratory in an ice box.

Determination of Initial Microbial Loading: Collected dates were classified according to the stages of maturity into Khalal, Ruttab and Tamur.* Three

☆ Khalal: dates in fully grown, glossly yellow stage. Rutab: dates in their soft statge, when they are sold for (fresh) consumption.
Tamur: dates in their fulls — ripened, prune-like stage.

dates of each stage were then randomly picked, surface meausred and washed by vigorous shacking in 25 ml M/15 Sorinson phosphate buffer (pH 7.2). Primarily to check the initial surface loading, 0.2 ml aliquote of the washing (now called soaking) suspension were serially diluted and plated out on nutrient agar (NA) and potato dextrose agar (PDA), (pH. 5.4), using the surface spreading technique (2). Colony counts from the two media after 48 h, incubation at 37° C (for NA) and 26° C (for PDA), were used in evaluating the initial level of contamination. This was then used in selection of the appropriate dilution to determine the precise loading.

Determination of Precise Microbial Loading: The microbial loading (number of viable bacteria, moulds and yeasts) per unit area (cm^2) of date samples was accurately measured by diluting and plating out 0.2 ml aliquotes from the soaking buffer which was maintained at 4° C. The number of viable cells (cells able to produce visible colonies on NA and PDA media) was calculated from a mean count of at least three plates. The total number of contaminents per ml of soaking buffer was calculated from a mean of three separate heamocytometer counts (2). Total and viable counts were then used to calculate the viability percentage.

The surface area of any date fruit was determined from a calibration curve set between diameter ratio (ratio of largest diameter/diameter of the base) versus the fruit length. This curve was established from a least 100 plantographic measurements of date fruit at different stages of maturity.

Identification and classification of Microbial Isolates: Bacterial isolates showing apparent variation in colonial morphology were microscopically examined and classified to cocci and aerobic spore forming bacilli. The later which gave positive Gram and Catalase reactions belonged to the genus Bacillus and were then classified to different species according to Berguys (2). All cocci, however, gave positive Gram and catalase reactions and ferment glucose aerobically. They belonged to the genus *Micrococcus.* Classification to different species was the done according to Berguys (5) and Parker (12).

Genus classification of moulds, was made on the basis of the morphology of sporing structures using Harrigon and McCanee (9), and Barnett and Munter (4) methods. Yeast isolates were identified and classified according to the method described by Lodder (10).

RESULTS AND DISCUSSION

Types of Microbial Contamination: A list of the most abundent genera and species of bacterial, mould and yeast isolates appears in Table I. They represent the persistent types of microorganisms that contaminate dates at

tested stages of maturity. Types disappeared at any stage were ruled out from this Table.

Extent of Contamination: A. With Bacteria: Amounts of bacterial loading (percentage viable bacteria per cm^2 universal surface area of tested dates) in relation of time of picking of the four tested varities at Khalal, Rutab and Tamur stages are illustrated in Figures 1,2 an 3 respectively. The maximum loading of the tested varieties at each stage of maturity appeared in Tables 2, 3 & 4. In Khalal stage (Figure 1) a wide range of contamination was observed. Extents of this contamination, however, varied irregularly from one week to another. Despite the fact that this variation is statistically significant, it can be, however, generally postulated that Maktoom, Tabarzel and Zahdi varieties exhibit a similiar pattern of contamination, with maximum extents varied between 10^2 and 10^3 viable cells/cm^2 throughout the eleven weeks of experiment which was repeated successively in four following seasons. Khastawi, however, revealed a higher level of contamination in comparison to other varieties, mainly at mid-season (6th week). Variation in this seems to be in consistence with high atmospheric humidity. It could be that Khastawi is the most susceptable, amongst other varieties, to bacterial contamination at this stage of maturity. This can be argued from the point that Khastawi retains high water content (6), and has a very thin epicarp (13). In Rutab (Figure 2) Khastawi, Maktoom and Tabarzel showed a similar pattern of irregular levels of contamination. Zahdi was not included in this study due to its rapid transformation from Khalal to Tamur.

The high contamination level in Khastawi while in Khalal was again observed in Rutab. Maktoom, on the other hand, showed a surprisingly low level of contamination at both stages. In Tamur (Figure 3), the four varieties showed same irregularity in the pattern of contamination. It was striking, however, to note that Khastawi at later stages of maturity, became more resistant to bacterial contamination, a situation reversed with Maktoom. This could reveal the importance, at this stage, of variation in chemical constituents of the fruit (mainly soluble sugars, pectic and phenolic compounds) (8,7).

B. With Moulds: The mould loading observed on the tested varieties throughout maturity stages is illustrated in Figures 4,5 & 6. Generally, it seems that extent of moulds contamination is not dependant on stage or variety. Variation in loadings was significant between and within varieties at Khalal and Rutab strages. This may associate with apparent changes in physical structure (shrinking and cracking) of dates, which fascilitate moulds invasion. The maximum extent of contamination was about 10^3 viable cells/cm^2 of date (Table 2) and was progressing with maturity reaching its top maximum at later weeks of picking. The significance of these findings can be argued in relation to variation in meterological conditions (humidity and

optimal temperature) as well as the water content of dates, and their chemical constituents at later stages of maturity.

C. With Yeast: Variation in yeast loading/cm^2 of date fruit during maturity stages are well illustrated in Figures 7,8,9. Despite the wide variation in extent of contamination among the tested varieties, it is apparent that contamination with yeast increased immensily, at the Tamur stage in comparison to preceeding stages. The susceptibility of dates to yeast infection at this stage, whith was directly associated with atmospheric humitidity, is largley responsible for the major deterioration and taste spoilage (souring) observed in Tamur during picking and later during storage.

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Table 1
A list of classified microbial isolates of the tested date varieties

Bacteria		Moulds		Yeast	
Bacillus	*megaterium*			*Zygosaccharomycescavarae*	
	lichiniformis	*Aspergillus*	spp (5)		
	pumilus	*Penallium*	spp (1)		*globiformis*
	pasteurii	*Alternaria*	spp (1)		*barkeri*
	cereus	*Pythium*	spp (1)	*Saccharomycescerevisiae*	
	subtilis			*Torula*	spp.
Micrococusureae				*Mycoderma*	spp
	luteus			*Candida*	*Krusei*
	varians				*mycoderma*

Table 2
The maximum microbial loading/cm² exposed date surface, of the four varieties in Khalal stage.

Type of Loading	Time* on which maximum loading was observed			
	Maktoom	Khastawi	Tabarzel	Zahdi
Bacteria	7th week☆☆	6th week	6th week	3rd week
	6.25×10^2	2.58×10^4	2.00×10^3	$2.00\times1:^3$
Moulds	11th week	11th week	11th week	11th week
	1.50×10^3	1.10×10^3	1.33×10^3	1.04×10^3
Yeast	10th week	11th week	8th week	11th week
	1.41×10^3	5.83×10^3	2.90×10^2	7.50×10^2

☆ The weekly evaluation of extents of microbial loading started 1st July and prolonged eleven successive weeks.

☆☆ Numbers of weeks represent the median of those observed in four successive seasons.

☆☆☆ Each number represents a pooled mean extracted from repeatable values obtained in the four successive seasons.

Table 3
The maximum microbial loading/cm^2 exposed date surface, of the four varieties in Rutab stage.

Type of Loading	Time on which maximum loading was observed		
	Maktoom	**Khastawi**	**Tabarzel**
Bacteria	9th week 8.00×10^2	6th week 1.54×10^3	9th week 3.33×10^3
Moulds	9th week 1.02×10^3	8th week 5.83×10^2	10th week 7.00×10^3
Yeast	3rd week 8.33×10	3rd week 1.25×10^2	10th week 5.40×10^2

Table 4
The maximum microbial loading/cm^2 exposed date surface, of the four varieties in Tamar stage.

Type of Loading	Time on which maximum loading was observed			
	Maktoom	**Khastawi**	**Tabarzel**	**Zahdi**
Bacteria	9th week 1.12×10^3	6th week 1.45×10^3	8th week 3.33×10^3	7rd week $1.96\times1:^3$
Moulds	10th week 1.29×10^3	9th week 8.33×10^3	11th week 1.33×10^3	11th week $7.5—\times10^3$
Yeast	10th week 7.91×10^3	10th week 4.58×10^3	9th week 1.88×10^2	9th week 7.50×10^2

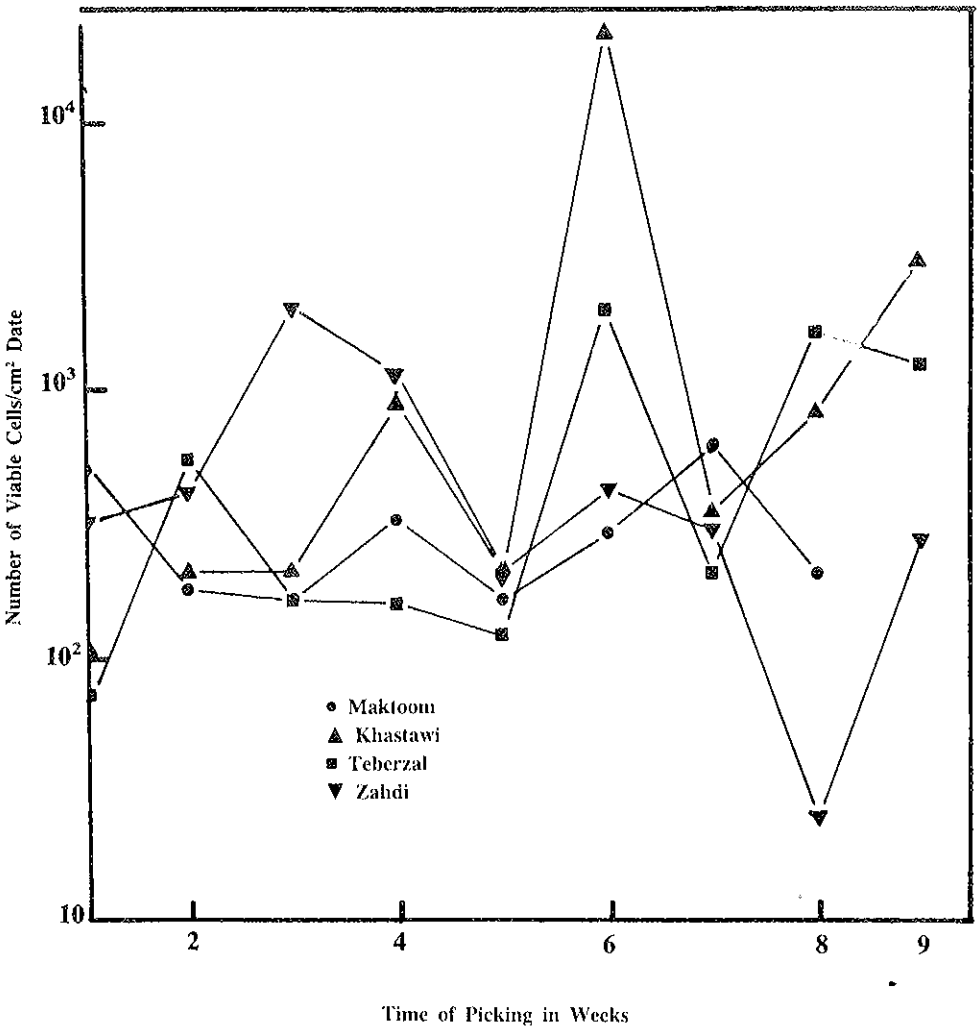

Fig.1 The relationship between number of viable bacteria/cm^{2}of exposed surface area of dates and time of picking of the four tested varieties, in the Khalal stage.

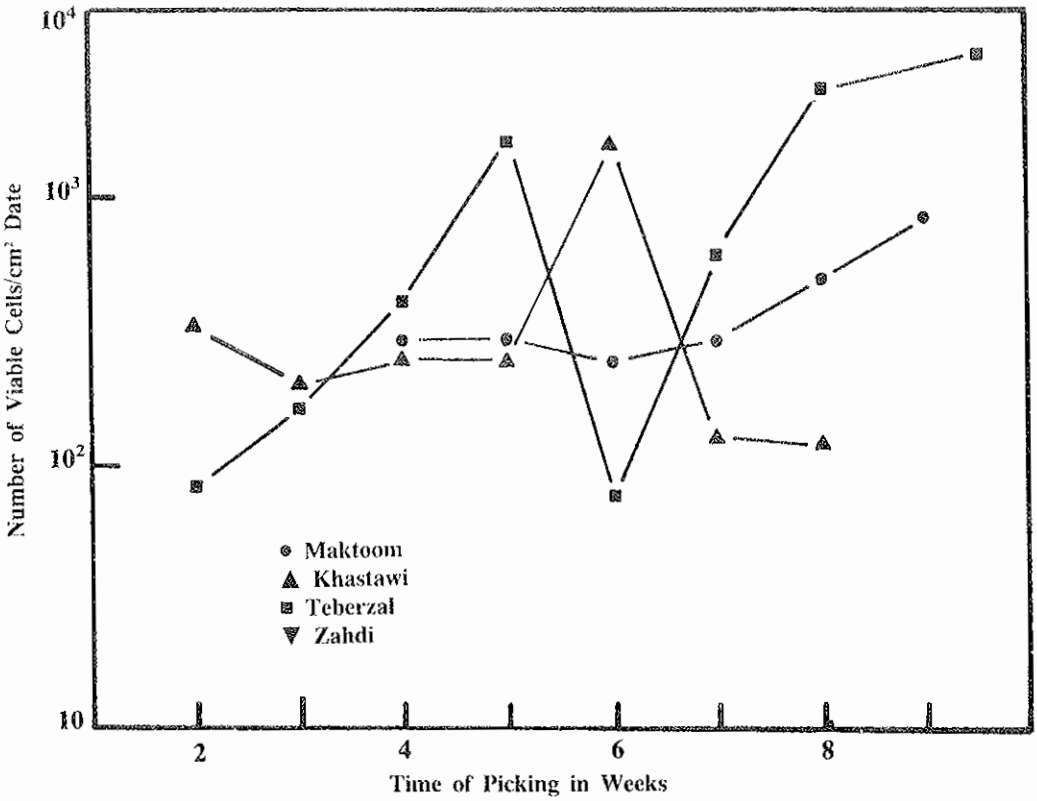

Fig.2 The relationship between number of viable bacteria/cm^2 of exposed surface area and time of picking of the four tested varieties in the Rutab stage.

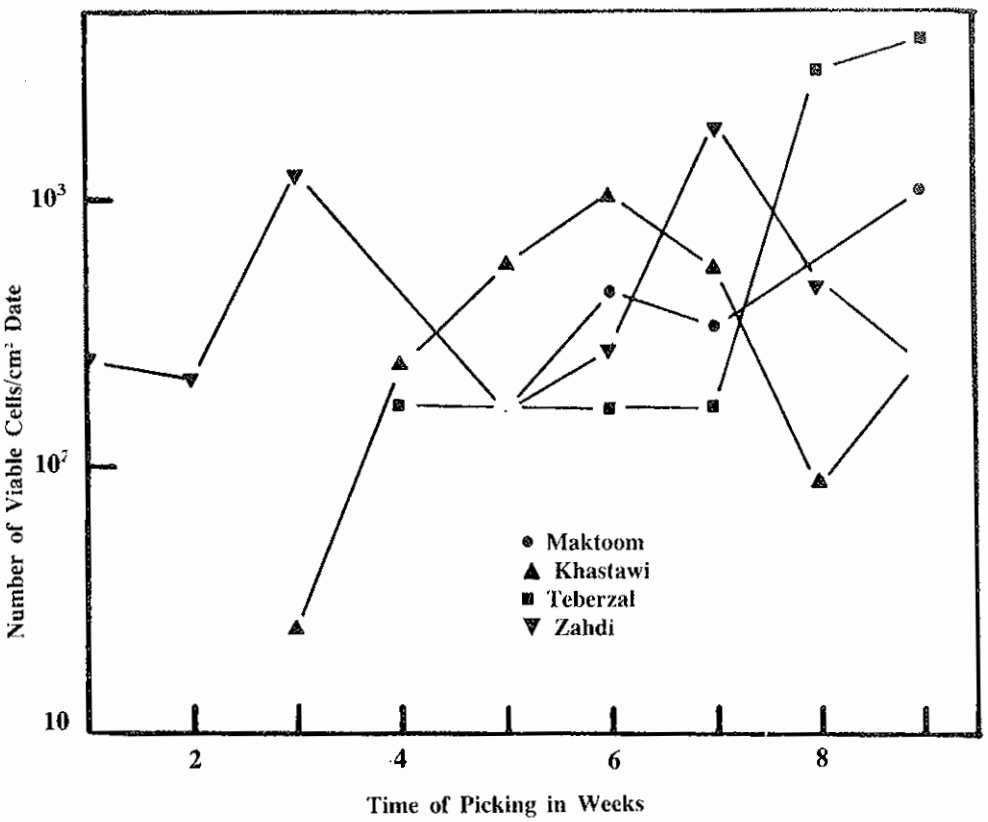

Fig.3 The relationship between number of viable bacteria/cm^2 of exposed surface area and time of picking of the four tested varieties in the Tamur Stage.

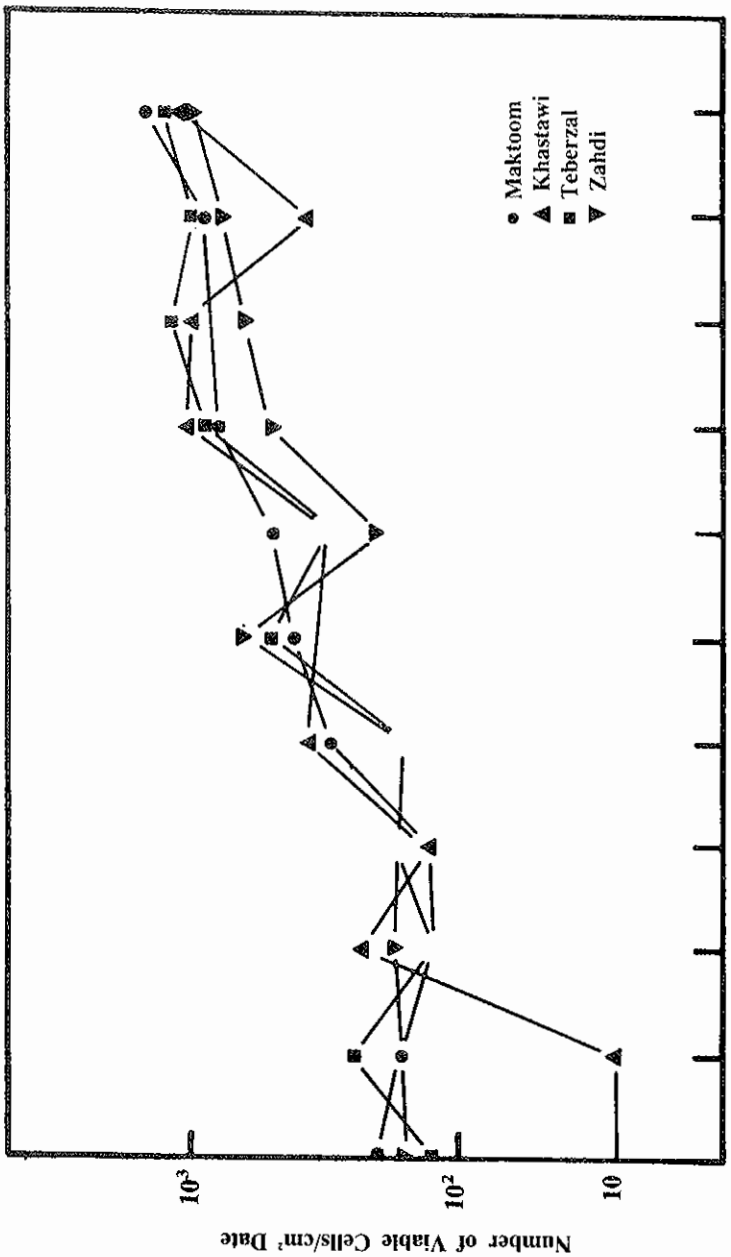

Fig.4 The relationship between number of viable moulds/cm² of date and time of picking of the four tested varieties in the Khalal stage.

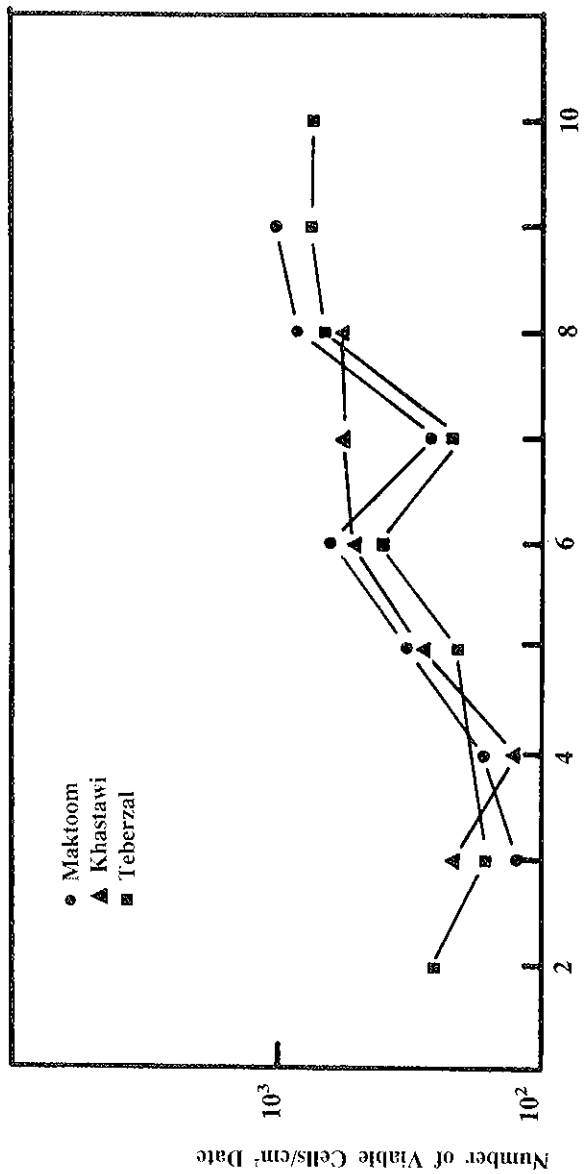

Fig.5 The relationship between number of viable moulds/cm² date and time of picking of three tested varieties in the Rutab stage.

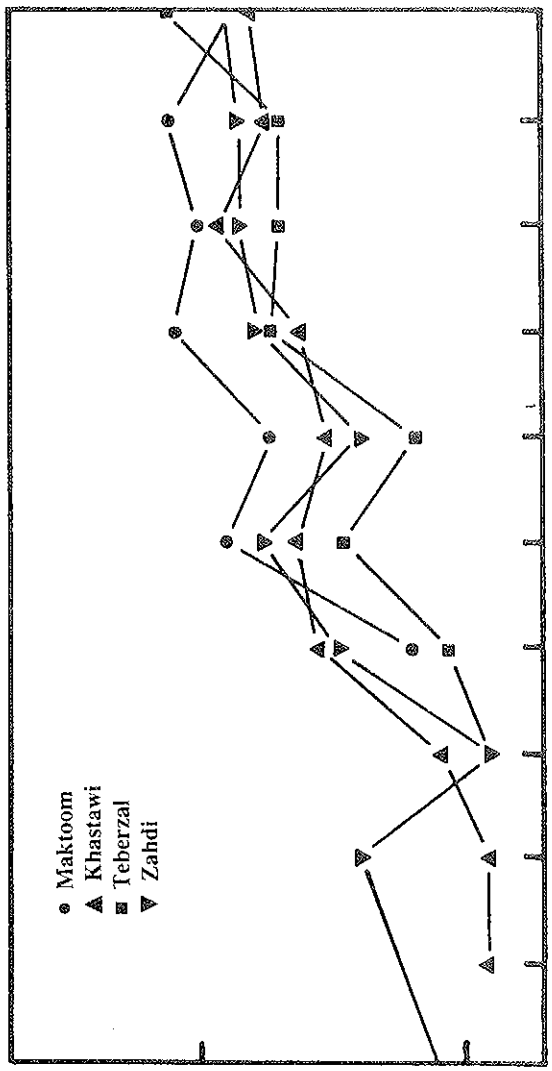

Fig.6 The relationship between number of viable moulds/cm² date and time of picking of the four tested varieties in the Tamur stage.

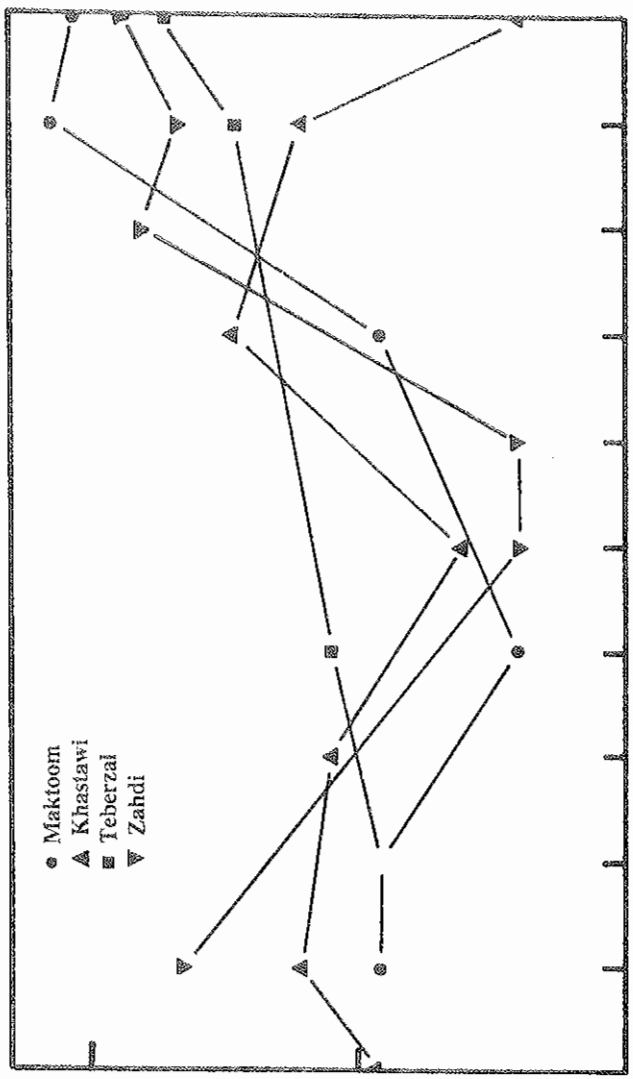

Fig.7 The relationship between number of viable yeast/cm² date and time of picking of the four tested varieties in the Khalal stage.

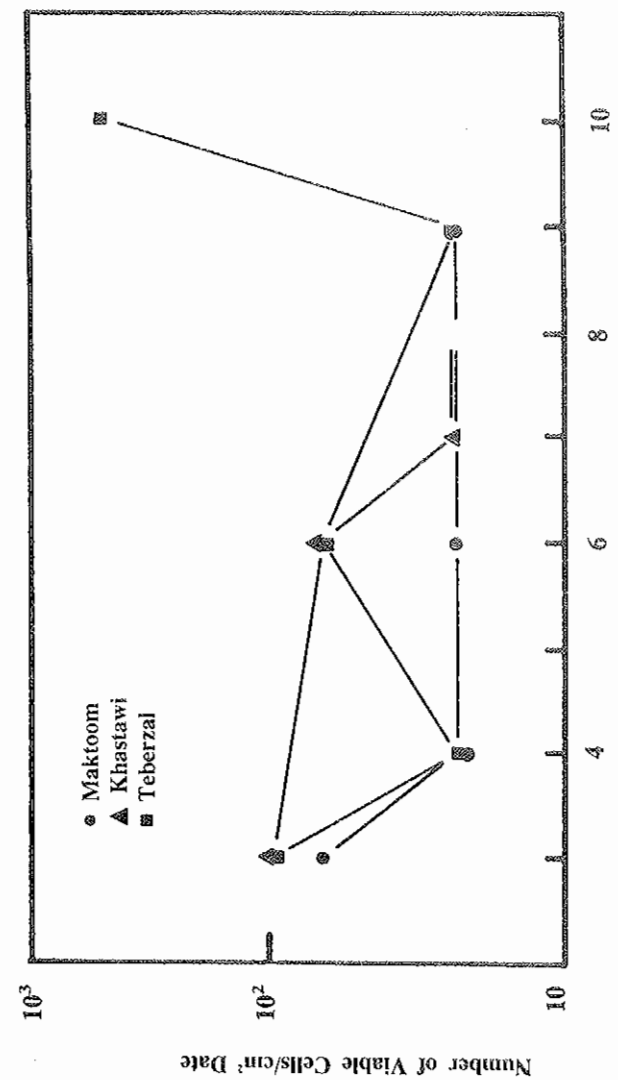

Fig.8 The relationship between number of viable yeast/cm² date and time of picking of three tested varieties in the Rutab stage.

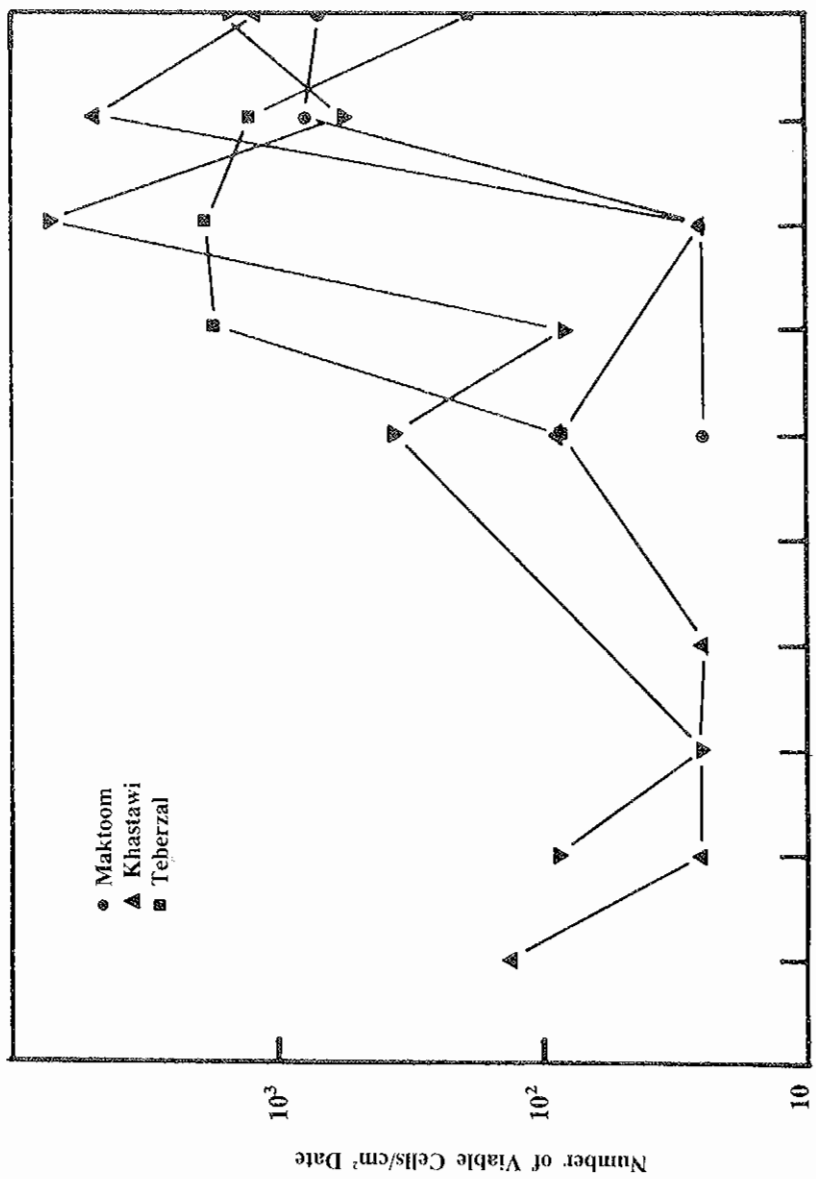

Fig.8 The relationship between number of viable yeast/cm² date and time of picking of four tested varieties in the Tamur stage.

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HYGROSCOPICITY OF CERTAIN DRIED DATE PRODUCTS

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ABSTRACT

Hygroscopicity of sugary materials is accentuated by the presence of constituents such as proteins, pectin and salts. Date being the richest fruit in sugar content, is particularly hygroscopic. Type of sugar and its phase are important in determining the extent of moisture uptake of a dried foodstuff. Monosaccharides are more active in this respect than disaccharides. Moreover, an amorphous sugar is more inclined to hold moisture than its crystalline counterpart. Dried date products are not merely apt to undergo changes in texture, but also in their storage stability and property of free flow.

A controlled R.H./T/air circulation system was eveloved for assessing hydrophilicity of various dried date preparations. Study included leading commercial varieties in international trade and some secondary ones in order to cover different groups in chemical and consistency schemes of classification. Some chemical treatments proved fairly effective in limiting moisture adsorption. However, this entailed quite high rates of addition.

امتصاصية الماء في منتوجات معينة من التمور المجففة

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الخلاصة

تزداد الرغبة لارتشاف الماء في المواد السكرية بوجود مواد مكونة أخرى كالبروتين، البكتين والاملاح. وحيث ان التمور هي أغنى الفواكه في المحتوى السكري، فعليه تعتبر متميزة بهذه الخاصية. من العوامل المهمة في تقدير مدى الاستعداد لامتصاص الماء في المواد الغذائية المجففة هي نوع السكر وطوره. فالسكريات الاحادية أكثر فعالية من الثنائية. كما ان السكريات اللاشكلية أكثر ميلاً من نظيرتها المتبلورة. ليس من شأن منتوجات التمور المجففة ان تكون عرضة لتغيرات في انسجتها فحسب بل وفي استقراريتها الخزنية وخاصية تدفقها الحر أيضاً.

تم تصميم منظومة سيطرة على الرطوبة النسبية/درجة الحرارة/ حركة الهواء لتقدير درجة الشغف المائي في تحضيرات تمرية مختلفة. تضمنت التمور المدروسة أهم الاصناف التجارية الدولية فضلاً عن عينات ثانوية لتغطية مختلف المجاميع في أنظمة التصنيف الكيمياوي ودرجة الطراوة. اتضح ان لبعض المعاملات الكيمياوية أثار نسبية في تخفيف حدة الامتصاصية، على ان ذلك تطلب الاضافة بمستويات عالية.

INTRODUCTION

Water does not simply contribute to texture or structure of foodstuff, but its interaction with chemical components determines relative storage stability of food (14). Even physically it may have pronounced effect on food quality and stability, as bound water is the portion that is closely associated with the host material (15). Water vapour pressure measured as equilibrium relative humidity (E.R.H.) indicates the intrinsic humidity or activity of water present in the food (6). Water activity may be determined by holding the samples in closed vessels containing saturated salt solutions each of which imparts a characteristic relative humidity (R.H.) medium or in vessels

containing certain concentrations of sulfuric acid (1). Equations dealing with estimations of a_w of food products and their models are continuously being developed (1, 7, 11).

upon plotting moisture content of a tested product against a séries of R.H.S. the moisture sorption isotherm curve is obtained (MSI). The differential coefficient of moisture with respect to R.H. ($\triangle m/\triangle R.H.$) which, can be calculated from a given M.S.I. may be related to stability characteristics (18). M.S.I's of foods represent the integrated hygroscopic properties of numerous constituents whose sorption behaviour may change as a consequence of physical and/or chemical interactions induced by heating or other pretreatments (12). Tendency of powdered food materials to agglomerate and subsequently cake has been utilized, using various means and tools, to assess hygroscopicity (4,8,9,17).

There are a number of factors which goven the hygroscopic characteristics of sugar containing plants. Probably the most important is that plant sugars are naturally amorphous with a consequently greater ability to absorb moisture upon drying. This kind of dried material is rendered amenable to cohering and caking up additionally (10,16,24).

There is only a limited reported information on the hygroscopic characteristics of the different varieties of dates. Sucrose varieties are easy to handle. Similarly is the case with semi-dry varieties. Moisture content of soft or invert sugar dates is higher at equilibrium than that of Deglet Nur when the two types are held in the same storage room (19).

The critical figure for reducing sugars in dates is around 25%; higher levels than that lead to a strongly hygroscopic and tacky dehydrated product, whenever dehydration is encountered (20). A limited number of experiments on date moisture sorption isotherms had been conducted in Hungary (22).

This study was designed to find out the active constituants of different dates that may accentuate the undesirable phenomenon, hygroscopicity and its effects. Possible means to overcome the problem are also attempted.

MATERIALS AND METHODS

The studied date varietis represent various groups of both consistency (horticultural) and the chemical (sugar or tannin type) schemes of classification. In addition to the major commercial Iraqi varieties, the major North African date, Deglet Nur was also investigated.

When whole-, half- and quarter- dates were required fissuring of the flesh was inevitable. To obtain pieces of geometric shapes (flat discs), cork borers of given diameters were pierced through the date flesh. The flesh was minced and/or mixed when a paste was needed using a Kenwood Cheff (Kenwood

Manufacturing Co. Ltd. Havant, Hants, England). This served production of date powder in a vacuum oven (Townson and Mercer Ltd., Croydon, England). A pilot scale tunnel air dryer and the vacuum oven were employed for assessing drying behaviour.

To study the susceptibility of the different dried date materials to resorb moisture, saturated salt solutions of high chemical purity were sufficed, thus:

Salt	% r.h.	Salt	% r.h.
LiCl	11	K_2CO_3	43
$KC_2H_3O_2$	23	$NaNO_2$	63
$MgBr_2$	30		

The last, $NaNO_2$, was employed to expedite adsorption behaviour, i.e. exposing the sample for a few minutes instead of several hours or a few days to attain equilibrium moisture content, e.m.c. For the present tests, a new appliance was innovated, whereby samples tested for a_w were placed in cups over a carriage hanging inside a closed jar. A revolving shaft that was geared to a driving motor helped stirring the salt solution vide a submerged fan. Another fan mounted at the middle of the shaft circulated the air inside the vessel at the rate of 97 rpm (Fig. 1). All jars were immersed in a water bath that maintained the temperature at 30°C throughout the entire research to minimize loss of vapour other than that of water (23).

Tests on humectancy in dates involved the use of various R.H. media. Most frequently 43% R.H. was chosen for the various treatments as it was a moderate level.

Both forms of the partially acetylated monoglycerides, solid Myvacet 700 and 707K and liquid Myvacet 940 were gratefully supplied by Eastman Chemical International A.G., Hemel Hempstead, England. They were intended to serve as film coats against hygroscopicity.

Several prospected additives considered to be permissible by the FAO/WHO (UN) had been tested in an attempt to alleviate hygroscopicity or its deleterious effects, especially stickiness. even a chelating agent was tried to coalesce between the date product surface and the tested chemical. They were usually administered in a dry form, and are listed in the relevent figures in the next section.

Determination of moisture content was based on dry weight according to proposed method which is essentially in line with the standard method designed for high-sugar content fruit by AOAC (cf. 21).

RESULTS

A number of experiments were conducted. Their results are submitted as follows:

Extent of Hygroscopicity. A simple experiment was designed to illustrate the extent of hygroscopicity of the date powder. The powder was compared with its pre-powdering form, namely the flakes for moisture sorption. Both were exposed to 43% R.H./30°C. Figure 2 shows that after 4 hours the powder regained twice the m.c. percentage of that regained by the flakes.

The Role of Certain Active Constituents in Hygroscopicity. The influence of sugar the major active constituent, on hygroscopicity was investigated. Figure 3 shows how the devised system (cf. Figure 1) for powder hygroscopicity could accelerate e.m.c. as compared to ambient conditions. It also reveals that Deglet Nur does not need treatment with granulated sucrose as Zehdi does. Both Algerian and Iraqi varieties are semidry in consistency.

Powder hygroscopic qualities of five of the studied varieties Bedrayeh, Zehdi, Helwai, and cooked khalal of Braim and Kibkab were surveyed Figure 4 indicates that, in general, there are connections between e.m.c. and group type, i.e. the soft (invert sugar) variety powders adsorb the highest moisture 11.5% and the dry ones containing some sucrose adsorb somewhat less moisture, 9.5%

Treatment with Chemicals: Dry additive application: Figure 5 shows effects of samples of the numerous treatments on hygroscopicity,among them|were fructose (F), glucose (G), granulated sucrose (G.S.), powdered sucrose (P.S.) and ethylenediamine tetraacetic acid (EDTA) in association with some of the prospected additives in hyrgroscopicity control. Sets 1&2 show application of dry additive (A) to the date powder (P). And sets 3-5 show application of (A) to (P) with some moistening with water (w). In the latter applications, subsequent redrying and repowdering were resorted to obviously.

Upon reaching equilibrium under a condition of 43% R.H./ 30°C, the results observed in Fig. 5 are briefly:

The effects that passed the margin of mere dilution included (a) glucose + fructose (1:1, at 5%) and (b) glucose produced the best reduction in moisture adsorption of all sugar types and forms.

Film Coating: Liquified Myvacet 700 gave better protection when applied to pieces (¼ th dates) by immersion. Liquid Myvacet (940) failed to impart any level of hydrophobicity.

Immersion was not suitable for the powder form because of the agglomeration caused. Myvacet coating rate is dependent on the date piece of particle diameter. Its excessive amount in the particle sample did not lead to a greater restriction of moisture uptake with average values of approximately 7% for the particles (diam. 2-2.35 mm) compared with approximately 4% for the date discs (diam. 11.4 mm, thickness 4.5 mm) after exposure to 63% R.H./30° C for 21 h.

In another experiment, in addition to the advantage of moisture uptake reduction brought about by coating with molten Myvacet 707K, the date skin gave positive effects, while fissuring of flattened pieces accentuated hygroscopictiy, Fig. 6.

Moisture Adsorption: Moisture sorption isotherm of Zehdi powder treated with certain additives has been studied. R.H. conditions, 11%, 23%, 30% and 43%, all at 30°C temperature were sufficed.(Fig. 7). Fructose, granulated sucrose and glucose showed some improvement on the stability of the freshly produced Zehdi powder. Compared to the control, they displayed a better effect at a_w 0.23 than at a_w 0.43 however.

Extremeness of hygroscopicity is best illustrated by observation at relative short periods. Five minute exposures were quite sufficient to trigger clumping to one extent or another in both soft and semi-dry date varieties and in the control and chemically treated samples (Fig. 8 & 9).

Of the wide range of additives used in powder form in these trials, only glucose and, to a lesser extent, α - lactose showed any effect on the hygroscopicity characteristics of the date powder. The latter observation is in agreement with an earlier finding (3). EDTA had some enhancing effects on these additives.

DISCUSSION

Dates are solids of fibrous structure. They have a moisture content in the range of 8-27% depending on variety. Their sugar content is about 77% ± 5% d.w.b. (20) which renders them quite amenable to moisture upon exposure to a R.H. higher than their e.r.h. medium.

It has been shown in the investigations that both date pieces and powder are extremely hygroscopic. In terms of the dry material the major characteristics which have been considered in this respect are consistency (i.e. the degree of dryness) and sugar type.

It appears that although the dry varieties produce a powder of slightly improved hygroscopic properties, there is no substantial effect on hygroscopicity of the biochemical and physical changes associated with consistency.

Sugar Type: There are differences in hygroscopic characteristics of pure

invert and none-invert sugars (13). The experimental evidence from this investigation shows that powder from a high sucrose variety (Deglet Nur, 45% sucrose) did exhibit a relatively lower hygroscopic tendency than a low sucrose variety (Zehdi, 10%) from the same consistency group. However, the difference between these cultivars was only small. This agrees with the statement that invert sugar contents of greater than 25% lead to problems of hygroscopicity with dates and similar products (Carpenter, cited '20').

It seems probable that where a mixture of sugars of different hygroscopicity occurs, the more hygroscopic sugar will make moisture available for the less hygroscopic compound, and hence the latter would have only a limited effect on the absorption characteristics of the mixture (5).

The major inference from sugar type/variety relationship is that the high sucrose dates could be utilized in the production of somewhat less hygroscopic dried date products.

Date Product Treatment: The experimental work on treating the date powder to reduce hygroscopicity showed a generally greater problem of protection than has been reported with some other materials. This is probably because of the particularly hygroscopic characteristics of the date.

The improvement produced by addition of glucose, compared with fructose, has not been reported by other workers in allied fields. It seems unlikely from its known absorption characteristics that glucose would be better at preferentially absorbing moisture than the other additives. It therefore appears that glucose must have some degree of attachment at the powder surface which restricts moisture adsorption sites.

Attempting to spread a surface coating by addition of, for example, a sugar in solution proved unsatisfactory probably because it was not possible to remove the added water before it had in part been absorbed by the date powder.

The partially acetylated monoglyceride, Myvacet, was found to have only a limited application. When an adequate coating could be applied, there was substantial reduction in moisture uptake(for example by a factor of ten with quarter dates).

On the basis of the present investigations, to obtain a reduction in moisture uptake by the particles would require either a complicated procedure for adding a coating material such as Myvacet (in the case of date discs) or the addition of very large proportions (say more than 20%) of glucose. Both of these have economic disadvantages for industrial production of the date powder.

Undoubtedly, some apprehension of the moisture sorption isotherm of a

newly processed product contributes towards its preservation. Date powder is the more minute size of the prospected dried date products; hence, it is quite conceiveable that it has an extremely low water activity definitely < 0.20. Nevertheless, once it is recalled that a less sugary material freeze dried watermelon juice has a stringent stability requirement, e.g. a_w 0.22 - 0.25 (2), the reservations are appreciably substantiated. It is apparent then why the date powder should be packaged in material that does not transmit water vapour.

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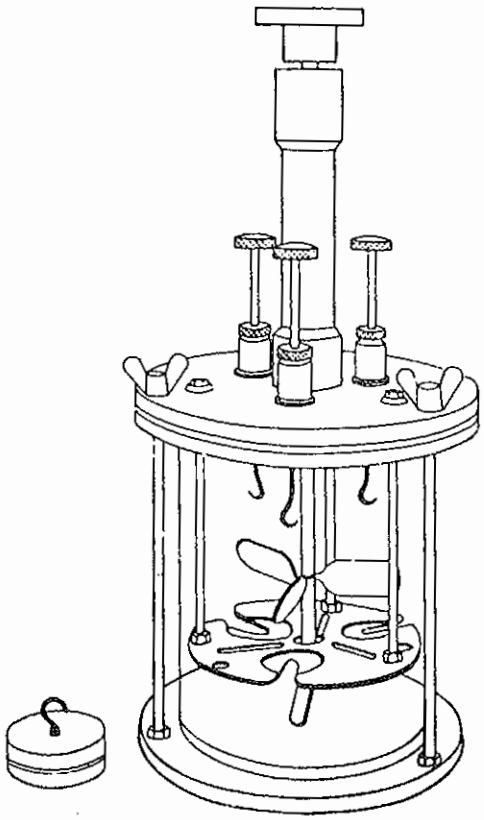


Fig.1 E.r.h. apparatus assembly and one of its capsules.

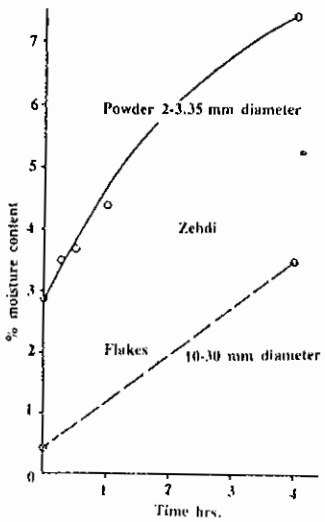


Fig.2 Adsorption behaviour of powder and flakes.

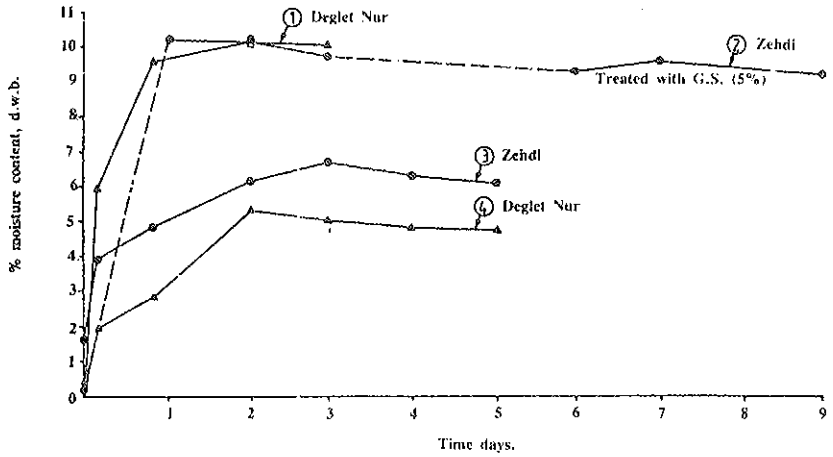
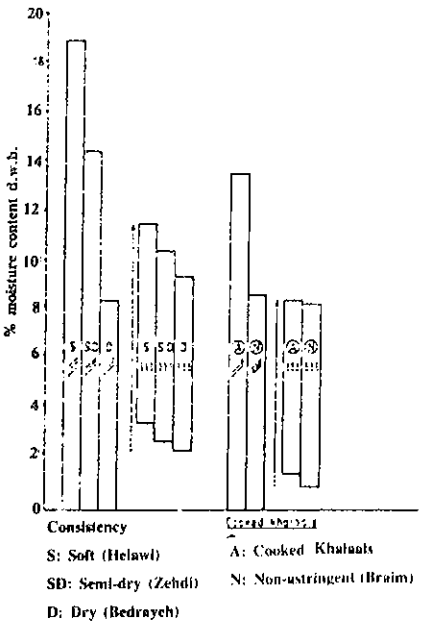


Fig.3 Fluctuation in % m.c. of powder over time under controlled medium (43% R.H.,30° C), (1) and (2); and ambient conditions (3) and (4);



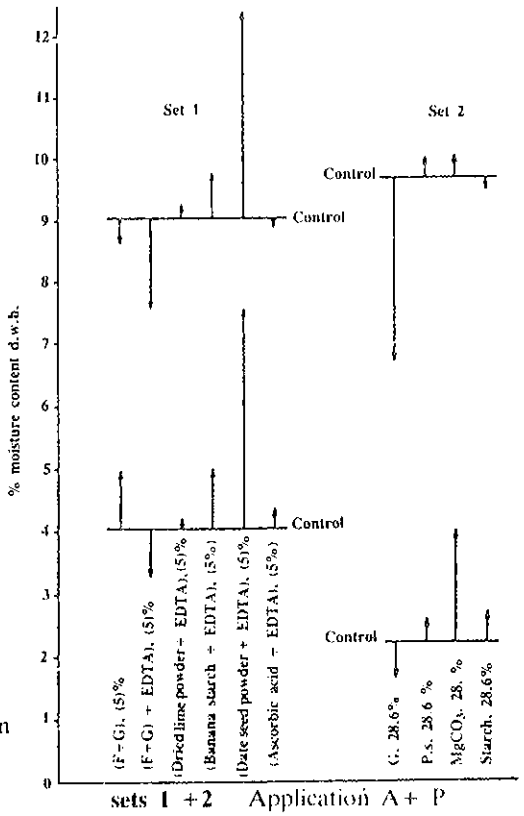


Fig. 4 Histogram showing% m.c. of the flesh of varieties representing the three consistency groups and of cooked khelals; also showing sorption reactions of their powders, at equilibrium with 43% R.H./30° C.

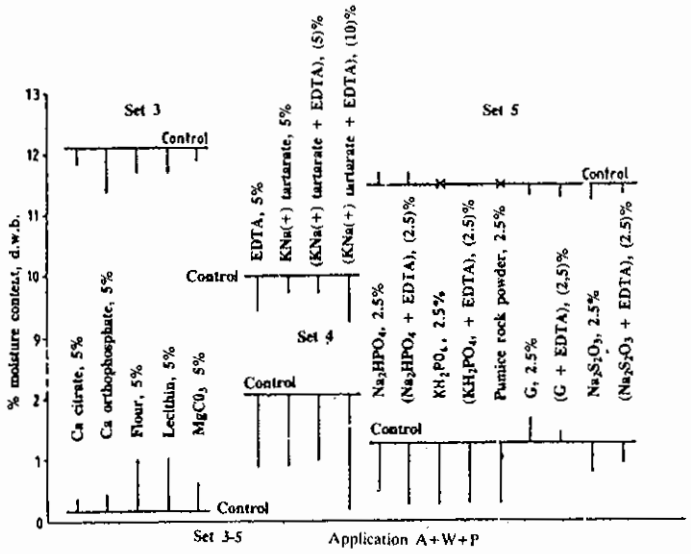


Fig. 5 Effects of additives on initial and equilibrium m.c. of Zehdi powder under 45% R.H./30° C

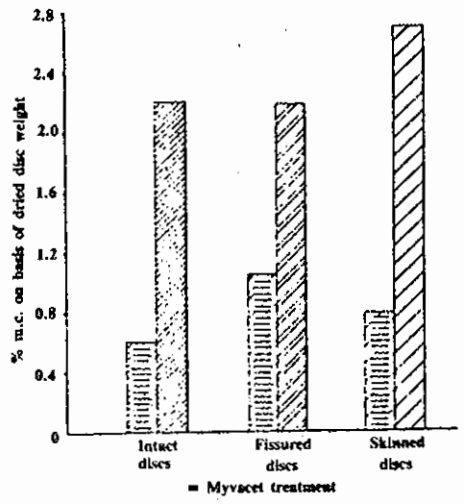


Fig.6 Effect of molten Myvacet 7-07 K treatment on various preparations of 12.3 mm diameter discs, Zehdi, Under 63% R.H. for 6 hours.

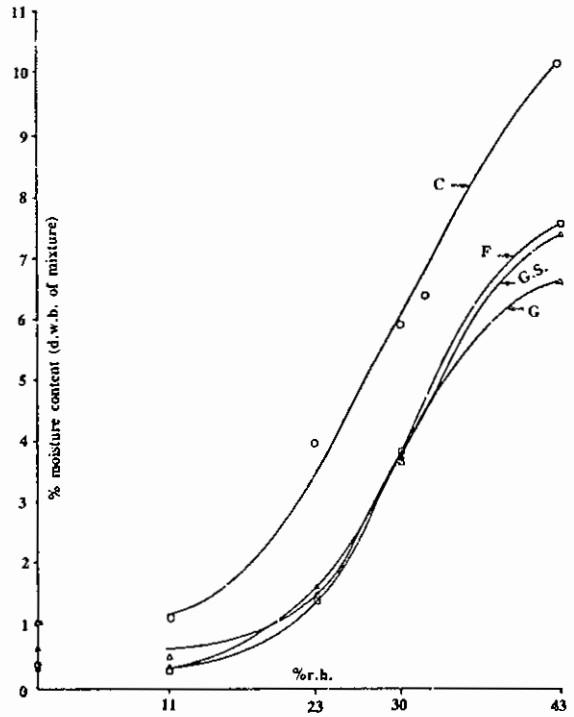


Fig.7 Adsorption isotherm of dry sugar additives to Zehdi powder at the rate of 1:3.C, control; F, frutctose, G, glucose; G.S, granulated sucrose.

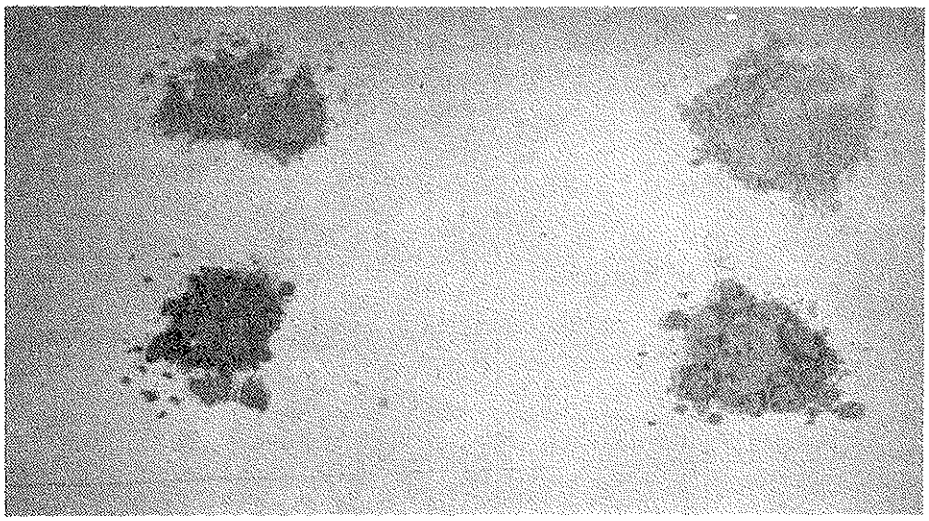


Fig.8 Tendency to readily form clumps by powder of both soft (left) and semi-dry (right) varieties. Lower samples were poured 5 min earlir than the upper ones.

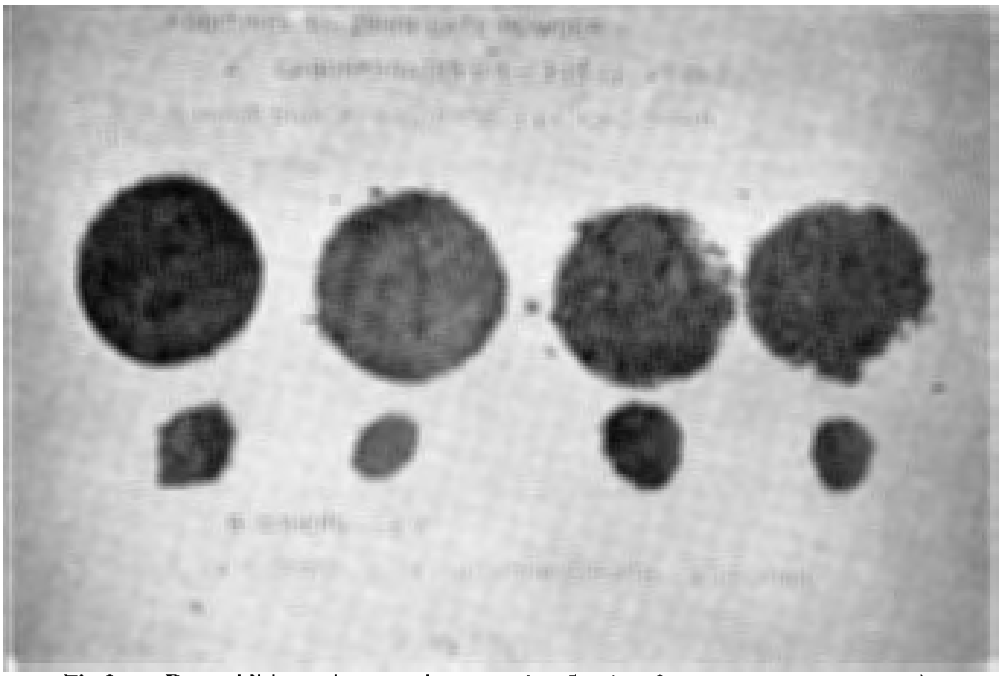


Fig.9 Dry additive mixes to date powder 5 min after exposure to open air. Treatments: upper row (A), certain carbohydrate compounds and lower row (B) other prospected materials to lower hygroscopic effects.

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EFFECT OF HIGH DOSES OF PHOSPHINE FUMIGATION ON THE AMINO ACID, PROTEIN AND SUGAR COMPOSITION OF IRAQI DATES.

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ABSTRACT

The influence of high doses of phosphine gas and different periods of post-treatment aeration on the amino acid, protein and sugar composition of dry date fruits of Zahdi variety was investigated. The data revealed variation in various individual amino acids. However, no significant changes could be shown in protein and major sugar components as a consequence of their treatment. The results are considered of importance to the toxicological evaluation of phosphine fumigated dry dates for disinfestation purposes.

تأثير جرعات عالية من غاز الفوسفين على الاحماض الامينية، البروتين والسكريات في التمور العراقية

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الخلاصة

اجريت هذه الدراسة لفحص تأثير جرعات عالية من غاز الفوسفين المستعمل في تعقيم التمور العراقية من حشرات المخازن وفترات تهوية مختلفة على محتويات هذه التمور (صنف زهدي) من الاحماض الامينية، البروتينات والسكريات. أوضحت النتائج إلى وجود تباين بين محتوى الاحماض الامينية. لم يلاحظ أي تغيرات واضحة على المحتوى البروتيني والسكري لهذه التمور بعد معاملتها بغاز الفوسفين. تعتبر هذه النتائج ذات أهمية خاصة لتحديد مدى صلاحية التمور المبخرة بهذا الغاز للاستهلاك البشري.

INTRODUCTION

More than 300,000 tons of dates are the annual production of Iraq, from which approximatly 60% are exported as dry fruits (average moisture content is about 10%) (11). Hydrogen phosphide (Phosphine gas) has been extensively used as an effective fumigant against stored product insects to reduce the infestation level during storage of prepacked dates (1).

Residual determination on different food items have shown a rapid

degredation of phosphine within short time (9,17). Moreover, toxicological studies on phosphine-fumigated food revealed no |deleterious| effect on several biological parameters of laboratory animals (2, 3, 4, 10, 12). Several studies were also carried out on the effect of phosphine fumigation on some chemical constituents of different food items and cereals (14-16). In general, the analytical data revealed no evidence of any change in the raw protein, alcohol dehydrogenase, lipoxygenase and glutamic acid decarboxylase, and the A, B1, B2 and E vitamins contents as a consequence of phosphine exposure.

Qualitative and quantitative determination of the chemical constituents of several Iraqi varieties of dates are reported (6-8). However, little information is available regarding the chemical interaction and inducible changes in these constituents in dates as a result of phosphine fumigation.

The present study is, therefore, conducted to provide supporting data to the toxicological results reported previously on insect feeding tests (2-4).

MATERIALS AND METHODS.

Sampling: Fully matured dry date fruits (Zahdi variety) were obtained from trees that have never been sprayed with pesticides. These fruits were selected for uniformity and maturity, placed in plastic bags and stored at −15° C until used. Prior to the treatment one hundred fruits were taken out of the freezer and left to thaw overnight at room temperature. These fruits, after removing their perianths, were divided into five batches (20 fruits each) and placed into 12-litre desiccators for treatment.

Fumigation and Aeration: In every desiccator a shell vial was placed in the middle and in each vial 1,2,3, or 4 pellets of Phostoxine (R)(Degesch, West Germany) were placed, respectively. The fifth desiccator was left without treatment to serve as a control. all the desiccators were tightly sealed with their lids and adhesive taps around each lid. The final concentrations of active phosphine gas released were calculated to be 0, 16.67, 23.34, 40.00 and 56.68 mg/l, respectively. After fumigation for 72 hours, the fruits were left for aeration at room temperature (25° C± 2°C) by replacing the lids with two layers of Muslin cloth. The chemical analyses were carried out on date samples aerated for either 1 or 10 days.

Protein and Amino Acid Analysis: Values of protein content and amino acids of date fruits were determined using the Kjeldahl method and a Bechman Model 120° C Amino Acid Analyzer, respectively. The analytical methods adopted here are described elsewhere (7).

Paper-Chromatographic Analysis of Sugars: Five to 10 grams of ground dates were extracted with 2-methoxy ethanol and centrifuged. A final volume

of 50 ml of the liquid phase was prepared by adding solvent (8). This extract was used in paper-chromatographic procedure. The chromatograms were developed descendingly for 48 hours at room temperature. The solvent used for sucrose, glucose and fructose seperation was methyl glycol-saturated ethyl acetate 240 ml: acetic acid 48 ml: distilled water 48 ml (4.6:1:1 Vol. ratio). The chromatograms were then treated according the method described by Auda et al (8).

High Performance Liquid Chromatographic Analysis of Sugar (HPLC): 10 g of ground dates of each batch was extracted with 50 ml 2-methoxy ethanol and centrifuged (8). When the solvent was removed from the extract under reduced pressure a thick syrup was obtained. 20 ml of this syrup was dissolved in 1 ml of acetonitril: water (75:25 Vol. ratio). 20μl of this solution was then analysed for its sugar content using a Pye Unicam High Performance Liquid Chromatography (HPLC) fitted with Lichrosorb 10 NH_2 column.. Flow rate was 1 ml per min.Mobil phase as acetonitrile: water.75:25 V/V. Standared sugars, sucrose, glucose and fructose were used to calibrate the column.

Statistical Analysis: The data were statistically analyzed using the following formula for the evaluation of changes induced in the content of protein and each individual amino acid after each dose of phosphine.

$$\% \text{ change} = \frac{\text{Control value} - \text{Treated value}}{\text{Control value}} \times 100$$

RESULTS AND DISCUSSIONS

The data in Table 1 revealed variation in the content of various individual amino acid in response to phosphine fumigation of date fruits. Upon statistical evaluation of the results, any average percentage of change lies between 0 and 20% level was considered comparable to that of the control value (i.e. unchanged). Therefore, the content of 5 amino acids (arginine, proline, tyrosine, phenylalanine and aspartic acid) and 6 amino acids (arginine, thrionine, proline, glycine, tyrosine and phenylalanine) were considered unchanged after phosphine treatment of the date fruits and stored for aeration for 1 and 10 days post-treatment, repsectively. The contents of 4 amino acids (lysine, histidine, serine and alanine) were found to increase substantially after all doses of phosphine treatment in both aeration regims. However,the contents of another 5 amino acids (glycine,valine, Iso leucine, leucine and glutamic acid) were found to increase after phosphine treatment of dates and aerated for 1 day only.

In contrast, the contents of 2 amino acids (thrionine and methionine) and 6 amino acids(aspartic acid,methionine, Isoleucine,leucine,valine and glutamic

acid)were found to decrease substantially after phosphine treatment of the dates and aerated for 1 and 10 days, respectively.

When the totals of amino acids were taken into consideration (Table 2) it could be concluded that most amino acids decreased in value upon aeration (storage). This observation is in agreement with previous findings of Auda and Al-Wandawi (6). However, treatment of dates with phosphine gas seemed to increase the total amino acid content in some of the batches that were aerated for 1 day. The reasons for this effect is obscure and need further chemical studies. The variation observed in the response of several amino acids to phosphine fumigation is probably due to several reasons. The most important one is the wide variability among individual date samples or even between fruits as previously noted (6).

Table 3, clearly shows that for both aeration times (1 and 10 days) of fumigated dates no significant differences could be found between the protein content. At all treatments protein values were comparable to that of unfumigated samples.

The results of paper chromatographic analysis of sugar content of phosphine-fumigated dates are shown in Table 4. The R_G values revealed that phosphine gas did not cause significant changes in glucose, fructose and sucrose as compared with the R_G values of these sugars in untreated fruits or with those of standard sugars. However, upon storage of these fruits for 10 days post-fumigation aeration slight increases in the R_G values of these sugars could be seen. Such increases were not observable when the contents of these sugars were further analysed using the modern technique of high performance liquid chromatography (HPLC) (Table 5).

Looking at the results as a whole, it could be concluded that fumigation of dried date fruits with such high doses of phosphine did not influence the contents of its major chemical constituents. In contrast, *Dietrich et al* (9) have stated that organic compounds of high molecular weights and with large number of unsaturated double bonds are considered to be particularly susceptible to react with phosphine gas.

The present results are considered of importance in clearifying some relevent aspects of toxicological evaluation of phosphine fumigation procedure for disinfestation purposes of stored dates particularly if we consider the recent evidence reported by Al-Omar and Al-Bassomy (5) that phosphine residue could persist in fumigated dates for as long as 10 days of aeration at normal storing temperature (28°C), and even for longer periods at low temperature (4°C).

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Table 1
Amino acid content[a] (mg/10g dry weight)[b] of dates (Zahdi variety)[c] fumigated with different high doses of phosphine gas and aerated for 1 or 10 days at room temperature

Amino acids	1 day aeration					10 days aeration				
	Phosphinedose dose (mg/l)					phoshpinedose dose (mg/l)				
	C	16.7	23.3	40.05	56.7	C	16.7	23.3	40.0	56.7
Lys	2.01	2.95	3.60	3.14	4.86	1.67	1.99	2.71	2.18	1.73
His	6.81	6.90	13.15	13.39	10.62	4.62	5.30	12.03	12.56	8.86
Arg	1.35	1.27	2.40	1.53	1.33	1.40	0.95	1.86	0.95	0.90
Asp	5.55	2.91	6.06	6.27	3.87	6.49	3.60	5.45	5.07	3.96
Thr	4.82	1.79	1.62	1.32	0.77	1.35	1.48	1.02	1.11	0.90
Ser	0.89	0.93	1.78	4.04	1.68	1.35	1.61	1.26	2.77	1.76
Glu	7.00	5.22	10.40	10.32	8.49	10.42	7.92	9.80	8.83	8.07
Pro	2.12	2.17	2.34	2.90	2.25	2.55	2.47	2.17	2.46	2.85
Gly	2.10	2.23	4.70	6.13	5.85	3.94	2.72	3.09	5.85	5.33
Ala	2.22	2.75	5.97	3.45	3.20	2.97	2.87	5.37	3.81	4.13
Val	1.70	1.68	3.15	2.98	2.67	3.85	2.32	2.05	1.55	1.69
Met	1.31	0.44	0.49	0.62	0.24	1.32	0.32	0.34	0.82	0.40
Ile	0.80	0.77	1.08	1.72	0.85	1.43	0.65	0.75	1.15	1.07
Leu	1.24	1.45	2.15	1.87	1.80	3.24	1.31	1.61	1.49	2.70
Tyr	3.27	3.35	2.94	2.97	2.08	3.28	2.49	2.98	2.98	2.29
Phe	0.54	0.47	0.77	0.54	0.44	0.81	0.58	0.71	0.77	1.01
Total	43.73	37.28	62.60	63.19	51.00	50.69	38.58	53.20	54.35	47.65

a cystine was not determined;
b Averag of duplicate analysis;
c 10 fruits per sample

Table 2
Percentage of changes in amino acid contents of dates (Zahdi variety) fumigated with different high doses of phosphine gas and aerated for 1 or 10 days at room temperature (Data of Table (1)

Amino acids	1 day aeration					10 days aeration				
	% change from control after phosphine dose mg/l					% change from control after phosphine dose mgl/l				
	16.7	23.3	40.0	56.7	average	16.7	23.3	40.0	56.7	average
Lys	+ 46.8	+ 79.1	+ 56.2	+ 141.8	+ 81.0	+ 19.2	+ 62.3	+ 30.5	+ 3.6	+ 28.9
His	+ 1.3	+ 93.1	+ 96.6	+ 55.9	+ 61.7	+ 14.7	+ 160.4	+ 171.9	+ 91.8	+ 109.7
Arg	− 5.9	+ 77.8	+ 13.3	− 1.5	+ 20.9	− 32.1	+ 32.8	− 32.1	− 35.7	− 16.8
Asp	− 47.6	+ 9.2	+ 13.0	− 30.3	− 13.9	− 44.5	− 16.0	− 21.9	− 39.0	− 30.4
Thr	− 62.9	− 66.4	− 72.6	− 84.0	− 71.5	+ 9.6	− 24.4	− 17.8	− 33.3	− 16.5
Ser	+ 4.5	+ 100.0	+ 353.9	+ 88.8	+ 136.6	+ 19.2	− 6.7	+ 105.2	+ 30.4	+ 37.0
Glu	− 25.4	+ 48.6	+ 47.4	+ 21.3	+ 23.0	− 24.0	− 6.0	− 15.2	− 22.6	− 17.0
Pro	+ 2.4	+ 10.4	+ 36.8	+ 6.1	+ 13.9	− 3.1	+ 14.9	− 3.5	− 11.8	− 2.4
GlY	+ 6.2	+ 123.8	+ 191.9	+ 178.6	+ 125.1	− 31.0	− 21.6	+ 48.5	+ 35.3	+ 7.8
Ala	+ 23.9	+ 168.9	+ 55.4	+ 44.1	+ 73.1	− 3.4	+ 80.8	− 28.3	+ 39.1	+ 36.2
Val	− 1.2	+ 85.3	+ 75.3	+ 57.1	+ 54.1	− 39.7	− 46.8	− 59.7	− 56.1	− 50.6
Met	− 66.4	− 62.6	− 52.7	− 81.7	− 65.8	− 75.8	− 74.2	− 69.7	− 64.4	
Ile	− 3.8	+ 35.0	+ 115.0	+ 6.2	+ 38.1	− 54.4	− 47.6	− 19.6	− 25.2	− 36.7
Leu	+ 16.9	+ 73.4	+ 50.8	+ 45.2	+ 46.6	− 59.6	− 50.3	− 54.0	− 16.7	− 45.2
Tyr	+ 2.4	− 10.1	− 9.2	− 36.4	− 13.3	− 24.1	− 9.1	− 9.1	− 30.2	− 18.1
Phe	− 14.7	+ 42.6	0.0	− 18.5	+ 2.8	− 28.4	− 12.3	− 4.9	+ 24.7	− 5.2
Total	− 14.7	+ 43.2	+ 44.5	+ 16.6	+ 22.4	− 23.9	+ 5.0	+ 7.2	+ 6.0	− 4.4

Table 3
Protein content of dates (Zahdi variety) fumigated with different doses of phosphine gas and aerated for 1 or 10 days

Phosphine dose mg/l	Protein %dry weight			
	1 day aeration		10 days aeration	
	content	% change	content	% change
C	2.58	—	2.49	—
16.7	3.02	+ 17.1	2.97	+ 19.3
23.3	3.06	+ 18.6	3.02	+ 21.3
40.0	3.06	+ 18.6	3.06	+22.9
56.7	2.44	− 5.4	2.41	− 3.2
		Average+ 12.2		Average+ 15.1

a 2 grams samples from 10 grounded fruits were used for protein determination.

Table 4

R_G values of dates sugars and standard sugars developed in methyl glycol saturated ethyl acetate: acetic acid: distilled water (4.6: 1: 1) after treatment of the date fruits with different doses of phosphine gas and aerated for 1 or 10 days.

Phosphine dose mg/l	Spot no.from origin								
	1 day aeration			10 days aeration					
	1	2	3	1	2	3	Sucrose	glucose	fructose
C	0.54	1.03	1.40	0.60	1.14	1.55	0.50	1.00	1.30
16.7	0.47	0.95	1.30	0.52	1.02	1.47			
23.3	0.47	0.92	1.33	0.53	1.00	1.46			
40.00	0.47	0.91	1.32	0.55	1.12	1.60			
56.7	0.52	0.92	1.29	0.56	1.10	1.56			

Table 5
High performance liquid chromatographic analysis of sugars from dates treated with differnt doses of phosphine gas and aerated for 1 or 10 days

Phosphine dose mg/l	Relative area% of sugars in the date extract		
	Fructose	Glucose	Sucrose
	1 day aeration		
C	38.65	40.12	21.13
16.7	36.97	41.62	21.41
23.3	38.14	40.77	21.09
40.0	37.78	42.18	20.04
56.7	37.16	40.07	22.76
	10 days aeration		
C	36.21	41.66	22.12
16.7	38.17	40.70	21.12
23.3	37.27	41.00	21.73
40.0	36.79	40.67	22.54
56.7	37.20	39.87	22.93

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A SURVEY OF INSECT PESTS OF DATE PALMS IN QATAR*

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ABSTRACT

In 1985, the author surveyed borer problems and recommended a method for their control as well as surveyed insect pests of date palms in Qatar including identification and intensity of infestation of all insects found during November. Eleven insect pests were found on date palms, 10 of which might be a new record. They were: palm stem borer, *Jebusea hammerschmidti* Reiche; fruit stock borer, *Oryctes elegans* Prell.; parlatoria date scale, *Parlatoria blanchardi* (Targ.); the green scale, *Asterolecanium phoenicis* Ram. Rao.; the red date scale, *Pheonicoccus marlatti* Ckil.; the dubas bug, *Ommatissus binotatus* Deberg.; the greater date moth, *Arenipses sabella* Hampson; the termite; the cicada, and on fruits, *Ephestia* sp. and the dried fruit beetle, *Carpophilus* sp. Rodents were found in orchards. Among the insects the stem borer and the fruit stalk borer were the most important pests. They were found in most orchards visited. A research plan was suggested.

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مسح للآفات الحشرية على النخيل في دولة قطر

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الخلاصة

أجري إيفاد في عام 1985 لمسح مشاكل حفارات سيقان النخيل في دولة قطر مع التوصية لطريقة مكافحتها. ولعدم توفر المعرفة عن حشرات النخيل فيها فقد تضمنت الدراسة تشخيص وانتشار وتحديد شدة الإصابة للحشرات التي يتم إيجادها على النخيل خلال فترة الدراسة في شهر تشرين الثاني من العام المذكور.

ونتيجة لذلك، فقد وجدت إحدى عشرة آفة حشرية على أشجار النخيل عشرة منها ربما تسجل للمرة الأولى في دولة قطر. وهذه الآفات هي: حفار ساق النخيل *Jebusea hammerschmidti* Reiche حفار عذوق النخيل *Parlatoria blanchardi* (Targ.) البارلتوريا القشرية *Oryctes elegans* Prell. الحشرة القشرية الخضراء *Asterolecanium phoenicis* Ram. Rao. القشرية الحمراء *Pheonicoccus marlatti* Ckil. حشرة دوباس النخيل *Ommatissus binotagus Deberg.* عثة طلع النخيل (Mampson) *Arenipses sabella* والأرضة وحشرة السكادا وعلى التمر وجدت عثة الأفستيا *Ephestia sp.* وخنفساء الثمار الجافة *Carpophilus sp.* ومن الآفات غير الحشرية وجدت الجرذان.

من بين الحشرات ظهر أن حفار ساق النخيل وحفار عذوق النخيل من أهمها ومن أخطرها على زراعة النخيل، فقد وجدتا بكثرة وبشدة إصابة عالية في أغلب البساتين التي تمت زيارتها في مختلف مناطق القطر. نوقشت طرق المكافحة واقترحت خطة للبحث.

INTRODUCTION

1. Objective

At the request of the Qatari Ministry of Industry and Agriculture (MIA).

the Regional Project for Palm & Dates Research Centre in the Near East & North Africa, Baghdad, sponsored the author for a 10 days consultancy mission to survey and identify stem borers of date palms and to suggest method of their control.

The mission was undertaken in November 1985. Since no study had been made before on stem borers and other insects of date palms, it was felt necessary that survey should include identification, intensity of infestation and distribution of insect pests attacking date palms in Qatar.

2. Present Status

Qatar had over 200,000 date palms, planted in orchards (Fig. 1) and along streets and high ways. Because the date palm has a religious and economic value, a campaign toward planting more trees is underway. However, there is little knowledge on the pests and diseases of the tree.

a. Insects: There is a lack of knowledge on species, distribution, economic importance, life history and natural enemies of insect pests of date palms in Qatar. The only information available is that mentioned by Thabit (date unknown) in an extension publication on insect pests and plant diseases in which he reported only two insects on date palms and a publication of El-Haidari (3) who reported three insects; the first two already reported by Thabit. The three insects are the following:

1. The grub *Phyllophaga rugosa* (Melsheimer) Coleoptera: Scarbabeidae.

2. Stalk borer *Elaphidion villosum* Coleoptera: Cerambycidae.

3. The lesser date moth *Batrachedra amydraula* Meriek Lepidoptera: Cosmopterygidae.

El-Haidari informed the author that when he was in Qatar in 1979 surveying date palm insects, he did not find any insect borers or other insects (except the lesser date moth). He advised the authorities at that time against importing infested trees into the country.

At present there is no information available at the Qatari MIA. Plant Protection Department on the identity of the insects causing the problem at the magnitude threatening the entire date palm culture in the country.

b. Insect Control: Thabit (9) reported that the larvae of *P. rugosa*, «was treated with Aldrin or Deildrin that was diluted in water and irrigated at the rate of 2.4 pounds for each 1000m^2 in the infestation site and by so doing it kills the larvae within 12 hours.» He recommended «the control of weeds because it provides a place preferred by this insect to lay its eggs.» In connection with stem borer *E. villosum*, he pointed out that an effective method used in Qatari orchards which gave good results was placing crystals

of paradichlorobenzene inside the holes and closing them with wax or mud, thereby causing the insecticide vapour to kill larvae.

Iki (6) of the Plant Protection Department at MIA had tried light traps with kerosene lamps placed in a pan with water as a means of borer control. He placed 10 traps, one per orchard, during May 1985. He reported that only one insect was caught! He also tried chemical control with bait made from Aldrin, wheat bran and molasses. He placed the bait in rings over the bases of pruned date fronds at the trunk of the trees and on the ground around the bases of the trunks. He could not find even one dead insect anywhere.

It was noted that a Swiss insecticide company began testing insecticides several months prior to November 1985 but all work or results have been kept confidential.

Study Plan: The following plan was made for this mission:

(i) to visit a number of designated date palm orchards in different part of the country; (ii) identify the stem borer insects as well as other insect pests attacking palms; (iii) estimate the rate of infestation of insect pests; (iv) suggest research plans for the near and far future; (v) suggest a temporary method of control.

METHOD OF STUDY

The survey of date palm insect pests included visits to orchards in different parts of the country. In every orchard several trees were checked including cutting fronds, removing frond bases, peeling the trunks, dissecting the tree and digging the soil around the bases of some trees to search for soil insects.

After identification of insect pests, estimates of their densities were made by counting the number of insects in random samples. For the stem borer, the number of its exit holes in parts of the stems facing the surveyer were counted in 5 randomly selected date palms per orchard. Numbers were recorded. Insects of leaves and fruits were counted in several leaves and/or fruits and the numbers were averaged. Some insects which were not identified were kept in 75% alcohol in small glass containers for further study. In addition, coloured photos were taken of insects or insect damage.

RESULTS AND DISCUSSION

The insects which were found are identified as follow:

A. Borers: 1. Palm stem borer, *Jebusea hammerschmidti* Reich, (*Pseudophilus testaceus* Ghahan, Coleoptera: Cerambycidae.

2. Fruit stalk borer, *Oryctes elegans* Prell., Coleoptera: Scarabeidae..

B. Scale insects: 3. Parlataria date scale, *Parlateria blanchardi* (Targ.), Homoptera: Coccidae.

4. Green scale, *Asterolecanium phoenicis* Ran. Rao., Homoptera: Coccidae.

5. Red date scale, *Phoenicoccus marlatti* Ckll. Homoptera: Coccidae.

C. Other insects: 6. the dubas bug, *Ommatissus binotatus* Deberg, Homoptera: Tropiduchidae.

7. The greater date moth, *Arenipses sabella* (Hampson), Lepidoptera: Pyralidae.

8. Termite.

9. Cicada, perhaps *Platyplura arabica,* Homoptera: Cicadidae.

10. Ephestia, perhaps *Ephestia cautella* Walk., Lepidoptera: Pyralidae.

11. The dried fruit beetle, *Carpophilus* sp., Coleoptera: Nitidulidae.

D. Animal pests other than insects.

12. Rodents.

The following is a brief account of each pest. The distribution wherever mentioned, was taken from El-Haidari (3).

1. Palm stem borer *Jebusea hammerschmidti* Reich: This insect was identified from the presence on the trunk of adult exit holes which are mainly round and little more than 1 cm. in diameter (Fig. 2 and 3) or from the shiny brown, or dark brown substance (Fig. 4) secreted by the trunk below the larvae entrance or from the larvae damage inside fronds or stems (Fig. 5 and 6). The larvae reach 50 mm. long; are cylindrical and tapering toward the end, white or with pinkish colour, legless but with pubescent body. This insect may be the same one reported by Thabit as *Elaphidion villosum.* (9).

It appears that this insect is the most important pest of date palms in Qatar at the present time. The cause of weakness and or broken or fallen trees is attributed to this pest. The insect exit holes in the tree trunks (Fig. 2 and 3) expose the moist living conductive vessels to spores of bacteria and fungi, which cause moulding and death of the tissues (Fig. 7 and 8). Such infection stops nutrient movement, weakens the tree and causes easy breakage (Fig. 9). Tree weakness or death, in turn, attracts the fruit stalk borer for breeding and aggravates the damage.

The palm stem borer was found in all orchards visited. Intensity of

infestation, however, varied from tree to tree and from orchard to orchard (Table 1). Death of trees was seen in orchards in Gharafa and in Um Slal Ali. In Gharafa, one tree 1.5 m. high was abnormally affected by the infestation. The diameter of the trunk near the ground was about 40 cm. tapering upward to about 20 cm. at the head. When the tree was dissected, 30 larvae of *J. hammerschmidti* were found. Some were near the growing tip in the head (Fig. 10). This same tree was also infested with the fruit stalk borer, *O. elegans*. One larva of the stalk borer was found at 20 cm. above the ground in a side hole of a longitudinal furrow apparently made by the insect.

The palm stem borer is distributed in Iraq, Bahrain, Saudi Arabia, United Arab Emirates, Egypt, Algeria, Iran and India.

Several workers have studied the life cycle of this pest (3). Its insect enemies were reported in Iraq (8) and in Saudi Arabia (4).

2. Fruit stalk borer *Oryctes elegans* Prell.: This insect was identified from its large furrows and holes (Fig. 11) and from the larvae, pupae and adults (Fig. 12) that were found in date palm trunks especially near their bases. The larvae was found inside weak or dead date palm trunks. This insect appears to be next in importance after the palm stem borer. The stem borer infestation weakens the trees which in turn are attacked by the fruit stalk borer for breeding. The presence of both borers in trees hastens tree death.

The fruit stalk borer was found on the Doha Kornish, Gharafa, Sadria, Um Slal Ali and Um Slal Mohamad. A high infestation was found in Mazraa region, 25 km. north of Doha. One farmer had burned the surface of the trees as a control measure. Despite trunk burning, larvae were found in the trunk at 30 cm. above the ground level. In one tree which had a broken head and a burned trunk, larvae, pupae and adults were found at different heights up to 2 m. from the base. In the North of the country, in one orchard the stubs of dead and fallen trees were burned but were still full of holes and furrows (Fig. 13). Many researchers have studied the life cycle of the fruit stalk borer (3). The latest study was done in Iraq (8) and in Saudi Arabia (4). In Iraq adults appear from March until October.

3. Parlatoria date scale *Parlatoria blanchardi* (Targ.): This insect (Fig. 14) was found in small trees along the street in Khalifa township in Doha, on the Kornish, at Um Slal Mohamad and in Sadria. The highest infestation was found in Kornish trees and in offshoots in Sadria. On one leaf all of its leaflets were infested. The number of scales in infested leaflets ranged from 24 to 320, avering 155/leaflet. In Um Slal Mohamad, an average of 20 /leaflet was found on one tree.

This level of infestation is not high when compared with infestation in Basra, Iraq. Hussain (5) found an average of 12,460 scales/leaflet on the upper surface and 7072 scales/leaflet on the lower surface. It is likely that infestation in Qatar is recent; it is expected to increase and spread since weather conditions are favourable. Parlatoria scale is found in Iraq, Kuŵait, Bahrain, United Arab Emirates, Saudi Arabia, Morocco, Algeria, Tunisia, Libya, Egypt, Sudan, Somalia and Palestine.

4. Green scale *Asterolecanium phoenicis* Ram. Rao: The green scale was found in low densities on the Kornish date palms and in an orchard in Um slal Mohamad, on leaflets together with the Parlatoria date scale. The average of infested leaflets in both areas were 9 and 5, respectively. This scale is less dangerous to trees than is Parlatoria date scale. The insect is found in Iraq, Saudi Arabia and Palestine.

5. Red date scale *Phoenicoccus marlatti* Ckll.: The red scale was found on the bases of fronds (fig. 15) and sometimes attacking the fruits. Its injury to trees is similar to that of other scale insects but the extent of its injury is known to be less than Parlatoria scale. The insect was found on the bases of the leaves in most of the orchards visited. This scale has a wide distribution.

6. The dubas bug *Ommatissus binotatus* Deberg: This insect was identified from its eggs which were partly inserted inside the midribs of the leaflets. Shedded skins of the insect with spots of balck mould which grows on honeydew droplets secreted by the insect were also noted. These are only indications of the presence of this insect at study time and were observed on the Kornish in Doha. MIA authorities reported an abundance of honeydew on fronds of date palms in spring. This additionally confirms the presence of the insect in Qatar. It has already been reported in Iraq, Kuwait, United Arab Emirates, Oman, Saudi Arabia, Egypt, Libya, Algeria, Iran and Bahrain.

7. Greater date moth *Arenipses sabella* (Hampson): A larva, dark in colour, about 20 mm. long, typical of this insect, was found in the head of one tree in an orchard in Gharafa. Further confirmation is needed in the spring when the insect becomes active. In Iraq this insect becomes active in March and April. The greater date moth is present in Iraq, Palestine, Egypt, Saudi Arabia, Iran and the Punjab.

8. Termite: Termite tunnels without insects were observed only in one date palm in an orchard in Gharafa. Search for its presence in other orchards failed. Termites are very important pests on date palms and other trees in Iraq, Saudi Arabia and Egypt.

9. Cicada *Platyplura arabica:* The shedded skins of the cicada were found on trunks of date palms in many orchards. El-Haidari communicated that in 1979, he found the cicada *P. arabica* in Ras El Khaima, (UAE), laying their eggs in the fronds during April. It is possible that the shedded skins reported above belong to this species in Qatar.

10. Date moth *Ephestia sp.:* Pinkish larvae of about 10 mm. long were found inside dates still on the trees in two regions in Gharafa and in Sadria. It is suspected that this might be *E. cautella* Walker. Up to 10% infestation was found. It is known that this insect starts infesting mature dates on the trees. When the fruits are transferred to the storehouses, the small infestation increases. In Iraq, Hussain (5) found that infestation of Zehdi date variety increased up to 85% after one year in storehouses. This insect is present in Iraq, Saudi Arabia, Egypt, Sudan, Libya, Algeria and Morocco.

11. Dried fruit beetle *Carpophilus* sp.: Adults of this insect were found in date fruits left on the trees in Sadria in North Qatar. Usually the insect attacks mature dates with high moisture content in the field and in the storehouses. The adults are about 2–4mm. in length with the elytron wings shorter than the abdomen. The white legless larvae reach up to 6 mm.

C. hemipterus L. one of the species of this group of insect is distributed in Iraq, Palestine, Egypt, Somalia and Libya.

12. Rodents: Skeletons of small and large rats were observed in orchards and their burrowing holes with heaps of soil near the bases of trees were seen, as well (Fig. 16). It appears, on first survey, that the rat population is dangerously high. Rats gnaw the roots and stems and feed on the fruits.

CONCLUSIONS

1. In this survey more than 11 insect species and more than one species of rodents were observed attacking dates or palm trees in Qatar as recorded.

2. Out of the 11 insect pests, 10 which were identified and recorded could be the first records in Qatar.

3. Other insect pests may also be found if a survey is conducted between March-and June.

4. The most important insect pest of date palms and those responsible for the present problems are the stem borer *J. hammerschmidti* and the fruit stalk borer *O. elegans*. Other insects which could become important problems are the parlatoria date scale , *P. blanchardi* and the dubas bug *O. binotatus.*

5. The methods of chemical control of most insects on date palms in Qatar, are known with the exception of the stem borer and the stalk borer. The nature of their biology and their presence within the tree trunks made the control difficult. At present, there is no chemical control method that we know which could be recommended.

DISCUSSION ON THE CHEMICAL CONTROL METHODS OF BORERS

Despite the drawbacks from the use of insecticides for the control of date palm borers, such as the imbalance between the insect pests and their enemies as well as their dangers to man and his livestocks; it is the openion of the author, that chemical control is the only quick method available at present to meet the borer problem in Qatar.

Biological control as an alternative method to chemical control, is not certain at present but it should be considered. Integrated control should be practised whenever it is possible. The following is a discussion on the use of chemical insecticides against date palm borers.

Systemic insecticides injected into the trunks of date palms have been mentioned as possible methods of controlling the borers. Placing fumigant insecticides into the exit holes of the stem borers is also suggested. Most likely neither of these methods would be effective. Points to consider are the following:

1. It is not known how a systemic insecticide moves within date palm trunks; (these trees are monocotylydenous with the conducting vessels filling the trunks).

2. It is not known if a systemic insecticide can reach the borer larvae in an infested tree in which parts of the conductive tissues are destroyed, cut or moulded.

3. It is also not known which systemic insecticide can reach and kill the larvae inside the trunk and at what dosage.

4. In the case of the stalk borer, the larvae are usually found in weak trees or dead trunks, neither of which is good for insecticidal movement.

All the above points need investigation and should make interesting research studies.

Points to consider when using fumigant insecticides:

1. A fumigant insecticide placed in the borer exit holes in the tree trunk probably would not be effective because the holes of the stem borer would be empty, the borers having already left the trunk. It is not known if toxic fumes would penetrate the trunk through these exit holes reaching the larvae

located somewhere within the trunk tissue and belonging to subsequent infestations.

2. Over 250 holes were estimated in some trees; too many holes for practical application.

3. Fumigants disappear shortly after application, but further infestation takes place. If the application is carried out at the end of the season, the borer damage has already been done.

Spraying an effective contact and stomach insecticide to cover tree head and trunk in sufficient amounts to kill emerging adults or egg laying females or boring larvae during their active periods, appear to have better chance to succeed as a control method than systemic or fumigant insecticides.

However, the use of contact and stomach insecticides depends upon having the following information on each borer species: a) Established date of adult emergence; b) Period of adult presence in the field; c) Period of adult peak; d) Time of adult disappearence; e) Results of laboratory tests for screening insecticides.

With regard to selecting an insecticide the following must be considered: f) Selection of an insecticide with a high toxicity for larvae and adults with long persistance on the tree and low mammalian toxicity. g) Results of testing candidate insecticides in a few orchards. h) the establishment of dosage, timing of first application, and frequency of application, predicted on information obtained in a-e above.

When an efficient insecticide has been selected then a campaign should be started to stimulate awareness among farmers and orchards owners of the dangers of borer insects and the necessity for controlling them. Information media (publications, radio, TV) should be used to disseminate the information as well as meeting with the farmers. The campaign must also include the dangers arising from handling and treating trees with insecticides and how to avoid them.

RECOMMENDATIONS

1. Another insect survey of date palms in Qatar should be made any time from March through June to identify other insect pests and to record the intensity of infestation and their distribution.

2. The survey should include enemies of date palm insect pests mainly insect parasites and predators as well as their pathogens with any observation on their efficiency in suppressing the insect pest population.

3. Good cultural practices should be applied in all date palm orchards (and other areas where palms are planted). These practices include such things as

regular irrigation as needed, fertilizing, cutting dead leaves and dying trees and burning them completely without leaving any part of the stem or stubs. Complete burning is a measure to reduce borer populations.

4. Special attention should be paid now to finding out if bayoud disease is present in Qatar and immediate measures should be taken to stop a possible epidemic.

5. Strong enforcement of quarantine measures should be applied at frontiers and importing date palms from North Africa should be prohibited.

6. A research unit for date palm pests and their enemies should be established at the MIA.

7. A plan for biological control research should also be included. Testing of the fungus *Beauvaria bassiana* against *J. hammerschmidti* and testing the virus of the *O. rhinoceros* a pest of coconut in the Far East, against *O. elegans* should also be considered.

8. A full or part-time researcher is required for research on borers and their control for a minimum of 3 years.

9. A research budget must be allocated to meet research expenses.

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My thanks go to Dr. Yahya Salah, FAO Representative/SAA-FAO Country Representative, Baghdad and to Dr. M.M.A. Khairi, formerly Officer-in-Charge of the Regional Project for Palm and Dates; to Mr. S. Mohan, presently Officer-in-Charge for arranging all matters related to the mission. Thanks are also due to Mr. Abdul Rahman Abdulla, UNDP Resident Representative and to Mr. Leang, Deputy Resident Representative, UNDP Qatar. Thanks also go to Mr. Abdalla Al-Gawari, Deputy Minister of Industry and Agriculture; Mr. Ibrahim Al-Badr, Head of the Office of Agricultural Affairs, whose meeting with me and discussions of the problems were very valuable; Mr. Saeed Iki, Engineer in the Plant Protection Dept., MIA who accompanied me and worked with me during the survey; and to Mr. Ahmad, driver who helped me in many ways.

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Table 1
Intensity of infestation with palm stem borer *J. hammerschmidti* in different regions of Qatar (5 trees/orchards).

Region	Distance from Capital	Average height of date palm (m.)	Range of holes/tree	Average holes/tree
Kornish Avenue	Doha	2.5	8-30	21
Gharafa	10 Km.	3.0	20-83	45
Gharafa	10 Km.	3.6	10-73	28
Um Slal Moh.	20 Km.	4.5	1-36	9
Um Slal Ali		5.0	1-27	21
Um Slal Ali		6.0	7-126	54
Mazraa	25 Km.	5.0	4-47	34
Sadria	100 Km.	4.0	0-4	2
Sadria	100 Km.	5.0	2-11	5

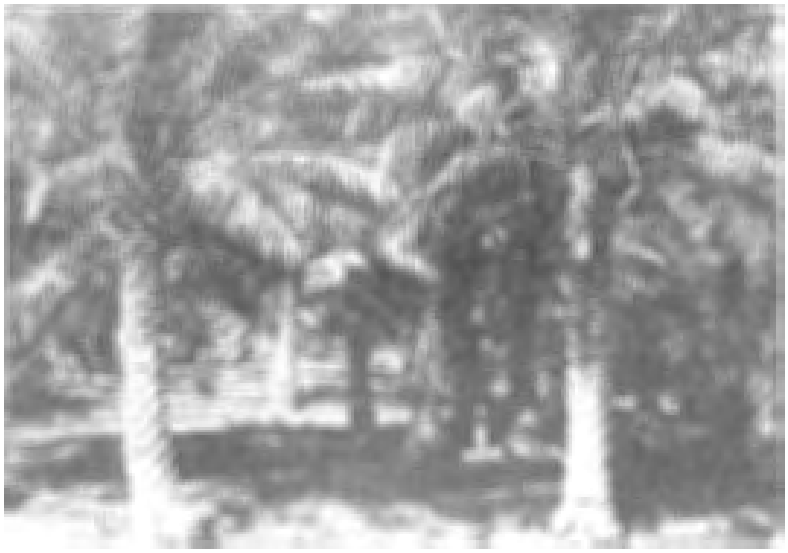

Fig.1 A typical date palm orchard in Qatar.

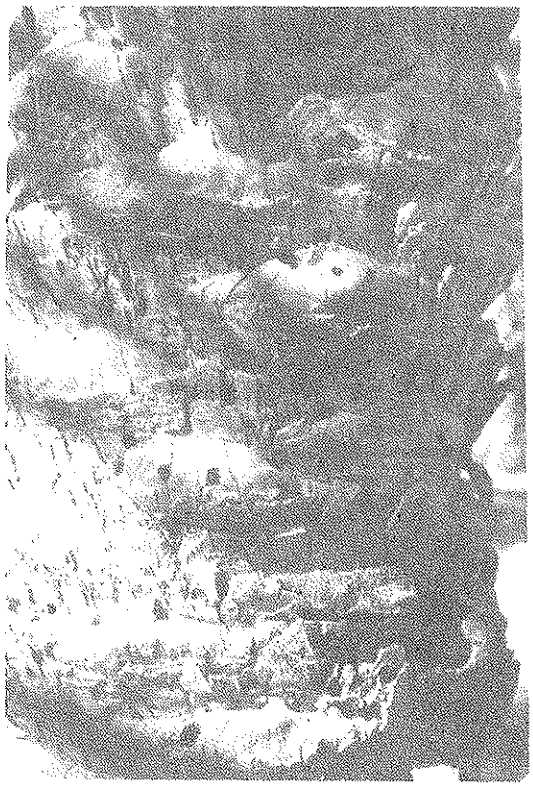

Fig.2

Exit holes on the date palm trunk, a sign of stem borer *Jebusea hammerschmidti* infestation. This tree is heavily infested with the borer and so in most orchards visited in Qatar.

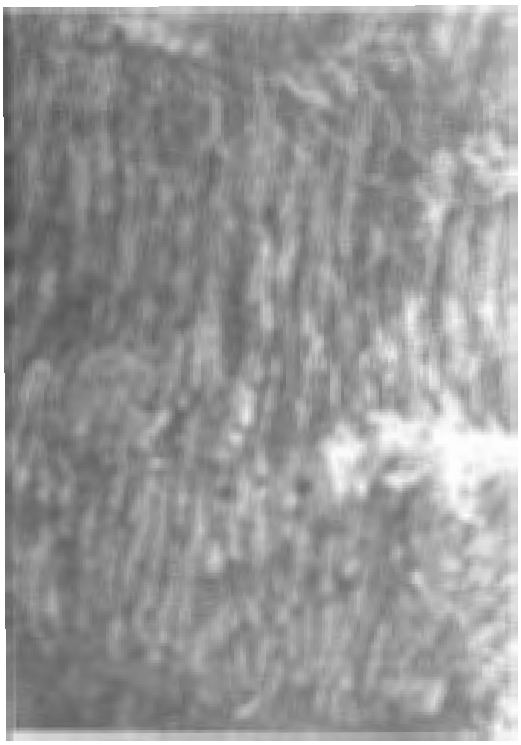

Fig.3

Exit holes on date palm root region; a sign of stem borer infestation, *J. hammerschmidti.*

Fig.4

Brown substance secreted by trunk covers the area below the entrance of the stem borer *J. hammershcmidti* larvae.

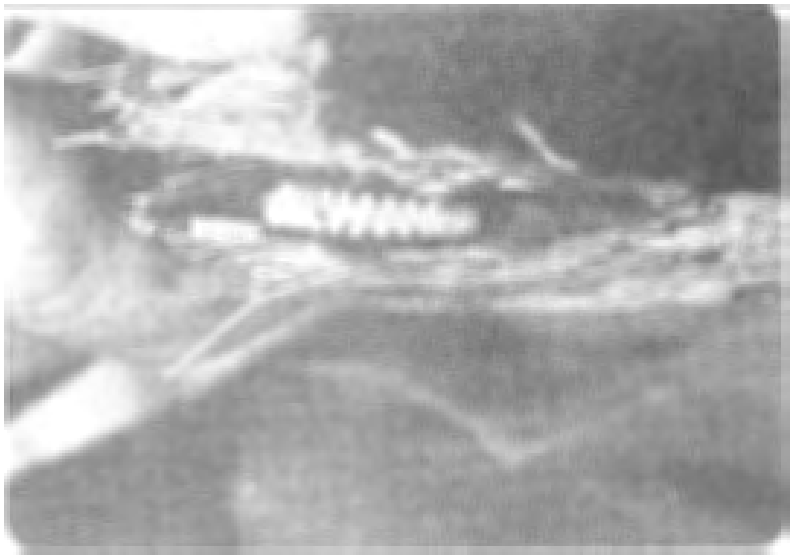

Fig.5 The larva of stem borer *J. hammerschmidti* inside base of an infested frond.

Fig.6 Larva of stem borer *J. hammerschmidti* inside a date palm trunk.

Fig.7

A date palm trunk cut open to show dead tissue the trunk due to *J. hammerschmidti* infestation.

Fig.8

A date palm trunk, cut open to show infected tissue caused by bacteria & fungi, whose speres entered through exit holes of the stem borer *J. hammerschmidti*.

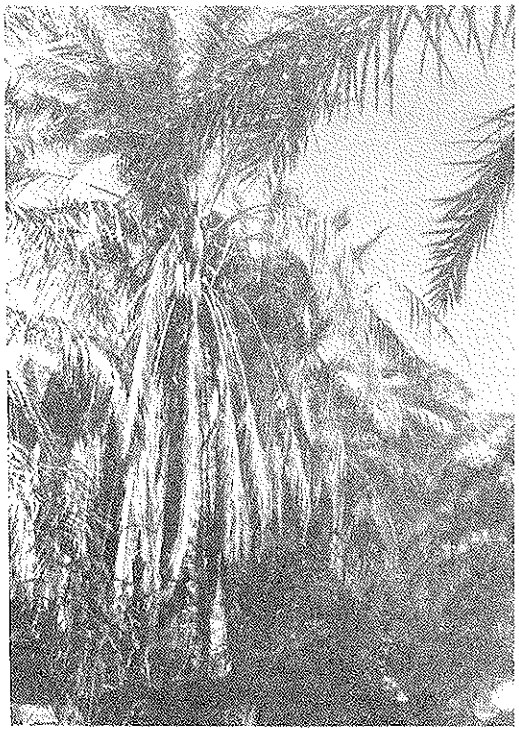

Fig.9

A weak tree with dead fronds believed to be caused by stem borer infestation *J. hammerschmidti* in Qatar.

Fig.10

Dissected head of tree showing furrows of larvae of stem borer *J. hammerschmidti* found in the growing tip.

Fig.11

Date palm trunk heavily infested with fruit stalk borer *O. elegans*.

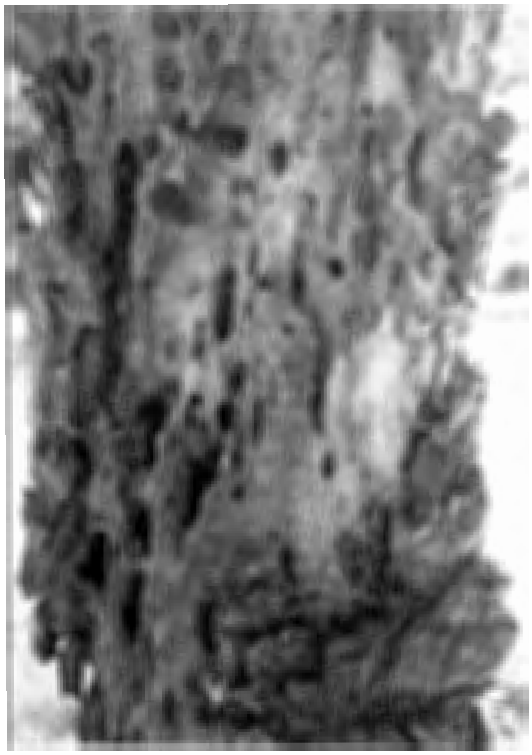

Fig.12 Fruit stalk borer *O. elegans*. Clockwise from top, pupa, pupa inside a hole, larva and adult. All were found in a dead, but standing date palm and at different heights.

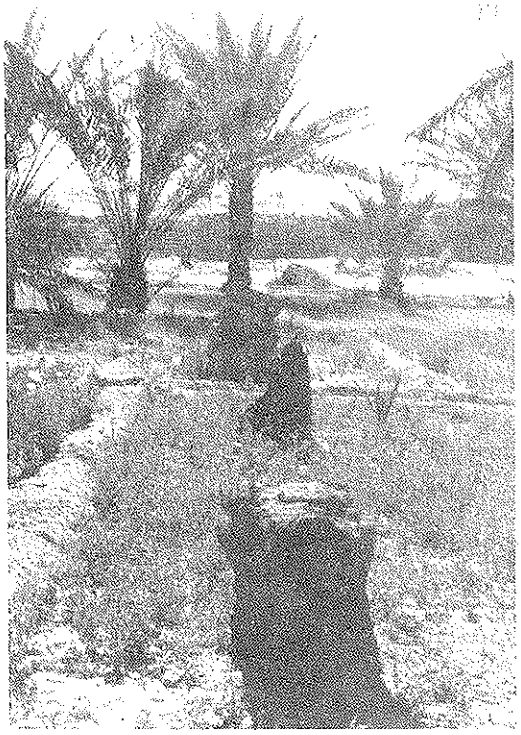

Fig. 13

Stubs from fallen date palm were burned to control borers. The stubs are full of furrows & holes of the fruit stalk borer *O. elegans*.

Fig. 14 Parlatoria scales, *Parlatoria blanchardi* on leaflet from infested tree in Cornich & Other areas.

Fig.15 Red scale, *Phoenicoccus marlatti* on bases of fronds was found in most of the orchards visited.

Fig.16 Rodents burrowing holes with heaps of soil near bases of date palm trunks, heavy infestation with rodents was found.

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AN ANALYSIS OF MARKET CONDUCT IN THE DATE-MARKETING SYSTEM OF SIND-PAKISTAN

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ABSTRACT

The aim of this paper is to analyse the market conduct of the date marketing system in Sind-Pakistan. The methods of exchange, price formation at each marketing level and non-price practices are analysed. The impact of market structure on conduct is also evaluated.

تحليل ادارة السوق في نظام تسويق التمور في مقاطعة السند في الباكستان

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قسم الاقتصاد الزراعي، الجامعة الملكية في بلفاست، بلفاست BT9 SPX ،
ايرلندا الشمالية، المملكة المتحدة

الخلاصة

تهدف هذه الورقة إلى تحليل ادارة السوق فيما يخصّ نظام تسويق التمور في مقاطعة السند ـ الباكستان . لقد جرى تحليل طرق التبادل والأسعار على مستوى التسويق والعمليات غير السوية . كذلك تم تقييم تأثير تركيب السوق على الادارة .

(1) The authors are respectively research student and lecturer in the Department.

INTRODUCTION

The paper examines methods of purchase and disposal of dates at auction markets as well as at procurement centres, methods of price formation at date orchard, wholesale and retail levels and non-price practices particularly those carried out by wholesalers at assembly markets. The data analysed in this paper are mainly primary and were collected from the date growers and the marketing intermediaries by personal interviews. A brief discussion of the meaning and significance of market conduct is given prior to the analysis of empirical data.

Due to lack of time, the price analysis in this paper uses data limited to ten firms only at each marketing level. At producer level data were collected in the districts of Sukkur and Khairpur, the most prominent date producing districts of Sukkur and Khairpur, the most prominent date producing districts in Sind. At wholesale and retail levels the coverage extended to three most important date markets in Sind viz. Sukkur, Hyderabad and Karachi. All prices were obtained by personal interviews. Due to limited cooperation by the authorities at procurement centres the selling prices of date producers were taken to be the same as the purchasing prices of these centres. The prices of dates sold abroad, supplied by the Pakistan Export Promotion Bureau, were assumed to be their selling prices. The period of analysis covers only one year i.e. 1983-84. This was the only period for which it was possible to collect reliable primary data. Clearly, this restricts somewhat the conclusions which can be drawn from the analysis.

Bain (1) defines conduct and set its limit as «the composite of 'acts' practices, and policies of sellers in arriving at and in some way coordinating their several decisions as to what prices to charge, what output to produce, what selling costs to incur, what product designs to offer, what actual or potential competitors to discourage and so on». However, Bain (1) encountered difficulty in empirically establishing Structure-Conduct-Performance links and therefore stresses the formulation of direct empirical links between market structure and performance excluding the intervening conduct variable. But Clodius & Mueller (4), Sosnick (7) & Caves (3) have stressed the importance of the intervening conduct variable. More recently economists have again admitted to its importance. According to Needham (5) «the central hypothesis of industrial organization theory is that there exists a systematic relationship between 'industrial structure' and a firm's conduct and therefore between industrial structure and economic performance.» Baker (2) also has quoted Richard Caves idea that «market structure is important because the structure determines the behaviour which in turn determines the quality of the industry's performance.»

1. Methods of Exchange: In Sind, traditionally dates were sold through two major outlets i.e. assembly auction markets and primary local markets.

Howevers, after the entry of procurement centres the selling outlets have changed and at present dates are sold through the assembly auction markets and procurement centres.

Auction was by far the most important method accounting for 96 per cent of the total sample quantity purchased by the date wholesale firms. The major portion of dates (i.e. 52 per cent) were sold in Sind markets whereas 29 per cent were sold to other provinces of Pakistan and 19 per cent were exported abroad.

Purchases at procurement centres were made direct from date producers on negotiated prices, and at present are limited to the Asil variety in dehydrated form.The major outlet of the supplies at these centres was exports abroad. Only a meagre percentage (i.e. 10 per cent of their total supplies) is sold at Sind urban markets.

2. *Methods of Price Formation:* In Sind, the methods of price formation at each marketing level are haphazard. In the date season, the prices are determined through open auction at assembly auction markets. In the off-season when there is little demand and the number of bidders is small, the producers prefer to sell their dates at negotiated prices directly to wholesale firms at assembly auction markets. In the month of fasting (if it falls in the off-season) when the demand is relatively high, the producers prefer to sell their surpluses in open auction.

At wholesale level due to improper storage facilities the marketing of unprocessed dates is limited to the date season only, whereas the processed dates are sold throughout the year. Most of the wholesale firms working in the assembly markets sell their stocks at negotiated prices when purchased by retailers particularly in the off-season. The wholesale firms who work in the urban markets have to reauction their purchased stocks (from the assembly markets) particularly during the date season. In the off-season these wholesale firms also sell their stocks in small quantities at negotiated prices, particularly to the retailers. Although the date does not come under the 'essential commodities' the Government intervenes in the public interest during the fasting month when the demand increases to keep the prices in control by restricting wholesale profit margins to between 5 and 10 per cent on their auction purchased prices[1].

At retail level the prices are set by the owners at shop level. It has been observed that price formation methods are very haphazard particularly by small multiple shop retailers. Many smaller retailers mostly use a large local retailer as a price reference.

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(1) In Sind-Pakistan twenty commodites come under 'essential commodities' and their prices are controlled and declared by the Government.

3. *Inequity and Inefficiency in Market Structure:* It has been observed that the following practices and traditions were possible sources of inequity or inefficiency. These issues were raised by producers and other market agents during the course of interviews.

(a) Policies towards the setting of prices at wholesale level are unfair. Rizvi & Davis (6) indicated that competition is being eliminated by the dominant group of wholesale firms which they referred to as type 'A' wholesalers.

(b) The prices paid to producers are uncompetitive, due to low bargaining power of the date producers resulting from the perishable nature of the product and lack of storage facilities.

(c) Policies towards the setting of quality standards for the product particularly at the procurement centres are not satisfactory (i.e. price discrimination exists in the name of so called low quality of the product).

(d) Non-price practices are significant elements of competition in the Sind date market, particularly at wholesale level.

(e) the methods of exchange are not fair. The wholesalers-cum-commission agents (type 'A') who are also working as auctioneers in the same market are known to practise unfair tactics in acquiring the supplies for themselves or for their buyers.

(f) As the date trade is not very sophisticated, sales promotion and advertising do not appear to be major competitive weapons.

4. *Date Producer Prices: Figure 1,* shows the monthly current selling prices (Rupees Per Maund) in both Sukkur and Khairpur districts. It is apparent that prices of the Asil variety in all three forms are higher than the Fasli variety. The reasons for this are the quality, weight and high average proportion of pulp with fruit of the Asil variety. The consumer preference for the dehydrated form is evident from its higher price compared to dry (being 1.29 times higher in weight also) in both Asil and Fasli varieties. The consumer preference for processed dates over unprocessed dates is evident from its higher prices. The main reason for the lower prices for unprocessed dates is a limited demand coupled with the high supplies available for a limited time period.

A significant increase in prices occurred at both these assembly markets between July and October, which reflects high demand pressure during the date season. From October to April the prices remained mostly static with small fluctuations reflecting a constant demand during this period. They started increasing again in both markets from April due to the expected increase in demand because of the fasting month which fell in June 1984.

A considerable and fairly constant price differential exists between the two main date producing districts viz Khairpur and Sukkur of Sind province. This reflects the better bargaining position of Khairpur district date producers.

Table 1 shows the average negotiated prices of Asil (dehydrated) dates. It is evident that the average prices at procurement centres were significantly lower than the prices at Khairpur assembly auction market for the same date form and variety. This suggests that considerable bargaining power is possessed by these procurement centres.

5. Date Wholesale Prices: Figure 2 shows the average current selling prices during 1983-84 at Sukkur, Hyderabad and Karachi wholesale markets of each date variety and form separately. It is apparent that prices at wholesale level are flexible and reflect considerable variations in date producer prices.

In a competitive market structure the prices at geographically separated markets are expected to move in a uniform manner in response to changes in enonomic forces of supply and demand. The speed and accuracy with which relative prices react and adjust to these stimuli can be taken as an indication of the degree of economic interrelationship between the markets. To investigate this, correlation analysis Table 2 wasemployed to determine the degree of association between the prices of three geographically separated wholesale markets.

In a market structure satisfying the precondition of perfect product mobility not only the correlation coefficients between market prices should be very high, but also inter-market price differentials should be equal to or less than the transshipment costs. Any difference in prices of various markets in excess of these costs is taken as evidence of market imperfection and should be eliminated in order to satisfy the requirements of effective competition.

Table 3 shows the selling prices and transshipment costs between Sukkur assembly market and Hyderabad and Karachi urban markets. It is apparent that the price differentials between the markets are higher than the transshipment costs which indicates market imperfections at these market levels.

6. Non-Price Practices: An attempt was made to detect the non-price practices prevailing in Sind date market. *Table 4* lists the restrictive trade practices carried out at the wholesale level, particularly in the assembly markets. Competition in the urban and rural markets is usually confined to price competition and the non-price aspects are not widespread. Although the effects of these are not directly quantified there may be a case for restricting them in the public interest, particularly if it can be shown that they restrict price competition.

7. Date Retail Prices: Figure 3 shows the average current retail prices in 1983-84. The prices reflect the demand and supply balance during the consumption periods and the variations in the wholesale and orchard prices.

From the above price discussion it is hypothesized that the conduct of date sellers with regard to determination of prices at each marketing level is either independent or quasi-independent. At the orchard level date producers are not in such a strong position to be called price makers but must be treated as price-takers.

At the wholesale level type 'B' wholesale firms are generally following the prevailing prices charged by the type 'A' wholesale firms and there is no apparent collusion between them. If they did collude it could put them into a loss making position if the type 'A' wholesale firms started to employ coercive tactics, through the use of predatory and exclusionary measures, such as price-squeezing. Therefore, it is hypothesized that at the wholesale level the relationship between type 'A' and 'B' firms is one of tactical collusion or co-operation. This hypothesis will be tested during the assessment of market performance as at this stage it is rather difficult to predict the aims pursued from the observed market conduct. However, if moderate concentration tends to be associated with a hybrid profit maximization type of behaviour, it should tend to lead to lower profits and larger outputs by wholesale firms than very high concentration levels.

At retail level the prices reflect considerable variations in the wholesale and producer prices. Due to the relatively strong position of the wholesale sector it is hypothesized that wholesalers take a larger portion of the 'consumer Rupee' than the date retailers.This hypothesis will be tested in an on-going examination of date market performance.

8. CONCLUSION

The following conclusions may be drawn about market conduct in the Sind date market.

(i) In 1983, out of the portion of the dates (i.e. 82 per cent) sold through the Sind auction markets, 52 per cent was consumed at the domestic level and 29 per cent was sold to other provinces in Pakistan and the balance (i.e. 19 per cent) exported.

(ii) The prices for both Asil and Fasli varieties (form wise) rose in the date consumption periods and were static during the rest of the year.

(iii) The prices of processed dates were higher than the unprocessed dates and the prices of dehydrated dates were higher than the dry dates for both date varieties. Moreover the prices of the Asil variety were higher than the Fasli variety.

(iv) A considerable and fairly constant differential exists between Khairpur and Sukkur date producers' prices which shows the better bargaining position of Khairpur district date producers.

(v) The prices received by the date producers at Khairpur procurement centres were lower than the prices received at the auction markets in Khairpur, which may reflect the better bargaining position of the procurement centres.

(vi) The price movements at wholesale and retail levels reflected variations in producer prices.

(vii) Spatial pricing inefficiency is apparent between the rural assembly market and the urban central markets.

(viii) Non-price practices may play a role in restricting price competition between wholesalers in the Sind date market.

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Table 1

Average Prices at Procurement Centres

Month	Asil (dehydrated)
August 1983	195 -
September 1983	* 215 -
	* Includes Rain Allowance.

SOURCE: Personal interviews with Date Producers 1983

Table 2
Correlation Coefficients between Sukkur, Hyderabad and Karachi. Wholesale markets for each variety (form wise) during 1983 - 84

Form of Date Coeficient		Coefficient of determination[1]
Sukkur (wholesaler) — Hyderabad (W.S.)		(r^2)
Asil	Fresh	0.99
	Dry	0.48
	Dehydrated	0.89
Fasli	Fresh	0.96
	Dry	0.41
	Dehydrated	0.87
Hyderabad (wholesaler) — Karachi (W.S.)		
Asil	Fresh	0.85
	Dry	0.87
	Dehydrated	0.86
Fasli	Fresh	0.96
	Dry	0.35
	Dehydrated	0.81
Sukkur (wholesaler) — Karachi (W.S.)		
Asil	Fresh	0.87
	Dry	0.61
	Dehydrated	0.79
Fasli	Fresh	1.00
	Dry	0.69
	Dehydrated	0.77

1) All Coefficients for the main varieties and forms were highly significant indicating a very high degree of association between prices in the three markets.

Table 3
Wholesale Market Prices and Transhipment Costs

(Rupees per maund)

Market	**Selling** Price	**Transshipment** Costs	**Price** Difference
Sukkur	217/57	—	—
Hyderabad	238/78	6/75	21/21
Karachi	263/67	9/37	46/10

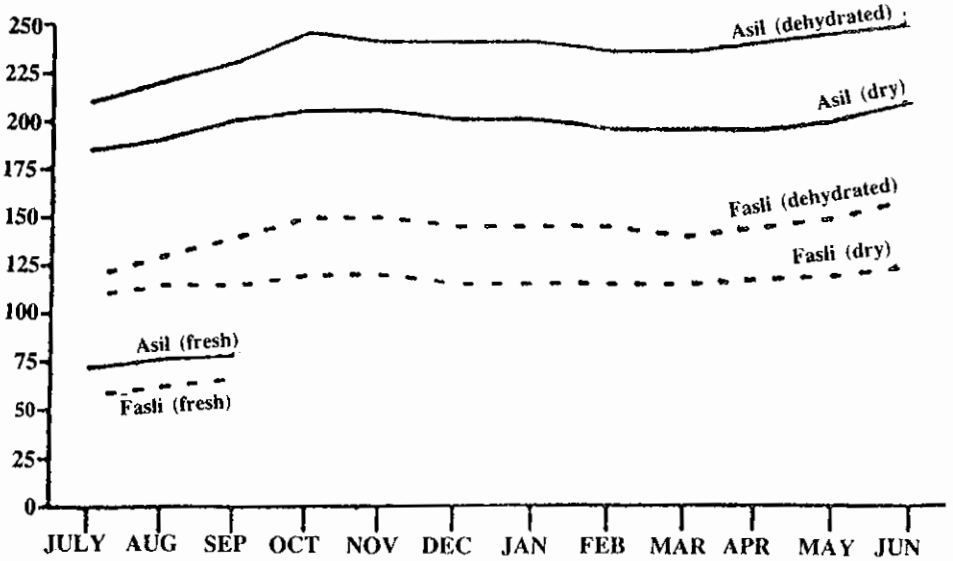
Source: Field Survey data 1983.

Table 4
Non Price Practices

Financing
Providing Foreign Exchange Facilities, Lodging and Boarding Facilities
Providing Packaging Material at Date Orchards
Providing Haulage Facilities, Free Technical Services and Employment to Desendants of Large Producers
Storage Facilites.

Source: Personal interviews with wholesale firms.

Fig.1 Monthly date producer prices at Sukkur and Khairpur assembly auction markets during 1983-84



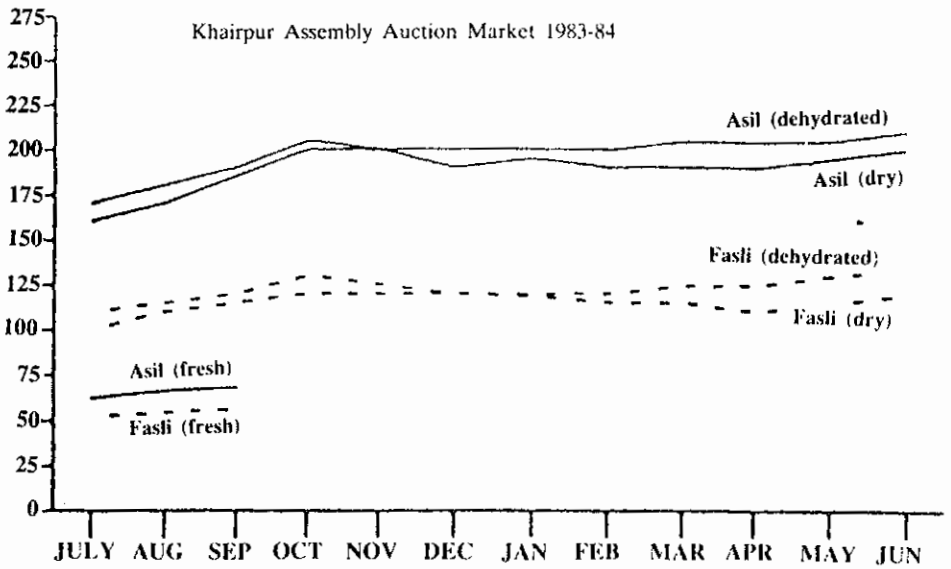


Fig.2 Monthly wholesale prices at Sukkur, Hyderabad, Karachi markets during 1983-84

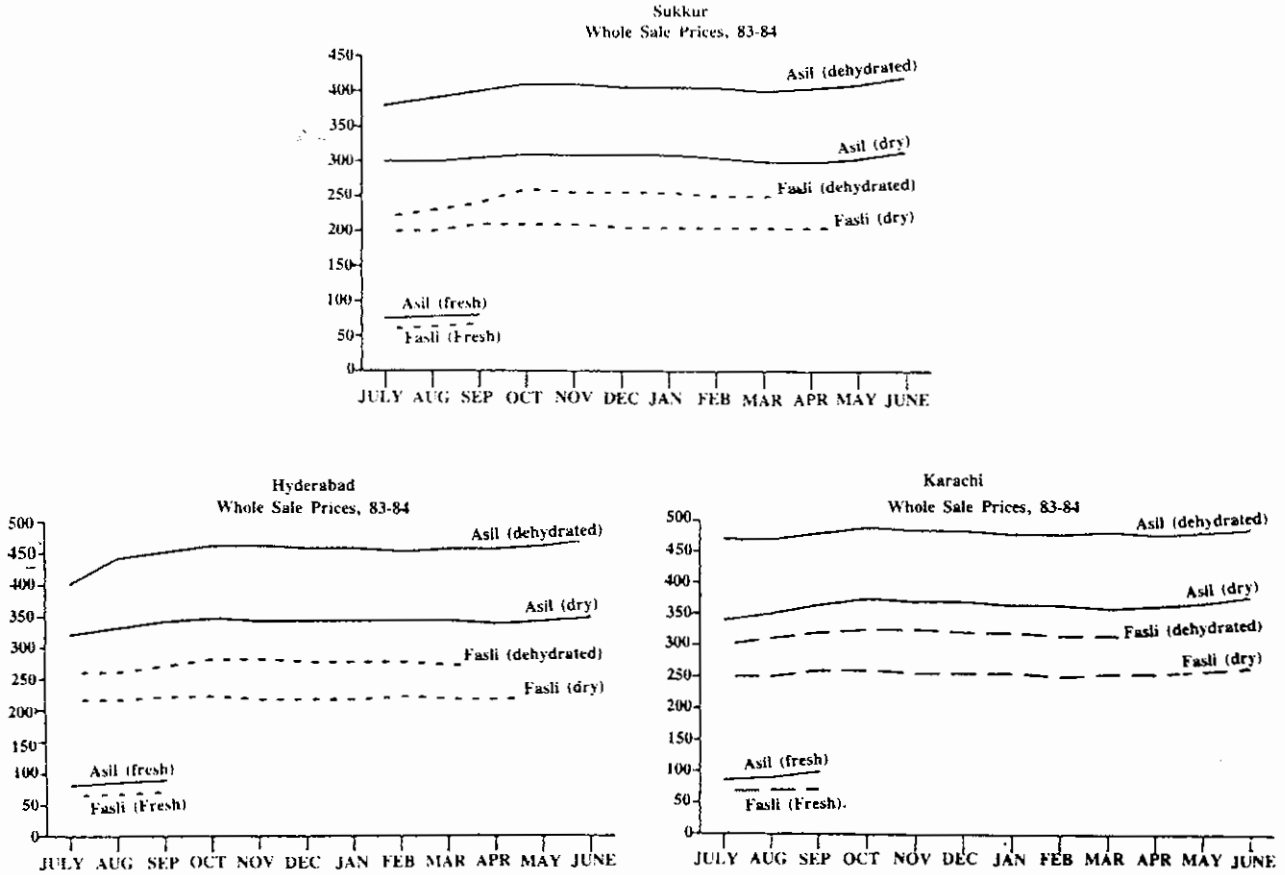
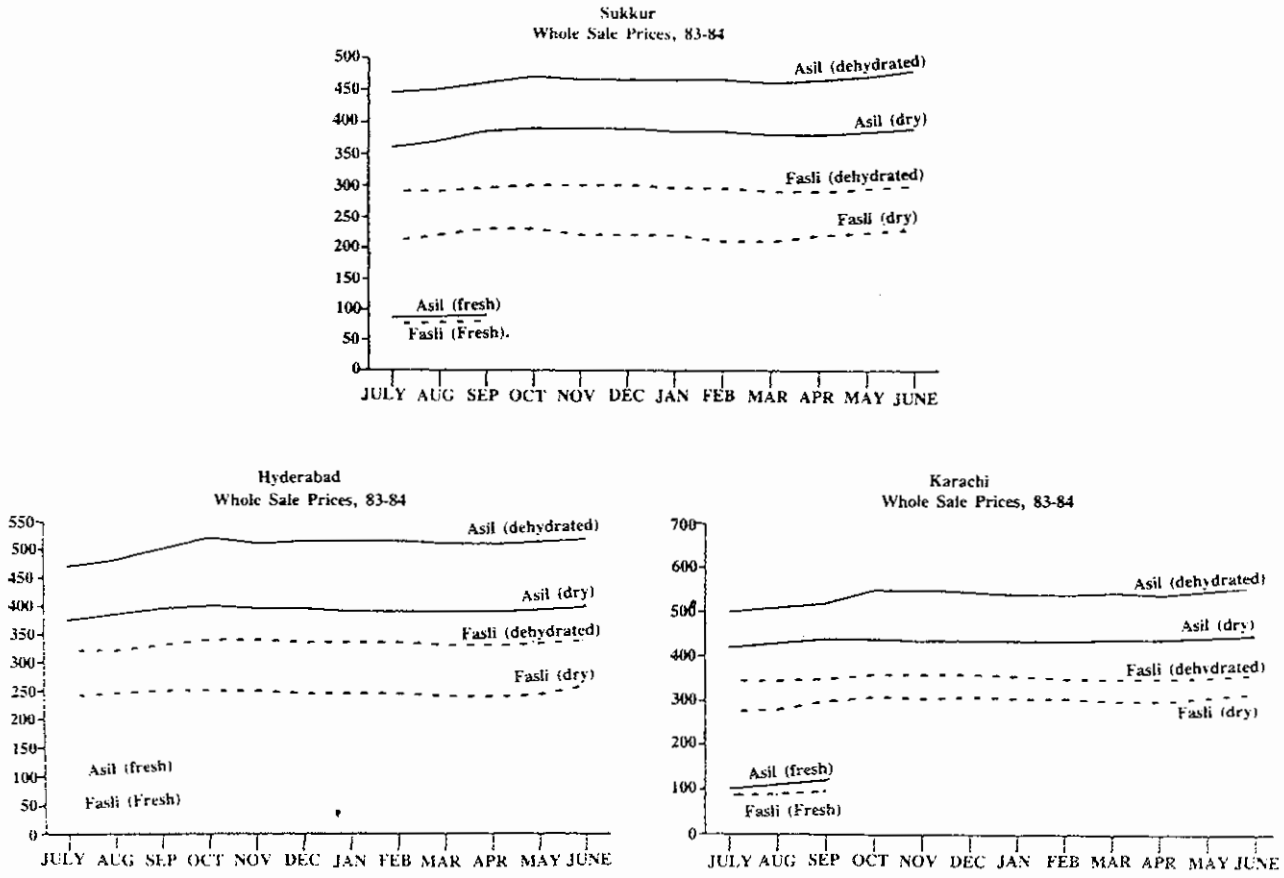


Fig.3 Monthly retail prices at Sukkur, Hyderabad and Karachi markets during 1983 -84



Date palm J 4 (2): 279-289
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DOCUMENTATION

ABSTRACTS OF RECENT RESEARCH ON THE DATE PALM

PRODUCTION

General

NIGERIA, NIGERIAN INSTITUTE FOR OIL PALM RESEARCH. Nineteenth Annual Report. Benin City, Nigeria, 1982, 88 pp.

Research is also reported on dates.

PAKISTAN, AYUB AGRICULTURAL RESEARCH INSITUTE, FAISALABAD. Annual Report 1982-83. Faisalabad, Pakistan 1984, 393 pp.

Short research report on dates is also included.

DEMASON, D.A. Histochemical and ultrastructural changes in the haustorium of date (*Phoenix dactylifera* L.) Protoplasma 1985, 126 (3): 168-77 [24 references, 20 plates]. California University, Riverside, CA 92521, USA.

During imbibition of Medjool date embryos, all cotyledon cells showed the same changes: protein and lipid bodies degraded, somooth endoplasmic reticulum (ER) increased in amount, and dictyosomes appeared. At germination, the distal portion of the cotyledon expanded to form the haustorium. At this time, epithelial cells had a dense cytoplasm with many extremely samll vacuoles. Many ribosomes were present along with Er, dictyosomes, and mitochondria. the parenchyma cells had large vacuoles and a small amount of peripheral cytoplasm, Between 2 and 6 weeks after germination, epithelial cells still retained the dens cytoplasm and many organelles appeared: glyoxysomes, large lipid bodies, amyloplasts, large osmiophilic bodies, and abundant rough and smooth ER which appeared to merge into the plasmalemma. A thin electron-transparent inner wall layer with many small internal projections was added to the cell walls. Starch grains appeared first in the subsurface and internal parenchyma and

subsequently in the epithelium. Lipid bodies, glyoxysomes, protein, and osmiophilic bodies occurred in the epithelial and subepithelial cell layers but not in the internal parenchyma. At 8 weeks after germination, the cytoplasm became electron transparent, vacuolation occurred, lipid bodies and osmiophilic degraded and the endomembranes disassembled. After 10 weeks, the cells were empty. These data supported the hypothesis that the major functions of the haustorium were absorption and storage.

Abstract taken from Horticultural Abstracts)

DEMASON, D.A.; SEXTON, R.; GORMAN, M.; REID, J.S.G. Structure and biochemistry of endosperm breakdown in date palm (*Phoenix dactylifera* L.) seeds. Protoplasma (1985), 126 (3): 159-67 [En, 20 refs, 13 plates] California University, Riverside, CA 92521, USA.

The zone of endosperm breakdown in the germinated Medjool date seed was a narrow area immediately adjacent to the surface of the enlarging cotyledon, or haustorium. The zone width was correlated with the amount of cell division in the adjacent region of the haustorium. The sequence of endosperm breakdown was: (1) protein bodies vacuolated; (2) storage cell walls became electron-transparent immediately adjacent to the protoplast of each endosperm cell; (3) all remaining cytoplasm and lipid bodies disappeared; and (4) the remaining cell walls became electron-transparent and collapsed against the haustorium surface. Two cell wall hydrolases were present:endo-β-mannanase (EC 3.2.1.78)and β-mannosidase (EC 3.2.1.25). β-Mannosidase was detectable in the endosperm before germination. At germination, the major portion of activity was found in the softened endosperm. β-Mannanase was detectable from germination and there was always much greater activity in the softened endosperm than elsewhere. Proteinase was detectable in trace amounts at germination in the softened endosperm but was also found in the haustorium at later stages. Isolated haustoria incubated in extracted ivory nut *(Phytelephas macrocarpa)* mannan in buffer, caused no mannan breakdown. Haustoria incubated in a solution of locust bean galactomannan caused no decrease in galactomannan viscosity. It is suggested that although haustoria probably regulate mannan breakdown in the endosperm, they do not seem to secrete the hydrolytic enzymes concerned.

(Abstract taken from Horticultural Abstracts)

Propagation:

ATA-UR-REHMAN; AHMED, S.; JOHN, I.; QURAISHI, A. and GHAFOOR, A. Growth responses by different explant tissues *Phoenix dactylifera*, the date palm.

Plant Tissue Culture: Proceedings and Recommendations of the First

National Meeting of Tissue Culture held at NARC, Islamabad, 18-19 May 1983. National Agricultural Research Centre, Islamabad (Pakistan) p. 73-78. (14 refs., 2 tables).

DRIRA, N.; BENBADIS, A. Vegetative multiplication of date palm (*Phoenix dactylifera* L.) by reversion of *in vitro* cultured female flower buds. Journal of Plant Physiology 1985, 119 (3): 227-35. [Fr. with En summ, 8 refs, 13 plates] Ecole Nationale des Ingénieurs de Sfax, BP «W», 3038 Sfax, Tunisia.

Culturing inflorescences of cv. Allig on a medium containing Murashige and Skoog salts, saccharose, vitamins, amino acids, 2,4-D, IBA and BA achieved a reversion from the reproductive to the vegetative phase in 50% of the explants. Removing IBA or 2,4-D from the medium markedly reduced the percentage of reverting explants (to 10.4 and 6.2%, respectively). The stage of flower primordia differentiation at the time of placing on the culture medium was important since explants with pedicels <1 cm long mostly reverted to the vegetative phase, but as the pedicels became longer, up to 3 cm, more and more developed thin and elongated flowers.

(Abstract taken from Horticultural Abstracts).

GABR, M.F.; TISSERAT, B. Propagating palms *in vitro* with special emphasis on the date palm (*Phoenix dactylifera* L.). Scientia Horticulturae 1985, 25 (3): 255-62 [8 refs] Desert Institute, Mataria, Egypt.

Tissue culture methods are described for the vegetative propagation of several palm species either through shoot tip culture or plantlet differentiation via embryogenic callus. *P. dactylifera* seedling shoot tips of various sizes were cultured in either liquid or agar modified Murashige and Skoog (MS) medium containing 0.0-1.0 mg/litre NAA and 0.0-15.0 mg/litre BA or 2iP to enhance shoot growth and induces axillary budding. Satisfactory *P. dactylifera* shoot tip growth and proliferation was obtained from explants that were 3 mm in length, consisting of the apical meristem region and 2-5 adjacent leaf primordia. Optimum shoot tip development and axillary budding was obtained by initially establishing explants on an agar medium for 2 weeks, then transferring to a liquid medium. In another trial shoot tips from several species were cultured on MS media containing 100 mg/litre 2,4-D, 3 mg/litre 2iP and 3g/litre activiated charcoal, or on MS medium containing 1 mg/litre NAA and charcoal. Shoot tips of *Metroxylon* sp., *Phoenix canariensis*. *P. dactylifera* cultivars Khalasa, Thoory and Zahidi, and *P. roebelenii* cultured on a medium with 2,4-D and 2iP initiated callus, asexual embryos and free-living plantlets after 4-8 months in culture. Shoot tips from *Erythea edulis*, *P. canariensis*, the 3 *P. dactylifera* cultivars, *Washingtonia filifera* and *W. robusts*, cultured on medium containing NAA, developed into plantlets with well-developed leaves and adventitious roots

within 2-6 months from the time of planting. In some cases cultured date palm shoot tips gave rise to axillary buds.

(Abstract taken from Horticultural Abstracts)

MAURICE, V.; VANDERCOOK, C.E.; TISSERAT, B. Automated plant surface sterilization system. Physiologie Végétale (1985), 23(1): 127-33 [En with Fr summ., 7 ref] Ecole Nationale Supérieure des Industries agro-alimentaires, 91300 Massy, France.

An apparatus for sterilizing plant material before tissue culture is described. Agitation, application and removal of disinfectant, sterile water rinsing and time of surface sterilization are controlled automatically using a microcomputer. No significant differences between manual and automated sterilization were found for *Cucurbita pepo seeds* or dill *(Anethum graveolens)* petiole explants, but when Alcide or NaOCl was used as a disinfectant, automated sterilization of date seeds was more effective than manual sterilization.

(Abstract taken from Horticultural Abstracts)

TISSERAT, B.; DEMASON, D.A. Occurrence and histological structure of offshoots and inflorescences produced from *Phoenix dactylifera* L. plantlets *in vitro*. Bulletin of the Torrey Botanical Club 1985, 112(1): 35-42 [22 refs, 3 plates] Fruit and Vegetable Chemistry Laboratory, Agricultural Research Service, Pasadena, CA 91106, USA.

Studies are reported on plantlets derived from lateral bud callus, excised zygotic embryos and shoot tip cultures. Plantlets, about 2-4 months old, could produce offshoots when grown on a basal nutrient medium supplemented with 0.1 mg/litre NAA. These additional shoots were derived from a common shoot axis *via* lateral bud proliferations. Suckering occurred in about 40% of the asexual plantlets derived from callus, but less frequently in plantlets derived from excised embryos and shoot tips (10% and 20%, respectively). Inflorescences were sometimes produced from these lateral bud outgrowths in cultured shoot tip and excised embryo cultures. Inflorescence production occurred on nutrient media containing 0.1 mg. NAA and 5-15 mg/litre BA, Kinetin or N^6 -($\triangle^2$-isopentyl) adenine.

(Abstract taken from Horticultural Abstracts)

Pollen & Pollination:

GROSZ, F.; SARIG, Y. and RASIS, A. Development of ground-operated mechanical pollinator for date palms. Tropical Agriculture (Trinidad and Tobago). 1986, 63(1): 49-51.

A simple one-man operated mechanical pollinator was designed for use at

ground level and tested on date palms. The specific objectives: (1) to achieve fruit set and yield at least equal to that obtained from hand pollination; to consume no greater amount of pollen than currently-used mechanical pollinators; (3) to mount the system on a standard tractor; and (4) to provide safe and comfortable conditions for the operator. Fruit set, size and quality were the same as or better than with currently used methods. Working capacity with the new method was 300-500 trees/h for 2 persons vs. 10 trees/h for one person performing manual pollination. The working capacity for the high/lift platform is the same, but this system is less safe and less confortable.

(Abstract taken from Abstracts on Tropical Agriculture).

KHALIFA, A.; HAMDY, Z.M.; AZZOUZ, S. and El MASRY, H. Effect of sources of pollen on the physical and chemical quality of 'Amhat' date variety. Agricultural Research Review 1980 (published in 1982), 58(3): 15-23 [En with Ar summ, 13 refs.] Hort. Res. Institute, Agric. Res. Centre, Min. Agriculture, Cairo, Egypt.

Pollination of 'Amhat' rutab dates with pollen from 'Haiyan' males increased fruit set, accelerated ripening and gave fruit with better fresh wt., total soluble solids, tannin, total sugars, sucrose and reducing sugar content values than pollen from 'Sewy' , 'Samany' and 'Amhat' var.

(Abstract taken from Food Sc. & Tech. Abstract).

SHABANA, H.R.; EBRAHIM, T.K. and MAWLOD, E.A. Biological study of some date palm male cultivars and comparison between mechanical and hand pollen extraction. J. Agric. Water Resources Res. (SRC), Iraq 1985, 4 (4): 271-85.

Some biological characters concerned with pollen grains production were studied in seven male date palm cultivars at Zaffaraniyah Date Palm Research Centre near Baghdad for 1983 and 1984 seasons. The cultivars were Galami, Smaesmi, Khukri Greatli, Ghannami Ahmir, Ghannami Akhdar, Khukri Wardi, and Adi. A comparison was made between mechanical and hand pollen extractions to study the time effort and quantity of pollen produced by each method. Ghannami Akhdar was found to be superior than other cultivars in relation to the number of spadix per one tree in addition to the higher quantity and viability of its pollen grains. The mechanical extraction was much more superior than hand extraction per one spadix in addition to saving time and effort especially when it was clear that this method has not influence on extracted pollen grains viability.

PROCESSING & PRODUCTS

CHATHA, G.A.; GILLANI, A.H. and AHMAD, S. Effect of curing agents on the chemical composition and keeping quality of date fruit. Journal of Agricultural Research (Pakistan) 1985, 23(1): 71-77 (11 refs, 2 tables).

KHALIL, J.K.; SAWAYA, W.N.; KHATCHADOURIAN, H.A.; SAFI, W.J. Fortification of date bars with yeast proteins and dry skim milk. Canadian Institute of Food Science and Technology Journal 1984, 17 (3): 131-36 [En with Fr summ, 17 ref] Reg. Agric. & Water Res. Cen., Min. of Agric & Water, Riyadh, Saudi Arabia.

In an attempt to produce palatable high protein and high energy date bars, plain and chocolate-coated bars were fortified with yeast proteins [Toruway (T) or Zyest (Z)] and dry skim milk (DSM) in different proportions (9% T + 6.5% DSM; 12% T+ 3.5% DSM; 2% Z + 11.5% DSM and 4% Z + 9% DSM). The fortified bars showed higher amounts of protein, fat, fibre, ash, Na, K, Ca, Mg and P, compared to the unfortified date bar. Fortification also improved the amino acid profile resulting in an approx. 2-fold increase int he chemical score. The in-vitro protein digestibility (IVPD) value (77.8%) increased only slightly but the calculated protein efficiency ratio (C-PER) increased significantly (P 0.05) from 1.36 to 2.35-2.43 as a result of fortification. In comparison, IVPD and C-PER values for ANRC-Casein were 90.0% and 2.50, resp. Milk chocolate coating on the date bars further improved the nutritional quality so that the C-PERs of the fortified chocolate bars were equal to hat of casein. Sensory evaluation data showed that all the bars were equally acceptable and could be stored for 6 months at ambient temp. without significant loss of quality attributes. 9% T + 6.5% DSM or 2% Z + 11.5% DSM were the optimum economic levels of supplementation in terms of nutritive benefit.

KUNZ, P. Equipment for processing dates German Federal Republic Patent Application (DE 32 38313 A1 (1984) [in German]

Equipment for use in processing dates comprises a device receiving the date to be processed. This device has an upper recess receiving a date; ≥ 1 element supports the date in the recess, this support-element being prestressed in the direction of the recess. A conveyor transports the device from a date-feeding point to a processing station.

MOHAMMED, H.H.; BAGHDASSAR, G.A. and MUHSIN, A.A. The effect of feeding date stones supplemented with two levels of single cell protein and barley on the performances of Awassi lambs. J. Agric. Water Resources Res. (SRC), Iraq 1985, 4 (4): 109-22,

Thirty two Awassi lambs, aged 5-6 months, were blocked to live weight

and allocated randomly to four different diets. Diets 1 and 2 comprised of 50 and 75% single cell protein (SCP) of the total protein diet. Diet 3 contained 50% urea nitrogen in the diet. Diet 4 was a concentrate mixture. The animals were penned individually and fed *ad. lib.* over a 91-day period. Balance trial was undertaken, using 4 rams in a 4 × 4 latin square, simultaneously with the fattening trial. The experiment was terminated by slaughtering the animals. The highest animals performances were achieved with group 4 when the animals were fed on concentrate mixture, however a reasonable performances were obtained with the animals fed on diet 1 and 2. Daily metabolizable energy intake and live weight gain were significantly higher in group 4 as compared with the other groups (8.77, 8.97, 5.65, 11. 03 MJ and 121, 114, 84 and 191g for groups 1, 2, 3 and 4 respectively).

NEZAM EL-DIN, A.M.; BENJAMIN, N.D. and MAISARA, M.S. A study on the production of sheets from Zahdi date (in Iraq). Zanco (Iraq) 1985, 3(1): 75-84 (Arabic with Ar & En summs).

This study was carried out to find the possibility of sheet production from Zahdi date variety as well as assessing its quality. Sheet products from dates juice were poured intostainless steel trays. The product was then dried up at 65° C for 26 hrs. The various treatments involved the incorporation of tartaric acid, citric acid, milk powder, sulphur dioxide and pectin at several concentration levels. Sulphur dioxide imparted a good quality in taste, colour and cohesion. Tartaric acid produced an acceptable taste. Finally the addition of milk powder gave a supplementary effect in amino-acid content and pectin had a good action on cohesion.

Entomology:

AHMED, T.R. Susceptibility of different varieties of dates to Carob moth, *Ephestia calidella (Guenee) in the middle of Iraq. J. Agr. Water Resources Res. (SRC), Iraq 1985 4(4): 11-20.*

Five varieties of date palms: Jamal Aldeen, Khadrawi, Zahdi, Sayer and Khassab were evaluated for susceptibility to attack by Carob moth ***Ephestia calidella*** (Guenee). The moth infested dates prior to harvesting, and the infestation rate is related directly to delay in harvesting. Also there were significant differences among varieties tested and among the dates on the tree and wind-detached dates within the same variety. It has been found that Jamal Aldeen variety was more susceptible than other varieties, while Khassab showed high resistance for infestation. This may be due to either late maturity of the dates or lack of preference by the pest.

AL-OMAR, M.A. and AL-BASSOMY, M. Persistence of phosphine gas in

fumigated Iraqi dates. Journal of Food Safety 1984, 6 (4): 253-60 [En, 6 ref] Environmental Pollution Dept., Biol. Res. Cen. Jadiriyah Baghdad, Iraq.

Phosphine gas (PH_3) is a widely used fumigant for stored fruits and grains. Previous studies indicated that all residues of this gas are eliminated by normal aeration, but the exact time has never be determined. The objective of this work was to determine the time required for desorption of phosphine from fumigated dates relative to aeration time and temp. Flame photometric detection by gas chromatography was used for detection of sorbed phosphine. Results indicate that the initial residue level of PH_3 falls rapidly within 24 h after fumigation, but residues persist for a least 9 days. Higher residue levels were found in dates stored at low temp (4° C) than at 28° C. It is recommended that fumigated dates be marketed after longer periods of aeration, especially those aerated at ≤ 4° C.

BLUMBERG, D.; DORON, S.; BITTON, S. Effect of triflumuron on two species of nitidulid beetles, *Carpophilus hemipterus* and *Urophorus humeralis*. Abstract in Horticultural Abstracts 1985, 55 (9): Abstract No. 7271.

The toxicity of the chitin inhibitor triflumuron to *Carpophilus hemipterus* and *Urophorus humeralis*, which are important pests of date palms, was investigated in the laboratory. The results were promising; adults provided with diets treated with 0.0125% triflumuron produced eggs that did not hatch (the effect lasting for 48 h after the adults ceased feeding on the treated diet). Adults dipped in 0.0125% triflumuron also produced eggs that failed to hatch. Though there was no direct ovicidal effect when eggs 0-24 h old were dipped for 3 s in a solution of 0.0125% triflumuron, larvae provided with diets treated with 0.0125 or 0.00125% of the compound were killed. An application of 0.0125% triflumuron in a date grove did not prevent infestation of the dates by the adults but prevented egg hatch, and virtually no larvae developed in the fruits. *C. hemipterus* was somewhat more susceptible to the compound than was *U. humeralis*.

EL-BASHIR, S. and EL-MAKALEH, S. Control of the lesser Date moth *Batrachedra amydraula* Meyrick in the Tihama region of the Yemen Arab Republic. In Proceedings of the first symposium on the date palm in Saudi Arabia; King Faisal University 1983, 418-22 [En, 3 ref., 1 fig.] Agricultural Research Service P.O. Box 5788, Yemen Arab Republic.

Date Palms and bananas are the two most important fruit crops grown in the Tihama coastal plain. The date palm population is estimated at 1.25 million, mainly of the cultivar Taal. Yields are low averaging 5 kg/tree, partly because of damage by *B. amydraula*. In trials with several insecticides, applied at fruit set and then at 3-week intervals, the best results were obtained with Kafil 10% EC (permethrin) at 1.55 cm^3/litre, with yields/tree of

22.3 kg. All insecticides increased the yield/tree threefold or more compared with untreated controls.

(Abstract taken from Review of Applied Entomology, Ser. A).

KEHAT, M.; BLUMBERG, D.; GREENBERG, S.; GORDON, D.; BITON, S.; GANTZ, S.; EINI, M. Laboratory and field evaluation of insecticides for the control of sap beetles (Coleoptera: Nitidulidae) on dates. Abstract taken from Horticultural Abstract Nov. 1985, 55 (11): Abst. No. 9060.

The effectiveness of twelve insecticides for the control of *Carpophilus humeralis* adults was tested in the laboratory. Azinphos-ethyl, chlorpyriphosethyl (chlorpyrifos), cypermethrin, permethrin, deltamethrin and pirimiphos-methyl were effective. Dimethoate, monocrotophos, methomyl, endosulfan, diazinon and malathion, were much less effective. The residual effect under field conditions of azinphos-ethyl (w.p.) was much longer than that of azinphos-ethyl (e.c.), chlorpyrifos (e.c.) and cypermethrin (e.c.). The addition of Coax (unspecified) at 0.1% to chlorpyrifos or cypermethrin greatly prolonged their residual effect. The residual effect of azinphos-ethyl (w.p.) was not affected by Coax. In further field trials, azinphos-ethyl (w.p. 25%) at 0.4% or cypermethrin (e.c. 10%) at 0.2% + Coax at 0.1% were the most effective and BAY SIR 8514 [1-(2 chlorobenzoyl) — 3 — (4-trifluoromethoxyphenyl) urea] (w.p. 25%) at 0.05% was also effective.

(Abstract taken from Horticultural Abstracts).

KLIEN, M.; VENEZIAN, A. The dubas date tropiduchid *Ommatissus binotatus lybicus*, a threat to date palms in Occupied Palestine. Phytoparasitica 1985, 13 (2): 95-101 [17 refs., 5 figs] Department of Entomology, Agricultural Research Organization. Volcani Center, Bet Dagan, Occupied Palestine.

The tropiduchid *Ommatissus binotatus* var. *lybicus* has become an important pest of date palms in recent years. It was first observed in 1981 at Qetura (Southern Arava). Within 2 years it had attacked an entire orchard of 2000 palms of the varieties Medjhool and Deglet Noor. Large quantities of honeydew were excreted by the pest on the palms. It was bivoltine and overwintered in the egg stage.

MANSOUR, S.A. and AL-HASSAN, M.S. Determination of residues of pirimiphos-methyl and some of its degradation products in dates. Journal of Pesticide Science (Japan) 1985, 10 (1): 7-10 (En. & Jap. summs, 8 refs.).

MEISNER, J. WEISSENBERG, M.; BLUMBERG, D.; ASCHER, K.R.S. Date Palm fruit stone extracts as phagostimulants for the adult date stone beetle, *Coccotrypes dactyliperda* F. (Coleoptera: Scolytidae). Zeitschrift für Pflanzenkrankheiten und Pflanzenschutz (1985), 92 (3): 305-309. Abstract taken from Review of Applied Entomology. Ser A. Agricultural 1985, 73 (9): Abstract no. 6276.

The feeding response of adults of *Coccotrypes dactyliperda* to crude extracts of date fruit stones and purified extracts obtained from them was studied in the laboratory using polystyrene foam discs. The number of holes bored by females into treated discs as compared with untreated ones was used as the criterion of feeding stimulation. Finely ground date palm stones were extracted succesively with petroleum ether, chloroform, methanol and water. The highest activity was observed for the methanol extract at 0.5-4%. The petroleum ether extract showed slight activity at 1%, whereas no activity was demonstrated in the chloroform or aqueous extracts. One of the fractions obtained by chromatography of the methanol extract on silica gel exhibited slight activity at 1%.

HASSAN, H.K; TUCKY, N.K. and NEZAM ELDIN, A.M. Effect of type of drying on Zahdi Khalaal. J. Agric. Water Resources Res. (SRC), Iraq 1985, 4 (4): 285-94.

Two methods of dedhydrating ovens, were used to prepare dried Khalaal of Zahdi cultivar. One method involved the use of conventional oven at 65° C for 24 hours whereas in second a freeze dryer was used, after treating the fruits with sulfur dioxide. The data showed that, there was an increase in total acidity of samples treated with sulfur dioxide for both drying methods. The best results concerning colour index was with Khalaal sample treated with sulfur dioxide, also freezing has an inhibitory effect to browning reaction. This was clear by decline of amino acids in coloured samples. Tanin content was found to be higher in treatments 2 and 3. Treatment no. 3 got the higher score in odour and taste. However, the colour of treatment no. 1 was accepted by the consumer.

WOOD, T.G. and KAMBAL, M.A. Damage to date palms in northern Sudan by *Odontotermes* (Isoptera). Tropical Pest Management 1984 30 (4): 469-70 [En, 5 ref.] Tropical Development & Research Institute, London, W 8 5 SJ, United Kingdom.

Damage to date palms by termites was observed in the Dongola district of northern sudan. A species of Odontotermes of uncertain identity, which has been referred to in the literature as *O. smeathamani* and *O. nilensis*, foraged externally and internally on palm trees. Termite damage was possibly the most important agricultural problem in the area; 100% of trees were estimated to be infested at Dongola, and one farmer indicated that he lost 1-2% of his trees each year. The majority of these were at the peak of their production, and replacement would take 20 years. There are an estimated 3 million palm trees in the district, and at their peak each produces an average date crop of 2 sacks/year. New trees can be given some protection by being planted in holes treated with aldrin, dieldrin, chlordane or heptachlor at 0.5 g/hole, applied as an emulsion in 100 ml water. New methods such as toxic baits will be required to protect mature trees.

(Abstract taken from Rev. of Applied Entomology).

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14 - Tressler, D.K. & M.A. Jonlyn; Fruit and vegetable juice processing and technology. The A.V.I. publishing company Inc. Copyright (1961).

جدول رقم (4)
معدل درجات التقييم الحسي

المنتوج		معدل درجات التقييم			
		الطعم	النكهة	اللون	درجة التقبل
عينة المقارنة		9.2	9.4	9.5	9.8
الشربت المخفف	قبل الخزن	8.9	8.4	9.4	9.7
	بعد الخزن 5 م	8.9	8.7	9.4	9.7
	بعد الخزن 28 م	8.7	8.7	9.4	9.6
العصير المركز	قبل الخزن	8.7	8.7	9.3	9.8
	بعد الخزن 5 م	8.7	8.6	9.3	9.7
	بعد الخزن 28 م	8.6	8.6	9.3	9.7

عينة المقارنة: الشربت المستخدم فيه السكروز
مدة الخزن: لمدة ستة أشهر
التحليل الاحصائي: عدم وجود فروقات معنوية بين المنتوجات على مستوى 0.05

لذلك يستنتج من هذه الدراسة امكانية انتاج الشربت المخفف المعد للشرب والعصير المركز باستخدام السكر السائل المستخلص من التمور المحلية وان الدراسة الحسية والخزنية لم تؤشر وجود عوامل او تغيرات سلبية تؤثر على استخدام السكر السائل في مثل هذه الصناعة كما ان هنالك امكانية واسعة لاستخدام مختلف عصائر الفاكهة والخضروات في مثل هذه الصناعة سواء ما كان منها مستورداً أو منتج محلياً.

جدول رقم (3)

التغيرات الفيزياوية والكيمياوية بعد فترة الخزن

درجة حرارة الخزن	مدة الخزن بالشهر	المواد الصلبة الذائبة		٪ للسكريات الكلية		٪ للحموضة الكلية		كثافة اللون	
		المخفف	المركز	المخفف	المركز	المخفف	المركز	المخفف	المركز
5° م (ثلاجة)	3	13.0	63.0	9.8	52.4	0.35	1.85	0.860	1.505
	6	13.0	63.0	9.78	52.34	0.36	1.86	0.856	1.501
28° م (حرارة الغرفة)	3	13.0	63.0	9.81	52.38	0.35	1.84	0.858	1.492
	6	13.0	63.0	9.72	52.24	0.36	1.87	0.851	1.482
40° م (حاضنة)	3	13.0	63.0	9.12	48.38	0.37	1.91	0.812	1.32
	6	13.0	63.0	8.97	47.32	0.41	1.95	0.802	0.92

ستة أشهر(9) . ويعزز هذا التقييم الحسي حيث يلاحظ من جدول (4) عدم وجود أي فرق احصائي معنوي بين نموذج المقارنة والنماذج المنتجة مباشرة او بعد فترة الخزن من حيث الطعم والنكهة والرائحة ودرجة التقبل لكل من الشربت المخفف او العصير المركز الذي يتم تناوله بعد التخفيف بالماء بنسبة 4:1 أو حسب الرغبة حيث يمتاز المنتوج الأول الشربت المخفف المعد للشرب مباشرة بتركيز 13 بركس بطعم ونكهة ولون البرتقال وذلك بسبب استخدام مركز عصير البرتقال الطبيعي من حيث المظهر والنكهة والطعم واللون، وان استخدام مركز عصير البرتقال في تصنيعه والمنتوج الثاني وهو العصير المركز بتركيز 63 بركس الذي يعطي بعد تخفيفه بالماء شراباً مشابهاً لعصير البرتقال الطبيعي من حيث المظهر والنكهة والطعم واللون،وان استخدام مركز عصير البرتقال في المنتوجين اعطى درجة تقبل عالية من قبل المحكمين كما انه يمكن استخدام عصير الفواكه والخضروات (عنب، الليمون، رازبري) في مثل هذه الصناعة وخاصة ان الاقبال الكبير على استهلاكها في العراق يشجع على انتاجها.

اما عند الخزن على درجة حرارة 40° م فقد لوحظ بعد فترة ثلاثة اشهر من الخزن حدوث انخفاض في النسب المئوية للسكريات الكلية وارتفاع درجة الحموضة الكلية في الشربت المخفف والعصير المركز وصاحب ذلك تغيير في لون المنتوجين. يعزى ذلك الى عمليات الأكسدة والتفاعلات الكيمياوية (10) التي تسبب تغيرات في الطعم والنكهة ودرجة التقبل من قبل المحكمين لذلك يفضل خزنها على درجة حرارة اقل حيث أوضحت الدراسة الخزنية امكانية خزن المنتوجين على درجة حرارة الغرفة (28° م) وفي الثلاجة (5° م) دون تغيير في الصفات الحسية للمنتوجين لمدة ستة اشهر كما ان لارتفاع نسبة الحموضة الكلية وزيادة تركيز المواد الصلبة الذائبة في العصير المركز واضافة المواد الحافظة وعدم وجود تلوث بالاحياء الدقيقة بعد المعاملة الحرارية والتعقيم بالاشعة فوق البنفسجية يعطي لهذه المنتوجات ميزة امكانية خزنها لمدة اطول دون حدوث تغيرات كيمياوية اوفيزياوية،وقد اوضحت البحوث والدراسات حول عصائر الفاكهة الطبيعية والعصائر المركزة امكانية خزنها لمدة تزيد على ستة أشهر دون حدوث تغيرات واضحة في صفاتها الفيزياوية. والكيمياوية والحسية (9,11)

جدول رقم (2)

الفحص المايكروبي خلال مراحل الانتاج والخزن

مرحلة التصنيع	المحتوى الكلي للميكروبات		كوليفورم		الخمائر	
	مركز	مخفف	مركز	مخفف	مركز	مخفف
1 خزان التحضير	+	+	–	–	+	+
2 ـ قبل المعاملة الحرارية	+	+	–	–	+	+
3 ـ بعد المعاملة الحرارية	–	–	–	–	–	–
4 ـ المنتوج النهائي	–	–	–	–	–	–
5 ـ المنتوجات المخزونة 5° م	–	–	–	–	–	–
28° م	–	–	–	–	–	–
40° م	–	–	–	–	–	–

(+) ظهور نموات في النماذج المزروعة

(–) عدم ظهور نموات في النماذج المزروعة

التغيرات الفيزياوية والكيمياوية اثناء الخزن:

يلاحظ من جدول (3) عدم حصول تغيرات في النسب المئوية لكل من المواد الصلبة الذائبة، السكريات الكلية والمختزلة، الحموضة الكلية وكثافة اللون في الشربت المخفف والعصير المركز عند الخزن على درجة حرارة 5° م و28° م لمدة

جدول رقم (1)

التركيب الكيمياوي للمنتوج

	عينة المقارنة	الشربت المخفف	العصير المركز
1 ـ المواد الصلبة الذائبة	13.0	13.0	63.0
2 ـ الأس الهايدروجيني	2.80	2.75	2.50
3 ـ الحموضة الكلية ٪	0.3	0.3	1.83
4 ـ الرطوبة ٪	86.2	86.5	36.45
5 ـ السكريات الكلية ٪	10.2	9.8	52.4
6 ـ السكريات المختزلة ٪	1.2	8.9	50.3
7 ـ الرماد ٪	0.05	0.13	1.52
8 ـ شدة اللون	0.75	0.86	1.505

المصدر الرئيسي للسكريات والقسم الآخر من عصير البرتقال المركز المستخدم لاعطاء اللون والطعم والنكهة المرغوبة. كما ان ارتفاع نسبة الحموضة الكلية (المحسوبة على اساس حامض الستريك) ساعد على اعطاء الطعم المقبول اولاً وزاد من قابلية حفظ المنتوج وذلك لأن من المعروف ان ارتفاع نسبة الحموضة تحد من نمو الاحياء الدقيقة (7) ولا يظهر فرق بين عينة المقارنة والشربت المخفف من حيث الحموضة الكلية.

يوضح جدول (2) نتائج الفحص المايكروبي حيث تظهر النتائج عدم وجود نموات للاحياء الدقيقة المسببة للتلف وذلك لأجراء عملية التعقيم بالاشعة فوق البنفسجية (u.v. light) اولاً ثم المعاملة الحرارية على درجة 90° م لمدة 15 دقيقة للشربت المخفف، اما المنتوج الثاني فقد كان ارتفاع تركيز السكر فيه عامل مساعد للحفظ اضافة الى المعاملة الحرارية على درجة 85°م لمدة 15 دقيقة (12). كما ان عملية الانتاج والتعبئة كانت بشكل مستمر ومغلق داخل المعمل المتخصص لهذه المنتوجات بعيداً عن عمليات التلوث الخارجي بعد تعبئة وتعقيم خط الانتاج قبل مرحلة التصنيع. ان النتائج الايجابية للفحص المايكروبي في المنتوج النهائي تعطي مؤشر لامكانية خزنها دون حدوث أي تلوث بالاحياء الدقيقة المسببة للتلف كما ان استخدام المواد الحافظة في المنتوجين يزيد من قابلية حفظهما (3) حيث ان وجود نموات في النماذج التي اجري عليها الفحص لكل من المحتوى الكلي للاحياء المجهرية ظهر قبل المعاملة الحرارية في حين انه لم تظهر اي نموات بعد المعاملة الحرارية او بعد فترة الخزن وهذا ما يزيد من مدة الحفظ وجودة الناتج.

3 ـ طرق التحليل :

أ ـ قدرت النسبة المئوية للرطوبة والحموضة الكلية والسكريات الكلية والمختزلة تبعاً لطريقة برلين (6) والمواد الصلبة الذائبة بواسطة جهاز Refractometer على درجة حرارة 20° م . ولاس الهايدروجيني باستخدام جهاز pH. Meter وشدة اللون بواسطة جهاز Spectrophotometer بعد تخفيف المنتوجين بالماء بنسبة : 10:1 و25:1 للشربت المخفف والعصير المركز على التوالي وتبعاً للطريقة الواردة في (10)

ب ـ التخزين والفحص المايكروبي :

خزن الشربت المخفف والعصير المركز لمدة ستة أشهر على ثلاثة درجات حرارية مختلفة 5° م ∓ 1 (الثلاجة) 28° م ∓ 2 (درجة حرارة الغرفة) 40 °م ∓ 1 (حاضنة) لغرض معرفة التغيرات الكيمياوية والحسية اثناء الخزن اما الفحص المايكروبي فقد تناول مراحل التصنيع قبل وبعد المعاملة ومن خزان التحضير، والمنتوج النهائي بعد التصنيع مباشرة وخلال مراحل الخزن لكل من المحتوى الكلي للاحياء الدقيقة الكوليفورم والخمائر في كل من المنتوجين وتبعاً للطريقة المعطاة في (12)

جـ ـ التقييم الحسي :

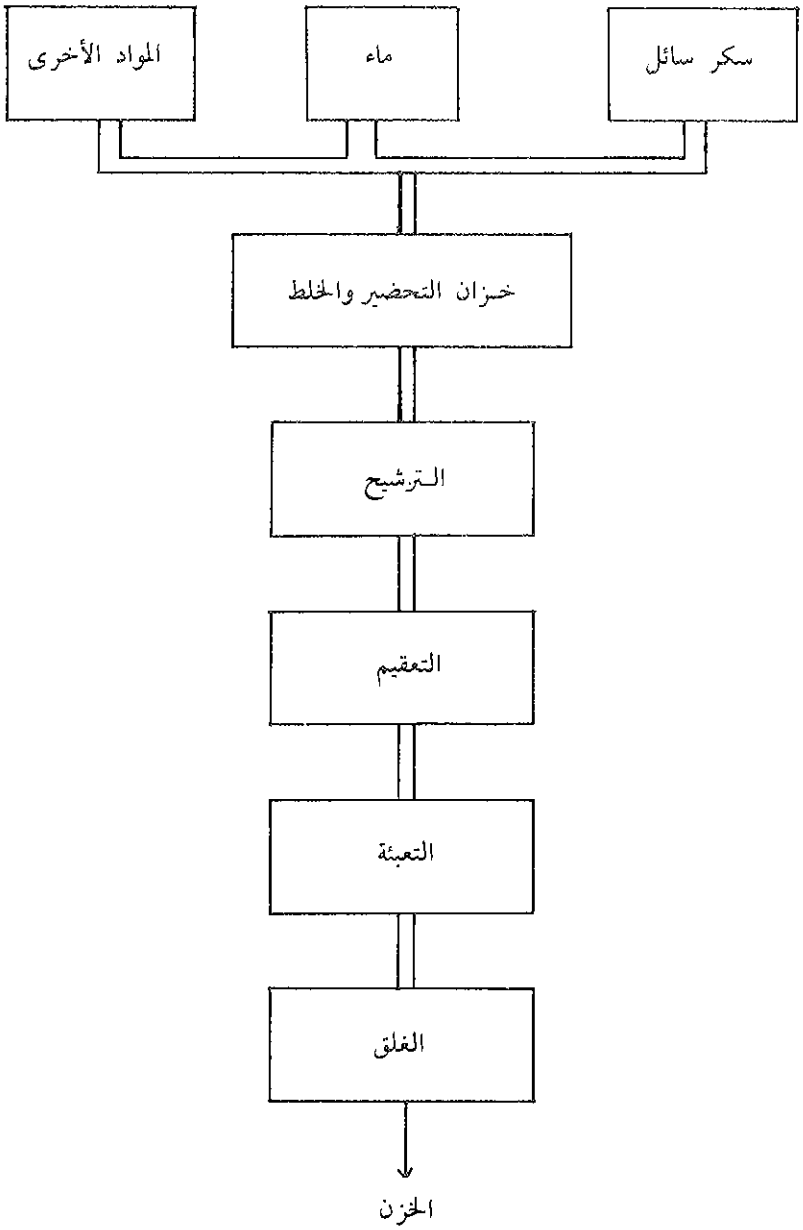
اعدت استمارات خاصة لاعطاء درجة تقييم للمنتوج من اصل عشرة درجات للتقييم الحسي من حيث اللون والطعم والنكهة ودرجة الحلاوة والحموضة ودرجة تقبل المحكمين للمنتوج وقدمت النماذج الى 10 محكمين من ذوي الخبرة والاختصاص لمقارنتها مع المنتوج الاصلي المستعمل فيه السكروز لتحديد درجة التقبل عن طريق اجراء اختبار الاستذواق Scoring difference test (8)

النتائج والمناقشة :

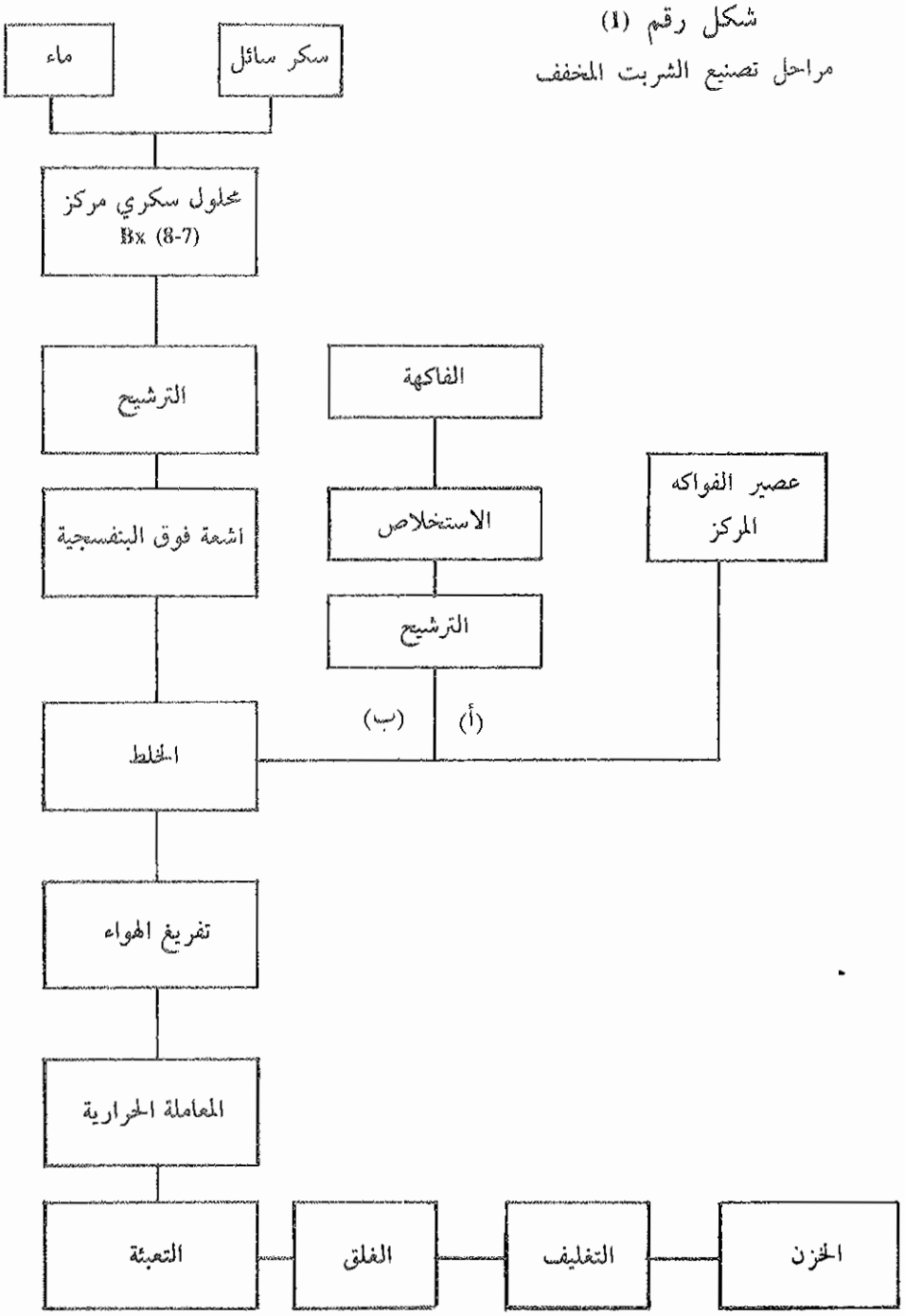
يوضح جدول (1) نتائج التحليل الكيمياوي للمنتوج مع نموذج المقارنة حيث تصل نسبة السكريات الكلية في الشربت المخفف 13% والعصير المركز 63% ونموذج المقارنة 13% والمحسوبة على اساس الوزن الجاف. ويلاحظ ارتفاع نسبة السكريات المختزلة في المنتوجين وذلك لاستخدام السكر السائل (4) ، حيث انه

شكل رقم (2)

مراحل تصنيع العصير المركز



شكل رقم (1)
مراحل تصنيع الشربت المخفف



2 ـ اعداد وجبة انتاجية

صنعت وجبة من الشربت المخفف والعصير المركز مختبرياً وتم تحديد نسب المواد المضافة من السكر السائل ومركز عصير البرتقال ومواد النكهة واللون والمواد الحافظة وحسب المسموح بها دولياً. ثم نقل العمل على نطاق صناعي حيث صنعت وجبة من المنتوجين في أحد المعامل المحلية للمنتوجات الغذائية وحسب الطريقة التالية:

أ ـ الشربت المخفف تركيز 13 بركس

يوضح شكل (1) خطوات تصنيع الشربت المخفف حيث يحضر أولاً محلول سكري من السكر السائل بتركيز (7-8) بركس في خزان التحضير ويمرر على اجهزة الترشيح لازالة المواد العالقة والمتكتلة ويتم تعقيم الناتج بجهاز الاشعة فوق البنفسجية (u.v. light) ويتم مزج المحلول السكري مع مركز البرتقال المحضر سلفاً في (خط أ) والذي اضيفت إليه المواد الحافظة حسب المواصفات الدولية لانتاج شربت مخفف (يمكن تحضير العصير المركز داخل المعمل في خطوة اضافية خط ب).

يضبط الاس الهايدروجيني على 2.75 pH بواسطة حامض الستريك ويمرر المنتوج على جهاز تفريغ الهواء بعدها يعامل حرارياً على 90° م ولمدة 15 دقيقة والناتج يعبأ في اقداح من البلاستك اتوماتيكياً ثم يغلق ويخزن على 10 م حيث يكون جاهزاً للاستهلاك.

ب ـ العصير المركز

يوضح شكل (2) مراحل تصنيع العصير المركز تركيز 63 بركس حيث يتم خلط السكر السائل والماء ونكهة ولون البرتقال والمواد الحافظة وحسب المواصفات.والمقاييس الدولية في خزان التحضير مع ضبط الاس الهايدروجيني على 2.0 pH بواسطة حامض الستريك والناتج يمرر عبر اجهزة التصفية والترشيح للتخلص من المواد الغير ذائبة ويعامل الشراب حرارياً على 85° م ولمدة 15 دقيقة ثم يعبأ في قناني من البلاستك وتحفظ في المخازن المبردة على 10 م بعد غلقها وتغليفها حيث يستهلك بعد التخفيف بالماء.

الفاكهة أو الخضروات الطبيعية ذات القيمة الغذائية العالية ومواد النكهة واللون الطبيعية او المصنعة والمواد السكرية والاحماض العضوية المناسبة ويتم تخفيف العصائر المركزة بالماء لتعطي شراباً مشابهاً للعصير الطبيعي للفاكهة الممثل لها من حيث الطعم والنكهة واللون(14).

يهدف البحث الى انتاج شربت عصير الفاكهة المخفف (المعد للشرب) والعصير الصناعي المركز وذلك باستخدام السكر السائل المنتج من التمور كبديل للسكروز لفتح ابواب جديدة في استخدام مصادر مختلفة للسكريات في هذه الصناعة. والمنتوج الأول ينتج بتركيز 13 بركس حيث يستخدم فيه مركز عصير البرتقال والسكر السائل كمادة اساسية والذي يمتاز بنكهة وطعم ولون عصير البرتقال الطبيعي، اما العصير المركز فانتج بتركيز 63 بركس ويدخل فيه السكر السائل كمادة أساسية اضافة الى مواد الطعم والنكهة واللون ويمتاز بتركيزه العالي حيث يعطي بعد تخفيفه بالماء شراباً مشابهاً لعصير البرتقال الطبيعي من حيث النكهة والطعم ولون ويكتسب استخدام عصائر الثمار المختلفة كالعنب والليمون والرازبري في صناعة المشروبات المرطبة والعصائر المركزة أهمية متزايدة بسبب الاقبال الشديد على هذه المنتجات في العراق (13).

المواد وطرق العمل:

1 ـ المواد المستخدمة

أ ـ السكر السائل: تم جلب نماذج السكر السائل من معمل السكر السائل في الهندية بدرجة تركيز 68 بركس ولون يميل قليلاً إلى الاصفرار.

ب ـ المركزات ومواد النكهة: استعمل مركز عصير البرتقال الطبيعي ونكهة البرتقال المنتجة من قبل شركة MEPA. AS. Turkey.

جـ ـ سوربات البوتاسيوم وحامض الستريك: استخدم حامض الليمون food grade والمجهز من قبل شركة B.D.H. وسوربات البوتاسيوم كمادة حافظة من نفس الشركة.

د ـ الماء: استخدم ماء الاسالة المعقم والمخصص لمعامل المنتوجات الغذائية.

produced from date liquid sugar and orange flavour and colour with pH 2.5 and concentration of 63° Bx.

The two products could be stored for 6 months at the temperatures of 5° and 28° C with no effects on the chemical, physical and organoleptic properties.

المقدمة :

يعتبر العراق البلد الأول في عدد مشاريع مشتقات التمور في الوطن العربي والتي تتضمن انتاج الدبس، السكر السائل، الكحول، الخل... الخ وينتج العراق سنوياً 30 الف طن من السكر السائل من التمور التي تعتبر مصدراً غنياً بالسكريات حيث تصل نسبتها إلى 60-80% (1). ان لادخال السكر السائل في صناعة المشروبات المرطبة والعصائر المركزة اهمية اقتصادية بالنسبة إلى العراق الذي يستهلك سنوياً 600 الف طن من السكروز في مجال التصنيع الغذائي ولا ينتج سوى نصف هذه الكمية تقريباً (5) وان زيادة الطلب على السكروز وما رافقه من اتجاه في ترشيد الاستهلاك وعدم استقرار اسعاره الدولية جعل التفكير باتجاه ايجاد البدائل المناسبة له من الامور الجديرة بالاهتمام والبحث من قبل مؤسسات الدولة المختصة وخاصة التي تعني بالبحث العملي في القطر.

تعتبر سكريات التمور من البدائل المناسبة ذلك لأن استخدامها يحسن المردود الاقتصادي للتمور ويوجد قنوات مجدية لتصريف هذه الثروة القومية الهامة وبالتالي توفير العملات الصعبة التي يمكن توظيفها في نشاطات تنموية اخرى. ان صلاحية استخدام السكر السائل في المنتوجات الغذائية يعتمد اساساً على نوعية المنتوج وعلى ثبات صفاته الفيزياوية والكيمياوية خاصة ان السكر السائل محلول سكري رائق تصل نسبة المواد الصلبة الذائبة الى 70-73% ودرجة نقاوة 97-99% كمواد سكرية (2).

لقد ساعد التقدم العلمي الحاصل في تكنولوجيا التصنيع الغذائي والتطور في اساليب الحفظ والتخزين على انتشار صناعة المشروبات المرطبة والعصائر المركزة التي يتزايد الاقبال على استهلاكها في العالم وبالأخص الدول التي تتسم بالمناخ الحار ومنها العراق اضافة الى ان هذه المنتجات محضرة من مزج مركزات عصائر

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استخدام السكر السائل في إنتاج المشروبات المرطبة

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الخلاصة

تهدف هذه الدراسة إلى استخدام السكر السائل المنتج من التمور في صناعة المشروبات المرطبة والعصائر المركزة بدلاً من السكروز. بينت النتائج امكانية استخدام سكر التمر في انتاج المشروبات المرطبة باستخدام عصير البرتقال الطبيعي مع ضبط الاس الهيدروجيني على pH 2.75 والتركيز على 13 بركس، أما العصير المركز فامكن انتاجه باضافة نكهة ولون البرتقال على ان يكون بتركيز 63 بركس والاس الهيدروجينيpH 2.0 .

وان الدراسة الخزنية اوضحت امكانية خزن المنتوجين لمدة ستة اشهر على درجة حرارة 75 °م و28°م دون أي تأثير في الصفات الفيزياوية والكيمياوية والحسية.

PRODUCTION OF SOFT DRINKS USING DATE LIQUID SUGAR

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ABSTRACT

This study aims at using date liquid sugar instead of crystalline sucrose to produce soft drinks.

The results declare the possibility of producing adiluted soft drink by mixing natural orange juice and date liquid sugar while maintaining the pH at 2.75 as well as the concentration at 13° Bx. The concentrated juice was

شكل 1. ثلاث طلعات استخرجت من نخلة صنف زهدي اثناء تشريحها في 1978/11/1 ويلاحظ ان اطوالها لا تزيد عن 4 سم

شكل 2. ثلاث طلعات استخرجت من نخلة صنف ساير اثناء تشريحها في 1979/2/20 ويلاحظ ان اطوالها لا تزيد عن 20 سم

جدول 3
عدد رؤوس النخيل والطلع المفحوص خلال الفترتين 1979-1978 و1980-79

الشهر	عدد الرؤوس المشرحة		مجموع الطلع المفحوص		نتيجة العزل من الطلع		نتيجة العزل من قواعد السعف والليف	
	عـام		عـام		عـام		عـام	
	1979-78	1980-79	1979-78	1980-79	1979-78	1980-79	1979-78	1980-79
تشرين الثاني	18	13	207	137	—	—	+	+
كانون الأول	15	19	173	259	—(1)	+	+	
كانون الثاني	21	31	163	365	—	—(2)	+	+
شباط		11	14	358	193	+(3)	+	+

1) نتيجة العزل سالبة

2) عزل الفطر *M. Scaettae* من طلع نخيل صنف ساير بتاريخ *1980/1/23*

3) عزل الفطر *M. Scaettae* من طلع نخيل صنف ذكر بتاريخ *1979/2/4*

جدول 1 ـ عدد وأصناف النخيل التي تم تشريح رؤوسها خلال الفترتين 1978-1979 و1979-1980

الاصناف	الاشهر								مجموع الرؤوس	
	تشرين الثاني		كانون الاول		كانون الثاني		شباط			
	1979	1980	1979	1980	1979	1980	1979	1980	1979-78	1979-80
ساير	6	6	5	8	9	12	10	1	30	27
خضراوي	3	4	3	4	4	9	8	2	18	15
حلاوي	2	1	2	2	3	3	2	5	9	11
زهدي	4	—	4	3	1	2	2	2	11	7
فحل	3	2	1	2	3	5	3	4	10	13

جدول 2 ـ معدل الطلعة بالسم خلال الاشهر التي تم فيها تشريح الرؤوس*

الشهر	معدل طول الطلعة بالسم	
	1979-1978	1980-1979
تشرين الثاني	2.5-1	4-2
كانون الاول	5-2	12.5-4
كانون الثاني	20-9	25-15
شباط	اكثر من 20	اكثر من 25

* ان معظم النخيل الذي تم قياس طلعه جلب من منطقة الفاو ومن صنفي الساير والخضراوي.

تكون أكثر ملائمة لنمو ونشاط الفطر المسبب للمرض.

ومن نتائج هذا البحث يمكن الاستنتاج بان الفطر *M. scaettae* يبدأ بمهاجمة الطلع خلال شهر كانون الثاني. ولغرض توفير حماية له يجب ان يبدأ رش النخيل المصاب بالمبيدات الفطرية الفعالة خلال هذا الشهر والشهر الذي يسبقه (شهر كانون الأول) للقضاء على الفطر قبل مهاجمته للطلع حيث اثبتت الدراسات السابقة (3) ان نسبة الاصابة بهذا المرض تقل بصورة ملحوظة في النخيل المرشوش بالمبيدات بوقت متأخر (شهر كانون الأول) وترتفع هذه النسبة في النخيل المرشوش بنفس المبيدات عند رشها بوقت مبكر (خلال شهر تشرين الثاني).

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قواعد السعف القديم والحديث وكذلك من قواعد الليف للتحري عن وجود الفطر المسبب للمرض فيها.

النتائج والمناقشة:

لقد أظهرت نتائج البحث بأن الفطر موجود في قواعد سعف وليف جميع النخيل الذي تم تشريحه خلال الأشهر الأربعة حيث شوهد نموه الأبيض وجرائيمه عليها بينما لم يلاحظ على الطلع المأخوذ منها أي نمو جدول (3). ويظهر ان الفطر يبقى من سنة إلى أخرى في القمة النامية للنخلة في قواعد السعف والليف على شكل نمو خضري مستغلاً المواد العضوية المتوفرة لإسناد نموه. وعندما يتكون الطلع الجديد ويصبح في تماس معه يهاجمه ويحدث الإصابة فيه.

كما أظهرت النتائج أيضاً عدم مهاجمة الفطر الطلع خلال شهري تشرين الثاني وكانون الأول رغم وجودها حيث لم يعزل الفطر من نسيجها الا في نهاية شهر كانون الثاني واوائل شباط (جدول رقم 3). وربما يعزى سبب ذلك إلى ان الطلع المتكون خلال الشهرين الأوليين لا يزال صغيراً (شكل 1). مختبئاً في الفجوات المتكونة في قواعد السعف بعيداً عن مصدر العدوى للفطر حيث يلاحظ من جدول 2. ان معدل طول الطلعة المتكونة خلال شهر تشرين الثاني 1.5-3.25سم ومعدل طولها خلال شهر كانون الأول 3-8.75 سم. وعندما تقدم الطلع بالعمر وكبر حجمه خلال شهري كانون الثاني وشباط جدول 2 وشكل 2. ملأ الفجوات المتكون فيها وأصبح في تماس مباشر مع الليف المحيط بالفجوات وهذا مما يؤدي إلى حدوث خدوش وجروح فيها وبالتالي مهاجمتها من قبل الفطر. ومما يؤكد هذا الافتراض هو ظهور علائم المرض في الجزء العلوي للطلعة في معظم الطلع المصاب. وبصورة عامة ان نسبة الإصابة في الطلع المتكون بعيداً عن القمة النامية للنخلة أعلى بكثير من نسبة الإصابة في الطلع المتكون بالقرب من القمة النامية. ويمكن تعليل هذا الاختلاف في نسب الاصابة الى احتمال تلوث قواعد السعف والليف البعيد عن القمة اكثر بكثير من احتمال تلوثها عندما تكون قريبة من القمة باعتبار ان الأولى قد تكونت قبل التالية واصبحت معرضة للتلويث بالفطر لفترة زمنية أطول. هذا من جهة ومن جهة أخرى أن الطلع البعيد عن القمة النامية يتكون عادة بوقت متأخر تكون فيه درجات الحرارة أعلى من تلك المتوفرة في وقت تكون الطلع المبكر وبالتالي

محافظة البصرة فقد انتخبت خمس مناطق في هذه المحافظة مشهورة بزراعة النخيل في الفاو، السيبة، أبو الخصيب، شط العرب والهارثة. وقد انتخب من كل منطقة عدد من البساتين مصابة بشدة في العام الماضي بهذا المرض لأخذ رؤوس النخيل منها للتشريح. وقد حددت أربعة أصناف من النخيل لإجراء هذه الدراسة عليها هي: خضراوي، حلاوي، زهدي، ساير بالإضافة إلى الفحل (جدول 1)

بدأت عملية قطع رؤوس النخيل وتشريحها بتاريخ 1978/11/2 وانتهت بتاريخ 1979/2/22 كما أعيدت عملية القطع والتشريح لرؤوس نفس اصناف النخيل خلال الفترة 1979-1980 حيث بدأت عملية القطع والتشريح بتاريخ 1979/11/7 وانتهت بتاريخ 1980/2/24 باعتبار ان الفترة من بداية الشهر الحادي عشر إلى نهاية الشهر الثاني تمثل بداية تكوين الطلع الجديد حتى اكتمال نموه وخروجه من القمة النامية للنخلة.

سير العمل

قبل الابتداء بعملية القطع والتشريح فقد نظم جدول عمل على شكل فترات زمنية امدها 1-3 أيام بحيث تجلب إلى المختبر خلال كل فترة عدد من رؤوس النخيل (1-3 رؤوس) وتشرح وبعد اتمام تشريحها خلال الفترة المحددة وأخذ كافة المعلومات عن الطلع المستخرج تجلب أعداد أخرى من الرؤوس من منطقة أخرى وتشرح وهكذا بقية المناطق الباقية. وبعد الانتهاء من آخر منطقة تعاد الكرة وتجلب رؤوس نخيل من المنطقة التي بدأ فيها أولاً ثم المنطقة التي تليها وهكذا إلى آخر فترة التشريح. وبعد الأنتهاء من عملية التشريح ينتخب من كل رأس عدد مناسب من الطلع (5-7 طلعة) وتؤخذ من نسيج كل طلعة قطع صغيرة تؤخذ من مناطق مختلفة وتوضع بعد تعقيمها سطحياً بمحلول السليماني 0.1% داخل اطباق بتري تحتوي على اوساط غذائية ملائمة لنمو الفطر (PDA) بعدها تحضن الاطباق في حاضنة كهربائية ذات درجة حرارة 24 م° لمدة 5-7 أيام. وفي نهاية فترة الحضانة تستخرج الاطباق ويتحرى عن الفطر المسبب للمرض في كل طبق ثم تسجل المعلومات المطلوبة عنه. كذلك تزرع اعداد أخرى من الأطباق تحتوي على نفس الوسط الغذائي بقطع صغيرة تؤخذ من

A HISTOLOGICAL STUDY ON DATE PALMS TO DETERMINE THE TIME OF SPATHE-INFECTION BY *MAUGINIELLA SCAETTAE* CAV.

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ABSTRACT

During the periods 1978-79 and 1979-80, a histological study on date palms in Basrah province was conducted to determine the time of spathe infection by *Mauginiella scaettae*.About 150 date palms brought from different regions were dissected and all of their spathes were subjected to laboratory examination. Results showed that the fungus existed in the tissues of leaf bases during the months of dissection but did not attack the spathes till the end of January.

المقدمة:

يصاب نخيل التمر في العراق بامراض كثيرة من أهمها مرض خياس طلع النخيل الذي يسببه الفطر *Mauginiella scaettae* . يهاجم هذا الفطر الطلع بأطوار نموها الأولى ويقضي عليها قبل أو بعد خروجها من غلافها وفي كثير من الأحيان يكون المرض وبائياً ويسبب خسارة كبيرة في الإنتاج، لذا فقد درس المرض في العراق من جوانب شتى منها دراسات حيوية للتعرف على خصائص مسبب المرض (10, 9, 7, 6, 1) ومنها دراسات وقائية تخص مقاومته والحد من انتشاره بواسطة المبيدات الفطرية (8, 5, 4, 3, 2). اشتدت الإصابة بهذا المرض في محافظة البصرة عام 1977 بحيث قضي على معظم طلع النخيل وبالأخص نخيل بساتين قضاء الفاو وكان المرض شديداً على جميع النخيل بما فيها المكافح بالمبيدات وغير المكافح مما أثار الشكوك بفعالية المبيدات المستعملة وكذلك بمواعيد المكافحة لذا فقد نفذ هذا البحث في محاولة لتحديد الوقت الذي يهاجم فيه الفطر الطلع وبالتالي تحديد الوقت المناسب لإجراء عمليات المكافحة بالمبيدات.

الطرق والمواد المستعملة:

لغرض تحديد الوقت الذي يبدأ الفطر *M. scaettae* بمهاجمة طلع النخيل في

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دراسة تشريحية على نخيل التمر في محافظة البصرة لتحديد الوقت الذي يهاجم فيه الفطر *Mauginiella scaettae* Cav. الطلع

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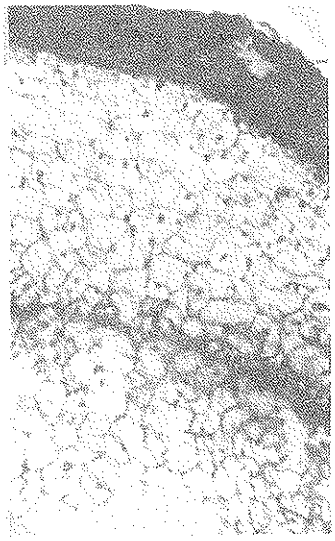
الخلاصة

نفذت خلال العامين 78-1979 و79-1980 بعض الدراسات التشريحية على نخيل التمر في محافظة البصرة لغرض تحديد الوقت الذي يهاجم فيه الفطر *Mauginiella scaettae* طلع النخيل وقد استندت هذه الدراسة على تشريح حوالي 150 نخلة جلبت من مناطق مختلفة من المحافظه وفحص جميع الطلع المستخرج منها في المختبر للتحري عن الفطر المسبب.

وقد أظهرت نتائج هذه الدراسة بان الفطر موجود في قواعد السعف والليف على شكل نمو خضري خلال أشهر التشريح إلا أنه لم يهاجم الطلع إلا في نهاية شهر كانون الثاني رغم وجودها خلال شهري تشرين الثاني وكانون الأول.

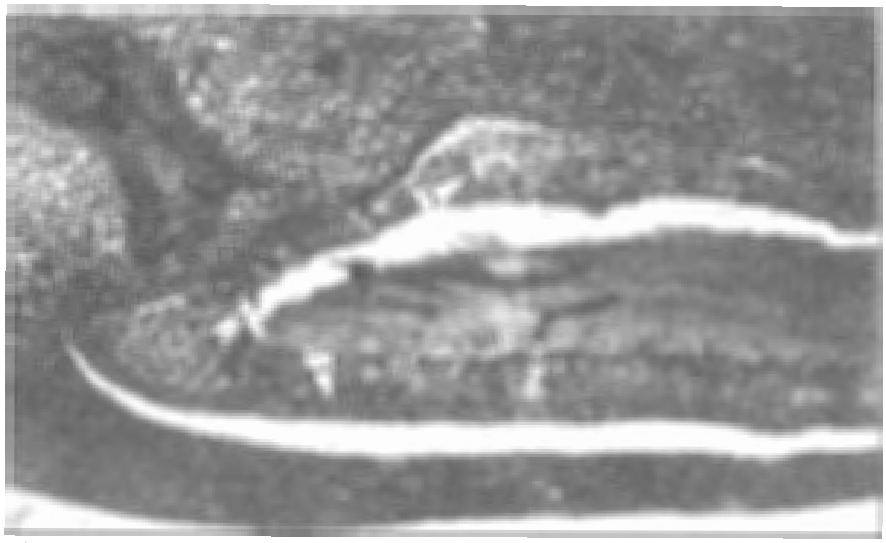


(15) مقطع طولي للثمرة يظهر فيه السويداء الخلوي للخارج وشبه الخلوية الى الداخل قوة التكبير (100) مرة.

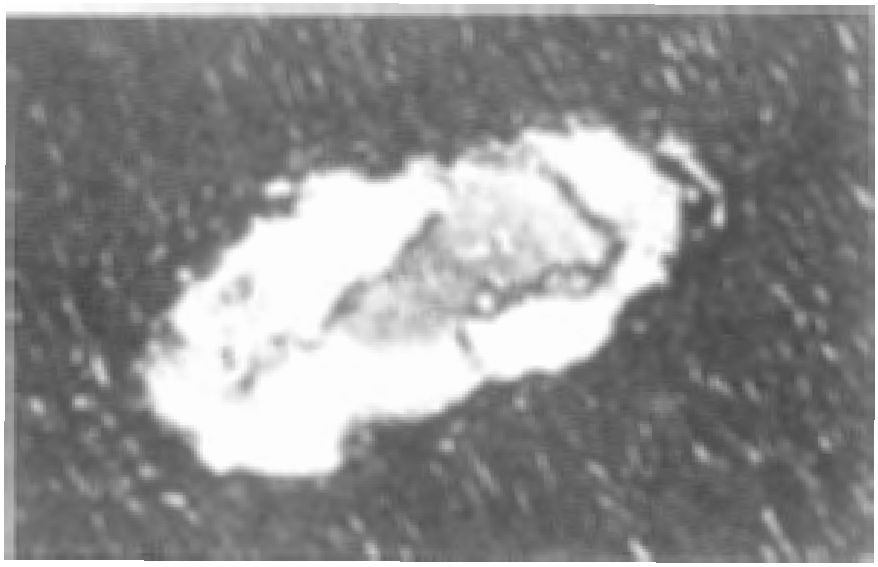
(16) مقطع طولي للبويض بعد (7) أيام من التلقيح يظهر فيه نوى السويداء (1) أغلفة البويض (2) و(3) النقير (4) التكبير (150) مرة.

(13) مقطع طولي للزهرة تظهر فيه الخلايا الصخرية (1) والتنينية (2) قوة التكبير (100) مرة.

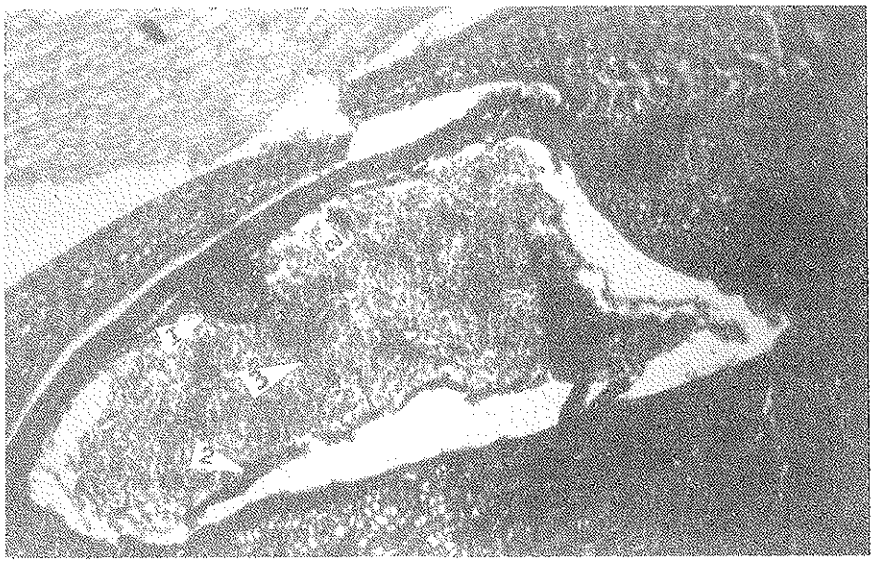
(14) مقطع طولي للمبيض بعد 24ساعة من التلقيح يشاهد فيه قناة المرور (1) البلورات الابرية (2) خلايا التنين (3) التكبير (150) مرة.



صورة (11) مقطع طولي للثمرة بعد (40) يوم يبين 3-5 صفوف من السويداء الخلوي المحيطي (1) (10) صفوف من السويداء الخلوي المحبطي (1) (10) صفوف من السويداء لمنطقة النقير التكبير (100) مرة.

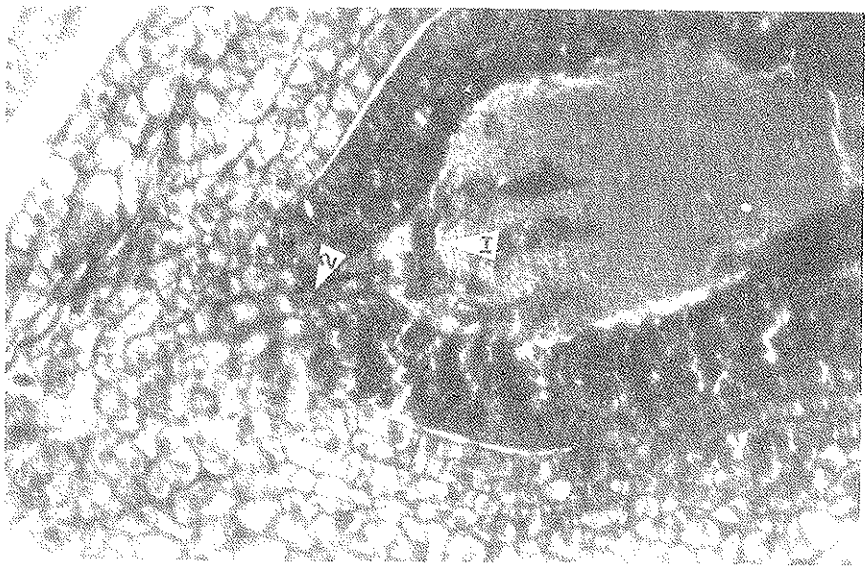


صورة (12) مقطع طولي لبويض جاهض بعد 50 يوما من التلقيح يشاهد فيه نوى السويداء المتجمعة حول الحويصلات (1) وانخراط السليتوبلازم (2) التكبير 20 مرة.

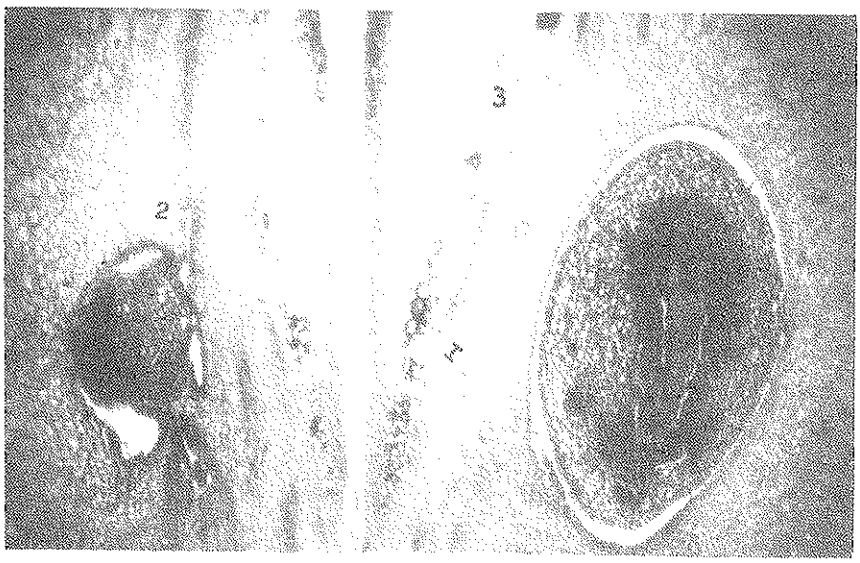


صورة (9) مقطع طولي للثمرة بعد (20) يوم يلاحظ فيه الجنين الكروي (1) السويداء المحيطي شبه الخلوي (2) نوى السويداء (3) التكبير (125) مرة.

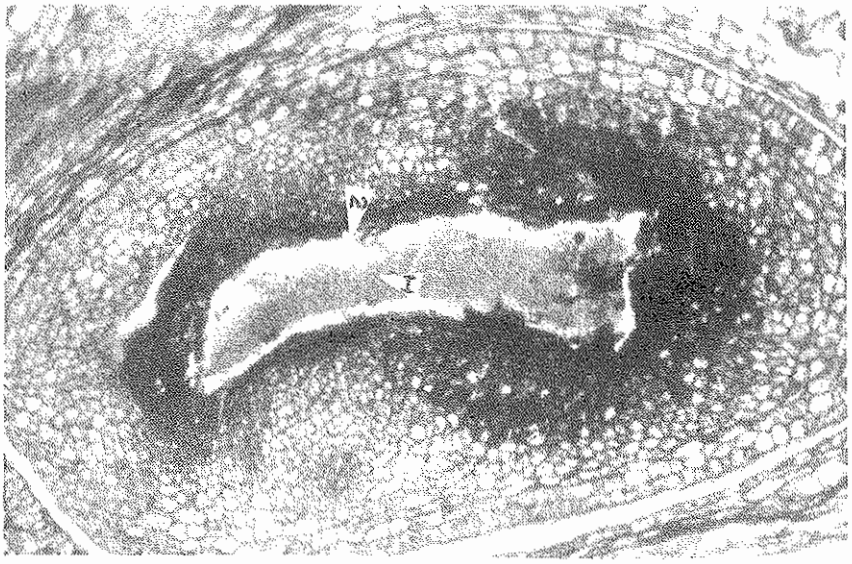
صورة (10) مقطع طولي للثمرة بعد (30) يوم يوضح السويداء الخلوي (1) النووي (2) طيات وتموجات السويداء (3) التكبير (48) مرة.



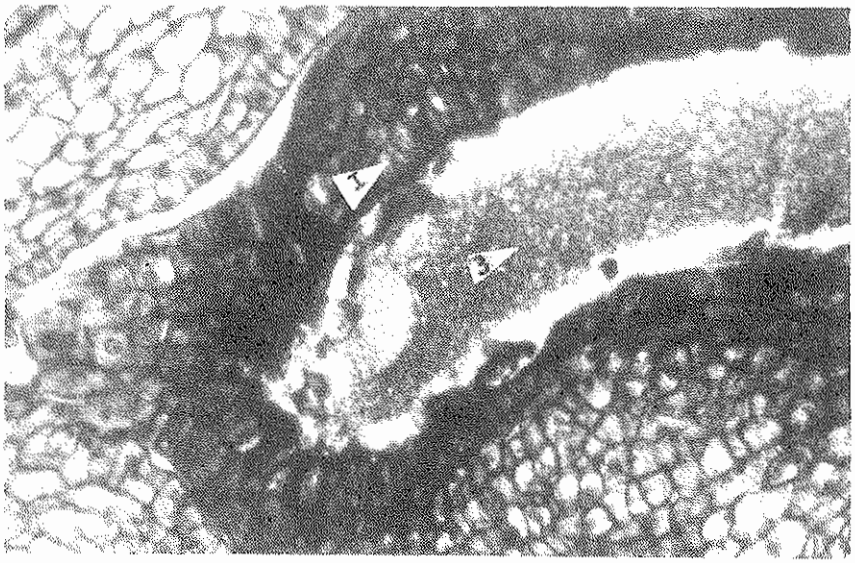
صورة (7) مقطع طولي للبويض بعد (5) أيام من التلقيح بين الجنين (1) النقير (2) قوة التكبير (410) مرة.



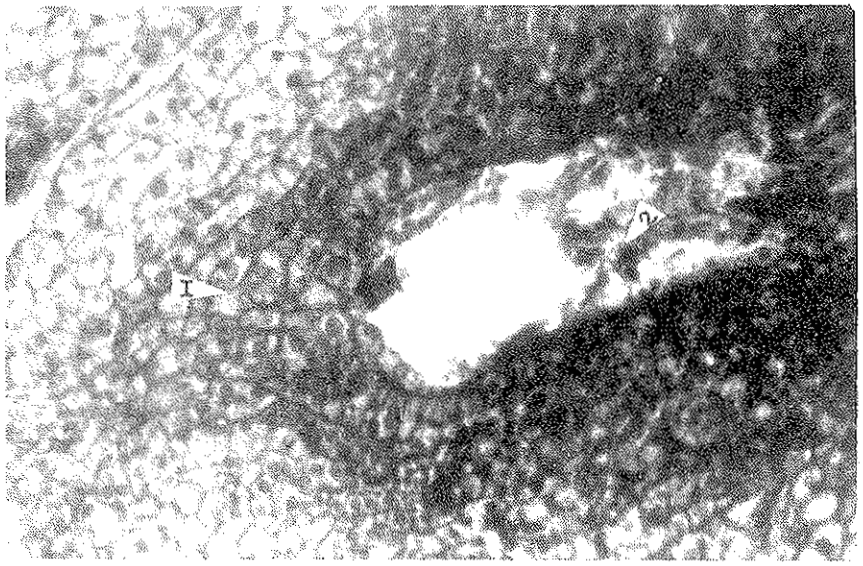
صورة (8) مقطع طولي لكربلتين بعد سبعة أيام من التلقيح يظهر فيه الخلايا التنينية (1) بدأ اضمحلال خلايا المرور (2) نسيج الكربلة (3) التكبير (65) مرة.



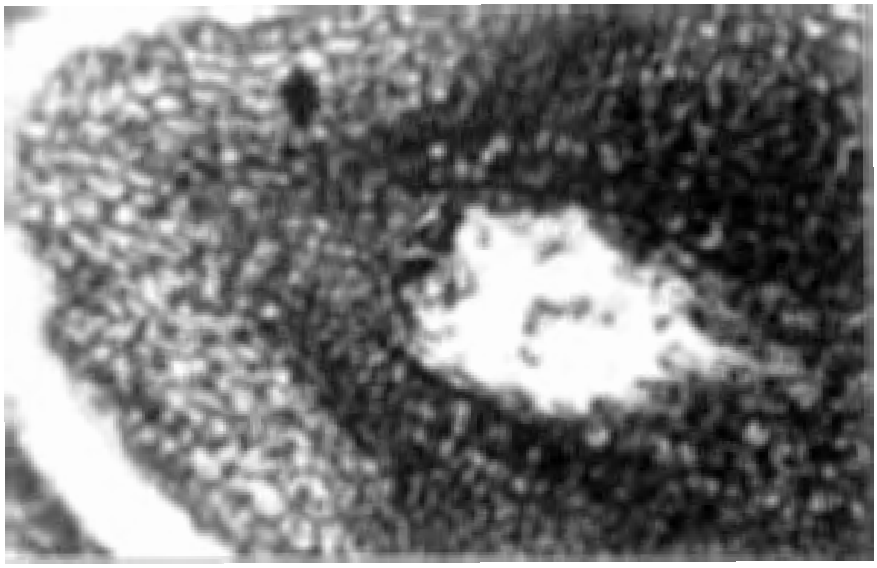
صورة (5) مقطع طولي للبويض بعد (4) أيام من التلقيح يظهر فيه السايتوبلازم الكثيف وإنتشار نوى السويداء (1) تحطم الأغلفة (2) التكبير (160) مرة.



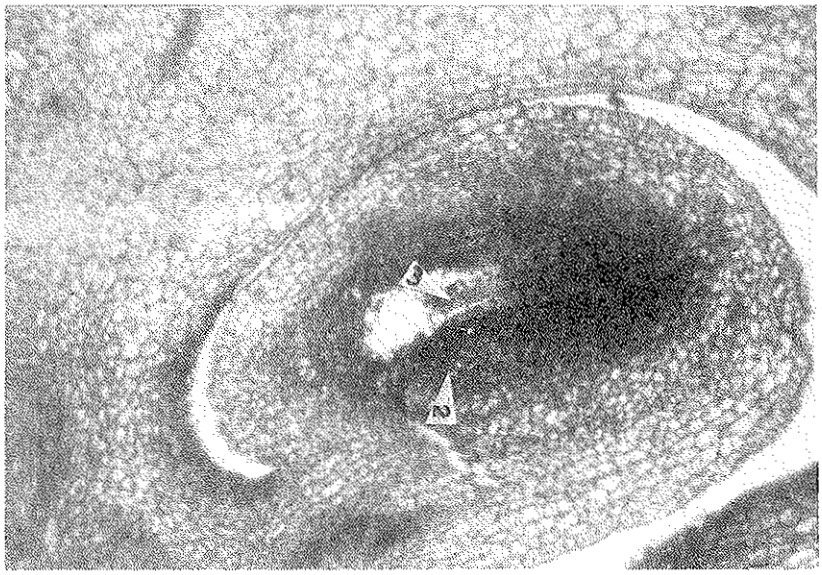
صورة (6) مقطع طولي للبويض بعد (4) أيام من التلقيح يبين الغلاف الداخلي (1) موقع الجنين (2) سايتوبلازم كثيف وإنتشار نوى السويداء التكبير (410) مرة.



صورة (3) مقطع طولي للبويض بعد يومين من التلقيح يبين النمو التاجي لخلايا الأغلفة (1) الخلايا السمتية (2) التكبير (380) مرة.



صورة (4) مقطع طولي للبويض بعد يومين يوضح خلية البيضة المخصبة (1) الخلايا المساعدة (2) اضمحلال بشرة الجويزاء (3) التكبير (300) مرة.



صورة (1) مقطع طولي للبويض بعد (24) ساعة من التلقيح يوضح فيه الأغلفة (1) و(2) نمو الخلايا السمتية (3) التكبير (160) مرة.

صورة (2) مقطع طولي للبويض بعد (24) ساعة من التلقيح يوضح النواتين القطبيتين (1) خلية البيضة (2) الخلايا السمتية (3) التكبير (300) مرة.

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13. Turrel, F.M., *et al* (1940): Structural and chemical factors in relation to fungus spoilage of date. Date Growers' Inst. Rept. 17:5-11.

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(17) العطار، عدنان والعلاف، سهيلة والمختار، كواكب (1982) التحضيرات المجهرية/الجمهورية العراقية/وزارة التعليم العالي والبحث العلمي .

(18) عبد الله، نوال (1977) بعض التغييرات الكيميائية والفيزيائية والنسيجية ونشاط بعض الانزيمات ودراسة ظاهرة ابي خشيم في تمر الحلاوي . رسالة ماجستير بكلية العلوم/جامعة بغداد .

(19) السعداوي، ابراهيم شعبان، والعاني، بدري عويد وبنيامين، زنفرود داود (1975) دراسات مورفولوجية وتشريحية وخلوية على ثمرة النخيل للسلالة زهدي، المؤتمر الدولي للتمور والنخيل/بغداد .

بالسويداء غير المنتظم، إن هذه الظاهرة وجدت في بعض الاجناس التابعة لـ 32 عائلة من مغطاة البذور (5) كذلك سجلت في بعض الاجناس التابعة لقبيلتين من القبائل الثمانية للعائلة النخيلية حسب نظام (3) حيث ذكر (10) وجود هذه الظاهرة في أغلب اجناس قبيلتي Areceae و Sabaleaeولم تذكر في قبيلة الـ Phoeniceae والتي تعود لها نخلة التمر حيث تسجل هذه الظاهرة ولأول مرة في هذه القبيلة. أما بعد 50 يوماً لم يحصل تغير كبير في حجم الكيس سوى التحول التدريجي لجميع نوى السويداء الى خلايا (صورة 15) وبعد 60 يوماً بدأت جدران خلايا السويداء بالسمك كذلك تحول الجنين من الشكل الكروي الى الاسطواني. ويذكر (14) إن الفترة التي يستغرقها السويداء منذ البدء بالانقسام الى أن ينتهي من مرحلة التطور حوالي 60 يوماً بينما أشار (9) إلى تحول جميع النوى الى خلايا بعد 60 يوماً وتبدأ جدران الخلايا بالتسمك بعد 60 يوماً.

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بعد (20) يوماً لوحظ زيادة في حجم الكيس الجنيني حيث نما على حساب خلايا الأغلفة وخلايا منطقة النقير حيث بلغ معدل طوله وعرضه 1,2 و 0,4ملم وتميزت بعض الخلايا البرنكيمية الواقعة تحت خلايا البشرة لغلاف الكربلة الخارجي الى خلايا سكليريدية. أما الجنين فقد شوهد في الثلث النقيري للكيس الجنيني وفي الجانب المقابل للرفاية وهو كروي الشكل حيث بلغ قطره 0,080 ملم أما السويداء فقد تميز النوى المحيطة له عن غيرها استعداداً لتكربن خلايا بينما ملئت بقية النوى الحرة وسط الكيس (صورة 9) وهذه الملاحظات تأتي منسجمة مع ما أورده (9) حيث أشار الى الزيادة التي تطرأ على الكيس الجنيني في خلال الاسبوع الثالث والرابع في الوقت الذي لا يزال السويداء في الحالة النووية الحرة في وسط الكيس الجنيني. بعد 25 يوم استمر الكيس الجنيني في الزيادة حيث بلغ معدل طوله وعرضه 2,2 و 0,6ملم وتكون صف واحد من السويداء الخلوي في الجهة المقابلة للرفاية و4-5 صفوف في جهة الكلازا وتجمع عدد كبير من نوى السويداء وسط الكيس. أما بعد 35 يوماً (صورة 10) فقد طرأت زيادة بسيطة على طول وعرض الكيس حيث بلغ معدل طوله وعرضه 2,5 و 0,8ملم ولوحظ تكون 2-3صفوف من السويداء الخلوي في الجهة المقابلة للرفاية حيث تميزت خلايا الصف الوسطي بنموها القطري وكبر فجواتها بينما تكون 8-12 صف من الخلايا في الثلث الكلازي ويقل عدد صفوف هذه الخلايا تدريجياً كلما اقتربت من الثلث النقيري لجهة الرفاية (صورة 10) أما خلايا الأغلفة المنضغطة فقد بلغ معدل صفوفها 9. وهذه الملاحظات مخالفة نسبياً لما لاحظه (9) وذلك بتكون صف واحد من السويداء الخلوي بعد 48 يوماً وثلاث صفوف بعد 56 يوماً. بعد 40 يوماً حصلت زيادة كبيرة في حجم الكيس الجنيني ولوحظ تكون 3-5 صفوف من السويداء الخلوي المحيطي عدا منطقتي النقير والكلازا حيث بلغ معدل عدد الصفوف 10 (صورة 11). إن عدم إنتظام أو تساوي النشاط المحيطي لنووي السويداء في التحول إلى خلايا خاصة في المراحل الاخيرة من التطور جعلت من سطحه الداخلي يظهر بشكل متعرج وذو طيات أو أخاديد (صورة 10 و11). إن اي درجة من درجات عدم الانتظام أو تساوي تظهر على سطح السويداء وفي مراحله الاخيرة تدعى

الداخلي (صورة 6). بعد خمسة أيام لم يطرأ تغير عن المرحلة السابقة سوى زيادة في عدد خلايا الجنين حيث بلغ (5-7) وهو مستمر بدورانه (صورة 7)، ويذكر (14) بأن الجنين مستمر بدورانه ويصبح مالئاً ثلث طول الكيس الجنيني في نهاية الاسبوع الأول بعد التلقيح. كذلك شوهد تميز وتخصص عدد من الخلايا البرنكيمية للكربلة والواقعة عند قاعدة القلم إلى خلايا سكليريدية (صخرية) (صورة 13) وتكون (1-3) صفوف من الخلايا التنينية الصغيرة تحت بشرة نسيج الكربلة وزيادة في عدد خلايا التانينيه المنتشرة في خلايا النسيج ذاته وبدأ ضمور قناة المرور (صورة 8) وهذا يتفق مع ما أوضحته الدراسة (2) في مرحلة الحبابوك بخصوص خلايا التنين ومع ما ذكره كل من (18,13) بخصوص الخلايا السكليريدية.

عند دراسة القطاعات المتتالية للكرابل الثلاث للزهرة الواحدة لوحظ أن كل كيس جنيني داخل كل كربلة ينمو ويتطور ويصل مرحلة الثمان نوى ومستعد للاخصاب ولم تلاحظ أي حالة إجهاض قبل ذلك (صورة 16) ولكن لوحظ بعد اليوم السابع من التلقيح أن المبايض الجاهضة تظهر ضمور في عدد الخلايا ذات السايتوبلازم الكثيف في أغلفة البويض وبطيء في نمو خلايا انسجة الكربلة وهذا يتفق مع ما وجده (9) بأن البويضات الثلاث كل واحدة في كربلة تظهر نشاط إنقسامي فعال وتصل في نموها إلى كيس جنيني ناضج مما تعطي مؤشرات أن البويضات الثلاثة مستعدة للاخصاب وتكوين البذور كذلك لم يلاحظ عملية إجهاض الا بعد اليوم السابع لقد أظهرت الدراسة إن بعض حالات الاجهاض قد لوحظت بعد 50 يوماً من التلقيح حيث شوهد تكتل نوى السويداء للوبيض الجاهض حول الحويصلات السايتوبلازمية داخل الكيس الجنيني (صورة 20) بينما ذكر (9) ان حبوب اللقاح لسلالات مختلفة لها تأثير على سرعة الاجهاض حيث وجد أن حبوب لقاح لسلالة Boyer 11 تسبب إجهاض وتساقط كربلتين بعد أسابيع قليلة من التلقيح بينما حبوب لقاح سلالة Fard 4 تسبب إجهاض وتساقط كربلتين بعد تسعة أسابيع من التلقيح ويعزي ذلك إلى أن حبوب اللقاح من ذكور مختلفة تضيف هرمونات تختلف في شدة تأثيرها على إظهار المنافسة بين الكرابل الثلاث وبالتالي حدوث الاجهاض.

الى ذلك كل من (14 و15) وأوضح كل من (9و2) إن نسيج الكربلة يتميز الى ثلاث طبقات الخارجية وتشمل صفاً واحداً من خلايا البشرة وصفين أو أكثر من خلايا تحت البشرة، ثم طبقة الغلاف الوسطي والمتميزّة الى جزئين خارجي وداخلي وتفصل بينهما خلايا حلقة التانين وتنتشر في الجزء الداخلي لهذه الطبقة خلايا كبيرة نسبياً تحوي على بلورات ابرية، بينما (لاحظ 19) ان البلورات الموجودة في سلالة الحلاوي هي من النوع النجمي أو الوردي .

بعد يومين من التلقيح لم يطرأ تغير على خلايا أغلفة البويضات ونسيج الكرابل ولكن لوحظ في الكيس بدء نواة السويداء الأولية بالانقسام وتحطم الخلايا المساعدة وتكون سايتوبلازم كثيف حول خلية البيضة واضمحلال بشرة الجويزاء (صورة 4) مما يؤكد حدوث عملية الاخصاب في هذه الفترة، كذلك شوهد تميز قناة المرور لانبوب اللقاح ولوحظت الخلايا الطلائية الافرازية على جانبي القناة ابتداءاً من الميسم مروراً بأنسجة القلم القزمية وانسجة الكربلة وصولا لقاعدة البويض واستمرت في الظهور حتى اليوم السابع، (صورة 8 و14) .

وتأتي هذه الدراسة منسجمة مع وجده (4,1,8) حيث ذكروا ان افضل عملية تلقيح هو ما تم بين اليوم الثالث والرابع من إنشقاق القنوة كذلك أوضح (12) ان عملية التكييس ساعدت في التغلب على إنخفاض نسبة العقد في السلالات مبكرة الطلع كالخضراوي وتكاد تكون عديمة الأهمية في السلالات المتأخرة مثل الزهدي ودكلة نور بينما أوضح (11) ان عملية إنبات حبة اللقاح ونمو أنبوبة اللقاح وحدوث الاخصاب تستغرق أسبوعاً وقد تمتد إلى أسبوعين، وكذلك لاحظ (9) تأثير عملية الاخصاب بعد (7) أيام من التلقيح لازهار دكلة نور .

في اليوم الثالث والرابع لوحظ زيادة نسبية في عدد خلايا التنين وخلايا البلورات الأبرية وزيادة في معدل طول وعرض الكيس الجنيني حيث بلغ 0,65 ملم و0,10 ملم وامتلأ وسط الكيس الجنيني بسايتوبلازم كثيف الذي انتشرت خلاله عدد من نوى السويداء (صورة 6) كذلك لوحظ الجنين المكون من (3-2) خلايا والمطمور بسايتوبلازم كثيف جداً وبدء تحطم خلايا الغلاف

والانكاز والتشريب والطمر بشمع البارافين مع بعض التغيرات بزيادة الفترات الزمنية لكافة العمليات؛ عملت قطاعات طولية متسلسلة بسمك (7-13) مايكرون باستخدام المشراح الدوار وتم تحضير أكثر من (500) شريحة. صبغت القطاعات بالسفرانين والاخضر الثابت، حملت ببلسم كندا ثم فحصت مجهرياً وتم أخذ القياسات باستخدام المجهر العارض نوع Projectina وتم تصوير بعض القطاعات.

النتائج والمناقشة

لدى فحص الشرائح المحضرة بعد 24 ساعة من التلقيح وحتى 60يوماً لوحظ ما يلي: ظهر البويض بعد 24 ساعة من التلقيح أي بعد 48 ساعة من إنشقاق القنوة بين مقلوب إلى شبه مقلوب ومحاط بغلافين خارجي وداخلي. يتألف الداخلي من (2-3) صفوف من الخلايا قرب النقير وتزداد عدد صفوف هذه الخلايا حتى تصل إلى (5-6) صفوف في الطرف المقابل (الكلازي) وتكون خلايا هذا الغلاف ذات سايتوبلازم كثيف، أما الغلاف الخارجي فيتألف هو الآخر من (5-6) صفوف قرب النقير وتصل إلى (10-12) صف في الطرف الكلازي (صورة 1 و2) أما خلايا نسيج الجويزاء فهي من النوع الرهيف أو الرقيق حيث لم يبقَ منها سوى بشرتها التي تغلف صف واحد من الخلايا المفككة. وهذا مطابق لما ذكره (9) من حيث الأغلفة ونسيج الجويزاء لسلالة دكلة نور. بلغ معدل طول الكيس الجنيني الكميتوفايتي 0,14 ملم وبداخله كل من خلية البيضة والخليتين المساعدتين عند الطرف النقيري والنواتين القطبيتين وسط الكيس، والخلايا السمتية في الطرف المقابل للنقير والتي أظهرت نشاط انقسامي ونمو سريع الى داخل الكيس (صورة 2 و3) اي أن الكيس من النوع العادي ومحاط من جهة النقير بخلايا الأغلفة والتي تميزت بنمو تاجي (صورة 3). بلغ معدل صفوف خلايا نسيج الكربلة في هذه المرحلة (20) صفاً من الخلايا البرنكيمية ذات الجدران الرقيقة والتي انتشرت خلالها بعض الخلايا والحجيرات التنينية وخلايا تحوي على بلورات ابرية لا اوكزلات الكلسيوم خاصة في الجزء العلوي من الكربلة قرب قاعدة الميسم (صورة 14) حيث أشار

والتسميد والحراثة وطرق اكثارها والتشذيب والتلقيح وخف الثمار والتدلية والتكميم وطرق الجني والآفات التي تصيبها وأصنافها ومنتجاتها وصناعتها والقيمة الغذائية وإعدادها للتسويق وغيرها. إلا أن الدراسات حول النمو وتطور الكيس الجنيني والجنين والسويداء وعلاقته بموعد التلقيح وانشقاق القنوة تكاد تكون معدومة وإن وجدت فهي دراسات غير كاملة، لذا شرع في هذا البحث والذي يمكن إعتباره أول دراسة في هذا المجال. لقد اختيرت السلالة الزراعية خضراوي لهذه الدراسة وذلك لجودتها وأهميتها التسويقية وقلة الدراسات المتعلقة بها أولا (2) وجودة الياف سعفها من الناحية المظهرية لصناعة الورق ثانياً (16).

المواد وطريقة العمل

تم اختيار شجرتين من نخيل تمر الخضراوي لغرض الدراسة حيث اجريت عملية تكييس الطلع الانثوي بأكياس من القماش قبل تشققها ثم ثبتت عليها مواعيد التشقق، أزيلت الطلعات المبكرة والطلعات المتأخرة واختيرت أربعة طلعات بأربعة إتجاهات من كل شجرة، نزعت القنوة المنشقة عن اغريضها وتم تلقيح كافة الازهار المحمولة على الشماريخ بعد 24 ساعة من إنشقاق القنوة (لقحت بين الساعة العاشرة والحادية عشر صباحاً) بلقاح فحل الغنامي الاخضر وذلك باستخدام فرشاة ناعمة بعد غمسها عدة مرات بغبار الطلع وامرارها على مياسم الازهار ثم أعيد تغليف كافة الاغاريض. حضر غبار الطلع الذكري بإزالة القنوة عن اغريضها وتجزئة الأغريض الى عدد من الشماريخ ووضعت على ورق جاف داخل المختبر ولمدة (5) أيام لتجفيفها، بعد الجفاف تم نشر كافة الشماريخ والحصول على غبار الطلع الذي استخدم في عملية التلقيح.

جمعت عينات من الازهار الملقحة (شمراخ واحد من كل طلعة) وعلى فترات زمنية من 1-15 يوم ثم بعد 60,50,40,35,30,25,20يوماً حفظت وثبتت العينات بمحلول فورملين، حامض الخليك، 70% كحول اثيلي بنسبة 18:1:1 حجماً. استخدمت الطريقة المرصوفة من قبل (17,7) في غسل العينات

some of them contain tennin and raphides crystals. Fertilization takes place after 48 hours of pollination, indicated by the formation of dense cytoplasm around the fertilized egg, disintegration of nuclear tissue & synergids cells, also the appearance of pollen tube canal.

Five days after pollination the embryos consist of 5-7 cells and still moving inside the sac, few endosperm nuclei were obsrved in the cytoplasm of the sac. The carpillary tissue at the base of style differentiate into sclereids, and the pollen tube canal begin to diminish. Abortion was observed to occure in two out of three carples 7 days after pollination. Twenty days after pollination, a spherical-shaped embryo was noticed at micropylar 1/3 of the anit-raphae side, while the peripheral free endosperm nuclei were differentiated to form cells. After 25 days one layer of endosperm cells was formed at the anti-raphae side and 4-5 layers at the chalazal region, at this time only 8-9 layers of integuments remain. After 30 days three layers of endosperm cells were formed at anti-ra-hae side and 1-2 layers of cell at the micropylar 1/3 of the anti-raphae side and 8-12 layers at the chalazal region. After 40 days, 2-5 layers of endosperm cells were formed at the raphae and anti-raphae side, while 8-12 layers at the micropylar and chalazal region.

Due to unequal and irregular peripheral activity of the endosperm cells during the late stage of its development, the endosperm cells shows undulation and folding, after 50 days gradual changes from spherical to cylindrical shaped of the embryo were observed and the whole endosperm became cellular, and ultimately after 60 days the endosperm wall became unevenly thick.

المقدمة :

من المعروف أن النخيل من أقدم الاشجار التي عرفتها ارض الرافدين حيث عرفها السومريون والبابليون ووجدت آثارها في بابل والتي يمتد عمرها الى حوالى 400 سنة قبل الميلاد، كما ورد ذكرها في الكتب السماوية المقدسة والأحاديث النبوية الشريفة وأمثال العرب وأشعارهم كما ذكرت في شريعة حمورابي. ويوجد في العراق قرابة (450) سلالة زراعية مختلفة (15,14). ونظراً لاهمية منتجات النخيل من التمور والسعف والألياف والعثوق وغيرها والتي تساهم بجزء كبير في الدخل القومي حيث تأتي صادراته بالدرجة الثانية بعد النفط، لذا فقد ظفرت في الحاضر كما حظيت في الماضي بعناية لا يستهان بها ودراسات لا بأس بها عن أصل النخيل وانتشارها وتأثير المناخ والتربة

المقابل للرفاية وهو كروي الشكل، أما نوى السويداء المحيطة فقد تميزت استعداد لتكوين خلايا. بعد 25 يوماً لوحظ تكون صف واحد من السويداء الخلوي في الجهة المقابلة للرفاية و(4-5) جهة الكلازا، أما خلايا أغلفة البويض فلم يبق منها سوى (8-9) صفوف. بعد (30) يوماً شوهد تكون ثلاث صفوف من السويداء الخلوي في الجهة المقابلة للرفاية و(1-2) صف من الخلايا في الثلث النقيري لجهة الرفاية و(8-12) صف في جهة الكلازا، أما بعد (40) يوماً فقد اكتمل تكون (3-5) صفوف من خلايا السويداء المحيطة عدا منطقة الكلازا والنقير حيث بلغ عدد الصفوف (8-12) صف، ونظراً لعدم إنتظام أو تساوي النشاط المحيطي لخلايا السويداء جعلت من سطحه الداخلي يظهر وبشكل متعرج أو غير منتظم. بعد (50) يوماً لوحظ التحول التدريجي في شكل الجنين الكروي الى بيضوي وتحول جميع نوى السويداء الى خلايا وأخيراً وبعد 60 يوماً تسمكت جدران خلايا السويداء وأصبح من الصعب قطع مقاطع جيدة.

STUDIES ON DEVELOPMENTAL ANATOMICAL CHANGES IN KHADRAWI DATE PALM EMBRYOS IN RELATION TO TIME OF POLLINATION AND CRACKS OF SPATH.

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ABSTRACT

Studies of permanent serial sections of flowers & fruits of date palm (*Phoenix dactylifera* L.) CV. Khadrawi showed the ovules after 24 hrs. of pollination (48 hrs from spathe cracks) appear to be anatropus to semi-anatropus, the nucellar tissue are of tenunucellate type and enclosed by two integument, the embryo-sac of polygonum type and the antipodule cell differentiate and grows rapidly inward, while the integumentary cells around the micropyle differentiated to crown-shaped.

The average alyers of carpillary tissues reach 20 layers of parenchyma cells,

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دراسة التطور الجنيني لازهار وثمار نخيل الخضراوي وعلاقته بوقت التلقيح وانشقاق القنوة

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الخلاصة

لدى دراسة التحضيرات الثابتة للشرائح المجهرية المتسلسلة لازهار وثمار نخيل التمر للسلالة الزراعية خضراوي بعد 24 ساعة من التلقيح وحتى 60 يوماً، تبين ما يلي:

ظهر البويض بعد 24 ساعة من التلقيح (بعد 48 ساعة من إنشقاق القنوة)، بين مقلوب الى شبه مقلوب ونسيج الجويزاء من النوع الرهيف ومحاط بغلافين الكيس الجنيني من النوع العادي غير أن خلاياه السمتية تميزت بنمو سريع الى داخل الكيس، بينما نمت خلايا الأغلفة حول النقير إلى الشكل التاجي. بلغ معدل صفوف خلايا نسيج الكربلة 20 صفاً من الخلايا البرنكيمية الحاوية على بعض الخلايا والحجيرات التنينية وبلورات ابرية. حدثت عملية الإخصاب بعد 48 ساعة من التلقيح حيث لوحظ تكون سايتوبلازم كثيف حول خلية البيضة المخصبة واضمحلال نسيج الجويزاء وتحطم الخلايا المساعدة ووضوح قناة المرور لانبوب اللقاح. بعد 5 أيام شوهد الجنين وهو مؤلف من 5-7خلايا ومستمر بدورانه داخل الكيس الجنيني بينما انتشر عدد من نوى السويداء في سايتو بلازم الكيس. بدأ تخصص بعض الخلايا البرنكيمية لنسيج الكربلة عند قاعدة القلم إلى خلايا صخرية (سكليريدية)، وبدأ اضمحلال قناة المرور لانبوب اللقاح. لوحظت حالات الاجهاض تحدث لكربلتين من الكرابل الثلاث للزهرة بعد اليوم السابع. بعد 20 يوماً لوحظ الجنين في الثلث النقيري

المحتويات

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مجلة نخلة التمر

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