

Evaluation of Eight Seedling Date Palm (*Phoenix dactylifera* L.) Males and Their Effects on Fruit Character of Three Female Cultivars

Abdullah S. Al-Ghamdi, G.M. Al-Hassan and M. Jahjah

*Horticulture Department, College of Agriculture and Food Sciences,
King Faisal University, P.O. Box 400, Al-Hassa 31982, Saudi Arabia*

ABSTRACT. Some morphological characters of eight seedling males grown in Al-Hassa were studied. Males varied considerably with respect to vegetative and reproductive characters. Pollen quality, percent germination and pollen tube length after six hours showed major differences. Pollen from the eight seedling males was used to pollinate three commercially important female cultivars, *i.e.* Khalas, Rizaiz and Shieshi. Fruitset, Fruit weight, flesh or pulp weight, fruit diameter, fruit length, moisture content, seed weight and seed length and diameter were recorded. Pollen source was found to affect fruit and seed characters and exhibited metaxenic effect depending on the female cultivar used and the character investigated. The influence of seedling males on fruit and seed characters showed within and between female variation.

The value of date palm in Saudi Arabia stems not only from its dietary contribution, or its economical importance but also from its environmental impact in a desert climate. Such varied and significant aspects of date palm in the Kingdom justify all the emphasis for improvement of its productivity and propagation. As the date palm is known to be a dioecious plant, both female and male plants have to be considered in evaluation programmes. Males, although most neglected in the Kingdom, play a major role in yield and quality enhancement of date fruits. This has been documented by several investigators since the early papers by Swingle (1928) and Nixon (1928a&b) in which the phenomenon of metaxenia in dates was reported. Such metaxenic effect was found to be reflected in time of maturity, weight, shape, size and chemical quality of date fruits and seeds (Whittlesey 1933, Ahmed and Ali 1960, Al-Delaimy and Ali 1969, El-Wakeel and Ibrahim 1969, Mahdi 1969, Mathews *et al.* 1975, Osman *et al.* 1974, and Ream 1976). Anon (1954) after conducting pollen studies has recommended that growers select male parent palms for quality as well as for quantity.

The emphasis attached to the selection of male date palms has prompted these series of studies that focus on seedling males grown in Al-Hassa region. The

objectives of the study were to evaluate male seedlings from a morphological, pollen quantity and quality and fruit quality aspects. Such an evaluation is expected to help in identifying superior males that may constitute the nucleus for collection, propagation and utilization of valuable male date palms. The existing practice of mixing pollen from different males to be used in pollinating female dates obscures the contribution of superior males and does not help in identifying worthwhile males for future use.

Materials and Methods

An established date palm orchard in Al-Hassa, Eastern Province, Saudi Arabia, was selected for this study. The orchard contained different known date cultivars as well as seedling males. Three commercial cultivars namely, Khalas, Rizaiz and Sheishi were chosen as the female palms. Three female trees from each cultivar were identified as three replications of each cultivar. Eight seedling males of unknown parentage were chosen and given serial numbers from one to eight for easy reference (M1-M8). The evaluation aspects of the study were carried out as follows:

Morphological Characters of Seedling Males

The number of leaves in each seedling male was counted. A one-year old leaf was removed from each male and its length, number and weight of leaflets, number, length, width and percent of leaf length occupied by spines were determined. Width of fiber, number and total weight of spathes on each male were recorded. Three spathes from each male were used to determine their length, breadth and percent dry weight.

Inflorescence or Fruit Bunch

The mean length of spikes or strands and the mean number of flowers per each strand were determined for each male. Observations were taken for the beginning and duration of the flowering period for each male.

Pollen Quantity and Germination

Spathes of each male were removed and the quantity of pollen was determined after shade-drying and shaking. Pollen germination after 30 min, one, two and six hrs was recorded using agar medium containing 15% sucrose. The length of pollen tubes was measured microscopically after six hours growth in petri dishes with agar medium.

Fruit and Seed Characters

About 250 mg of pollen from each male were applied to each female inflorescence or fruit bunch for pollination. Each inflorescence was bagged

separately before and after pollination to avoid contamination by foreign pollen. Eight inflorescences from each female palm were pollinated by pollen from the eight seedling males, each inflorescence received pollen from a different male. Percent fruitset and fruit characters such as fruit weight, flesh or pulp weight, percent fruit moisture and fruit shape were determined using an average of 25 fruits per female. The weight and shape of seeds were also obtained. Shape of fruit and seeds were determined by dividing length by width.

Results and Discussion

As a clear evidence of variability in the vegetative and reproductive parts of the eight date seedling males under study, Tables 1 and 2 show a wide range of leaf, spathe and spike morphological characters. Such variation could be useful in identifying the different seedling males and in tracing their parentage as it is not clear how these males originated. Information pertaining to parentage of seedling males coupled with their characteristics may aid in planning and directing breeding efforts to concentrate on favourable female and male combinations in crossing programmes (El-Sabrou 1979).

Table 3 shows the quantity of pollen obtained from each seedling male and the percent germination after different periods. Substantial differences exist among the seedling males with respect to the quantity of pollen produced and the rate at which pollen tubes grow. There seems to be no evident relationship between the quantity of pollen and its germination or pollen tube length after six hours. Mean percent fruitset affected by the individual males does not show significant variation as seen in Table 4 but percent fruitset of the female cultivar Rizaiz varied significantly with the different males used, males 7 and 2 giving the highest and lowest percentage respectively. Al-Delaimy and Ali (1969) indicated that different pollen may influence the amount of fruitset of 'Zehadi' date cultivar.

Weight of Khalas and Rizaiz fruits did not differ significantly with pollen source but Shieshi fruits showed significant variation depending on the pollen type (Table 5). Male 7 gave the highest while male 4 gave the lowest fruit weight with Shieshi female cultivar. Similar trend was shown by weight of fruit pulp or flesh and moisture content of fruit (Tables 6 and 7). The shape of fruits and weight of seeds were markedly affected by the pollen source when Khalas and Rizaiz were used as females but not Shieshi (Tables 8 and 9). Male 7 gave the highest value for length/width ratio for fruit shape of both Khalas and Rizaiz and male 1 gave the lowest value for both. Males 5 and male 2 resulted in the heaviest seeds of Khalas and Rizaiz while males 3 and 7 gave the lowest weights, respectively. The shape of seeds was affected significantly by pollen source when Rizaiz and Shieshi were used as females (Table 10). Males 2 and 3 gave the highest and males 5 and 4 gave the lowest ratios for seed shape of Rizaiz and Shieshi, respectively. Such data provide

Table 1. Morphological characters of eight seedling date males

	M1	M2	M3	M4	M5	M6	M7	M8
No. of leaves	83	140	84	121	101	73	93	60
Leaf length (cm)	322	357	316	352	417	340	405	349
No. of leaflets/leaf	172	193	178	141	200	169	175	170
Length of leaflet (cm)	54	58.5	4.6	58	54	69	48.5	62
Width of leaflet (cm)	4.5	3.5	4.5	4.7	4.5	5	4.8	4.3
No. of spines	18	12	8	14	13	18	28	14
Length of spine (cm)	9.5	7	8	8	14	10.5	9	11.5
Width of spine (mm)	7	5	3.5	8	6	4	7	5.5
% Spine area/leaf	16.3	14	11.4	17	11	17.6	12.8	20
Width of fibre (cm)	30	40	38	38	32	50	40	34
No. of spathes	23	18	19	15	22	17	17	10
Weight of spathes (kg)	64.5	47.2	34.3	30.6	40.8	36.7	44.6	18.9
Beginning of flowering	15/3/86	15/3/86	15/3/86	18/3/86	24/3/86	24/3/86	23/3/86	25/3/86
Duration period of flowering (days)	35	46	44	43	42	38	39	36

Table 2. Some spathe characters of eight seedling date males

	M1	M2	M3	M4	M5	M6	M7	M8
Length of spathe (cm)	98.3 b	118 c	67.7 a	80.3 a	109 bc	106.3 bc	97.8 b	78.3 a
Breadth of spathe (cm)	16.7 bc	14.7 b	15 b	16.3 b	13.2 b	10 a	15.3 bc	17.2 c
% dry weight spathe	26.6 a	31.5 abc	27.2 ab	31.2 ab	34.3 bc	36.2 c	34.9 bc	27.3 a
Mean length of spikes (cm)	29.9 c	30.3 c	19.9 a	30.2 c	30.4 c	22.5 ab	25.6 bc	24.2 ab
Mean no. of flowers/spikes	109 d	64 bc	60.7 b	77.3 c	66.3 b	40.3 a	58.7 b	53.0 ab

Values (within rows) having the same letters are not significantly different at 5% level, by student - Newman - Keuls range test.

some evidence that pollen source exerted pronounced effects on fruit and seed characters and substantiate the existence of metaxenia in date grown in Saudi Arabia. However, it is worth mentioning that the influence of male pollen on fruit and seed attributes vary depending on the particular female cultivar used. Thus, there seems to be what could be termed interaction between the pollen source and the female receiving it. However, there are some indications that certain males tend to maintain the same level of influence with the different females with respect to specific characters. Figure 1 illustrates the comparative effects on the three female cultivars. Males 1, 2, 6 and 8 maintained the same ranking positions with respect to their effect on fruit weight of two date females. This may mean that it is not necessary that a particular male may have stimulatory effect on all kinds of females or show the same level of metaxenic influence on all fruit and seed characters. If this is proved to be of common occurrence then evaluation of males for their specific influence assumes greater importance.

The implication of character-specific impact of males within and between different female cultivars is not only to put more emphasis on male evaluation programmes but also to consider the effect of different mixtures of pollen and their synergistic effect, if any, on fruit and seed characters. The random mixing of available pollen for date pollination is a practice that needs reconsideration.

Table 3. Some pollen parameters of eight seedling date males

Males	Total amount of pollen (g)	Percent pollen germination after:				Pollen tube length after
		30 (min)	one (hr)	two (hr)	six (hr)	six hours (microns)
M1	58.0 c	59	78	87	97	209.9
M2	53.2 b	4	11	17	61	140.3
M3	39.7 b	14	28	40	95	202.9
M4	42.9 b	13	43	52	74	197.6
M5	46.1 b	17	24	45	76	130.8
M6	15.7 a	10	12	86	96	194.9
M7	46.0 b	37	62	66	94	–
M8	46.7 b	14	24	46	94	–

Values having the same letter are not significantly different at 5% level

Table 4. Percent fruitset of three female date cultivars as influenced by pollen from different seedling date males

Males	Females			Mean
	Khalas	Rizaiz	Shieshi	
M1	55.03 a	81.66 ab	60.00 a	65.56 a
M2	49.20 a	53.80 c	62.33 a	55.11 a
M3	52.97 a	71.23 ab	61.27 a	61.82 a
M4	61.40 a	66.43 bc	63.37 a	63.73 a
M5	48.03 a	70.43 ab	60.47 a	59.64 a
M6	47.07 a	67.10 abc	57.77 a	57.31 a
M7	55.13 a	82.07 a	59.50 a	63.57 a
M8	50.83 a	72.27 ab	62.70 a	61.93 a

Values (within columns) having the same letter are not significantly different at 5% level

Table 5. Weight of fruits (g) from three female date cultivars as influenced by different seedling date males

Males	Females			Mean
	Khalas	Rizaiz	Shieshi	
M1	9.85 a	8.73 a	11.32 ab	9.97 ab
M2	10.05 a	9.61 a	11.14 ab	10.27 a
M3	9.04 a	8.80 a	10.24 b	9.36 ab
M4	9.50 a	8.99 a	6.09 c	8.19 b
M5	9.78 a	8.45 a	12.20 ab	10.14 a
M6	10.03 a	8.82 a	12.60 ab	10.48 a
M7	9.26 a	8.18 a	13.36 a	10.27 a
M8	9.98 a	8.97 a	9.64 b	9.53 ab

Values (within columns) having the same letter are not significantly different at 5% level

Table 6. Weight of fruit pulp (g) of three female date cultivars as influenced by different seedling date males

Males	Females			Mean
	Khalas	Rizaiz	Shieshi	
M1	8.90 a	7.97 a	10.56 bcd	9.14 a
M2	9.21 a	8.72 a	10.46 bcd	9.46 a
M3	8.38 a	8.05 a	9.58 bc	8.67 a
M4	8.58 a	8.22 a	5.39 a	7.40 a
M5	8.75 a	7.71 a	11.48 bcd	9.31 a
M6	9.20 a	8.09 a	11.80 cd	9.70 a
M7	8.50 a	7.54 a	12.62 d	9.55 a
M8	9.10 a	8.24 a	8.92 b	8.75 a

Values (within columns) having the same letter are not significantly different at 5% level

Table 7. Percent moisture of fruits from three female date cultivars as influenced by different seedling date males

Males	Females			Mean
	Khalas	Rizaiz	Shieshi	
M1	28.9 a	29.1 a	24.67 c	27.56 a
M2	24.8 a	30.3 a	17.6 a	24.23 a
M3	25.6 a	29.2 a	24.0 c	26.27 a
M4	22.0 a	32.4 a	18.6 ab	24.33 a
M5	27.2 a	27.2 a	25.8 c	26.73 a
M6	26.0 a	30.5 a	27.2 c	27.90 a
M7	24.3 a	26.9 a	23.3 bc	24.83 a
M8	23.9 a	27.1 a	23.3 bc	24.77 a

Values (within columns) having the same letter are not significantly different at 5% level

Table 8. Shape of fruits of three female date cultivars as influenced by pollen from different seedling date males

Males	Females			Mean
	Khalas	Rizaiz	Shieshi	
M1	1.67 b	1.41 b	1.62 a	1.56 a
M2	1.67 b	1.43 ab	1.60 a	1.58 a
M3	1.72 ab	1.47 ab	1.58 a	1.59 a
M4	1.72 ab	1.48 ab	1.44 a	1.55 a
M5	1.73 ab	1.48 ab	1.49 a	1.57 a
M6	1.69 ab	1.50 ab	1.53 a	1.57 a
M7	1.81 a	1.53 a	1.59 a	1.64 a
M8	1.69 ab	1.45 ab	1.57 a	1.51 a

Values (within columns) having the same letter are not significantly different at 5% level

Table 9. Weight of seeds (g) as influenced by different seedling date males

Males	Females			Mean
	Khalas	Rizaiz	Shieshi	
M1	0.95 bc	0.76 b	0.75 a	0.82 a
M2	0.84 abc	0.89 c	0.68 a	0.80 a
M3	0.66 a	0.75 ab	0.65 a	0.69 a
M4	0.92 bc	0.77 b	0.70 a	0.80 a
M5	1.03 c	0.74 ab	0.72 a	0.83 a
M6	0.82 ab	0.73 ab	0.80 a	0.78 a
M7	0.76 ab	0.65 a	0.73 a	0.71 a
M8	0.88 bc	0.73 ab	0.73 a	0.78 a

Values (within columns) having the same letter are not significantly different at 5% level

Table 10. Shape of seeds as influenced by different seedling date males

Males	Females			Mean
	Khalas	Rizaiz	Shieshi	
M1	3.20 a	2.57 ab	3.00 a	2.92 a
M2	3.12 a	2.64 a	3.03 a	2.93 a
M3	3.06 a	2.43 ab	3.16 a	2.88 a
M4	3.17 a	2.53 ab	2.51 a	2.74 a
M5	3.21 a	2.37 b	2.96 a	2.85 a
M6	3.13 a	2.49 ab	2.89 a	2.84 a
M7	3.18 a	2.48 a	3.15 a	2.94 a
M8	3.24 a	2.45 ab	2.85 a	2.85 a

Values (within columns) having the same letter are not significantly different at 5% level

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(Received 22/12/1987;
in revised form 03/05/1988)

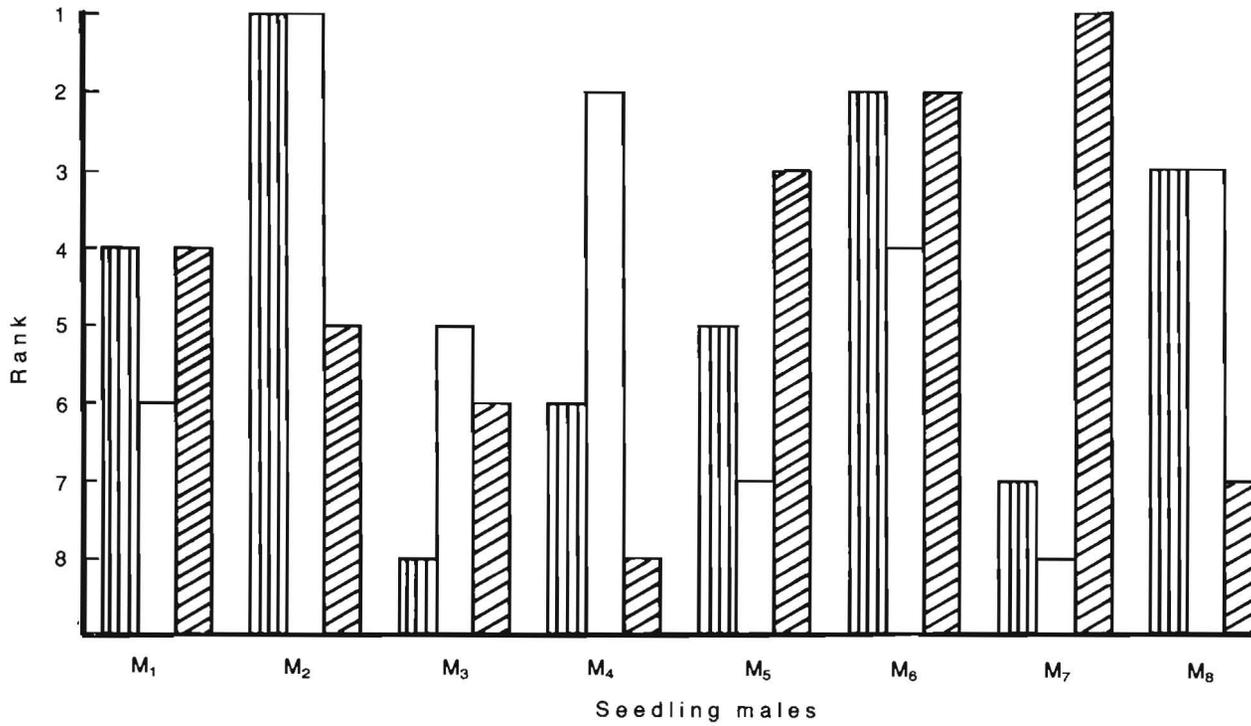


Fig. 1. Effect pollen from different seedling males on fruit weight of three female cultivars of date plum.

khalas
 rizaiz
 shieshi

تقويم ثمانية ذكور بذرية من نخيل التمر وتأثيرها على صفات الثمار لثلاثة أصناف مؤنثة

عبدالله صالح الغامدي و جعفر الحسن و محمد جحجح

قسم البساتين - كلية العلوم الزراعية والأغذية - جامعة الملك فيصل
ص. ب. ٤٠٠ - الاحساء ٣١٩٨٢ - المملكة العربية السعودية

درست بعض الصفات المورفولوجية لثمانية ذكور بذرية من نخيل التمر نامية بمنطقة الأحساء بالمملكة العربية السعودية ومن أهم الصفات التي درست عدد الأوراق، عدد الوريقات لكل ورقة، طول وعرض الوريقات، عدد الأشواك لكل ورقة، طول وعرض منطقة الأشواك، نسبة منطقة الشوك إلى الورقة، عرض الكربة، عدد ووزن الأغاريض. كما تم تحديد تاريخ الإزهار وفترته لكل الأشجار المذكورة. وقد وجد أن هناك فروقات واضحة بين الذكور وبعضها في الصفات المدروسة.

كما درست بعض صفات الأغاريض ومن أهم الصفات التي درست طول الإغريض وعرضه، ووزنه الجاف، متوسط عدد الشماريخ لكل إغريض، كذلك متوسط عدد الأزهار لكل شمراخ.

كما درست حبوب اللقاح المستخلصة من الأغاريض وذلك بمعرفة كميتها، ونسبة الإنبات لفترات مختلفة، نصف ساعة، ساعتين، ست ساعات - وكذلك قيست اطوال أنابيب حبوب اللقاح بعد أن نمت لمدة ست ساعات، وقد وجد أن هناك فروقاً واضحة بين الذكور وبعضها في الصفات المدروسة.

ثم استخدمت حبوب اللقاح من أشجار النخيل المذكورة الثمانية في تلقيح ثلاث أصناف مؤنثة من نخيل التمر معروفة تجارياً وهي خلاص ورزيز وشيشي، ودرس تأثير مصادر حبوب اللقاح على صفات الثمار (الميتازينيا)، ومن أهم الصفات التي درست هي عقد الثمار، وزن لب الثمار، طول وعرض الثمار، نسبة

الرطوبة في الثمار، وزن وشكل الثمار، وزن وشكل البذور، طول البذور وعرضها. وقد أظهرت النتائج أن الذكور الثمانية المستخدمة في التلقيح قد كان لها تأثيراً معنوياً على صفات الثمار والبذور في الصنف الواحد وبين الأصناف الثلاثة المؤنثة المستخدمة في التلقيح في معظم الصفات المدروسة.