

POLLEN ULTRASTRUCTURE OF SEEDLING DATE PALM (*PHOENIX DACTYLIFERA* L.)*

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ABSTRACT

Pollen from 61 seedling date palm males grown in the Central Region were examined and photographed using a scanning electron microscope (SEM). Pollen grains from all males were monad, elliptical-peroblate with one deep germinal furrow across the surface. In all types of pollen grains, the exine pattern was reticulate with irregular and semicircular shaped pores. Significant differences were found in pollen size and shape in most cases. A comparison between pores frequency, size and exine porosity of pollen grains proved to differentiate date palm males under study. Therefore, these parameters could be used as a taxonomic tool for the identification of date palm males.

Key words: Pollen ultrastructure, exine pattern, pore frequency, exine porosity.

INTRODUCTION

Most attempts to distinguish date palm males are mainly based on morphological characteristics. Pollen structure proved to

offer a reliable way for distinguishing some species of tree fruits. Thus, Thakur and Thakur (1970) reported that pollen grain size was not useful but pollen morphology afforded a new tool for the identification of stone fruit species. Fogle (1977a, b) indicated that differences in size and exine surface of pollen grains were useful for distinguishing peaches, nectarines, apples, sweet cherry and European plums. Maas (1977) examined pollen from small fruit tree species and found that pollen form, size, exine characteristics and pore structure were of taxonomic value. Westwood and Challice (1978) classified 18 pear species by observing pollen grains exine topography, perforation type, perforation size and frequency and exine features.

Little information is available in this respect on pollen grains of date palm. Parthasarathy (1970) found differences in pollen exine among five palm species. Tisserat and De Mason (1982) identified cultivars and clones in *Phoenix* based on grain length and width, occurrence of waxy materials and perforation frequency, shape and

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size. Shaheen (1983) indicated that pollen size and shape, pores frequency, size and exine porosity could be reliable as a taxonomic tool for the identification of date palm males.

The present investigation was undertaken to evaluate the surface morphology and ultrastructure of pollen grains from selected seedling date palm males used in the pollination of date palm cultivars in the Central Region of Saudi Arabia.

MATERIALS AND METHODS

Pollen samples were collected from flowers of 61 seedling date palm males grown in the Central Region of Saudi Arabia. The spathes were collected as soon as the sheath had opened. The strands of each spathe were cut off and spread in a thin layer on paper sheets for 3-4 days until they became dry. Then, the pollen grains were separated from the flower parts by using fine sieves (40 mesh). The pollen grains were kept in desiccators. Air-dried pollen grains from each male were affixed to metal stubs using double-faced tape and then sputter-coated with a 60:40 gold palladium alloy 200 Å thick. Four specimens of each single male tree were examined with a scanning electron microscope. At least 50 pollen grains of each cultivar were viewed before selecting representative pollen grains. Representative pollen grains were photographed to compare exine patterns of all samples.

An area of 4 cm² was projected at a magnification of 10 x on a square sheet of paper (20 x 20 cm.). The image of pores was counted. The percentage of porosity was determined by weight on a precision balance. The mean area (of a single pore) and the porosity per micrometer square were reckoned. The measurements of length and width of the pollen grains were carried out

by a Carl Zeiss light microscope.

RESULTS AND DISCUSSION

A scanning electron microscope (SEM) study of the pollen grains of 61 date palm males, grown in the Central Region of Saudi Arabia, indicated that all males had a monad, elliptical - peroblate pollen with one deep germinal furrow across the polar surface (Figures 1 and 2).

Statistical analysis for the morphological characteristics (length, width and length/width ratio) of the pollen grains indicated highly significant differences among the males (Table 1). These results are in line with those results obtained by Tisserat and De Mason (1982) and Shaheen (1983) on different cultivars of *Phoenix dactylifera* males. Similar results were reported in strawberries, stone fruits and *Pyrus* species (Mass, 1977; Fogle, 1977a,b, and Westwood and Challice, 1978).

Length of pollen grains varied from 22.1 to 25.7 μm. Pollen grains of the 61 males could be classified according to their length into three classes; the first class had a length less than 23.5 μm (18 males), the second class had a length of between 23.5 to 25.0 μm (36 males), and the third class had a length of more than 25.0 μm (7 males).

Width of the pollen grains ranged between 10.4 to 14.5 μm in all males. Males could be also classified according to their width into three classes (Table 2).

The length and width ratio (L/W ratio) which was used as an index of pollen grains shape ranged from 1.70 to 2.26 μm. Fifty-three males had a ration between 1.8 and 2.10 μm, whereas the other males (8 males) had a ratio more or less than this range (Table 2). These results showed that most

Pollen ultrastructure

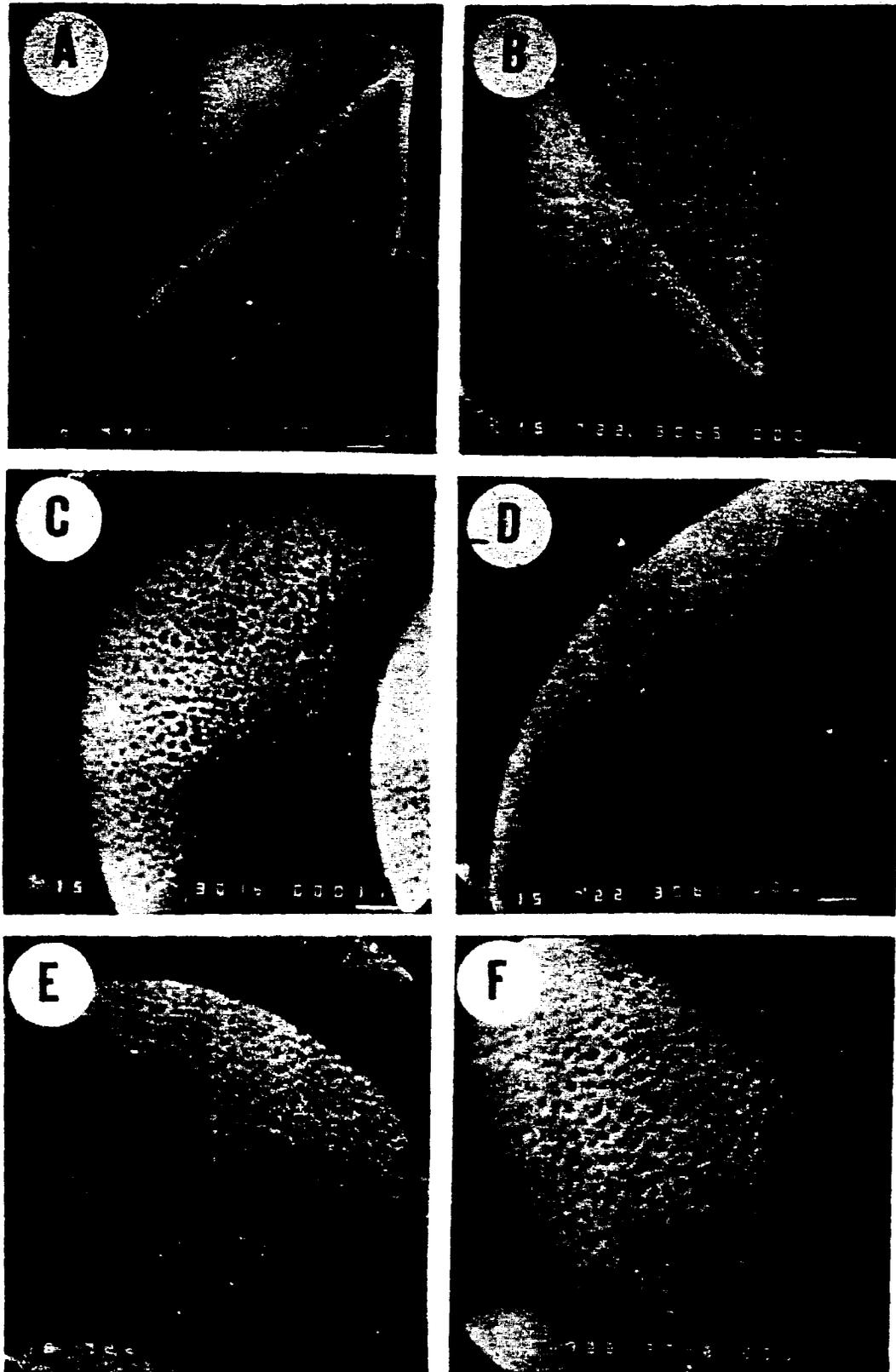


Figure 1. Individual pollen grains of some seedling date palm males (2000 x).

A: Seedling Male No. 58
B: Seedling Male No. 1
C: Seedling Male No. 2

D: Seedling Male No. 19
E: Seedling Male No. 59
F: Seedling Male No. 102

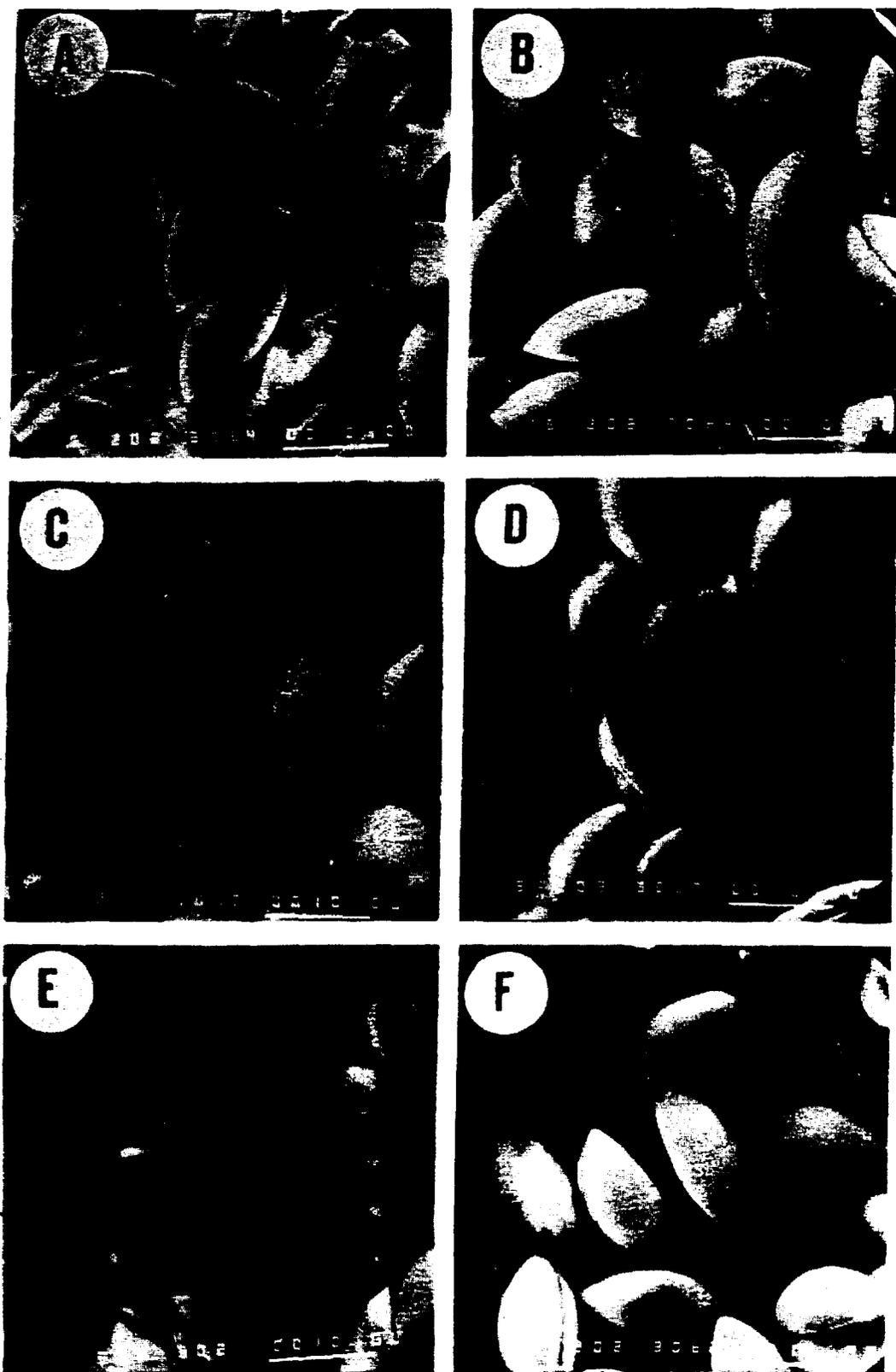


Figure 2. Pollen morphology and surface features by some seedling date palm males (7200 x).

A: Seedling Male No. 58

B: Seedling Male No. 1

C: Seedling Male No. 2

D: Seedling Male No. 19

E: Seedling Male No. 59

F: Seedling Male No. 102

Table 1. Means square from analysis of variance of length, width and length/width of pollen grains from 61 date palm males.

Source of variation	d.f.	Mean square		
		Length	Width	Length/width
Replication	9	3.231	0.579	0.013
Males	60	8.180**	4.936*	0.126**
Error	540	1.777	0.821	0.028

**Significant at the 1% level.

of the date palm males had an elliptical - peroblate shape.

Differences between the males for surface feature (number of pores, pore area and porosity) were highly significant (Table 3). The porosity of the pollen grains varied from 0.0455 to 0.2391 μm^2 , whereas pore area ranged from 0.0034 to 0.0314 μm^2 in the different males (Table 4).

Concerning the number of pores/ μm^2 , it was found that pollen grains of the males had a number of pores that ranged from 6 to 20 pores per μm^2 of the pollen grain surface, as a result these males could be

divided into three classes as follows: (1) males having a low number of pores (under 10), (2) males having a medium number of pores (10-14 pores), and (3) males having a high number of pores (more than 14 pores). The number of males pertaining to these classes was 30, 25 and 6, respectively (Table 4). Thus, each of the 61 date palm males had a distinctive number of pores that could be used for the identification of such males. Similar variation have been reported by Tisserat and De Mason (1982) and Shaheen (1983) on date palm and Fogle (1977) in some other fruit tree species.

Table 2. Means square from analysis of variance of pores, pore area and porosity of pollen grains from 61 date palm males.

Source of variation	d.f.	Mean square		
		Length	Width	Length/width
Replication	3	5.266	0.00002	0.48
Males	60	35.846**	0.00017**	0.0094 **
Error	180	4.737	0.00003	0.00079

**Significant at the 1% level.

Table 3. Some morphological characteristics of pollen grains of 61 date palm males

Character	Range	Class No. length		No. of males	Average
Length (μm)	22.1 - 25.7	I	(<23.5)	18	23.98
		II	(23.5-25)	36	
		III	(>25)	7	
Width (μm)	10.4 - 14.5	I	(<11)	3	12.43
		II	(11 - 13)	47	
		III	(>13)	11	
Length/width	1.70 - 2.26	I	(<1.8)	3	1.94
		II	(1.8 - 2.10)	53	
		III	(>2.10)	5	

< Less than.

> More than.

Table 4. Surface feature of pollen grains of 61 date palm males

Character	Range	Class No. length		No. of males	Average
Number of Pore area (μm^2)	6 - 20	I	(<10)	30	10.39
		II	(10 - 14)	25	
		III	(>14)	6	
Pore area (μm^2)	10.4 - 14.5	I	(<0.013)	28	0.014
		II	(0.013-0.023)	28	
		III	(>0.23)	5	
Porosity (μm^2 (No. x area)	1.70 - 2.26	I	(<0.10)	20	0.124
		II	(0.10-0.16)	29	
		III	(>0.16)	12	

< Less than.

> More than.

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الجزئيات الدقيقة لحبوب لقاح فحول نخيل تمر بذرية

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الخلاصة

استخدمت حبوب لقاح من ٦١ فحلا بذرياً مزروعة بالمنطقة الوسطى حيث تم فحصها وتصويرها
بالمجهر الإلكتروني (SEM).

حبوب اللقاح من كل الفحول مفردة مغزلية ولها شعر إنبات على طول السطح، كما أن الطبقة الخارجية
من حبة اللقاح لها زخرفة شبكية وبها ثقب نصف دائرية أو غير منتظمة. لقد كانت هناك فروق معنوية في
أحجام حبوب اللقاح وأشكالها في معظم الأحيان، عند مقارنة توزيع الثقب وحجم نفاذية الطبقة
الخارجية. يمكن استخدام هذه الصفات كمقاييس لتصنيف الفحول.

الكلمات الدليلية : الجزئيات الدقيقة لحبوب اللقاح، توزيع الثقب، نفاذية الطبقة الخارجية لحبوب
اللقاح.
