

## RESPONSE OF DATE PALM POLLEN TUBE GROWTH TO STORAGE PERIOD AND CONDITIONS

BY

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### إستجابة نمو أنبوبة تلقيح حبوب لقاح النخيل إلى طول فترة التخزين وظروف التخزين

على عبد المحسن الهلال

لقد تم دراسة تأثير درجة حرارة التخزين (٢٥ ، ٤ ، -٨م) وطول فترة التخزين (٣ ، ٧ ، ١٢ شهراً) على معدل إستطالة أنبوبة حبوب لقاح النخيل سواء حبوب اللقاح المجففة وهي جامدة Freeze - dried أو غير المجففة وهي جامدة Unfreeze - dried وقد أوضحت النتائج أن معدل نمو أنبوبة التلقيح يعتمد على فترة التخزين وظروف التخزين .

وقد وجد أنه يحدث نقص كبير أثناء التخزين في معدل نمو أنبوبة التلقيح في حبوب اللقاح المخزنة عند درجة ٢٥م أو ٤م بينما لم يحدث تغير في معدل هذا النمو لحبوب اللقاح المخزنة عند درجة -٨م .

كذلك أوضحت النتائج أن حبوب اللقاح المخزنة عند -٨م تحتفظ بحيويتها لمدة ٢٤ شهراً من التخزين .

*Key Words:* Date palm, Freeze-dried, Growth rate, Pollen tube, Storage period, Storage temperature, Unfreeze dried.

#### ABSTRACT

The growth rate of pollen tube of date palm (*Phoenix dactylifera* L.) pollen grains stored either freeze-dried or unfreeze-dried at 25, 4 and - 8°C was measured after 3,7 and 12 months of storage. The growth of pollen tube was found to be a function of storage period and storage conditions. The elongation rate of pollen tube of pollen grains stored at 25°C and 4°C decreased during storage and the reduction was obvious for unfreeze-dried pollen, while pollen grains stored at - 8°C maintained high pollen tube growth rate over the storage period.

Unfreeze-dried Pollens stored at - 8°C retained viability after 24 months of storage and pollen tube had high rate of growth.

#### INTRODUCTION

Date palm is a cross pollinated crop adapted to arid environment. It is often desirable to store pollen grains under uncontrolled conditions from one season to the following flowering season to pollinate the early flowering female tree.

There are several reports on the biology of date palm pollen grains focused on in vitro germination of date palm pollen grains [1,2 and 3] which can be used to test viability of stored pollen, pollen characteristics [4] and analysis of

isoenzymes [5]. But there is no detail information concerning the effect of storage period and storage conditions on pollen vigour and chemistry. Johri and Vasil [6] reviewed briefly the work on storage of date palm pollen and they pointed out that it is a custom in some date-growing communities to have a small supply of pollen from each year to the next, but there is no confirmed reports on the viability of stored pollen. There are conflicting reports concerning the use of stored pollen for pollination, Albert [7] reported that he was able to obtain a moderate fruit set using pollen stored at room temperature

from the previous year, while Crawford [8] failed to sue stored pollen for pollination. Recently Al-Helal *et al.* [9] reported that date palm pollen grains remain viable for a year when stored at 0°C but pollen stored either at 4°C or room temperature lost viability.

The aim of this work is to study the effect of storage period and conditions on growth rate of date palm pollen tube.

### MATERIALS AND METHODS

The date palm pollen grains used for this investigation were collected in 1990 from spadices of "fahal" grown in the University Campus. The pollen grains were air dried for two days and part was stored in closed containers at 25°C, 4°C and -8°C and the other were freeze-dried for 24 h and stored at 25°C, 4°C and -8°C in closed containers.

In vitro germination of pollen and the measurement of pollen tube growth were carried out as described before [1].

### RESULTS

#### After 3 months of storage

As shown in Fig. 1 and Fig. 2 the pollen grains stored at -8°C showed higher pollen tube growth rate than those stored either at 4°C or at 25°C and there was no apparent differences in pollen tube growth between freeze-dried and unfreeze-dried pollen grains.

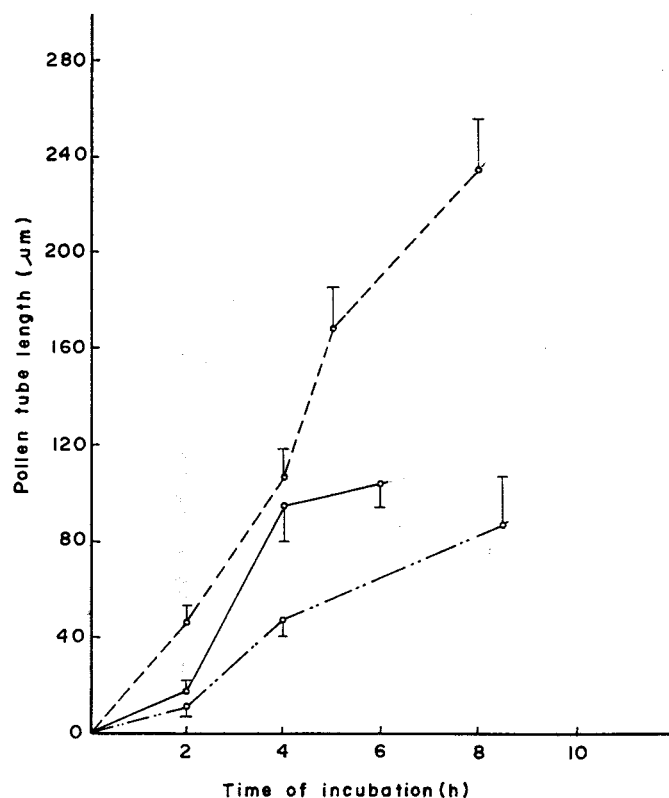


Fig. 1: Pollen tube elongation of freeze-dried date palm pollen stored for 3 months  
 Stored at 25°C  
 Stored at 4°C  
 Stored at -8°C  
 Note: Each figure is the mean of 40 measurements

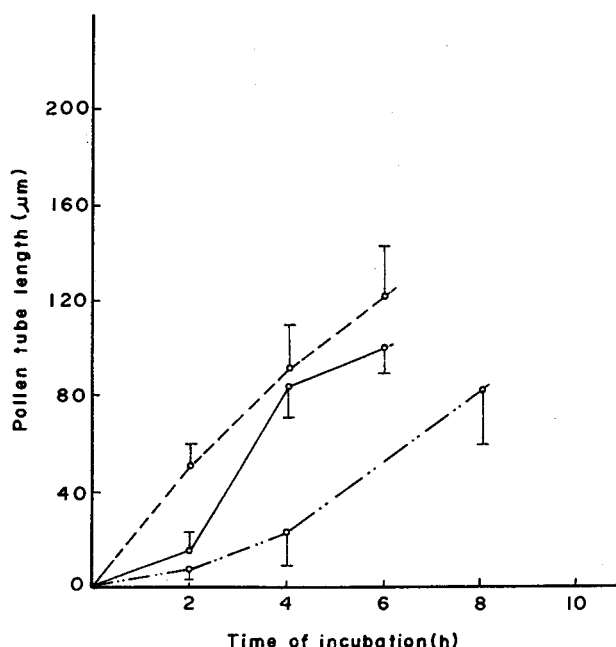


Fig. 2: Pollen tube elongation of unfreeze-dried date palm pollen stored for 3 months  
 Stored at 25°C  
 Stored at 4°C  
 Stored at -8°C  
 Note: Each figure is the mean of 40 measurements

#### After 7 months of storage

Fig. 3 and Fig. 4 indicate that pollen grains stored at -8°C maintained high pollen tube growth rate and there was no apparent reduction in tube growth during the storage period (cf. 1 and 2).

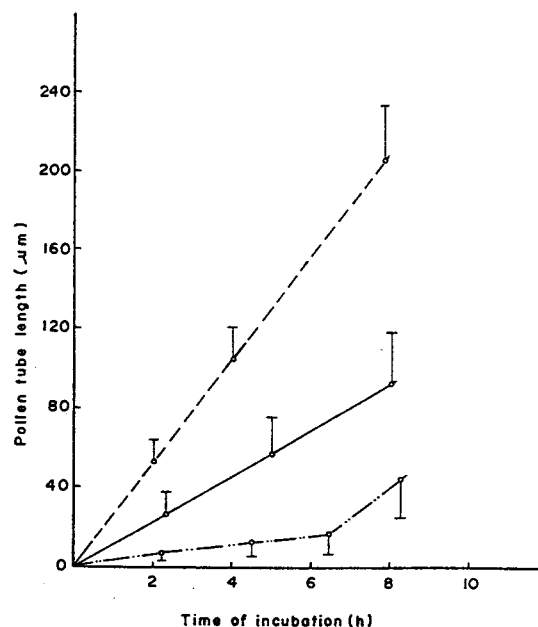


Fig. 3: Pollen tube elongation of freeze-dried date palm pollen stored for 7 months  
 Stored at 25°C  
 Stored at 4°C  
 Stored at -8°C  
 Note: Each figure is the mean of 40 measurements

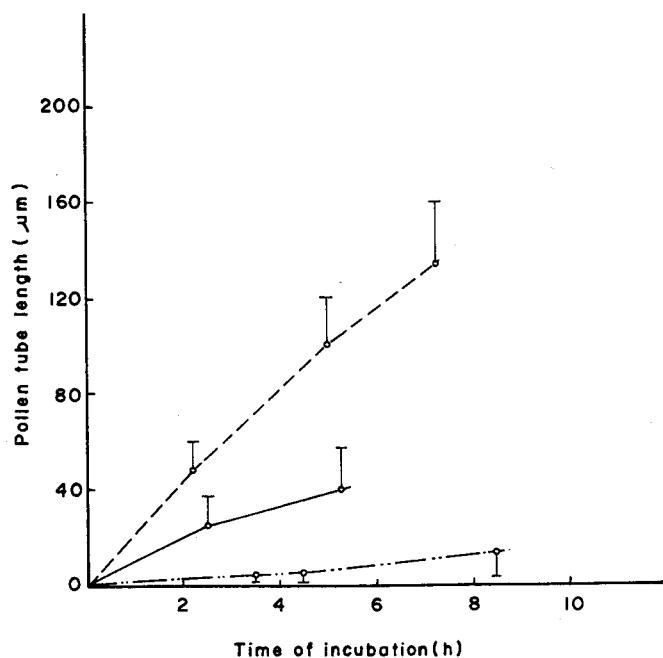


Fig. 4: Pollen tube elongation of unfreeze-dried date palm pollen stored for 7 months  
 Stored at 25°C  
 Stored at 4°C  
 Stored at -8°C  
 Note: Each figure is the mean of 40 measurements

Pollen tube growth rate of pollen grains stored at 4°C was reduced during the storage period especially of unfreeze-dried pollen grains.

It is clear from the figures that pollen tube growth of pollen grains stored at room temperature (25°C) was very greatly reduced during the storage period. The rate of pollen tube growth was very low, particularly of the unfreeze-dried pollen grains.

**After 12 months of storage**

Fig. 5 and Fig. 6 show that pollen grains stored at - 8°C had high pollen tube growth rate and there was no apparent reduction in pollen tube growth during the storage period.

Pollen grains stored at 25°C had very low germination percentage (less than 6%), as shown in Table 1. The germinated pollen grains had a remarkably low pollen tube growth rate and the average tube length was less than 10 µm after 4 h of incubation and less than 400 µm after long time of incubation (Table 2).

The unfreeze-dried pollen grains stored at 4°C had an extremely low rate of pollen tube growth and the average pollen tube length was less than 15 µm after 6 h of incubation (Fig. 6) and 123 ± 55 after long time of incubation (Table 2), while the freeze-dried pollen grains had relatively high pollen tube growth rate (Fig. 6) and pollen tube was very long after 24 months of storage.

Effect of 24 months storage period on pollen tube elongation was studied on unfreeze-dried pollen grains collected in the flowering season of 1989 stored at - 8°C and

the results presented in Fig. 7 show that these pollen grains had pollen tube with high growth rate.

**Table 1**  
 The estimated germination percentage after 4 h of incubation of pollen stored 12 months

Storage temperature	% germination	
	freeze-dried Pollen	unfreeze-dried Pollen
- 8°C	more than 50	more than 50
4°C	more than 50	25
25°C	3.6	4

**Table 2**  
 Pollen tube length after long time of incubation period (18-21 h) of pollen stored 12 months

Storage temperature	% germination	
	freeze-dried Pollen	unfreeze-dried Pollen
- 8°C	more than 1500	
4°C	1040	123 ± 55
25°C	357 ±	105 ± 53

Note: Each figure is the mean of 30 measurements.

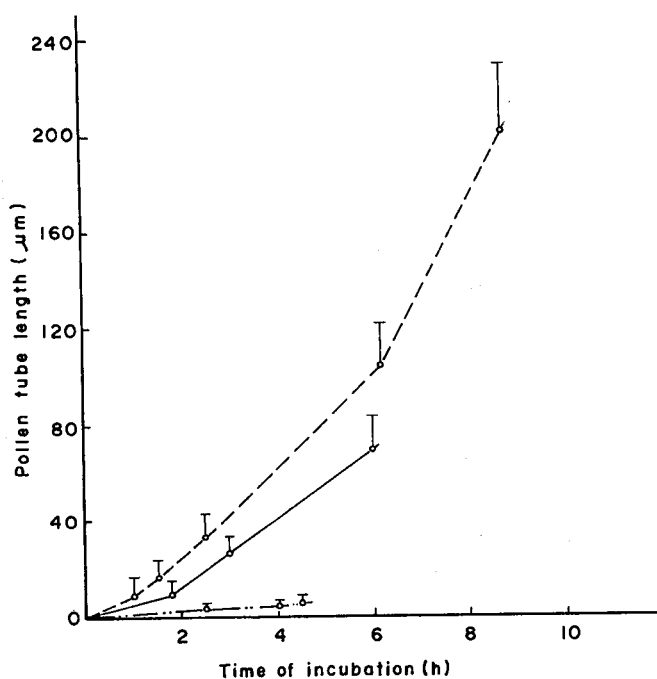


Fig. 5: Pollen tube elongation of freeze-dried date palm pollen stored for 12 months  
 Stored at 25°C  
 Stored at 4°C  
 Stored at -8°C

Note: Each figure is the mean of 40 measurements except pollen stored at 25°C where each figure is the mean of 20 measurements.

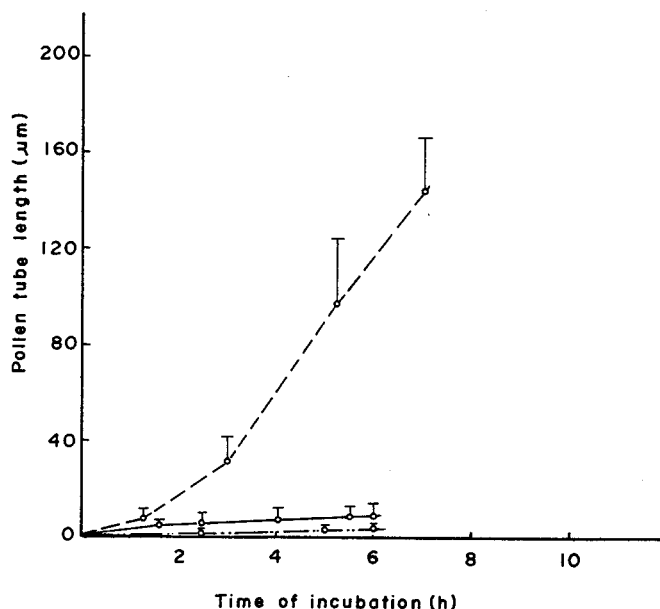


Fig. 6: Pollen tube elongation of unfreeze-dried date palm pollen stored for 12 months  
 Stored at 25°C  
 Stored at 4°C  
 Stored at -8°C  
 Note: Each figure is the mean of 40 measurements except pollen stored at 25°C where each figure is the mean of 20 measurements.

DISCUSSION

It has been reported in several plant taxa that several factors affect pollen viability and vagour such as storage conditions [10, 11 and 12], temperature stress [13] and pollen genotype [14].

Therefore, the primary aim of the present study was to find the best storage temperature for date palm pollen grains. The data obtained in this paper along with the results of the previous paper [9] provide information on the effect of storage temperature on in vitro germination of date palm pollen grains. The results suggest that storage temperature of 0°C or below is an adequate for long period storage and there was no noticeable reduction in growth rate of pollen tube over a 12 month storage period.

The finding that storage temperature below 0°C is best for date palm pollen is in a good agreement with that reported for pollen of other plant species [15 and 16].

The data of the present investigation demonstrate that both storage conditions and storage period effect pollen tube elongation and that unfavorable storage conditions reduce the rate of pollen tube elongation and the reduction is proportional to the storage period. But the factors that are responsible for the reduction in pollen tube growth during storage are not known at the present time. However, it is known that pollen tube emergence and elongation is an active metabolic process involves RNA synthesis [17], protein synthesis [18], carbohydrate breakdown [19], loss of pectic material and

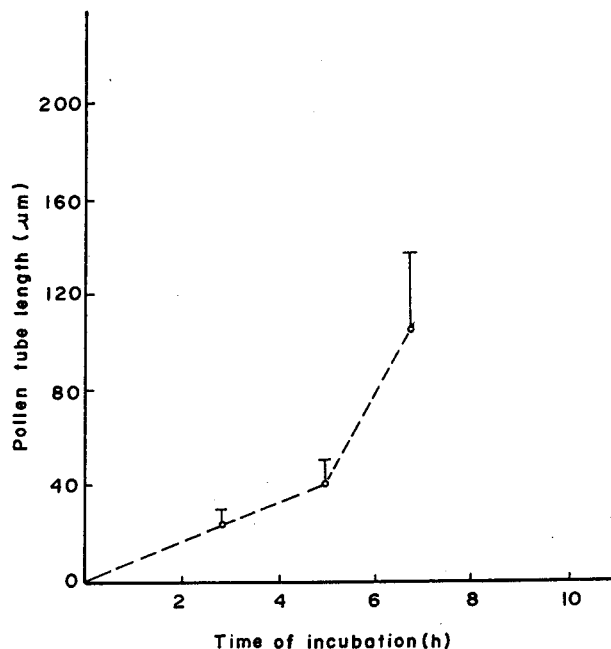


Fig. 7: Pollen tube elongation of freeze-dried date palm pollen stored for 24 months.

Note: Each figure is the mean of 40 measurements  
 Pollen tube length (µm)  
 Time of incubation (h)  
 Pollen tube length (µm)  
 Time of incubation (h)  
 Pollen tube length (µm)  
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 Pollen tube length (µm)  
 Time of incubation (h)

polarization of cell organelles [20]. Therefore the reduction of pollen tube elongation during the storage might be due in part to the reduction in these process and also might due to the reduction in the activity of enzymes concern with cell wall and cell membrane synthesis.

Beside it is important to store pollen viable at uncontrolled conditions, it is necessary that the stored pollen should have pollen tube with high rate of elongation that able it to reach the embryo sack before the abscission of the flower. Also it has been reported that growth rate of pollen tubes influences both pollen competition [21] and sporophytic characteristics [22]. The results of this work indicated that the unfavorable storage temperature reduces pollen tube elongation and therefore it might affect the fertilization ability of stored pollen while storage temperature below 0°C had no effect on growth rate of date palm pollen tube.

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