


## Fruiting of the Barhy Date Palm (*Phoenix Dactylifera* L.) Through New Pollination Technique Under Conditions in El-Dakhla, New Valley, Egypt

Radwan, E.M.A.<sup>1\*</sup> ; El-Salhy, A.M.<sup>2</sup>; Yousef, S. Diab<sup>3</sup> and Heba A.M. Mohamed<sup>1</sup>

<sup>1</sup>Horticulture Department, Faculty of Agri. New Valley University, El-Kharga, New Valley, Egypt

<sup>2</sup>Pomology Department, Faculty of Agriculture. Assiut University, Assiut, Egypt

<sup>3</sup>Date Palm Central Lab. Agric., Res. Center, Giza, Egypt.

### \* Corresponding author

Radwan, E.M.A.

Received: 27/7/2022

Revised: 12/8/2022

Accepted: 12/8/2022

Published: 13/8/2022

### Abstract

Pollination is a critical process in date palm production lines that affects yield and fruit quality. The main aim of this study was to evaluate the effect of different pollination methods (dusting of pollination powder and spraying of pollen grain suspension with sugar or ascorbic acid) on yield and fruit quality of Barhy date palm. This study was conducted in El-Dakhla Oasis, New Valley during the 2019, 2020 and 2021 growing seasons. After three and six days of pollination, the modified approach (trimming 25% of tufts and setting 10 tufts/spathe plus dusting with 0.1 g pollen powder and bagging with shaking) or spraying female spathes with 1 g pollen grains + 10% ascorbic acid produced a higher performance yield and improved fruit quality. Furthermore, the proposed modified method of combining pollination and thinning has various advantages; including saving time, effort, labor and cost, and improving applicability, and can be recommended as a promising pollination strategy for the future.

Keywords: Barhy date palm, pollen grain suspension, pollination, fruit quality.

## Introduction

The date palm (*Phoenix dactylifera L.*) is to be considered one of the most important trees in the world's arid regions, especially in North Africa and the Arab world, especially in Egypt and all Muslim nations. In 2018, there are around 100 million palm trees worldwide.

Egypt is considered one of the top 10 date growers. The most commercially important date palm varieties planted in Egypt are Zaghloul, Samany and Hayany. Egypt grows date palms both in the Nile Valley and in desert areas. The total area of female date palms was 117073 feddan and 14379648 palms, respectively. According to (M.A.L.R. 2019), the yield produced was 1465030 tons.

The date palm is dioecious with male and female inflorescences on separate individual trees. In fact, in different parts of the countries where dates are grown, fruit set always occurs through natural pollination by wind and bees, and female flowers cannot be fertilized without natural pollination, resulting in the formation of parthenocarpic fruits with little economic value (Zaid and De Wet, 1999; Hafez et al., 2014; Anushma et al., 2018).

Consequently, artificial pollination methods must be used to achieve commercial yield (Khushk et al., 2009; El-Salhy et al., 2010 and Shaaban et al. 2019). Various pollination strategies used in date palm production, including the use of fresh male strands, dried pollen, and pollen suspensions (El-Salhy et al., 2010; Sayed et al., 2018; Munir et al., 2020). Some researchers are now using combined different strategies in date palm production.

The most important yield of date development is a consequence of the high percentage of fruit set. Achieving this rate depends on a mix of a few variables, namely pollen source quality, pollination process, male-female, compatibility and environmental conditions, irrigation, soil and fertilization (El-Salhy et al., 2012).

Changing the pollination method and switching from the conventional pollination

strategy to spraying with a pollen grain-water suspension resulted in an increase in fruit set to an ideal level without the need for thinning. Using pollen suspension technology in water reduces labor and thinning costs (Shaaban et al., 2019; El-Sharabasy et al., 2020 and El-Salhy et al., 2021).

Mixing pollen grains with various carriers, nutrient minerals and ascorbic acid was helpful to establish physical pollination and achieve a high yield with good fruit quality. It is also responsible for increasing pollination efficiency (Zaen El-Daen et al., 2017; Shaaban et al., 2019; El-Sharabasy et al., 2020 and El-Salhy et al., 2021).

Therefore, the aim of this study is to evaluate the influence of alternative pollination methods (spraying a solution with different combinations or pollination with pollen grain powder) on the yield components and physical and chemical properties of the Barhy date palm.

## Materials and Methods

This study was conducted in El-Dakhla Oasis (Gharb El Mauhoub), New Valley Governorate, Egypt (25th latitude and 29th longitude) on Barhy date palm cultivar selected for its optimal fruit quality during the 2019, 2020 and 2021 growing seasons. Ten healthy Barhy palms were selected. The selected palms were planted 6 x 6 m apart in sandy soil and irrigated through a drip irrigation system, and were similar age, vigorous growth and optimal fruit quality. Agricultural procedures were carried out as usual. At the end of the flowering period, the leaf-to-cluster ratio was set at 8:1. The artificial pollination was uniform in terms of source, date. The number of spathes per palm has been reduced to 12 to achieve the following six treatments:

- 1- Hand pollination by inserting 18-20 strands/spathe (traditional hand)
- 2- Shortening 25% of strand and inserting 10 strand/spathe plus 1.0 g dusty and bagging with shaking after three and six days of pollination (modified method).
- 3- Spraying pollen grain suspension 2 g pollen/L plus 10 % vitamin C.

4- Spraying pollen grain suspension 2g pollen/L plus 10 % sugar.

5- Spraying pollen grain suspension 1 g pollen/L plus 10 %vitamin C.

6- Spraying pollen grain suspension 1 g pollen/L plus 10 % sugar.

All these procedures were performed on the same palm. The method of pollination was maintained in relation to the source to avoid residues of *Metaxenia*. The design of the experiment was a (RCBD) randomized complete block design with ten replicates, one spathe each. On the third day of spathe rupture,

hand pollination and pollination treatments were performed. Dusting of pollen powder is done with a small hand spreader, while spraying of the pollen suspension is done with a small handheld sprayer (12-liter capacity) at a rate of 100ml/spatula. To prevent pollen contamination, after spraying with pollen grain suspension, each spathe was bundled into paper bags, which were removed four weeks later. Table (1) shows the temperature (°C) and relative humidity (%) during the pollination periods and fruit growth of the current study.

**Table (1): Monthly air temperature, relative humidity, and wind speed for the three seasons studied.**

Month	(TM) Maximum temperature (°C)			(Tm) Minimum temperature (°C)			(T) Mean temperature (°C)			(H) Mean humidity (%)			(V) Mean wind speed (m/s)		
	2019	2020	2021	2019	2020	2021	2019	2020	2021	2019	2020	2021	2019	2020	2021
<b>Feb.</b>	13.2	13.0	14.0	21.0	20.5	22.2	6.7	6.6	7.1	36.6	46.3	37.4	2.6	2.36	2.50
<b>March</b>	16.8	18.0	18.4	24.8	26.4	26.9	9.6	10.6	10.8	29.1	34.3	28.3	3.1	2.94	2.64
<b>April</b>	22.2	22.0	23.0	30.6	30.1	32.1	14.4	14.2	14.5	24.2	26.3	19.1	2.9	2.53	2.30
<b>May</b>	29.3	27.4	29.3	37.8	35.4	37.8	21.0	19.6	20.8	14.1	21.3	15.3	2.7	2.50	2.90
<b>June</b>	31.8	30.4	30.2	39.4	38.4	37.7	24.0	22.4	22.6	19.4	19.2	22.7	2.8	2.76	2.79
<b>July</b>	32.4	31.0	32.0	39.6	38.2	39.2	25.0	23.4	24.4	20.7	21.1	22.2	2.5	2.56	2.69
<b>Aug.</b>	32.1	31.4	31.7	39.4	38.8	39.2	24.7	23.9	24.0	21.1	21.9	22.5	2.5	2.37	2.84
<b>Sept.</b>	28.3	29.9	28.2	35.7	37.7	35.3	21.3	22.5	21.4	28.3	24.8	31.2	2.7	1.99	3.26
<b>Oct.</b>	25.8	25.6	23.9	33.8	33.5	31.5	19.0	18.8	17.5	28.2	31.5	36.8	2.2	1.92	2.67

Data obtained from the New Valley Weather Station.

The following parameters were determined to assess the effects of different pollination methods on fruiting:

1-Yield components

Initial fruit set and retained fruit: Five inner and outer strands per spathe were selected and

used to estimate percentages of fruit set and retention at one month of pollination and at the harvest stage. The following equation was used to estimate the percentage of Initial fruit set and fruit retention:

$$\text{Initial Fruit set \%} = \frac{\text{Total number of setting fruits/stand}}{\text{total number of setting fruits/strand} + \text{number of flower scars}} \times 100$$

$$\text{Fruit retained \%} = \frac{\text{Total number of retained fruits/stand}}{\text{number of retained fruits/strand} + \text{number of flower scars}} \times 100$$

a- **Bunch weight and yield per palm:** Bunches were harvested and their weights (kg) recorded before yield/palm (kg) was calculated by multiplying the average bunch weight (kg) by the total number of bunches per palm.

**b- Fruit characteristics**

At harvest, twenty fruits were randomly selected as a sample for each replicate (bunch) to measure physical properties such as fruit weight (g), flesh %, and fruit dimension (cm). TSS was determined using a handheld refractometer, total acidity percentage (as ascorbic acid/100 g/pulp), and sugar contents were determined according to the methods of (A.O.A.C. 1995).

In addition, the tannin concentration was evaluated using the indigo-carmen indicator developed by (Balbaa 1981). Titrations were performed using 0.1N potassium permanganate solutions. Fresh weight tannins were determined (as a percentage of total tannins) using the following equation:  $0.00416 \text{ g tannins} = 1 \text{ ml potassium permanganate (0.1N)}$ .

**Statistical analysis**

The data were analyzed statistically using the methods described by (Gomez and Gomez 1984 and Snedecor and Cochran 1990). In the three seasons tested, treatment means were calculated using the New L.S.D. Least Significant Difference test compared at the 5% probability level.

**Results**

**1- Yield components:**

The data in Table (2) show the effect of pollination treatments such as dusting 0.1 g pollen powder or spraying pollen grain suspension at various concentrations (1 & 2 g/l) with 10% sugar or 10% ascorbic acid, Initial fruit set, fruit retention percentage and bunch weight of the Barhy date palm during the 2019, 2020 and 2021 seasons. It is worth noting that

initial fruit set, fruit retention percentage and bunch weight all responded identically over the three seasons studied.

During the three study seasons, different hand pollination methods had a significant influence on initial fruit set, fruit retention percentages and bunch weight. Pollination with pollen grains dust at 0.1 g (modified technique) with a suspension containing 2 g or 1 g plus ascorbic acid or sugar increased initial % fruit set and %fruit retention percentages as well as bunch weight in comparison compared to conventional hand pollination. Compared to traditional hand pollination or other pollination treatments, pollination by a modified approach yielded the greatest results.

Results showed that increasing pollen concentration from 1 to 2 g/L in combination with ascorbic acid was more beneficial than using sugar. Also, there were no significant differences between the doses of 1 or 2 grams of ascorbic acid or sugar used. In this regard, the decrease in percentage of initial fruit set and bunch weight could be attributed to a decrease in pollen grain concentration in the suspension. These results underlined the existence of a positive relationship between the number of pollen grains and the percentage of initial fruit set.

In this regard, the decrease in initial fruit set and bunch weight could be attributed to a decrease in pollen grain concentration in suspension. These results underscored the existence of a positive relationship between pollen grain count and percentage of initial fruit set.

It is worth noting that, shortening of the strands and pollination by dusting 0.1 g pollen grains (modified method) gave the highest values of fruit bunch weight compared to traditional hand pollination. In contrast, bunch weight significantly increased response to shortening 25% strands and dusting 0.1% pollen grain and bagging compared to traditional hand pollination (control). The weights of the bunches were (on average)

11.57, 14.33, 13.67, 13.75, 13.15 and 12.69 kg (during the three seasons studied) due to the traditional hand (T1), the modified method (T2), the suspension with 2 g pollen + 1% ascorbic acid (T3), 2 g pollen + 10% sugar (T4), 1 g pollen + 10% ascorbic acid (T5) or 1 g pollen + 10% sugar (T6), respectively. Thus,

the increase of mean bunch weight was 23.85 %, 18.15 %, 18.84 %, 13.66 %, and 9.68 %, for T2, T3, T4, T5 and T6 treatments, respectively compared to T1. From this it could be concluded that the reducing the concentration of the pollen grain suspension leads to a reduction in the bundle weight.

**Table (2): Influence of different pollination methods on the yield components of the Barhy dates palm during the 2019, 2020 and 2021 growing seasons.**

Charact. Season Treat	Initial fruit set %				Fruit retention %				Bunch weight (kg)			
	2019	2020	2021	Mean	2019	2020	2021	Mean	2019	2020	2021	Mean
T <sub>1</sub>	42.55	45.18	46.11	44.35	29.69	31.38	32.61	31.22	10.55	11.63	12.54	11.57
T <sub>2</sub>	51.81	52.39	53.96	52.72	35.34	36.41	36.56	36.10	13.83	14.40	15.68	14.33
T <sub>3</sub>	48.96	50.21	51.84	50.07	33.82	34.48	35.84	34.71	12.44	13.65	14.92	13.67
T <sub>4</sub>	47.83	49.75	51.26	49.61	33.27	33.79	35.36	34.14	12.62	13.78	14.86	13.75
T <sub>5</sub>	47.12	49.88	51.60	49.53	32.28	33.82	35.27	33.79	12.15	12.95	14.35	13.15
T <sub>6</sub>	46.25	47.63	49.35	47.74	31.78	32.67	34.55	33.00	11.86	12.11	14.10	12.69
New LSD	2.66	2.45	2.87		1.98	1.81	1.73		0.78	0.59	0.86	

## Fruit quality

### 1- Physical fruit properties

The physical properties of Barhy date palm fruits are shown in Tables (3 and 4) based on the effects of dusting or spraying pollen grain suspensions with either ascorbic acid or sugar. From the above data it could be concluded that the results took the same trend throughout the study seasons. Pollination with dilute pollen grains, either dusting or suspension, was found

to be more effective than conventional hand pollination in boosting fruit weight, flesh percentage, fruit dimension and flesh percentage all while pollination weight increased as well (control). Ascorbic acid or sugar have been used in conjunction with a decrease in pollen grain suspension content from 2 g/L to 1 g/L to improve these characteristics.

**Table (3): Effect of different pollination methods on fruit weight and flesh % of Barhy date palm during the 2019, 2020 and 2021 growing seasons.**

Charact. Season Treat	Fruit weight (g)				Flesh %			
	2019	2020	2021	Mean	2019	2020	2021	Mean
T <sub>1</sub>	15.61	16.85	17.55	16.67	88.17	89.26	89.11	88.85
T <sub>2</sub>	18.36	19.20	20.66	19.42	92.98	94.33	93.96	93.76
T <sub>3</sub>	16.80	17.65	19.28	17.91	93.11	94.21	93.85	93.72
T <sub>4</sub>	16.90	17.91	19.13	17.98	92.85	93.56	93.81	93.41
T <sub>5</sub>	16.96	18.50	19.85	18.73	92.58	92.98	93.50	93.02
T <sub>6</sub>	16.81	18.21	19.63	18.61	92.35	92.88	93.55	92.92
New LSD	<b>0.72</b>	<b>0.75</b>	<b>0.88</b>		<b>4.11</b>	<b>3.89</b>	<b>4.18</b>	

**Table (4): Effect of different pollination methods on Barhy date palm fruit dimensions during the 2019, 2020 and 2021 growing seasons.**

Charact. Treat.	Season	Fruit length				Fruit diameter (cm)			
		2019	2020	2021	Mean	2019	2020	2021	Mean
T <sub>1</sub>		3.28	3.36	3.57	3.40	2.59	2.73	2.84	2.72
T <sub>2</sub>		3.66	3.75	3.81	3.74	2.98	3.05	3.13	3.05
T <sub>3</sub>		3.42	3.51	3.70	3.54	2.76	2.82	3.07	2.88
T <sub>4</sub>		3.55	3.65	3.72	3.64	2.86	2.97	3.06	2.96
T <sub>5</sub>		3.51	3.62	3.66	3.60	2.84	2.90	3.05	2.93
T <sub>6</sub>		3.58	3.68	3.73	3.66	2.88	2.98	3.05	2.95
<b>New LSD</b>		<b>0.11</b>	<b>0.10</b>	<b>0.10</b>		<b>0.11</b>	0.10	0.12	

Reducing pollen grain pollination (modified technique) or suspension concentration increased fruit weight. The use pollen grain dust at 0.1% or suspension at 1 g/L increased this significantly compared to the control treatment. The highest fruit were obtained from palm trees pollinated with a modified technique or 1 g pollen grain suspension + ascorbic acid. For treatments from T<sub>1</sub> to T<sub>6</sub>, fruit weights averaged 16.68, 19.42, 17.91, 17.98, 18.73, and 18.61 g Due to T<sub>2</sub> to T<sub>6</sub> compared to T<sub>1</sub>. Moreover, the increase ratio over the control were 16.43, 7.37, 7.79, 12.29 and 11.57 % due to altered technique and pollen grain suspension over the control. In general, ascorbic acid or sugars in the pollen grain suspension did not affect fruit weight.

## 2- Fruit chemical constituents

From the data presented in Tables 5 and 6, there is no doubt that pollination using the modified method or dilute low-concentration pollen grain suspensions had a significant impact on the chemical components of the fruit, particularly regarding total sugars and soluble solid acidity and tannins. Compared to conventional hand pollination, dilute pollen grain or suspensions below 2 g/L resulted in significantly higher levels of soluble solids and sugars. Average soluble solids result for the three seasons analyzed showed that they ranged from average (33.82% to 37.55%) of T<sub>1</sub> to T<sub>6</sub>, with a range of 33.82 to 37.03% as a result from T<sub>1</sub> to T<sub>6</sub>. As a result, total soluble solids

increased by 11.03, 4.35, 4.41, 7.71, and 9.49% from treatments T<sub>2</sub> through T<sub>6</sub> compared to T<sub>1</sub>, respectively. The traditional hand pollination method has been shown to have higher levels of tannins and total acidity than dilute pollen grain solution (Tables 5 and 6). The improvement in these fruit traits was associated with the reduction in pollen grain pollination at 0.1% or suspension concentration from 2 to 1.0 g/L. The highest values for total solubility and sugar content and the lowest values for tannins and total acidity were obtained with the modified pollen grain method or the 1.0 g plus 10% sugar suspension, while the minimum values for total solubility and sugar content and the highest values were obtained with the moisture and tannin content as well as total acidity were determined using the conventional method of hand pollination. The use of pollen grain diluting solution thus has the same effect as fruit thinning to increase fruit quality.

## Discussion

Pollination is considered the most critical, complex and costly method to ensure a healthy yield of date palms. The low pollen grain numbers justify the use of spray and dust devices for mechanical pollination. The positive effect of pollen with carriers on production and fruit quality was due to their crucial function in increasing pollination and fertilization efficiency. Mechanical pollination requires diluting pollen grains with a bulky substance to reduce the required amount of



pollen grains. To produce a homogeneous mixture, this bulky material must be readily available, inexpensive, and have a specific gravity close to that of pollen grains (Alabri et al., 2006; El-Salhy et al., 2010; Abdalla et al., 2011; Awad, 2011 and El-Salhy et al., 2021). These findings can be attributed to the reduction in fruit set percentage due to the use of diluted pollen grain solution or powder. Such a reduction in fruit set was effective in reducing inter-fruit competition, resulting in adequate carbohydrate and other essential nutrient uptake for the remaining fruit, increasing their weight, accelerating their ripening, and increasing their total soluble solids and sugar content. The improved method that combines pollination and fruit thinning by removing about 25% of the female strands before pollination. In addition, this strategy reduces the amount of pollen required for pollination and increases pollination efficiency. This is a significant aspect of the acute shortage of pollen grains

caused by the growth of date palm farms without regard to the increase in males. The physical qualities of the fruit were improved comparable to the effects of fruit thinning. In this way, either alternative pollination methods or fruit thinning could be used to identify the initial fruit set that yielded a sufficient quantity and quality of fruit. Ascorbic acid's ability to protect tissues from oxidation and its role in promoting cell turnover and glucose production may explain the current findings (Elade, 1992). The germination and development of pollen grains and the flow of sugar are also stimulated by sugar (El-Salhy et al., 2007). These results have been confirmed by the results of other researchers (Al-Wasfy 2014; Samouni et al., 2016; El-Sharbasy et al., 2020 and El-Salhy et al., 2021). They confirmed that the modified pollination method increased production and improved the physical and chemical properties of the fruit.

**Table (5): Effect of different pollination methods on total solubility and sugar content of Barhy date palm during the 2019, 2020 and 2021 growing seasons.**

Charact.	TSS				Reducing sugars %				Total Sugar %						
	Season	2019	2020	2021	Mean	2019	2020	2021	Mean	2019	2020	2021	Mean		
Treat.															
T <sub>1</sub>		33.58	33.79	34.11	33.82		22.45	23.34	22.86	22.88		28.65	28.85	28.48	28.66
T <sub>2</sub>		37.28	37.52	37.86	37.55		25.36	26.51	25.93	25.93		32.18	32.69	32.20	32.35
T <sub>3</sub>		34.99	35.25	35.63	35.29		23.69	24.81	24.43	24.32		30.21	30.56	30.48	30.41
T <sub>4</sub>		35.05	35.29	35.62	35.31		24.28	25.35	24.85	24.82		30.86	31.25	30.91	31.00
T <sub>5</sub>		36.17	36.38	36.74	36.43		24.30	25.37	24.84	24.83		30.78	31.17	30.85	30.94
T <sub>6</sub>		36.77	36.96	37.38	37.03		24.86	25.88	25.53	25.42		31.69	31.98	31.64	31.77
<b>New LSD</b>		<b>1.28</b>	<b>1.19</b>	<b>1.35</b>			<b>0.92</b>	<b>1.03</b>	<b>1.18</b>			<b>1.18</b>	<b>1.28</b>	<b>1.43</b>	

**Table (6): Effect of different pollination methods on the acidity and tannin content of the Barhy date palm during the 2019, 2020 and 2021 growing seasons.**

Charact.	Non reducing sugars %				Acidity %				Tannins %						
	Season	2019	2020	2021	Mean	2019	2020	2021	Mean	2019	2020	2021	Mean		
Treat.															
T <sub>1</sub>		6.20	5.51	5.62	5.77		0.253	0.248	0.295	0.265		0.145	0.153	0.163	0.153
T <sub>2</sub>		6.82	6.18	6.27	6.42		0.198	0.194	0.234	0.208		0.123	0.129	0.140	0.130
T <sub>3</sub>		6.52	5.75	6.05	6.10		0.220	0.218	0.260	0.232		0.134	0.140	0.150	0.141
T <sub>4</sub>		6.58	5.90	6.06	6.18		0.233	0.219	0.263	0.235		0.135	0.139	0.154	0.142
T <sub>5</sub>		6.48	5.82	6.01	6.10		0.215	0.208	0.255	0.224		0.131	0.137	0.149	0.135
T <sub>6</sub>		6.83	6.10	6.11	6.34		0.207	0.202	0.246	0.218		0.127	0.133	0.145	0.135
<b>New LSD</b>		<b>0.23</b>	<b>0.21</b>	<b>0.30</b>			<b>0.016</b>	<b>0.011</b>	<b>0.019</b>			<b>0.009</b>	<b>0.008</b>	<b>0.010</b>	

## Conclusion

The results obtained provide sufficient evidence that artificial pollination of Barhy dates is one of the most important cultural practices to maximize yield and fruit quality. Modified procedure (cut 25% struts and insert 10 male streaks/spathe plus pollinate 0.1% pollen grain powder and shake after three and six days of pollination) or spray female spathes with 1g pollen plus 10% vitamin C or 10% sugar spraying resulted in high fruit set percentage and reasonable yield, as well as high fruit weight, dimensions and total sugars. In addition, modified methods differ in that they combine pollination and fruit thinning, reducing time, effort, labor and cost, making them more viable for large farms, and increasing pollination efficiency. In addition, it is a promising technology.

## Conflict of interest statement

This manuscript has no conflicts of interest.

## Data availability statement:

All data sets collected and analyzed during the current study are available from the corresponding author on reasonable request.

## References

- Abdalla, M. G., El-Salhy, A. M., & Mostafa, R. A. A. (2011).** Effect of some pollination treatments on fruiting of Zaghloul date palm cultivar under Assiut climatic condition. *Assiut J. of Agric. Sci.*, 42, 350-362.
- Ahmed, E. F. S. (2014).** Increasing pollination efficiency in Saidy date palms using starch carrier along with pollens suspension. In *Proceeding of the 5th International Date Palm Conference, Abu Dhabi, UAE, March* (pp. 16-18).
- Alabri, N., Al-Busaidi, K., & Alhemaimee, S. (2006, May).** Effect of pollen grains suspension on fruit set and physicochemical characteristics of two date palm (*Phoenix dactylifera*.) cultivar Qnt. In *Conf. on date palm production and processing technology May* (pp. 9-11), P 19.
- Al-Wasfy, M. M. M. (2014).** Yield and fruit quality of Zaghloul date palms in relation to using new technique of pollination. *Stem Cell*, 5(1), 14-17.
- Anushma, P. L., Vincent, L., Rajasekharan, P. E., & Ganeshan, S. (2018).** Pollen storage studies in date palm (*Phoenix dactylifera L.*). *Int. J. Chem. Studies* 6 (5): 2640-2642
- Association of Official Agricultural Chemists (1995).** Official Methods of Analysis (A.O.A.C.), 4<sup>th</sup> Ed. Benjamin Franklin Station 490- 510.
- Awad, M. A. (2011).** Pollination of Date Palm (*Phoenix dactylifera L.*) cv. 'Lulu' with Pollen Grains-Water Suspension. *Meteorology, Environment and Arid Land Agriculture*, 22(1), 91-101.
- Balbaa, S. I. (1981).** Chemistry of drugs. *Laboratory manual. Cairo Univ*, 127-132.
- Elade, Y. (1992).** The use of antioxidants to control gray mould (*Botrytic cibera*) and white mould (*Sclerotinia Aclerotiorum*) in various crops. *Plant Pathol*, 141, 417-426.
- El-Salhy, A. M., El-Bana, A. A., Abdel-Galil, H. A., & Ahmed, E. F. S. (2010, March).** Effect of Pollen Grains Suspensions Spraying on Yield and Fruit Quality of 'Saidy' Date Palm. In *IV International Date Palm Conference* 882 (pp. 329-336).
- El-Salhy, A. M., Masoud, A. A. B., El-Kassas, D. S., Gadalla, E. G., & Hassan, H. K. (2021).** Effect of pollination methods on yield and fruit quality of Barhy date palm under Aswan conditions. *Assiut J. Agric. Sci.*, 52(2), 60-69.
- El-Salhy, A. M., Mostafa, R. A. A., El-Banna, A. A., & Diab, Y. M. (2012).** Effect of pollination methods and pollen grains di-



- lution on bunch weight and fruit quality of sewy Date palm, cultivar. *Assiut J. Agric. Sci.*, 43, 2: 119-131., Assiut Univ.
- El-Salhy, A., Marzouk, H. M., Abdel-Galil, H. A., & Mahmoud, A. E. (2007, May).** Effect of some pollination treatments on yield and fruit quality of some date palm cultivars. In *The 4th Symposium on date palm in Saudi Arabia, King Faisal Univ., Al-Hassa* (pp. 5-8).
- El-Sharabasy, S. F., Saber, T., & Ghazzawy, H. S. (2020)** RESPONSE OF BARHEE DATE PALM CULTIVAR TO DIFFERENT POLLINATION METHODS. *Plant Arch* 20 (2), 4001-4006.
- Gomez, K. A., & Gomez, A. A. (1984).** Statistical procedures for agricultural research, pp: 680, j. nd Wiley and sons' ltd. *New York*.
- Hafez, O. M., Saleh, M. A., Mostafa, E. A. M., Naguib, M. M., & Ashour, N. E. (2014).** Effect of pollen grain sources on yield and fruit quality of Samany date palm. *Inter. J. Agric. Res.*, 9(3), 164-168.
- Khushk, A. M., Memon, A., & Aujla, K. M. (2009).** Marketing channels and margins of dates in Sindh, Pakistan. *J. Agric. Res.*, (03681157), 47(3): 293-308.
- M.A.L.R. (2019).** Ministry of Agriculture and Land Reclamation Publishers Economic Affair – Sector.
- Munir, M.; M.R. Alhajhoj; A.A. Sallam; H.S. Ghazzawy; A.A. Sallam; A.M. Al-Bahigan and M.A. Muiweed (2020).** A comparative study of the effects of pollination methods on the changes in fruit yield and physiochemical attributes of date palm cultivar Khalas. *Asian J. Agric. and Biol.*, 8(2):147-157.
- Samouni, M. T., El-Salhy, A. M., Badawy, I. F., & Ahmed, E. F. (2016).** Effect of pollination and thinning methods on yield and fruit quality of Saigy Date palms. *Assiut J. Agric. Sci.*, 47, 92-103.
- Sayed, D. R., Aly, M. H. A., & Sayed, G. H. (2018).** Improving quality of date palm (*Phoenix dactylifera L.*) fruits CVS. Khalas and Sagae under different climate by spraying of date palm pollen grains extract. *Int. J. Biosci.*, 12(3), 56-69.
- Shaaban, M. M., Ahmed, E. F. S., & El-Akkad, M. M. (2019).** Studies on the improvement of date palm productivity using different methods of pollination and fruit thinning levels. *J. Plant Prod.*, 10(4), 373-377.
- Snedecor, G. W., & Cochran, W. G. (1990).** Statistical methods. 7th. Iowa State University USA, 80-86.
- Zaen El-Daen, E. M. A., El-Merghany, S., & El-Rahman, A. (2017).** Improving fruit set and productivity of Barhee date palm under heat stress conditions. *J. Plant Prod.*, 8(12), 1403-1408.
- Zaid, A., & De Wet, P. F. (1999).** Pollination and bunch management. Date palm cultivation. FAO, Roma (Italia). Plant Production and Protection Paper No., 156: 144-174.

إثمار نخيل البلح (*Phoenix dactylifera L.*) البرحي باستخدام طرق حديثة للتلقيح تحت ظروف الداخلة، الوادي الجديد،  
جمهورية مصر العربية

عصام محمد عبد الظاهر رضوان<sup>1</sup>، عبد الفتاح مصطفى الصالحي<sup>2</sup>، يوسف مصطفى سيد دياب<sup>3</sup>، هبه أحمد محمود<sup>1</sup>

1- قسم البساتين – كلية الزراعة – جامعة الوادي الجديد – مصر

2- قسم الفاكهة – كلية الزراعة – جامعة أسيوط

2- المعمل المركزي لنخيل البلح، مركز البحوث الزراعية الجيزة – مصر.

تعتبر عملية التلقيح من العمليات البستانية الضرورية ذات التأثير المباشر على نمو الثمار وجودتها وكذلك إنتاجية نخيل البلح. ويعد تطوير عمليات التلقيح التي من شأنها الحصول على نسبة عقد مرتفعة مع جودة عالية للثمار دون الحاجة لاستخدام كميات كبيرة من حبوب اللقاح أمراً ضرورياً وفعالاً لتحسين إنتاجية نخيل البلح. ولذا أجريت هذه الدراسة خلال مواسم 2019 و2020 و2021 على نخيل البلح البرحي النامية بمزرعة خاصة بواحة الداخلة – محافظة الوادي الجديد - مصر حيث تضمنت الدراسة التلقيح بالطرق المحورة (تقصير 25% من الشماريخ المؤنثة ثم التلقيح بمعدل 10 شمراخ مذكرة/نورة مع التعفير 0,1 جم مسحوق حبوب لقاح والتكبيس وهز النورة مرة كل 3، 6 يوم من التلقيح) أو الرش بمعلق مائي يحتوى 1 أو 2 جم حبوب لقاح بالإضافة إلى 10% من السكر أو حمض الأسكوربيك. وقد أظهرت النتائج أن التلقيح بالطريقة المحورة أو معلق 1 جم حبوب لقاح بالإضافة إلى 10% حمض أسكوربيك أو سكرز أدت إلى زيادة نسبة العقد والعقد النهائي مع زيادة وزن الثمار وتحسين جودتها مقارنة بالتلقيح اليدوي العادي. وعليه تعتبر الطريقة المحورة جيدة لإنتاج محصول عال ذو خصائص ثمرية جيدة فضلاً عن تقليل كمية حبوب اللقاح المستخدمة كما أنها عملية تجمع بين التلقيح والخف حيث تقلل من تكلفة الإنتاج وتحسين كفاءة التلقيح وخصائص الثمار.

**الكلمات الدالة:** النخيل البرحي، معلق حبوب اللقاح، التلقيح، جودة الثمار.