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EFFECT OF POLLEN SOURCE IN SOME CHEMICAL CHARACTERISTICS OF DATE PALM (*PHOENIX DACTYLIFERA* L.) C.V. AL-MAKTOUM

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Abstract

This study was conducted during the 2018 season in a private orchard in the city of Baladrooz Diyala, Iraq. Objectives were to study the effect of pollination method and pollen sources (Gannami red, Dijal AL, mixture between them) on some chemical properties of male palms of Al-Maktoum species. The results showed that there were significant differences in the effect of pollination method, whereby the method of pollination with cotton balls exceeded the normal (Natural) pollination of most traits. The pollination with cotton balls with a Gannami red had a significant variations in total sugar content percentage, reducing sugar and TSS. In comparison to normal (Natural) pollination with male Dijal method no significant differences found among most variations.
***Keywords*:** Date Palm, pollination, pollen sources, Total sugar.

Introduction

Date Palm is a monocotyledon plant, an evergreen fruit trees that belong to the Palmae, which is considered as one of the most well-known plant Orders to which many species of palms are affiliated to. It is cultivated in many parts of the world. Date Palm belong to the Arecaceae family (that composes about 200 genera, 1500 species), the Phoenix Genus and the Species dactylifera (AL-baker, 1983). Until recently, Iraq was one of the most important dates producing countries in the world, but the productivity of palm has become low and the number of palm has decreased substantially for several factors. Maktum variety is grown unevenly in the middle and southern regions, and is consumed in the phase of khalaal, Rutab and Tamr (the final ripening phase) maktum fruit is characterized as soft compared to other verities. Palms are monogamous trees, that is, the female flowers on a tree and the male found variation between the flowers are carried another tree (Abdelal, 1983) female varieties in fruit production and in some phenotypic and chemical characteristics as a result of pollination using pollen from different varieties, and Homed (2013) concluded that the male varieties (Gannami red, Dijal, mixture between them) used in pollinating Ashrasi date palm varieties resulted in different physical and chemical effects. Pollen plays an important role in the formation and development of fruits through two phenomena. First one is Metazenia, which is the indirect influence that pollen have on the fruits' maternal tissues in terms of natural and chemical qualities and maturity of fruits. Second one is called Xenia where the shape, size and seed are influenced directly by Pollen (Shafique *et al*., 2011). This study was conducted to examine the optimum method of pollination along with the best male variety of the cultivar (Maktoum) through characterizing some chemical properties of the fruits of the studied variety.

Materials and Methods

This study was conducted during the 2018 season in a private grove in the city of Baladrooz Diyala, Iraq. To study the effect of pollination method and pollen sources (Gannami red, Dijal, mixture between them) on some chemical properties from the male palms of Al-Maktoum species. Three homogeneous trees were selected. The trees were in good growth and had same agricultural operations till they reached about 30 years old at the time of selection.

Extraction of pollen

Four mature pollens pods selected before cracking from each of the male varieties. They were in good growth, homogeneous in age, and their service processes. Pollen extraction carried out in isolated chambers for each variety to avoid mixing between pollen of different varieties. Pollen covers were removed, and male for each variety were separated by different persons (to avoid mixing) single candles were placed on dry paper towels. After seven days, pollen was extracted from the dry spikelets (strands) using normal sieve used to purify the bread flour (Abdel Wahab, 1999). The pollen extracted from each variety was stored in a sealed glass containers at -18 ° C. until the pollination time.

The pollination process

The pollination was conducted after the arrival of the pollen to the appropriate size of the normal size was selected six sorties for each female tree, and was distributed on the perimeter of the head of the palm, and the rest of the pollen was removed, the pollen elected bagged paper bags. And dimensions of 20 * 80 cm for the period from 9 to 23 May.

For the purpose of conducting the vaccination, without any confusion between the pills, three sorties were vaccinated by placing five spikelets (strands) inverted inside the female sortie. Then, the contents of each bag of pollen and cotton balls were tied to a cotton thread to avoid volatilization and spread. The cyst was then stirred several times to ensure that pollen fell on the largest possible proportion of flowers in the feminine nora. Fifteen days after the vaccination, the bags were removed from all the inflorescence.

Studied qualities

Sugars; Reducing, non-reducing sugars and total sugars were determined by using the method described by Hortwitz (1960).

Dry matter, total soluble solids (TSS) and titratable acidity were determined. According to Anon (1990a) methods. Fruit samples were cleaned and seeds were removed. Date flesh were cut into pieces and dried at 60-70c.Thedry matter content percentage was calculated using the following equations;

$$\text{Dry matter}(\%) = \frac{\text{Average Dry weight}}{\text{Average Fresh weight}(g)} \times 100$$

Moreover, total soluble solids (TSS) content was determined in the fruit juice using a hand refractometer. However, fruit acidity was determined using 10 ml of fruit juice(a known fruit flesh weight blended in known water volume) which were titrated against sodium hydroxide using phenolphthalein as an indicator according to the official methods and the titratable acidity was calculated as malic acid.

Proteins content

The total proteins content was determined calorimetrically using the folinciocalteu reagent, as described by lowry, Rose-Brough, Farr, and Randall (1951).

Statistical analysis

SPSS version 11.0, (RCBD) used, each tree represents a block where all treatments applied with three replications. ANOVA with tukeys test used to analyze the results under 5% probability (Steel *et al*.,1997).

Results and Discussion

Table 1 Shows that pollen extracted from different male varieties had significant variations in sugar content percentage of Maktoum variety fruits. Different pollination methods resulted in significant differences that could be seen when cotton balls used, the highest sugar content reached (67.515%) compared to the normal pollination method which gave (65.0378%) of sugar content. As for pollen source, KHanammy variety produced the highest percentage of total sugar which was (68.9017%) and was significantly different from the other sources that showed no significant variation among them. Also, combination of pollen source and method influenced the sugar content significantly. Cotton balls method introduced the highest sugar content (69.5133%) when used red Gannamy variety and differed significantly with the other methods. Furthermore, natural pollination with Dijal variety was the lowest in the total sugar percentage (63.8700%).

Table 1 : Effects of pollination method and pollen source on the total sugar content percentage of Maktoum variety fruits.

Pollination method	Pollen source			Average of pollination method
	Dijal	Gannamy red	Mixture of Dijal + Gannamy	
Natural pollination	63.8700 c	67.9333 ab	64.153 C	65.0378 b
Cotton balls	67.0900 ab	69.5133 a`	65.9900 Bc	67.8122 a
Average of pollen variety	65.9017 b	68.3017 a	65.0717 B	

*Treatments with same letter and/or letters have no significant variation following TOKKI test at P= 0.05.

Table 2 : Effect of pollination method and pollen source on the total percentage of Reducing Sugar of Maktoum fruit.

Pollination method	Pollen source			Average of pollination method
	Dijal	Gannamy red	Mixture of Dijal +Gannamy	
Natural pollination	61.4333 c	64.7133 ab	61.2667 c	62.222 B
Cotton balls	63.9667 abc	66.3467 a`	62.7933 c	64.6178 A
Average of pollen variety	63.0733 b	65.1567 a	62.0300 b	

*Treatments with same letter and/or letters have no significant variation following TOKKI test at P= 0.05.

Table 3 : Effect of pollination method and pollen source on sucrose percentage of maktoum fruit.

Pollination method	Pollen source			Average of pollination method
	Dijal	Gannamy red	Mixture of Dijal +Gannamy	
Natural pollination	2.4367 b	3.2267 ab	2.8867 ab	3.0044 A
Cotton balls	3.6900 a	3.1667 ab`	3.1967 ab	3.1967 A
Average of pollen variety	2.8317 b	3.4283 a	3.0417 b	

*Treatments with same letter and/or letters have no significant variation following TOKKI test at P= 0.05.

Table 4 : Effect of pollination method and pollen source on the total dissolved solids in Maktoum variety.

Pollination method	Pollen source			Average of pollination method
	Dijal	Gannamy red	Mixture of Dijal + Gannamy	
Natural pollination	76.1867 c	87.4567 bc	76.8400 Bc	76.8478 b
Cotton balls	77.5167 bc	81.0700 a`	78.8667 Ab	79.4644 a
Average of pollen variety	77.3217 b	79.2933 a	77.8533 B	

*Treatments with same letter and/or letters have no significant variation following TOKKI test at P= 0.05.

Table 5 : Effect of pollination method and pollen source on the percentage of dry matter in fruits.

Pollination method	Pollen source			Average of pollination method
	Dijal	Gannamy red	Mixture of Dijal+Gannamy	
Natural pollination	78.5567 c	83.8400 bc	80.3333 c	80.4544 B
Cotton balls	82.4733 b	85.4067 a`	82.7500 b	83.9989 A
Average of pollen variety	81.1983 b	83.9400 a	81.5417 b	

* Treatments with same letter and/or letters have no significant variation following TOKKI test at P= 0.05

Table 6 : Effect of pollination method and pollen source on the fruit acidity.

Pollination method	Pollen source			Average of pollination method
	Dijal	Gannamy red	Mixture of Dijal + Gannamy	
Natural pollination	0.47000 a	0.41667 b	0.42333 b	0.43222 A
Cotton balls	0.40333 b	0.39000 b	0.40667 b	0.40444 B
Average of pollen variety	0.44333 a	0.39666 b	0.41500 b	

*Treatments with same letter and/or letters have no significant variation following TOKKI test at P= 0.05.

Table 2 shows that Different male source of pollen affected the percentage of reducing sugar in fruits of Maktoum variety. In table 2, it could be seen that pollination method differed significantly where cotton balls method gave the highest percentage of reducing sugar that reached (64.6178%) in comparison to natural pollination method which gave lowest percentage of reducing sugar that was (62.222%). As for the pollen source, Gannamy red variety gave the highest percentage of reducing sugar with (65.1567%), where it was significantly different to the other pollen source that showed no significant variance. The combination of source of pollen and method of pollination produced significant differences when cotton balls with Gannamy red showed significant difference compared to other sources and gave the highest percentage of reducing sugar (66.3476%). Additionally, the combination of natural method with the mixture of Gannamy red and Dijal varieties showed the lowest percentage of reducing sugar (61.2667%).

Pollination method showed no significant difference in percentage of nonreducing sugar of Maktoum variety Table 3. The pollen source of Gannamy red gave the highest percentage (3.4283%) of nonreducing sugar and varied significantly with the other sources which showed no significant variation. The combination of pollen source and pollination method were significantly varied, where cotton balls gave highest percentage (3.6900%) of nonreducing sugar when used with Dijal Variety that was significantly varied compared to the other pollen sources.

These results showed that pollination method and pollen source had an evident effect on the total sugar content, reducing and nonreducing sugar, in the fruit of Maktoum variety. This could be related to hormones exist in pollen (1975, Benjamin et al). It has been stated by Alapresam (2012), that there were significant variations in the total reducing and nonreducing sugar. Also Homed (2013) found that total percentage reach high levels in fully ripened fruits (Tamer). In addition, these results were consistent with Farag (2011) where the genetic compatibility between the male and female verities has an influence on the pollen effect mechanism to complete pollination process and maturity. This could be further explained by the pollen content of plant hormones, amino acids and minerals that influence fruits characteristics (Al-baker, 1972). As for the reducing sugar of date fruits, there was a significant increase which could be related to the effect pollen hormones on the invertase enzyme that convert sucrose to reducing sugar. Building of reducing sugar increasing during rutab and tamer stage as a result of sucrose transformation from plant top to fruits with the

continuation of sugar flow that synthesized in leaves to fruits (Mohammed *et al*., 1983). These results indicated that sugar increase is one of the chemical reactions that accompany ripening where sweetness and sugar content of fruit increase gradually towards ripening (Burton *et al.*, 1982; Booij, 1992).

Table 4 shows that different pollen sources used significantly affected fruits total dissolved solids (TSS). On one hand, cotton balls used with Gannamy red variety resulted in the highest percentage of (TSS) (81.0700%). and differed significantly to the other pollen sources. On the other hand, natural pollination used with Dijal variety produced the lowest (TSS) and was (76.1867%). Also, different pollination methods varied significantly when cotton balls method gave the highest (TSS) compared to natural method that gave the lowest (TSS) and were (79.4644%) and (76.8478%) respectively. As for pollen sources, Gannamy red gave the highest (TSS) (79.2933%), and was significantly different compared to the other sources that did not show significant differences.

This difference is in line with the total sugar content that represents th vast percentage of (TSS) .(1983) Abdelal Furthermore, these results were relevant with results obtained by other researchers on different date palm varieties (El-sese *et al*., 2001; El-sese *et al*., 2000; Shabeene *et al*., 1999) .

The pollination methods were significantly different (Table 5) and the cotton ball gave highest percentage of fruit dry matter (83.9989%), whereas natural method gave the lowest dry matter (80.4544%). A pollen extracted from Gannamy red produced the highest dry matter (83.9400%) and was significantly different to other sources used in this study. Pollen sources and pollination methods showed significant differences when cotton balls method used with Gannamy red gave the highest dry matter (85.4067%) and was significantly different to other sources. Natural method used with variety Dijal gave the lowest fruit dry matter (78.5567%). This could be related to the methazine effect of Gannamy red that caused this variation in dry matter percentage these results were relevant (Rygg, 1977). Acidity percentage was significantly different in relation to the Pollen source and pollination methods (Table 6.). The highest acidity produced when natural pollination method used with Dijal variety (0.47000%) and was significantly different with other sources. Cotton balls method gave the lowest acidity (0.40444%) compared to the natural method that gave the highest acidity (0.43222%). these results were relevant (Hulme, 1970).

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