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# Effect of Pollen Sources on Quality Characteristics of Different Cultivars of Date Palm (*P. dactylifera* L.) under Haryana Conditions

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**A B S T R A C T**

The present study was undertaken to find out the effect of different pollinizers and cultivars on quality traits of date palm (*Phoenix dactylifera* L.) at experimental orchard of Department of Horticulture, CCS Haryana Agricultural University, Hisar during 2015. Four different date palm cultivars (Hillawi, Zahidi, Khadrawi and Shamran) and two pollinizers (*P. dactylifera* and *P. sylvestris*) were selected for present investigation. The results indicated that the improvement in total soluble solids was observed with *P. sylvestris* (39.40 °Brix) pollens over the pollens of *P. dactylifera* (34.98 °Brix). The cv. Khadrawi (41.17 °Brix) was found superior in total soluble solid followed by cv. Shamran (40.20 °Brix). Fruit acidity was observed nearly equal with pollens of P. *dactylifera* (0.16%) and P. *sylvestris* (0.15%). Among the cvs, Zahidi (0.16%) and Shamran (0.16%) recorded higher value for acidity followed by cvs. Hillawi (0.15%) and Khadrawi (0.14%). The cv. Shamran (27.10%) was superior to all other cvs for total and reducing sugars followed by cv. Khadrawi (24.79%). In future, these experimental results will prove very useful for the induction of metaxenia effect in this fruit crop.

## Introduction

*Phoenix* has very good adaptability and a lot of potential in arid and semi-arid zones of Haryana, Punjab, Rajasthan and Gujarat states (Abbas, 2014). Under Hisar conditions summer is hot and dry but fruit maturity and ripening coincide with the rainy season. Fruits are generally harvested at doka/ khalal stage and sometimes reach dang/ rutab stage. It is one of the most delicious and nutritious fruit containing high calorific value of about 282 kcal per 100g, 60-65% sugars, vitamins like A (10IU), $B_1$ (5%), $B_2$ (6%), $B_3$ (8%), $B_5$ (12%), $B_6$ (13%) and minerals like iron (8%), calcium (4%), potassium (14%), phosphorus (9%), magnesium (12%), zinc (3%). Being rich in sugar, it is a good source of energy. (USDA nutrient data base).

All species of *Phoenix* are dioecious with male individuals bearing staminate flowers and female individuals pistillate flowers. It has been observed that some date cultivars had better yield when pollinated with selected males rather than with other (Djerbi, 1995). To make pollination effective, it is better if 2 to 3 strands of male flowers are inserted between strands of female spathe. To meet with this problem of artificial pollination is considered to be the most important factor affecting fruit set and yield (Hussain *et al.*,

1979). Failure of effective pollination leads to the formation of triple parthenocarpic fruits of no economic value (Zaid and De Wet, 1999). Although fertilization and fruit set are the two major results of pollination, there is still another interesting but uncommon effect called 'Metaxenia': the direct influence of pollen on the maternal tissues of the fruit (Janick, 1979). Pollen source has been reported to effect fruit set, ripening and quality (AI-Obeed and Abdul-Rahman, 2002). Most of the male palms available are of seedling origin with great variations in their pollen quality. These pollen grains can bring about a lot of variations in the productivity, size, quality and maturity of date fruits in combination with different female cultivar. These effects on tissue of purely maternal origin, rather than on parts resulting from syngamy have been described as 'Metaxenia' (Swingle, 1928). No work has been reported on effect of pollinizers on fruit growth and development of date palm fruit under Hisar conditions. Keeping in view improving better fruit quality in date palm cultivars the present investigation was conducted to study the effect of pollinizers on fruit set, physical parameters and maturity of date palm cultivars.

## Materials and Methods

The present study on effect of pollen source and cultivars on quality characteristics of date palm was carried out in experimental orchard of Department of Horticulture, CCS Haryana Agricultural University, Hisar during the year 2015. The plants of selected female cultivars (Hillawi, Zahidi, Khadrawi and Shamran) were tagged for the pollination. Two male pollinizer's *P. dactylifera* and *P. sylvestris* were used as pollen parents. The experiment was laid out on more than 30 years old plant in Randomized Block Design with three replications and data was collected on bio chemical parameters.

The total soluble solids were recorded with Erma hand refractrometer (0-32 °Brix and 32-60 °Brix) by putting a drop of juice and recorded the reading. The refractrometer was calibrated with distilled water with every use and the values were expressed in °Brix soluble solids. The method suggested by A.O.A.C. (1980) was followed for estimation of titratable acidity. The total and reducing sugars were estimated as per the method described by Hulme and Narain (1993). Statistical analysis of data collected during the study was done by applying the technique of analysis of variance (Rai and Grover, 2006). All the statistical analysis was carried out by using OPSTAT statistical software.

## Results and Discussion

### T.S.S. (°Brix)

The perusal of data given in table 1 revealed that the total soluble solids of four date palm cultivars as affected by pollen source differed significantly. All cultivars significantly differed to each other, except Khadrawi, which was statistically at par with cultivar Shamran. The highest total soluble solids (39.40 °Brix) were recorded in fruits produced from pollination of *P. sylvestris* as compared to fruits which were fertilized by *P. dactylifera* (34.98 °Brix). Amongst cultivars the fruits of Khadrawi showed the highest T.S.S. (41.17 °Brix) content which was statistically at par with the cultivar Shamran (40.20 °Brix), whereas, minimum total soluble solids (31.88 °Brix) was observed from cv. Zahidi. The interactive effect of cultivars and pollen source was found non-significant. However, numerically maximum total soluble solids content of 42.97 °Brix was observed in fruits of cultivar Khadrawi when pollens of *P. sylvestris* were used. Reason behind this might be due to differences in genetic makeup, growth, health, vigor and spathe characteristics (Nasir *et al.,* 1986). The results

are partly in agreement with those obtained by Maradi (1995), El-Kassas *et al.,* (1996), Iqbal and Ghafoor (2000), Marzouk *et al.,* (2002a, 2002b), Ghaffar and Iqbal (2003) and Iqbal (2007) who reported that total soluble solids seemed to be influenced by type of used of pollen.

## Acidity (%)

Data pertaining to fruit acidity as influenced by the two pollen parents is presented in table 2. The perusal of data show that the pollen sources as well as cultivars did not differed significantly. However, the titratable acidity was more in the fruits which were pollinated with the *P. dactylifera* (0.16%) pollens as compared to the fruits pollinated by *P. sylvestris* (0.15%) pollens. These results are in harmony with Musa (1981), Mawlood (1980) and Farag *et al.,* (2012).

## Total sugar (%)

The data on total sugar of fruits as affected by pollinizers is given in table 3. It can be clearly seen that the pollen sources showed the non significant results, while the cultivars Hillawi, Khadrawi and Shamran differed significantly to the cultivar Zahidi. There was no significant difference among these three cultivars. The flowers treated with pollens of *P. sylvestris* recorded the significantly higher total sugar content (32.67%) as compare to flowers pollinated with *P. dactylifera* (31.27%). Amongst cultivars the highest percentage (34.93%) of total sugar was found in cultivar Shamran followed by cultivars Khadrawi and Hillawi having 34.36% and 32.67% total sugar content, respectively. The three cultivars discussed above were significantly differed from cultivar Zahidi which have least total sugar content (25.91%). Interactive effect of pollen sources and cultivars were non-significant. However maximum total sugar (36.62%) was observed in cultivar Shamran pollinated with *P. sylvestris* pollens. Minimum total sugar percentage (25.35%) was recorded in cultivar Zahidi when pollens of *P. dactylifera* were used. Reasons behind this might be due to activities of the enzymes system initiated by the metaxenic effect and later on passed into extra cellular sites, get dissolve readily into water and invert the sugar. Similarly, the hydrolytic enzymes, such as polygalacturonase and cellulose may also be involved in these biochemical changes by solubilizing the pectin and cellulose of cell wall (Hasegawa and Smolensky, 1971; Ghnaim and Al- Muhtaseb, 2006). The effect of pollen source on the physiology and biosynthesis of sugars is still not fully clear (Helail and El-Kholey, 2000; El-Ashry, 2009; Omar *et al.,* 2014).

**Table.1** Effect of pollinizers on T.S.S. (°Brix) in cvs. of date palm

| Pollinizers | Cultivars | | | | Mean |
|---|---|---|---|---|---|
| | Hillawi | Zahidi | Khadrawi | Shamran | |
| ***P. dactylifera*** | 32.47 | 30.20 | 39.37 | 37.90 | **34.98** |
| ***P. sylvestris*** | 38.57 | 33.57 | 42.97 | 42.50 | **39.40** |
| **Mean** | **35.52** | **31.88** | **41.17** | **40.20** | |
| **CD (P=0.05)** | Pollinizers = 0.99, Cultivars = 1.39, Pollinizers × Cultivars = NS | | | | |

**Table.2** Effect of pollinizers on acidity (%) in cvs. of date palm

| Pollinizers | Cultivars | | | | Mean |
|---|---|---|---|---|---|
| | Hillawi | Zahidi | Khadrawi | Shamran | |
| ***P. dactylifera*** | 0.17 | 0.18 | 0.13 | 0.15 | **0.16** |
| ***P. sylvestris*** | 0.14 | 0.15 | 0.14 | 0.17 | **0.15** |
| **Mean** | **0.15** | **0.16** | **0.14** | **0.16** | |
| **CD (P=0.05)** | Pollinizers = NS, Cultivars = NS, Pollinizers × Cultivars = NS | | | | |

**Table.3** Effect of pollinizers on total sugar (%) in cvs. of date palm

| Pollinizers | Cultivars | | | | Mean |
|---|---|---|---|---|---|
| | Hillawi | Zahidi | Khadrawi | Shamran | |
| ***P. dactylifera*** | 32.11 | 25.35 | 34.36 | 33.24 | **31.27** |
| ***P. sylvestris*** | 33.24 | 26.48 | 34.36 | 36.62 | **32.67** |
| **Mean** | **32.67** | **25.91** | **34.36** | **34.93** | |
| **CD (P=0.05)** | Pollinizers = NS, Cultivars = 2.91, Pollinizers × Cultivars = NS | | | | |

**Table.4** Effect of pollinizers on reducing sugars (%) in cvs. of date palm

| Pollinizers | Cultivars | | | | Mean |
|---|---|---|---|---|---|
| | Hillawi | Zahidi | Khadrawi | Shamran | |
| ***P. dactylifera*** | 20.00 | 18.88 | 25.07 | 25.64 | **22.40** |
| ***P. sylvestris*** | 24.51 | 19.44 | 24.51 | 28.55 | **24.25** |
| **Mean** | **22.26** | **19.16** | **24.79** | **27.10** | |
| **CD (P=0.05)** | Pollinizers = NS, Cultivars = 2.84, Pollinizers × Cultivars = NS | | | | |

**Table.5** Effect of pollinizers on non reducing sugars (%) in cvs. of date palm

| Pollinizers | Cultivars | | | | Mean |
|---|---|---|---|---|---|
| | Hillawi | Zahidi | Khadrawi | Shamran | |
| ***P. dactylifera*** | 12.11 | 6.47 | 9.29 | 7.60 | **8.87** |
| ***P. sylvestris*** | 8.73 | 7.04 | 9.85 | 8.06 | **8.42** |
| **Mean** | **10.42** | **6.76** | **9.57** | **7.83** | |
| **CD (P=0.05)** | Pollinizers = NS, Cultivars = NS, Pollinizers × Cultivars = NS | | | | |

## Reducing sugars (%)

The perusal of data given in table 4 revealed that the reducing sugars did not differ significantly by pollen parents but among cultivars significant difference was recorded, whereas, the cultivars Khadrawi and Hillawi were at par with each other. The pollen source showed non-significant effect on reducing sugars. However higher reducing sugars (24.25%) were observed in the fruits which were pollinated with pollen of *P. sylvestris* and with *P. dactylifera* pollens gave lower (22.40%) reducing sugars. Amongst the cultivars the highest reducing sugars (27.10%) were recorded in cultivar Shamran which was significantly differed from cultivars *i.e*. Hillawi (22.26%) and Zahidi (19.16%). The cultivars Hillawi and Khadrawi were statistically at par with each other. The cumulative effect of cultivars and pollen sources on reducing sugars showed non-significant effect. However, numerically the maximum reducing sugars content (28.55%) were observed in the fruits of cultivar Shamran pollinated with *P. sylvestris* pollens. The minimum reducing sugars (18.88%) were found in cultivar Zahidi when pollinated with pollens of *P. dactylifera*. This might be due to activities of the enzymes system initiated by the metaxenic effect and other biochemical changes in the fruit. Similarly the hydrolytic enzymes, such as polygalacturonase and cellulose may also be involved in these biochemical changes by solubilizing the pectin and cellulose of cell wall (Hasegawa and Smolensky, 1971; Ghnaim and Al- Muhtaseb, 2006). The effect of pollen source on the physiology and biosynthesis of sugars is still not fully clear (Helail and El-Kholey, 2000; El-Ashry, 2009; Omar *et al.*, 2014).

## Non-reducing sugars (%)

Data pertaining to non-reducing sugars as affected by the pollen sources on date palm cvs. is presented in table 5. The perusal of data showed that effect of pollen sources as well as cultivars on non reducing sugars did not differ significantly. However, the non reducing sugars content was higher in the flowers fertilized with *P. dactylifera* pollens (8.87%) than the flowers pollinated with *P. sylvestris* pollens (8.42%). Amongst the cultivars highest percentage (10.42%) of non reducing sugars were observed in cv. Hillawi which was followed by cultivars Khadrawi, Shamran and Zahidi having reducing sugar content of 9.57 per cent, 7.83 per cent and 6.76 per cent, respectively. There was no effect of cvs. on percentage of non reducing sugar content. The non significant effect of pollen sources and cultivars on percent non reducing sugar was observed. Numerically highest non reducing sugars were recorded in

cultivar Hillawi (12.11%) when pollens of *P. dactylifera* were used. The same pollen source gave the lowest (6.47%) content of non reducing sugars in cultivar Zahidi. These results were in close agreement with the finding of Shafique *et al.,* (2011).

From the present study it can be concluded the pollinizer *P. sylvestris* showed metaxenic effect for TSS only. The cultivar Khadrawi showed maximum TSS compared to the other cultivars. The pollen source doesn't have any significant effect on acidity, total sugar, reducing and non reducing sugars.

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